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SUPPLEMENTARY NOTES ON BASIDIOCARP ONTOGENY IN AGARICS

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Basidiocarp ontogeny is described and illustrated of eight species of agarics, viz. *Hygrophoropsis aurantiaca, Hygrophorus pudorinus, Tricholoma populinum, T. ustaloides, T. vaccinum, Marasmiellus candidus, Marasmius wynnei*, and *Panellus mitis*

In many cases it still is not clear to what extent ontogenetic structures of basidiocarps of agarics can be used as taxonomic characteristics. Earlier (Reijnders, 1963) we published a table with data on the development of the basidiocarp of 232 species of Agaricales. Although the data of some of these species were still incomplete, a number of regularities or conformities between allied species became nevertheless apparent from the table. The difficulty of the application of these data in systematics is that, in most cases, they are known of too few species. For instance, it is not known if a special structure is correlative with other features and consequently is characteristic of a certain group; in other words, the limits of the different structures are insufficiently known.

Although veils in mature basidiocarps are only remnants of primordial structures and thus can be studied better and more completely in the primordium, one can determine their presence or absence with routine methods in all species of a monographically treated group. The development of the veils in the primordium is only to be studied by time-absorbing technics and is known in only a few cases. That counts even more for another aspect of basidiocarp development: the succession of the internal differentiation of stem, cap and gills.

When only a limited amount of data are available one is easily inclined to generalize; the application of ontogenesis in mycological taxonomy indeed bristles with such often unwarrented generalisations.

Yet in a completely elaborated taxonomy the characteristics of ontogenesis will have to play their rightfull part. It has already often been said that in a taxonomy reflecting natural affinities, all characteristics have to be weighed by their importance. So we are still intent on extending our investigations on ontogenetic structures in agarics as far as they are perceptible by the light-microscope (a limiting factor is often the difficulty to collect primordia of the desired species). In the following notes we present the results of our studies of another eight species.

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Hygrophoropsis aurantiaca (Wulf.: Fr.) Maire

1. Here we are concerned with a pure stipitocarpous species. The first stages of the developing basidiocarp consist of long very slender stems, even up to 1–2 cm high.

Fig. 1 shows the microphoto of a top of such a stem; width approximately 345 μm. In general the hyphae are parallel, but not strictly so; they are divided into short, binucleate cells of a rather varying width (2–7.5 μm).

2. The cap comes into being because hyphae at the top of the stem change direction and bend outward. Consequently the upper part widens and a chromophilous rim develops in which the radial hyphae run parallel. At the same time the hyphae in the centre of the stem do not grow straight upwards anymore but begin to intertwine and the cells are becoming wider (up to 10 μm; those in the section of the cap have an average width of ± 6.5 μm; in the stem only 3–5 μm). Fig. 3 shows a median section of a cap at that stage. At the underside of the cap and decurrent on the stipe the formation of anastomosing veins has already started by now. These veins are lined with a hymenial palisade (width of the elements ± 5 μm) in which already numerous slender basidia (diam. ± 7 μm) with mature spores are present. This palisade continues over about 1 mm downwards along the stipe (Fig. 5) and then changes into a more irregular covering with strongly branched hyphae, often with club-shaped extremities (diam. ± 6.5 μm) (Fig. 6). On the surface of the cap we already find some differentiation, viz. a layer (50–60 μm thick) in which the hyphae are closely interwoven and in which many ramifications take place. The hyphal tips tend to turn outwards and make the surface more or less felty; sometimes they form a loose palisade.

3. A tangential section shows clearly that gill-folds are joined by anastamoses (Fig. 2; width of the section of the cap ± 3.5 mm). The descriptions of the gill-trama by Kühner (1980: 652), by Singer (1975: 688) and by Corner (1966: 134) are rather different, although all three authors recognize a mediostratum, which has a loose texture and outer layers consisting of hyphae or cells with mucilaginous walls, densely packed together. Singer distinguishes in these outer layers a hymenopodium and a subhymenium but he adds that the latter is only slightly differentiated from the former. Apart from the fact that in our opinion the term 'hymenopode' is rather questionable in such cases, we were unable to detect any differentiation in the outer layers, which have mainly a cellular structure with some short scattered hyphae and a width of 20 μm (also according to Corner). With respect to the mediostratum: Kühner observes in cross-sections a wedge-like structure, with the sharp angle pointing towards the edge of the gill, consisting of loosely interwoven hyphae like in the trama of the cap ('aérifere comme la chair piléique'). Though he did not observe divergent hyphae he quotes Singer's mentioning of such hyphae in the hymenopodium ('but this divergence is inconstant and not persistant').

When we follow the formation of the gills from the beginning (Fig. 4) we must conclude that the folding-activity is exclusively brought about by inflation of the narrow cells of the subhymenium and the hymenial palisade. In this manner arise the shallow folds near the margin of the cap. There is neither in the beginning nor afterwards any pushing done by the hyphae of the mediostratum: some hyphae of the pileal trama are simply taken along with the folds; they may ramify and increase in number to a certain extent and show a somewhat divergent or axillary arrangement, but the construction remains so loose that there are finally only a few hyphae which traverse the space between the lateral strata. Corner mentions that the trama becomes: 'hollow and mucilaginous' (Fig. 11). Kühner was struck by the fact that the lamellae of *Hygrophoropsis* easily split along the medial plane. This is not caused by the divergent trama with a mediostratum of strictly parallel hyphae as in *Limacium*, but by the almost empty space between the lateral layers.

It must be stressed that the hymenophoral trama of *Hygrophoropsis* is quite different from the divergent (or somewhat bilateral) trama of the Boletaceae and the Paxillaceae, etc. The relation of *Hygrophoropsis* with the latter family has been thought to be proved by the presence of a pulvinic-acid derivate, but can by no means be based on the structure of the gill-trama, which is more similar to that of *Cantharellus*.

Hygrophorus pudorinus (Fr.) Fr.

At present it is general practice to divide Fries' large genus *Hygrophorus* into different genera. In the first place the three sections, into which Fries divided this genus, have been raised to the rank of genus. *Limacium* is one of them, now bearing again the name *Hygrophorus* (s.str.). This genus is specially characterized by the permanently divergent gill-trama and the usually viscous covering of stem and cap. As to the development, a certain amount of species of this genus have been examined with few differences between them (see Reijnders 1963: 146). To this we should like to add some more observations.

1. *Hygrophorus pudorinus* is a species with large basidiocarps. The primordia show a stipitocarpous development. Soon a ring-shaped edge growing outward originates at a short distance below the top of the primordial stem. This is the beginning of the cap. The youngest stage represented (Fig. 7) has a diameter of 4.2 mm where it is widest. In this median section one can see the edge of the cap turning downward and inward. Lamellae are already present as well: shallow folds with divergent trama. The tissues of stem and cap differ already considerably but the demarcation is not clear. In the stem-part the hyphae are more or less parallel. They are not yet strongly inflated (diameter in the base up to 10 µm, higher up in the stem 6 µm on an average). The hyphae in the pileus are intricate; their width is on the whole somewhat larger (diam. up to 11 µm). This is also the case above the lamellae. Parallel hyphae are rather restricted to the edge of the cap.

At the outside of the stem, especially in the upper part, one finds thin hyphae (diam. ± 3 µm) which are more or less interwoven, but underneath the edge of the cap they form bundles which are directed outwards and here this layer is widest (± 250 µm).

Fig. 8 shows the edge of the cap in a younger stage (largest width 1.8 µm) than in the above-described median section. Over the pileipellis, composed of closely jointed hyphae, there is in addition a fluff of entangled short hyphae.

Fig. 9 shows the margin of the cap at a later stage (diam. of the primordium here 7.7 mm). The outwards turning hyphae along the surface of the stem are here to be found over a greater length (the stem has become longer) but the layer is less broad (110 µm). The walls of these hyphae, which more or less form a palisade, have already become mucous at an early stage. Fig. 10 represents the stem-surface further downwards in the stage of 7.7 mm width.

At the stage of which we have represented the median section (diam. 4.2 mm, Fig. 7) the fluff on the cap has disappeared and the cap is completely closed in by a thick mucous layer (± 250 µm). Just as in the other species of *Hygrophorus* examined the strong development of mucous appears first on the cap. One might consider the hyphae that grow outwards from the stem and the fluff on the cap as a veil but then as an emanated veil. There is hardly a connection between the hyphae on the edge of the cap and those along the stem, even at an early stage. So the species is rather gymnocarpous than mixangiocarpous.

Tricholoma populinum J. Lange, **T. ustaloides** Romagn., and **T. vaccinum** (Pers.: Fr.) Kumm.

In a former publication (Reijnders, 1963: 59–63, 162–169) we described the development of some species of the genus *Tricholoma*. It is remarkable that all these species show a primary angiocarpy, though mostly in a very rudimentary form.

Most of these species are monovelangiocarpous but some are weakly paravelangiocarpous, i.e. the universal veil is lacking completely. The paravelangiocarpy in those species is however quite weak, as the hyphae of the hymenophore in the initial stage are hardly internal and are enveloped by only a few hyphae (as in *Tricholomopsis rutilans*; see Reijnders, 1963: pl. 17).

We are able now to add some more species of *Tricholoma* to the list of those that have been examined so far. Since the development of these species is very much alike, we describe them together. We shall observe the same order as in the title above.

1. The youngest stage consists of a small column which is widest in *Tricholoma populinum* (diam. in the centre respectively about 755 µm, 690 µm and 380 µm). It consists of protenchymatic hyphae, which are interwoven in the entire primordium of *T. populinum*, but in the other two species only in the lower half (Fig. 12, Fig. 17, Fig. 23). In the last two species the hyphae in the upper half run more longitudinally. The universal veil is clearest in *T. ustaloides*, where it consists of slightly wider hyphae (diam. 1.5–3.5 µm) which are interwoven or directed outwards. In *T. vaccinum* the universal veil is hardly showing and consists of a few loose hyphae. These are also found in *T. populinum* but then at the outside of a dark-coloured zone, consisting of hyphae which deviate in colour, parallel to the surface (diam. 15–20 µm). The loose hyphae on the outside are by no means present everywhere along the surface (diam. of this layer at most 30 µm); they are either pushed off or possibly have been removed artificially during the preparation of the mounts.

2. We now have to pay attention to the origin of the margin of the cap and the hymenophore. In the present three species these develop underneath the universal veil (Fig. 14, width at the hymenophore 504 µm; Fig. 18, width 380 µm; Fig. 24, width also 380 µm). The primordium of *T. populinum* remains widest and shortest, the other primordia are very slender. The universal veil in *T. ustaloides* remains the strongest developed one. To demonstrate that the first palisade-hyphae of the hymenophore really develop internally (although they are covered by only a very thin layer of other hyphae), we add a few photos of details of *T. ustaloides* (Fig. 19; diam. of the primordium 440 µm) and of *T. vaccinum* (Fig. 25; diam. 706 µm).

3. The next stage is slightly more developed. Here the universal veil is already reduced to remnants at the margin of the cap, which probably will disappear in later stages (Fig. 13, diam. at the hymenophore 135 µm; Fig. 20, diam. 755 µm; Fig. 26, diam. 690 µm). The hyphae in the stem in *T. populinum* (of which only one side of the median section has been photographed) are still rather strongly interwoven, while, in the other species they are longitudinal. In *T. populinum* they are also rather strongly widened: diam. in the stem up to 10 µm and in the trama of the cap up to 6.5 µm, or even up to 8 µm. In the other *Tricholoma*'s in the base of the stem, in the top of the stem and in the trama of the cap respectively diam. up to 6.5 and 13 µm, up to 5 and 9.5 µm, and up to 3 and 7 µm.

4. In later stages not much is to be perceived of the veil any more. Fig. 15 (diam. at the level of the margin of the cap 4 mm) shows an older primordium of *T. populinum.* The short, wide shape has been retained so far. Over the cap of this species a lively growth of new hyphae has developed, to be seen on the photograph as a strongly chromophilous layer (diam. ± 95 µm). In this layer we observe – as always, when in a plectenchyma new hyphae develop – the twisted hyphae of the hyphal knots, here present in abundance. The outward growing hyphae already have strongly mucous walls (width of this layer up to 130 µm, Fig. 16). The dark particles on the surface of the cap in the photograph for the greater part are fragments of dirt sticking to the cap. We may assume that the weak rests of the veil, barely visible any more, have been pushed away and have disappeared as a result of the strongly growing layer under it.

It is notable that in *T. populinum* the development of the hymenophoral palisade is relative late.

We also photographed the margin of the cap of the median section of *T. ustaloides* (Fig. 21; diam. of this stage 2.3 mm). Here one can see that the hymenophoral palisade runs down the apex of the stem; lower down the universal veil (width 50–100 µm) covers the entire stipe and consists of hyphae that are somewhat interwoven. The transition from the hymenophoral palisade to the veil is rather gradual.

It is interesting to compare the veil of *T. ustaloides* with that of *T. ustale* (Fr. ex Fr.) Kumm., of which we examined the development before (Reijnders 1963: 59). Romagnesi (1954: 157) distinguished *T. ustaloides* from *T. ustale* by a few characteristics, one of which is the stronger development of the veil in the former species. We were able to compare older primordia of the two species of about the same size. Pl. 16 fig. 6 in our publication of 1963 shows the margin of the cap of a primordium of *T. ustale* with a width of 2.5 mm. When we compare the median section of this primordium with one of a similar primordium of *T. ustaloides* (Fig. 20) we are indeed struck by the different widths of the veil along the stipe (in *T. ustale* 30–70 μm). There is also a difference in structure; in *T. ustale* the hyphae of the veil, which gradually merge into the cortex of the stem, run parallel; at the surface there are only very loose hyphae directed outwards.

Marasmiellus candidus (Bolt.) Sing.

1. We reproduce photomicrographs of median sections of a number of successive stages of this species, starting with a primordium of which the largest width is 271 μm and the height 240 μm (Fig. 22). Very often the basidiocarps of this species develop in lenticels of small twigs, which then are filled with intertwining mycelial hyphae (height e.g. ± 90 μm).

The section shows two chromophilous spots, to the right and the left of the axis, where a dense ramification of the generative hyphae takes place. These ramifications will turn downwards to form the hymenophore, which develops internally as the dark spots are surrounded by ordinary protenchyma. A universal veil, however, is not differentiated. Some strongly coloured hyphae, scattered in the tissue, may belong to a parasitic or saprophytic mould; at later stages they are lacking.

2. Fig. 27 shows a section of a stage of a similar size (greatest width 240 μm, height 195 μm), but here the whole primordium has been depicted. The hyphae in the stem already show a longitudinal direction but in the pileus they are interwoven. The veil is restricted to the sides of the stem.

3. The lipsanenchyma is thin and sparse but still clearly present in the next stage (Fig. 28; largest width 385 μm, height 390 μm). The hyphae in the stem are a little wider (diam. up to 3 μm), but the hyphae in the trama of the cap and also the chromophilous hyphae of the hymenophore, running downwards in a curve, are thin (diam. ± 1.5 μm). There is now, over the cap, a layer (width ± 25 μm) in which the interwoven hyphae are somewhat wider (diam. up to 3 μm).

4. A tangential section (Fig. 31; width of the section 330 μm) shows that the palisade of hyphae of the hymenophore is not interrupted and that the extreme tips of the hyphae are on the same level. This is quite normal in Agaricales and different in only a few groups.

5. In a rather more developed stage (Fig. 29; width 605 μm, height 630 μm) the lipsanenchyma has almost disappeared and exists only of a few loose hyphae. The diameter of the longitudinal hyphae of the stem is up to 5 μm. Here the separate upper layer of the cap, as well as the demarcation between stem and trama of the cap, show up more clearly

6. The gills develop through folding as in most of the Agaricales. The hymenophoral trama is divergent at first, as usual. We photographed the young folds of the gills of a section of which the largest width was 695 µm (Fig. 32; the height of the fold at the right is 95 µm). Also in a later stage, when the gills are slightly higher, the trama remains divergent or – as so often happens – it shows a more or less regular structure. The gills, however, do not become very high. It is known that in mature sporocarps they anastomose and form a kind of network of veins. The hyphae of the hymenophoral trama remain thin.

7. In a following stage the stem starts lengthening (Fig. 30; diam. of the cap 1010 µm, height 1640 µm). The cells of the hyphae of the stem show a strong inflation (diam. up to 11 µm), while the diameter of those in the trama of the cap only attains 5 µm.

8. In most cases the cap will later develop one-sidedly and consequently the stem will become excentric or even lateral. This can already be observed at a stage in which the cap has a width of ± 2 mm (Fig. 33). Here again we are dealing with a species where the primordia are radially symmetric but where the cap may develop excentrically depending on how the basidiocarp is situated on the wood (compare Reijnders, 1963: pl. 12, fig. 1–5, *Pleurotus dryinus*, pl. 13, fig. 1–3, *Pl. ostreatus*, etc.).

The demarcation between the trama of the cap and the trama of the stem is very clear here and lies considerably higher than the level of the hymenophore so that the trama of the cap is thin. The covering of the cap is little differentiated in this species (diam. of the hyphae of the trama of the cap, also in the upper part, up to 6.5 µm). The cells in the stem can reach a width of ± 10 µm, which is not particularly much.

Summarizing it can be said that *Marasmiellus candidus* is paravelangiocarpous. The youngest primordia are relatively short and remain so for some time. When the hyphae of the stem become longitudinally arranged, the hyphae of the cap remain interwoven. This species is at least pileostipitocarpous and because of the relatively early development of the hymenophore it could even be considered isocarpous.

Marasmius wynnei Berk. & Br.

1. The youngest stages of this species have the shape of subglobular to ellipsoid bodies with a smooth outline. We represent sections of two of them. In the first the hyphae in the lower part show already a longitudinal arrangement (Fig. 34; largest width 500 µm, length ± 655 µm), while the hyphae in the future cap trama form a plectenchyma (diam. of the hyphae in the stem up to 5 µm, in the cap 2–3 µm). Already the pileipellis consists of club-shaped elements (diam. up to 8 µm). The second section depicted is somewhat smaller (Fig. 35; width 365 µm, length 575 µm), but shows a little more differentiation; the parallel hyphae in the lowest part of the stem are up to 7 µm wide, those of the trama of the cap up to 6 µm. In this section we can see a fissure developing underneath the future margin of the cap, probably as a result of tensions caused by irregular growth. In this fissure the tissue is torn and some hyphae are crushed. The slowly

downwards and inwards curving margin of the cap has a tendency to press firmly against the stem. The fissure has a depth of 95 to 110 µm.

2. In a slightly more differentiated stage the outer primordial tissue that was originally covering the developing margin of the cap, has been torn loose and as a result of further growth of the stem is now situated a little below the margin of the cap (Fig. 36; largest width 530 µm, length 705 µm). The tendency of the margin of the cap to press against the stem is very clear here; this margin consists of bundles of generative hyphae ramifying strongly (diam. 1–2 µm) and running in a downward direction. A detail of the margin of the cap at this stage we present stronger enlarged (Fig. 37).

3. We photographed still another median section of a primordium demonstrating the typical development of this species (Fig. 39; width 730 µm, height 1090 µm). The curved margin of the cap presses firmly against the stem. The demarcation between the trama of the cap and the parallel hyphae of the stem has become very clear now. At a short distance below the margin of the cap are the remnants of the torn outer primordial tissue in the shape of a ring-like rim round the stem. Although the hyphae of this stage have not become much wider, the club-shaped elements of the pileipellis have reached a diameter of 10 µm.

4. The margin of the cap of a broader primordium is shown separately and higher magnified (Fig. 43; width of the primordium 975 µm, height 895 µm). Here the tissue that is pushed aside still lies against the margin of the cap. It is notable that hyphae are still passing from the margin of the cap into this strip of tissue.

5. Finally a median section of a somewhat older primordium (Fig. 38; width of the cap 945 µm, height 1555 µm) is depicted. The now strictly parallel hyphae of the stem have not yet widened much (diam. up to 6 µm). The demarcation between the trama of stem and cap is very abrupt since the thin hyphae of the cap often have a direction perpendicular to that of the hyphae of the stem. The trama of the pileus consists of two parts: a central loose tissue of thin hyphae (diam. 2–4 µm), about 110 µm high, is surrounded by a compact plectenchyma in which the hyphae usually are a little wider (diam. up to 6 µm) and in which there are many club-shaped terminal cells (diam. up to 7 µm). The pileipellis consists of a compact tissue of cells with, at the outside, many palisade-like elements. The margin of the cap is still pressed against the stem, which shows at that spot a ring of inflated hyphae (diam. 10 µm). It is clear that the unevenness of the stem, still present in mature basidiocarps, is caused by fragments of the primordial cortex of the stem and the margin of cap. When we call this a veil, it is a very rudimentary one.

Marasmius wynnei is paravelangiocarpous since in the early stages the palisade of hymenophoral hyphae develops more inward, between other elements. The primordium is robust and at first short. Since the plectenchyma of the trama of the pileus, the margin of the cap, and the stem differentiate more or less simultaneously we consider this species pileostipitocarpous. A comparison with the fairly related *Marasmius rotula* (Scop.: Fr.) Fr. is given in the concluding paragraph.

Panellus mitis (Pers.: Fr.) Sing.

1. Young primordia of this species have an oblong form; the length can be very different. Our photo (Fig. 40) shows a median section which is 410 μm thick and 865 μm long. Usually these primordia are already more or less flat so that the width is larger than the thickness. The body consists of flexuous, mainly parallel hyphae which are 3 μm wide in the base and 1–2 μm in the top where they have more protoplasm and thinner walls. The top of the primordium is turned down and shows a strong growth. Already at this stage the primordium is, up to about half the length, enveloped by a mucous layer. This mucous layer develops first at the base of the primordium. On the outside of this layer is a covering of loose hyphae which have not become mucous (diam. 2–3 μm). This felty layer is only ± 10 μm wide, but is still present in mature basidiocarps.

2. The next stage (Fig. 41) has a length of 1.7 mm and is 960 μm thick. In principal there are no changes, but a thick mucous layer (diam. 190–260 μm) now envelops almost the whole primordium, with the exception of the tip which keeps growing continually. Although the hyphae gather little width they get a thicker wall in the lower part of the primordium and therefore are stained more highly. The presence of thick-walled hyphae (but no skeletals) is a generic characteristic of *Panellus*.

3. Figs. 42 represents the distal extremity of a stage with a length of 3–4 mm and a largest thickness of 1.5 mm. We can see here that, at the underside of the curved zone of growth, a hymenial palisade has started to develop; its elements are still thin (diam. up to 3 μm). Folds of the lamellae are already developing; in this practically median section one of them has been cut. At this stage in a large part of the primordium the hyphae are somewhat wider (diam. up to 7 μm), however without being subject to strong inflation.

4. Finally a few photos of a young fungus (Fig. 45; length 6.3 mm, thickness 2.2 mm). At this stage the young specimen is already divided into a stem-shaped part, and a flat or shell-shaped part. The edges of this second part are curved downwards, not only at the apex, but also at the sides. Lamellae originate only at the underside of the shell-shaped part. The mucous layer still envelops almost the whole primordium and thus is also to be found on the outside of the inflexed margin. This explains why, in a not quite median section, a part of this mucous layer seems to cover the part with the hymenophore (Fig. 44). In this section the shell-shaped part with the hymenophore is 770 μm long. The hyphae of the stem have hardly widened (diam. up to 8 μm).

From these observations it appears that *Panellus mitis* is stipitocarpous and gymnocarpous as earlier mentioned by Singer (1975: 340).

A short comparison with *Tectella patellaris* (Fr.) Murr. will be given in the concluding chapter.

CONCLUSIONS

1. The development of *Hygrophoropsis aurantiaca* shows the primitive character of this species; stipitocarpy, and the simple origin of the cap from outward-curving apical

hyphae. We have treated the origin of the trama of the gills at some length. The folding of the hymenium is caused by the multiplying and inflating hymenial elements and not by tramal hyphae growing downwards from the underside of the trama of the cap. In this respect *Hygrophoropsis* is pronouncedly cantharelloid.

2. The development of *Hygrophorus pudorinus* is comparable to that of other species of *Hygrophorus* s. str. (see Reijnders, 1963: 146). In all cases there is an emanated universal veil which becomes mucous, to begin with on the cap. Consequently these species are mixangiocarpous or, when, like in this species, the veil is only very slightly developed, they are practically gymnocarpous.

3. The development of the three species of *Tricholoma* which have been examined here, also fits in well with the pattern already determined for *Tricholoma* (Reijnders, 1963: 162). In general these species are monovelangiocarpous with a rather weakly developed universal veil, which is, however, clearly visible in most cases. There is no clear lipsanenchyma. In *Tricholoma focale* (Fr.) Ricken (see Reijnders, 1952: pl. 7, fig. 2–6) however there is no veil over the cap; that species is paravelangiocarpous. We already examined *Tricholoma ustale* (Fr. ex. Fr.) Kumm. (Reijnders, 1963: 59, 162). Comparing *Tricholoma ustaloides*, described in the paper, with the previous species, we observe a stronger development of the universal veil in the last one, which agrees with Romagnesi's observations when describing *T. ustaloides* as a new species. Generally these species are stipitocarpous; however the exceptionally robust form of the primordium of *T. populinum* is striking.

4. It stands to reason that the development of *Marasmius wynnei* is compared with that of *Marasmius rotula* (Scop. ex Fr.) Fr. (see Kühner, 1980: 607; Reijnders, 1963: 64, 150) and that of *Marasmiellus candidus* with that of *Marasmiellus ramealis* (Bull.: Fr.) Fr. (Reijnders, 1963: 68, 150). But there also is reason to compare these four species with each other for they show remarkable similarity in the most important criteria of the ontogeny among themselves and with the related genus *Micromphale* (*M. perforans* (Hoffm.: Fr.) S.F. Gray; see Reijnders, 1963: 69, 150, pl. 23). They all are pileostipitocarpous and paravelangiocarpous.

There is some difference between the sections of the youngest stages of *Marasmius rotula* represented by Kühner (l.c.) (1980: fig. 174) and ours (1963: pl. 21). The fact is that in Kühner's illustrations the tissue at the side of the stem, which we would call lipsanenchyma, is much stronger developed; in the youngest stage even so strongly, that Kühner talks about a 'bourrelet' and thinks of 'endocarpy'. We do not believe, however, that this tissue ever was closed at the upper side and that it ever enveloped the whole primordium. In our figures this 'bourrelet' is indeed visible (1963: pl. 20 fig. 6, pl. 21 fig. 2); it apparently develops in the same way as the rings of *M. wynnei*. In *M. rotula* the margin of the cap is also pressed against the stem.

Apart from the amyloïdity one may wonder if the structural differences, which are the basis of the distinction of the genera *Marasmius*, *Marasmiellus*, and *Micromphale*, are sufficient to justify this distinction, where on the other hand there is such a remarkable conformity in the development of the basidiocarps. It is well known that in *Copri-*

us the structural differences are greater (see among others Reijnders, 1979) and that ne still has not succeeded in splitting up this genus in a satisfactory way. Especially in ases like the marasmioid fungi it would be of great value to know the development of nore species. See also Kühner's observations on marasmioid fungi (1980: 735–763).

5. *Panellus mitis* has been studied in order to be able to compare the development f this species with that of *Tectella patellaris* (Fr.) Murr. We had the good luck to obain primordia in all stages of the latter from the South of France. The results of our bservations on the development of this rare and important species have recently been ublished (Reijnders, 1983).

There are certainly a number of resemblances between *Panellus mitis* and *Tectella* uch as the character of the tramal hyphae (thick-walled, without strong inflation), the presence of the enveloping mucous layer and in the form and size of the spores. But the development is very different: in *Panellus mitis* stipitocarpous and gymnocarpous, from the beginning a continuous growth; in *Tectella* at least isocarpous and bivelangiocarpous with a primordium that remains short for a certain time, with a hymenium developing deeply internally, and with a veil that covers the hymenophore for a long time. Further observations are to be found in the above mentioned publication.

ACKNOWLEDGEMENT

The author is very much indebted to Dr. J. van Brummelen for making the photomicrographs.

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EXPLANATION OF THE FIGURES

Figs. 1–6. *Hygrophoropsis aurantiaca*. — 1. Tip of youngest stage × 172. — 2. Tangential section of cap and gills × 20. — 3. Median section; older stage × 10. — 4. Trama of young gill-fold × 223. — 5. Palisade on upper part of stem × 203. — 6. Surface of stem below palisade × 225.

Figs. 7–10. *Hygrophorus pudorinus*. — 7. Rather young stage; median section × 10. — 8. Margin of cap; young stage × 86. — 9. Surface of stem and margin of cap of rather advanced stage × 86. — 10. Surface of lower part of stem × 86.
Fig. 11. *Hygrophoropsis aurantiaca*; longitudinal section of trama of older gill × 330.

Figs. 12–16. *Tricholoma populinum*. — 12. Young stage × 86. — 13. Margin of cap of somewhat older stage × 220. — 14. Origin of margin of pileus in rather young stage × 105. — 15. Upper part of older primordium × 20. — 16. Gelatinized surface layer of cap of older stage × 220.
Fig. 17. *Tricholoma ustaloides*; young stage with veil × 56.

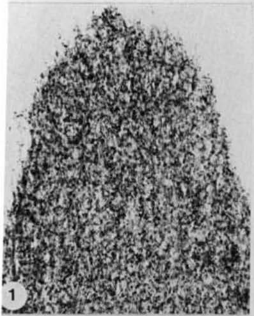
Figs. 18–21. *Tricholoma ustaloides*. — 18. Somewhat older stage × 70. — 19. Origin of margin of cap in young stage × 340. — 20. Somewhat more advanced stage × 56. — 21. Margin of cap of more advanced stage × 170.
Fig. 22. *Marasmiellus candidus*; origin of hymenophore in very young stage × 347.

Figs. 23–26. *Tricholoma vaccinum* — 23. Very young stage × 59. — 24. Somewhat older stage with margin of cap × 72. — 25. Margin of cap of more advanced stage × 226. — 26. Upper part of primordium of more advanced stage × 71.
Figs. 27–28. *Marasmiellus candidus*. – 27. Young stage × 213. — 28. Rather young stage with veil × 138.

Figs. 29–33. *Marasmiellus candidus*. — 29. Rather young stage (veil cast off) × 86. — 30. Somewhat more advanced stage with last fragments of veil × 43. — 31. Tangential section of a rather young stage × 213. — 32. Young gill-fold × 259. — 33. More advanced stage with beginning of one-sided development of cap × 35.
Figs. 34. *Marasmius wynnei*; very young stage without differentiation × 86.

Figs. 35–39. *Marasmius wynnei*. — 35. Very young stage with differentiation of margin of cap × 136. — 36. Young stage (note rib below margin of cap) × 86. — 37. Detail of preceding section × 345. — 38. More advanced stage with two zones in trama of cap × 55. — 39. Intermediate stage with margin of cap pressed against stem × 57.

Figs. 40–42, 44–45. *Panellus mitis*. — 40. Very young stage (gelatinized coating reaching up to halfway) × 86. — 41. Young stage with gelatinized layer enveloping whole primordium × 43. — 42. Distal part of somewhat older stage × 86. —44. Advanced stage with hymenium at distal end × 87. — 45. Median section of advanced stage × 12.
Fig. 43. *Marasmius wynnei*; detail of margin of pileus and rib below margin × 340.



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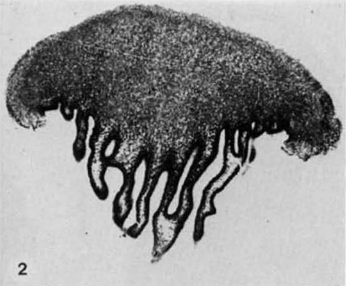

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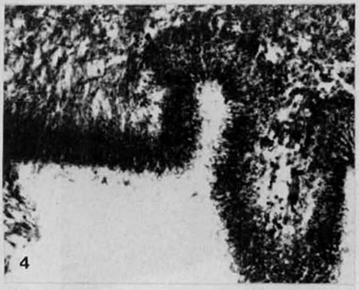

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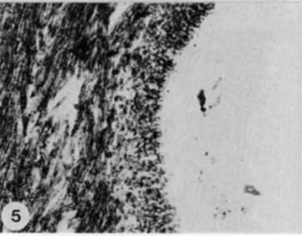

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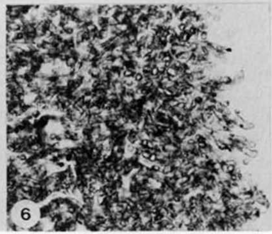

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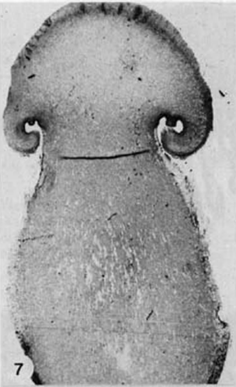
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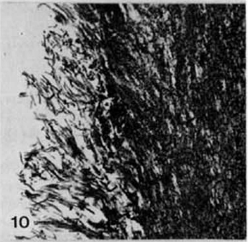
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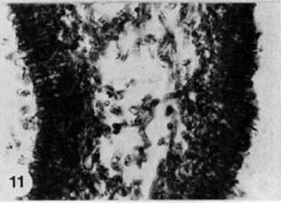
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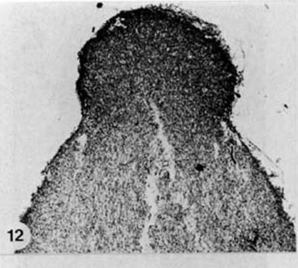
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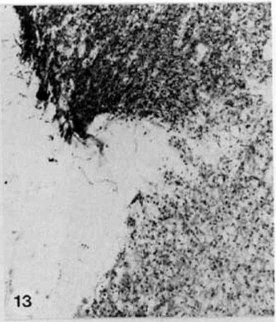
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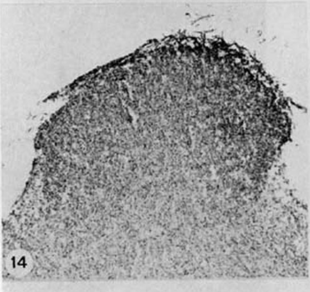
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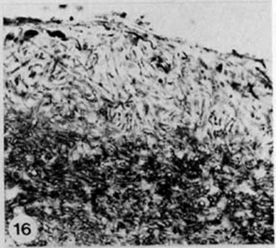
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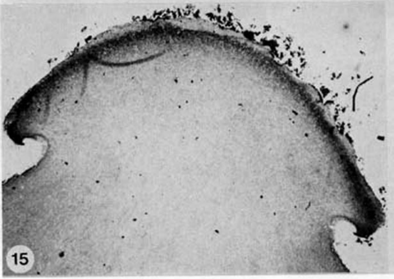
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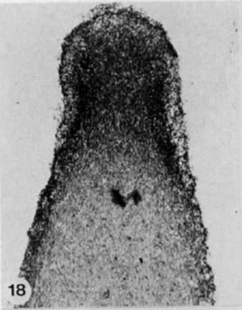
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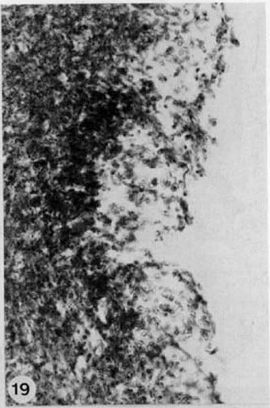
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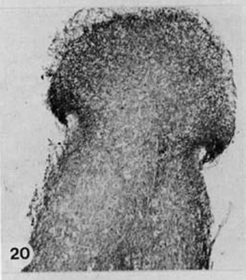
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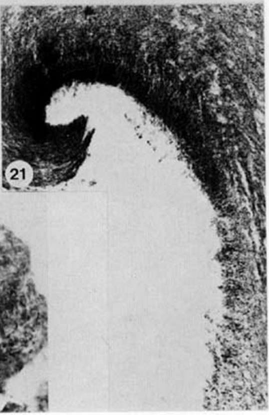
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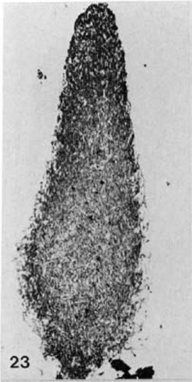
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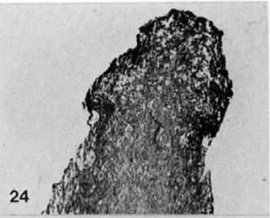
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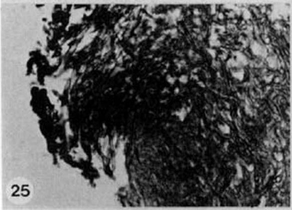
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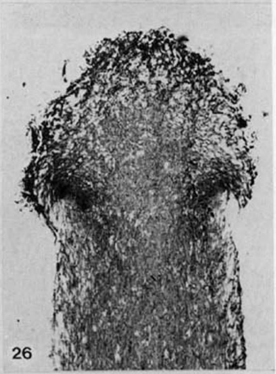
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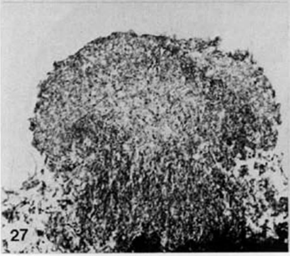
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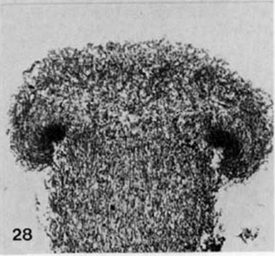
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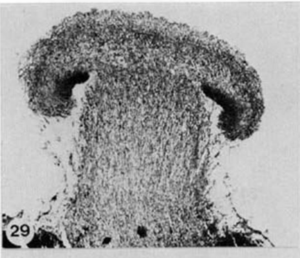
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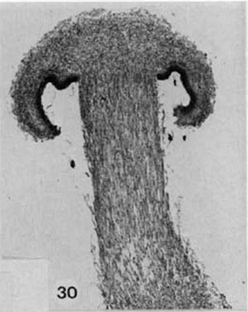
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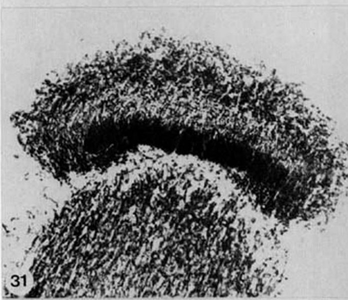
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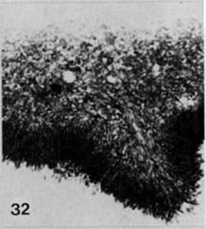
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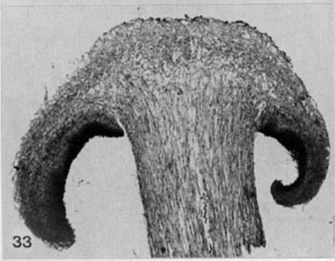
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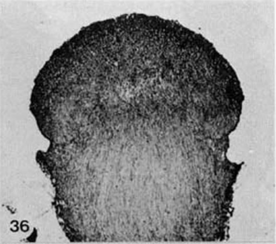
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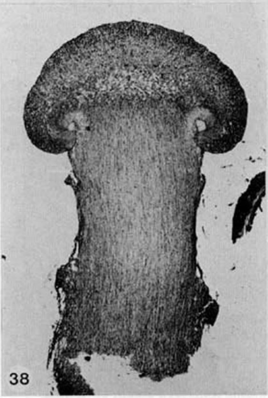
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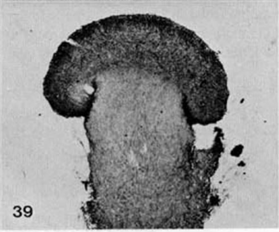
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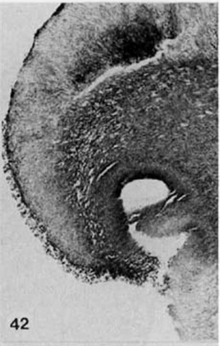
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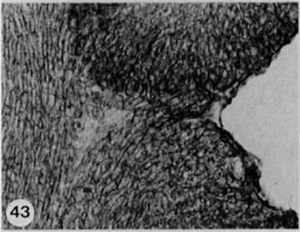
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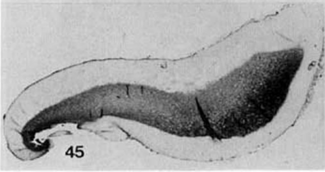
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THE CLAVARIOID RAMARIA SUBGEN. ECHINORAMARIA

E. J. H. CORNER

*Cambridge**

This article investigates the re-arrangement in classification proposed for this subgenus in the monograph by R.H. Petersen (1981). It is found to be wanting in many ways.

The recent monograph by R.H. Petersen (1981) deals with 35 species from all parts of the world and, in his introductory words, has 'brought to order' the subgenus. As the only one who could be held responsible for the previous disorder, I perused the work with growing wonder that has led to this criticism. Many differences between the author and myself are glossed over unexplained if, indeed, mentioned; there are many misleading directions, careless mistakes, omissions, and idiosyncracies. Among the tropical species I find what I can only call colloquially a rare old muddle. The specialist may feel bound to tussle with the work but the attentive student will be bewildered. My advice is to consult original articles, wherever cited, to ascertain the facts.

The approach is not prepossessing. Nowhere are we told how the subgenus is to be recognised. A lengthy subgeneric description relays features which refer to *Ramaria* as a whole and it is not until line 15 that the decisive character appears without indication. The author makes 6 new species, 1 new variety, 7 new combinations, and 6 'stat. nov.'. This information is not in the author's nomenclator or in the index; it can be gathered only by turning one by one 144 pages of the text. During this labour, I met variations in type-setting for equal taxa and in the citation of authors, e.g. Petersen and Pet., as well as species without author's name. There have been two previous systematists of this surname, J.B. Petersen (1887–1961) and O.G. Petersen (1847–1937); strictly, the citation should be R.H. Petersen. Then I noticed that all of the four colour-plates covered more than one species or variety and that, while the legends were numbered for distinction, the individual pictures were not. The expert may puzzle them out but the student will have great difficulty.

The descriptions are full but very confusingly prolonged with trivialities. Italics are not used to emphasize salient points which are hard to trace through the diagnostic, yet faulty, key. Thus it is difficult to learn the author's concepts of the species. The reader is left to work them out and, in doing so, will wonder why details in one case are characters in another, mostly in the lesser understood. Indeed, criteria in the key are often ignored or distorted in the ensuing text. Under every species there are references for

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nomenclature but few, if any, for biological or floristic information. Some mycologists who have contributed much to the subject, such as Petch in Ceylon, Pilat in Czechoslovakia, and Maas Geesteranus in Holland, are practically forgotten.

The text opens with a historical account. The first sentence leads us to infer that Persoon began the study of *Echinoramaria* in 1797. We are, then, taken through the rigmarole of what I call the dark age of mycology, in growing wonder that the history of *Ramaria* and *Lachnocladium*, so much confused with *Echinoramaria*, has no bearing on the subject. The history ends on p. 6. We read on and come, almost incidentally, on a line of nomenclatural reference (p. 35) which implies that the subgenus was not created until 173 years later. There is no mention of a type-species here or anywhere in the monograph. Is it Persoon's *Clavaria abietina*? If the reader refers to the original account of the subgenus in 1970, he will find that it is a species unknown to Persoon who had, in fact, no thought about such a subgenus. It was first mooted as Echinospora (Corner, 1950) but not instated as *Echinoramaria* until twenty years had elapsed and provided satisfaction. The real, if very brief, history of the subgenus is omitted. Misgivings multiply as we read such generalisations that the north temperate species have relatively small spores, and find later in the text that the north temperate *R. americana* and *R. broomei* have very large spores. The misspelling of the Linnean Society of London (p. 64, 71, 182) seems unscholarly.

In the section on taxonomic characters and in several specific descriptions it is often not clear whether the author refers to living or dried fruit-bodies; it is a common and tiresome failing in many monographs. Agglutinated hyphae in these clavarias must refer to the dried specimen; darker or paler branch-tips may refer to the living or the dead; we are not sure. There is no explanation how branching alters as the fruit-body grows, how the hymenium may thicken, and how the sterile hymenium may form; it is as if no one had cared. The last sentence on p. 13, about the colour of the fruit-body in tropical species is far from the truth; it was through the study of these species that the importance of the feature was realised.

Spores become a main consideration. The author supplies SEM photographs of the spores of all available species. The trouble is that these pictures, however excellent, seem to numb understanding. In this monograph they are in such disorder that comment is difficult. The spores are shown from different angles, in different positions, and at some thirty different magnifications (× 5400 to × 22500). Different examples of one species are on different plates where they are mixed up with others at different magnifications. The author distinguishes five sorts of spines or warts but we are not shown how the spines develop, whether sharp from the first or as warts that sharpen, at what spacing, how they may join, and whether or not spine-tips are broken off in the course of preparation. There is no systematic co-ordination of the details. When the pictures have been sorted out, it is still uncertain whether those with short or obtuse spines or warts represent mature or immature spores. In this connection a paragraph (p. 19) debates whether the spores of *R. suecica* refer to the species to *Echinoramaria* or not, without noting that it has already been done (Corner, 1970).

In a section on 'Interpretation of Spore Statistics' the author considers the sporograph and has a graph of a 'sporogram' (relation of length to width of the spore). In not understanding, however, that this relation is hyperbolic and refers to the volume of the spore which refers, in turn, to the volume of the basidium, the author overlooks spore-number, basidium-width, and the ampoule-effect. The result is the confused information in his uncritical Table 1 and his faulty conclusions. He alters for no reason the notation for these relations which I introduced in 1947 and have used consistently (Corner, 1972) in order to emphasize the most important relation *d/w* (spore-width to basidium-width). On such uncertain ground he complains that I erred in comparing the spores of *R. botrytis* with those of *R. formosa*, though both belong to subgen. *Ramaria*; and he misleads by stating that the spore of *Echinoramaria* may be boletoid.

In the subgeneric description it is not mentioned if the spines are coloured, if the spores have oil-drops, or if the spore may be in any way amyloid. 'Odor none to mild' is not what others have written.

The introductory part of the monograph concludes with some meagre remarks on phylogeny. The careful reasoning and thoughtful conclusions of others are not permitted in this prerogative where *Gomphus* is just another spore.

In the ensuing descriptive part of the work I find that the three series which I had offered purposely and comprehensively on the same page, had clearly distinguished, and had provided with types, have been brushed aside without comment, not even historical. In their place the author puts two sections, *Dendrocladium* (Pat.) Peterson on p. 44 and sect. *Flaccidae* (Corner) Petersen in different type on p. 100. There is no direct comparison between them. The first is given a lectotype, the uselessness of which is at once apparent, and the second, which is a plural adjective and not a sectional substantive, has no type. As I turned page after page to discover what the author intended I came upon his confession that he did not know himself, that he could not distinguish the sections, and that for this lack of reason their species were mixed up throughout the one diagnostic key for their determination. By taking botanical names published by others, altering the position or status of these names, and adding his own, the author avoids a critical latin diagnosis and saddles botany in a way that neither he nor another can ride.

For sect. *Dendrocladium* Petersen makes *Lachnocladium giganteum* Pat. a lectotype, and gives as an exact synonym the genus *Dendrocladium* (Pat.) Lloyd (1919). Lloyd, however, did not include *L. giganteum* in his genus for which a totally different species had been chosen for the type by Stevenson & Cash in 1935. Petersen omits these points which vitiate his intervention, though he could hardly have been unaware of them (Corner, 1950, 1970). What, then, is *L. giganteum*? In the works just cited, I referred it either to *R. cyanocephala* (Berk. et Curt.) Corner or to *R. zippelii* (Lév.) Corner because, in the absence of essential colour-notes, *L. giganteum* could not be identified more exactly. Now, *R. cyanocephala* is the type of subgen. *Echinoramaria*, which this monograph is at pains not to mention. Its author splits the type-species into *R. grandis* f. *cyanocephala* (Berk. et Curt.) Petersen (listed as var. *cyanocephala* in the index) and *R. zippelii* f. *aeruginosa* comb. nov. in different print and without the symbol (Pat.) Pet.

So the type of the subgenus is degraded to the minimum of nomenclatural status as two forms of different species. Whether this has brought the subgenus to order needs examination.

R. cyanocephala is a wide-spread and common, tropical and subtropical, species extremely constant though habitually altering in appearance, living and dried, as it grows. I have studied it from many living specimens in Asia and tropical America. It produces some of the largest fruit-bodies in the genus and these, with slow growth, are long-lived. My reasons for holding it apart from *R. zippelii* were clearly given in 1950. Petersen, in disregard, states 'Corner apparently assumed that only one blue-tipped fungus existed ....' and infers (p. 99) that Corner was misled by his own illustrations. Yet, Corner had studied the growth of individual fruit-bodies and recorded their change in colour, form and texture. What, then, are the two blue-tipped forms of the two species to which Petersen refers? They are distinguished in his diagnostic key (p. 37, item 5) by features of the branch-tips and dried appearance. Both features are simply the difference between young and old fruit-bodies of *R. cyanocephala*. The young fruit-bodies are *R. grandis* f. *cyanocephala*; old fruit-bodies are *R. zippelii* f. *aeruginosa*; I have watched the one grow into the other. Neither belongs with the species to which Petersen refers them. The mistake arises from that failure to understand the branching of the fruit-body, which I have mentioned, and failure to follow the course of development.

Now, *R. grandis* dates from *Clavaria grandis* Peck (1902) and *R. cyanocephala* from *Clavaria cyanocephala* Berk. & Curt. (1868). By the rules of nomenclature, one should write *R. cyanocephala* f. *grandis* if this reduction is correct. However, according to the author's records, *R. grandis* f. *grandis* lies outside the distribution of f. *cyanocephala*, which would not be expected of a forma. Thus it happens that an elementary error induces the author to split a species into two, to associate the halves wrongly, to break the nomenclatural code, and to maintain this course as the restoration of order.

I return to *L. giganteum*. Petersen's description is compounded from four sources, one of which is *R. zippelii* var. *gracilis* Corner; it supplies the only information on living colours. In recording this variety from the Malay Peninsula, the Solomon Islands, and Brazil, I published colour-notes and the fact that the spores were consistently smaller than those of var. *zippelii* and *R. cyanocephala*, as well as those of the types of *L. giganteum* and *L. echinospora*; they may be identical with those of *L. olivaceum* as given by Petersen (Table 4, p. 68). Petersen overlooks this difference as well as the occurrence of var. *gracilis* in the Malay Peninsula, as type-locality, and the Solomon Islands. Therefore I do not consider that var. *gracilis* belongs with his *R. gigantea*. A critical point for him is whether the basidia bear 2 spores (actually 1–2) or 2–4 spores (actually 2–3–4, rarely 1). Var. *gracilis* has 2–3–4. Concerning the type of *L. giganteum*, and therefore the type of sect. *Dendrocladium*, Petersen is oddly silent on this point just as he must be on the colour of its branch-tips. The large spores of *L. giganteum*, indistinguishable from those of *R. cyanocephala*, suggests that its basidia were (1–)2-spored and not 2–3–4-spored as Petersen gives in his compounded description. He does not explain the issue. According to his key, the species nearest to *R. gigantea* is *R. pancaribbea* Petersen. Two distinctions are given, the first in spore-ornamentation and the second in the colour of the fruit-body, but as this is not known for *R. gigantea* except as var. *gracilis* which is to be excluded, there is only the first difference. Examination of Petersen's plates of the spores shows more difference between the two examples of *L. olivaceum* (a synonym of *R. gigantea*) than there is between *R. pancaribbea* and the other synonyms of *R. gigantea*. It may be that *L. olivaceum* is *R. zippelii* var. *gracilis* and that *R. gigantea* (from French Guyana) is *R. pancaribbea*, but *R. gigantea*, as compounded in this monograph, is unrecognisable. It is no wonder, therefore, that the whole section *Dendrocladium* is unrecognisable. I note that *pancaribbea* is the spelling in the text, the index, fig. 28, Plate 7 and Plate 12, but that it is *pancarribea* in the key and the colour-plate. This resurrection of *Dendrocladium* reveals the dead hand of that necrotic nomenclature from whose annihilating grasp biology must escape. We are returned in this monograph to the dark age of mycology.

As regards *R. zippelii*, Petersen chooses a neotype in the apparent type of *Clavaria phaeocladia* Pat., but he does not say what was the colour of the living fruit-body (so essential for distinction from *R. cyanocephala*) or whether the basidia are 2-spored, or why Patouillard described the spores as smooth. This neotype is equally unidentifiable. Omitted, too, is the habitat of *R. zippelii* and its occurrence in tropical Africa. Whereas I reduced *Lachnocladium hookeri* to *R. zippelii* on account of its large spores, though with doubt because the colour of the branch-tips was not known, Petersen refers it to *R. mutabilis* of sect. *Flaccidae* with much smaller spores, and omits reference to my conclusion. Original work must be consulted.

Next, I enquired into *R. fragillima* which, as *Clavariella fragillima*, van Overeem had taken up. Petch and I followed him because there was no denying his contention. In this sence the name has been used for over fifty years. Petersen states that our work was based on folklore (p. 21) and, unfamiliar himself with this wide-spread tropical fungus, makes it part of *R. cokeri* Petersen (1976); he discards *R. fragillima* as a *nomen dubium* and seeks justification in the falsified remark that I had said that my description of *R. fragillima* was 'seriously at odds' with the original description. I never wrote that, but pointed out two discrepancies of little weight. If *R. cokeri* were identical with *R. fragillima*, I would reduce *R. cokeri* accordingly and note that the purpose of nomenclature is the conservation of names, not their frivolous debunking. When it comes to comparing the two species in detail, it will be noticed that Petersen's colour-plate of *R. cokeri* does not show the red branch-tips invariably present in *R. fragillima* and that there is considerable difference between their spores as shown in Petersen's plates. Their identity has yet to be proved.

In several places, especially in the specific key, Petersen insists that only 2-spored basidia (not those with 2–3–4 spores) have yellow or yellow-brown contents. Reference to my description of *R. fragillima* will show that its living basidia with 2–3–4 spores have yellowish brown contents. Likewise I noted this for the (2–)4-spored basidia of *R. invalii*, which Petersen reduces to *R. eumorpha* in his dubious sect. *Flaccidae*. He overlooks these unsolicitied facts which prove that his dictum is wrong.

R. zippelii var. *cristatospora* becomes *R. cristatospora* (Corner) Petersen with the false remark that Corner gave no description. Its fruit-bodies agree with those of var. *zippelii* in all points, as I did explain, except for the markings on the spores. I added that in one collection several spores had scattered spines as in var. *zippelii*; hence I saw no reason for supposing a specific difference. Petersen has a SEM illustration of one spore and a line-drawing of two others. None shows the typically cristate marking, as illustrated by me and corroborated by Perreau, but all show the intermediate character of var. *zippelii.* Petersen refers to a sporograph but, without analysis into spore-number, it is not helpful. Modern mycology tends to deny specific variation; splitting, such as this, prevents it. A similar case is *R. campestris*, described originally as *R. zippelii* var. *campestris*. It is extremely close to var. *zippelii* and differs mainly in its habitat in open grassland; Petersen, as noted, fails to give the habitat of *R. zippelii*. He compares his *R. campestris* with his *R. cokeri* but forgets its different habitat in forest soil and that it should have red branch-tips. For *R. campestris* he gives the tips as concolorous with rest of the fruit-body in the key and as white in the description where the fruit-body is not white.

As regards *R. broomei* which seems to take over from the error of *Phaeoclavulina nigrescens* introduced by Coker and Donk, I note that in discussing its distribution Petersen overlooks Imai's record from Japan and omits from his description the all-important spore-number. This species introduces the difference between Petersen's treatment of his first nine species and mine. I preferred the character of the fruit-body; he prefers, without mention of my point of view, the spore-number of the basidium. That most of his 2-spored species have their 2–4-spored counterparts in fruit-body character escapes his notice; thus, *R. apiahyana* – *R. fragillima, R. broomei* – *R. americana, R. cyanocephala* – *R. pancaribbea* (? *R. gigantea*), *R. guyanensis* – *R. longicaulis,* and *R. zippelii* – *R. grandis,* with *R. zippelii* var. *gracilis* and var. *cristatospora*. In many homobasidiomycetes 2-spored states occur as variants or close allies of the 4-spored. I still hold this opinion for subgen. *Echinoramaria* which these pairs of species re-inforce, and continue to uphold the red, white, and blue of *R. fragillima, R. zippelii*, and *R. cyanocephala.*

Sect. *Flaccidae* untypified and indefinable, sets off with one of those endless nomenclatural wrangles that are so useless and frustrating for the progress of science. It is over the correct botanical name for the common little virescent clavaria of northern coniferous forest, which Petersen says is rare. He calls it *R. abietina* with a prolonged and one-sided account without reference to the alternative standpoint which advocates *R. ochraceovirens*; he dumps this name as a *nomen dubium* because he cannot find an original specimen, though the original description has left no doubt about the identity of the fungus. This is in contrast to his procedure with *R. zippelii* which he upholds though it, also, has no type-specimen and was accompanied by a much poorer description; as noted, he denies this privilege also to *R. fragillima*. So pundits vacillate, and what does it matter? What we need is stability that will not cloud knowledge with synonyms. The code, or rules, is inadequate. I am reminded of the breadfruit tree which has three apparently plausible botanical names without decision; we use the vernacular. It would serve science better if these these disputes were settled by an international referee tossing a coin or drawing names from a hat.

The dichotomy of the key which begins the species of sect. *Flaccidae* has 'Fruitbodies lignicolous' versus 'Fruitbodies terricolous', which means also humicolous. Anyone who as collected in primeval forest will know how difficult it may be to distinguish very rotten wood, of which there is plenty, from humus. However, by this uncertain means, etersen extracts *R. articulata* and *R. camellia* as lignicolous. For the first there is Siner's field-note 'rather superficially on dicot wood'. For the second, Petersen overlooks he type-habitat 'inter folia ad humum in silvis'. At the outset the key does not work; it oes on faltering. *R. ochracea* is put among the terricolous though the type-collection has the note 'ad truncos putridos', as Petersen quotes but fails to enter in his specific description. He would refer to this species some collections from South America without mentioning their habitat. It seems that he would treat as other synonyms *R. flaccida* ar. *chilensis* (terricolous) and *R. intricatissima* (on fruits of *Eucalyptus*). The criteria in he key are nullified in the ensuing text and it becomes impossible to understand what he author means by a species in a group where species-mongering is rife. There is the naïve distinction between under bamboos in contrast with under trees which, of course, may grow over or under bamboos. Thus a bamboo-species is extracted as *R. capucina* Pat.) Pet., which is a superfluous name (Corner, 1950, 1970). The equally unreliable feature of the unilateral hymenium is introduced without explanation of its fallibility. R. *eumorpha* is said to have dull-coloured fruit-bodies which does not agree with the well known *R. invalii*, reduced as a synonym. For *Clavariella subspinulosa* and *Clavaria spinulosa* no author is given; neither is in the index or nomenclator; their synonymy is confused. *R. flaccida* is thought to be rare; it has also escaped the nomenclator. *R. incognita* has no habitat. The vinescence of *R. myceliosa* is confused. *R. subdecurrens* has no author. For the last species in sect. *Flaccidae* (*R. tropicalis*) the only other with which it is compared is *R. pancaribbea* of sect. *Dendrocladium* thus finalising the futility of these impositions.

Another dichotomy of the key is between spores over or under a mean (average of ten measures) length of 5.6 μm. As this implies averaging spores from 2–3–4-spored basidia, I am not convinced that ten measures are enough. I compared Petersen's results for *R. cyanocephala* and *R. fragillima* with the measures of fifty spores given by me (Corner, 1950), and found discrepancies of 7–8%.

The text ends with the section 'Nomina Miscellanea Deposita' where some twelve species or specific names are, through sundry pretexts, deposed; perhaps 'Disponenda' was intended. Thus, the first, as *Clavaria acutissima* Berk., is deposed because Peterson is puzzled. He refers this fungus with yellow-brown spores to *Clavulina* without a reason. The last is *Clavaria tubulosa* auct., which is in fact *C. tubulosa* Fr. with a type-specimen that Petersen overlooks. It is the common pantropical *Lachnocladium tubulosaum* (Fr.) Lév. (Corner, 1970). I note that *R. angustata, R. flaccida* var. *longiramosa*, and *R. fuscobrunnea* have escaped deposition as they have escaped this wayward monograph entirely. I close the book with thorough distrust.

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NOTULAE AD FLORAM AGARICINAM NEERLANDICAM
Introduction

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After more than 30 years of intensively collecting, describing and studying agarics in the Netherlands, both by professional and amateur mycologists, it was felt that the time had come to endeavour the publication of a critical Agaric Flora of the Netherlands, in order to make the accumulated data on taxonomy, ecology, phenology, and distribution of Netherlands' agarics available to everyone interested in any aspect of the agarics.

In spite of the work on agarics up to now done in the Netherlands, the many recent (but often conflicting) publications in Europe, and the rather limited agaric flora of the Netherlands (the total number of species being estimated at 1600), this is certainly not a mean task, if 'critical' as used above is taken to mean that (i) this Flora, as much as possible, be based on original observations, (ii) all taxa, although often to be treated by different authors, be rather extensively described in an entirely comparable way, (iii) the habit and the most important microscopical characters of each species be illustrated, and (iv) the most recent edition of the International Code of Botanical Nomenclature be closely followed.

Fortunately several mycologists, academically trained in the fields of taxonomy and floristics of agarics, were available, while the "Netherlands' Organization for the Advancement of Pure Research (Z.W.O.)" was found willing to supply a generous grant, allowing four of them to join temporarily the two staff-members of the Rijksherbarium participating in the project. This, together with the voluntary, but considerable co-operation of some other mycologists (professionals as well as amateurs), should make it possible to complete the publication of the 'Flora agaricina neerlandica' within a limited number of years.

The project is well on its way now. Publication in 3 volumes, written in the English language, is planned; the manuscript of the first of these, in which Hygrophoraceae, Tricholomataceae s.l., Pleurotaceae, Entolomataceae and possibly also Pluteaceae and Amanitaceae will be treated, is expected to be completed in 1984.

The working team of the 'Flora agaricina neerlandica' is well aware of the fact that the Netherlands are by no means a well-delimited mycogeographical unit. Therefore collections available from adjacent areas will be taken into consideration also. Taxa not yet recorded from the Netherlands, but to be expected here on the strength of their ecology and/or distribution, will at least be included in the keys with references to descriptions in literature.

Notwithstanding the vast and still rapidly growing amount of literature on temperate agarics, it has already turned out that taxonomic and nomenclatural problems remain to be solved in almost all genera, sometimes even in the case of very common fungi. In order to avoid lengthy discussions on taxonomy and nomenclature in the 'Flora' itself, a separate series of numbered precursory 'Notulae' is started, the first three of which are to be found on the following pages. More will follow. New taxa and new names will also be published in these 'Notulae'.

Comments on these 'Notulae' from colleagues disagreing with certain concepts or observations are kindly requested and will be taken into serious consideration.

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NOTULAE AD FLORAM AGARICINAM NEERLANDICAM — I-III

Marasmiellus, Macrocystidia and Rhodocybe

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Keys to and critical notes on the European species of the genera *Marasmiellus* and *Rhodocybe* are given. The nomenclature of *Macrocystidia* is elucidated. Two rare species, viz. *Rhodocybe melleopallens* and *R. fallax* are fully described and illustrated. *Rhodocybe mundula* is reduced to the synonymy of *R. popinalis*. *Rhodocybe nauceodulcis* is transferred to *Omphaliaster*. The new combinations *Rhodocybe microsporum* (Velen.) Noordel., *Marasmiellus omphaliformis* (Kühn.) Noordel., *Omphaliaster nauseodulcis* (Horak) Noordel. and *O. kyrtosporus* (Horak) Noordel. are made.

I. **Marasmiellus** Murr.

In the present paper Singer's concept of the genus *Marasmiellus* is fully accepted (Singer, 1973). For details on the generic limits and infrageneric taxonomy the reader is referred to the cited publication. Although the European flora is comparitively poor in species, only 8 species being known so far, I am sure that an increasing interest in little whitish mushrooms on various debris of woody plants and herbs will lead to interesting discoveries. In two previous publications (Noordeloos, 1975, 1977) extensive descriptions are given of *Marasmiellus trabutii* and *M. pachycraspedum*. In the present paper a key to all European species is given, followed by a checklist with critical notes on nomenclature, taxonomic position and chorology. Full descriptions of the species occurring in the Netherlands, viz. *Marasmiellus ramealis, M. vaillantii, M. trabutii, M. tricolor, M. pachycraspedum,* and *M. candidus* will appear in the first part of the Flora agaricina neerlandica. Two extralimital species, *Marasmiellus humillimus* and *M. omphaliformis* are characterised by a summary of their most important characters.

KEY TO THE SPECIES OF MARASMIELLUS IN EUROPE

1. Most of the spores longer than 11.5 µm 2
1. Most of the spores shorter than 11.5 µm 3
2. Cheilocystidia 30–50 × 5–9 µm, irregularly cylindrical-coralloid or clavate-coralloid (Fig. 2); pileipellis with well-developed ramealis-structure (Fig. 11); pileitrama gelatinised; on dead leaf-sheaths of *Juncus maritimus* in salt-marshes . . . . 1. *M. trabutii*

2. Cheilocystidia 45–90 × 6–12.5 (at base) × 3–5 (at apex) µm, filiform to slenderly lageniform with swollen basal part and long, slightly tapering neck (Fig. 4); pileipellis made up of c. smooth hyphae and long dermatocystidia (Fig. 12); pileitrama not gelatinised; on twigs, branchlets and other debris of woody plants in deciduous forest . . . . 2. *M. candidus*
3. Cheilocystidia absent 4
3. Cheilocystidia present 5
4. Pileipellis with strongly developed ramealis-structure (Fig. 6); on grasses . . . . . . 3. *M. tricolor*
4. Pileipellis a trichoderm of long, tapering, brown, setulose hairs (Fig. 10) without ramealis-structure . . . . 4. *M. omphaliformis*
5. Cheilocystidia clavate of broom-cell type (Fig. 1) with finger-like excrescences in upper half . 6
5. Cheilocystidia different 7
6. Basidiocarps minute; pileus 1.5–3.5 mm broad, white or creamy; spores 7–10 × 2.5–3 µm, subfusiform to subcylindrical; stipitepellis with non-encrusted, cylindrical hairs; on grass 5. *M. humillimus*
6. Basidiocarps larger; pileus 2–20 mm broad, creamy pink to yellowish brown; spores 7.8–11 × 2.5–4 µm, subcylindrical to bean-shaped; stipitepellis with encrusted, coralloid hairs; on various debris of woody plants, rarely on herbaceous plants . . . . 6. *M. ramealis*
7. Cheilocystidia clavate, usually encrusted (Fig. 5); lamellae with thickened edge; pileipellis with weakly developed ramealis-structure (Fig. 8); terrestrial among mosses . . 7. *M. pachycraspedum*
7. Cheilocystidia coralloid with one or more bladder-like projections (Fig. 3); lamellae with normally thick edge; pileipellis without or with poorly developed ramealis-structure (Fig. 9); on grasses, sedges or branchlets of trees (*Alnus, Fraxinus, Corylus,* etc.) . . . . 8. *M. vaillantii*

ANNOTATED CHECKLIST

1. **Marasmiellus trabutii** (Maire) Sing. in Lilloa 22: 300. 1951.—*Marasmius trabutii* Maire in Bull. Soc. bot. Fr. 57: 278–279. 1909.—Figs. 2, 11.

Clitocybe caespitosa Pat. in C. r. Congr. Socs sav. Paris, Sect. Sci.: 248. 1909, non Peck 1888.—*Marasmiellus caespitosus* (Pat.) Sing. in Pap. Mich. Acad. Sci. 32: 129. 1949.

Selected description and illustrations.—Noordeloos in Persoonia 8: 223–226 (as *M. caespitosus*). 1975.

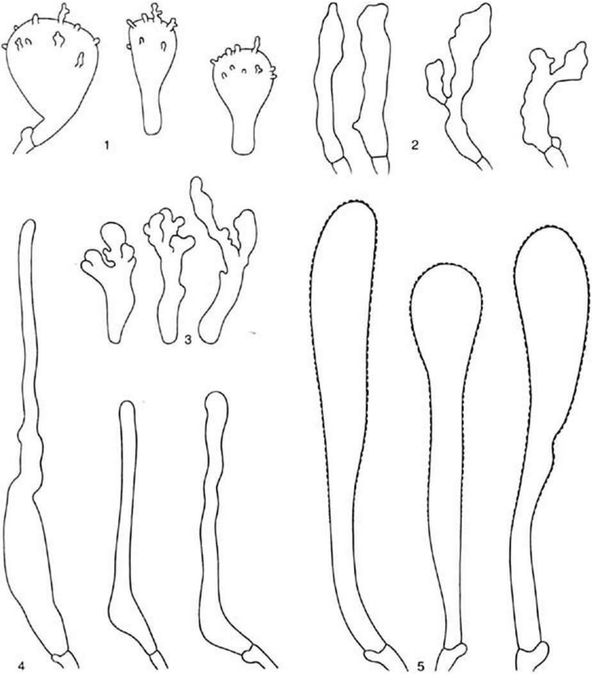
When I published a description of the Netherlands' rediscovery of *Marasmiellus caespitosus* (Pat.) Sing. I was not aware of the fact that *Clitocybe caespitosa* Pat. is an illegitimate name, being a later homonym of *Clitocybe caespitosa* Peck 1888 in Rep. N.Y. State Mus. 41: 61. Thus *Marasmius trabutii* is the oldest valid and legitimate name for *Clitocybe caespitosa* Pat. As a consequence the binomial *Marasmiellus trabutii* (R. Maire) Sing. has priority over *Marasmiellus caespitosus* (Pat.) Sing.

2. **Marasmiellus candidus** (Bolt.) Sing. in Pap. Mich. Acad. Sci. 32: 129. 1948.—*Agaricus candidus* Bolt., Hist. Fung. Halifax 1: 39. 1788.—*Marasmius candidus* (Bolt.) Fr., Epicr.: 381. 1838.—Figs. 4, 12.

Agaricus albus-corticis Secr., Mycogr. Suisse 2: 229. 1833 (not val. publ.).—*Marasmiellus albus-corticis* (Secr.) Sing. in Lilloa 22: 300. 1951 (not val. publ.).

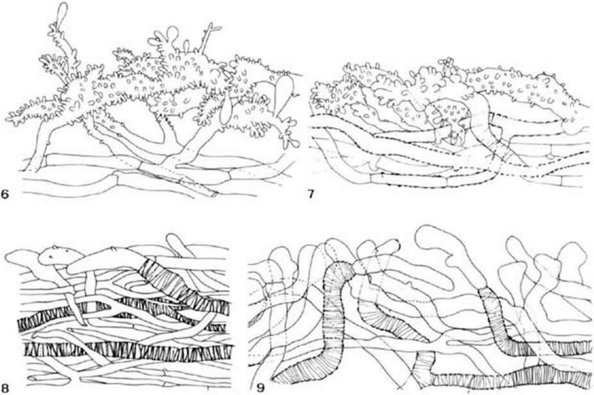
Marasmius magnisporus Murr. in Mycologia 4: 166. 1912.

Selected descriptions and illustrations.—Kühner, Botaniste 25: 109–111. 1933.—Malençon & Bertault, Fl. Champ. Maroc. 2: 354–356. 1975.—Phillips, R., Mushrooms and other fungi: 67. 1982.



Figs. 1–5. Types of cheilocystidia in *Marasmiellus*. — 1. *M. ramealis*. — 2. *M. trabutii*. — 3. *M. vaillantii*. — 4. *M. candidus*. — 5. *M. pachycraspedum* (all figs. 1000 ×).

According to the Internationcal Code of Botanical Nomenclature (1978, art. 23.6 (c)), none of the names published by Secretan (1833) is considered validly published because Secretan did not consistently use the Linnaean system of binary nomenclature. As Singer did not supply a latin diagnosis, also the recombination *Marasmiellus albus-corticis* (Secr.) Sing. is invalid.

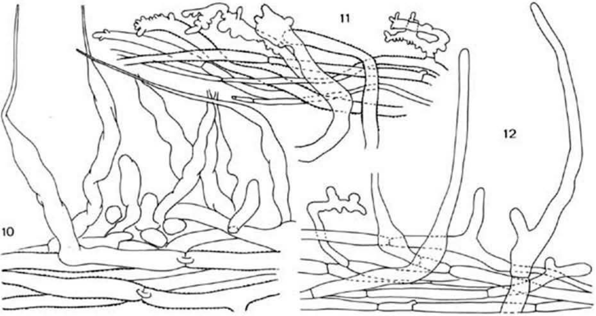


Figs. 6–9. Types of pileipellis in *Marasmiellus*. — 6. *M. tricolor*. — 7. *M. ramealis*. — 8. *M. pachycraspedum*. — 9. *M. vaillantii* (all figs. 670 ×).

In his monograph of the genus *Marasmiellus*, Singer (1973: 30) used the binomial *Marasmiellus albus-corticis* instead of *Marasmiellus candidus* (Bolt. ex Fr.) Sing., because according to him the latter name was preoccupied by the binomial *Marasmiellus candidus* (Bres.) Sing. 1951 in Lilloa 22: 298, a name now considered to belong to a species of the genus *Hemimycena*. If one accepts Singer's view and the decision of the 'Code' on Secretan's names, neither the binomial *Marasmiellus candidus* nor *M. albus-corticis* can be used for the well-known species concerned. Then the only other validly published name available for it is, according to Singer (1973: 30), *Marasmius magnisporus* Murr.

I disagree, however, with Singer on the priority of *Marasmiellus candidus* (Bres.) Sing. (1951) over *Marasmiellus candidus* (Bolt. ex Fr.) Sing., because in my opinion the latter combination has been published already in 1948.

Singer (1948: 128–130) published a note on some species intermediate between *Marasmius* and *Marasmiellus* in which he transferred *Marasmius* sect. *Rameales* Kühn. to the genus *Marasmiellus*. Simultaneously he explicitely transferred a number of species from *Marasmius* to *Marasmiellus*, proposing the following new combinations: *Marasmiellus trabutii*; *M. caespitosus; M. ramealis; M. anthocephalus; M. rugulosus*, and *M. nigripes*. *Marasmius candidus* (Bolt. ex Fr.) Fr. was not transferred in the same explicite way, but it was mentioned as follows: 'In view of the transitional character of certain tropical species such as *Marasmiellus semiustus* (Berk. & Curt.) Sing. and of certain European (*M. candidus* (Bolt. ex Fr.) Sing.) and Asiatic (*M. pseudoconidiophorus* Sing.) species



Figs. 10–12. Types of pileipellis in *Marasmiellus*. —10. *M. omphaliformis*. —11. *M. trabutii*. — 12. *M. candidus* (all figs. 670 ×).

between *Marasmius, Rameales* and *Marasmiellus* (= *Hemimycena*), I prefer to transfer the section *Rameales* to the genus *Marasmiellus*'. Because Singer cites the author's names (Bolt. ex Fr.) Sing. the only conclusion that can be drawn is that he meant *Marasmiellus* with 'M.' and not *Marasmius*, since in that case the author citation should have been (Bolt. ex Fr.) Fr. Singer (1962: 321) himself confirmed my theory while ranging as a synonym of *Marasmiellus albus-corticus* the following name: '*Marasmiellus candidus*' (Bolt. ex Fr.) Sing. 1948 non (Bres.) Sing. 1951'. Therefore I consider the binomial *Marasmiellus candidus* (Bolt.: Fr.) Sing. the correct name for the present species (according to the International Code of Botanical Nomencalture, art. 33.1, a new combination is considered to be definitely indicated when there is a typographic device which indicates that an epithet is associated with a particular generic name). Thus a widely used and undisputed epithet is saved. According to recent changes of the 'Code' the correct citation is: *Marasmiellus candidus* (Bolt.) Sing.

3. **Marasmiellus tricolor** (Alb. & Schw.: Fr.) Sing. in Pap. Mich. Acad. Sci. 32: 128. 1948. —*Agaricus tricolor* Alb. & Schw., Conspect. fung.: 228. 1805. —*Agaricus tricolor* Alb. & Schw.: Fr., Syst. mycol. 1: 166. 1821. —*Marasmius tricolor* (Alb. & Schw.: Fr.) Kühn. in Botaniste 25: 89. 1933. — *Marasmiellus tricolor* (Alb. & Schw.: Fr.) Sing. in Pap. Mich. Acad. Sci. 32: 128. 1948. —Fig. 6.

Agaricus languidus Lasch in Linaea 3: 385. 1828. —*Marasmius languidus* (Lasch) Fr., Epicr.: 379. 1838 (non sensu Kühn. & Romagn. 1953 = *M. vaillantii*). —*Marasmiellus languidus* (Lasch) Sing. in Lilloa 22: 300. 1951. (See type-study by Singer (1973: 315)).

Selected descriptions & illustrations. —Kühner in Botaniste 25: 89. 1933.

4. **Marasmiellus omphaliformis** (Kühn.) Noordel., *comb. nov.* —Basionym: *Marasmius omphaliformis* Kühn. in Bull. Soc. Nat. Oyonnax 8: 111. 1954. —Fig. 10.

Characteristics.—Pileus 7–19 mm broad, convex-umbilicate, beige-pinkish, pubescent to granulose-subsquamulose; lamellae L = 15–18, l = 0–1, arcuate-decurrent, white; stipe 8–14 × 0.7–1 mm, white at apex, brown to blackish below, entirely pruinose, attached to substratum with radiating mycelial strands. Spores 8–10 × 3.5–4.5 μm, ellipsoid; basidia 4-spored; cheilocystidia absent, occasionally in old specimens some filiform hairs present on lamellar edge; pileipellis a trichoderm of long, flexuose-cylindrical hairs attenuate towards apex, with brown walls; pileitrama brown-encrusted, metachromatic in Cresyl blue; clamp-connections present in all tissues.

Habitat & distribution.—On branches and other debris of woody plants; mediterranean. France, Maroc.

Collections examined.—France, Charente Maritime, Corniche de Nauzan près Royan, 2 Sept. 1935, R. Kühner (fragm. in PC).

Descriptions & illustrations.—Kühner, 1954, l.c. 86.—Malençon & Bertault, Fl. Champ. Maroc. 2: 373, fig. 79, 1975.

Within the genus *Marasmiellus* this is a remarkable species because of the trichodermal pileipellis with almost setiform hairs. In Singer's monograph (1973) *Marasmiellus omphaliformis* keys out in section *Stenophylloides* because of the presence of this type of pileipellis. Considering the European species it comes closest to *M. candidus*, which however widely differs in size and shape of spores, colour of the pileus, structure of the pileipellis, etc. Very peculiar is the metachromatic reaction of the trama in Cresyl blue, which I have never observed in other species of the genus.

5. **Marasmiellus humillimus** (Quél.) Sing. in Beih. Nova Hedwigia 44: 308. 1974.—*Collybia humillima* Quél., in C. r. Ass. fr. Av. Sc. (La Rochelle, 1882) 11: 389. 1883.—*Marasmius humillimus* (Quél.) Quél., Fl. mycol.: 316. 1888.

Marasmius flosculus Quél. in Bull. Soc. bot. Fr. 25: 289. 1879 (non Berk. 1842).

Marasmius anthocephalus Sacc., Syll. fung. 9: 69. 1891.—*Marasmiellus anthocephalus* (Sacc.) Sing. in Pap. Mich. Acad. Sci. 32: 130. 1948.

Marasmius flosculinus Bataille in Bull. Soc. Hist. nat. Doubs 30: 80. 1919.

Characteristics.—Pileus 1.5–3.5 mm broad, convex or slightly umbilicate, white or slightly tinged cream, radially grooved-sulcate, not translucent, smooth; lamellae L = 2–11, l = (0–)1, adnate, white with flocculose, concolorous edge; stipe 1.5–3.5 × 0.1–0.16 mm, fauve to brownish, becoming blackish brown in lower part, pale and apex, entirely white pruinose; spores 7.2–10 × (2.5–)2.7–3 μm, subcylindrical to subfusiform; basidia 4-spored, cheilocystidia clavate, 6.5–11.5 μm wide, with numerous filiform appendices at apex (broom-cells); pileipellis filamentous, hyphae 2–10 μm wide with strongly developed ramealis-structure; stipitepellis with smooth, cylindrical hairs.

Habitat & distribution.—On grasses, sedges etc., rare (overlooked?); France, Italy, Czechoslovakya.

Marasmiellus humillimus is one of the smallest European species of the genus and comes close to *M. ramealis* and *M. tricolor* in having a strongly developed ramealis-structure in the pileipellis. It differs from both species in size, colour, smaller, narrower spores and stipe-covering.

6. **Marasmiellus ramealis** (Bull.: Fr.) Sing. in Pap. Mich. Acad. Sci. 32: 130. 1948.—*Agaricus ramealis* Bull., Herb. Fr., pl. 336. 1786.—*Agaricus ramealis* Bull.: Fr., Syst. mycol. 1: 135.—*Gymnopus ramealis* (Bull.: Fr.) S.F. Gray, Nat. Arr. Br. Plants.: 611. 1821.—*Marasmius ramealis* (Bull.: Fr.) Fr., Epicr.: 381. 1838.—Figs. 1, 7.

Agaricus amadelphus Bull., Herb. Fr., pl. 550, fig. 3. 1791.—*Agaricus amadelphus* Bull.: Fr., Syst. mycol. 1: 135. 1821.—*Marasmius amadelphus* (Bull.: Fr.) Fr., Epicr.: 380. 1838.—*Marasmiellus amadelphus* (Bull.: Fr.) Mos., Kl. KryptogFl., 2. Aufl., 2b/2: 118. 1967.

Selected descriptions & illustrations.—Cooke, Ill. Br. Fungi, pl. 1082a (1127); 1082b (1127) (as *M. amadelphus*) 1889.—Lange, J., Fl. ag. dan. 2, pl. 48a, 1936.—Phillips, Mushrooms and other fungi: 67. 1982.

7. **Marasmiellus pachycraspedum** Noordel. in Persoonia 9: 275. 1977.—Figs. 5, 8.

Selected description & illustrations.—Noordel., 1977, l.c.

8. **Marasmiellus vaillantii** (Pers.: Fr.) Sing. in Beih. Nova Hedwigia 44: 313. 1973.—*Agaricus ericetorum β vaillantii* Pers., Synopsis: 472. 1801.—*Agaricus vaillantii* Pers.: Fr., Syst. mycol. 1: 136. 1821.—*Marasmius vaillantii* (Pers.: Fr.) Fr., Epicr.: 380. 1838.—*Marasmiellus vaillantii* (Pers.: Fr.) Sing. in Beih. Nova Hedwigia 44: 313. 1973.—Figs. 3, 9.

Misapplied names.—*Marasmius languidus* (Lasch) Fr. sensu Kühn. & Romagn., Fl. anal.: 86. 1953.—*Marasmius calopus* (Pers.: Fr.) Fr. sensu P.D. Orton in Trans. Br. mycol. Soc. 43: 303. 1960.—*Marasmius candidus* (Bolt.: Fr.) Fr. sensu J. Lange, Fl. agar. dan. 2: 25. 1936.—*Marasmius insititius* Fr. sensu P.D. Orton in Trans. Br. mycol. Soc. 43: 303. 1960.

Selected descriptions & illustrations.—Bresadola, Icon. mycol. 505–1. 1929.—Lange, J., Fl. agar. dan. 2: 47c. 1936 (as *M. candidus*).—Nathorst-Windahl in Acta Horti Gotoburg. 22: 78. 1958 (as *M. languidus*).—Singer in Beih. Nova Hedwigia 44: 313.1973.

The binomial *Marasmiellus vaillantii* is used here in accordance with Singer (1973: 313), and the use of *'Marasmius calopus'* as proposed by P.D. Orton (1960: 303) is rejected. In my opinion, which also agrees with that of Gilliam (1975: 31), *Agaricus calopus* Pers.: Fr. represents a small, pale, odourless form of *Marasmius scorodonius* which I collected several times during my studies in *Marasmius*. Furthermore, Persoon and Fries described *Agaricus calopus* as a fungus with a smooth, red-brown stipe, which excludes the possibility that it could be identical with *M. vaillantii*. *Marasmius languidus* (Lasch) Fr. sensu Kühner & Romagnesi (1953: 86) must be rejected as a misinterpretation. The diagnosis of Lasch and the type-study of Singer (1973, l.c.) clearly show that *Agaricus languidus* Lasch is conspecific with *Agaricus tricolor* Alb. & Schw. *Marasmius candidus* sensu J. Lange (1936, l.c.) is definitely identical with *Marasmiellus vaillantii*, and Lange's plate is an excellent and representative illustration of it. But the true *Agaricus candidus* is another species (see above). Two other synonyms suggested by Orton (1960, l.c.), viz. *Marasmius insititius* Fr., and *Agaricus angulatus* Batsch are also rejected. The first name stands for a doubtfull species, which moreover is published much later than *Agaricus vaillantii*, and *Agaricus angulatus* Batsch in its original sense is a tiny white fungus which probably is a species of *Mycena* or *Hemimycena*. Batsch mentioned a plate of Micheli (1729: 146, tab. 74, fig. 4) in the protologue, which I consider now the lectotype of *Agaricus angulatus* Batsch., and it is clear that *Marasmiellus vaillantii* has nothing to do with Micheli's and Batsch' fungus. Therefore I consider *Agaricus angulatus* a nomen dubium. Singer (1961: 6) proved that *Agaricus angulatus* sensu Persoon belongs to the genus *Psilocybe*. According to the recent change of the starting-point rules in the International Code of Botanical Nomenclature the combination '*Psilocybe angulata* (Batsch ex Pers.) Sing.' is no longer legitimate, as it is based on Persoons' misinterpretation of Batsch's species.

II. **Macrocystidia** Joss.

According to Donk (1962: 181) the generic name *Macrocystidia* should be attributed to Josserand, because that author was the first who used this name in print. Heim (1931: 71) originally published the genus *Macrocystis* to accommodate '*Naucoria' cucumus* Fr. Soon this name appeared to be a later homonym of *Macrocystis* Agardh 1824 and Heim started to use the new name *Macrocystidia* for it, for the first time in print, however, some months after the publication of Josserand, viz. Heim (1934: 127). The correct synonymy is given below:

Macrocystidia Joss. in Bull. Soc. mycol. Fr. 49: 376. 1934. Name change for *Macrocystis* Heim, Genre Inocybe: 71. 1931 (non *Macrocystis* Agardh 1824).

Agaricus subgen. *Hypomnema* Britz. in Ber. naturh. Ver. Augsburg 27: 196. 1883.

Also the transfer of the only European species of this genus to *Macrocystidia* has to be attributed to Josserand:

Macrocystidia cucumis (Pers.: Fr.) Joss. in Bull. Soc. mycol. Fr. 49: 373. 1934.

III. **Rhodocybe** Maire

Rhodocybe is one of the smaller genera in the *Entolomataceae* and characterised by a very variable habit: pleurotoid, omphalioid, clitocyboid, mycenoid or tricholomatoid. It is dinstinguished from *Entoloma* and *Clitopilus* by the spores which are angular-pustulate in polar view and almost smooth to nodulose, undulate or pustulate in side-view (see also Noordeloos, 1981: 122). Recently Baroni (1981) monographed the genus, while Horak (1979) added much to the knowledge of *Rhodocybe* from the Southern Hemisphere. Nevertheless, while preparing keys and descriptions for the Flora agaricina neerlandica I was confronted with so much additional information on European taxa not included in Baroni's monograph, that an annotated key and a checklist to the European species seem useful.

KEY TO THE SPECIES OF RHODOCYBE IN EUROPE

1. Hymenial pseucocystidia present 2
1. Hymenial pseudocystidia absent 4

2. Spores 6.8–9 × (5.7–)6.2–7.5 µm, broadly ellipsoid in outline; pseudocystidia with colourless contents when mounted in 5% KOH . . . . 1. *R. finnmarchiae*
2. Spores distinctly narrower (3.5–5.5 µm) and more slenderly ellipsoid; pseudocystidia with yellowish-orange to yellowish grey contents when mounted in 5% KOH 3
3. Smell and taste unpleasant, farinaceous or like rotten fish; pileus argillaceous to pale brown; spores 7.5–10 × 4.5–5.5 µm . . . . 2. *R. obtusatula*
3. Smell none; taste none or slightly bitterish; pileus grey to greyish brown, usually fairly dark; spores (5.5–)6–9 × (3–)3.5–4(–4.5) µm . . . . 3. *R. caelata*
4. Basidiocarp small, more or less collybioid; pileus and stipe with yellow, orange or reddish tinges; clamp-connections present 5
4. Basidiocarp usually omphalioid, clitocyboid or tricholomatoid, white or grey to greyish brown; if reddish then basidiocarps robust and tricholomatoid; clamp-connections absent 6
5. Basidiocarp yellowish brown to honey-coloured; spores (4–)4.5–7 × 3–4(–4.7) µm 4. *R. melleopallens*
5. Basidiocarp orange-brown to red-brown; spores 7–10 × 5–5.5 µm . . . . 5. *R. nitellina*
6. Pileus and stipe white, occasionally with cream-coloured or ochraceous central spot on pileus in old specimens . . . . 6. *R. fallax*
6. Pileus and stipe slightly to distinctly coloured 7
7. Pileus flesh-coloured brown to reddish; stipe white or flesh-coloured . . . . 7. *R. truncata*
7. Pileus and stipe greyish brown or lead grey 8
8. Basidiocarp small, omphalioid; pileus up to 20 mm broad; septate cheilocystidia present; spores 5.5–7.5(–8) × 4–5.5(–6) µm, almost smooth when seen with the light-microscope 8. *R. hirneola*
8. Basidiocarp medium-sized to large, clitocyboid to tricholomatoid; pileus 20–110 mm broad; cheilocystidia, if present, not septate; spores appearing minutely warty in the light-microscope 9
9. Cheilocystidia present, filamentous, 24–60 × 3–7; pileus very dark greyish brown 9. *R. obscura*
9. Cheilocystidia absent 10
10. Smell none; taste mild; spores 5.3–6.4 × 3.5–4.7 µm, Q = 1.25–1.4–1.7 . . . . . 10. *R. parilis*
10. Smell farinaceous; taste bitter; spores (4.7–)5.0–7.0(–8.0) × (3.5)4–5.5(–6) µm, Q = 1.1–1.2–1.4 . . . . 11. *R. popinalis*

ANNOTATED CHECKLIST

1. **Rhodocybe finnmarchiae** Noordel. in Norw. J. Bot. 26: 277–278. 1979.

Only known from the type-locality in Lapland.

2. **R. obtusatula** Horak in Sydowia 31: 74. 1979 ('1978').

For description see Horak, 1979 l.c. Only known from the type-locality in Switzerland.

3. **Rhodocybe caelata** (Fr.) Maire in Bull. Soc. mycol. Fr. 40: 298. (1924) 1929.—*Agaricus caelatus* Fr., Epicr.: 42. 1838.—*Tricholoma caelatum* (Fr.) Gill., Hymen. Fr.: 114. 1874.—*Clitopilus caelatus* (Fr.) Kühn. & Romagn., Fl. anal.: 173. 1953. (not val. publ., no full refer. to basionym).
Rhodocybe dubia Favre in Erg. wiss. Unters. schweiz. Nationalpark 6: 587. 1960.
Rhodocybe australis Sing. in Beih. Nova Hedwigia 29: 335. 1969.

Agaricus retustus var. *arenicolus* Fr., Icon. sel. Hymen.: 78. 1874. — *Omphalina arenicola* (Fr.) P.A. Karst., Hattsv. 1: 131. 1879. — *Rhodocybe arenicola* (Fr.) M. Lange & Sivertsen in Bot. Tidsskr. 62: 198. 1966.

Habitat & distribution. — Usually in grasland, forest, *Juniperus*-shrubs etc., wide-spread, cosmopolitan.

Selected descriptions & illustrations. — Baroni in Beih. Nova Hedwigia 67: 47–49, figs. 11–14, 64, 65, 113, 115, 118 and 148. 1981. — Lange & Sivertsen, l.c. (as *R. arenicola*). — Kühner & Lamoure in Bull. Soc. mycol. Fr. 87: 15–23. 1971.

4. **Rhodocybe melleopallens** P.D. Orton in Trans. Br. mycol. Soc. 43: 380. 1960. — Figs. 14–16.
Collybia nitellina forma minor *Dössing* in Friesia 6: 340. 1961 (not val. publ., no Latin diagn.).

Pileus 11–30 mm broad, conico-convex then expanding to almost flattened, with or without small papilla, with straight margin, strongly hygrophanous, when moist vividly orange-ochraceous to orange-brown or yellowish brown (at centre 7.5 YR 4/4, 4/6, 5/6 or 6/8, towards margin 7.5 YR 5/6, 5/8, 6/6, 6/8, 7/8; 10 YR 6/6, 6/8) translucently striate up to 2/3 of radius, pallescent on drying to pale yellowish brown (10 YR 7/6, 7/8, 8/6 or 7.5 YR 6/8, 7/8), smooth, dull, sometimes slightly radially fibrillose-subfelted. Lamellae L = 20–30, l = 1–5(–7), moderately distant, (broadly) adnate, sometimes with decurrent tooth, segmentiform to subventricose, brownish yellow (10 YR 7/4, 7/6, 7/8, 6/4 or 7.5 YR 6/8, 7/8) with entire, concolorous edge. Stipe 20–40 × 1.5–3(–5) mm, cylindrical or often tapering towards base, straight or flexuose, concolorous with pileus or slightly darker at upper part, occasionally slightly paler than pileus in lower part, smooth, shining as if polished, with more or less undulating surface. Flesh concolorous with surface. Smell farinaceous, especially when cut. Taste strongly oily-rancid, very nasty. Spore-print pinkish-brownish.

Spores (4–)4.5–7 × 3–4(–4.5) µm, shortly ellipsoid to pip-shaped with weakly nodulose-angular outline. Basidia 20–30 × 7–9.5 µm, (2–)4-spored, with clamp. Cystidia none. Hymenophoral trama with numerous cuboid crystals, regular, made up of cylindrical cells, 50–85 × 8–17 µm. Pileipellis a cutis made up of thin-walled, cylindrical, 4.5–9 µm wide hyphae with membranal pigment; subpellis regular, made up of short, inflated cells gradually passing into pileitrama with yellow-brown encrusting pigment. Pileitrama regular, made up of short, inflated cells. Clamp-connections present in hymenium and on most septa of narrowest hyphae in pileipellis.

Habitat & distribution. — In deciduous and mixed deciduous-coniferous forest, usually on more or less calcareous, sandy soil, once found on old fire-place; known to occur in Great Britain, Netherlands, and Denmark.

Collections examined. — GREAT BRITAIN, Surrey, Mickleham, Norbury park, 13 Oct. 1958, *P.D. Orton* (holotype, K). — NETHERLANDS, prov. Zeeland, Zeeuws Vlaanderen, 26 Oct. & 3 Nov. 1981, *A. de Meyer* (L); prov. Zuid-Holland, Isl. Voorne, Oostvoorne, near Weeversduin, 4 Nov. 1981, *C. Bas 7863* (L). — DENMARK, Isl. of Falster, Systofte skov, 20 Oct. 1960, *L. Dössing* (C); Southern Jutland, Kjelstrup plantage, 30 Sept. 1978, *L. Dössing* (C).

So far *Rhodocybe melleopallens* was only known from its type-locality and a few additional places in Great Britain. Recently the species was found abundantly in the southwestern part of the Netherlands, and during a recent visit to the Botanical Museum at Copenhagen, the occurrence of this species was also established for Denmark. Therefore I am able to give an emended description of the species. *Rhodocybe melleopallens*

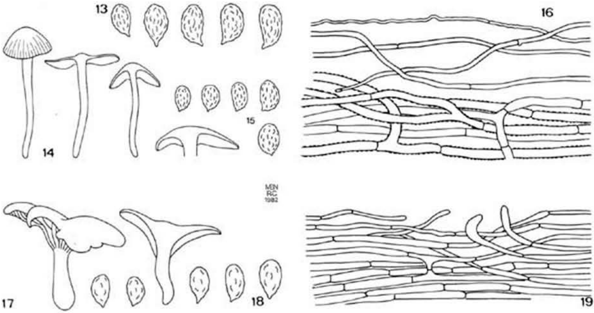


Fig. 13. *Rhodocybe nitellina* – Spores (× 1000).

Figs. 14–16. *Rhodocybe melleopallens*.—Habit (× 1), spores (× 1000), and pileipellis (× 670). (all figs. from A. de Meijer, 3 nov. 1981).

Figs. 17–19. *Rhodocybe fallax*.—Habit (× 1), spores (× 1000), and pileipellis (× 670). (all figs. from A. de Meijer 320).

can easily be distinguished from *R. nitellina* by its smaller spores, and also by the slightly paler, more yellowish colour.

5. **Rhodocybe nitellina** (Fr.) Sing. in Mycologia 38: 687. 1946.—*Agaricus nitellinus* Fr., Epicr.: 80. 1838.—*Collybia nitellina* (Fr.) Quél. in Mém. Soc. Emul. Montbéliard, sér. 2(5): 434. 1875.—*Rhodopaxillus nitellinus* (Fr.) Sing. in Annls mycol. 34: 332. 1936.—Fig. 13.

Collybia cuprea Favre in Erg. wiss. Unters. Schweiz. Nat. Park 42: 401. 1960.—*Rhodocybe cuprea* (Favre) Horak in Sydowia 31: 73. ('1978') 1979.

On account of the type-study by Horak (1979, l.c.) of *Collybia cuprea*, combined with Favre's description of the macroscopical characters of this species I have no doubt that the name *C. cuprea* is a later synonym of *Rhodocybe nitellina*, as both the colour of the basidiocarp and the size and shape of the spores are perfectly within the range of the variability of *R. nitellina*.

6. **Rhodocybe fallax** (Quél.) Sing. in Farlowia 2: 549. 1946.—*Omphalia fallax* Quél. in C. r. Ass. fr. Av. Sci. 24: 617. 1895.—*Clitocybe fallax* (Quél.) Sacc. & Trott., Syll. fung. 21: 42. 1912.—*Rhodopaxillus fallax* (Quél.) Maire in Bull. mens. Soc. linn. Lyon 6: 19. 1927.—*Paxilliopsis fallax* (Quél.) J. Lange, Fl. agar. dan. 5: VI. 1940.—*Clitopilopsis fallax* (Quél.) Kühn. ex Konr. & M., Agaricales 1: 380. 1948.—*Clitopilus fallax* (Quél.) Kühn. & Romagn., Fl. anal.: 173. 1953.—Figs. 17–19.

Pileus 10–40 mm broad, convex then flattened, often shallowly depressed, with or without weak umbo, with margin involute to reflexed, with marginal zone strongly undulate-lobed with age, not hygrophanous, not striate, white, occasionally tinged cream or yellow at centre, dull c. smooth, glabrous. Lamellae L = 50–70, l = 1–3, fairly crowded, arcuate-decurrent, pale then yellowish flesh-colour, with concolorous, entire edge. Stipe 10–50 × 2–7 mm, cylindrical usually tapering, rarely broadening downwards, white, subtomentose all over or pruinose-flocculose at apex and then fibrillose downwards. Flesh solid, white. Smell not distinctive. Taste bitter.

Spores 5–8.3 × 3.5–4.7(–5) µm, Q = 1.4–1.7–2.0(–2.3), ellipsoid or amygdaliform, weakly nodulose in side-view, thin-walled. Basidia 18–31 × 7–11 µm, 4-spored, clampless. Cystidia absent. Pileipellis a cutis of narrow cylindrical hyphae, 2.5–6.5(–9) µm wide, smooth or with very minutely encrusted walls. Clamp-connections absent.

Habitat & distribution.—In deciduous and mixed forest, in the Netherlands preferably on calcareous sandy soils near the coast, also in grassland, e.g. in *Corynephoretum* in coastal dunes (Denmark), wide-spread but rare.

Collections examined.—DENMARK, North Jutland, dunes near Febbersted, 20 Oct. 1980, *J. Howalt* (C).—NETHERLANDS, prov. Noord Holland: Castricum, 24 Aug. 1954, *G. D. Swanenburg de Veye* (L), idem, 8 Sept. 1954, *R. A. Maas Geesteranus* 10146 (L); Ankeveen, Looidijk, 26 Sept. 1956, *J. Daams* (L); prov. Zeeland, Zeeuws Vlaanderen, Sas van Gent, Braakmanpolder, bos van Calon, 29 June 1981, *A. de Meyer 320* (L).

Rhodocybe fallax is easily distinguished from all other *Rhodocybe* by its white basidiocarp. It can be confused with small specimens of *R. popinalis*, but that species has smaller, more ellipsoid spores and turns red with KOH in dried specimens. The spores *R. fallax* are very thin-walled and only slightly pustulate. Therefore it is very important to stain them very well, e.g. in Cotton blue, to recognize the angular pustulate nature of the spores. Baroni (1981: 102) gives only a short description of the species, mainly compiled from literature. Therefore a more extensive description of this rare species is given here.

7. **Rhodocybe truncata** (Schaeff.: Fr.) Sing. in Mycologia 38: 687. (Full synonymy in Baroni 1981: 79–80).

Selected descriptions & illustrations.—Baroni, 1981, l.c.: 79–84, figs. 34, 52, 110, 130 and 146.—Gulden in Norw. J. Bot. 22: 5–6. 1975.—Maire in Bull. Soc. mycol. Fr. 40: 296–298, pl. 18 figs. 4–12. 1924.

Rhodocybe truncata is a very variable species. Several infraspecific taxa have been described, which seem to be only the extremes of long chains of intermediate forms. I have not been able to differentiate any in the Netherlands' collections, and therefore I accept the species in a wide concept.

8. **Rhodocybe hirneola** (Fr.) P. D. Orton in Trans. Br. mycol. Soc. 43: 181. 1960.
(Full synonymy, description and illustration in Baroni, T.J. in Beih. Nova Hedwigia 67: 110, figs. 42, 43, 79, 80, 112, 118 and 120. 1981.)

9. **Rhodocybe obscura** (Pilát) Moser in Gams, Kl. KryptogFl. 3. Aufl., 2 b/2: 151. 1967.—*Rhodopaxillus obscurus* Pilát Sb. nar. Mus. Praze 9B(2): 67. 1953.

Selected descriptions & illustrations.—Baroni in Beih. Nova Hedwigia 67: 95–96, figs. 10, 84, 85. 1981.—Enderle in Mitt. Ver. Naturw. Math. Ulm 31: 30–32. 1981.

Rhodocybe obscura can be distinguished from dark pigmented *R. popinalis* by its filamentous cheilocystidia. So far it is only known from Czechoslowakia, German Federal Republic and Sweden.

10. **Rhodocybe parilis** (Fr.) Sing. in Agaric. mod. taxon., 2nd. Ed.: 678. 1962.—*Agaricus parilis* Fr., Syst. mycol. 1: 168. 1821.
Description.—Arnolds in Bibl. mycol. 90: 452. ('1982') 1983.

Rhodocybe parilis comes close to *R. popinalis*, from which it differs mainly in size, smell and taste, and size and shape of the spores.

11. **Rhodocybe popinalis** (Fr.) Sing. in Lilloa 22: 609. 1951.—*Agaricus popinalis* Fr., Syst. mycol. 1: 194. 1821.—*Clitopilus popinalis* (Fr.) Kumm., Führ. Pilzk.: 97. 1871.—*Paxillus popinalis* (Fr.) Rick., Blätterp. 94. 1911.—*Clitocybe popinalis* (Fr.) Bres., Icon. mycol. 4: 160. 1928.—*Paxillopsis popinalis* (Fr.) J. Lange, Fl. agar. dan. 5: VI. 1940.—*Rhodopaxillus popinalis* (Fr.) Konr. & M., Rév. Hymén. Fr.: 327. 1937.—*Clitopilopsis popinalis* (Fr.) Konr. & M., Agaricales: 379. 1948.
Agaricus mundulus Lasch in Linnaea 4: 527. 1829.—*Clitopilus mundulus* (Lasch) Kumm., Führ. Pilzk.: 97. 1871.—*Rhodopaxillus mundulus* (Lasch) Konr. & M., Icon. sel. fung. 8, pl. 278. 1934.—*Paxillopsis mundulus* (Lasch) J. Lange, Fl. agar. dan. 5: VI. 1940.—*Clitopilopsis mundulus* (Lasch) Kühn. ex Konr. & M., Agaricales: 379. 1948.—*Clitocybe mundula* (Lasch) Pearson & Dennis in Trans. Br. mycol. Soc. 31: 153. 1948.—*Rhodocybe mundula* (Lasch) Sing. in Lilloa 22: 609. 1951.
Agaricus noveboracensis Peck in Rep. N.Y. State Cab. 23: 89. 1872.—*Clitopilus noveboracensis* (Peck) Sacc. Syll. 5: 702. 1887.—*Pleuropus noveboracensis* (Peck) Murr., N. Amer. Fl. 10(2): 702. 1887.—*Rhodocybe noveboracensis* (Peck) Sing. in Lilloa 22: 609. 1951.
Clitopilus noveboracensis var. *tomentosipes* Peck in N.Y. State Mus. Bull. 2: 27. 1887.
Clitopilus noveboracensis var. *subviolaceus* Peck, Ann. Rep. N.Y. State Mus. 54: 165. 1901.
Clitopilus noveboracensis var. *umbilicatus* Peck., Ann. Rep. N.Y. State Mus. 54: 165. 1901.
Clitocybe himantiigena Speg. in Bol. Acad. Cienc. Cordoba 23: 373. 1919.—*Rhodocybe himantiigena* (Speg.) Sing. in Lilloa 22: 227. 1951.
Clitocybe alachuana Murr., Proc. Florida Acad. Sci. 7: 217. 1944.—*Armillariella alachuana* (Murr.) Sing., Lilloa 22: 217. 1951.—*Lulesia alachuana* (Murr.) Sing., Fl. Neotrop. 3: 17. 1970.
Hygrophorus meyendelli Boetje v. Ruyven in Levende Natuur 39: 324. 1935 (not val. publ., no Latin diagn.).
Selected descriptions & illustrations.—Baroni: in Beih. Nova Hedwigia 67: 97–102, figs. 82, 83, 86–99, 119, 128. 1981.

Pileus 25–60(–90) mm broad, hemispherical at first then conico-convex to convex, finally flattened, usually with broad, low umbo, occasionally slightly depressed at centre, with margin enrolled when young, with marginal zone often irregularly lobed-undulating with age, very variable in colour from dingy white to cream, greyish, brownish or fairly dark grey-brown, sometimes with violaceous-lilaceous tinge, not striate, dull, more or less glabrous or minutely pruinose to subtomentose, often zonated, frequently with concentric rings of irregular, dark, smooth spots ('wasserfleckig'), often cracking with age, glabrescent with age, sometimes blackening when handled or from exposure, distinctly changing colour when water-soaked, slightly pallescent on drying. Lamellae L = 40–80, l = 3–7, crowded, adnate-subdecurrent when young, then arcuate-decurrent, narrow, 3–5 mm broad, greyish white, then yellowish brown or ochraceous grey, sometimes staining blackish when bruised, with concolorous entire edge. Stipe 15–60 × 4–17 mm, cylindrical, tapering downwards or subbulbous at base, sordid white then brownish grey, always paler then pileus, smooth or pruinose-fibrillose, at base felted-tomentose, sometimes entire basal half felted-tomentose, sometimes blackening when handled. Smell strongly farinaceous. Taste bitter.

Spores (4.7–)5.0–7.0(–8.0) × (3.5)4–5.5(–6) μm, Q = 1.1–1.2–1.4, subglobose to broadly ellipsoid, in outline with up to 12 facets in side-view. Basidia 20–40 × 6–9 μm, 4-spored. Cystidia absent. Hymenophoral trama irregular, made up of 3–8 μm wide hyphae with colourless or brownish walls. Pileipellis a cutis made up of 2–8 μm wide cylindrical hyphae sometimes with tufts of erect terminal cells. Pileitrama irregular, made up of closely packed, 2–9 μm wide, more or less cylindrical hyphae. Pigment membranal or slightly encrusting in upper layer of pileus. Clamp-connections absent.

Habitat & distribution.—In deciduous and coniferous forests, grassland, and in coastal dunes with *Salix repens*. Wide-spread, Europe, America.

Collections examined.—NETHERLANDS, prov. Friesland: Isl. of Terschelling, Noordsvaarder, 27 Oct. 1982, *M.E. Noordeloos 1831*.—Isl. Schiermonnikoog, Johannes-polder, 2 Nov. 1975, *C. Bas 6717*.—prov. Noord-Holland, Vogelenzang, Dunes of Amsterdam Water Supply, 9 Oct. 1956, *C. Bas 1088*.—IJsselmeerpolders: S. Flevoland, near harbour of Noordernauw, 24 Nov. 1978, *F. Tjallingii & G. Tjallingii-Beukers*; N. Flevoland, Revebos, 16 Oct. 1978, *F. Tjallingii & G. Tjallingii-Beukers*; idem, de Abbert, 31 June 1979, 30 June 1979, *F. Tjallingii & G. Tjallingii-Beukers*; Spijk, 30 June 1979, 17 July 1980 and 5 Oct. 1981, *F. Tjallingii & G. Tjallingii-Beukers* (all collections in L).

Agaricus mundula Lasch has always been considered to be closely related to *A. popinalis* Fr. Fries (1838: 149, 1857: 280, and 1874: 198) distinguished *A. mundula* from *A. popinalis* by the thin-fleshed, pale, slightly villose, blackening pileus in the first species versus the more fleshy, grey, smooth, not blackening pileus of *A. popinalis*. Furthermore the habitat was said to be different and *A. mundula* was said to be inodorous. Both species were accepted by later mycologists with about the same differences. However, both 'species' are far more variable than suggested by Fries, and many mycologists found it difficult to distinguish the two with certainty.

Kühner & Romagnesi (1953: 173) and Moser (1982: 189) consider the blackening of the surface and flesh of *Rhodocybe mundula* as the most important character to distinguish it from *R. popinalis*, since colour of the carpophores varies too much and both species have about the same microscopical characters. The blackening of the basidiocarps when very old or bruised, however, is a very variable character, and may be distinct or not in different basidiocarps from the same mycelium. Baroni (1981: 97) in his excellent world-monograph of the genus *Rhodocybe*, admits that both macroscopically and macroscopically *R. popinalis* and *R. mundula* are very similar. It appears almost impossible to distinguish them on account of colour or surface of the pileus. According to him it is possible to distinguish the two on account of the habitat (cf. Fries, l.c.!) and a slight difference in spore-size. Studying the collections of *R. popinalis* and *R. mundula* available, I was unable to select any of the characters mentioned above as a good one to distinguish these taxa on specific level. Even the differences mentioned by Baroni could not be used. Habitat-characters could not be combined with other characteristics, and though a slight difference in spore-size was found between some *mundula*-like collections and *popinalis*-like ones, this was not valid for all collections studied. In a very large collection made in the coastal dunes of the isl. Terschelling in Oct. 1982 (Noordeloos 1831), which apparently originated from one mycelium, since the basidiocarps were growing in a large fairy-ring around a small *Salix repens* shrub, I found specimens responding to typical *R. popinalis* with grey-brown, cracked cap, as well as typical *R. mundula* with pallid, blackening, villose pileus, as well as intermediates. Specimens growing on sheltered places under the branches of *Salix repens* showed the typical *R. mundula* habit, whereas those growing on more exposed spots were more like *R. popinalis*. No significant difference in spore-size was found between both types. On account of the observations described, I decided to reduce *Rhodocybe mundula* to the synonymy of *R. popinalis*.

EXCLUDED AND/OR DOUBTFUL TAXA

asterospora.—*Rhodocybe asterospora* (J. Lange) M. Lange & Sivertsen in Bot. Tidsskr. 62: 201. 1966.—Belongs to the genus *Omphaliaster* (Lamoure, 1971: 282).

borealis.—*Rhodocybe borealis* M. Lange & Skifte in Acta Borealia, A. Scientia, 23: 45. 1967.—Belongs to the genus *Omphaliaster* (Lamoure, 1971: 281).

griseospora.—*Rhodocybe griseospora* (Pearson) P.D. Orton in Trans Br. mycol. Soc. 43: 181. 1960.—*Collybia griseospora* Pearson in Trans. Br. mycol. Soc. 35: 102. 1952.

Doubtfull species, close to or identical with *R. nitellina*. It was said to have a grey spore-print. Awaits rediscovery.

lutetiana.—*Rhodocybe lutetiana* (E.J. Gibb) Bon apud Bon & Chevassut in Docum. mycol. 3(11): 7. 1973.—*Rhodopaxillus lutetianus* E.J. Gilb. in Bull. Soc. mycol. Fr. 42: 66. 1926.

This is most probably one of the forms of *Rhodocybe popinalis*. I do not attach much value to the slightly tomentose pileal surface, contrary to Baroni (1981: 72) who created even the new section *Tomentosi* for this taxon. I observed in *R. popinalis* all transitions from a smooth to a subtomentose pileal surface, due to infraspecific variation, even within one population.

microsporum.—**Rhodocybe microsporum** (Velen.) Noordel., *comb. nov.* —basionym: *Entoloma microsporum* Velen., Novitates mycologicae: 140. 1939.

Pileus 10–20 mm broad, expanded-convex, slightly umbonate, at centre dark brown, at limb and margin grey with violaceous tinge; lamellae not crowded, boradly triangular, white then pink: stipe 20–40 × 2–3 mm, cylindrical, white, entirely granulose; smell none; spores 4.7–7.0 × 3.5–4.7 µm, ellipsoid, minutely warty; basidia 20–26 × 5–7 µm, 4-spored; clamps seen at base of basidia; cystidia absent.

In *Prunus spinosa* thicket; Bohemia.

The description above is based upon the original macroscopic notes by Velenovsky and my study of the holotype (Noordeloos, 1980: 82). *Rhodocybe microsporum* clearly belongs to section *Rhodophana* on account of its stature and clamped hyphae. It comes close to *R. nitellina* from which it differs in colour. Needs rediscovery.

nauseodulcis. — *Rhodocybe nauseodulcis* Horak in Sydowia 31: 76. 1979.

This curious species, excellently described by Horak, has strongly nodulose spores, rather unlike those found in other species of the genus *Rhodocybe*. When he created this species Horak was aware of that, and pointed at similarities to the genera *Ripartites* and *Hygroaster*. Through courtesy of Dr. Horak I was able to study the holotype of this very intriguing species. Light microscopic and scanning electron microscopic studies revealed that the spores are not cyanophilic and show a strong resemblance to those of *Omphaliaster asterospora* and *Tephrocybe ambusta*, but considerably less resemblance to *Ripartites* (compare Plate 1). I checked also the siderophily of *Rhodocybe nauseodulcis*, but could not demonstrate a clearly positive reaction. Dr. C. Bas and Dr. H. Clemençon (Lausanne) kindly confirmed the non-siderophilous nature of the basidia. This excluded the possiblity of ranging *Rhodocybe nauseodulcis* among the nodulose species of *Tephrocybe*.

Hygroaster is also excluded, although Singer (1962) and Horak (1966) used this generic name in connection with the epithet *asterospora* J. Lange. Lamoure (1971) clearly showed that *Hygroaster* is a genus of the *Hygrophoraceae*, characterized, besides by nodulose spores, by long basidia and intracellular pigment. Therefore Lamoure (l.c.) created the genus *Omphaliaster* to accommodate *Omphaliaster asterospora* and *O. borealis*. *Rhodocybe nauseodulcis* easily fits in *Omphaliaster* on account of a number of characters such as spore-ornamentation, structure and pigmentation of the pileipellis, and general habit. The only difference that seems to be important is the presence of clamp-connections in *Rhodocybe nauseodulcis*. Recently Baroni (1982: 869) emended the concept of *Omphaliaster* by including *O. ianthinocystis* (Sing.) Baroni. This species has many features in common with *O. asterospora* and *O. borealis*, but differs also in having clamped hyphae. The spores of *O. ianthinocystis* show strong resemblance with those of '*Rhodocybe*' *nauseodulcis*. Both clamped species cannot be placed in the genus *Mycenella*, among other things because of the lack of a true ramealis-structure in the pileipellis.

Therefore I accept Baroni's view and emended concept of the genus *Omphaliaster* and consequently introduce the following new combination: **Omphaliaster nauseodulcis** (Horak) Noordel., *comb. nov.* — basionym: *Rhodocybe nauseodulcis* Horak in Sydowia 31: 76. 1979. Another species which comes close to *Omphaliaster nauseodulcis* has been described by Horak from the Austrian Alps as a species of *Hygroaster*, viz. *H. kyrtosporus*. This species has spores with only 2–5 conical projections, but in all other characters it strongly reminds of *Omphaliaster nauseodulcis*, and *O. asterospora*. Therefore I do not hesitate to transfer it to the genus *Omphaliaster:* **Omphaliaster kyrtosporus** (Horak) Noordel., *comb. nov.* — basionym: *Hygroaster kyrtosporus* Horak in Schweiz. Z. Pilzk. 44: 91. 1966.

stangliana. — *Rhodocybe stangliana* (Bresinsky & Pfaff) Riousset & Joss. apud Riousset & al. in Bull. mens. Soc. linn. Lyon 46: 125. 1977. — *Squamanita stangliana* Bresinsky & Pfaff in Z. Pilzk. 34: 169. 1968.

Moser (1982: 189) in the fifth edition of his Kleine Kryptogamenflora places *Squamanita stangliana* in the genus *Rhodocybe*, following Riousset & al. (1977). I agree that undoubtedly the spores of this highly peculiar agaric are similar to the spores of *Rhodocybe*, but other characters, inclusive of the endocarpic development suggest that *'Squamanita' stangliana* should not be placed in *Rhodocybe*, nor in *Squamanita*, but on a place of its own right in the *Agaricales*. A final decision will be taken by Dr. C. Bas, specialist in *Squamanita*, in a future paper.

ACKNOWLEDGEMENTS

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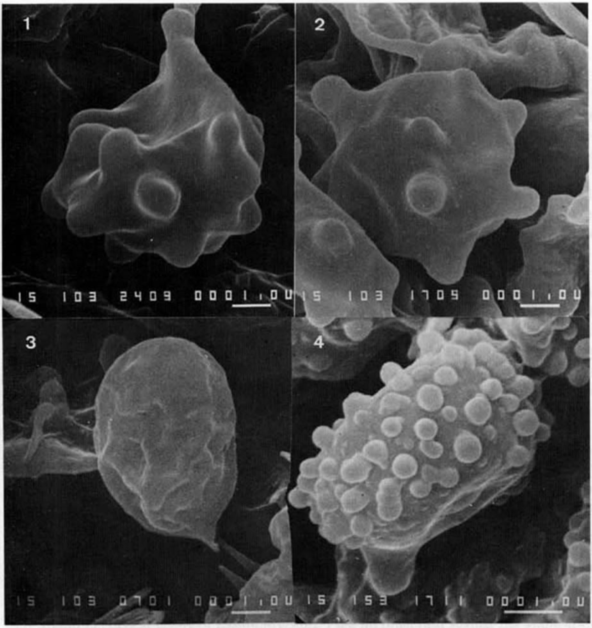

Plate 1. S.E.M.-photographs of spores. — 1. *Omphaliaster nauseodulcis.* — 2. *Omphaliaster asterosporus.* — 3. *Rhodocybe nitellina.* — 4. *Ripartites tricholoma.* (The bar represents 1 μm.)

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FLAMMULINA IN WESTERN EUROPE

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A new species, *Flammulina fennae*, is described. *Flammulina velutipes* is subdivided into two varieties, var. *velutipes* and var. *lactea* (Quél.) comb. nov., and two formae, f. *velutipes* and f. *longispora* f. nov. Keys to the western European taxa of *Flammulina* are given.

Several authors (e.g. Métrod, 1952: 87; Arnolds, 1977: 36; Klán, 1978: 211) have drawn attention to the great variation in spore-sizes attributed to *F. velutipes* in current literature, the reported measurements of the length ranging from 5.5–6.5 to 8–10 μm and of the width from 2.5–4 to 5–6 μm.

There are at least two reasons for these incongruent reports. First an undescribed, well-characterized species with broad, relatively small spores is hiding in the *F. velutipes*-complex. Secondly within *F. velutipes* sensu stricto two variants differing in spore-shape can be distinguished.

Spore-size and -shape appear to be important characters in *Flammulina*. Some of the differences being, however, rather subtle, accurate measuring is required. Usually I measure spores taken from the lamellae (spore prints being too rarely present). But in *Flammulina* I found it very difficult to distinguish between mature and immature spores and therefore measured spores deposited on the pileal surface (where they are usually very abundant). To prevent mistakes these spores have always been compared with those on the lamellae. Because of the narrowness of the spores, measurements have to be carried out under 100 × or 63 × objectives. For comparable results, per sample at least 10 spores have to be measured. It should be avoided that germinating spores are included.

In the following descriptions the code of Munsell Soil Color Charts has been used for designating colours. Notations like [100/9/8] stand for: '100 spores measured from 9 basidiocarps from 8 collections'. 'Q' means the quotient of the length and the width of spores; 'average Q' is the average Q (per sample of at least 10 spores) per collection. 'R' is the radius of the pileus.

For the gelatinizing, more or less erect, hyphae-like, terminal elements in the pileipellis of *Flammulina* I use the term 'ixohyphidia', although I am aware of the fact that Donk (1956: 3, 1964: 229) introduced the term 'hyphidia' for terminal hypha-like elements in the hymenium of basidiomycetes. But as most hymenial elements are occasionally found in cortical layers of basidiomycetes, I see no objection against the application of this term to similar elements in cortical layers. It seems to me that the hair-like structures in the pileipellis of *Russulaceae* (Singer, (1975: 6): 'ciliate dermatocystidia') could be called hyphidia also.

All collections studied are deposited in the Rijksherbarium, Leiden, unless otherwise indicated.

KEY TO THE SPECIES OF FLAMMULINA IN WESTERN EUROPE

1. Basidiocarps on or near Ononis spinosa in poor grasslands on calcareous soil. Spores large and broad, 8.5–12.5 × 4.5–5.5 μm . . . . *F. ononidis*
1. Basidicarps on wood or seemingly terrestrial near shrubs or trees. Spores shorter than 8 μm or narrower than 4.5 μm.
   2. Spores 6–8 × 4–4.5(–5) μm, average Q 1.5⁵–1.7. Mature pileus white to yellowish buff with slightly darker ochraceous centre, often with brown spots. Pileocystidia at centre of expanded pileus very crowded and not or hardly interspersed with rather simple ixohyphidia. Basidiocarps often on subterraneous wood . . . . *F. fennae*
   2. Spores 7–11 × (2.5–)3–4 μm, average Q 2.0–3.0. Pileus yellow to red-brown or pileus and stipe completely white to cream. Pileocystidia at centre of expanded pileus interspersed with ixohyphididia branching at wide angles. Basidiocarps usually on stumps, stems or branches *F. velutipes*

Flammulinae fennae[1] Bas, *spec. nov.* — Figs. 1–4

Speciem nomine *Flammulina velutipes* simulans. Sporae 6–7.5 × 4–4.5 μm, ellipsoideae vel elongato-ellipsoideae (medium Q 1.5⁵–1.7). Pileus albus vel pallidus centro plus minusve ochraceus. Centrum pileipellis pileocystidiis confertis compositum. Typus: 'C. Bas 7727, 19 Oct. 1980, Netherlands, prov. Zuid-Holland, Voorschoten, estate "Ter Wadding", (L)'.

Basidiocarps single or in clusters of up to about 100 on subterranean roots, more rarely on stumps of broad-leaved trees.

Pileus 20–50(–70) mm in diameter, from convex with inflexed outermost margin when very young to plano-convex with vague umbo, finally more or less flat with slightly deflexed margin and vague umbo sometimes with a slight depression in the middle, in very young stages (up to 2.5 mm diam.) rusty ochraceous to pale ochraceous brown (Munsell from between 5 YR 6/8 and 7.5 YR 6/8 to c. 7.5 YR 6/6), but soon white to pale yellow or yellowish buff, (from pure white to nearly 10 YR 8/6), sometimes almost unicoloured but mostly with a pale ochraceous brown centre (between 7.5 YR 6/6 and 10 YR 7/8 or 10 YR 6/8), sometimes with conspicuous red-brown spots, when moist short translucently striate (up to 0.2 R) at margin of mature basidiocarps, smooth, minutely pruinose when very young but later on minutely velvety to glabrous and dry to greasy (in dry weather) to viscid (when wet), very long remaining minutely pruinose to minutely subgranular at centre, thick-fleshed, rather elastic.

Lamellae from very crowded in young to very distant in large pilei (from 16 to 6 per 10 mm half-way R), from nearly free to sinuately or emarginately adnate, or narrowly adnexed, sometimes uncinate, moderately broad (up to 8 mm wide), white or whitish cream to pale cream (near 10 YR 8/2 to 8/4 but paler) sometimes bruising slowly but rather vividly yellow-brown, often with conspicuous red-brown spots, very elastic, with concolorous, even edge, with 1–3 lamellae between each pair.

Stipe 25–120 × 1–10 mm, cylindrical but often with fusiform subbulbous base, solid to stuffed, tough, connate at base when growing in clusters, with one or more

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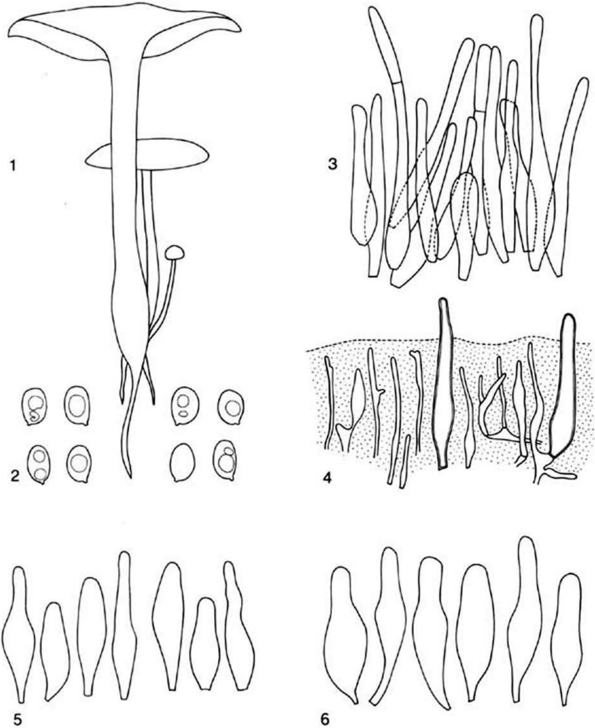
[1] Named after the author's wife, Fenna Moes, in gratitude for help and forbearance.



Figs. 1–6. *Flammulina fennae*. — 1. Basidiocarps × 1. — 2. Spores, × 1250. — 3. Radial section of pileipellis at centre of pileus, × 500. — 4. Radial section of pileipellis 1/3 R from centre, × 500. — 5. Cheilocystidia, × 500. — 6. Pleurocystidia, × 500. (Figs. 1–3, 5 from type; 4, 6 from Balke 1965).

pseudorhiza when growing on subterranean or rotten wood, whitish to pale buffy ochraceous (10 YR between 8/6 and 8/8) colour of apex downwards passing gradually into dull reddish brown to nearly blackish colour of lower 2/3 or 4/5 (5 YR between 3/2 and 3/3 to 10 YR 4/4), often with a narrow to broad brighter yellow-brown, orange-brown or red-brown zone in between, with very minute white to red-brown dots on pale apex, downwards with minutely subvelutinous-subtomentose covering concolorous with or somewhat paler than dark red-brown background, in large specimens with a few conspicuous longitudinal grooves, elastic.

Context white, with somewhat yellowish tinge in centre of pileus, yellowish buff to brownish ochraceous in lower 2/3 to 1/3 of stipe, dark red-brown in cortex of stipe. Smell rather typical, like fermenting fruits with a resinaceous component (also recorded as sweetish fungoid), sometimes tending to fish-like when crushed. Taste fungoid-subadstringent or mild. Spore print cream-white to pale cream, 1b(–2a) in *Russula*-scale of Romagnesi (1967), soon darkening when kept.

Spores [125/12/12] (5.5–)6–7.5(–8) × (3.5–)4–4.5(–5) µm, Q 1.4–1.8(–1.9^5), average Q 1.5^5–1.7, ellipsoid to elongate-ellipsoid, rarely elongate, thin-walled, smooth, colourless, usually containing one or two refractive droplets, with abrupt small apiculus. Basidia 30–35 × 4.8–6.0 µm, 4-spored, with clamp. Cheilocystidia abundant but intermixed with basidia, (35–)40–80(–115) × (8–)10–16(–21) µm lageniform or ventricose-lageniform, more rarely utriform or ventricose-fusiform, with 4–9(–12) µm wide neck and obtuse apex, thin- to slightly thick-walled, colourless to somewhat yellowish. Pleurocystidia very scarce to abundant, 40–70 × 12–18 µm, subutriform-sublageniform, sometimes utriform or lageniform, nearly always with broadly rounded apex, thin- to slightly thick-walled, colourless. Trama of lamellae regular but 4.5–20 µm wide hyphae somewhat undulating, with very slightly thickened walls, colourless to pale yellowish. Subhymenium narrow, 15–20 µm thick, composed of 1–2 µm wide densely ramose hyphae. Pileipellis with pileocystidia at centre very crowded and seemingly the only constituents but towards margin gradually more and more interspersed with thin, c. erect, gelatinizing hair-like elements (ixohyphidia); pileocystidia (55–)70–14 × (6–)8–15 µm, slenderly lageniform, sometimes septate, thin- to slightly thick-walled (wall up to 0.4 µm thick) colourless to yellowish or pale brown; ixohyphidia 0.5–1.5(–3.6) µm thick, often very long, sparsely branching at narrow angles, colourless, thin-walled. Clamps abundant.

Habitat & distribution.—On subterranean roots and at the base of stems and stumps of deciduous trees (*Fagus, Fraxinus, Populus, Platanus* and possibly *Ulmus*) on rich, often clayey or loamy soil, from April to October; known to occur in the Netherlands, France, Czechoslovakia, and Hungary, but probably widespread.

Collections examined.—NETHERLANDS: prov. Gelderland, Beesd, estate 'Mariënwaard', 1 Oct. 1980, *W.V. Rubers 8160* (herb. Rubers); prov. Utrecht: Breukelen, estate 'Nijenrode', 27 Sept. 1980, *J. Daams*; Breukelen, estate 'Boom en Bosch', 16 Sept. 1982, *Th. Kuijper 2220*; prov. Noord-Holland, Vogelenzang, A.W.-dunes, 14 Oct. 1980, *E. Arnolds*; prov. Zuid-Holland, Voorschoten, estate 'Ter Wadding', 19 Oct. 1980, *C. Bas 7727* (holotype); Rotterdam, Kralingse bos, medio Aug. 1965, *N.P.W. Balke*; prov. Zeeland, Zeeuws Vlaanderen: Kloosterzande, 10 May 1981, *A. de Meijer 149C*; Sas van Gent, Braakmanpolder, 'Bos van Barbé', 27 June 1981, *A. de Meijer 319A*; prov. Limburg, Gronsveld, Savelsbos, 17 Oct. 1970, *F. Benjaminsen 701029* (herb. Benjaminsen).—CZECHOSLOVAKIA, between Bubovice and Hostin (c. 20 km SSW of Prague). 4 Sept. 1981, *Th.W.M. Kuyper 1709*.—HUNGARY, Budapest, Városliget, 8 Oct. 1971, *M. Babos*.

Note: The macroscopic description is based mainly on the rich type-collection and *Kuijper 2220*, as most collections cited reached the author in dried state and often without notes or with short descriptions only.

This taxon is more than just a variant of *F. velutipes* with small broad spores, as it differs from that species also in several other respects.

In its most typical form *F. fennae* is easy to recognize by the slender fruit-bodies, white to pale colours of at least the margin of the pileus and the early fruiting.

In border-line cases between *F. fennae* and the short-spored form of *F. velutipes* the structure of the pileipellis was decisive. In *F. velutipes* the pileocystidia are clearly interspersed with ixohyphidia also at the centre of the pileus and quite a few of these hyphidia have a characteristic shape. They are frequently branching often at rather wide angles, slightly thick-walled and have somewhat moniliform terminal branches tapering towards their apex.

A collection made by E. Arnolds (Vogelenzang, 14 Oct. 1980) is aberrant because of the bright orange-brown pileus with more yellowish margin and the ochraceous yellow gills. It has spores within the range of *F. fennae*: 5.5–8(–8.5) × (3.5–)4–4.5 µm. Q (1.45–)1.5^5–19^5(–2.1), average Q 1.7. Its pileipellis consists at the centre of the pileus of very crowded pileocystidia and very few ixohyphidia which have a simple, c. hair-like shape and agrees in these respects with *F. fennae.* But the pileocystidia are strongly coloured and often have a crooked base, which are *F. velutipes* characters. Because of the spores and the composition of the pileipellis I consider this collection to represent a strongly coloured form of *F. fennae* but it may be another underscribed taxon. Unfortunately this collection could not be taken in culture.

It is probable that the fungus mentioned by Kühn. & Romagn. (1953: 95) under the name *Collybia velutipes* var. *lactea* Quél. is identical with *F. fennae* as it is said to have a whitish to pale margin of the pileus, to fruit early in the season and to grow also on subterranean wood.

The taxon described by Quélet (1881: 663) as *Pleurotus velutipes* var. *lacteus* represents, however, an albino variant of the true *F. velutipes* (see elsewhere in this paper).

A species possibly related to *F. fennae* is *Agaricus laxipes* Fr. (1838: 86).

Fries, who had not seen the species himself, based his description mainly on Battara's description and figure (1755: 46, pl. 9, fig. 1) of '*Monomyces pedunculo longissimo*' and referred in addition to Sowerby's (1800: pl. 263) illustration of *A. velutipes*.

The specimens depicted by Sowerby on the cited plate are densely fasciculate, have long curved red-brown stipes and pale yellow-buff pilei. The very young pilei have the same colour as the expanded ones. The specimens were collected in a wood-shed and probably represent a somewhat etiolated form of *F. velutipes*.

Battara's uncoloured figure shows one single basidiocarp with a very long, somewhat undulating stipe (105 × 4 mm in the drawing and yet apparently not drawn in its full length) and a small, flat pileus with a short sulcate margin and broad, distant gills. It is described by Battarra as growing on roots of *Quercus*, having a uniformly milk white pileus with a pectinate margin, a very long rigid stipe, solid and white inside, with a rufous silky to hirsute covering.

Perhaps Battara's species is a meditteranean taxon of *Flammulina* (unfortunately the nature of the pileal surface is described merely as 'laevis'). *Flammulina fennae* differs from it by its coloured pileal centre, its straight and not unusually long stipe and the buff to ochraceous context in the stipe.

It is possible that Battara's species was rediscovered by Quélet (1873: 342, pl. 2, fig. 2), who gave a description and coloured picture of a similar fungus. Quélet's material had subglobose spores, a separable velutinous cortex, and was found growing on buried twigs in woods.

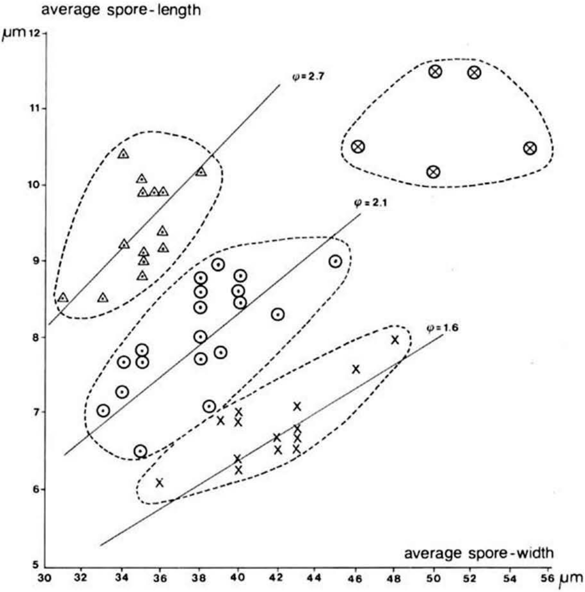


Fig. 7. Scatter diagram of average length and width of basidiospores of *Flammulina fennae* (×), *F. velutipes* f. *velutipes* (○) and f. *longispora* (△), and *F. ononidis* (⊗).

Another taxon to be considered in connection with *F. fennae* is *Agaricus sphinx* Batsch (1786: 145, pl. 22 fig. 112). It is described and depicted with a pale pileus with a rusty yellow centre not unlike that of *F. fennae*, but with a stipe that is not velutinous but 'pruinato-scaber'.

It is clear that now spore-shape and -size and the microscopic structure of the pileipellis appear to play an important role in the taxonomy of *Flammulina*, most of the older European names, particularly of varieties and forms of *F. velutipes* have to be disregarded if no types are available, and that *Agaricus sphinx* is one of these.

Flammulina velutipes var. *radicans*, illustrated and briefly but validly described by Wichansky (1968: 70) bears some resemblance to *F. fennae* because of the long *pseudorhizae* connected with subterraneous wood. This taxon has been described without notes on the colour of the pileus and without microscopical data. A study of the type at PR (*Wichansky 682577*, 1 Febr. 1968, Prague, Kinskélo sady), kindly sent on loan, revealed that this variety represents a rooting form of the true *F. velutipes* and that its spores (7.1–8.9 × 2.7–3.7, Q 2.3–3.0, aver. Q 2.6) fit in the range of *F. velutipes* f. *longispora* (see elsewhere in this paper).

In 1922 Singer published *Collybia velutipes* f. *aestivalis* characterized by early fruitinf (July-August) and an at first glabrous but later thinly velutinous stipe remaining glabrous at the apex. This forma has however colours typical for *F. velutipes*. Later Singer (1964: 183) reported that the type of this forma has been lost, identified South American material with it, and depicted spores of that material which are too slender (Q 2.4^5–2.5^5) for *F. fennae*. Therefore it is unlikely that Singer's forma *aestivales* is synonym of *F. fennae*.

Dr. J. Stalpers (C.B.S., Baarn) was so kind as to bring *F. fennae* in culture and to carry out interfertility-tests between this species and *F. velutipes*. He generously allowed me to publish the outcome of his experiments.

'Because of the very low viability and the long dormancy of the basidiospores of *F. fennae* (less than 0,1% and about 3 weeks compared with more than 50% and 1–2 days in *F. velutipes*) only 14 monokaryons could be obtained. These have been mated with each other and with both monokaryotic and dikaryotic strains of *F. velutipes*.

The intraspecific matings resulted in 4 mating types which differed also in growth rate.

The matings with monokaryotic strains of *F. velutipes* were consistently negative; neither anastomoses nor clamp connections were observed. Di-mon matings with dikaryotic *F. velutipes*-strains never resulted in the formation of clamp connections in the hyphae of *F. fennae*. There were, however, other interactions. The monokaryotic strains of *F. fennae*, which are easily distinguishable from those of *F. velutipes* by the slower growth rate, the lack of arthroconidia and the very scanty aerial myclium, penetrated and killed the colonies of both mono- and dikaryotic *F. velutipes* The contact zone was marked by a yellow discolouration, which gradually disappeared. Slides showed healthy mycelium of *F. fennae* and only empty hyphae of *F. velutipes*. Strains of *F. fennae* used in matings:

monokaryotic: mating types of *Kuijper 2220*.

Strains of *F. velutipes* used in matings:

dikaryotic: CBS 439.79 (sent by R. Kühner) and *Bas 7758* (f. *velutipes*).

monokaryotic: CBS 435.79, 436.79, 438.79, mating types of CBS 439.79 and of *Bas 7758* (f. *velutipes*).

Thus the specifity of *F. fennae* is firmly supported by cultural characters and interfertility tests with *F. velutipes*. Its aggresive behaviour against cultures of *F. velutipes* is an interesting aspect of its biology.

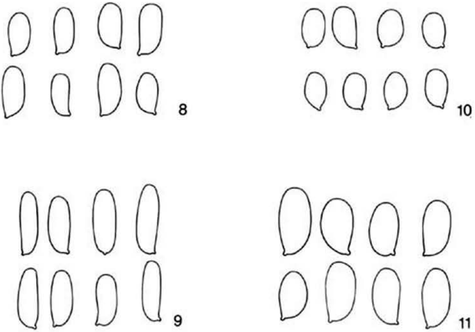
Flammulina ononidis Arnolds — Fig. 11

Flammulina ononidis Arnolds in Westf. Pilzbr. 11: 33. 1977.

Collybia velutipes var. *pratensis* Schieferdecker in Z. Pilzk. 21: 21. 1949 (not val. publ.; no latin). — *Collybia velutipes* subsp. *pratensis* Schieferdecker apud Schieferdecker & Müller in Z. Pilz. 29: 109. 1963 (not val. publ.; no type).

Pileus 5–35(–45) mm wide, convex to plano-convex, sometimes with umbo, honey yellow to pale orange-brown with darker orange-brown centre, translucently striate when moist, viscid. Lamellae distant, adnate, from yellowish-whitish to pale ochraceous yellow. Stipe 15–55(–80) × 1–4 mm, attenuate downwards, from pale yellow at apex via orange-brown and red-brown to dark brown at base, completely velutinous, frequently with blackish pseudorhiza.

Spores (7.5–)8.5–12.5(–14) × (4–)4.5–5.5(–6) µm, Q (1.6–)1.7–2.4^5, average Q 1.9–2.3, elongate to cylindrical, basidia 4-spored. Cheilocystidia 30–55(–60) ×



Figs. 8–11. Basidiospores, × 1250. — 8. *Flammulina velutipes* f. *velutipes*. — 9. *F. velutipes*, f. *longipes*. — 10. *F. fennae*. — 11. *F. ononidis*. (Fig. 8 from *Bas 7730*; 9 from *Van Crevel, 31.XII.1979*; 10 and 11 from type.)

5–15 μm, abundant, utriform to lageniform, thin-walled. Pleurocystidia scattered (sometimes absent?), similar to cheilocystidia. Pileipellis gelatinous, with c. erect embedded 1–2.5 μm wide branching ixohyphidia and large, partly projecting, lageniform, fusiform or subcylindrical pileocystidia (45–)50–100(–110) × (3–)6–11(–17) μm, with thickened brown walls but usually colourless and thin-walled apex. Stipitepellis with hairs and caulocystidia. Clamps present.

The description given here is merely a compiled characteristic. *Flammulina ononidis* has extensively been described and discussed by Arnolds (l.c.), Klán (1978: 205), Kriegelsteiner (1978: 1), Schieferdecker (l.c.), and Schieferdecker & Müller (l.c.). It is fully characterized by its large, broad spores and its habitat. This species has been recorded from dry, poor, calcareous grasslands, always on or near *Ononidis spinosa*, in West- and East-Germany and Czechoslovakia.

Flammulina velutipes (Curt.: Fr.) Sing.

Agaricus velutipes Curt., Fl. Londin. 4: 212, pl. 70. 1777.—*Agaricus velutipes* Curt.: Fr., Syst. mycol. 1: 119. 1821.—*Collybia velutipes* (Curt.: Fr.) Kumm., Führ. Pilzk. 116. 1871.—*Pleurotus velutipes* (Curt.: Fr.) Quél., Enchir.: 147. 1886.—*Gymnopus velutipes* (Curt.: Fr.) Murrill, N. Amer. Fl. 9: 361. 1916.—*Myxocollybia velutipes* (Curt.: Fr.) Sing. in Schweiz. Z. Pilz. 17: 72. 1939 (inval. name).[1] —*Flammulina velutipes* (Curt.: Fr.) Sing. in Lilloa 22: 307. ('1949') 1951.—Lectotype (select. mihi): Curtis, l.c. pl. 70.

Agaricus nigripes Bull., Herb. France: pl. 344. 1788.

Collybia veluticeps Rea in Trans. Brit. mycol. Soc. 1: 157. 1900.—*Collybia eriocephala* Rea apud A.L. Smith & Rea in Trans. Brit. mycol. Soc. 3: 46. 1908 (inval. name change, superfluous name).[2]

KEY TO THE INFRASPECIFIC TAXA OF VELUTIPES

1. Pileus yellow to red-brown. Stipe pale yellow to dark brown . . . . var. *velutipes*
  2. Spores 6–9.5 × 3–4 μm, average Q (1.8–)2.0–2.3 . . . . f. *velutipes*
  2. Spores 8–11.5 × 3–4 μm, average Q 2.5–3.0[5] . . . . f. *longispora*
1. Pileus and stipe white to cream and remaining so . . . . var. *lactea*

var. **velutipes**

Basidiocarps in small to large clusters on wood, more rarely gregarious or solitary. Seldom on subterranean wood.

Pileus (8–)15–45(–95) mm wide, from convex soon plano-convex, finally sometimes plano-concave, often with low umbo or with flattened to slightly depressed centre, with margin at first inflexed but later straight or slightly reflexing and then often undu-

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[1] *Myxocollybia* (1936) has been published without Latin and has not been validated since.

[2] This name has incorrectly been introduced by Rea for his *C. veluticeps* because of the existence of the Australian *Agaricus (Collybia) veluticeps* Cooke & Mass. apud Cooke (in Grevillea 17: 30. 1887). Rea's description seems to apply to old midwinter specimens of *F. velutipes*. The spore-size given (7–8 × 3–4 μm) fits forma *velutipes*.

lating; from golden yellow (2.5 Y 8/8) or ochraceous yellow (10 YR 8/8–8/7), rarely more greenish yellow (5 Y 8/8), to ochraceous brown (10 YR 6/8) or orange-red-brown (5 YR 5/8 to 7.5 YR 5/8), and sometimes uniformly so, but usally with darker ochraceous brown to orange-red-brown or dark red-brown (5 YR 4/4) centre and paler yellow margin, more rarely uniformly greenish yellow or buff (5 Y 8/6, 2.5 Y 8/6, 2.5 Y 7/8–7/6), somewhat hygrophanous, slightly fading when drying up, when moist often outermost margin darker and short translucently striate (up to 0.2 R), densely pubescent when very young, later subpubescent to glabrous, greasy to very viscid when moist, subviscid to dry when dehydrated; pileipellis not peeling at first but easily peeling later on.

Lamellae moderately crowded to very crowded, in large old specimens sometimes very distant (10–16, rarely 6–8 per 10 mm half-way R), adnate, sinuate or (deeply) emarginate, sometimes nearly free, rarely seceding and forming a pseudocollarium, rather narrow to moderately broad (2.5–7 mm), elastic, whitish, pale buffy cream (2.5 Y 8/4), ochraceous yellow (10 YR 8/8–7/8), more rarely ochraceous buff to sordid buff (2.5 Y 8/6, 7/6, 7/4) sometimes even brownish ochre (10 YR 6/6), sometimes with brown spots, with slightly irregular but entire edge; (1–)2–3 tiers of lamellulae and these occasionally anastomosing.

Stipe (15–)20–50(–155) × (1.5–)2.5–6(–18) mm, cylindrical or attenuate downwards, rarely slightly broadening downwards, sometimes rooting (pseudorhiza up to 65 × 3 mm), sometimes with subbulbous base, connate below, frequently somewhat flattened, fistulose to hollow, usually in the very beginning cream to pale yellow (2.5 Y 8/6), soon darkening from base upwards and then via ochraceous yellow (10 YR 7/8), yellow-brown and rusty ochraceous (7.5 YR 5/8) to reddish brown or dull dark (red-) brown (5 YR 3/4, 10 YR 3/4, 3/2), outermost apex long remaining pale yellow but finally completely blackish brown, densely concolorously pubescent to velutinous but pale apex sometimes red-brown punctate, at base occasionally hirsuut with pale hairs.

Context elastic, white to yellowish in pileus and upper part of stipe, somtimes darker under pileipellis, sordid yellowish to greenish yellow to brownish yellow in lower part of stipe. Smell rather typical, pleasant, somewhat fruity with a resinaceous component; when crushed sourish fungoid. Taste indistinct to fungoid, sometimes slightly bitterish. Spore deposit cream-white to pale cream, 1b–(2a) in *Russula*-scale of Romagnesi (1967).

Spores (5.5–)6–11.5(–12) × (2.5–)3–4(–5) µm, Q 1.6^5–3.4^5(–3.8), mean Q 2.0^5–3.0^5, elongate-ellipsoid to cylindrical or even bacillar, sometimes slightly bent, with small abrupt apiculus, colourless to very pale yellowish in NH_4OH, thin-walled, inamyloid, non-cyanophilous, easily germinating. Basidia 25–36 × 5.5–7.2 µm, 4-spored (in some collections a small percentage 5-spored[1]), with clamp. Cheilocystidia scarce and scattered to rather abundant, 32–62(–70) × 6–16 µm, utriform to lageniform, intermixed with basidia, thin- to slightly thick-walled, colourless to somewhat yellowish-brownish. Pleurocystidia very scarce to fairly abundant, 35–70(–90) × (7–)10–21 µm, from cylindrico-clavate or broadly utriform to slenderly lageniform or fusiform, slightly thick-walled, colourless. Lamellitrama regular, but when young outer layer in upper part diverged, composed of 3–11 µm wide, colourless, thin-walled hyphae. Pileipellis an ixotrichoderm with pileocystidia and ixohyphidia; pileocystidia abundant to very rare, (30–)50–110(–140) × 5–13 µm, slenderly lageniform to hair-shaped, often with crooked base, sometimes septate, sometimes capitate, from colourless to yellow-brown or red-brown, with up to 0.4 µm thick walls, with their lower 1/3 to 2/3 embedded in gelatinous substance; ixohyphidia abundant, thin-walled and colourless to slightly thick-walled and (yellow-)brown in lower part, branching at wide angles and narrow branches

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[1] Dr. D. Pegler, Kew, was so kind to draw my attention to this phenomenon; later I observed it in several collections.

often submoniliform, tapering to a less than 1 µm thick apex, completely embedded in gelatinous substance. Covering of stipe made up of: (i) at apex large, up to 160 µm long, lageniform, colourless or at the base brown or entirely brown, sometimes somewhat encrusted caulocystidia, usually intermixed with colourless, pale brown or golden yellow-brown 2–5 µm wide hairs tapering towards frequently colourless apices; (ii) in the middle 2–7 µm wide (colourless to predominantly) red-brown hairs mixed with rare to rather abundant caulocystidia; (iii) at base very long 2–4.5(–7) µm wide, red-brown, agglutinate hairs in bundles. Stipitetrama composed of parallel 7–16 µm wide, cylindrical hyphae with slightly thickened yellowish walls, sometimes intermixed with a few golden yellow to red-brown straight vascular hyphae. Clamps abundant.

Habitat & distribution.—Throughout the year but abundant only from September to March; on stumps, stems (also of living trees) and fallen branches of deciduous, very rarely coniferous trees, only occasionally on subterranean wood; in the material studied showing a preference for *Salix, Populus, Fraxinus* and *Sambucus*[1]. In the Netherlands abundant in areas with rich alluvial soils, particularly clay, but rather rare and locally lacking in those with poor diluvial soils.

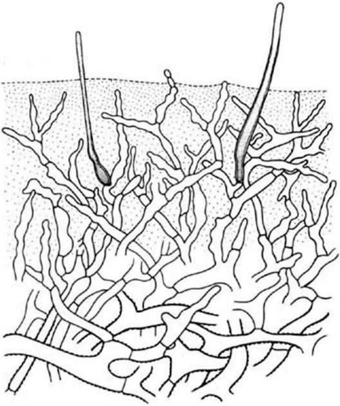

Fig. 12. *Flammulina velutipes* f. *velutipes*, radial section of pileipellis near centre of pileus, × 500. (From *Bas 7730*).

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[1] An extensive list of hosts (but probably including those of *F. fennae*) has been published by Kreisel (1961: 68).

forma **velutipes** — Figs. 8, 12

Spores [200/23/20] 6–9.5 × (2.5–)3–4(–5) µm, average Q (1.85–)2.0–2.3. Very common from August to March, occasionally also in summer. Found on *Ulmus, Populus, Fraxinus, Alnus, Fagus, Betula, Juglans, Rosa, Passiflora* and *Picea.*

Collections examined. — NETHERLANDS: prov. Noord-Holland: Amsterdam, 16 Febr. 1981, *R. van Crevel*; Velzen, 3 Nov. 1982, *A.G. Becker*; Haarlem, 18 Jan. 1981, 11 Febr. 1981, *E. Vellinga*; Vogelenzang, 20 Oct. 1980, *C. Bas 7730*; prov. Zuid-Holland: Leiden, 7 Jan. 1981, 11 Jan. 1981, 30 Jan. 1981, *C. Bas 7751, 7756, 7758*; Gouda, 16 March 1980, *C.M. den Held-Jager*; De Vlist, 20 Sept. 1976, *C.M. den Held-Jager*; prov. Zeeland: Houtenisse, 21 Sept. 1981, *A. de Meijer*; Koewacht, 21 Oct. 1981, *A. de Meijer*; Hengstdijk, 10 Oct. 1981, *A. de Meijer*; Sas van Gent, 28 June 1981, *A. de Meijer 318*, Kloosterzande, 10 May 1981, *A. de Meijer 142b.* — FINLAND, Inari-Lappland, Kevo, 16 Aug. 1978, *M.E. Noordeloos.* — ENGLAND; North Harrow, 15 Jan. 1981, *J. Burns*; East London, Wanstead Flats, 25 Jan. 1981, *F.W.K. Young.* — BELGIUM, Hasselt, Bolderberg, 27 Sept. 1981, *F. Benjaminsen 810911.* — CZECHOSLOVAKIA, Karlsteijn, 7 Sept. 1981, *Th. Kuijper.*

forma **longispora** Bas[1] — Fig. 9

Spores [140/16/16] (75–)8–11.5(–12) × (2.3–)3–4(–4.7) µm, average Q 2.5–3.0^{5}. Rather common from November to April. Collected on *Salix, Ulmus, Populus, Fraxinus* and *Alnus.*

Collections examined. — NETHERLANDS: prov. Gelderland: Winterswijk, ultimo 1980, *J. Schreurs*; Buren, 13 Dec. 1972, *H.S.C. Huijsman*; prov. Utrecht, Linschoten, 21 April 1977, *J. Schreurs & al.*; prov. Noord-Holland: Amsterdam, 'Klein Danzig', 16 Febr. 1981. *R. van Crevel*; Heemskerk, North-Holland dune reserve, 27 Nov. 1980, *Th. Kuijper* (type); Vogelenzang, 8 March 1981, *C. Bas 7758*; prov. Zuid-Holland: Noordwijk, Vogelenveld, 7 March 1981, *E.C. Vellinga*; Sassenheim, 'Klinkenberg', 18 Jan. 1953, *R.A. Maas Geesteranus 9296*; Leiden, 22 Dec. 1980, *Th. Kuijper*; Leiden, 11 Jan. 1981, *C. Bas 7753, 7754, 7755*; Leiden, 28 Nov. 1964, *R.A. Maas Geesteranus 14466*; Numansdorp, 12 Nov. 1970, *P.A. Slim*; prov. Noord-Brabant, Budel, 31 Dec. 1979, *R. van Crevel*; prov. Limburg, Margraten, 23 Jan. 1982, *E. Vellinga.* — SWITZERLAND, Colombier, Planeyse, 30 Jan. 1967, *H.S.C. Huijsman 67002.* — CZECHOSLOVAKIA, Prague, Febr. 1968, *E. Wichanský* (type of *F. velutipes* var. *radicans*; PR).

Even after the segregation of *F. ononidis, F. fennae* and *F. velutipes* var. *lactea*, the remaining *F. velutipes* var. *velutipes* is still a highly variable taxon.

Measuring the spores of a few decades of collections of var. *velutipes* I came to the conclusion that there are a short-spored and a long-spored variant, a fact visualized by the two clouds of dots in the scatter diagram setting out average length against average width of the spores of the collections studied (Fig. 7).

Trying to correlate this difference in spore-shape with other characters, I studied: (i) abundance, shape, septation, and colouration of the pileocystidia; (ii) shape, size, and

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[1] **Flammulina velutipes** forma **longispora** Bas, *f. nov.* A typo differens sporis cylindraceis vel bacillariformibus; medium Q 2.5–3.0^{5}. Typus: '*Th. Kuijper*, 27.XI.1980, Netherlands, prov. Noord-Holland, Heemskerk, North-Holland dune reserve' (L).

distribution of cheilo- and pleurocystidia, and (iii) shape, colouration, and distribution of hairs and cystidia of the stipe. I found all these features to vary to a great extent, but failed to correlated these variations with the spore-characters. Therefore I decided to recognize these variants only on the level of formae. It is remarkable, however, that the long-spored form has been found only from November to April and the short-spored form almost all through the year. In winter I collected both forms at several localities on one day.

The decision to indicate the short-spored variant as the typical form (forma *velutipes*) is based on the fact that it is the most common of the two and the fact that two collections from the surroundings of London (where Curtis collected the original material of his *Agaricus velutipes*), kindly sent to my be Dr. D. Pegler, Kew, represent this form.[1]

Buch (1952: 100) invalidly published *Collybia velutipes* forma *macrospora*, found on stumps of deciduous trees in alluvial woods in Saxony. He gave the spores as measuring 9–12 × 5–6 µm, which is even slightly larger than in *F. ononidis.*

The collection of *F. velutipes* with the longest spores (9.5–11.6 µm) studied by me has relatively very narrow spores (2.9–3.9 µm, Q 2.6^5–3.8, average Q 3.0^5). This collection (*Maas Geesteranus 9296*) is moreover marked by large pilei, deeply rooting stipes and above all by very distant lamellae (c. 6–8 per 10 mm half-way). As the distance between the lamellae is also in the rest of *F. velutipes* a rather variable character (although I saw them nowhere else so widely separated) I have included the collection in f. *longispora*, but it may represent a separate taxon.

Flammulina velutipes var. **lactea** (Quél.) Bas, *comb. nov.* — Figs. 13–20

Pleurotus velutipes var. *lacteus* Quél. in C.R. Ass. franç. Av. Sci. (Reims 1880) 9: 663. 1881 (basionym). — *Collybia velutipes* var. *lactea* (Quél.) Rea., Brit. Basid.: 332. 1922. — *Collybia lactea* (Quél.) Sacc., Syll. Fung. 5: 212. 1887.

Excluded. — *Collybia velutipes* var. *lactea* sensu Kühn. & Romagn., Fl. anal. Champ. sup.: 95. 1953 (= *F. fennae*).

Carpophores in small clusters on stumps, sometimes together with var. *velutipes*. Pileus 5–25 mm wide, convex with margin inflexed with young, somewhat hygrophanous, when moist ivory (creamy pale buff, e.g. Munsell 2.5 Y 8/4), short translucently striate and viscid, when dry white, subviscid and under strong lens minutely pubescent, particularly when very young. Lamellae adnexed, somewhat distant, relatively broad, white with yellowish reflexion, sometimes formed or anastomosing, with one tier of lamellulae. Stipe 4–20 × 0.8–2.5 mm, cylindrical, bent, white to pale cream at apex to ivory at base, but sometimes slightly brownish at base when old, densely and minutely white pubescent. Context white. Smell indistinct. Taste unknown. Spore print whitish cream.

Spores [30/3/3] 7.3–10.1(–10.6) × (2.7–)2.9–4.0 µm, Q 2.0–3.0(–3.3), average Q 2.1^5–2.8, cylindrical, rarely bacillar. Basidia 4-spored, with clamp, 29–36 × 6.0–7.2

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[1] I refrained from designating one of these collections as neotype, because I received them dried and without descriptive notes. In my opinion, neotypes of fleshy fungi consisting of recently collected material have to be extensively annotated and illustrated and should include a spore print.

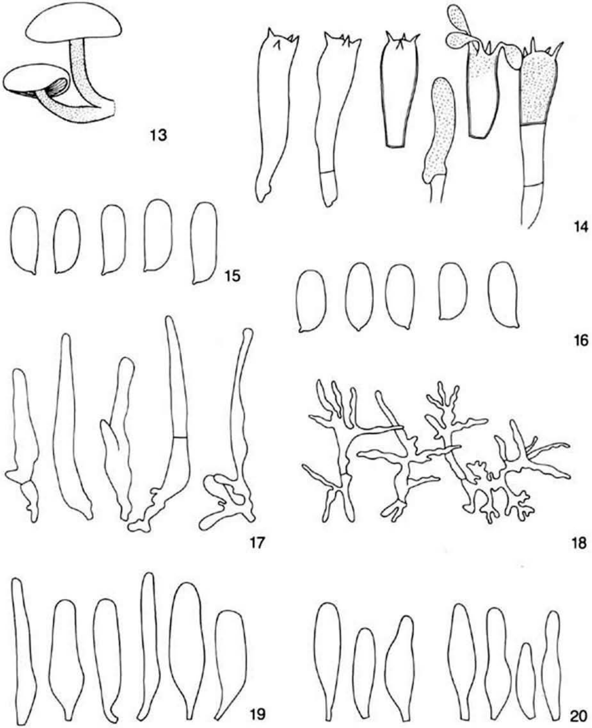

Fig. 13–20. *Flammulina velutipes* var. *lactea*. — 13. Basidiocarp, × 2½. — 14. Incidental septate basidia with thickening walls, × 1250. — 15–16. Basidiospores, × 1250. — 17. Pileocystidia, × 500. — 18. Ixohyphidia from pileipellis, × 500. — 19. Pleurocystidia, × 500. — 20. Cheilocystidia, × 500. (Figs. 13, 15, 19 from *De Meyer*, 23.XI.1981; 14, 16, 20 (right 4 figs.) from *Freese-Woudenberg*, 19.XII.1971; 17, 18, 20 (left 3 figs.) from *Jansen*, 14.I.1978).

µm, sometimes shortened by secondary septation and then slightly thick-walled and easily detachable in squashed mounts (Fig. 14). Cheilocystidia 30–54(–68) × 8–14 µm, abundant, utriform to lageniform, more rarely clavate or subcylindrical, sometimes strangulate, usually with obtuse apex, with colourless, slightly thickened wall. Pleurocystidia 50–65 × 7.5–15 µm, scarce to fairly abundant, mostly utriform to clavate or broadly cylindrical with broadly rounded apex but more rarely also slenderly lageniform, colourless and slightly thick-walled. Pileipellis an ixotrichoderm, strongly gelatinized, with dendroid to coralloid, thin-walled to slightly thick-walled ixohyphidia and rather scattered slightly thick-walled, colourless to slightly brownish, irregularly shaped, sublageniform pileocystidia (Fig. 17), 30–95 × 6–12 µm. Clamps present.

Habitat & distribution.—Probably with same distribution as var. *velutipes*, but rare. At one of its known Netherlands' localities growing on *Sambucus nigra*, at the other two on unidentified stumps. Late autumn and winter.

Collections examined.—NETHERLANDS: prov. Noord-Holland, Amsterdam, Slotervaart, 19 Dec. 1971, *W. Freese-Woudenberg*; prov. Zeeland, Zeeuws Vlaanderen, Vogelwaarde, 23 Nov. 1981, *A. de Meijer*; prov. Noord-Brabant, Terheijden, Eendekooi, 17 Dec. 1977 and 14 Jan. 1978, *P. B. Jansen*.

It is possible that var. *lactea* can be divided into a short- and a long-spored form, just as var. *velutipes*, but the small number of collections studied does not allow a definite conclusion. The spores of the Zeeland collection agree with those of var. *velutipes* f. *longispora*, the spores of the other collections with those of f. *velutipes*.

Basidiocarps of var. *lactea* are sometimes so small that they are mistaken for those of *Marasmiellus* or *Mycena* species.

Dr. J. Stalpers at Baarn cultured this taxon from a tissue sample of the Zeeland collection. Basidiocarps produced in petri dishes were very similar to those of the original collection with exception of the much longer stems, the more ochraceous centre of the pileus and the very densely pubescent pileipellis.

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ULTRASTRUCTURE OF BASIDIOSPORES

1. Beenakia

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The ultrastructure of the spore walls of *Beenakia dacostae* (Beenakiaceae, Gomphales) has been studied. Spore walls are mainly composed of a distinct episporium and a thick, dark, ornamented ectosporium. The general structure is identical with that of other members of the Gomphales, such as *Gomphus* and *Ramaria*

In a series of papers, the spore-wall ultrastructure of certain taxa of Basidiomycetes will be discussed. Fresh as well as dried herbarium material has been studied, and although it was found that fresh specimens show somewhat more detail, dried specimens are also worthy of study. The technical, time consuming part of these studies was performed by the second author.

Unfortunately, a large number of descriptive terms have been introduced in the literature for the different wall layers of spores. Since no general consensus seems to be in sight, I have hesitatingly used a few of them. Without wishing to enter into a discussion of the correctness of these terms, I refer the reader to the photos for illustration, and to the relevant literature in which the terminology is discussed (Clémençon, 1970, 1977; Keller, 1974; Kühner, 1980; Perreau, 1967, 1976).

METHODS

Samples of spores from herbarium specimens were rehydrated in 0.1% glutaraldehyde in 0.1 M Na-cacodylate-HCl buffer (pH = 7.3), to which the wetting agent invadine was added. After several washings in buffer the samples were post-fixed for two hours in 1% OsO_4 in 0.1 M cacodylate buffer, washed in buffer, and dehydrated in a graded ethanol series. During dehydration the material was stained with 1% uranyl acetate in 30, 50, 70 and 96% ethanol. Samples were embedded via propylene oxide in Epon (Luft, 1961) or via acetone in Spurr's low viscosity embedding medium (Spurr, 1969) with the additive dibuthylphthalate (Clémençon, 1973). Sections were cut with a diamond knife on a LKB ultramicrotome III, and were poststained with uranyl acetate (Glauert, 1967) and/or lead citrate (Reynolds, 1963).

Preparations were viewed with a Philips EM 300 electron microscope.

Beenakia dacostae Reid

Material studied: Australia, Victoria, Dandenong Ranges, Sherbrooke Forest, 8 Sept. 1956, *H. H. Willis* (L).

The genus *Beenakia*, with the single species *B. dacostae*, was described by Reid (1956) based on a specimen from Australia. The genus, characterized by small, stipitate basidiocarps with hydnoid hymenophores and brown, ornamented spores, was placed in the family Hydnaceae sensu lato.

The type species was subsequently found several times in New Zealand and was redescribed by Cunningham (1958) who placed the genus also in the Hydnaceae.

Beenakia was restudied by Maas Geesteranus (1963) who gave a detailed analysis of the hyphal structure of *B. dacostae*.

In his discussion of the systematic position of the genus, he emphasized the *Ramaria*-like, cyanophilous spores, very slender basidia, and fragile, inflating hyphae, and consequently placed the genus in the family Gomphaceae. With the arrangement of the Aphyllophorales and the recognition of the Gomphales as a distinct order, *Beenakia* was placed in a special family Beenakiaceae (together with *Kavinia, Psathyrodon* and *Ramaricium*), differing from the Gomphaceae and Ramariaceae in the construction of the basidiocarps (Jülich, 1981).

The genus is still very small and comprises but three species: *B. dacostae* Reid from Australasia, *B. fricta* Maas G. from Africa, and *B. informis* (Rick) Maas G. from South America.

ULTRASTRUCTURE OF THE SPORE WALLS

The spores are brown, elongate, ellipsoid, 7–10 × 3.4–4 μm, thin- to slightly thick-walled, and are covered with small, cyanophilous warts. Ultra-thin sections show an essentially two-layered structure:

i) The inner layer, the episporium, appears greyish and slightly granular. In most sections it seems to be uniform, although sometimes a faint stratification is visible. The episporium is separated from the cytoplasm by a thin, not always preserved, dark layer. In some spores the greyish episporium overlies a thick, almost hyaline layer which is more or less well delimited from the cytoplasm. We can offer no explanation for this thick, innermost layer; it might be the strongly inflated and in other spores almost invisible endosporium, but it might also be an artifact.

ii) The outer, rather thick, ornamented layer of the spore wall, the ectosporium, appears black, homogeneous, and is abruptly separated from the episporium. The ectosporium forms a continuous layer with local thickenings which appear as warts under light and scanning electron microscopy.

RESULTS

We conclude that the spore-wall structure illustrated for *Beenakia dacostae* is identical with the structures known for spores of *Gomphus* and *Ramaria* (Perreau, 1967). In all three genera a greyish episporium surrounded by a black, continuous ectosporium is found. Light and electron microscopy, therefore, leave no doubt that the correct systematic position of the genus *Beenakia* is within the Gomphales.

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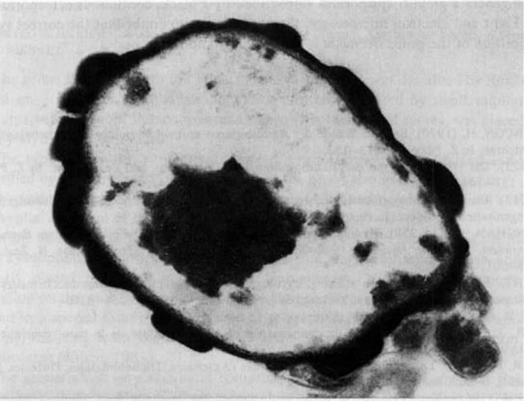

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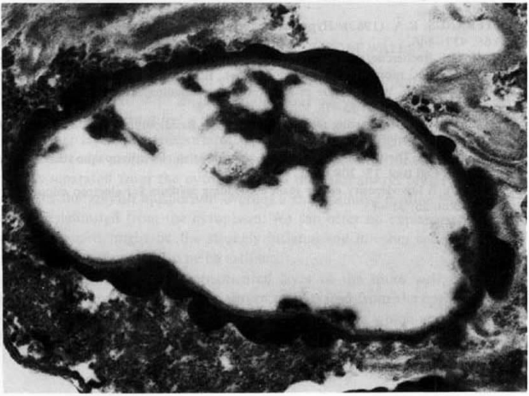

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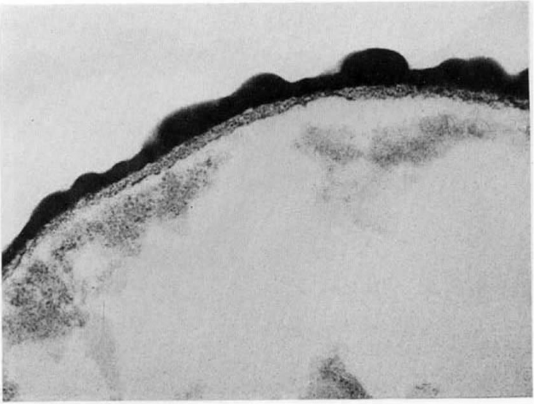
Figs. 1–2. *Beenakia dacostae*; spores with two-layered wall, × 27300. — In Fig. 1 with nucleus.



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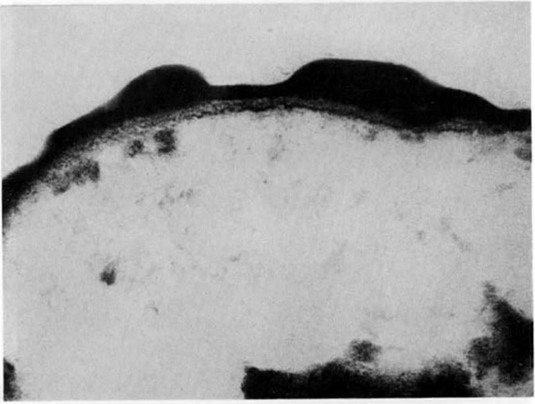

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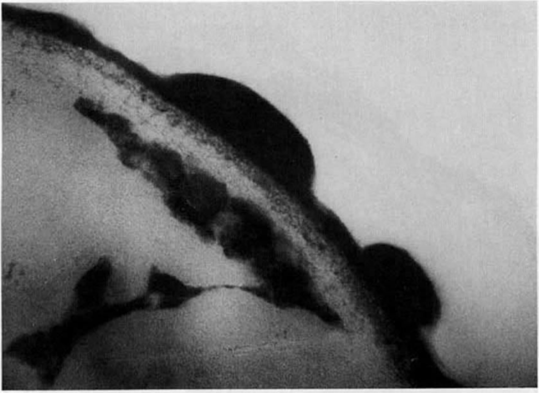
Figs. 3–4. *Beenakia dacostae*; spore walls with epi- and ectosporium, × 57200.



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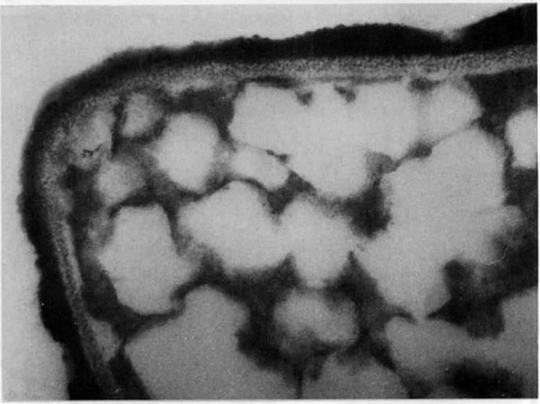

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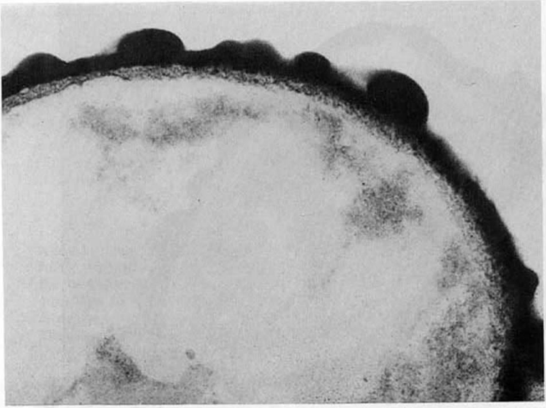
Figs. 5–6. *Beenakia dacostae*; spore walls with epi- and ectosporium, × 57200.— In Fig. 6 with vacuolated cytoplasma.



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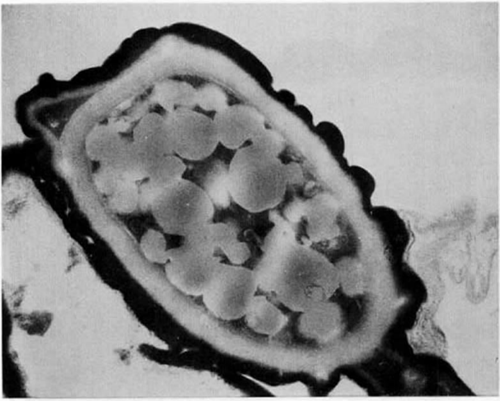
Figs. 7–8. *Beenakia dacostae;* spore walls with epi- and ectosporium, × 57200.



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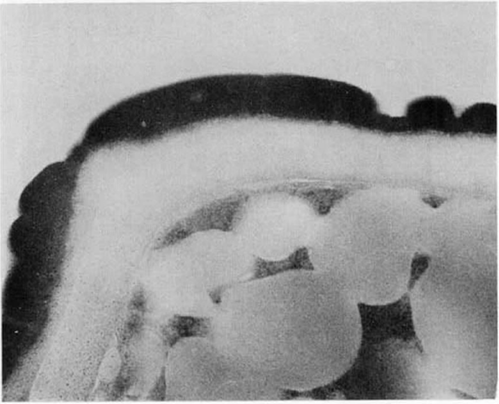

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Figs. 9–10. *Beenakia dacostae*; spore walls with ?endo-, epi-, and ectosporium; the cytoplasma with numerous vacuoles. — Fig. 9 × 23100. — Fig. 10. × 57200.

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STUDIES IN ENTOLOMA—7

Entoloma sect. Phlebophora, sect. nov.

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A new section is created in *Entoloma* subgenus *Inocephalus* Noordel., viz. sect. *Phlebophora*, characterised by a rimose pileal surface and a pileipellis reminding that of *Pluteus* sect. *Hispidoderma*. One new species is described, viz. *Entoloma kitsii* from the Netherlands; type-studies are given of *E. lagenicystis* Hesl. and *E. rimosum* Hesl., and a key is given to all species known in sect. *Phlebophora*. The new combination *Entoloma pluteicutis* (Romagn. & Gilles) Noordel. is made.

At the time I gave a synopsis of the infrageneric taxonomy of *Entoloma* (Noordeloos, 1981) no representative of subgenus *Inocephalus* was known from Europe. The subgenus seemed to be restricted to (sub-)tropical areas mainly of the southern hemisphere (Romagnesi, 1941; Romagnesi & Gilles, 1979; Horak, 1973, 1980) where they are rather well represented. By courtesy of Dr. E. Kits van Waveren, Amsterdam, I was enabled to study a most interesting European new species from his personal herbarium, which belongs to subgenus *Inocephalus*. In addition, type-studies of the North-American *Entoloma lagenicystis* Hesl. and *E. rimosum* Hesl., revealed that these species have much in common with the species collected by Dr. Kits van Waveren, and also have to be placed in subgenus *Inocephalus*. Within the subgenus these species are unique in the structure of the pileipellis and therefore a new section is proposed:

Entoloma sect. **Phlebophora** Noordel., *sect. nov.*

Statura pluteoidea; pileus radialiter venosus vel venosulus, interdum in centro squamulosis; pileipellis trichoderma elementis fusoideis; pigmentis intracellulosis interdum in additione leviter incrustantibus; cheilocystidia abundantia, magna, subcylindracea vel lageniformia; fibulae presentes. — Holotypus: *Entoloma kitsii* Noordel.

Habit pluteoid; pileus minutely, radially veined like in some species of *Pluteus (P. phlebophorus)*, sometimes also minutely squamulose at centre; pileipellis a trichoderm of broadly fusoid cells; lamellar edge fimbriate, entirely sterile; cheilocystidia subcylindrical to lageniform; pigment intracellular in pileipellis, sometimes in addition minutely encrusting; clamp-connections present. — Holotype: *Entoloma kitsii* Noordel.

Section *Phlebophora* comes close to sect. *Inocephali* and sect. *Calliderma*[1] from which it differs in the structure of the pileipellis and the surface of the pileus. So far 4 species are known.

KEY TO THE SPECIES OF ENTOLOMA SECT. PHLEBOPHORA

1. Stipe dark red-brown; pileipellis with intracellular and encrusting pigment; spores (8.7–)9.3–11 × 5.8–7 μm, Q = 1.25–1.55–1.9, ellipsoid 5–8-angled in outline; cheilocystidia cylindrico-flexuose, 37–127 × 4.7–8.1(–9.3) μm, subcapitate; smell and taste farinaceous; Europe . 1. *E. kitsii*
1. Stipe white, dingy or pale brown with violaceous tinge; pigment intracellular; spores shorter, average Q per collection 1.5, more or less pentagonal; smell none 2
2. Stipe brown with violaceous tinge; spores 8.5–10 × 7–7.5 μm; cheilocystidia cylindrical to utriform, 30–75 × (4–)6–14 μm; Africa . . . . 2. *E. pluteicutis*
2. Stipe white, pale grey to dingy; cheilocystidia ventricose-lageniform, 7.5–20 μm wide 3
3. Spores 8.7–10(–10.4) × 7.1–8.7(–9.1) μm, Q = 1.0–1.2–1.4, subisodiametrical 4–6-angled in side-view; cheilocystidia lageniform; U.S.A. . . . . 3. *E. lagenicystis*
3. Spores 8.7–11 × 6–7 μm, Q = 1.3–1.45–1.6, 5–7-angled in outline, ellipsoid; cheilocystidia ventricose-sublageniform; U.S.A. . . . . 4. *E. rimosum*

Entoloma kitsii Noordel., *spec. nov.* — Fig. 1

Pileus planoconvexus, papillatus, margine undulatus, fuscus, centro atrofusco, haud hygrophanus, radialiter venosulus; lamellae liberae vel leviter adnatae, sordido-rosae; sporae (8.7–)9.3–11 × 5.8–7 μm, Q = 1.25–1.55–1.9; pileipellis trichoderma; pigmentis duobus: pileipellis pileitramaque incrustantibus pariter in pileipelle intracellulosus; cheilocystidia magna, subcapitata, cylindraceo-flexuosa, 37–127 × 4.7–8.1(–9.3) μm; fibulae presentes. — Holotypus: E. Kits van Waveren, 21–X–1980, 'Leyduin, prov. Noord-Holland, Netherlands' (L.).

Etymology: Named in honour of the eminent mycologist Dr. E. Kits van Waveren.

Pileus 47 mm broad, plano-convex with strongly undulating margin and small papilla, dark bronze brown (7.5 YR 4/2), paler at margin (7.5 YR 4/4), almost black at centre (papilla), shortly translucently striate at margin, minutely tomentose at centre, minutely radially veined from margin to centre. Lamellae free or narrowly adnate, ventricose, pale brown with pink tinge then sordid pink-brown (7.5 YR 7/4–6/4) with concolorous, fimbriate edge. Stipe 50 × 3.5 mm, reddish brown (5 YR 3/1 at base, upwards 5 YR 4/2 with grey tinge), at apex minutely striatulate-grooved and very finely white pruinose, fistulose. Flesh concolorous. Smell weakly farinaceous. Taste strongly farinaceous.

Spores (8.7–)9.3–11.0 × 5.8–7.0 μm, Q = 1.25–1.55–1.9, ellipsoid 5–8-angled in side-view with dihedral base. Basidia 25–42 × 9–15 μm, 4-spored, clamped. Cheilocystidia 37–127 × 4.7–8.1(–9.3) μm, irregularly cylindrical-flexuose, sometimes subcapitate. Hymenophoral trama regular, made up of fusiform-cylindrical, up to 500 μm long and (4.5–)7–3.5 μm wide elements. Pileipellis a trichoderm of fusoid to clavate cells, 50–120 × 10–25 μm with brown intracellular pigment and sometimes in addition brown encrusted walls. Pileitrama regular, made up of long cylindrical elements with (coarsely) encrusted walls. Clamp-connections abundant in hymenium.

Habitat. — On humus-rich sandy soil in mixed forest of *Quercus* and *Pinus* on old coastal dune.

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[1] **Entoloma** sect. **Calliderma** (Romagn.) Noordel., *comb. nov.* — basionym: *Rhodophyllus* sect. *Calliderma* Romagn. in Bull. mens. Soc. linn. Lyon 43: 329. 1974.

Collection examined. — Netherlands, prov. Noord-Holland, Leyduin, 21 Oct. 980, *E. Kits van Waveren* (holotype, L.).

Entoloma kitsii is a very remarkable species with its dark pileus with an almost plu-
us-like surface and with its enormous cheilocystidia. *Entoloma lagenicystis* Hesl., and
rimosum Hesl. are closely related but differ in having a pale stipe, smaller and/or
ightly more isodiametrical spores, smaller and broader cheilocystidia and in the lack of
ncrusting pigments.

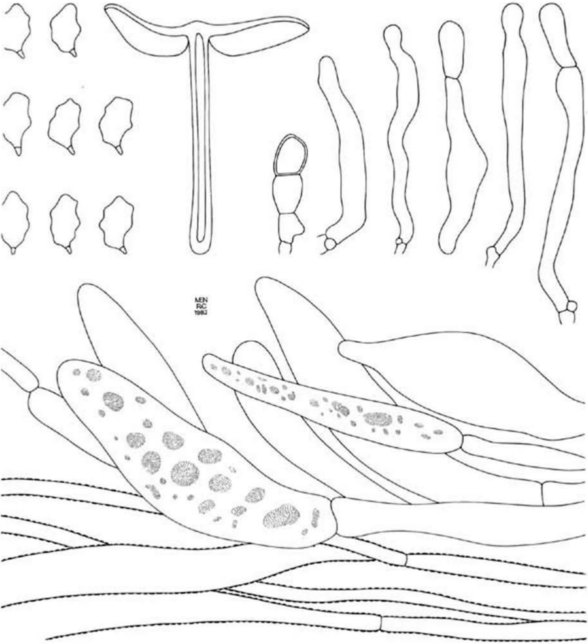
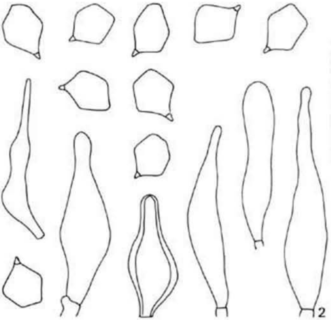


Fig. 1. *Entoloma kitsii*. — Habit (× 1), spores (× 1000), cheilocystidia (× 670), and pileipellis ×670) (all figs from holotype).



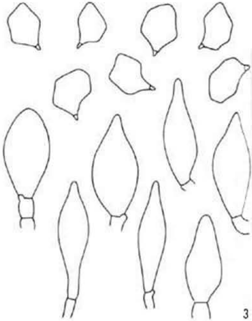


Fig. 2. *Entoloma rimosum.*—Spores (× 1000) and cheilocystidia (× 670) (all figs. from holotype).

Fig. 3. *Entoloma lagenicystis.*—Spores (× 1000) and cheilocystidia (× 670) (all figs. from holotype).

Entoloma lagenicystis Hesl.—Fig. 2

Entoloma lagenicystis Hesl. in Beih. Nova Hedwigia 23: 133. 1967.

'Pileus (20–)30–60(–90) mm broad, conico to conico-campanulate or convex-campanulate; umbonate or papillate-umbonate, more or less expanding, first fuscous or darkker, the disk black, then light brownish-olive (snuff-brown, Prouts' brown or Dresden brown), silky fibrillose, the recurving ends forming minute scales, more or less rimose, margin striatulate. Context white or pallid; odor mild; taste mild or slightly adstringent. Lamellae crowded, white then 'light pinkish cinnamon', medium close, broad, edges fimbriate. Stipe 40–80(–100) × (2–)3–6(–8) mm, whitish or greyish and pruinose above, dingy and glabrous below, equal or slightly enlarged below, striate, hollow.'

Spores 8.7–10(–10.4) × 7.1–8.7(–9.3) µm, Q = 1.0–1.2–1.4, isodiametrically subcuboid to pentagonal. Basidia 22–36 × 8–14 µm, 4-spored with clamp. Cheilocystidia 40–75 × 7.5–20 µm, slenderly to broadly lageniform, thin- or slightly thick-walled, abundant; lamellar edge entirely sterile. Pleurocystidia sparse, similar to cheilocystidia. Hymenophoral trama regular, made up of long cylindrical elements, up to 400 µm long and 11–32 µm wide. Pileipellis trichodermal, made up of fusoid cells up to 26 µm wide. Pigment intracellular. Clamp-connections present.

Collection examined.—U.S.A., Tennessee, Great Smokey Mountains National Park, near Tremont, 1 Aug. 1963, *L.R. Hesler 25742* (holotype, TENN).

Entoloma rimosum Hesl.—Fig. 3

Entoloma rimosum Hesl. in Beih. Nova Hedwigia 23: 149. 1967.

'Pileus 30–60 mm broad, convex-umbiliate, expanded, rimose and splitting radially, pale greyish olive, umbilicus black, fibrillose, striatulate when wet, even when dry. Context brittle, thin, whitish, oder and taste slight, not distinctive. Lamellae short-decurrent, close, broad, white then pale flesh, edges concolorous, rough to denticulate. Stipe 40–60 × 3–6 mm, pallied or dingy, apex mealy, equal, hollow.'

Spores 8.7–11 × 6–7 µm, Q = 1.3–1.45–1.6, 5–6(–7)-angled in sideview with dihedral base. Basidia 27–48 × 10–14 µm, 4-spored, with clamp? (see below). Cheilocystidia 28–45 × 9–18 µm, broadly ventricose lageniform, numerous, edge sterile. Pleurocystidia none. Hymenophoral trama regular, made up of cylindrical elements, 55–170 × 6–10 µm. Pileipellis a trichoderm of very long and broad, strongly inflated cells, 60–220 × 10–32 µm, subpellis not differentiated. Pigment intracellular in pileipellis and upper pileitrama. Vascular hyphae numerous in pileitrama. Clamps not seen with certainty (but the base of the basidia shows a distinct knack, probably caused by outgrown clamps).

Collection studied.—U.S.A., North Carolina, Indian Creek near Bryson City, 9 Aug. 1952, *L.R. Hesler 20456* (holotype, TENN).

Entoloma pluteicutis (Romagn. & Gilles) Noordel., *comb. nov.*

Basionym: *Rhodophyllus pluteicutis* Romagn. & Gilles in Beih. Nova Hedwigia 59: 465. 1979.

For a description and illustrations of *E. pluteicutis* is referred to the original publication of Romagnesi & Gilles (1979).

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SPORE ORNAMENTATION AND SPECIES CONCEPT IN SYNCEPHALASTRUM

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Morphological studies and mating experiments indicate the synonomy of *Syncephalastrum verruculosum* and *S. racemosum*. The ornamentation of the sporangiospores is due to folds of the merosporangial wall. It is highly variable and cannot be used for species delimitation.

In his revision of the merosporangiferous Mucorales Benjamin (1959) considered all the species (6) and varieties (1) described in the genus *Syncephalastrum* J. Schroet. as synonyms of the only accepted species, *S. racemosum* Cohn ex J. Schroet. He studied more than thirty isolates and concluded that variation in vesicle diameter, number of spores per sporangium and size and shape of the spores (globose to ovoid) had no taxonomic value at species level. Since 1959 two additional species have been described, viz. *S. alma-ataense* Novobr. (1972) and *S. verruculosum* Misra (1975).

Benjamin (1959) described the sporangiospores as smooth, but in later reports they have been repeatedly described as roughened or verruculose (Young, 1968; Matsushima, 1975; Watanabe, 1975). Misra used the ornamentation of the sporangiospores as a main character to distinguish *S. verruculosum*. O'Donnell (1979) published SEM photographs of nearly smooth sporangiospores, while those published by Cole and Samson (1979) were definitely warty. In both cases the strain had been grown on malt extract agar (MEA). In 1981 a strain on MEA (Merck) with smooth spores was sent for identification; after transfer on CBS beerwort agar it produced warty sporangiospores. This phenomenon and the different interpretation of the taxonomic value of the spore ornamentation prompted us to a reconsideration of this character.

MATERIAL AND METHODS

Strains examined. — CBS 348. 35 (-), orginating from Blakeslee's collection. — CBS 440.59 (+), CBS 442.59 (+), CBS 443.59 (+), CBS 444.59 (-), all isolated from soil, California, U.S.A., sent by R.K. Benjamin — CBS 441.59, isolated from coyote dung, California, U.S.A., sent by R.K. Benjamin. — CBS 213.78 (-), type strain of *S. verruculosum*, from air, Gorakhpur, India, sent by P.C. Misra.—CBS 556.81 (-), CBS 557.81 (+), from foodstuff, the Netherlands.

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All strains were grown at 25°C on PDA, YpSs, YEA (yeast + malt extract agar), malt extract no. 5398 (Merck, pH = 5.6), malt extract CM59 (Oxoid), CBS beerwort agar, containing 4% sugar, at pH = 4, 5, 6 and 7. To establish an eventual influence of the temperature, strains were also grown at 20, 30 and 36°C. Slides were mounted in water, 0.1 N NaOH, 0.1 N HCl, Congo Red in 10% NH_4OH and Cotton Blue in lactic acid. Mating experiments were performed on YE agar at 25°C in the dark. SEM preparations were made according to Samson & al. (1979); after critical point drying some spores were gently squashed between object glasses in order to get more information on the nature of the ornamentation. Capitalized colour names refer to Ridgway (1912); colour codes refer to Kornerup & Wanscher (1978).

RESULTS

On beerwort agar all strains resembled each other in general morphology. The variation encountered did not exceed the usual range in species of Mucorales. All strains contained ornamented spores, albeit that smooth spores also occurred and that the ratio smooth versus ornamented spores and the degree of ornamentation (slightly roughened versus distinctly verrucose) varied. On all other media similar results were obtained. CBS 556.81 which was received with smooth sporangiospores, later also produced warty spores on Merck malt agar, the medium on which it was originally received. Various temperatures (20, 25, 30, 36°C) did not affect the ornamentation.

When mounted in 1 N HCl the ornamentation disappeared almost completely (Fig. 4); in 1 N NaOH and in Congo Red the ornamentation seemed to be less distinct, but did not disappear. In Cotton Blue the ornamentation was similar to that seen in water.

SEM photographs revealed that the ornamentation is formed by the merosporangial wall. When this wall is damaged (Fig. 5–6) or dissolved (Fig. 4), the smooth or nearly smooth spore wall is clearly visible. The type of ornamentation (Fig. 1–3) varied from wart-like to wrinkled or plate-like, often within the same strain. In addition the density of the warts varied considerably.

The mating experiments also indicate that only one species is involved (Table 2).

DISCUSSION

The merosporangial wall, which remains in close contact with the spore wall (Cole & Samson, 1979), is responsible for the ornamentation. TEM photographs of Fletcher (1972) and also our own observations suggest that the warts and ridges are mere folds of the sporangial wall. The ornamentation is thus due to a deformation of the sporangial wall during maturation. This may be caused by a shrinkage of the sporangiospores during the process of maturation, wich indeed seems to occur. This explanation, however, is only partly satisfactory; it may account for the long and low irregular ridges as seen in the lower spores of Fig. 1, but hardly for the rather high and abrupt plate-like structures as seen in Fig. 6. In additional explanation may be found in the residual contents which remain in the sporangium after the spores have been separated and fill some space

	S. racemosum after Benjamin (1959)	*S. verruculosum* after Misra (1975)	*S. racemosum* CBS 441.59 (Benjamin)	*S. verruculosum* CBS 213.78 (Type strain)
Conditions	YpSs or PDA, 21°C	SMA or PDA, 25°C	CBS beerwort agar, 25°C	CBS beerwort agar, 25°C
Colony	nearly white or Drab (7D3) to Deep Neutral Gray (18F3)	greenish grey to light brown	Deep Olive Gray (28D2)	Deep Olive Gray (28D2) to Dark Olive Gray (29E2)
	0.5–1.5 cm high	1 mm high	1.5 cm high	low, aerial mycelium collapsed
Sporangiophores	erect, ascending or recumbent, 10–25 μm diam. branching racemose or cymose	erect or ascending 7–13 μm diam. cymosely branched	up to 15 μm diam. series of short, racemose lateral branches and a few cymose branches	up to 7.5(–15) μm diam. series of racemose lateral branches
	lateral branches straight or recurved	lateral branches straight or recurved	lateral branches straight or recurved	lateral branches mostly straight, some recurved
Terminal vesicles	globose or ovoid 30–80 μm diam. pale or brownish usually subtended by septa	globose 25–40 μm diam. light brown usually subtended by septa	globose, rarely ovoid up to 40 μm diam. brownish often subtended by septa	globose or ovoid up to 30(–40) μm diam. brownish usually subtended by septa
Sporeheads	pale to dark grey or brownish 40–150 μm diam.	dark grey 45–90 μm diam.	pale to dark grey or brownish up to 80 μm diam.	pale to dark grey or brownish up to 80 μm diam.
Merosporangia	rod-like (3–)5–10(–18) spores	clavate, 13–23 × 4–7 μm (2–)3–5(–6) spores	clavate, av. 25 × 5 μm av. 7 spores	clavate, av. 25 × 5 μm av. 6 spores
Sporangiospores	globose to ovoid, rarely oblong to cylindrical about 3–5 μm diam. smooth	globose to subglobose, rarely obovoid or oblong 4–7 μm diam. verruculose	globose to subglobose 3–5 μm diam. slightly verruculose	subglobose 4–6(–7) μm diam. verruculose

Table. 1. Comparison of literature data and observations of *S. racemosum* and *S. verruculosum*.

+ −	440.59	442.59	443.59	199.81	557.81
348.35	+		+	+	+
441.59	+	+			+
444.59	+	+	+	+	+
213.78	+		+	+	+
556.81	+	+	+	+	+

Table. 2. Results of matings in *Syncephalastrum* (+ = zygospores produced).

between the spores and the sporangial wall. This wall is partly broken down from the inside (Fletcher, 1972). The liquid then either evaporates or is absorbed by the spores and consequently the meiosporangial wall collapses.

The above results clearly demonstrate that the ornamentation of the sporangiospores has no taxonomic value at species level. Other characters used by Misra (1975) to separate *S. verruculosum* from *S. racemosum* are summarized in Table 1 and compared with the description of Benjamin (1959) and our own observations on an original strain of Benjamin (CBS 441.59) and the type strain of *S. verruculosum*. These data clearly indicate, that *S. verruculosum* falls within the morphological variability of *S. racemosum*. The results of the mating experiments (Table 2) support this statement.

No material was available for a study of *S. alma-ataense*. This is probably another synonym of *S. racemosum* as the only distinguishing character would be the slow growth on Czapek agar (Novobranova, 1972).

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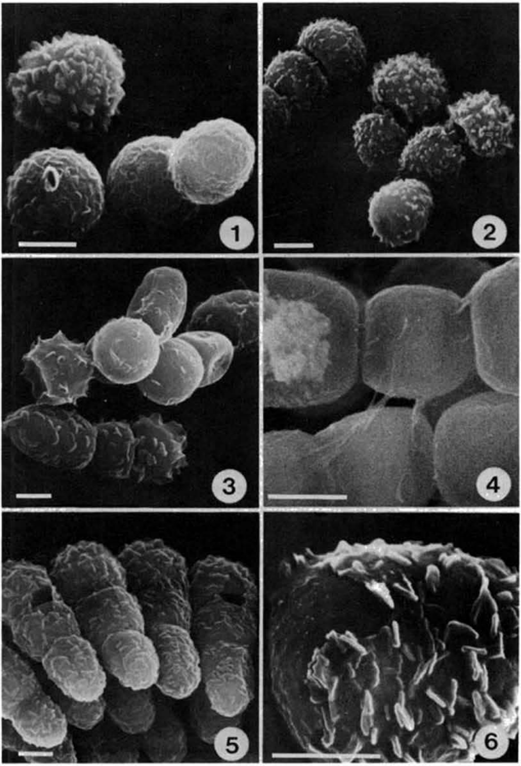

Figs. 1–6. — Sporangiospores of *Syncephalastrum racemosum*. — 1. *CBS 440.59* on CBS beerwort agar. — 2. *CBS 348.35* on CBS beerwort agar. — 3. *CBS 213.78* on CBS beerwort agar. — 4. *CBS 213.78* after treatment with 0.1 N HCl. — 5. Intact merosporangia of *CBS 199.81* on Merck malt agar. — 6. A spore of *CBS 213.78* on Merck malt agar. (The bar represents 2 μm.)

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DESCRIPTION OF MORPHOLOGY, ANATOMY, AND CULTURAL CHARAC- OF HYMENOCHAETE PAUCISETOSA SPEC. NOV.

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The flabelliform *Hymenochaete paucisetosa* spec. nov. is described from Gabon. Its main character is the scantiness of setae, ten percent of which moreover have an unusual shape. The new species is compared with the more or less closely related species *H. cacao, H. villosa* and *H. variegata*. Its cultures have been studied and compared with the only three hitherto described cultures of species of *Hymenochaete*.

In the genus *Hymenochaete* the shape of the basidiocarp varies from stipitate to effused. Whereas the stipitate species appear to be absolutely constant in their form (Reeves & Welden, 1967), many effused species have been reported also with effuso-reflexed or sessile-pileate basidiocarps. Among the African specimens deposited in the Lyon herbarium (LY), the species previously described as new all possess completely effused basidiocarps and exhibit this growth form consistently (Léger, 1980, 1981, 1982, and 1983). The new African species described in this paper, *Hymenochaete paucisetosa*, has a flabelliform (or rarely subdimidiate) habit and strongly resembles *H. cacao* Berk. Little is known about the cultural characters of *Hymenochaete* species. The work of Boidin (1968), restricted to three species, summarizes the limited knowledge, to which the present publication adds information on the cultural characters of *H. paucisetosa.*

Hymenochaete paucisetosa Léger & Lanquetin, *spec. nov.* — Figs. 1–4

Basidioma saepissime flabelliforme, raro subdimidatum, coriaceum, firmum, in sicco fragile, pileo usque ad 3.5 cm lato. Superficies pilei velutina, zonata, striata, e rufa brunnea, ambitu primum magis luteo dein subconcolore. Superficies hymenii radiatim leviter plicatula, in sicco griseo-luteola, margine maxime sericea, in sicco lutea. Trama monomitica ex hyphis luteis, hymenio parallele jacentibus, pariete crassa, septatis ramosisque, 3–4 µm diam. Cortex abest. Tomentum ex hyphis brunneo-luteolis, pariete crassa, septatis, parum ramosis, 3.5–4 µm diam. Hymenium constans e basidiolis dense confertis atque rarioris basidiis, 10–12 × (2–)2.5–3 µm, sterigmatibus 2 µm longis, utrisque permulta granula non crystallina ferentibus. Spinulae brunneae rarissimae, lanceolatae vel ventricosae, pariete crassa, (20–)30–40(–45) × 5–7(–8) µm, usque ad 20(–25) µm eminentes vel inclusae. Aliquae spinulae insolitae videndae sunt. Sporae oblongae breves subellipsoideae, 2.8–3.2 × (1.5–)1.8–2 µm, hyalinae, uninucleatae, haud amyloideae, in massa albae.

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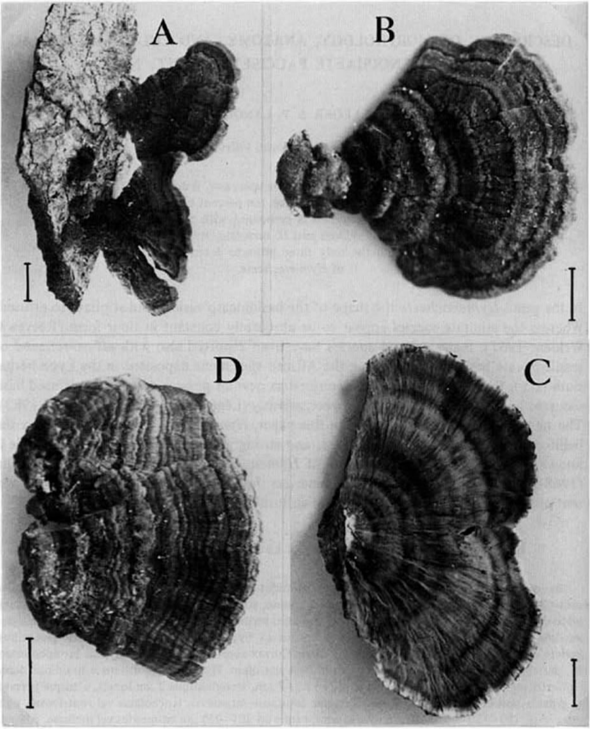

Figs. 1A–D. *Hymenochaete paucisetosa* — A.,B. Upper surface of flabelliform pilei of type. — C. Hymenial surface of type. — D. Subdimidiate pileus of paratype (LY 7902). (Each bar represents 0.5 cm).

Holotypus: A. David, Julius 1970, Gabon, Makokou, in substrato incognito (LY 6513).
Etymology: from 'paucus' (few) and 'setosus' (setose).

Basidiocarp pileate-sessile, rarely subdimidate (Fig. 1D), very often flabelliform and then attached to substratum by narrow base. Although sessile, pileus sometimes arising from a small adnate patch of basidiocarp resembling a very short stipe (Fig. 1A, B).

Pileus coriaceous and firm, brittle when dry, up to 3.5 cm in radius and 0.7 mm thick in section. Upper surface velvety, concentrically zonate and sulcate, reddish brown (Munsell 5 YR 5/6) with brighter (5 YR 5/8 = ochraceous tawny of Ridgway) and darker zones (5 YR 4/6). Margin somewhat lighter, sometimes entire but lobed in most specimens. Hymenial surface matt umber when fresh (5 YR 4/4–4/3), becoming much brighter when dry, i.e. yellowish grey (10 YR 6/3–6/4 to 10 YR 5/4 = Saccardo's umber of Ridgway), concentrically marked with some narrow lines (corresponding to main grooves of upper surface) and with radiately arranged, very crowded, faintly projecting ridges. Margin of hymenial surface very clearly marked, up to 1 mm wide, very silky, beige when freshy (10 YR 7/4), much more yellow when dry (2.5 YR 8/6 = Naples yellow of Ridgway) (Fig. 1, C). Context (Fig. 2) monomitic, composed of rather compact parallel, light yellow, thick-walled, branched and septate hyphae, 3–4 μm in diam. Cortext (= cuticle sensu Reeves & Welden, 1967) absent though basal zone of context which gives rise to tomentum is composed of more compact parallel, yellowish brown hyphae. Tomentum 100–300 μm thick in young specimens, thinner in older ones, composed of loosely woven, yellowish brown, thick-walled, septate, somewhat branched hyphae, 3.5–4 μm in diam. Hymenium 10–15(–20) μm thick, a close palisade of basidioles, 10–15 × 3 μm, and scattered clavate basidia, 10–12 × (2–)2.5–3 μm, with four slender and arcuate sterigmata 2 μm long. Both basidioles and basidia covered with numerous small, non-crystalline granulations turning dark blue in Cotton Blue. Setae extremely scattered, arising only from subhymenium, lanceolate to ventricose, thick-walled, reddish brown, (20–)30–40(–45) × 5–7(–8) μm, projecting up to 20(–25) μm or remaining immersed in hymenium, about 10 out of 100 unusually shaped, some very strange and never described before in the genus, e.g. furcate ones (Fig. 3). Spore print white. Spores oblong to subellipsoid, 2.8–3.2 × (1.5–)1.8–2 μm, hyaline, uninucleate (Giemsa), non-amyloid (Fig. 3).

Collections examined.—GABON, Makokou: July 1970, *A. David* (LY no. 6513; holotype); July 1970, *A. David* (LY no. 6513 bis); 20 May 1976, *J. Boidin* (LY no. 7902, 7907).

The main character of this flabelliform species is the extreme scarcity of the setae. It proved impossible, however, to express the density of the setae in the number per unit of area because of those setate which remain immersed and cannot be detected from the outside. A study of sections taken along radii from the base to the margin of the pileus gave the following results: out of 50 sections, 8 were completely without setae; the greatest number of setae found was 18 in a 2000 μm long section; the average number of setae per millimeter of section length was 3 (as compared with 80–120 being the average number of setae in similar sections of *H. tabacina* (Sow. ex Fr.) Lév.). The setae are not evenly distributed over the hymenial surface. In some zones they are less rare than in others where they are nearly or completely absent (especially at the margin).

Hymenochaete paucisetosa must be included in section *Fultochaete* Escobar, defined by the presence of a setigerous layer seated on a context devoid of setae and by the lack of a cortex (Escobar, 1978). The only species of this section greatly resembling *H. pau-*

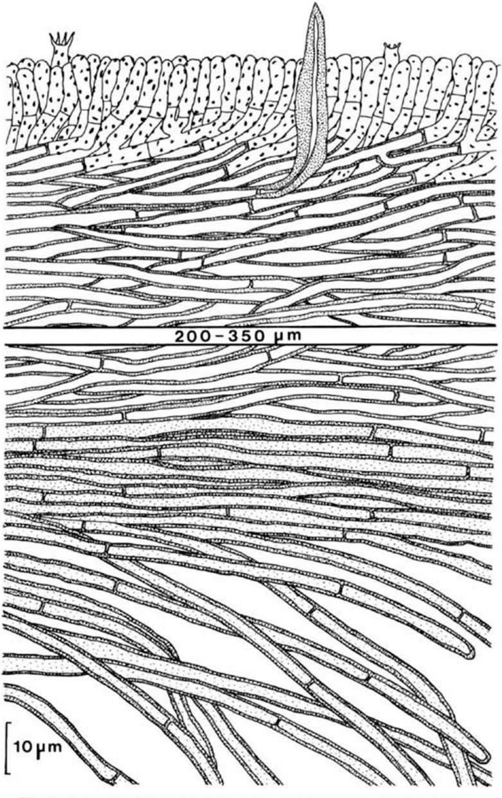

Fig. 2. *Hymenochaete paucisetosa* (type). — Transverse section of basidiocarp.

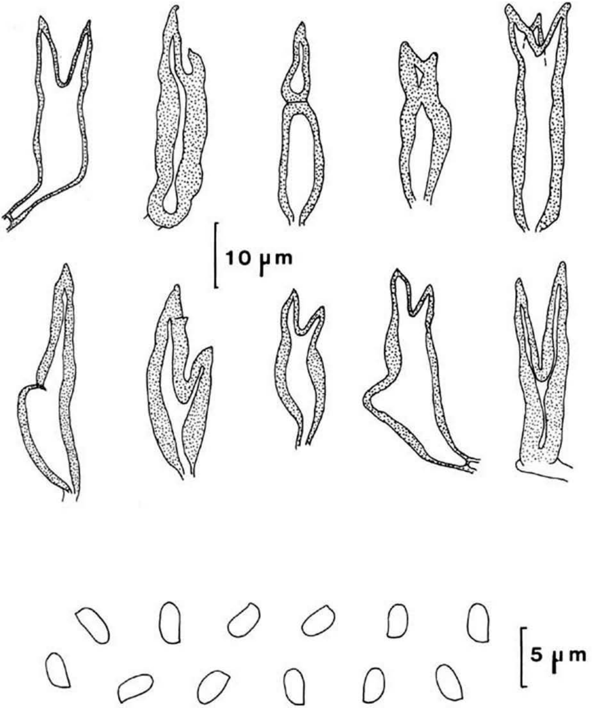

Fig. 3. *Hymenochaete paucisetosa* (type). — Above: Some examples of unusually shaped setae. Below: Spores as seen in phloxine–5%. KOH mixture.

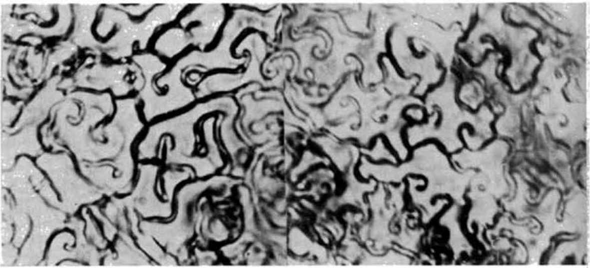

Fig. 4. *Hymenochaete paucisetosa* (type). —Microphotograph of the crust developed in culture.

cisetosa is *H. cacao* Berk., which is distinguished from our species by having larger spores (3.5–4 × 2–2 µm) and smaller setae (20–35 × 4–7 µm) densely crowded in 3–6 overlapping rows. *H. paucisetosa* resembles also *H. villosa* (Lév.) Bres. which possesses larger spores (3.5–4 × 2–2.5 µm), a dimitic hyphal system, and above all a cortex of cemented hyphae (Cunningham, 1957). As mentioned above, some specimens of *H. paucisetosa* are subdimidiate. So it seemed interesting to compare this species with the imperfectly known dimidiate species, *H. variegata* Bres. This species, described in 1915, has not been found nor studied again since that time. Examination of the type has shown that two microfeatures, not observed by Bresadola, permit an easy distinction between *H. variegata* and *H. paucisetosa*: the spores of *H. variegata* are short cylindrical, 4–4.5 × 2–2.5 µm and a distinct cortex composed of reddish brown, septate, and thick-walled hyphae, 4 µm in diam. is present. In addition the upper surface of the pileus of *H. variegata* is zoned with very dark, almost black lines which are never present in *H. paucisetosa.*

Summarizing it can be said that *H. paucisetosa* is an attractive and well-characterized new flabelliform species growing in Africa, which probably remained undiscovered till now because it occurs on a mycologically poorly investigated continent.

CULTURAL CHARACTERS OF HYMENOCHAETE PAUCISETOSA

(Type, LY no. 65131)

Spores: uninucleate.

Germination: the spores germinate after five days, producing one to two hyphae composed of uni- or binucleate articles, most frequently in rows.

Monosporous cultures: the four cultures studied showed hyphae with binucleate articles. However, one of the cultures had rare and isolated cell containing 1–3 to 4 nuclei and exhibited some limited rows of trinucleate articles. The monosporous mycelia seem identical with the polysporous cultures thus this species could be homothallic.

Polysporous cultures:

Growth: very slow (Petri-dishes not covered after six weeks).

Aspect: Margin irregular. In the young part of the culture the aerial mycelium (poor, slightly mustard-coloured, loosely arachnoid to faintly flocculose by examination with (lens) does not conceal the red-brown colour of the medium. In the older half of the culture a pale chocolate crust (5 YR 5/3 to 6/3) takes form, covered initially with very fine down-like hyphae which from time to time produce dark tufts which finally agglomerate into a granular, honey coloured (2.5 YR 7/6) layer tending to become ferruginous (10 YR 6/6) when the layer is thicker. Reverse red-brown, about 5 YR 4/3 and 3/4. No odour.

Microscopical characters:

Aerial mycelium: made up of rather regular hyphae without clamps. The axis, 3.5–4 µm in diam., and the branches, 1.25–2 µm in diam., are slightly to clearly thick-walled, sometimes distinctly brown. On the surface of the medium, the brown crust is composed of brown hyphae which are joined in a jig saw puzzle manner (Fig. 4).

Submerged mycelium: the hyphae are identical with those of the aerial mycelium but with more irregular branches. The dark brown colour observed on the reverse of the cultures does not penetrate more than 3 mm; the remainder of the medium being simply amber-coloured.

Cytology: hyphae with regularly binucleate articles.

Oxidases: gallic acid: ++++, tr. gaiacol: +++, 0
p-cresol: - tyrosine: -, 0

Code (Nobles, 1965; Boidin, 1966): 2a-6-10-32-37-39-47-54-(57)-(61).

The main cultural characters of *Hymenochaete* species, which can be found in the work of Boidin (1958), are the absence of clamps, the presence of a brown crust and also the identical aspect and cytology of both monosporous and polysporous cultures (leading to the supposition that the species could be homothallic). The behaviour in culture of *H. paucisetosa* agrees with these three points.

ACKNOWLEDGEMENTS

We are grateful to Dr. A.L. Welden for giving his opinion about this new species and to Dr. C. Bas and Dr. R.A. Maas Geesteranus for critically reading the manuscript and linguistic corrections. Thanks are due to the Curator of the Naturhistoriska Riksmuseet, Stockholm (S) for the loan of the type of *H. variegata* Bres.

RÉSUMÉ

Description d'une nouvelle espèce d'*Hymenochaete: H. paucisetosa* Léger & Lanquetin. Cette belle espèce flabelliforme, récoltée en Afrique, est comparée à trois espèces qui semblaient les plus proches d'après la littérature: *H. cacao* Berk., *H. villosa* (Lév.) Bres. et *H. variegata* Bres. Le caractère majeur de *H. paucisetosa* est la rareté des spinules. Les caractères culturaux font d'autre part l'objet d'une étude détaillée qui apporte confirmation des principaux caractères déjá observés dans quelques espèces du genre.

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NOTES AND BRIEF ARTICLES

CALLISTOSPORA AND CREODIPLODINA, TWO COELOMYCETOUS GENERA FROM AUSTRALIA

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The coelomycete genera *Callistospora* and *Creodiplodina* were described but not illustrated by Petrak (1955, 1957). Both genera have been omitted in recent publications on Coelomycetes. The following notes and figures are based on a study of the type specimens collected by E. Gauba in Australia and maintained in herb. W.

1. **Callistospora gaubae** Petr.—Fig. 1.

Callistospora gaubae Petr. in Sydowia 9: 571. 1955.

The type specimen, collected on Mt. Kosciusko at 6000 ft on 29.3.1955, consists of conidiomata on some dead culms of *Danthonia frigida*. The conidiomata are deeply immersed in the host tissue, spherical or slightly flattened, 150–220 μm diam. and dark, the apical ostiolum being cylindrical or conical, 40–50 μm broad and 35–45 μm high. The 15–20 μm thick conidioma wall is composed of flattened, brown, rather thick-walled cells, 6–14 μm diam. The cells lining the cavity are smaller, hyaline and bear conical or cylindrical conidiogenous cells, 2–6 × 2–4 μm, which may elongate entero-percurrently to show 2–3 collars. However, most of the conidiogenous cells form a single conidium. The conidia are fusiform, often slightly curved, 8- to 10-euseptate, apically attenuated and rounded at the apex, attenuated and truncate at the base, with an unthickened, bulging scar, 40–60 × 11–15 μm. The central cells of the conidia are brown and thick-walled, the apical and basal ones subhyaline. Some filamentous, hyaline, 2–3 μm broad and 30–50 μm long paraphyses line the cavity and surround the conida.

The genus *Callistospora* is similar to *Labridella* Brenckle (including *Hyalotiella* Papendorf and *Hyalotiopsis* Punithalingam, see von Arx, 1981) and *Scolecosporiella* Petr. (including *Brencklea* Petr. and *Urohendersoniella* Petr., see Sutton, 1980), but differs by conidia which are non-rostrate or appendaged at the apex and by the conidiogenous cells, which often show collars and form conidia basipetally.

In *Labridella* and *Scolecosporiella* the conidiogenous cells apparently form a single conidium. The genera *Labridella* and *Scolecosporiella* are close to each other; in the former the apical appendages of the conidia are basally forked, in the latter the conidia are provided with an unbranched, apical rostrum. The genus *Scolecosporiella* also can be regarded as the graminicolous counterpart of *Labridella* which now contains 3 or 4 spe-

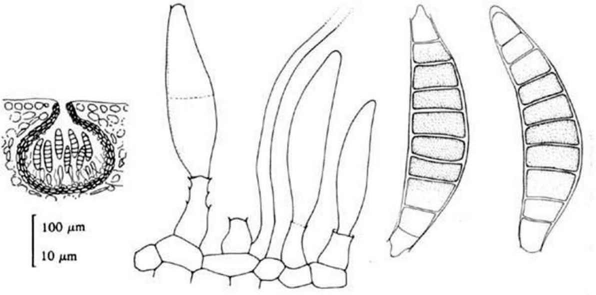

Fig. 1. *Callistospora gaubae*, conidioma, conidiogenous cells, and conidia.

cies growing on Dicotyledons. In *Scolecosporiella* Sutton (1980) accepted 5 species with partly dark, partly light conidia, which may be phragmosporous or dictyosporous. In the type species *S. typhae* (Oud.) Petr. the conidia are usually only slightly pigmented and often only indistinctly rostrate.

No teleomorphs are known in *Scolecosporiella*. Those of *Labridella* belong in *Lepteutypa* Petr., when ascospores are pigmented and asci have an amyloid apical ring, or in *Griphosphaerioma* Höhn. when ascospores are hyaline and the apical ring is not amyloid.

Callistospora is also close to *Sporocadus* Corda (including *Stigmina* Sacc.). This genus can be distinguished by sporodochial-acervular, erumpent, stromatic conidiomata and by longer, distinctly entero-percurrently elongating conidiogenous cells. Its teleomorphs belong to *Discostroma* Clem.

2. **Creodiplodina fusispora** Petr.— Fig. 2.

Creodiplodina fusispora Petr. in Sydowia 10: 316. ('1956') 1957.

The fungus has been collected on the Proteaceae *Grevillea linearis* on 9.6.1953 in Pigeon House Range in NSW. The conidiomata are immersed in the host tissue, spherical or turbinate, apically flattened, 150–260 µm, and disrupt the thick cuticle of the host by a 10–20 µm wide pore. The conidioma wall is 17–26 µm thick, fleshy and composed of several layers of thin-walled, 2–3 µm in size, pale cells which are slightly pigmented only around the pore. The conidiogenous cells line the inner cavity in a dense layer, are conical, 10–14 × 2–3 µm, form conidia basipetally and may proliferate percurrently. The conidia are fusiform-clavate, attenuated and rounded at both ends with a median septum, hyaline and 23–32 × 4–4.5 µm.

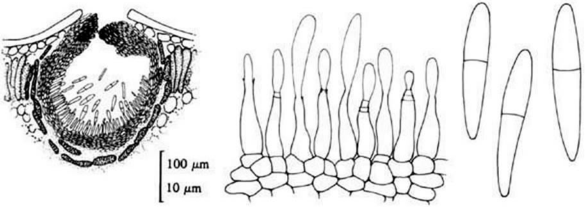

Fig. 2. *Creodiplodina fusispora*, condidioma, conidiogenous cells, and conidia.

The genus *Creodiplodina* is close to *Diplodina* Westend. (synonym: *Septomyxa* Sacc.), which contains anamorphs of *Cryptodiaporthe* Petr. *Creodiplodina* can be distinguished by the pale, fleshy conidiomata-wall, the proliferating phialides and the rather large, basally attenuated conidia.

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A NEW SPECIES OF MYROTHECIUM

VASANT RAO * & G.S. DE HOOG **

During a collecting trip for microfungi in Andhra Pradesh, India, the senior author collected an unusual fungus showing characteristics of both *Myrothecium* Tode: Fr. and *Sarcopodium* Ehrenb. Recent taxonomic accounts are available for both genera (e.g. Tulloch, 1972; Sutton, 1973, 1981; Ellis, 1971, 1976; Matsushima, 1971, 1975, 1981; Nag Raj & George, 1960). The genera comprise sporodochial or somewhat synnematous hyphomycetes forming conidia in slimy masses from densely aggregated phialides. In *Sarcopodium* the hymenium is interspersed with often coiled, branched, pigmented, mostly echinulate setae, whereas in *Myrothecium* the setae, if present, occur at the periphery of the conidioma and are straight, unbranched, hyaline or pale, and usually smooth-walled.

The present fungus has cupulate sporodochia from which large, straight, hyaline, smooth-walled peripheral setae grow out rapidly, each soon becoming covered by a weft of emerald green, echinulate hyphae structurally resembling the setae of *Sarcopodium*. We regard with Tulloch (1972) the hyaline peripheral setae and the marginal hyphae surrounding the sporodochium as the crucial characteristics in this group of fungi and therefore favour the accommodation of this apparently undescribed species in *Myrothecium* rather than in *Sarcopodium*. This classification is further supported by the green, later black, macroscopic colour of the conidiomata; most *Sarcopodium* species are pinkish to brown (Ellis, 1976; Sutton, 1981). The new species is described as follows:

Myrothecium bisetosum Rao & de Hoog, *spec. nov.* — Fig. 1

Coloniae in agaro farina avenacea confecto 24°C sub luce post 10 dies ad 95 mm diam., albae, lanosae. Sporodochia plus minusve aggregata, circularia, saepe confluentia, ad 2 mm diam., primum smaragdina, deinde nigrescentia, e conidiophoris subhyalinis vel dilute viridibus dense aggregatis et circulo plectenchymatico hypharum marginalium constantia; hyphae marginales plus minusve parallelae, crassitunicatae, verrucis regularibus, olivaceo-brunneis obtectae, septis tenuibus, 10–20 μm distantibus divisae, 3.7–4.2 μm latae. Setae hyalinae ex hyphis marginalibus oriundae, hyalinae, leves vel irregulariter incrustatae, 1.5–2.0 μm crassitunicatae, ad 950 μm longae, 5.0–7.5 μm latae, sursum apicem hebetem versus ad 4–5 μm angustatae, cito hyphis marginalibus verrucosis dense intricatae. Conidiophora parallela dense compacta, (sub-)hyalina, e cellulis 7–10 × 2.0–2.5 μm constantia, phialides cylindricae, 8–14 × 2.0–2.5 μm, in summo angustatae, collari inconspicuo vel paulo divergente praeditae. Conidia hyalina, levia et tenuitunicata, subhyalina, bacilliformia vel obclavata vel anguste ellipsoidea, 5.8–7.2 × 1.8–2.2 μm.

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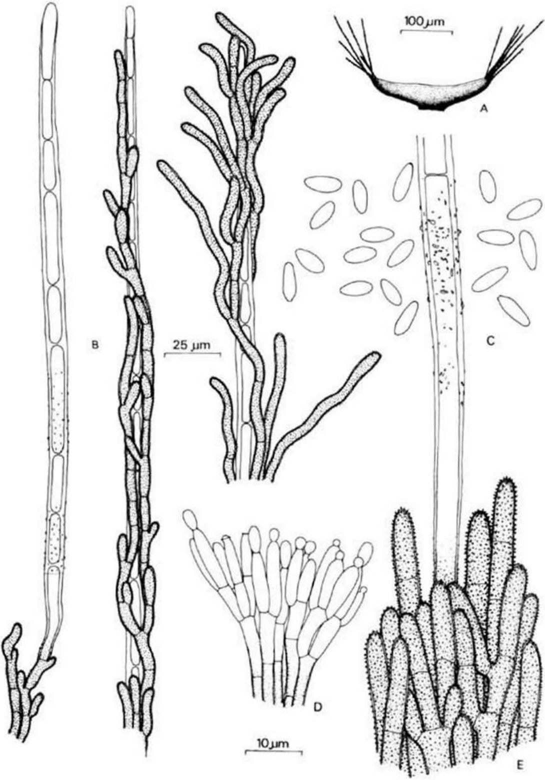

Fig. 1. *Myrothecium bisetosum*, CBS 459.82. — a. Sporodochia. — b. Setae in various stages of development. — c. Conidia. — d. Conidiophores. — e. Detail of marginal hyphae with seta.

Typus vivis *CBS 459.82* exsiccatus Herb. *CBS 1625*, isotypus *VMRL 1009*, isolatus e parte interiore corticis putrescentis cuiusdam, Pranheeta Valley, Adilabad, A.P. in India, coll. a V. et A.C. Rao, 16 Jan. 1981.

Colonies on oatmeal agar under near-UV light at 25°C attaining 95 mm diam. in 10 days, white, lanose, later with pale pinkish reverse particularly at the centre; some local hyaline exudate may be produced; aerial hyphae fragile, hyaline; numerous spirally coiled hyphae present in the submerged mycelium. Sporodochia cupulate, in small local clusters mainly at the centre of the colony, circular in outline but often confluent, up to 2 mm diam., initially emerald green, later nearly black, composed of subhyaline to pale green conidiophores, surrounded by a plectenchyma of marginal hyphae; the latter are parallel, compacted, regularly thick-walled and verrucose with regularly spaced, olivaceous brown warts, emerald green, with thin septa, cells about 10–20 × 3.8–4.2 µm. Setae rapidly growing out from marginal hyphae, hyaline; walls 1.5–2.0 µm thick, smooth or with local, irregular, hyaline incrustation; setae 200–600(–950) µm long, 5.0–7.5 µm wide, tapering to 4–5 µm at the blunt apex, septate every 10–30 µm, soon each seta becoming overgrown by a weft of marginal hyphae. Conidiophores parallel, forming a compact palissade, (sub-)hyaline, smooth- and thin-walled, often darker and with slightly thickened walls at the base, cells about 7–10 × 2.0–2.5 µm, branched repeatedly with 2–3 branches at each node, the ultimate branches are phialides. Phialides closely packed in a parallel layer, smooth- and thin-walled, cylindrical, 8–14 × 2.0–2.5 µm, narrowed at the tip, without collarette or slightly flaring. Conidia hyaline, smooth- and thin-walled, rod-shaped, obclavate or narrowly ellipsoidal, usually both ends rounded or with truncate base, 5.8–7.2 × 1.8–2.2 µm.

Type: *CBS 459.82* = *CBS herb. 1625* = *VMRL 1009*, on inner side of rotten bark, Pranheeta Valley, Adilabad, A.P., India, coll. V. and A.C. Rao, 16 Jan. 1981.

The species is easily recognized by its cupulate fructifications lined with two kinds of setae. Most species of *Myrothecium* are known from the Northern temperate zone (Tulloch, 1972). Agarwal (1980) described *M. viride* Agarwal from India, which has asetose sporodochia.

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ON THE APPLICATION OF THE NAME AGARICUS LACRYMABUNDUS BULL.: FR.

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In literature the name *Psathyrella lacrymabunda* (Bull.: Fr.) Moser is being applied to two species which in this note will be called *Psathyrella cotonea* (Quél.) Konr. & Maubl. and *Lacrymaria velutina* (Pers.: Fr.) Konr. & Maubl. or '*L. velutina*' s. auct.

Taxonomically the distinction between the two species involved offers no problems. The former is keyed out satisfactorily by Kühner & Romagnesi (1953: 370) as *Drosophila cotonea* and by Moser (1982: 272) as *Psathyrella cotonea*, in both cases with reference to Lange's plate (1939:) 146C; the latter by Kühner & Romagnesi (1953: 371) as *Drosophila velutina* and by Moser (1982: 272) as *Psathyrella velutina*, in both cases with reference to Lange's plate (1939:) 144B.

For both species the name *Agaricus lacrymabundus* could be the oldest available one: for *P. cotonea* because *A. lacrymabundus* Bull. (1785): Fr. (1821) is much older than the name *Stropharia cotonea* Quél. 1877 (the basionym of the name *P. cotonea*); for '*L. velutina*' because Fries in 1821 sanctioned the epithet *velutinus* Pers. on variety level under *A. lacrymabundus*.

As the decision about the correct application of the name *A. lacrymabundus* depends on its lecto- or neotypification, the most relevant information on the history of this name and arguments for the several possible typifications are given here point by point.

1. In 1785 Bulliard published in his 'Herbier de la France' plate 194, depicting a pale form of '*L. velutina*'. Plate and French description give all the diagnostic macroscopical characters of *L. velutina*, viz. a dry tomentose pileus, a cortina-like veil and crowded spotted gills with droplets along the edge. Bulliard named this fungus very appropriately *Agaricus lacrymabundus*. Under the 'International Code of Botanical Nomenclature' as modified in 1981 in Sydney, this name is to be considered validly published in 1785, as the later starting points for fungus names have been abolished.

In 1791 Bulliard published on pl. 525 fig. 3 of the same work a second picture of his *A. lacrymabundus*; this time a more slender fungus with a red-brown pileus, but again with droplets along the edge of the gills. Also this fungus undoubtedly belongs to the genus *Lacrymaria*. It probably represents the taxon *L. pyrotricha* (Holmskj.) Konr. & Maubl., which is perhaps nothing more than a form or variety of '*L. velutina*'.

Finally in 1792 (: 438) Bulliard published an extensive description under the name *A. lacrymabundus* with references to both his earlier plates.

2. According to the recently changed rules of botanical nomenclature, Fries (1821: 287) sanctioned the name *Agaricus lacrymabundus* (in the Index he wrote '*A. lacrymabundus* Bull.') which thus got priority over all earlier synonyms and homonyms.

3. In 1821 Fries gave a rather concise description of *A. lacrymabundus* Bull.: Fr., adding the abbreviation 'v.v.', which means that he saw specimens of this species in fresh state, at the same time citing Bulliard's plate 525, a plate of Sowerby (1796: pl. 41) and a description by de Candolle (1805: 146).

4. As Fries did not keep herbarium specimens of the species, we have to look for the most suitable elements in his 'protologue' of 1821 for the selection of a lecto- or neotype.

As mentioned under point 1 above, Bulliard's plate 525 represents a species of *Lacrymaria*, viz. a taxon that is either a red-brown form of '*L. velutina*' or *L. pyrotricha.*

The cited description of de Candolle undoubtedly concerns '*L. velutina*' also; moreover it refers to both plates of Bulliard.

Fries' 1821 description contains some elements (e.g. the pileus '...... albidus dein fuscus') that could point to Fries having had in hand specimens of another species than '*L. velutina*', but it is impossible to decide which species that could have been. (Later descriptions by Fries were altered in such a way that they fitted *P. cotonea*, but that was not yet the case in 1821).

5. As Fries, when taking up *A. lacrymabundus* Bull. in 1821, referred to two excellent plates and one unambiguous description, all representing a species of *Lacrymaria* and not a species of *Psathyrella*, it cannot be said that he made a mistake when he added a slightly deviating description of material seen by himself, but at most that he extended the species concept of *A. lacrymabundus* to include the material in hand.

6. Under the present wording of Article 13 of the 'Code' there are two or three possible lectotypes for *Agaricus lacrymabundus* Bull.: Fr.

(i) If we select Fries' description of 1821 (which is allowed according to Article 9.3 of the 'Code'), *A. lacrymabundus* becomes a dubious name as the 'lectotype' cannot be identified.

(ii) If we select one of the plates cited by Fries as lectotype (another possibility according to Article 9.3 of the 'Code'), it is most logical to select the cited plate of the author of the name, viz. Bulliard's plate 525 fig. 3. It is then a matter of interpretation of this plate and of taxonomic concepts whether the name *A. lacrymabundus* has to be used for '*L. velutina*' or for *L. pyrotricha*; a decision only to be taken after a careful study of the '*L. velutina*' complex.

(iii) However, I prefer to select Bulliard's first plate (1785, pl. 194), not directly but indirectly cited by Fries in 1821 by taking up Bulliard's name, and by referring to de Candolle's description in which that plate is cited, as the lectotype of *A. lacrymabundus* Bull.: Fr.; it is also the plate accompanying the (now) valid publication of the name *A. lacrymabundus* Bull. in 1785.

7. In 1821 Fries added to *A. lacrymabundus* the variety '*β A. velutinus*', with reference to *A. velutinus* Pers. described in 1801. Fries knew this taxon in 1821 only from

plates and descriptions ('Abbild. d. Schw. 3'[1]; 'Holmskj. Ot. II t. 35'). It probably is the more brightly coloured *L. pyrotricha* (Persoon: 'pileo ...... ferrugineo'; Holmskjold 1799: pl. 35 represents the type of *A. pyrotrichus*!).

That Persoon's *A. velutinus* (1801: 409) certainly is a species of *Lacrymaria* and not a *Psathyrella* appears from Persoon's description and references and from material in Persoon's herbarium studied by Singer (1961: 49), who, however, did apparently not consider the possibility that Persoon's lectotype material belongs to *L. pyrotricha* and not to '*L. velutina*' s. auct.

As Persoon's *A. velutinus* has been sanctioned by Fries as a variety of *A. lacrymabundus*, the latter name, simultaneously sanctioned, has priority on species level when typified as indicated under point 7b and 7c above and *L. pyrotricha* and *L. lacrymabunda* are considered conspecific.

It should be stressed that those who reject the selection of plates as lectotypes in favour of the selection of neotypes, have nevertheless to follow a reasoning similar to that given above, in order to find out what the neotype should look like and where it preferably should come from.

Another point I want to put forward is that this note could have been reduced to not more than 2 or 3 paragraphs, if in Sydney the new Article 13 of the Code about the sanctioning of mycological names had not been extended with the, in my opinion very unfortunate, rule that for the typification of a sanctioned name any element in the 'protologue' of the sanctioning author can be taken. The aim was flexibility in the 'Code' which would allow typification of sactioned names in accordance with current usage of such names. The result is a complex situation which will cause much confusion and dispute in the future.

Where there are choices, there are differences of opinion resulting in different solutions. Mycological nomenclature would be saved much trouble if the present rule about the typification of sanctioned names would be replaced by one declaring that the sanctioning of a name does not alter its typification in accordance with the (real) protologue and material studied by the author who validly published the name.

CONCLUSIONS

I. Fries' 'protologue' of *Agaricus lacrymabundus* Bull.: Fr. in 1821 comprises so many elements clearly pointing to a species of *Lacrymaria* that this name has to be typified in such a manner that it has to be used for a species of that genus.

II. The name *Psathyrella cotonea* (Quél.) Konrad & Maubl. for a true species of *Psathyrella* cannot on any account be replaced by the name *Pl. lacrymabunda* (Bull.: Fr.) Moser.

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[1] This is a reference to the plate and description of *Agaricus macrourus* Pers. in Hoffman's 'Abbildungen der Schwämme' the third fascicle (1793) of which is considered to be written by Persoon (see Stafleu, 1967: 205).

III. The most opportune lectotype for *A. lacrymabundus* Bull.: Fr. is Bulliard's plate 194 representing the type of Bulliard's name when it was validly published in 1785, and is here chosen as such. Thus *Lacrymaria lacrymabunda* (Bull.: Fr.) Pat. becomes the correct name for '*L. velutina*' s. auct. s.l., or, if *L. pyrotricha* is recognized as a taxon on species level, for '*L. velutina*' s. auct. s. str.

IV. The possibility should be considered that *Agaricus velutinus* Pers. (1801) is a synonym of *A. pyrotrichus* Holmskj. (1799).

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