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THE GENUS CONOCYBE SUBGEN. PHOLIOTINA

I. The European annulate species

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(With 54 Text-figures)

Sixty-five collections, comprising all known European annulate species of *Conocybe*, subgenus *Pholiotina*, were examined, including the type specimens of *C. vexans* P. D. Orton and *C. percincta* P. D. Orton. In accordance with Orton, it is argued that Ricken, Kühner, and several other authors reversed the original conception of *C. blattaria* and *C. togularis*, as used by Fries, but that the specific epithet 'togularis' should be replaced by 'arrhenii'. *Conocybe aporos* and *C. arrhenii* var. *hadrocystis* are described as a new species and a new variety respectively. It is argued that *C. vexans* is conspecific with *C. blattaria*, and *C. percincta* with *C. teneroides*. Singer's observation—hitherto the only one of its kind—that 2-spored basidia may occur in *C. filaris* was confirmed and such basidia were also found in one collection of *C. arrhenii*. The taxonomic significance of several macroscopic and microscopic characters, often used for the distinction of the species are both scrutinized and criticized and often found to be very little or none. A key to the annulate species of the subgenus *Pholiotina*, chiefly based on the characters of spores and cheilocystidia, is given.

The incentive to making an exhaustive study of the European annulate species of *Conocybe*, subgenus *Pholiotina*, was our private herbarium containing twenty-three personal finds of these species by the end of 1968. To these could be added eight collections from the Rijksherbarium at Leiden, twenty-four from the Herbarium, Royal Botanic Garden, Edinburgh, five from the herbarium of Mr. P. B. Jansen, Breda, and three finds from Mr. J. Daams, Oud-Loosdrecht, altogether sixty-three collections. All our own collections are deposited in the Rijksherbarium, including the type specimens of *C. aporos* and *C. arrhenii* var. *hadrocystis*. We were also able to study the type specimens of *C. vexans* P. D. Orton and *C. percincta* P. D. Orton. Apart from two of our own collections of *C. blattaria*, one of *C. arrhenii* and one of *C. filaris*, the twenty-four collections from the Herbarium at Edinburgh and the two type specimens aforementioned, all of which were found in the British Isles, only Dutch material was studied. In consecutive papers, Dr. R. Watling, Edinburgh, will deal with the exannulate species and the section *Intermediae* of the genus *Conocybe* and some extra-European annulate species of *Conocybe*.

For the benefit of the reader, a list is given of the European annulate species of this subgenus as we know them now, together with a list of the corresponding

names, used by Kühner in his monograph 'Le Genre Galera' (1935), and a list of names as given in the 'New Check List of British Agarics and Boleti' (Dennis, Orton & Hora, 1960).

Kühner	New Check List	Kits van Waveren
1. *C. blattaria* f. *typica*	*C. togularis* non sensu Kühn.	*C. arrhenii* var. *arrhenii*
C. blattaria f. *dentata*		*C. arrhenii* var. *arrhenii*
2.		*C. arrhenii* var. *hadrocystis*
3.		*C. aporos*
4. *C. togularis*	*C. vexans*	*C. blattaria*
5. *C. teneroides*	*C. percincta, C. blattaria*	*C. teneroides*
6. *C. filaris*	*C. filaris*	*C. filaris*

For the descriptions of the colours of the cap, stem, gills, and flesh and also of the spores, mounted in water (under oil immersion and with rather strongly lit field of view), we used the American Munsell Soil Color Charts (abbreviated in the text to M.) and the code, designating its colours. For the methods by which we studied and depicted spores, basidia, cheilocystidia, and the cells of the cuticle of the cap and made sporograms, basidiograms, and cheilocystidiograms, one is referred to a previous paper (Kits van Waveren, 1968: 132). Spore sizes were based on samples from the gills as in the majority of cases no spore-prints were available. Great care was taken to measure only ripe, i.e. dark coloured, spores.

The herbaria to which reference is made are abbreviated as usual (Lanjouw & Stafleu, 1959).

We wish to thank very much the Director of the Rijksherbarium, Leiden (L) for the hospitality received in his institute, the Director of The Herbarium, Royal Botanic Gardens, Kew (K) for lending the type specimens of *C. vexans* and *C. percincta*, and especially Dr. R. Watling for sending us the twenty-four specimens of the Herbarium of the Royal Botanic Garden, Edinburgh (E), for his comments on and corrections of the manuscript, and for our unique collaboration in dealing with the taxonomy of *Conocybe*, in which we both are so very much interested. We are greatly indebted to Dr. F. Kotlaba for translating some of Velenovský's descriptions and to Mr. G. A. Rasch for translating Singer's paper of 1950, published in Russian. Finally we wish to express our profound gratitude to Drs. M. A. Donk, R. A. Maas Geesteranus, C. Bas and J. van Brummelen for their very great help and their interest taken in our mycological activities.

CONOCYBE subgen. PHOLIOTINA (Fayod) Kühn.

Conocybe subgen. *Pholiotina* (Fayod) Kühn., Le Genre Galera 44, 139. 1935.

Cap 4–40 mm diameter, conical to conico-campanulate, then convex to applanate, often subumbonate, striate but never radially-sulcate, surface smooth, infrequently rugulose, hygrophanous, reddish-brown to dark brown and paler shades of brown. Velum partiale either forming a conspicuous ring with striate-plicate upper surface

(annulate species) or white denticles along the margin of the cap (ex-annulate species), but in the former group the veil sometimes forms denticles instead of a ring. Gills ochre-brown, ventricose, narrowly adnexed, edge white. Stem 20–70 × 1–6 mm, cylindrical or slightly thickened towards the base, pale yellowish-brown at the pruinose apex, increasingly brown towards the dark fuliginous brown base, colours partly masked by the whitish fibrillose-striate superficial layer. Spore-print deep rust-brown, ochre-brown. Cuticle of the cap hymeniform (hymeniderm). Spores ellipsoid to slightly amygdaliform with flattened adaxial face, yellow with just a trace of red when mounted in water, often with a germ-pore. Basidia as a rule 4-, but sometimes 2-spored. Cheilocystidia always present, cylindrical, sublageniform, lageniform, clavate, utriform, only in section *Intermediae* (to be described by Dr. R. Watling) more or less lecythiform. Pleurocystidia always absent.

Conocybe versus Pholiotina

According to Fayod (1889: 357) who erected *Conocybe* and *Pholiotina* as two separate genera, the species of *Pholiotina* have (1) a "voile général fibreux, formant l'épicutis; double et annuliforme sur le stipe," (2) the "subhyménium et hyménopodium denses et à éléments filiformes fins, peu distincts," (3) "cellules hyméniales allongées, claviformes," (4) "cystides allongés, cylindracés." The species of *Conocybe* have a "subhyménium très développé" and "cellules hyméniales courtes, subcylindriques," neither a veil nor cystidia being mentioned in the definition of *Conocybe*.

However, from the investigations of Kühner (1949: 275) and Reynders (1963: 347) we know that *C. pubescens* and *C. antipus* are paravelangiocarpic in that they show traces of a lipsanenchyma, i.e. a velum partiale (*C. hebelomatoides* was found to be gymnangiocarpic). Watling (*apud* Reynders, 1963: 347; doctorate thesis Edinburgh 1964, unpublished; and personal communication) found traces of a veil in several species of *Conocybe*, for instance *C. farinacea* (Watling, 1964: 309), *C. tenera*, *C. subovalis*, *C. coprophila*, *C. appendiculata*. In *Conocybe* therefore traces of a veil are also encountered outside *Pholiotina*.

Kühner (1935: 18) very carefully studied the hymenophoral trama in species of both *Conocybe* and *Pholiotina*. He indeed found that in *Pholiotina* the mediostratum is broad, consisting of inflated cells, and lined on both sides with filiform hyphae (the hymenopodium), separating the mediostratum from the subhymenium, whereas in *Conocybe* the subhymenium is so strongly developed that the hymenopodia from both sides almost touch each other, the mediostratum being almost obliterated. But he also noticed that the latter structure often could be found only in the small gills or near the edge of the large gills and that in several species of *Conocybe* at the base of the larger gills the hymenophoral pattern was similar to that in species of *Pholiotina*: broad mediostratum with widely separated hymenopodia, only narrowing near the edge of the gill, the hymenopodia touching (Kühner, 1935: 11, fig. 3; 19, fig. 5; and 20, fig. 6). He therefore considered the assumed structural differences between the two genera only to be "une différence de degré" as indeed they are.

Watling (personal communication) confirmed this in *C. pubescens*, *C. farinacea*, *C. subpubescens*, *C. tenera*, and *C. subovalis*.

Kühner's observations are in full agreement with the concept of the thickening hymenium in which the cells of the subhymenium during the process of producing the hymenial elements increase in number and size; this would imply that locally the stage of maturity in the gills decides the thickness of the subhymenium (Donk, 1957: 3 and personal communication). Kühner also very carefully measured and compared the sizes of spores and basidia in species of both *Conocybe* and *Pholiotina* and found the differences too small to serve the purpose of maintaining *Pholiotina* as a genus separate from *Conocybe*.

Singer (1949: 482; 1962: 521), later followed by Moser (1967: 225), is the only author to adopt Fayod's separation of *Conocybe* and *Pholiotina*, which he, however, based exclusively on the alleged difference in the structure of the hymenophoral trama.[1] Discarding Fayod's original definition this resulted with Singer in (1) the inclusion in *Pholiotina* of the species of section *Piliferae* of *Conocybe*, which lack a veil but possess pileocystidia, structures which are absent in the majority of species of *Pholiotina*; (2) the inclusion of the species of section *Intermediae*, which have lecythiform cheilo- and caulocystidia, while Fayod's concept of *Pholiotina* implies that this "genus" should only comprise species with "cystides allongés, cylindracés"; (3) the exclusion of some species of *Conocybe* which possess traces of an annulus.

In agreement with Watling (1965: 289–323) it was therefore decided not to maintain *Pholiotina* as an independent genus as Singer and his school did, but to subordinate it in *Conocybe* as a subgenus. This view was also recently expressed by Romagnesi (1968: 365).

Discussion of macroscopic characters

Caps, when young, moist, and fresh, very often are decidedly dark reddish-brown (M. 5 YR 3/3, 3/4, 4/3), but, being hygrophanous, the reddish colour very soon disappears, making way for some shade of brown (M. 7.5 YR 4/4, 5/6, 6/6), finally, when the process of drying out is complete, of pale brown (M. 10 YR 5/6, 6/6, 7/6 or even 7/4). Remoistening of the cap, for instance by putting the stem in water, never brings back the reddish colour but does bring back some of the brown colour but in all *Conocybe* species never quite the original shade of brown. This process of drying out and remoistening is bound to happen also while the carpophores are still in the field. The rapid loss of the red colour is particularly deceiving and one feels that quite a few descriptions in the literature must have been based on

[1] "In *Conocybe* the hymenophoral trama is reduced to a very thin mediostratum of a few filamentous hyphae which are flanked by the enormously developed hymenopodium, consisting of voluminous elements, the hymenopodia of both sides of the mediostratum almost touching each other," whereas in *Pholiotina* "the mediostratum is more developed and the hymenopodium less developed" (Singer, l.c.).

specimens in which the process of drying out was already well on its way. For instance the colour of the caps of the eight specimens of *Agaricus togularis* var. *filaris*, depicted by Fries (1884: pl. 104, fig. 4) on which J. E. Lange (1938: 63) based his description of *Pholiota filaris*, and also of the caps of the specimens depicted by Lange himself (1938: pl. 106 C, C 1) is obviously too pale (M. 10 YR 7/4 and only near the margin ± 7.5 YR 7/6 on Fries's plate; ± 7.5 YR 7/6 on Lange's plate, which does show, however, a trace of reddish in the centre of the caps). Accordingly the caps on both Fries' and Lange's plates are hardly striate. Caps may be dark warm brown and seem quite moist, when nevertheless they are already well on their way of drying out.

Moist caps of all species of the subgenus *Pholiotina* may be striate well beyond halfway to the centre, sometimes even up to 2/3–3/4 of the radius, even in *C. arrhenii* ("*blattaria*"), which in the literature is reputed to be somewhat less striate than the other species of *Pholiotina*. The extent to which the caps are striate, however, varies a great deal within one and the same species and depends largely on the degree of drying out, in the process of which the striation becomes less and less, finally to disappear. The degree of striation therefore cannot have any taxonomic significance, neither can it serve as a key character.

Kühner, however, did use the striation of the cap in his key to the subgenus *Pholiotina* (1935: 44): in item 5 the choice is between either "chapeau longuement et fortement strié" plus the striking pale colour of the cap (= *C. appendiculata*), or "chapeau plus fortement coloré" (degree of striation not mentioned). In the full description of *C. appendiculata*, it is then stated that the caps are "d'abord à peine striolé mais devenant vite nettement ou même fortement strié, souvent jusqu'au delà de la moitié rayon," so the striae may even reach beyond halfway to the centre of the cap. In the description of *C. blattaria* f. *exannulata*, the first species of the alternative choice, however, it is stated that the cap is "nettement strié, soit au bord seulement, soit jusqu'à la moitié du rayon piléique ou même au delà" and the cap of yet another of the alternative choices, the annulate *C. filaris*, is "assez longuement strié."

Particularly in *C. filaris*, the surface of the cap is sometimes definitely veined, rugulose, and this character led to the description of a new species by Peck (1898: 102), *C. rugosa*, and of a new variety by Singer (1950: 429), *C. filaris* var. *rugosa*. In both cases one no doubt is dealing with specimens of *C. filaris*, having a conspicuously veined surface of the cap. Our own material contains several collections of *C. filaris* in which the surface of the cap of some specimens was distinctly rugulose when fresh, while it was quite smooth in others. Although this phenomenon is more frequent in *C. filaris*, we also noticed it in specimens of *C. arrhenii*, *C. arrhenii* var. *hadrocystis*, and *C. aporos*.

The velum partiale causes the species of the *Pholiotina* group to be either annulate or exannulate, the margin of the cap then carrying a number of small white denticles, the remnants of the veil. But the dividing line between the two groups is by no means sharp. Kühner (1935: 150) described of *C. arrhenii* ("*blattaria*") a "forma

dentata," which neither macroscopically nor microscopically differed in any way from "forma typica" except for the veil, which in the former had failed to form a ring around the stem and instead had remained as denticles all along the margin of the cap. The inner surface (facing the stem) of the denticles was striate like the upper surface of the ring in "forma typica," thus proving the common origin of both ring and denticles. Kühner also noticed that on rare occasions in his "forma *dentata*," as might be expected, small remnants of a ring could still be found in spite of the presence of the denticles.

In our own material two out of the three specimens of our find of *C. arrhenii* of 28 Sept. 1968, representing Kühner's *C.* "*blattaria*" f. *dentata*, had, apart from distinct denticles along the margin of the cap, also remnants of a ring or the stem. Of our find of *C. arrhenii* of 11 Oct. 1969, consisting of fourteen specimens, one specimen did not show a ring but did show right in the centre of the cap quite a number of white velar fibres, also halfway down the centre a conspicuous circle of isolated patches of velar remnants and finally very close to the margin of the cap a few remnants of the veil. A few specimens of the same lot had a conspicuous be it sometimes rather small ring and besides a fairly large number of white velar flocci on the surface of the cap close to and along the entire margin of the cap and sometimes also higher up till even close to the centre.

On the other hand three out of the four specimens of our find of *C. brunnea* (lecythiform cystidia!) of 10 Sept. 1968 near Tomich (Scotland) had the white velar denticles along the margin of the cap, typical of this species, while the fourth specimen had quite a large ring and hardly any of these denticles. In this respect the twelve specimens of our find of *C. brunnea* of 19 Oct. 1969 in Ommen, were even more striking in that only one showed the denticles, two only a very conspicuous and distinctly striate-plicate ring and eleven neither denticles nor a ring! Kühner (1935: 146) stated that with some species of *Pholiotina*—his examples are *C. arrhenii* ("*blattaria*"), *C. brunnea*, and *C. appendiculata*—in some specimens the veil may remain attached to the margin of the cap, while in others it stays on the stem as a ring. Mr. P. B. Jansen, who for many years has been collecting the annulate *C. aporos* in the South of the Netherlands, reported that "in unfavourable weather conditions, slow growth, specimens of this species may show no ring, but instead an appendiculate veil along the margin of the cap."

One of our own collections, totalling ten specimens, found on 2 June 1962, which at the time had been described in detail, had remained unidentified until—while studying the subgenus *Pholiotina* recently—it became clear that they must be a "dentate" form of *C. aporos*. Next it was discovered that the forty specimens in the Rijksherbarium (No. 1281) found by Dr. J. van Brummelen on 22 April 1961 and at the time identified as *C. exannulata*, fully fulfilled all requirements for the identification as *C. aporos*, but that, when they were collected, none of them carried a ring, while most of them showed distinct remnants of the veil along the margin of the cap.

It is clear that under certain conditions (weather, velocity of growth or expansion of the cap, firmness by which the veil is attached to either the stem or the cap),

the veil, instead of remaining attached to the stem, forming a ring, may stick to the cap, breaking up into a number of denticles along its margin (*C. brunnea*, *C. arrhenii*, *C. aporos*) and vice versa (Kühner: *C. appendiculata*). Consequently we believe this phenomenon neither warrants distinguishing a "forma *dentata*" of the species involved, nor a "forma *annulata*" of *C. appendiculata*. We have therefore not recognized Kühner's f. *dentata* of *C.* "*blattaria*."

Great emphasis, however, must be put on the existence of these 'dentate' forms as in the field 'dentate' specimens may very easily be taken for some member of the exannulate group. A very careful study and particularly microscopical examination is needed to arrive at the proper identification.

In item 3 of his key (1960: 192) to the annulate species of *Conocybe*, Orton puts some emphasis on the appearance of the surface of the stem below the annulus. It is described as "not conspicuously floccose-scaly at first" in *C. blattaria* (= *C. teneroides*) as opposed to "whitish or yellowish floccose-scaly at first" for both species of item 4, *C. vexans* (= *C. blattaria*) and *C. percincta* (= *C. teneroides*). In the description of the microscopical characters to follow hereafter, it will be outlined that the superficial layer of the stem below the ring of all species of *Pholiotina* consists of colourless hyphae, of which many terminate in a chain of some 3 to 6 short and broader cells and that very often these chains lump together, forming clusters of often quite considerable size. The extent to which they lump together greatly varies, most likely with age and external conditions and these chains and their conglomerations were found in all species. It is clear that these clusters are responsible for the floccose-scaly appearance of the stems, often mentioned in descriptions in the literature. This appearance, although not always present, was often noticed by us too and in our opinion this floccose-scaliness can be of no taxonomic significance. All that may be stated is that the stems of *C. blattaria* and *C. teneroides* as a rule are more finely, silky striate than those of the other species.

With regard to the smell, it should be mentioned that specimens of *C. aporos* (and according to the excellent naturalist Mr. P. B. Jansen, particularly the young specimens) often have a very distinct smell of pelargonium, especially on bruising. Kühner (1935) reported an "odeur forte acide" in specimens of *C. arrhenii* ("*blattaria*") found early in the year (February, March, and May) so that these may well have been specimens of *C. aporos*, although shape of cystidia and absence of germ-pore were not mentioned.[2]

Discussion of microscopic characters

The microscopic characters have been admirably studied and described by Kühner (1935), who besides made a special study of the cuticle and flesh of the

[2] The one and only specimen of *C. appendiculata* var. *macrospora* we ever found had an acid, pelargonium-like smell and Kühner reported an "odeur acide nette" for *C. appendiculata* and even an "odeur fortement acide" for *C. appendiculata* var. *macrospora*.

cap and the trama of the gills, so that the reader is referred to his excellent treatise on these structures.

The cuticle of the cap might be called a palisadoderm, the cells constituting the cuticle being arranged in a palisade-like manner. Their shape and size vary considerably, besides they originate from different levels in the hypoderm, but their apices all lie more or less in one plane. They consist of a stalk and a vesiculose, more or less globose, thin-walled apex. A great many of the stalks are thick-walled and brown, the thicker the wall the browner the colour, but many stalks are thin-walled and colourless; small incrustations are rarely found at the base of the stalks.

At one time during our investigations, we believed that these cells might furnish differential characters between some of the species (in our two collections of *C. blattaria* and one of *C. teneroides*, for instance, the stalks were strikingly short and rarely slightly thickened and brown), but for the moment we prefer ignoring these possible differences as, because of the very great variability of these cells, a larger number of collections of each of the species would have to be available for examination. The age of the specimens largely seems to be responsible for these differences, the size of the cells and particularly the colour and thickness of the walls of their stalks seeming to increase with age.

Following Kühner's advice (1935: 27) we searched the surface of the stems of the annulate species of the subgenus *Pholiotina* below the level of the ring for caulocystidia, but never found any. The superficial whitish fibrillose layer of the stems at that level consists of a dense and chiefly longitudinal network of colourless hyphae, *c.* 1.6–8 μ thick. Many of these are seen to terminate in a chain of some 3 to 6 short (often very short) and broad cells (up to *c.* 12.8 μ) of which the terminal cell is broadest, obtuse, and sometimes forked or irregularly shaped or carrying 1 or 2 broad and blunt protuberances. Small and large clusters of these terminal hyphal chains are very frequent and no doubt cause the floccose-scaliness of the stems. There is no sharp dividing line between the colourless hyphae of this network and the thin superficial, very pale brown hyphae of the actual flesh of the stem, the latter becoming increasingly broader (up to 24 μ) and browner towards the centre of the stem. The hyphae of the superficial network and particularly those of the terminal chains, carry great numbers of clamps.

The spores are ellipsoid, slightly amygdaliform and yellow (M. 2.5 Y 7/6; 5 Y 7/6, 8/6) with just a trace of red in water, but in *C. blattaria* and *C. teneroides* the yellow colour is slightly darker (M. 2.5 Y 8/8), probably because their spores are larger and their walls thicker (germ-pore conspicuous!). The apiculus is small but distinct and all spores except those of *C. aporos* have a germ-pore, which is very inconspicuous in *C. arrhenii* ("subporé") and quite distinct, even large, in *C. blattaria* and *C. teneroides*.

The basidia are practically always 4-spored, but in *C. teneroides* 2-spored and we were able to confirm Singer's observation (the only one we found in the literature) that in *C. filaris* 2-spored basidia may occur adjacent to 4-spored. We also found 2-spored adjacent to a majority of 4-spored basidia in one collection of *C. arrhenii* of which the spores were slightly larger than usual.

The shape of the cheilocystidia is considered to be highly specific for each of the annulate species of the subgenus *Pholiotina* and therefore has been used by both Kühner—who depicted these cells for every single species—and us as a major key character for the delimitation of the species. These cells are very firmly fixed to the subhymenium and consequently very difficult to isolate with the object of making them visible over their full length. For *C. arrhenii* ("*blattaria*") Kühner (1935: 152) even contented himself by depicting only the top half of a bunch of seven cheilocystidia and only one at full length. The cystidia are colourless, their walls are of normal thickness, and rarely are some of the apices covered with a thin layer of mucus.

Habitat, frequency

The species of the annulate group of the subgenus *Pholiotina* prefer a rather rich, clayey soil and as a result are usually found along roadsides, in gardens, parks, in grass and particularly in orchards and in or near greenhouses. Except for *C. aporos*, which only grows in the spring, all species grow in the summer and autumn, even as late as November and December if the weather is favourable. They grow either solitary or in small groups (3–6 specimens) but *C. arrhenii*, *C. aporos*, and *C. filaris* have been found growing more or less gregariously and Mr. P. B. Jansen even reported having found *C. aporos* "by the hundred."

The annulate species of the subgenus *Pholiotina* are considered to be rare; Kühner & Romagnesi (1953: 343) called all species of this subgenus "rare" or "assez rare" and Kühner (1935) only had 15 finds of the annulate group at his disposal. In the Netherlands *C. arrhenii*, *C. aporos*, and *C. filaris* are uncommon, *C. arrhenii* var. *hadrocystis* has been found twice, *C. teneroides* only once, while *C. blattaria* has not yet been recorded.

Nomenclatural discussion

I. *Agaricus togularis* Bull. ex Fr. 1821, an *Agrocybe*.

In 1821 Fries (1821: 241) described *Agaricus togularis* and this name next appeared in all his subsequent publications (1828: 38; 1838: 161; 1857: 306; 1874: 216; 1884: 2. pl. 104 fig. 4) in which he consistently referred to Bulliard's species of that name (1809: 639) and to his Plate 595 fig. 2. Before embarking on Fries' concept of *A. togularis*, we must therefore first concentrate on the species Bulliard had in mind when he described *A. togularis*.

According to Bulliard's description, the cap of *A. togularis* is 30–50 mm broad and the largest specimen depicted on his plate even measures 60 mm (stem 80 × 4 mm and × 6 mm at the base); the cap of the one but largest specimen of his plate measures 41 mm, its stem measures 55 × 4.5 mm and × 7 mm at the base. The shape of the cap is described as "arrondie," then "semiorbiculaire," finally "aplati,"

the colour as "bistre-jaune-paille," the colour of the gills as white at first, soon "bistre-paille-cendré," but Bulliard's plate shows sordid brown gills (M. 5 YR 5/4; 7.5 YR 5/4). The stem is also "jaune-paille-cendré," it carries a fugacious ring which is not stated as being striate above, while the specimens depicted on Bulliard's plate do not show any striation either.

From the above it is clear that Bulliard's description and plate of *A. togularis* pertain to an *Agrocybe* (most likely *A. praecox*). Quélet (1888: 96) was of the same opinion; he put a question-mark behind his citation of Bulliard's plate as synonym of *Hylophila togularis*, while later (1894: 485) he wrote that "*A. togularis* Bull. pl. 595 fig. 2 paraît être la même espèce que *praecox* Pers., nom qui ne peut pas être identifié avec *Arrhenii* Fries." Singer (1950: 431) also considered Bulliard's *A. togularis* to be an *Agrocybe*.[3]

Our reasoning that Bulliard's *A. togularis* must have been an *Agrocybe* tells even more with the descriptions Fries (1821: 241; 1828: 38; 1838: 161; 1857: 306) gave of *Agaricus togularis*. With Fries the mature cap even measures 75 mm ("3 unc."), the cap is fleshy ("carnoso"), pale brown (1821: "subargillaceo, pallescens"; 1828, 1838, and 1857: "humidus dilute ferrugineus l. ferrugineo-lividus, siccus expallens argillaceus"), the margin is not or only a little striate (1828: "in vivo striatus"; 1838: "subexstrio"; 1857: "udi striatus"), the stems are robust and thick (1821, 1828, 1857: "3 unc. × 2–3 lin. et ultra" = 75 × 4.6–6.9 mm and more and in 1838 Fries even mentions a thickness of "5 lin." = 11.5 mm); in none of the descriptions is the ring called striate, whereas this striation is characteristic of all annulate species of *Conocybe!* The colour of the gills is called "pallide, dein dilute cinnamomeae" in 1821, "pallide, demum aquose ferrugineae" in 1828, "ex argillaceo ferrugineis" in 1838, and "pallide, dein aquose-ferrugineae" in 1857. It is quite clear that Fries' descriptions mentioned above also pertain to an *Agrocybe*, most likely *A. praecox*.

From Fries' comments, following his descriptions of 1821, 1828, 1838, and 1857, it is clear that he himself must have sensed that this species was, what we now call, an *Agrocybe*. Already in 1821 he stated that *Agaricus togularis* is perhaps a variety of *A. praecox* and in 1838 that Bulliard's species (diameter of cap 30–50 mm!) stands between *A. arrhenii* and *A. togularis*. In 1874, in his description of *A. ombrophilus*, he linked yet another species of the present-day genus *Agrocybe* with *Agaricus togularis* by declaring that species to be synonymous with *A. togularis*, as described by him in 1821. He repeated this in his comment on the picture of *A. ombrophilus* in his Icones (1884: 2. pl. 103), where he said that *A. togularis*, as described by him in the 'Epicrisis' (1838: 161) was synonymous with *A. ombrophilus*. Fries therefore must

[3] Bulliard himself referred to several earlier publications and, although these do not in the least influence the identifications of Bulliard's species, they may be briefly enumerated just for the sake of completeness: Battara's species (1755: 30. pl. 1 B) is unidentifiable; *Agaricus cereolus* Schaeffer (1762: pl. 51) represents *Agrocybe praecox* (colour of gills!); *Agaricus candicans* Schaeffer (1800: pl. 217) is almost certainly a *Stropharia* (blackish-brown gills!) and Bolton's (1788: 10) plate might pertain to *Psathyrella hydrophila*.

have had severe doubts about the identity of his *A. togularis*. This is stressed by J. E. Lange (1938: 63), who wrote: "The synonymy is made still more confused by the alterations made by Fries himself, who in 'Monographia' (while calling *P. togularis*, *P. arrhenii*) used the name *P. togularis* for the species which in 'Hymenomycetes' he calls *P. ombrophila*."

In the 19th century the use of the name *A. togularis*, given by Bulliard and by Fries in his earlier works for a species which undoubtedly was an *Agrocybe*, was wide-spread, while sometimes more confusing data were even added.

Agaricus togularis as described by Persoon (1801: 262) with reference to Bulliard's plate, had a cap measuring 50–75 mm and the stem measured 50–75 × 4.3–6.9 mm. With Secretan (1833: 83) the cap of *A. togularis* measured 50 mm, it was "fauve-nankin, revêtu d'un soyeux blanc," the flesh was 7 mm thick, the stem 62.5 × 10.3 mm and Secretan referred to Bulliard's plate. With Kickx (1864: 163), who referred to Bulliard's plate the cap of *A. togularis* was 40–50 mm broad and "jaune-argileux pâle." In Kummer's (1871: 85) key to the species of *Pholiota*, *P. togularis* follows immediately after *P. praecox*, of which it must have been just a form; later (1882: 83) it was made to follow immediately after *P. dura*.

The size, habitus, and colour of the specimens, depicted by Gillet (1876: 435, pl. 530) and named *Pholiota togularis*, strongly suggest that these must have been *A. praecox*; Gillet referred to Bulliard's plate but in the text Fries is mentioned as the author and in the index (1876: 788) *A. arrhenii* as being conspecific with *A. togularis*. *Pholiota togularis* as described by Quélet (1872: 125) is no doubt an *Agrocybe* (diameter of cap 90 mm) and so is probably *Pholiota togularis* as described by Saccardo (1916: 678) (stem 80–100 × 6 mm or more) as he referred to Quélet's description of 1872 and Bulliard's plate (on the other hand he also quotes Fries' Plate 104 fig. 4 of 1884, depicting *Conocybe filaris* and Cooke's Plate 350/379 of 1884–1886, depicting *C. blattaria!*).

Karsten (1879: 293) described *Pholiota togularis* as a very large species (diameter of cap 30–90 mm, stem 120 × 2–9 mm) with rust-brown gills. He referred on the one hand to Bulliard's plate, but on the other hand also to Fries' Icones, 1884: pl. 104 fig. 4 (= *Conocybe filaris*), to *A. arrhenii* Fr. (1838: 161), and to *A. mesodactylus* Berk. & Br. (1848: 261, pl. 9 fig. 1). Earlier he had given a description in Latin (1876: 114) of *A. togularis*, which is a true copy of Fries' description of that species of 1874, to which Karsten refers, as also to *A. arrhenii* Fr. (1838: 161). Needless to say the two descriptions do not tally. From Britzelmayr's (1883: 151) descriptions of *A. togularis* it is not clear to which species they pertain, very likely *Agrocybe praecox* as Britzelmayr later (1893: 9) described two forms, one of which he considered to be intermediate between *Pholiota togularis* and *P. erebia*, the other between *P. togularis* and *P. ombrophila*. It is impossible to identify the species described by Britzelmayr (1894: 252; reprint: 164) as *A. blattarius* as a *Conocybe*, as the surface of the cap is called "kurz faserschuppig."

The species described by W. G. Smith (1908: 123) as *Togaria togularis* also must have been an *Agrocybe* (cap 56 mm, "pallid ochraceous, mild sienna or umber," stem 78 × 4.7 mm).

II. *Agaricus arrhenii* Fr. 1838 and *A. togularis* sensu Fr. 1874.

Agaricus arrhenii was first described by Fries in the 'Epicrisis' (1838: 161) and again and in greater detail in the 'Monographia' (1857: 307), where, while citing his description of 1838, he distinguished three forms:

Form A was rather large but slender ("major at gracilis"), the stem measured 75–100 × 4.6 mm and was "fibrilloso-striatus," at the apex "lutescens," farther down "fuscescens," and it carried midway a large ring of which it was not stated whether it was striate or not; the cap measured 37.5 mm ("1½ unc."), it was "pallide ochraceo," not striate ("exstrius"); the gills did not turn brown ("lutescentes, demum pallide ferrugineae nec umquam fuscescentes").

Form B was more slender, the stem thinner and often "flexuoso" and of this form, of which no sizes were given, it was stated that it corresponded exactly ("haec forma quae exacte") with *A. mesodactylus* Berk. & Br. (diameter of cap 40 mm, stem 60 × 3 mm, slightly waving, and carrying midway a conspicuously striate ring).

Form C was called very small, "pusillus," but nevertheless the stem measured 25 (or even slightly longer) × 2.3 mm and the cap 25 mm. Fries believed these three forms to lie on a continuum and to be merely forms of one and the same species. From his description it is indeed clear that the difference in size is the only real difference.

It is most remarkable that in Fries' 'Hymenomycetes' the name *A. arrhenii* was withdrawn, having made way for *A. togularis*, of which accordingly *A. arrhenii* was cited as a synonym. It is equally remarkable to see that the description of this *A. togularis* differs on five points from all Fries' previous descriptions of *A. togularis*: in the 1874 description (1) no sizes of cap and stem are given, (2) the cap is still called "carnoso," but for the first time also "tenui," (3) the colour of the cap is not called "dilute ferrugineus," but "pallide ochraceus," (4) the colour of the gills is not "aquose ferrugineus" any more but "lutescentibus," and (5) although Fries still refers to Bulliard's Plate 595 fig. 2, he mentions for the first time *A. arrhenii* from 'Epicrisis' (1838: 161) and *A. mesodactylus* Berk. & Br. (1848: 261, pl. 9 fig. 1) as synonyms.

Obviously Fries changed his ideas about the identity of *A. togularis*, while stating that the many specimens, collected by him, had taught him, what he had already suspected earlier to be true that the fungus, described as *A. togularis*, belonged to *A. arrhenii*. Linking his description of *A. arrhenii* of 1857 with that of *A. togularis* of 1874 and choosing the latter name for the specific epithet, Fries stated that *A. togularis* is a very variable species with a variable habitus ("Proteus statura admodum varius"). Not too much significance should be attached (like many authors, however, did) to the fact that Fries never mentioned the striation of the ring in either *A. togularis* or *A. blattarius*. He must either have overlooked this character or failed to include it in his descriptions. His artist, however, painted this striation very clearly (1884: pl. 104 fig. 4) and after all Fries declared his form B

of *A. arrhenii* to be exactly the same as Berkeley & Broome's *A. mesodactylus* and their figure shows a conspicuously striate ring!

It is the unexpected use of an older name for a different and younger taxon (a clear case of a name being misapplied) that created a confusion which has lasted to the present day. Only very few authors mentioned *A. arrhenii* while discussing the nomenclature of *Pholiota* or *Conocybe togularis* or *blattaria* and even then only casually (Quélet, J. E. Lange, Kühner, Singer, Orton) and very few authors mentioned *A. arrhenii* in giving the synonymy of *Conocybe* "*togularis*" or "*blattaria*" as the case may be. This confusion is very well reflected in the works of Quélet. This author (1872: 125) described *Pholiota togularis*, which must have been an *Agrocybe* (diameter of cap 90 mm and gills "rouillés pâles"), like Quélet himself stated later (1894: 485). In his 'Additions aux Agaricinées' (1872: 248) Quélet described a *Pholiota arrhenii*, saying that this species should be inserted immediately after *P. togularis*, described earlier (1872: 125). Still later, in his 'Supplément' (1872: 319) he added *P. blattaria*, saying that that species should follow immediately after *P. arrhenii*. To Quélet these three species therefore must have seemed closely related. In the 'Flore mycologique' (1888: 96) we find a description of *Hylophila* (*Cyclopus*) *ombrophilus*, a typical *Agrocybe*-species. Accepting the lectotypification by Donk (1962: 79) *Cyclopus* (Quélet) Barbier 1907 is a typonym of *Agrocybe* Fayod. The description of *Hylophila togularis* in the 'Flore mycologique' is quite different from the one of 1872 and turns out to correspond very well with the description Quélet gave of *P. arrhenii* in 1872. The latter name has disappeared from the 'Flore mycologique', obviously having made way for *Hylophila togularis*, of which indeed *A. arrhenii* is said to be a synonym (only the spores are much too large, 14 μ).

In conclusion, in 1874 Fries described a taxon, which he called *A. togularis*, but in all his earlier publications this name had pertained to some species of *Agrocybe*. In 1874 Fries declared *A. togularis* to be identical with *A. arrhenii*, a species, which he had already described in 1838 and he withdrew the latter name in favour of the former. He stressed the point that *A. togularis* is a very variable species and this had led him earlier even to distinguish three forms of *A. arrhenii*. This fungus because of its structural characters has been transferred to the genus *Conocybe*, its correct name now should be *Conocybe arrhenii*.

III. *Agaricus blattarius* Fr.

In contrast to *Agaricus arrhenii* Fries never made alterations of any importance in his descriptions of *Agaricus blattarius* (1821: 246; 1828: 29; 1838: 162; 1857: 308; 1874: 216). From these it is clear that *A. blattarius* is a smaller and more slender species: "Est Galera optime annulata" (Fries 1857: 308). Later Quélet called this species "un Galera muni d'un anneau" and this comparison has been made by other authors as well (for instance, W. G. Smith, 1908: 123).

With Fries (1821: 246) the cap is "parvus" and "subcarnosus," later he called

it "pusillus" and "carnosulo" and of a darker colour than *A. arrhenii* ("ferrugineo, disco subumbonato obscuriore laevi"), the margin is always called "striato." The stem is 12.5–25 × 2.3 mm ("½–1 unc. × 1 lin.") and in all his descriptions the surface of the stem is described as "sericeus" (as against "fibrillosus-striatulus" in *A. arrhenii*) and the gills as "aquose cinnamomeus" ("lutescentibus" in *A. arrhenii*). In 1821 and 1857 Fries described the upper surface of the ring as "laevis" but in 1838 and 1874 no description of this surface was given (in 'Elenchus' this species is merely mentioned, no description being given).

Fries referred to the descriptions of this species by Duby (1830: 812), Secretan (1833: 86), and Weinmann (1836: 203) and these descriptions fully correspond with the one by Fries. But he only referred to a single illustration, Plate 525 fig. 2 of Bulliard, which represents *A. pygmaeus* Bull. Of this figure Fries said in 'Elenchus' that the species depicted, so perfectly corresponded with his *A. blattarius* that he considered Bulliard's species to be a non-annulate form of his *A. blattarius*! In 1874, however, he was somewhat more reluctant with regard to this statement and he then merely said that the habitus of his *A. blattarius* was almost the same as that of *A. pygmaeus*. Weinmann on the contrary believed that Bulliard's fungus did not correspond very well with *A. blattarius*, chiefly because the latter is annulate. Bulliard's illustration depicts fourteen specimens, all growing on a piece of wood and obviously representing specimens of *Psathyrella pygmaea* (Bull. ex Fr.) Singer. Both Fries (1828) and Weinmann (1836) in this connection mentioned the picture of *A. unicolor* (Fl. dan., pl. 1071), depicting an annulate agaric, which may well have been *Galerina marginata* (Fr.) Kühn. or might represent *A. blattarius* Fr.

Agaricus blattarius therefore is an annulate *Conocybe* with the facies of a *Galerina*, it is smaller and more slender than *A. arrhenii*, it has a rather conico-campanulate, brown to yellowish-ochre, striate cap, the surface of the stem is rather silky-striate, and the stem carries a conspicuous ring of which the upper surface is striate-plicate (see figures of *P. blattaria*, Harper, 1912: 1011, pl. 59 and of *P. togularis*, Ricken, 1912: pl. 56 fig. 5; Bresadola, 1930: pl. 687; Kühner, 1935: 161).

IV. 'Togularis' versus 'blattarius' in the literature.

Since Ricken (1912: 199) used the epithet 'togularis' for the species, which Fries named 'blattaria' and vice versa, a number of authors followed his example (Overholts, 1924: 265, and 1927: 113; Bresadola, 1930: pl. 687 and 688; Kühner, 1935: 165; Kühner & Romagnesi, 1953: 343; Moser, 1967: 230; Singer, 1950: 427). But already earlier Cooke (1884–1886: pl. 350/379) had depicted Fries' *A. blattarius* as *A. togularis* Bull. and subsequently (1889–1891: pl. 1172 B / 1173 B) Fries' *A. togularis* as *A. blattarius* Fr. Cooke's description (1890: 373) of *C. arrhenii* (*A.* "*blattarius*") and that (1886: 141) of *C. blattaria* (*A.* "*togularis*"), however, are far from clear and both descriptions show a good deal of resemblance. But the Plates 1172 B / 1173 B and 350/379 no doubt do represent *C. arrhenii* and *C. blattaria* respectively. Ricken's descriptions are much clearer and this is probably why the reversal of the

epithets is put down to him and not to Cooke. Curiously enough Cooke's plates and descriptions are not mentioned by Orton.

Thus, since Ricken great confusion has existed about which epithet belonged to which species; the epithets 'filaris' and 'teneroides' to some extent have been involved in this controversy. Indeed J. E. Lange (1938: 63) called the nomenclature for these species "hopelessly confused."

Kühner (1935: 166) made an unsuccessful attempt to arrive at an acceptable solution, but his own wording shows that he must have been rather sceptical about whether it was correct. He followed Ricken because "l'interprétation de *togularis* par Ricken ne nous semble pas notoirement inexacte," also "l'interprétation de *blattaria* nous paraît beaucoup moins certaine!" By leaving out a number of important data his exposition is very incomplete. He failed to stress sufficiently the confusion caused by Fries' earlier descriptions of *A. togularis*, pertaining to a species of *Agrocybe* and in no less than four footnotes he brought forward arguments against his own decision. On carefully reading Kühner's exposition one really finds more arguments against Kühner's conclusion than in favour of it.

Orton attempted to solve the 'togularis-blattarius' controversy and did so, but only partly. He demonstrated that the interchange brought about by Ricken was incorrect, but in the end still did not arrive at the correct nomenclature as he overlooked a few important facts. First of all he only compared Fries' descriptions of 1821 of *A. togularis* and *A. blattarius* without dealing with the exact identity itself of these two taxa. Neither did he mention the ever returning reference by Fries to Bulliard's Plate 595 fig. 2, which—as argued above—pertains to a species of *Agrocybe*, nor the fact that *A. togularis* from Fries' earlier publications really was an *Agrocybe*. He did quote the diameter of the cap of Fries' *Agaricus togularis* as being 75 mm broad (= 3 unc.) but then ignored the fact that this size is much too large for any species of the *Pholiotina* group of *Conocybe* and accordingly is never met with in any of the descriptions of these species by post-Friesian authors. Orton also ignored the fact that—although in none of Fries' descriptions the upper surface of the ring is described as either 'laevis' or 'striatus'—Fries in his description of 1874 of *Agaricus togularis* referred to Berkeley & Broome's *A. mesodactylus*, which was depicted by these authors with a beautifully striate ring. Next, Orton made no use of Fries' important statement that his form B of *A. arrhenii* (mentioned only casually by Orton, but considered identical with *A. togularis* by Fries in 1874) corresponds exactly with *A. mesodactylus*. He further wrote that Fries "replaced the name '*togularis*' temporarily by '*arrhenii*' in his 'Monographia'," but this work contains both names, each accompanied by its own description of a fungus. Finally Orton's statement that "*C. togularis* was described as *Agaricus* (*Pholiota*) *mesodactylus* by Berkeley & Broome" is not quite correct. It was Fries, who recognized in Berkeley & Broome's description of *A. mesodactylus* his own *A. arrhenii*, which later he called *A. togularis*.

A few more descriptions of *C. togularis* and *C. blattaria* and their interpretations may be mentioned to illustrate the existing confusion in this field.

The interpretation of Berkeley's (1866: 93–98, pl. 1, No. 1) black and white

picture (which lacks a description) of what he called *A. arrhenii* is hazardous, but favours *C. blattaria* rather than *C. arrhenii*.

Although Cooke (1877: 157) in a few short annotations mentioned *A. togularis* and said that this species was synonymous with *A. arrhenii* and *A. mesodactylus*, he also mentioned *A. mycenoides* as being related and he referred to his Plate 85 fig. 3, which depicts a species, which very much resembles *Conocybe blattaria* (this figure corresponds extremely well with Cooke's Pl. 350/379, depicting *Conocybe blattaria*, but by Cooke was called *A. togularis*).

Massee (1893: 213) gave the standard description of *Conocybe* ('*Pholiota*') *blattaria* to which he added a description of specimens seen by himself. These, indeed, must have been *Conocybe blattaria* as they "resemble a Galera with a ring." In the standard description, however, he referred both to *A. blattarius* Fr. (1821) and to Cooke's Pl. 1172/1173 B, which depicts *C. arrhenii*, and the spores are only 4 × 2 μ. Vice versa in his description of *Pholiota togularis*, which probably pertains to *C. arrhenii* (spores 8 × 3.5 μ), Massee (l.c.: 212) referred to Bulliard's Pl. 595 fig. 2 (= *Agrocybe*), to *A. mesodactylus* (= *C. arrhenii*)—the correct figure, Pl. 9 fig. 1 is cited but the text gives the wrong number of 681 (= *A. mycenoides*) instead of 329—and finally to Cooke's Pl. 350/379 (= *C. blattaria*).

The specimens that Harper (1912: 482) described as *Pholiota togularis* were "somewhat hygrophanous" and some "more hygrophanous," the gills were "toothed decurrent," the rings "evanescent," the spores 5 × 8 μ, but neither germ-pore nor basidia nor cystidia were mentioned. The description gives no sizes and the photograph of 7 specimens (Pl. 32, scale not mentioned but no doubt somewhat enlarged, as is clear from Overholts'—1927: pl. 15—reproduction of part of Harper's plate) shows these to have a habitus, which is unlike that of *Conocybe togularis* or *C. blattaria*, decurrent gills, and a ring, which looks more like an annuliform zone.

Judging by Velenovský's (1921: 552) description of the macroscopic characteristics of *Galera togularis*, this species represents *Conocybe blattaria*, although the size of the spores is slightly too small (8–10 μ). Velenovský did not state whether the spores had a germ-pore or whether the basidia were 2- or 4-spored; the cystidia were "from the ellipsoid base long sharp pointed" (translation Dr. F. Kotlaba). It is less certain whether Velenovský's (1921: 501) *Pholiota blattaria* is *Conocybe arrhenii*. The size of the spores was given as 9–10 μ (which means they are even longer than those of Velenovský's *Galera togularis!*) and it is not stated whether the spores had a germ-pore and whether the basidia were 2- or 4-spored. The marginal cells were called "big, lageniform, thin pointed" (translation Dr. F. Kotlaba).

Rea (1922: 113) described as *Pholiota togularis* very clearly *Conocybe arrhenii*, giving the correct sizes of the spores (7–9 × 3–4 μ), but unfortunately he quoted Ricken's data of *Pholiota togularis* (ss. Ricken) for the other microscopical details ("flattened germ-pore, cystidia fusiform, 25–36 × 6–8 μ"), obviously having failed to notice Ricken's switching of the epithets. Vice versa, Rea (l.c.) in his description of his *Pholiota blattaria* (spores 8–10 × 4–5 μ) quoted Ricken's data of *Pholiota blattaria* (ss. Ricken) for the other microscopical details ("cystidia fusiform-subulate"). Orton (1960: 191) has already drawn attention to this error.

Overholts' descriptions of *Pholiota blattaria* (1924: 265 and 1927: 113) certainly pertain to *C. arrhenii*, but considerable doubt is justified as to whether *Pholiota togularis* as described by Overholts (1924: 266 and 1927: 114) really is *C. blattaria* and not an *Agrocybe*. The colours given are not very convincing for *C. blattaria*, the diameter of the cap is too large (10–40 mm) and Bulliard's Plate 595 fig. 2 (= *Agrocybe*) and Boudier's Plate 101 (= *C. arrhenii*) were quoted. But Overholts did not mention a smell and he stated "cystidia none," no doubt meaning the absence of pleurocystidia, which disfavours the interpretation as an *Agrocybe*. He, however, also referred to the plates given by Harper (1912: 1011, pl. 59) and Cooke (1884–1886: pl. 350/379), both, particularly the latter, obviously depicting *C. blattaria*. Konrad & Maublanc (1929: pl. 69 fig. 2) interpreted Overholts' description of *Pholiota togularis* as *C. blattaria*, but their description of *C. blattaria* really pertains to *C. teneroides*, which macroscopically very closely resembles *C. blattaria*.

V. *Conocybe arrhenii*, *C. apoos*, *C. arrhenii* var. *hadrocystis*.

In the literature the descriptions of the macroscopical characters of *Conocybe arrhenii* show a fair uniformity and expose the variability of this species. Out of the only eleven descriptions, partly under the specific epithet 'togularis' (Quélet, 1888: 96; Boudier, 1906: 51; Rea, 1922: 113; Konrad & Maublanc, 1929: pl. 69 fig. 1) partly as 'blattaria' (Ricken, 1912: 199; Overholts, 1927: 113; Bresadola, 1930: pl. 688; Kühner, 1935: 150; Kühner & Romagnesi, 1953: 343; Singer, 1950: 427; and Moser, 1967: 230) in which the size of the spores is given, only five (Overholts, Kühner, Kühner & Romagnesi, Bresadola, and Singer) mentioned the number of spores per basidium (always 4) and only four the germ-pore. There is a great divergence of opinion about the latter, so that in the light of our further discussion the pore cannot serve our purpose. Overholts merely indicated the possible presence of a germ-pore by saying that the apex of the pore is "sometimes slightly truncate," Konrad & Maublanc denied the presence of a germ-pore, Kühner spoke of a "pore indiscutable mais pas toujours évident," and Singer described the pore as being narrow or broad.

But six authors mentioned the precence and shape of the cheilocystidia (not including Rea, who in his discription of 'togularis'—*C. arrhenii* in the present paper—quoted Ricken's discription of the marginal cells in what is *Conocyçe blattaria!*). The first description is by Ricken ("spindelig, pfriemlich" for what is *Conocybe arrhenii!*). Konrad & Maublanc called the cheilocystidia "cylindriques, sinueuses." In full accordance with both descriptions Kühner (1935: 150) described these cells as "filiforme, allongé, grêle," and Singer (1950: 427) as narrow and cylindrical.

In the *C. arrhenii*-group the longest-known species, *C. arrhenii* is therefore characterized microscopically by small spores and very narrow, cylindrical, and slightly flexuous marginal cells. They are very well depicted by Kühner (1935: 150), be it

not over their full length. Kühner is the only author to mention the width of the cells at the apex: 2–4.7 μ; moreover he added that these cells are "parfois clavulé au sommet," but none of the eight cells he depicted show this swollen apex.

It is thus very striking that J. E. Lange (1938: 62, pl. 106 A and A 1) described marginal cells with a conspicuously swollen apex ("coarsely hairshaped, apex slightly swelled up to 7 μ"); also his species occurred "early in the season, May–April." Earlier Lange (1921: 7) had already given a short and incomplete description of this species. In our material we have the same species (apex of the cheilocystidia 3–7 μ, occasionally 9 μ) and all our nine Dutch collections and five out of eight Scottish collections were found either in March, April, or May; three Scottish collections were found early in June. Moreover we found that the spores never had a germ-pore (not mentioned by Lange). This species had already been noticed earlier in our country by Dr. C. Bas, who gave it the provisional name of 'Conocybe vernalis'. On account of these three striking features (swollen apex of the cheilocystidia, absence of a germ-pore, and early occurrence) it is proposed to describe this as a new species—*Conocybe aporos*.

It is quite possible that this species had already been noticed by earlier authors and most certainly by Kühner himself. Quélet (1888: 96) for instance gave two separate periods of occurrence for *Hylophila togularis*: "printemps et fin d'automne." Of *P. togularis* (= *C. arrhenii*) Boudier (1906: 51) said it occurred "généralement printanière mais aussi en automne," Rea (1922: 113) gave May till November as time of occurrence, Konrad & Maublanc (1929: pl. 69 fig. 1) "printemps, été, automne," and Singer (1950: 427, as *Pholiotina blattaria*) May till October. But the latter two authors did not describe the cheilocystidia as having swollen apices.

Kühner (1935: 155) certainly must have seen this species. In his observations on a species he described as *C. blattaria* forma *exannulata*, he said having found in May [!] specimens which had remnants of the veil on the cap, spores measuring 7.2–8.7 × 4.2–5 μ and having no germ-pore [!], "l'extrémité de leurs poils d'arête souvent renflée en massue ou en tête de 5–12 μ de large [!]" and an "odeur parfois forte [!]. This description fully corresponds with ours of 'dentate' specimens of *C. aporos*, in which the veil instead of forming a ring had remained attached to the cap.

Bresadola (1930: pl. 688) described as *Pholiota blattaria* yet another form of *C. arrhenii*. Its cheilocystidia were "clavato-cylindraceae, subcapitatae, 35–50 × 12–18 μ," and its time of occurrence was not the spring, but the summer, and the species was "subinodora." We have in our material two collections answering this description, on which we based *C. arrhenii* var. *hadrocystis*.

VI. *Conocybe blattaria* and *C. vexans; Conocybe teneroides* and *C. percincta*.

For the discussion on the interpretation of Orton's *Conocybe vexans* (1960: 197) the reader is first of all referred to chapter III, at the end of which the macroscopic

characteristics of *C. blattaria* are given. As for the microscopic characteristics, the literature contains twelve descriptions (eleven authors) in which the size of the spores of that species is given as being c. 9–12 × 5–6 μ: Quélet (1872: 319 and 1888: 96), Schroeter (1889: 608), Ricken (1912: 199), Harper (1912: 1011), Velenovský (1921: 552), Rea (1922: 113), Bresadola (1930: pl. 687), Kühner (1935: 161), Singer (1950: 431), Kühner & Romagnesi (1953: 343), Moser (1967: 230). Only Quélet (1872: 319) first mentioned 8 μ, later (1888: 96) 10 μ; Bresadola (1930: pl. 687) mentioned 7.5–10 × 5–6 μ and Rea (1922: 113) 8–10 × 4–5 μ, but with these three authors the size is always larger than that of the spores of *C. arrhenii* (either described as *C. togularis* or as *C. blattaria*). Ricken (1912: 199) was the first to mention the presence of a germ-pore, which he called very conspicuous and such a germ-pore was also described by Rea, Overholts, Bresadola, Kühner, Singer, Kühner & Romagnesi. Only three authors (Kühner, Singer, and Kühner & Romagnesi) mentioned the number of spores per basidium: 4.

The first description of the cheilocystidia is by Schroeter (1889: 608) who called them "unten bauchig, oben haarförmig"; he also gave a clear description of the macroscopic characters of this fungus and mentioned the large spores. Velenovský (1921: 552) called the cheilocystidia "from ellipsoid base long sharp pointed" (translation Dr F. Kotlaba) and Kühner (1935: 162) called them "ventrues, à partie supérieure atténuée ou contractée en un bec court et obtus" (clearly depicted by Kühner).

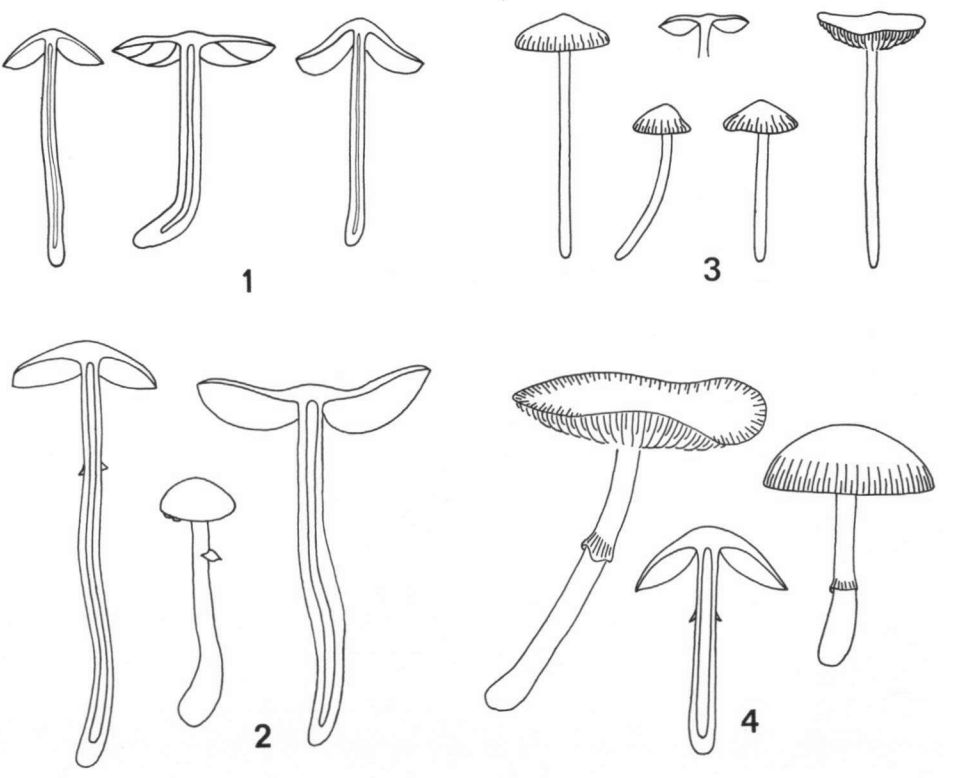
Since Fries' description of *C. blattaria* by its macroscopic characters, this taxon never caused any taxonomical problems, it was adopted by all post-Friesian authors, some of whom in the course of years added the microscopic characters (large spore-size and shape of cheilocystidia by Schroeter in 1889, large germ-pore by Ricken in 1912, basidia being 4-spored by Kühner in 1935). This is why we have rejected *Conocybe vexans* Orton, of which its author himself said, as indeed it is, that this species is identical with what Kühner had described as the 4-spored form of *C. togularis*, the latter, however, being just *Conocybe blattaria* as defined by us before.

Orton stressed in his description of *C. vexans* that the cap is "not or only slightly striate at margin only" and he believed that Ricken's *C. togularis* therefore must be his *C. vexans*, because Ricken "does not specify a striate cap and shows a strongly striate ring in his figure." Ricken, however, did call the cap striate ("durchscheinend gerieft"), and his Pl. 56, fig. 5 does show conspicuously striate caps and the rings of all annulate species of *Conocybe* are beautifully striate-plicate. Besides—as was reasoned in our chapter on morphology—the striation of the cap is of no taxonomic value.

There is one very characteristic species in the annulate group of *Pholiotina*, *Conocybe teneroides*, of which only six descriptions can be found in the literature: J. E. Lange (1921: 7, as *Pholiota teneroides*), Konrad & Maublanc (1929: pl. 69 fig. 2 as *Pholiota blattaria*, which they considered to be conspecific with *C. teneroides*), Kühner and Maire apud Kühner (1935: 162 as *C. teneroides*, but see p. 141), J. E. Lange (1938: 63,

pl. 106 B as *Pholiota teneroides*), and Singer (1950: 431 as *Pholiotina togularis* f. *bispora*, which he considered to be synonymous with *C. teneroides*). The macroscopic characters as described in each of these six descriptions resemble each other very much indeed and they can hardly be distinguished from those of *C. blattaria*. All six descriptions mention two very striking microscopic characteristics, which are quite different from those of *C. blattaria*, i.e. 2-spored basidia and strikingly variable cheilocystidia, the shape of which besides differs considerably from that in any other member of the group. Lange called these cystidia "cylindric, flask-shaped, obtuse," Konrad & Maublanc "fusiformes en forme de bouteille, à sommet obtus," Kühner "claviformes, non rétrécies en col au sommet," also "cylindracés ou subclaviformes à sommet arrondi obtus," Maire "fusiformes," Singer "flask-shaped, cylindric, clavate."

There is another description, really the seventh in this series that is the one of *C. percincta* Orton, of which the macroscopic characteristics are identical with those described for *C. teneroides* and like *C teneroides* it has 2-spored basidia and extremely



Figs. 1–4. *Conocybe aporos*, habit sketches. — 1. Overveen, 22 April 1961. — 2. Dorst, 2 April 1957. — 3. Santpoort, Duin en Kruidberg, 2 June 1962. — 4. Amsterdam, Amsterdamse Bos, 30 April 1965, holotype. (All figs.: × 1.)

variable and curiously shaped cheilocystidia, which Orton has described as "obtuse, cylindric-clavate, utriform or irregular fusiform." Except for Singer all authors gave pictures of these cystidia. The inevitable conclusion is that *C. percincta* Orton is conspecific with *C. teneroides*.

A few points, concerning Orton's description of *C. percincta*, however, need discussion.

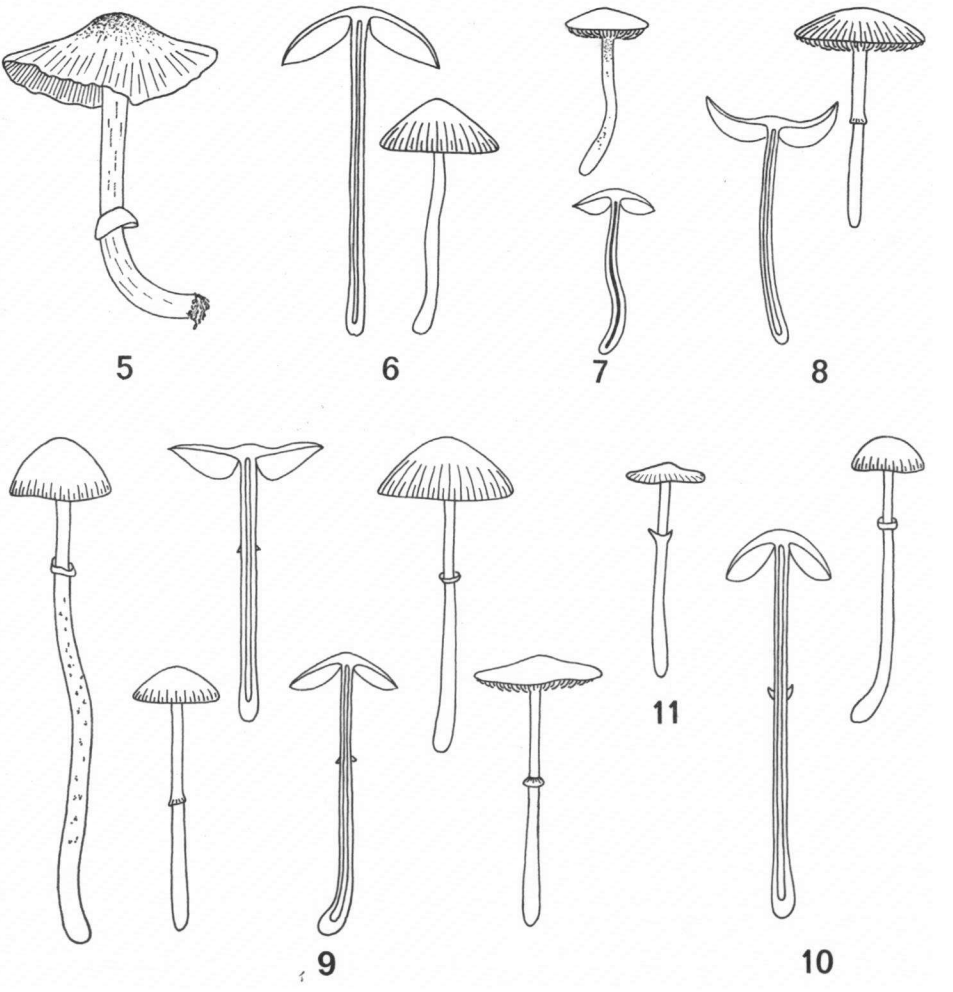
Orton concludes his description by saying that his species is "distinguished from its allies by yellowish ring, dark flesh in stem, obtuse marginal cystidia and spore size," thereby curiously enough leaving unmentioned the two major and very striking characteristics, the 2-spored basidia and curious cheilocystidia. However, in the actual description, the ring is called "pale yellowish," but in the description of *C. vexans* (= *C. blattaria*), certainly an ally and even its closest, the ring has the same colour, "pale dirty yellowish" and we found the ring in *C. blattaria* (also in *C. filaris*) whitish to even pale brown. Next, the flesh of the stems of all annulate species of the *Pholiotina* group is dark and even very dark to fuliginous brown in the lower part of the stem in mature specimen. For the spore size Orton gives 10–12 × 5–6 μ for *C. percincta* and 10–12 × 6–6.5 μ for *C. vexans* (= *C. blattaria*), so here there hardly is a difference either. The cystidia, indeed, are "obtuse," but their very striking and very variable shape is left unmentioned.

The size of the cap as given and depicted by Orton is rather large (12–38 mm), whereas Kühner mentions only 10–16 mm, Maire 10–12 mm and the caps of our own specimens also were small, 6–13 mm. This difference, we at first thought, might have some significance, but it has not, as Lange reported 15–20 mm and Konrad & Maublanc even 20–30 mm.

The gills in Orton's description are called crowded and, indeed, he found 34–40 large gills. But Kühner, while not actually stating anything about the gills being either crowded or not, counted only 23–28 large gills and would not have called these crowded, as even in *C. arrhenii* ("*blattaria*"), where he counted 26–35 large gills, he called them "moyennement serrées." Perhaps there were so many gills in Orton's specimens because they were so large.

With regard to the striation of the cap—an unreliable character, as pointed out in the chapter on morphology—, we found that Orton in his exposition partly based some of his arguments in favour of his interpretation of *C. vexans* and *C. percincta* on some misquotations. Orton said the cap of *C. togularis* "forme tetrasporique" (= *C. blattaria*) as described by Kühner was "usually non-striate," but in fact Kühner called it "striolé" (meaning: somewhat striate). He further said, having retained the epithet 'blattaria' for what Kühner had called *C. togularis* "forme bisporique" (= *C. teneroides*) "since this is stated to have a striate cap in the description of Maire and Lange." But Lange did not mention the striation at all, neither does his picture (Pl. 106 B) show any trace of striation. Orton called the caps of *C. percincta* "not striate when moist." Judging, however, from Orton's description of the colour of the cap ("pale yellow, deeper ochre-yellow at centre, then honey or tinged date-brown,") he may well have dealt with specimens which already

were in the act of drying. It is extremely unlikely that any of the annulate species of the *Pholiotina* group should be non-striate in the moist phase. Konrad & Maublanc recorded striate caps and Kühner, very prudently, stated of the cap of *C. teneroides* "non vu strié."



Figs. 5–10. *Conocybe arrhenii* var. *arrhenii*, habit sketches. — 5. Gronsveld, Savelsbos, 26 Oct. 1958. — 6. Castricum, 28 Sept. 1968. — 7. 's-Graveland, Boekesteyn, 8 Nov. 1968. — 8. 's-Graveland, Boekesteyn, 8 Nov. 1968. — 9. Apeldoorn, 11 Oct. 1969. — 10. Apeldoorn, 12 Oct. 1969. (All figs.: × 1.)

Fig. 11. *Conocybe arrhenii* var. *hadrocystis*, habit sketch. Nieuwersluis, Over-Holland, 30 Sept. 1967, holotype. (× 1.)

In conclusion, we agree with Lange that *C. teneroides* is a species in its own right. Kühner (1935: 162) apparently favoured an intermediate point of view; it is true that technically he made the recombination *Conocybe teneroides*, but he obviously did not accept this taxon as a species, as he interpreted it as a bisporous form of *C.* "*togularis*" (= *C. arrhenii*). Therefore, his recombination is not valid. His figures very clearly show the difference in shape of the cheilocystidia between his 4- and 2-spored forms of this species. Kühner & Romagnesi (1935: 343) mentioned *C. teneroides* as a separate species, adding "N'est probablement que la f. bisporique du *C. togularis* (ss. Ricken) Kühn." Singer (1950: 431) regarded this species as only a 2-spored form of *C. blattaria* ("*togularis*").

Konrad & Maublanc (1929: pl. 69 fig. 2) particularly stressed the point that what they described as *P. blattaria* is synonymous with *P. teneroides* Lange and from this it should be concluded that they found its basidia to be 2-spored, although they did not specifically say so in their description. Orton, in spite of this, interpreted the species described by Konrad & Maublanc as his 4-spored *C. vexans* for the same reasons as he believed *Pholiota togularis* as described by Ricken to be his *C. vexans*, i.e. cap not clearly striate and ring strongly striate. As we pointed out previously, both reasons are not valid, neither for *C. togularis* ss. Ricken, nor for Orton's *C. vexans*. Orton evidently overlooked the fact that Konrad & Maublanc's specimens must have been 2-spored.

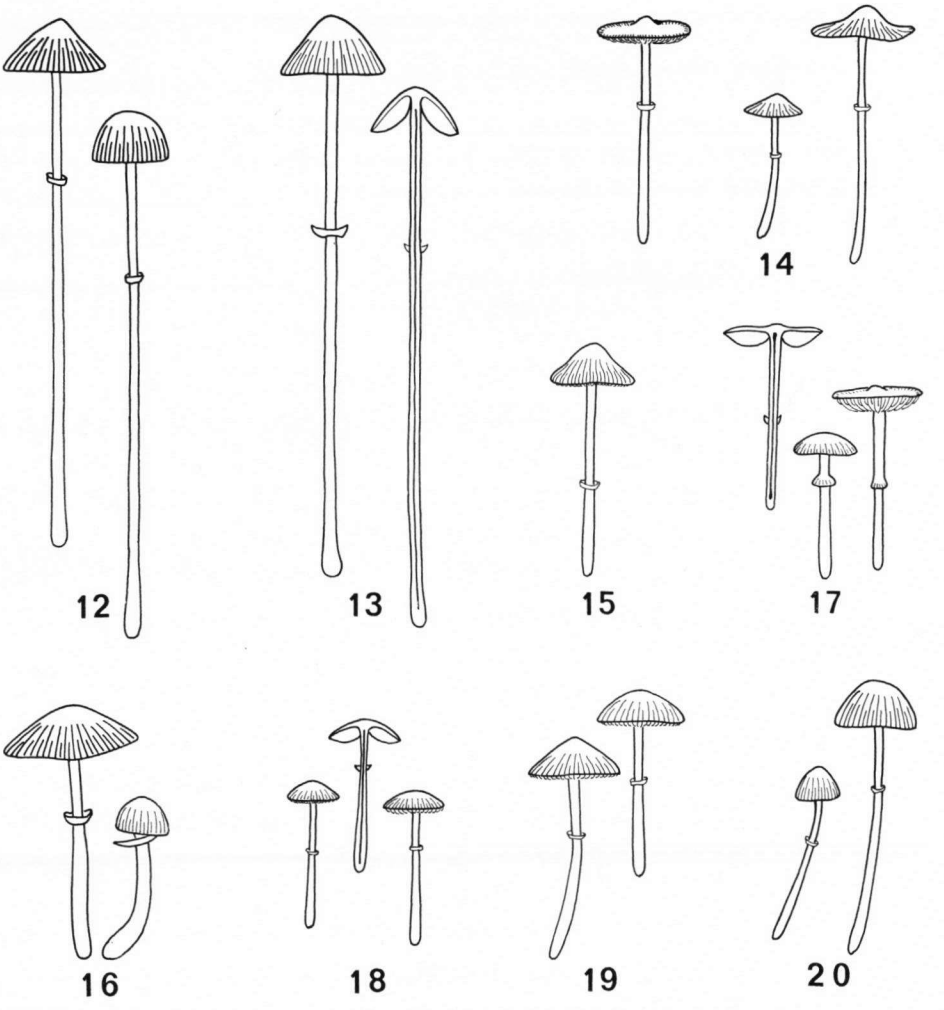
C. teneroides must be a very rare species and one must bear in mind that each of the six authors mentioned has only seen one or two collections, calling the species "rather rare," or "assez rare." We have found it only once. It would therefore be impossible from one collection to study adequately the striking shape of the cheilocystidia and the evidently even more striking variability of this shape. Only Singer found this species more often, once in the Kaukasus, once in the Altaj (Russia), also in Germany, Spain, and Australia, and he believed that this species probably occurs more often in the Soviet Union. According to Dr. Watling (personal communication) it is not uncommon in the British Isles.

The interpretation of *C. blattaria*, mentioned by Orton (1960: 192) in his key remains obscure. Under item 3 of the key the alternative choice is between *C. blattaria* and on the other hand *C. vexans* and *C. percincta* of item 4. But the differences between the macroscopic characters figuring in both items and advocated for the specific delimitation are too unreliable and vague. The colours of the cap and stem and particularly of the cap are—as argued in the chapter on morphology—too variable to go by in *Pholiotina*; besides under item 3 they are only called "frequently paler" for *C. vexans* and *C. percincta* (item 4) as compared with *C. blattaria*. Neither the striation of the cap (hardly different for *C. blattaria* as compared with the two species of item 4) nor the floccose scaliness of the stem can be used for specific delimitation in this group of fungi, as outlined in the chapter on morphology. Neither does the ring, being "sometimes rather small or only striate where it joins the stem" in *C. blattaria* as opposed to being "well formed, often strongly striate" in the two species of item 4 furnish a distinct difference. Far more important, however,

are the microscopic characters, but close scrutiny of the key reveals that both *C. blattaria* and *C. percincta* have large spores and 2-spored basidia (curiously enough, in the key the basidia of *C. percincta* are called 2-spored or 2–3(–4)-spored, whereas in the full description of the species they are just 2-spored and the cheilocystidia of *C. blattaria* are "variable, clavate, utriform or lageniform" and of *C. percincta* "cylindric-clavate or utriform or irregular fusiform-lageniform." Orton (1960: 191) said, having "retained the epithet 'blattaria' for *C. togularis* forme bisporique Kühn. (= *Pholiota teneroides* J. Lange)." So both *C. percincta* (as argued above) and *C. blattaria* sensu Orton are conspecific with *C. teneroides*.

KEY TO THE SPECIES

1. Velum partiale forming a distinct ring about half-way the stem or in upper half of the stem (in *C. arrhenii* var. *arrhenii* and *C. aporos* sometimes forming appendiculate denticles on margin of cap instead of a ring).
   2. Spores (9.9–)10.8–12.6 × 5.3–6.4 μ, germ-pore conspicuous.
      3. Basidia 2-spored, cheilocystidia very variable, globose, subcylindrical, clavate, obovoid, utriform (Figs. 49, 52) . . . . . *C. teneroides*
      3. Basidia 4-spored or sometimes 4- and 2-spored on same gill, cheilocystidia lageniform, obclavate or sicyoid and much more uniform.
         4. Basidia exclusively 4-spored; cheilocystidia sicyoid (neck cylindrical, distinctly delimited from ventricose cell-body) or lageniform, obclavate (neck tapering towards acute or subacute apex (Figs. 38, 41); tall species (stem 40–70 mm). *C. blattaria*
         4. Basidia both 2- and 4-spored and consequently spores both large (10.8–12.6 × 5.4–6.8 μ) and small (8.1–9.9 × 4.5–5.4 μ); cheilocystidia obclavate, lageniform, neck tapering towards acute or obtuse apex, not or indistinctly delimited from cell-body (Figs. 44–46); small species (stem 15–35 mm) . . . . . *C. filaris*
   2. Spores (6.8–)7.2–9.9 × 4.1–5.4 μ, germ-pore conspicuous, very small or absent.
      5. Cheilocystidia obclavate, lageniform, never capitate or subcapitate, neck tapering towards acute or subacute apex, not or indistinctly delimited from cell-body (Figs. 44–46); stem 1–1.5 mm thick, small species (cap 6–20 mm) . . . *C. filaris*
      5. Cheilocystidia different; stem 1.5 mm thick or thicker, larger species (cap 11–40 mm).
         6. Cheilocystidia filiform, subcylindric, lageniform, with elongated and often flexuose neck, few subcapitate (Figs. 32, 33), 22.5–50 × 2.5–7.5 × 1.5–4(–5) μ; veil usually forming a ring, sometimes only appendiculate denticles on margin of cap, Sept.-Nov. . . . . *C. arrhenii* var. *arrhenii*
         6. Cheilocystidia thicker and capitate (Figs. 30, 31, 34).
            7. Germ-pore present but small; cheilocystidia 25–50(–55) × 5–9(–10) × 5–15 μ, Sept.-Nov. . . . . *C. arrhenii* var. *hadrocystis*
            7. Germ-pore absent; cheilocystidia 22.5–60 × 4–12.5 × 3–9 μ; veil usually forming a ring, sometimes only appendiculate denticles on margin of cap; March-May . . . . . *C. aporos*
1. Velum partiale incomplete, never forming a distinct ring, but leaving remnants on lower half of stem or volva-like remnants at base of stem (hitherto not reported from Europe and only from Algiers; for description, see Kühner, 1935: 157) . . . . . *C. peronata*



Figs. 12, 13. *Conocybe blattaria*, habit sketches. — 12. Braemar, Invercauld Estate, 28 Aug. 1961. — 13. Tomich, 17 Sept. 1968.

Figs. 14–19. *Conocybe filaris*, habit sketches. — 14. Oldenzaal, Dijkhuis, 16 Oct. 1963. — 15. 's-Graveland, Boekesteyn, 3 Aug. 1968. — 16. 's-Graveland, Boekesteyn, 25 Sept. 1968. — 17. 's-Graveland, Boekesteyn, 3 Oct. 1968. — 18. 's-Graveland, Boekesteyn, 8 Nov. 1968. — 19. Santpoort, Duin en Kruidberg, 1 Dec. 1960.

Fig. 20. *Conocybe teneroides*, habit sketch. Santpoort, Duin en Kruidberg, 1 Dec. 1960.

Conocybe aporos Kits van Wav., *sp. nov.*

Figs. 1–4, 21–24, 30, 31

MISAPPLIED NAME: *Pholiota togularis* (Bull. ex Fr.) Quél. *sensu* J. E. Lange *in* Dansk bot. Ark. **2** (11): 7. 1921; Fl. agar. dan. **3**: 63, pl. 106 fig. A, A 1. 1938.

SELECTED DESCRIPTION AND ILLUSTRATION.—J. E. Lange, Fl. agar. dan. **3**: 63, pl. 106 fig. A, A 1. 1938 (*P. togularis*).

Pileus 12–40 mm latus, primo semiglobatus vel campanulatus, dein convexus vel plano-convexus vel plano-concavus, subumbonatus, striatus, centro obscure fulvus (Munsell 5 YR 3/4, 4/3, 4/4) vel fuscus (Munsell 7.5 YR 4/2), marginem versus brunneus vel ochraceo-brunneus (Munsell 7.5 YR 4/4, 5/4, 6/6), laevis vel interdum rugulosus, hygrophanus, sine velo.

Stipes 21–52 × 1.5–4 mm, cylindraceus, ad basin paulo incrassatus, 4–5 mm, etiam clavatus, striatura superficiali argenteo-albella ornatus, apice pallide cinnamomeus, deorsum brunnescens, ad basin atro-fuligineus, apice albo-pruinosus.

Annulus sat amplus, distans medius, superne striato-plicatus.

Lamellae 27–38, confertae, ventricosae, anguste vel peranguste adnexae, 3–5.5 mm latae, obscure ochraceo-brunneae (Munsell ± 10 YR 5/4), ad aciem flocculoso-denticulatae, albae.

Caro in pileo 2–3 mm crassa, obscure fulva, in stipitis parte apicali cinnamomea, deorsum brunnescens, ad basin atrobrunnea, odore nullo vel aciduloso vel *Pelargonii*.

Sporae (7.2–)8.1–9.9 × 4.5–5.4 μ, ellipsoideae, subamygdaliformes, sub microscopio citrinae, apiculo parvo, poro nullo. Basidia (19–)21–27.5(–30) × (5–)6–7.5(–9) μ, 4-sporigera. Pleurocystidia nulla. Cheilocystidia 22.5–60 × (3–)5–10(–11) × 3–7(–9) μ, copiosa, conferta (qua de causa lamellarum acies sterilis), subcylindrica vel sublageniformia, saepe flexuosa vel irregularia, apicibus incrassatis. Pilei cuticula e cellulis clavatis vel vesiculosis longe stipitatis saepe ochraceis formata.

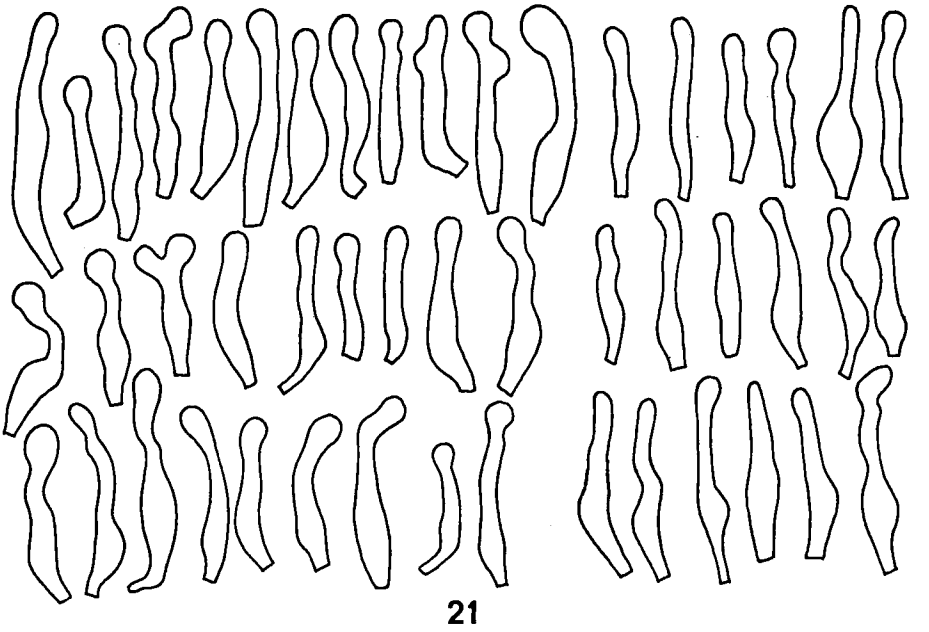
Terricola, vernalis, mensibus III–V inventa.

Typus: Amsterdam, Amsterdamse Bos, 30 Apr. 1965, *E. Kits van Waveren* (L).

MACROSCOPIC CHARACTERS.—Cap 12–40 mm, at first semiglobate to campanulate, more rarely conico-campanulate, soon convex, then plano-convex and even plano-concave, often subumbonate, when moist striate from margin up to 1/4–2/3 of radius of cap, surface smooth but sometimes slightly rugulose, very slightly viscid when moist, the centre dark reddish-brown (M. 5 YR 3/4, 4/3, 4/4) to dark brown (M. 7.5 YR 4/2) towards the margin brown or ochre-drown (M. 7.5 YR 4/4, 5/4, 6/6); hygrophanous, leaving central half ochre-brown (M. 7.5 YR 6/6) and the peripheral half yellowish (M. 10 YR 7/6; 2.5 Y 8/4) striae disappearing. Marginal veil as a rule absent.

Stem 21–52 × 1.5–4 mm, equal, at the base slightly thickened (4–5 mm) or even clavate, hollow, non-rooting, very pale yellowish-brown at the apex, increasingly brown towards the base and dark fuliginous brown in the lower part (1/2–1/3) of the stem and particularly at the base, these colours being partly masked by a silvery-whitish, somewhat shining, fibrillose-striate layer, often disjointed below the ring and covering the entire stem, the apex over a variable distance pruinose.

Velum partiale large, cuff-like, usually descending, about midway or even slightly lower down the stem, felt-like, white or orange-brown from spore-deposits, coarsely striate-plicate above. Occasionally the veil, instead of forming a ring, remains along the entire margin of the cap as small white denticles, either appendiculate or upturned or stuck to the surface of the cap very close to the margin.



Figs. 21–24. *Conocybe aporos* (Amsterdam, Amsterdamse Bos, 30 April 1965). — 21. Cheilocystidiogram. — 22. Cells of surface of cap. — 23. Spores. — 24. Basidia. (Figs. 21, 22, 24: × 575; Fig. 23: × 1212.)

Gills crowded, numerous (L 27–38), ventricose, narrowly to very narrowly adnexed, 3–5.5 mm broad, dark ochre-brown (M. ± 10 YR 5/4), edge flocculose-denticulate, white.

Flesh in the centre of the cap rather thick, up to 2–3 mm, dark reddish-brown, dirty pale yellowish when dry, in stem pale yellowish-brown at apex, increasingly brown towards the base, very dark brown to blackish-brown at the base.

Smell sometimes none but usually, particularly after bruising and particularly in young specimens, distinctly acidulous or pelargonium-like.

MICROSCOPIC CHARACTERS.—Spores ellipsoid to slightly amygdaliform, yellow (M. 2.5 Y 7/6; 5 Y 8/6), with a trace of red in water, apiculus small, germ-pore absent, wall of normal thickness (7.2–)8.1–9.9 × 4.5–5.4 μ.)

Basidia 4-spored, (19–)21–27.5(–30) × (5–)6–7.5(–9) μ. Cheilocystidia closely packed (edge of gill sterile or with only scattered basidia), subcylindrical, sublageniform to lageniform, often irregularly shaped and/or flexuose, the apex conspicuously swollen, colourless, the wall of normal thickness, 22.5–60 × (3–)5–10(–11) × 3–7.5(–9) μ, in between them often a small number of small spheropedunculate cells. Pleurocystidia none.

Cuticle of cap hymeniform, for full description, see p. 126.

Superficial hyphae of stem, for full description, see p. 126).

HABITAT.—On clayey or rich soil in deciduous woods (*Quercus*, *Salix*, *Populus*) and orchards, gardens, parks, along roadsides; solitary or in small groups, rarely gregariously in large groups. March to May. Uncommon.

COLLECTIONS EXAMINED.

NETHERLANDS

Noord-Holland: Amsterdam, Amsterdamse Bos, 1 May 1961, *E. Kits van Waveren* (L); 30 Apr. 1965, *E. Kits van Waveren* (type, L); Overveen, 22 Apr. 1961, *J. van Brummelen* (dentate form, L); Santpoort, Estate Duin en Kruidberg, 2 June 1962, *E. Kits van Waveren* (dentate form, L).

Noord-Brabant: Dorst, 20 Apr. 1954, 5 May 1955, 6 May 1965, 14 March 1966, *P. B. Jansen* (L); Dorst, 2 Apr. 1957, *C. Bas* (L); Baarle-Nassau, 2 May 1965, *P. B. Jansen* (L).

Limburg: 5 Apr. 1967, Eysder Bos, *P. B. Jansen* (L).

BRITISH ISLES

Perthshire: Loch Rannoch, 13 May 1967, *P. D. Orton 2945* (E); Camghouran, 14 May 1967, *P. D. Orton 2946* and *2947*; 24 May 1967, *P. D. Orton 2937* (E); Rannoch, 26 May 1967, *P. D. Orton 2938* (E); Trinafon, 4 June 1967, *P. D. Orton 2939* (E); Dall, 7 June 1967, *P. D. Orton 2940* (E); Camghouran, 11 June 1967, *P. D. Orton 2941* (E).

OBSERVATIONS.—For nomenclatural discussion, see p. 135.

The spores of this species when compared with those of *C. arrhenii*, apart from lacking a germ-pore are also very slightly larger, the difference being very small but real. This conclusion is based on the evidence of 20 measurements in each of six collections of *C. arrhenii* and each of eight collections of *C. aporos*. Accordingly, the basidia in *C. aporos* were also found to be very slightly larger. The cheilocystidia of *C. aporos* are not only capitate, but also slightly thicker than those of *C. arrhenii*.

Like in the description of *C. arrhenii*, we wish to stress the point that it is extremely misleading when the velum partiale, instead of forming a ring, fails to do so and

remains as appendiculate denticles on the margin of the cap. In attempting to identify such specimens one might very easily be led into the group of exannulate species of *Pholiotina*, some of which may have irregularly shaped and even capitate cheilocystidia. In the species of that group, however, a germ-pore is always present (except in *C. vestita*) and the species do not exclusively occur in the spring.

Conocybe arrhenii (Fr.) Kits van Wav., *comb. nov.*

Agaricus arrhenii Fr., Epicr. 161. 1838 (basionym); Monogr. 307. 1857. — *Pholiota arrhenii* (Fr.) Quél. *in* Mém. Soc. Emul. Montbél. **2**: 248. 1872.

Agaricus mesodactylus Berk. & Br. *in* Ann. Mag. nat. Hist. II **2**: 261, pl. 9 fig. 1. 1848.

MISAPPLIED NAMES.

Agaricus togularis Bull. ex Fr. *sensu* Fr., Hym. europ. 216. 1874. — *Hylophila togularis* (Bull. ex Fr.) Quél., Fl. mycol. 96. 1888.

Agaricus blattarius Fr. *sensu* Cooke, Ill. Brit. Fungi, pl. 1172 B / 1173 B. 1889–1891. — *Pholiota blattaria* (Fr.) Ricken, Blätterp. 199, pl. 56 fig. 3, 1915. — *Conocybe blattaria* (Fr.) Kühn., Le Genre Galera 150. 1935.

SELECTED DESCRIPTIONS AND ILLUSTRATIONS.—Berk. & Br. *in* Ann. Mag. nat. Hist. II **2**: 261, pl. 9 fig. 1. 1848 (*A. mesodactylus*); Cooke, Ill. Brit. Fungi: pl. 1172 B/1173 B. 1889–1891 (*A. blattarius*); Boudier, Icon. mycol., Sér. 4, Livrais. 18: pl. provis. 325. 1908 (= **1**: 51; **2**: pl. 101. 1904–11) (*P. togularis*); Ricken, Blätterp. 199, pl. 56 fig. 3. 1915 (*P. blattaria*); Konr. & Maubl., Icon. sel. Fung. **1**: pl. 69 fig. 1. 1929 (*P. togularis*); Bresadola, Icon. mycol. **14**: pl. 688. 1930 (*P. blattaria*); Kühner, Le Genre Galera 150. 1935 (*C. blattaria*).

OTHER DESCRIPTIONS.—Patouillard, Tab. anal. Fung. **4**: 154, pl. 112. 1885 (*A. togularis*); Saccardo, Syll. Fung. **5**: 738. 1887 (*P. togularis*); Peck *in* Bull. N.Y. St. Mus. **122**: 145. 1908 (*P. togularis*); Rea, Brit. Basid. 113. 1922 (*P. togularis*, except description of germ-pore and cystidia, misquoted from Ricken); Overholts *in* N. Am. Fl. **10** (4): 265. 1924 (*P. blattaria*); Overholts *in* Ann. Mo. bot. Gdn **14**: 113. 1927 (*P. blattaria*); Singer *in* Acta Inst. bot. Acad. Komar. Sci. URSS, Ser. 2 (Pl. crypt.) **6**: 427. 1950 (*P. blattaria*); Kühn. & Romagn., Fl. anal. 343. 1953 (*C. blattaria*); Orton *in* Trans. Br. mycol. Soc. **43**: 192. 1960 (*C. togularis*); Moser *in* Kl. KryptFl., Ed. 3, **2** (B/2): 230. 1967 (*P. blattaria*).

MACROSCOPIC CHARACTERS.—Cap 11–30 mm, at first campanulate, soon convex and often subumbonate, rarely distinctly umbonate, finally applanate or even plano-concave with upturned margin; surface smooth, often faintly to distinctly rugulose; when entirely moist or not or only slightly striate (but sometimes striate from margin up to 1/3–1/4 of radius of cap), dark reddish-brown or purplish-brown (M. 2.5 YR 2/4; 5 YR 3/3, 3/4, 4/3), near the margin browner (M. 5 YR 4/4) and at the margin just brown (M. 7.5 YR 5/6); when only slightly less moist or when striate, centre (and striae) reddish-brown or purplish-brown and towards the margin of the cap (between the striae) yellowish-brown (M. 7.5 YR 5/6, 6/6; 10 YR 5/6) and near the margin sometimes brownish-yellow (10 YR 6/6, 7/6), the centre remaining darker (M. 10 YR 6/8, 8/8), the striae disappearing. Marginal veil as a rule absent (but see below).

Stem 17–62 × (1–)1.5–3(–4) mm, equal, often slightly and gradually thickening at the base, firm, hollow, non-rooting, covered by a thin but dense fibrillose-striate silvery whitish layer in the upper half, becoming thicker in the lower half, sometimes

even flocculose to scaly-fibrillose and usually disjointed or even partly disappearing, exposing the colour of the stem. This colour, partly masked by the whitish layer, is very pale brown (M. 10 YR 8/3) at the apex, becomes increasingly brown towards the base, dark reddish-brown to fuliginous brown in the lower 1/4–1/3 of the stem and blackish-brown at the base. Stem slightly to coarsely pruinose above the ring or only at the apex.

Velum partiale almost always forming a very conspicuous cuff-like ring, which is large, descending but sometimes ascending, located about midway or either higher up or even slightly lower down the stem, felt-like, whitish to cream-colour, upper surface coarsely striate-plicate and usually orange-brown because of spore-deposits. Occasionally the veil, instead of forming a ring, remains along the entire margin of the cap as small white denticles, either appendiculate or upturned or stuck to the surface of the cap very close to the margin, rarely somewhat higher up or even close to the centre of the cap.

Gills crowded (L 26–33), ventricose, narrowly and sometimes very narrowly adnexed, 2–4 mm broad, ochre- or yellowish-brown (M. 7.5 YR 5/6; 10 YR 5/4–5/6), edge flocculose-denticulate, white.

Flesh in centre of the cap 0.75–1.5 mm thick, very thin near the margin, dark reddish-brown or very dark brown (M. 5 YR 3/3, 3/4; 10 YR 3/4) in the cap, in the stem pale brown (M. 2.5 Y 8/2, 8/4) at the apex, very soon becoming darker towards the base, very dark brown to reddish-brown in the lower half and fuliginous blackish-brown at the base.

Smell none.

MICROSCOPIC CHARACTERS.—Spores ellipsoid to slightly amygdaliform, yellow (M. 2.5 Y 7/6, 8/6; 5 Y 7/6, 8/6) with a trace of red in water, apiculus small, germ-pore small and inconspicuous, (6.8–)7.2–8.1(–9) × 4.1–4.5(–5) μ.

Basidia 4-spored, 17.5–25 × 5–7.5 μ.

Cheilocystidia closely packed (edge of gill sterile or with only scattered basidia), filiform, subcylindric, sublageniform to lageniform, rarely subcapitate, often irregularly shaped and/or flexuose, colourless, wall of normal thickness, 22.5–50 × 2.5–7.5(–9) × 1.5–4(–5) μ.

Pleurocystidia none.

Cuticle of cap hymeniform (for full description, see p. 126), cells 27.5–60 × 8–27.5 μ.

Superficial hyphae of stem below ring, for full description, see p. 126.

HABITAT.—On clayey or rich soil in deciduous woods (*Quercus*, *Salix*, *Populus*) and orchards, gardens, parks, along roadsides; solitary or in small groups. September to early November. Uncommon.

CONOCYBE ARRHENII var. ARRHENII—Figs. 5–10, 25–29, 32, 33

For synonymy, see p. 147.

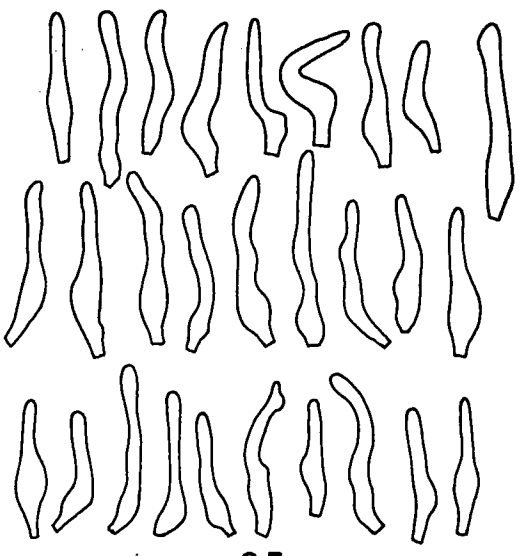
MICROSCOPIC CHARACTERS.—Cheilocystidia filiform, subcylindric, sublageniform to lageniform, rarely subcapitate, often irregularly shaped and/or flexuose, 22.5–50 × 2.5–7.5(–9) × 1.5–4(–5) μ.

COLLECTIONS EXAMINED.

NETHERLANDS

Gelderland: Apeldoorn, Royal Estate, 11 Oct. 1969, *E. Kits van Waveren* (L).

Noord-Holland: Amsterdam, Amsterdamse Bos, 7 Nov. 1959 and 26 Oct. 1961, *E. Kits van Waveren* (L); Castricum, Dunes of County Watersupply, 28 Sept.



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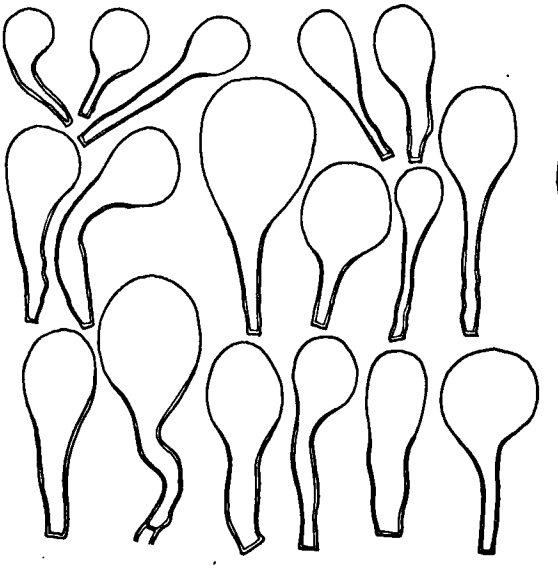

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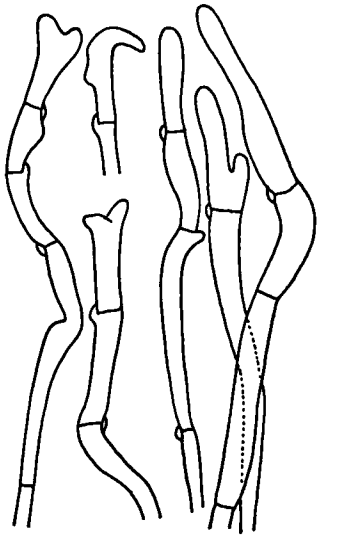

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Figs. 25–28. *Conocybe arrhenii* var. *arrhenii* (Amsterdam, Amsterdamse Bos, 26 Oct. 1961). — 25. Cheilocystidiogram. — 26. Spores. — 27. Basidia. — 28. Cells of surface of cap. (Figs. 25, 27, 28: × 575; Fig. 26: × 1212.)

Fig. 29. *Conocybe arrhenii* var. *arrhenii* (Lake Vyrnwy, 10 Sept. 1960). Hyphae of stem. (× 575.)

1968 *E. Kits van Waveren* (dentate form, L); 's Graveland, Estate Boekesteyn, 8 Nov 1968, *E. Kits van Waveren* (both annulate and dentate forms, L).

Limburg: Gronsveld, 26 Oct. 1958, *R. A. Maas Geesteranus* (L); Mook, near Plasmolen, 23 Oct. 1964, *E. Kits van Waveren* (L).

BRITISH ISLES

Montgomeryshire: Lake Vyrnwy, 10 Sept. 1960, *E. Kits van Waveren* (L).
Morayshire: Darnaway, 24 Sept. 1955, *P. D. Orton* 615 (E).

CONOCYBE ARRHENII var. **hadrocystis** Kits van Wav., *nov. var.*
Figs. 11, 34–37

MISAPPLIED NAME (but good description and illustration).
Pholiota blattaria (Fr.) Quél. *sensu* Bres., Icon. mycol. **14**: pl. 688. 1930.

A var. *arrhenii* differt cheilocystidiis latioribus, 5–9(–10) μ, et apice distinctissime clavato-capitatis, 5–15 μ.
Typus: Nieuwersluis, Over-Holland, 30 Sept. 1967, *E. Kits van Waveren* (L).

This variety differs from the typical variety by the more irregular and very variable shape of the cheilocystidia, which besides are broader, 5–9(–10) μ, and above all distinctly clavate-capitate, 5–15 μ. Isolated and small groups of spheropedunculate cells occur between them.

COLLECTIONS EXAMINED.

NETHERLANDS

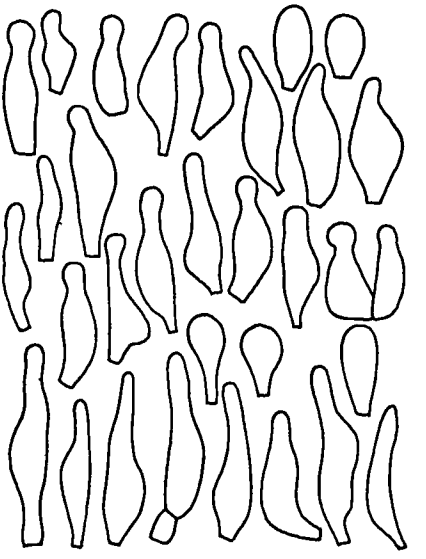
Utrecht: Nieuwersluis, Estate Over-Holland, 30 Sept. 1967, *E. Kits van Waveren* (type, L).
Zuid-Holland: Rotterdam, Kralingerhout, 17 Sept. 1960, *C. Bas* (L).

OBSERVATIONS.—For nomenclatural discussion, see p. 135.

Kühner's description (1935: 151) of the germ-pore in *C.* "*blattaria*" (= *C. arrhenii*) ("pore indiscutable mais pas toujours très évident") is exactly the same as that of the germ-pore in *C.* "*blattaria*" f. *dentata* ("pore indiscutable assez distinct, pas très évident pourtant"), but curiously enough he depicted very distinct germ-pores for *C.* "*blattaria*" f. *dentata* but none at all for *C.* "*blattaria*."

Again (see p. 124) we wish to stress the point that it is extremely misleading when the velum partiale, instead of forming a ring, fails to do so and remains as appendiculate denticles on the margin of the cap. In attempting to identify such specimens one might very easily be led into the group of exannulate species of *Pholiotina*, none of which, however, have the thin non-capitate cheilocystidia of *C. arrhenii*.

We once found ('s-Graveland, Estate Boekesteyn), specimens of the dentate form of *C. arrhenii*, of which the spores showed an unusual variation in size and were somewhat larger, (7.7–) 8.1–10.8 × 4.5–5.4 μ in one specimen in which 2-spored basidia were definitely found and (8.1–) 9–9.9 (–10.8) × 5–5.4 (–5.9) μ in another specimen in which in spite of a long search no 2-spored basidia were seen. The



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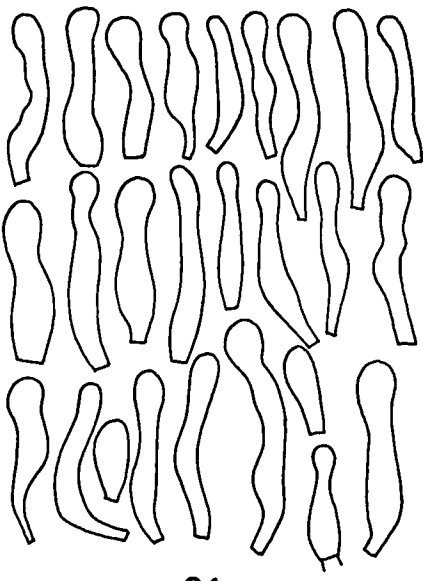

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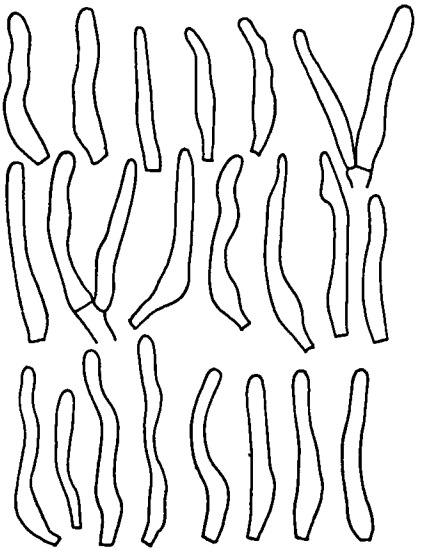

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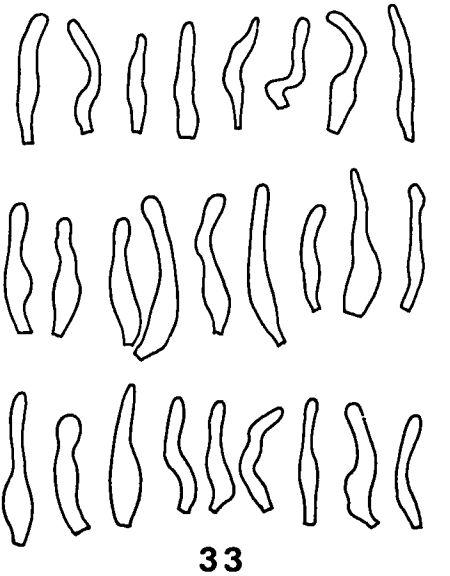

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Figs. 30, 31. *Conocybe aporos*, cheilocystidiogram. — 30. Overveen, 22 April 1961. — 31. Amsterdam, Amsterdamse Bos, 1 May 1961. (Both figs.: × 575.)

Figs. 32, 33. *Conocybe arrhenii* var. *arrhenii*, cheilocystidiogram. — 32. Castricum, 28 Sept. 1968. — 33. Mook, 23 Oct. 1964. (Both figs.: × 575.)

basidia in these specimens were larger than usual, 21–38 × 7.5–10 μ. In the same area of this locality we found specimens of *C. filaris* which were 4-spored and others which had both 4-spored and 2-spored basidia and also large quantities of specimens of the common 2-spored form of *Galerina nana* (Petri) Kühn.

Unlike *C. aporos*, of which the cheilocystidia also are distinctly capitate, var. *hadrocystis* occurs in the autumn and possesses spores with a germ-pore.

CONOCYBE BLATTARIA (Fr.) Kühn.—Figs. 12, 13, 38–43

Agaricus blattarius Fr., Syst. mycol. **1**: 246. 1821; Elench. **1**: 29. 1828; Epicr. 162. 1838; Monogr. Hym. Suec. **1**: 308. 1857; Hym. europ. 216. 1874. — *Pholiota blattaria* (Fr.) Quél. *in* Mém. Soc. Emul. Montbél. II **5**: 319. 1872. — *Hylophila blattaria* (Fr.) Quél., Fl. mycol. 96. 1888. — *Togaria blattaria* (Fr.) W. G. Smith, Syn. Brit. Basid. 123. 1908. — *Conocybe blattaria* (Fr.) Kühn., Le Genre Galera 161. 1935 (misapplied).

Conocybe vexans P. D. Orton *in* Trans. Br. mycol. Soc. **38**: 197. 1935.

MISAPPLIED NAMES.

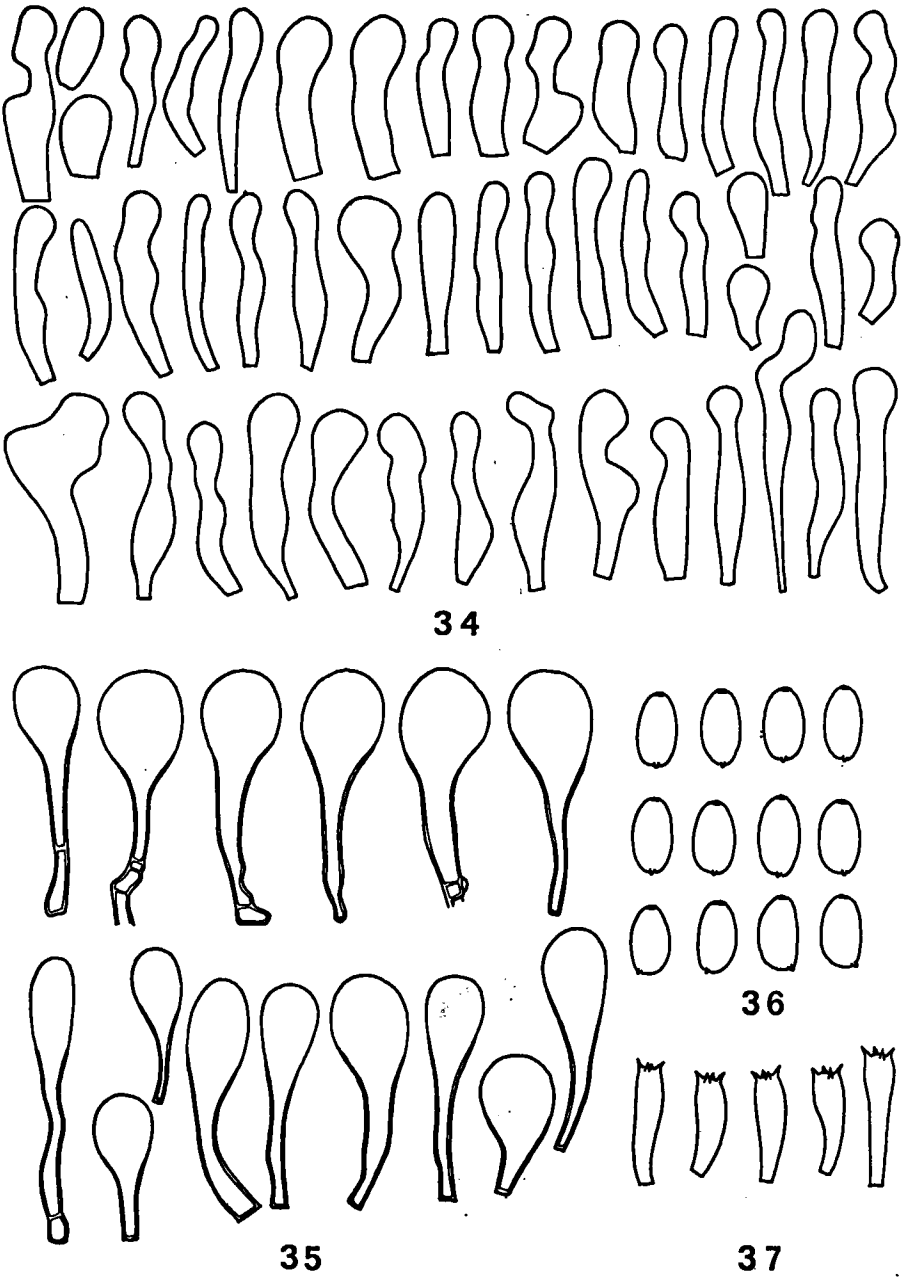
Agaricus togularis (Bull. ex Fr.) Fr. *sensu* Cooke, Ill. Brit. Fungi pl. 350/379. 1884–1886. — *Pholiota togularis* (Bull. ex Fr.) Ricken, Blätterp. 199, pl. 56 fig. 5. 1915. — *Conocybe togularis* (Bull. ex Fr.) Kühn., Le Genre Galera 161. 1935 ("Ricken").

SELECTED DESCRIPTIONS AND ILLUSTRATIONS.—Cooke, Ill. Brit. Fungi Pl. 350/379. 1884–1886 (*A. togularis*); Ricken, Blätterp. 199, pl. 56 fig. 5. 1912 (*P. togularia*); Bresadola, Icon. mycol. **14**: pl. 687. 1930 (*P. togularis*); Kühner, Le Genre Galera 161. 1935 (*C. togularis*); Kühner & Romagnesi, Fl. anal. 343. 1953 (*C. togularis*).

OTHER DESCRIPTIONS.—Duby, Bot. gall. 812. 1830 (*A. blattarius*); Secretan, Mycogr. suisse 86. 1833 (*A. blattarius*); Karsten *in* Bidr. Känn. Finl. Nat. Folk. **35**: 114. 1876 and **32**: 293. 1879 (*P. blattaria*); Gillet, Champ. Fr., Hymen. 433, pl. 519. 1876. (*P. blattaria*); Cooke, Handb. Brit. Fungi 141. 1886 (*A. togularis*); Saccardo, Syll. Fung. **5**: 738. 1887 (*P. blattaria*); Schroeter *in* KryptFl. Schles. **3**(1): 608. 1889 (*P. blattaria*); Massee, Brit. Fung. Fl. **2**: 213. 1893 (*P. blattaria*); Harper *in* Trans. Wis. Acad. Sci. Arts Lett. **17**(2): 1011. 1912 (*P. blattaria*); Velenovský, České Houby 552. 1921 (*Galera togularis*); Rea, Brit. Basid. 113. 1922 (*P. blattaria*, except description of cheilocystidia, misquoted from Ricken); Singer *in* Acta Inst. bot. Acad. Komar. Sci. URSS, Ser. 2 (Pl. crypt.) **6**: 431. 1950 (*Pholiotina togularis*).

MACROSCOPIC CHARACTERS.—Cap 8–15 mm, conical, campanulate or conico-campanulate, when moist strongly striate from margin up to 1/2–2/3 of radius of the cap, surface smooth, the centre and striae dark ochre-brown or dark yellowish-brown (M. 10 YR 5/8), outside centre and between striae brownish-yellow or dark yellow (M. 10 YR 6/8, 7/8); hygrophanous, drying out to yellow (M. 10 YR 8/8) and even pale yellow (M. 2.5 Y 7/4), striation completely disappearing. Marginal veil absent.

Stem 40–70 × 1–1.5 mm, equal, slightly thickened near and at the base, hollow, non-rooting, at first dirty whitish and only slightly coloured towards the base, covered over its entire length by a very thin, silvery, white, silky, fine fibrillose-striate superficial layer, through which the colour of the flesh appears, later very pale yellow (M. 2.5 Y 8/4) at the apex, becoming slightly darker and browner towards the ring, pale yellowish-brown (M. ± 10 YR 7/6) just above the ring, further down yellowish-brown (M. 10 YR 5/6) to brown or bronze-brown (M. ± 7.5 YR 5/6–4/4), after removal of the superficial whitish layer fuliginous brown at the base, increasingly pruinose from ring upwards.



Figs. 34–37. *Conocybe arrhenii* var. *hadrocystis* (Nieuwersluis, Over-Holland, 30 Sept. 1967, holotype). — 34. Cheilocystidiogram. — 35. Cells of surface of cap. — 36. Spores. — 37. Basidia. (Figs. 34, 35, 37: × 575; Fig. 36: × 1212.)

Velum partiale always forming a conspicuous, thick (0.5–1 mm) and broad (2.5–6 mm) ring, located about 1/4–1/3 of the total length of the stem from the apex, as a rule conspicuously standing out horizontally from the stem (not cuff-like and rather reminiscent of the ring of *Lepiota procera*), often becoming detached from the stem and then movable and easily slipping down the stem of breaking and then disappearing altogether, striate-plicate above, whitish or very pale brown (M. 10 YR 8/3), sometimes the upper surface orange-brown because of spore-deposit.

Gills fairly crowded (L 19–23) ventricose, narrowly adnexed, 2–2.5 mm broad, dirty brown (M. 10 YR 5/4) to yellowish-brown (M. 10 YR 5/6), edge flocculose-dentate, white.

Flesh in the centre of the cap 0.5–1 mm thick, very thin near the margin, dark yellowish-brown (M. 10 YR 5/8), in the stem very pale yellow at the apex, becoming pale brown near the ring and then increasingly brown towards the base, dark fuliginous brown at the base.

Smell none.

MICROSCOPIC CHARACTERS.—Spores ellipsoid to slightly amygdaliform, yellow (M. 2.5 Y 8/8) with a trace of red in water, apiculus fairly small, germ-pore large (1.5–2 μ), (9.9–)10.8–12.6 × 5.4–6.8 μ.

Basidia 4-spored, 22.5–35 × 7.5–10 μ.

Cheilocystidia closely packed (edge of gill sterile), neck cylindrical and distinctly delimited from the rather large and vesiculose (10–25 μ diameter) cell-body (sicyoid), or indistinctly delimited from smaller (7.5–14 μ diameter) cell-body (lageniform), and tapering towards the acute or subacute apex, also intermediate forms; colourless; wall of normal thickness.

Pleurocystidia none.

Cuticle of cap hymeniform (for full description, see p. 126), cells 15–50 × 7.5–27.5 μ.

Superficial hyphae of stem below ring, for full description, see p. 126.

HABITAT.—In deciduous woods in moss or soil, solitary or in very small groups. End of May to September. Rare.

COLLECTIONS EXAMINED.

BRITISH ISLES

Perthshire: Camghouran, 24 May 1967, *P. D. Orton 2949* (E); Dall, 25 May 1967, *P. D. Orton 2950*; 29 May 1967, *P. D. Orton 2951*; 7 June 1967, *P. D. Orton 2952*; 13 June 1967, *P. D. Orton 2953* (E); Camghouran, 17 July 1965, *P. D. Orton 2721*; 31 July 1965, *P. D. Orton 2722*; 26 September 1965, *P. D. Orton 2723* (E).

Aberdeenshire: Braemar, Invercauld Estate (Altdouri Road), 28 August 1961, *E. Kits van Waveren* (L).

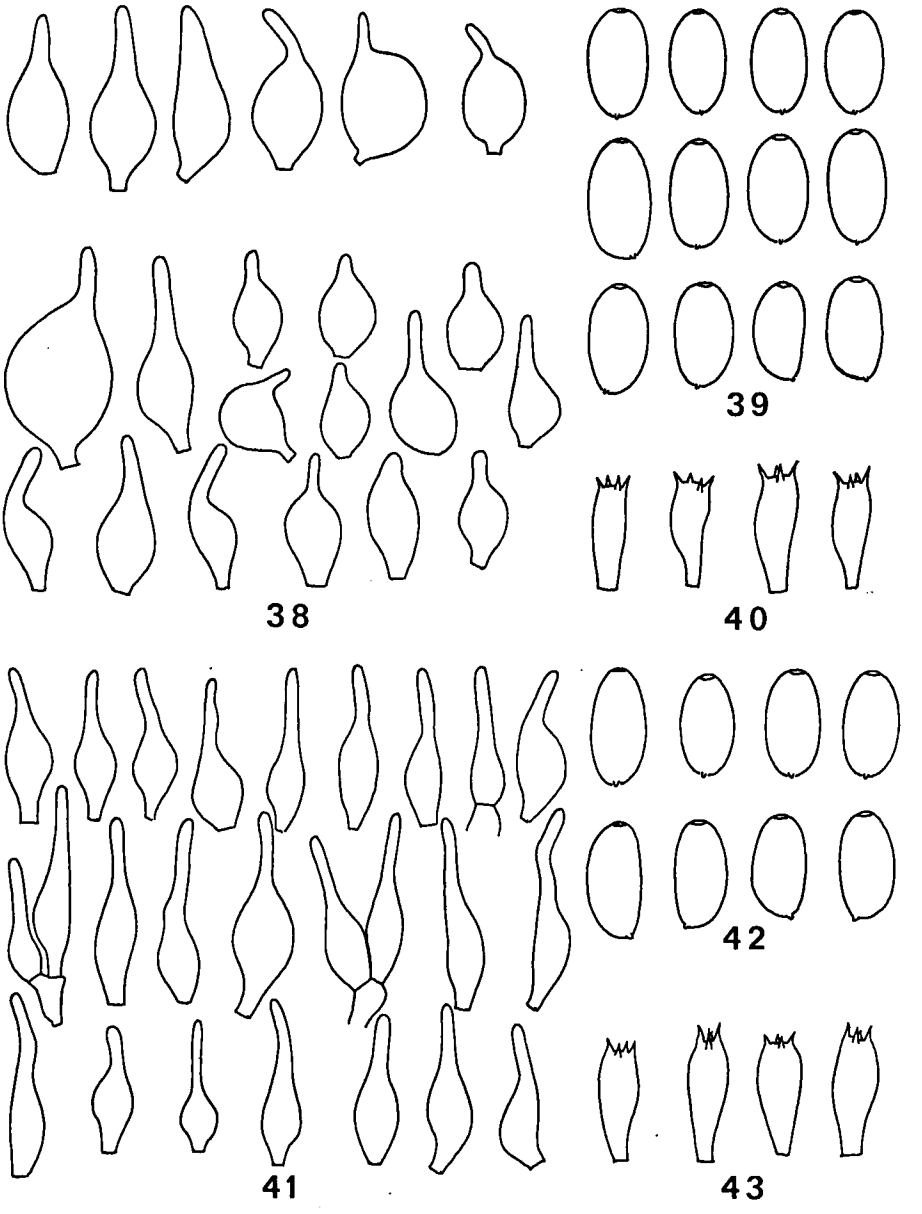
Invernesshire: Tomich, 1 September 1957, *P. D. Orton* (type specimen of *C. vexans*, K.); Guisachan, 19 September 1958, *P. D. Orton 1484* (E); Tomich, 17 September 1968, *E. Kits van Waveren* (L).

Durham: High Force Woodland, 22 September 1963, *R. Watling g. 415* (E).

OBSERVATIONS.—For nomenclatural discussion, see p. 131.

This species has not yet been recorded for the Netherlands.

C. blattaria being tall and slender, having a comparatively small cap and as a result having a striking habitus, very much resembles a *Galerina*; accordingly in the literature it is occasionally referred to as an "annulate *Galera*."



Figs. 38–40. *Conocybe blattaria* (Braemar, 28 Aug. 1961). — 38. Cheilocystidiogram. — 39. Spores. — 40. Basidia. (Figs. 38, 40: × 575; Fig. 39: × 1212.)

Figs. 41–43. *Conocybe blattaria* (Tomich, 17 Sept. 1968). — 41. Cheilocystidiogram. — 42. Spores. — 43. Basidia. (Figs. 41, 43: × 575; Fig. 42: × 1212.)

We found the walls of the stalks of the cells of the cuticle of the cap rarely and even then only very slightly thickened and coloured and the hyphae and inflated cells of the hypodermis also very little coloured and carrying comparatively few encrustations, which may well account for the cap being distinctly brighter and above all more yellow than the caps of *C. arrhenii*, *C. aporos*, and *C. filaris*.

Looking from underneath the cap into the gills of our specimens of 17 Sept. 1968, we were struck by the curious sordid yellowish-brown colour of the gills (looking at the face of the gills of some of the specimens the colour could be designated as M. 10 YR 5/4), which reminded us of the colour of the gills of *Galerina mniophila*. Orton's description of the colour of the gills of his *C. vexans*—which we consider to be conspecific with *C. blattaria*—also suggests a curious shade of brown: "clay-whitish then pale clay-ochraceous to dirty honey finally rusty-honey."

It is curious to note that Orton (1960: 197) found his *C. vexans* near Tomich (Invernesshire) on 1 Sept. 1957, where according to Dr. Watling (personal communication) it was again found on 14 Sept. 1958, while we found *C. blattaria* under trees near a farm at the far end of the same village Tomich on 17 Sept. 1968 (also near Braemar on 28 Aug. 1961).

CONOCYBE FILARIS (Fr.) Kühn.—Figs. 14–19, 44–48

Agaricus togularis var. *filaris* Fr., Icon. sel. **2**: 2, pl. 104 fig. 4. 1884. — *Pholiota filaris* (Fr.) Peck *in* Bull. N.Y. St. Mus. **122**: 144. 1908. — *Conocybe filaris* (Fr.) Kühn., Le Genre Galera 159. 1935. — *Pholiotina filaris* (Fr.) var. *kühneri* Sing. *in* Acta Inst. bot. Acad. Komar. Sci. URSS, Ser. 2 (Pl. crypt.) **6**: 429. 1950 (new name).

Galera pusilla Quél., Enchir. 81. 1886. — *Pholiota pusilla* (Quél.) Maire *apud* Kühn., Le Genre Galera: 160. 1935.

Pholiota rugosa Peck *in* Rep. N.Y. St. Mus. nat. Hist. **50**: 102. 1898. — *Pholiotina rugosa* (Peck) Sing. *in* Pap. Mich. Acad. Sci. **30**: 148. 1946. — *Pholiotina filaris* var. *rugosa* (Peck) Sing. *in* Acta Inst. bot. Acad. Komar. Sci. URSS, Ser. 2 (Pl. crypt.) **6**: 429. 1950.

Pholiotina filaris (Fr.) var. *ochracea* Sing. *in* Acta Inst. bot. Acad. Komar. Sci. URSS, Ser. 2 (Pl. crypt.) **6**: 429. 1950.

SELECTED DESCRIPTIONS AND ILLUSTRATIONS.—Fries, Icon. sel. **2**: 2, pl. 104 fig. 4. 1884 (*A. togularis* var. *filaris*); Kühner, Le Genre Galera 159. 1935 (*C. filaris*); J. E. Lange, Fl. agar. dan. **3**: 63, pl. 106 C, C 1 (*P. filaris*); Kühn. & Romagn., Fl. anal. 343. 1953 (*C. filaris*); Overholts *in* Ann. Mo. Bot. Gdn **14**: 115, pl. 15 upper left (*P. rugosa*).

OTHER DESCRIPTIONS.—Britz. *in* Ber. naturh. Ver. Augsburg **27**: 151. 1883 (*A. togularis* var. *filaris*); Peck *in* Bull. N.Y. St. Mus. **122**: 144. 1908 (*P. rugosa*); Harper *in* Trans. Wis. Acad. Sci. Arts Lett. **17**: 482. 1912 (*P. togularis* var. *filaris* and *P. rugosa*); J. E. Lange *in* Dansk bot. Ark. **2** (11): 6. 1921 (*P. togularis* var. *filaris*); Overholts *in* N. Am. Fl. **10** (4): 265, 266. 1924 (*P. rugosa* and *P. filaris*); Overholts *in* Ann. Mo. bot. Gdn **14**: 115, 116. 1927 (*P. rugosa* and *P. filaris*); A. H. Smith *in* Annls mycol. **32**: 478. 1934 (*P. filaris*); Singer & Digilio *in* Lilloa **25**: 312. 1951 (*P. filaris*); Moser *in* Kl. KryptogFl., Ed. 3, **2**(B2): 230. 1967 (*P. filaris*).

MACROSCOPIC CHARACTERS.—Cap 6–20 mm, predominantly conical with obtuse apex or conico-campanulate, later sometimes convex or even applanate and then sometimes with distinct obtuse umbo, when moist strongly striate up to 1/3–2/3 of

radius from margin, or up to umbo, surface smooth and often distinctly and sometimes even strongly rugulose, centre and striae dark reddish-brown (M. 5 YR 3/3, 3/4) between the striae dark brown (M. 7.5 YR 4/4; 10 YR 5/8) in the area around the non-striate centre becoming brown (M. 7.5 YR 5/6) and yellowish-brown (M. 10 YR 5/6, 6/6) towards the margin, hygrophanous, the reddish colour rapidly and already in early stages making way for brown (M. 7.5 YR 4/4, 5/6) then yellowish-brown (M. 10 YR 5/6, 5/8, 6/6), finally pale brown-yellow (M. 10 YR 7/4, 7/6), the striation disappearing. Marginal veil absent.

Stem 15–35 × 0.75–1.5(–2) mm, equal, sometimes slightly thickened at the base, firm, hollow, non-rooting, pruinose over some distance at apex, fairly and sometimes very coarsely fibrillose-striate by a whitish to greyish or very pale brown layer of fibrils, often below the ring even flocculose-fibrillose or woolly-hairy or disjointed and masking the brown colour underneath; very pale yellow or brown (M. 2.5 Y 8/4, 7/4 and 10 YR 7/4, 7/6, 6/6) at the apex, increasingly brown towards the base and fuliginous to blackish-brown at the base.

Velum partiale always forming a conspicuous ring just above to just below the middle of the stem, large, ascending, horizontal or descending, often detached from the stem and then easily sliding along the stem, whitish to pale brown, felt-like, coarsely striate-plicate and often orange-brown above because of spore-deposit.

Gills ventricose, not crowded (L 13–25), adnexed (sometimes narrowly or even very narrowly), 1–2.5 mm broad, ochre-brown (M. 7.5 YR 5/6 or paler), edge flocculose-denticulate, white.

Flesh of the cap 0.5–1 mm thick in the centre, very thin near the margin, very dark brown, of the stem very pale brown at the apex, increasingly brown towards the base, fuliginous brown to blackish-brown in the lower 1/4–1/3 of the stem and almost always black at the base.

Smell none.

MICROSCOPIC CHARACTERS.—Spores ellipsoid to slightly amygdaliform, yellow (M. 2.5 Y 7/6) with a trace of red in water, apiculus small, germ-pore conspicuous (1–1.5 μ), 8.1–9.9(–10.4) × 4.5–5.4(–5.9) μ in 4-spored specimens and many up to 12–12.5 × 6 μ in specimens with both 4- and 2-spored basidia.

Basidia usually 4-spored but sometimes both 4- and 2-spored basidia on the same gill, 17.5–27 × 5–10 μ.

Cheilocystidia closely packed (edge of gill sterile but often with scattered basidia or very small groups of basidia), obclavate, lageniform, the majority if not all the necks indistinctly delimited from the cell-body, tapering towards the acute to obtuse apex, colourless, wall of normal thickness, 20–50 × (4–)6–11 × 1.5–2.5(–3) μ.

Pleurocystidia none.

Cuticle of the cap hymeniform, for full description, see p. 126.

Superficial hyphae of the stem below the ring, for full description, see p. 126.

HABITAT.—In rich, clayey soil of gardens, parks particularly in and around greenhouses, along paths, in moss, also found in sawdust and compost. In small or, gregariously, in large groups, rarely solitary. Uncommon.

COLLECTIONS EXAMINED.

NETHERLANDS

Overysel: Ommen, Estate Ada's Hoeve, 15 Sept. 1963, *E. Kits van Waveren* (L); Oldenzaal, Estate Dykhuis, 16 Oct. 1963, *E. Kits van Waveren* (L).

Utrecht: Zaltbommel, 27 Oct. 1968, *M. H. J. Kortselius* (L).

Noord-Holland: 's-Graveland, Estate Boekesteyn, 12 June 1967, 27 May 1968, 3 Aug. 1968, *J. Daams* (L); 's-Graveland, Estate Boekesteyn, 25 Sept. 1968,

3 Oct. 1968, 8 Nov. 1968, *E. Kits van Waveren* (L); Santpoort, Estate Duin en Kruidberg, 1 Dec. 1960, *E. Kits van Waveren* (L).

Zuid-Holland: Leiden, Nieuweroord, 21 Aug. 1960, *R. A. Maas Geesteranus* (L).

Noord-Brabant: Breda in garden of Meerten Verhoffstraat 9, 2 Sept. 1961, *P. B. Jansen* (L).

BRITISH ISLES

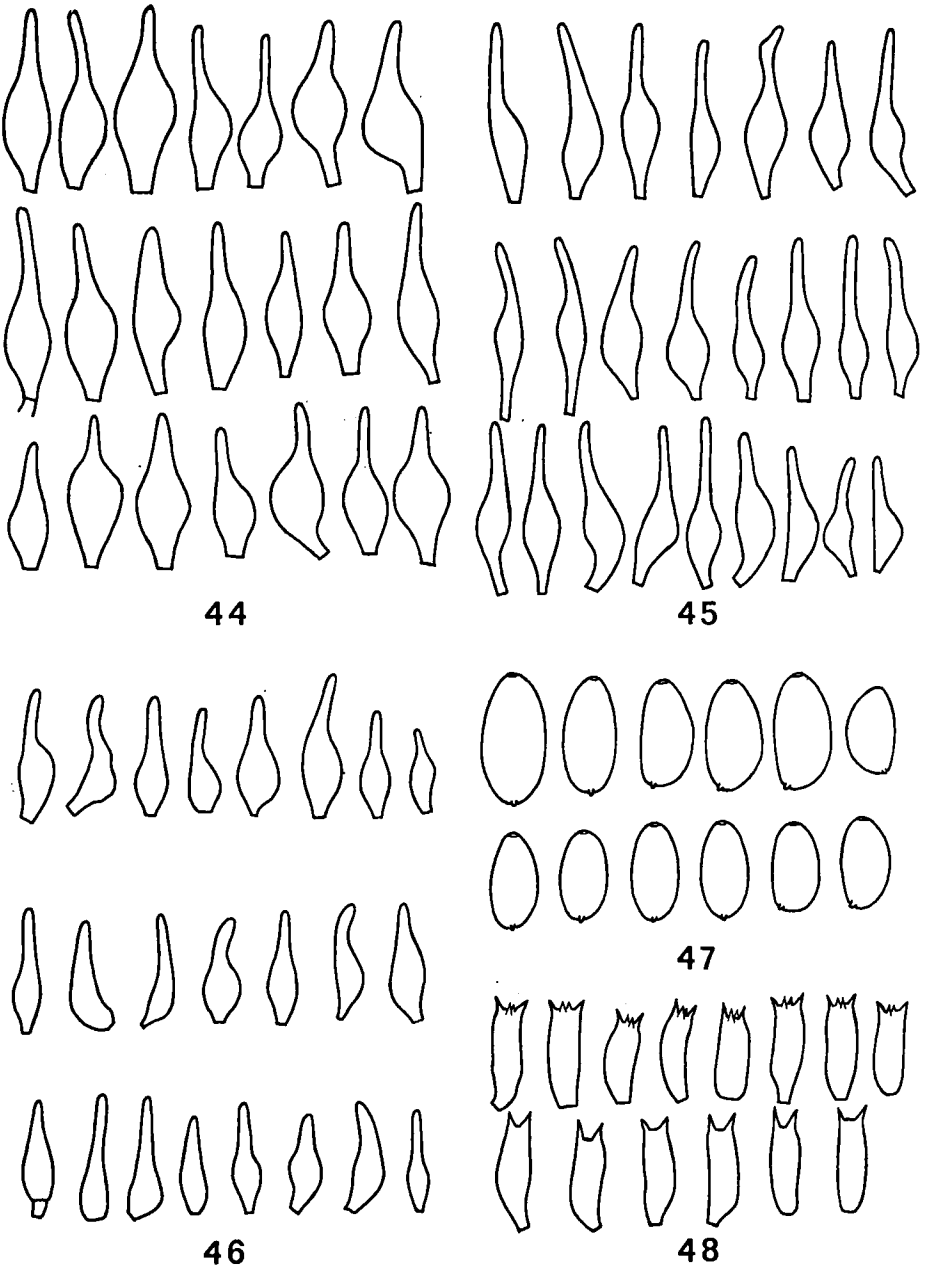
Montgomeryshire: Lake Vyrnwy, 5 Sept. 1959, *E. Kits van Waveren* (L).

Perthshire: Loch Rannoch, 31 Oct. 1964, *P. D. Orton 2559, 2560*; 2 Nov. 1964, *P. D. Orton 2561* (E).

OBSERVATIONS.—From Peck's descriptions (1896: 102; 1908: 144) of *Pholiota rugosa* and from the redescriptions by Overholts (1924: 265) and Singer (1946: 148) it is quite obvious that this species was based on specimens of *C. filaris* of which the surface of the cap—as so often is the case in this species—was distinctly wrinkled, all other macroscopic and microscopic characters being identical with those of *C. filaris*. Accordingly Singer & Digilio (1951: 312) stated that they wished to identify as *C. rugosa* those forms of *C.* ("*Pholiotina*") *filaris* which have a rugulose cap, and as *C. filaris* those forms of *C. rugosa* (of which Singer gave a description in 1946: 148) which have a smooth cap!

Earlier Singer (1950: 429) had distinguished no less than six varieties of *Conocybe* ("*Pholiotina*") *filaris*, all of which he believed to be intermediate forms between *C. filaris* and *C. arrhenii* ("*blattaria*"): var. *rugosa*, clearly the form of *C. filaris* with the surface of the cap wrinkled; var. *ochracea* also clearly *C. filaris* of which, however, all traces of red had disappeared from the cap (surface of cap slightly wrinkled, obtuse umbo, 2- and 4-spored basidia, etc.); var. *recedens*; var. *recedens* f. *subochracea*; var. *exannulata*, and var. *Kühneri*. Judging by Cooke & Massee's original description (apud Cooke, 1889: 25) of *Agaricus recedens*, this species is clearly not *C. filaris*, but, on account of its very long stem (75–100 × 4.6 mm) and fairly large cap (25 mm diameter), may well have been *C. blattaria* or *C. teneroides*. Singer's description looks like being merely a copy of the one by Cooke & Massee, both giving 9 × 5 μ for the size of the spores and neither of them mentioning the cheilocystidia or the basidia as being 4- or 2-spored or both. Var. *exannulata* is quite a different species (no ring, indistinct germ-pore, cheilocystidia lageniform but also, be it less often, clavate). Var. *Kühneri* is *C. filaris* as described above and accordingly Singer considered it to be conspecific with *A. togularis* var. *filaris* and *C. filaris* as described by Kühner (1935: 159).

In trying to identify the annulate species of the *Pholiotina* group from descriptions in the literature in which the microscopic characters are missing or described inadequately, one should—with regard to *C. filaris*—go by the two major macroscopic characteristics of this species, the small size (stem 15–35 mm) and the predominantly conical shape of the cap (the specimens depicted by Fries on his Pl. 104 fig. 4 also are predominantly conical). *Agaricus recedens* as described by Cooke & Massee (apud Cooke, 1889: 25) and *Galera togularis* as described by Velenovský



Figs. 44–48. *Conocybe filaris* (44: 's-Graveland, Boekesteyn, 3 Oct. 1968; 45: Leiden, Nieuwer-oord, 21 Aug. 1960; 46: Santpoort, Duin en Kruidberg, 1 Dec. 1960; 47 & 48: Oldenzaal, Dijkhuis, 16 Oct. 1963). — 44–46. Cheilocystidiogram. — 47. Spores. — 48. Basidia, 2- and 4-spored. (Figs. 44–46, 48: × 575; Fig. 47: × 1212.)

(1921: 552) in this respect cannot be regarded—as Singer (1950: 431) did—as synonyms of *C. filaris*. The stems of both species were very long and Velenovský used only the words "arch-like expanded" (translation Dr. Kotlaba) for the shape of the cap. Indeed, Watling (personal communication) who has examined the type material in Herb. Kew, stated *Agaricus recedens* is a member of the Cortinariaceae, named *Rescolea recedens* by Singer (1955: 407).

Kühner (1935: 161) concluded that *Galera pusilla* Quél. (1886: 81) only differed from *C. filaris* by its very small size (diameter of cap 4 mm) and concluded from Maire's unpublished notes that this author had also found this species "sous les cèdres de l'Atlas de Blida" and had named it *Pholiota pusilla*. On looking at Quélet's original description Kühner's conclusion certainly seems justified. Smith & Singer (1964: 296) believed *Pholiota minima* Peck (1888: 65), by that name also described by Overholts (1924: 266), to be a *Galerina*.

It was quite a surprise, when, while studying our collection of *C. filaris* of 16 Oct. 1963, large numbers of 2-spored basidia were found among the majority of 4-spored basidia, as at that time Singer's paper, the only one recording 2-spored basidia in *C. filaris*, had not yet come to our knowledge. Later we found 2-spored basidia in small numbers in the collections of 25 Sept., 3 Oct., and 8 Nov. 1968 from 's-Graveland.

Conocybe filaris evidently has great preference for growing in or near greenhouses. Singer (1950: 429) reported several of his varieties of *C. filaris* from greenhouses, Overholts (1924: 265), and Singer (1948: 148) reported the same for *C. rugosa*, and our own collections from 's-Graveland and Oldenzaal also were growing in or near greenhouses.

The caps of *C. filaris* dry out very rapidly, and this probably explains why many descriptions in the literature fail to mention its dark reddish-brown colour in the earliest stages (see p. 122). Coloured photographs in our collection, taken of specimens found 1 Dec. 1960, bring out this colour beautifully. The photographs reproduced by Overholts (1927: 115, pl. 15), although in black and white, are excellent and depict the typical size and shape of the carpophores very well; in the accompanying description the colour of the caps is called "yellowish-red or dark ferruginous."

Conocybe teneroides (J. E. Lange) Kits van Wav., *comb. nov.*
Figs. 20, 49–54

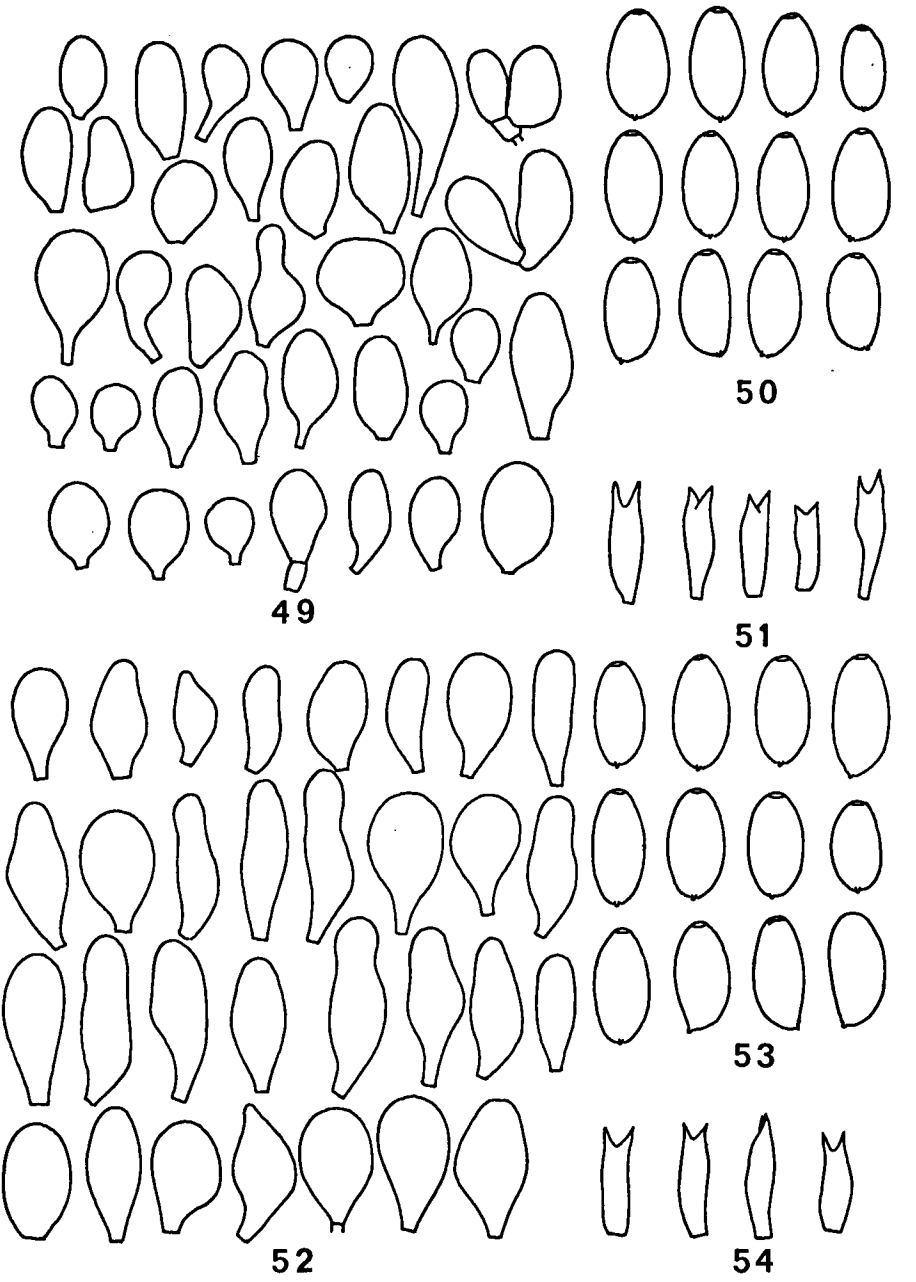
Pholiota teneroides J. E. Lange *in* Dansk bot. Ark. **2** (11): 7. 1921. — *Conocybe teneroides* (J. E. Lange) Kühn., Le Genre Galera 162. 1935 (not validly published).

Conocybe togularis forme bisporique, Kühn., Le Genre Galera 162. 1935.

Conocybe percincta P. D. Orton *in* Trans. Br. mycol. Soc. **43**: 194. 1960.

MISAPPLIED NAMES.

Pholiota blattaria (Fr.) Quél. *sensu* Konr. & Maubl., Icon. sel. Fung. **1**: pl. 69 fig. 2. 1929. — *Pholiotina togularis* f. *bispora* Singer *in* Acta Inst. bot. Acad. Nom. Komarovi Sci. URSS, Ser. 2 (Pl. crypt.) **6**: 431. 1950. — *Conocybe blattaria* (Fr.) Kühn. *sensu* Orton *in* Trans. Br. mycol. Soc. **43**: 191. 1960; Dennis, Orton & Hora *in* Trans. Br. mycol. Soc., Suppl. 33. 1960.



Figs. 49–51. *Conocybe teneroides* (Santpoort, Duin en Kruidberg, 1 Dec. 1960). — 49. Cheilocystidiogram. — 50. Spores. — 51. Basidia. (Figs. 49, 51: × 575; Fig. 50: × 1212.)

Figs. 52–54. *Conocybe percincta* (Covenhope, 21 Nov. 1959, type). — 52. Cheilocystidiogram. — 53. Spores. — 54. Basidia. (Figs. 52, 54: × 575; Fig. 53: × 1212.)

SELECTED DESCRIPTIONS AND ILLUSTRATIONS.—Konrad & Maublanc, Icon. sel. Fung. **1**: pl. 69 fig. 2. 1929 (*P. blattaria*); J. E. Lange, Fl. agar. dan. **3**: 63, pl. 106 B. 1938 (*P. teneroides*); Kühn., Le Genre Galera 162. 1935 (*P. teneroides*); Orton *in* Trans. Br. mycol. Soc. **43**: 191. 1960 (*C. percincta*).

MACROSCOPIC CHARACTERS.—Cap 6–13 mm, conico-campanulate to campanulate, when moist striate from margin up to 1/2–2/3 of radius of the cap, surface smooth, ochre-brown (M. 10 YR 5/6) to brownish-yellow (M. 10 YR 6/6), hygrophanous, drying out to yellow (M. 10 YR 7/6) and pale brownish-yellow (M. 10 YR 8/4, 8/6), striation completely disappearing. Marginal veil absent.

Stem 20–35 × 1.5–2 mm, equal, hollow, non-rooting, colour very pale yellowish at the apex, pale yellowish-brown slightly lower down, then increasingly brown and rather pinkish-brown towards the base, dark brown at the base, these colours breaking through a very thin, whitish, fine fibrillose-striate superficial layer, the apex pruinose.

Velum partiale forming a conspicuous, thick (c. 0.5–1 mm) and broad (2–5 mm) ring, located at about 1/4–1/3 of the total length of the stem from the apex, as a rule standing out horizontally from the stem (not cuff-like and rather reminiscent of the ring of *Lepiota procera*), often becoming detached from the stem and then movable and easily slipping down the stem or breaking and then disappearing altogether, striate-plicate above, whitish.

Gills fairly crowded, (L 20–24), ventricose, narrowly adnexed, 1.5–2.5 mm broad, brownish-yellow to ochre (M. 10 YR 6/6, 5/6), edge flocculose-dentate, white.

Flesh thin, ochraceous in cap, deep honey to dark ochre over the gills; in stem horn-ochraceous at apex and, when dry, rich ochre-yellow, tinted faintly tawny; sepia brown towards base, vandyke to umber at the very base; rapidly drying out.

Smell none.

MICROSCOPIC CHARACTERS.—Spores ellipsoid to slightly amygdaliform, yellow (M. 2.5 Y 8/8) with a trace of red in water, apiculus fairly small, germ-pore large (1.5–2 μ), 10.8–11.7 × 5.4–6.3 μ.

Basidia 2-spored, 17.5–25 × 7–8 μ.

Cheilocystidia closely packed (edge of gill sterile), very variable, sphero-pedunculate-globose, ellipsoid, cylindric, clavate, fusiform, obovoid, utriform, 15–40 × 9–20 μ, colourless, wall of normal thickness.

Pleurocystidia none.

Cuticle of cap hymeniform (for full description, see p. 126), cells 17.5–55 × 12–25 μ.

Superficial hyphae of the stem below the ring, for full description, see p. 126.

HABITAT.—In moss in woods, solitary or in very small groups. Autumn. Very rare.

COLLECTIONS EXAMINED.

NETHERLANDS

Noord-Holland: Santpoort, Estate Duin en Kruidberg, 1 Dec. 1960, *E. Kits van Waveren* (L).

BRITISH ISLES

Surrey: Mickleham, Juniper Hall, 19 Nov. 1954, *P. D. Orton 321* (E).

Perthshire: Tomich, Guisachan Forest, 1 Sept. 1957, *P. D. Orton 1141* (E); Covenhope, 21 Nov. 1959, *P. D. Orton* (type of *C. percincta*, K.).

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