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THE GENUS CONOCYBE SUBGENUS PHOLIOTINA II.

Some European exannulate species and North American annulate species *

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(With 78 text-figures and 2 Graphs)

Pholiota septentrionalis is transferred to the genus *Conocybe*, under the first available name i.e. *P. intermedia*, the taxon *Conocybe intermedia* var. *brunnea* is validated and given specific rank. The differences between these two taxa are given and a new species, *C. fibrillosipes*, is described. The new Section *Intermediae* is proposed and incorporated into *Conocybe* subg. *Pholiotina*. — The name *Conocybe appendiculata* Kühner 1935 is validly published and a full description given. — The following new species are described: *Conocybe fimicola*, *C. flexipes*, *C. pinguis* and *C. stercoraria*. The identity of *Galera mycenoides* is discussed.

During a study of the Bolbitiaceae it was found necessary in subgenus *Pholiotina* not only to provide Latin descriptions to validly publish the names of certain species—names already widespread in the literature—, but to describe several new taxa and re-examine the taxonomic position of certain members of the subgenus.

In order to accomplish the task it has been necessary to examine collections originally used by other authors in their published studies. I have through the kindness of Prof. A. H. Smith not only been able to examine in detail the holotype and paratypes of *Pholiota intermedia* but also to collect fresh material from the type locality within the Great Lake region and to examine his extensive collections of members of the Bolbitiaceae. I am also grateful to Prof. R. Kühner for the loan of the material he used in drawing up his excellent descriptions published in "Le Genre *Galera*".

Observations on the Bolbitiaceae—VI
Pholiota septentrionalis and its allies

Thirty six years ago Smith (*1934*) described *Pholiota intermedia* basing the name on a fungus with the following characters: (a) nine-pin (i.e. skittle)-shaped cheilo-

* Part of the research was supported by a Grant from the National Science Foundation of the United States of America (G 13282-03779) made available to me whilst at the University of Michigan Herbarium. This communication includes "Observations on the Bolbitiaceae VI—VIII". — For Part I (by E. Kits van Waveren), see Persoonia **6**: 119–165. 1970.

cystidia, (b) corticate, viscid pileus, (c) small, non-truncate basidiospores, (d) striate annulus and (e) lignicolous habit. Unfortunately, however, the name was preoccupied by *Pholiota intermedia* Sing. (*1930*), a name given to a fungus growing in the Caucasus on *Carpinus betulus* and *C. orientalis;* Smith later made the necessary correction, renaming his fungus *Pholiota septentrionalis (1935).* In his first article Smith drew attention to the fact that the pileus cuticle of his new species was composed of large, inflated cells (i.e. hymeniderm) and related the fungus to *Pholiota erebia, P. filaris,* and *P. rugosa;* the first of these three species is referable now to the genus *Agrocybe* and the other two to the genus *Conocybe.* Although possessing a pileal hymeniderm, *A. erebia* has one which is less pronounced than that of either of the two other species mentioned by Smith. Nevertheless the presence of such a structure when correlated with a brown spore-deposit and fairly complex spore-structure places this species, *P. filaris, P. rugosa.* and *P. intermedia* in the Bolbitiaceae as it is currently defined.

A year after Smith's publication J. E. Lange & R. Kühner (*apud* Kühner, *1935*) described a closely related fungus under the name *Conocybe intermedia* var. *brunnea;* the variety differed in habitat (on ground amongst herbs, i.e. not lignicolous), long stipe (up to 50 mm) and the presence of a veil, fragments of which did not form a distinct annulus but adhered to the margin of the pileus. Smith in his original description of *P. intermedia,* however, had mentioned that in a few of his collections the margins of the pilei of some specimens were adorned with thick, membranous patches from the veil and the annulus in these instances was lacking. It was this more than any other character which probably led Lange & Kühner to treat their fungus as a variety and not as a distinct species, but compare the earlier discussion by Kits van Waveren *(1970)* and Watling *(1971).* Kühner *(1935)* in describing the variety *brunnea* referred *P. septentrionalis,* as *P. intermedia,* to the genus *Conocybe;* Lange (*1938*) on the other hard used the epithet *brunnea* at specific level and at the same time transferred the fungus to the genus *Galera.*[1] Kühner & Romagnesi (*1953*) have also given this fungus specific rank but they retained it in the genus *Conocybe;* they used the epithet *brunnea.*

Moser has keyed out this fungus in all three editions of Gams' "Kleine Krytogamenflora" and did so in the genus *Pholiotina* Fayod. It has been argued by both Watling (*1965*) and Kits van Waveren (*1970*) that *Pholiotina* should, however, only be recognised at subgeneric level within *Conocybe.* Although *P. septentrionalis* is anomalous in some ways within the subgenus *Pholiotina* (see below) it is quite typical of the genus *Conocybe.*

Singer (1950) has described four "varieties"[2] under *Pholiotina septentrionalis:*—

[1] *Galera* (Fries) Kummer, 1871 is a later homonym of *Galera* Blume, 1825 (Orchidaceae) and cannot therefore be used.

[2] Singer himself states that three "varieties" are to be found but in fact lists four, probably meaning three variants plus the type variant.

(a) Michigan "variety" with short stipe, close lamellae, annuliform veil, narrow to broad cheilocystidia and lignicolous habit.
(b) European "variety" (including collections from Altai but not those from the Caucausus) with longer stipe, more distant lamellae, annuliform or fragmentary veil, narrow to moderately broad cheilocystidia and either terricolous or lignicolous habit.
(c) Caucasus "variety" with longer stipe, closer lamellae, annuliform veil, moderately broad to broad cheilocystidia and lignicolous habit.
(d) Florida "variety" with short or long stipe, more distant lamellae, non-annuliform veil, narrow cheilocystidia and lignicolous habit.

Singer's observations are based on six collections and the notes of Kühner (*1935*), Lange (*1938*), and Smith (*1934*, and probably some personal reports). It is difficult, however, to ascertain what longer in respect to the stipe, and closer in respect to the gills really means without any quantitative expression for the characters within any one population and measurements with which they can be contrasted. The variants in Singer's account appear to be compared with the Michigan variant.

In the genus *Conocybe* the first specific epithet for this Michigan variant is that originally proposed by A. H. Smith and transferred by Kühner i.e. *intermedia.*

CONOCYDE INTERMEDIA (A. H. Smith) Kühner—Figs. 1–7, 13–16

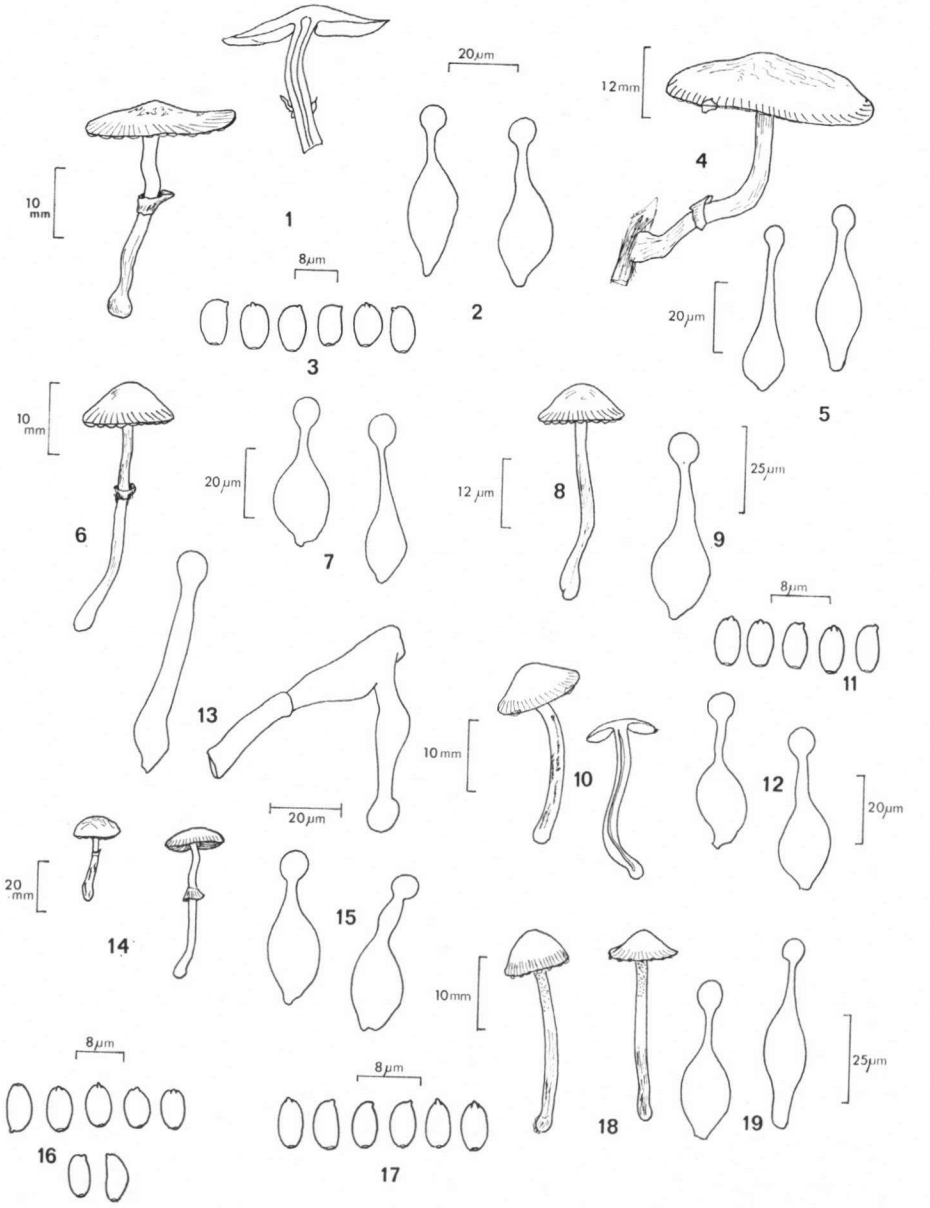
Pholiota intermedia A. H. Smith *in* Annls mycol. **32**: 479. 1934; not *Pholiota intermedia* Sing. *in* Beih. bot. Zbl. **46** (2): 227. 1930. — *Conocybe intermedia* (A. H. Smith) Kühner, Genre *Galera* 143. 1935. — *Pholiotina intermedia* (A. H. Smith) Sing. *in* Beih. Bot. Zbl. (B) **56**: 179. 1936. — *Pholiota septentrionalis* A. H. Smith *in* Mycologia **27**: 227. 1935 (avowed substitute name). — *Pholiotina septentrionalis* (A. H. Smith) Sing. *in* Notul. Syst. crypt. Inst. Komarov **5**: 90. 1945 ("1941"); *in* Trudy bot. Inst. Komar. (II, Spor. Rast.) **6**: 425. 1950 [but quoted as "(Smith) Singer apud Vasilieva ex Singer comb. nov." *in* Sydowia **4**: 143. 1950].

Pholiotina septentrionalis subsp. *smithii* Sing. *in* Trudy bot. Inst. Komar. (II, Spor. Rast.) **6**: 425. 1950.

Pileus 10–20(–30) mm, convex to obtusely conic, expanding to nearly plane or with slight obtuse umbo, smooth, glabrous, moist to slightly viscid, hygrophanous, 'chestnut brown'[3] to 'sudan brown' when young, ochraceous tawny at maturity and fading to dull buff or ochraceous buff on drying, striate to half-way when moist and becoming rugulose at maturity particularly at disc. *Stipe* 10–30 × 1.5–3 mm, buff at first, pale yellow at base darkening to become 'bistre' on handling or with age, fibrillose-scurfy at the apex; *annulus* median or inferior, membranous, striate above, yellowish, forming patches along the margin of the pileus in some fruit-bodies. *Lamellae* crowded, narrow to moderately adnate or adnate descending, ochraceous, with ± even margin, *Flesh* thin; *odour* and *taste* not distinct.

Basidia 4-spored, 14–18 × 7–8 μ, clavate, hyaline in KOH or flushed pale cinnamon, intermixed with some basidioles. *Basidiospores* 6–7.5(–8) × 4–4.5 μ, smooth, ovoid to subellipsoid in face-view, obscurely phaseoliform in side-view, not truncate although

[3] Colours in quotation marks follow Ridgway (*1912*).



FIGS. 1–19. Habit sketches and microscopic characters of *Conocybe intermedia* and *C. brunnea*. — 1–7, 13—16: *C. intermedia*. — 1–3 (Watling A 330/C 709). 1. Habit sketch and section. 2. Cheilocystidia. 3. Basidiospores. — 4, 5 (Watling A 392/G 667). 4. Habit sketch. 5. Cheilocystidia. — 6, 7 (Watling A 328/G 715). 6. Habit sketch. 7. Cheilocystidia. — 13–16 (Smith 33–714, type). 13. Caulocystidia. 14. Habit sketch. 15. Cheilocystidia. 16. Basidiospores. — 8–12, 17–19: *C. brunnea*. — 8, 9 (Watling A 326/G 811). 8. Habit sketch. 9. Cheilocystidium. — 10–12 (A 263/G 772). 10. Habit sketch. 11. Basidiospores. 12. Cheilocystidia. — 17–19 (Watling G 387). 17. Basidiospores. 18. Habit sketch. 19. Cheilocystidia. — (Magnification as indicated.)

with a distinct, small germ-pore, cinnamon-brown in mass, cinnamon-rust in KOH and NH_4OH. *Pleurocystidia* not seen. *Cheilocystidia* skittle-shaped, 18–26(–37) × 7–10 μ, ventricose with narrow neck and head 4–6 μ in diameter. *Hymenophoral trama* cinnamon in KOH, of interwoven or inflated cells about a central strand of swollen cells. *Pileal surface* a hymeniderm of clavate pedicellate cells with walls of pedicels in many somewhat thickened and deep rust-brown in NH_4OH, with or without accompanying pileocystidia. *Pileus trama* of floccose, inflated cells, pale cinnamon in NH_4OH but darker towards the base of hymeniderm. *Stipe surface* of parallel to subparallel, hyaline or slightly buff hyphae, many of which terminate in inflated and/or capitate cells. *Clamp-connections* present, particularly on hyphae of stipe and velar remnants.

Scattered on rotting wood and in rich humus near rotten logs of hardwood, particularly *Fagus*, June-September. Common in the Great Lakes Region of North America.

COLLECTIONS EXAMINED.—

UNITED STATES

M i c h i g a n: Holotype and paratypes. Blisswood, Harbor Springs, Emmet Co., 19 August 1953, *Smith 33-714* (HOLOTYPE) (consisting of four mature specimens, 3 immature specimens and a detached pileus); Cross Village, Emmet Co., 19 August 1933, *Smith 33-708;* Harbor Springs, Emmet Co., 21 August 1933, *Smith 33-732* (this collection is better placed in *Conocybe brunnea*—see below); Silver Creek, near Emerson, Chippewa Co., 25 August 1933, *Smith 33-769;* near Superior State Forest, north of Newberry, Luce Co., 28 August 1933, *Smith 33-787;* ibid., 30 August 1933, *Smith 33-823;* Huron Mountains, Big Bay, Marquette Co., 16 September 1933, *Smith 33-991*—all in MICH; slides in (E).[4]

Other material (Michigan). Kent Lake, Oakland Co., 17 September 1938, *Smith 10999* (MICH); The Gorge, near Univ. Mich. Biological Station, Cheboygan Co., 21 August 1949, *Harding 329* (MICH); ibid., 24 August 1949, *Harding 73* (MICH); near Pellston, Cheboygan Co., 10 September 1949. *Harding 384* (MICH). On decayed logs, Harbour Springs, Emmet Co., 21 July 1951, *S. C. Hoare* (DAOM): Upper Tahquamenon Falls, Luce Co., 23 July 1951, *A. H. Smith* (DAOM); Colonial Point, Emmet Co., 14 September 1949, *Smith 33697* (MICH); Tahquamenon Chippewa Co., 24 August 1957, *Smith 57440*, and 27 August 1957, *Smith 57723* (MICH); Emerson, Chippewa Co., 16 August 1965, *Watling A 286/G 730* & *A 287/G 762* (E); Tahquamenon, Chippewa Co., 25 July 1965, *M. Wells, Watling A 171/G 822* (E); Whitehouse Landing, Chippewa Co., 18 July 1965, *Watling A 330/G 709* (E); Hulbert, Chippewa Co., *Watling A 403/G 668* and *A 392/G 607* (E); Whitehouse Landing, Chippewa Co., *Watling A 328/G 715* (E).

N e w Y o r k S t a t e: Warren Co., 22 August 1934, *Smith 513* (MICH); North Creek Road, Warren Co., 1 September 1934, *Smith 640* (MICH); Pack Forest, Warrensburg, Warren Co., 16 September 1934, *Smith 791* and *949* (MICH).

T e n n e s s e e: India Creek, Great Smoky Mts. National Park, Bount Co., 21 July 1946, *Hesler 17661* (MICH).

CANADA

O n t a r i o: Paradise Lake, Lake Timagami, 2 September 1946, *Smith 4471* (MICH); Ramsayville, 14 September 1954, *Ruth Macrae* (DAOM). As *C. togularis*: Needle Point Magmtawa, *Howard A Kelly Myc. Herb. 1852* (MICH).

[4] Abbreviations for Herbaria follow Lanjouw & Stafleu (*1964*).

In Michigan U.S.A. *P. intermedia* is very common, particularly in the hardwood slashings of the upper areas of Lower Michigan and in the areas around the Tahquamenon water-shed of the Upper Peninsula. However, not only has typical material of this species been collected but also a second fungus with rather more distant, bright tawny ('raw sienna') gills, similar in fact to those mentioned below under Smith 41704. Such collections regularly possessed a marginal veil amd very rarely was there any evidence of a ring to be found; in the true *P. intermedia*, however, the reverse was true. The development of the ring was frequently positively correlated with crowded, dull coloured gills ('sudan brown' to 'bistre'). Thus in a single area of hardwood timber one could locate Smith's original fungus and one which agreed in all ways with European material of what Kühner called *Conocybe intermedia* var. *brunnea*.

It is true that intermixed populations of the two fungi were found in some of the areas in which collecting was carried out and so variability within a single species might be suspected, but when specimens of each were compared side by side there were at least two very obvious differences. It is quite a frequent phenomenon to find closely related, but autonomous, agaric species growing within a single, small area e.g. members of the genus *Coprinus* section *Setulosi* on a single manure-heap. Thus in some areas of woodland *C. intermedia* grew to the exclusion of other members of *Conocybe* subgenus *Pholiotina*, whilst in other areas *C. intermedia* grew in association with an exannulate member of the same group. These two fungi in fact might have slightly different fruiting periods in any one given locality, but one cannot be certain without much longer periods of study. *Conocybe intermedia* would appear to be the earlier fruiting of the two.

The European variant.—Unlike some authorities I propose to keep the taxon formerly known as *C. intermedia* var. *brunnea* as an autonomous species closely related to *C. intermedia* and characterised particularly by the colour and number of the gills; I wish to reduce slightly the emphasis placed in the past on habitat, stature of the fruit-body and position of the velar remnants.

Conocybe intermedia var. *brunnea* has not been validly published according to Article 36 of the "International Code of Botanical Nomenclature" (*1966*). The following validation is therefore proposed:—

Conocybe brunnea J. E. Lange & Kühner ex Watling, *sp. nov.*—Figs. 8–12, 17–19

Conocybe intermedia var. *brunnea* J. E. Lange & Kühner *apud* Kühner, Genre *Galera* 143. 1935 (not validly published; lacking Latin description). — *Galera brunnea* (J. E. Lange & Kühner) J. E. Lange *in* Dansk bot. Ark. **9** (6): 39. 1938 (not validly published). — *Pholiotina septentrionalis* subsp. *brunnea* (J. E. Lange & Kühner) Sing. *in* Trudy bot. Inst. Komar. (II, Spor. Rast.) **6**: 425. 1960 (not validly published). — *Pholiotina intermedia* var. *brunnea* (J. E. Lange & Kühner) Moser *in* Kl. Krypt Fl. **2**: 190. 1953 (not validly published). — *Conocybe brunnea* (J. E. Lange & Kühner) Kühner & Romagn., Fl. anal. Champ. sup. 343, 1957 (not validly published).

? *Galera ravida* Velenovský, Česká Houby 546. 1922, *fide* Kühner, Genre *Galera* 143. 1935.

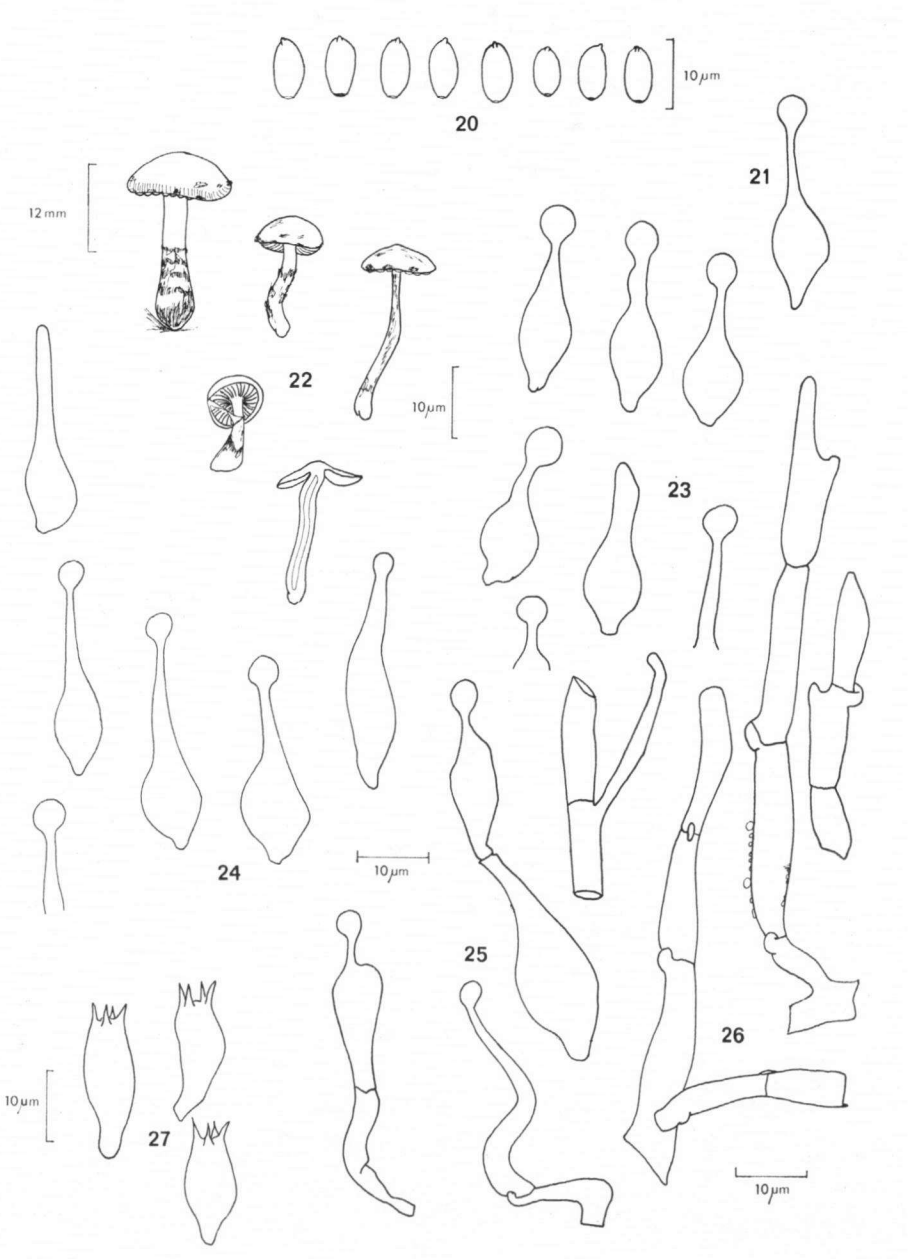
MISIDENTIFICATIONS.—*Pholiotina septentrionalis* (A. H. Smith) Singer *sensu* Moser *in* Kl. Krypt-Fl. (Pilze) **b/2** (3. Ausg.): 230. 1967.
Naucoria tremulenta forma *typica* Heim & Romagn. *in* Bull. Soc. mycol. Fr. **50**: 175. 1934.

Pileus 9–14(–20) mm e convexo vel conico-convexo expansus, umbonatus, badius vel castaneus, sicco ochraceo-mellinus vel flavido-ochraceus, jove pluvio striatus. Stipes 25–40 × 1.5–3 mm, aequalis, sursum leviter attenuatus vel deorsum incrassatus, farctus vel anguste cavus, ochraceo-brunneus mox sursum umbrinus vel obscure fuscus, mellino-flocculosus. Lamellae ferrugineae. Basidia 4-sporigera, 20–26 × 6–7.5 μ. Basidiosporae phaseoliformes-ellipsoideae, laeves, (6.0–)6.5–8(–9.5) × 3.5–4.5(–5.0) μ. Cystidia aciei lamellarum apicibus capitatis, 25–45 × 5–7.5 μ. Cystidia stipitis similia.
TYPUS.—Boissy-Saint Leger, Paris, France, 5 x 1932, *R. Kühner* (Herb. Kühner, Lyon, France).

Pileus 9–14(–20) mm, convex or conico-convex, expanding to become broadly conic with slight umbo, 'bay' or 'chestnut' when fresh and young, paler at maturity, becoming rusty tawny, hygrophanous, ochraceous 'clay-colour' or yellow-buff when dry, minutely striate to half-way when moist; margin appendiculate with minute, white or creamy, fugacious, membranous scales. *Stipe* 25–40 × 1.5–3 mm equal, slightly attenuated upwards or thickened at base, stuffed then hollow, pale clay-buff or whitish then yellowish brown, darker towards the base particularly at maturity or after excessive handling, floccose throughout very rarely with apical ring. *Lamellae* crowded, broad, ventricose-adnate, rust-brown with irregular margin which in fresh specimens is whitish. *Flesh* buff in pileus, more deeply coloured under pileus-disc, 'bistre' in stipe-base, darkening upwards.
Basidiospores (6–)6.5–8(–9.5) × 3.5–4.5(–5) μ, ellipsoid to elongate ovoid in face-view, obscurely subcylindrical to phaseoliform in side-view, smooth, pale cinnamon-rust to honey-brown in NH_4OH, with a distinct although small germ-pore about 1 μ broad. *Basidia* clavate, 4-spored, 20–26 × 6–7.5 μ. *Pleurocystidia* not seen. *Cheilocystidia* numerous (15–)25–45 × 5–7.5(–9) μ, ventricose with apex drawn out into thin neck up to 2 μ broad, and surmounted by subglobose to ellipsoid head up to 6 μ broad, usually 3.5–5.5 μ broad. *Hymenophoral trama* of short, swollen units up to 25 μ broad, surrounding regularly arranged, slightly inflated cells constituting a central strand. *Pileal surface* a hymeniderm of clavate, pedicellate cells up to 22 μ broad with slightly to strongly coloured pedivels, often associated with tibiiform pileocystidia up to 40 μ long. *Pileus trama* of floccose, inflated cells, pale cinnamon in NH_4OH. *Stipe surface* of parallel to subparallel, clamp-connected, hyaline or slightly buff hyphae many of which terminate in capitate cells. *Velar remnants* of irregularly asperulate to smooth, yellowish brown, diverticulate hyphae, 3—6 μ broad, clamp-connected and shortened, some giving rise to cells similarly shaped to those at gill-margin and with head 1–5 μ broad and body 4.5–9 μ broad.
On rich soils, rendzinas and brown-earths etc., amongst herbaceous debris and under herbs, in woodland clearings or wet depressions, by roadsides, more rarely in Europe on rotten wood; more frequently on woody debris in North America.
TYPE.—In humus and amongst leaves in humid depression, Boissy-Saint Leger, Paris, France, 5 x 1932, R. Kühner (in Herb. Kühner, Lyon, France and slide in E).
COLLECTIONS EXAMINED (all in E).—

BRITISH ISLES

Hampshire: Denny, New Forest, 19 October 1958, *Orton 1478*. — Herefordshire: Covenhope, 22 November 1959, *Orton 2020*. — Inverness-



FIGS. 20–27. *Conocybe fibrillosipes* (type). — 20. Basidiospores. 21. Cheilocystidia. 22. Habit sketch and section. 23. Pileocystidia. 24. Cheilocystidia. 25. Caulocystidua. 26. Veil constituents. 27. Four-spored basidia. — (Magnification as indicated.)

shire: Guisachen near Tomich, 31 August 1957, *Watling G 69/C 138.* — Midlothian: near Cramond, 16 October 1965, *Watling G 550.* — Perthshire: Kindrogan, 25 August 1968, *Watling G 1189.* — Ross and Cromarty: Rassal Nature Reserve, 14 September 1963, *Watling G 387.* — Surrey: Juniper Hall, Mickleham, 5 October 1952, *Orton 45*, 1 October 1955, *Orton 616*, and 4 October 1955, *Orton 620;* Gomshall, 22 September 1958, *Orton 1477.* — Sussex: North Amersham Common, near Chichester, 5 September 1967, *Kits van Waveren.* — Yorkshire: Langcliffe Wood, Settle, 29 August 1958, *D. M. Henderson, Watling G 144;* Nun Appleton, 16 September 1961, *Watling G 180;* Deep Dale, Barnard Castle, 21 September 1963, *Watling G 417* and 23 September 1963, *Watling G 419;* Brignall Bank Wood, Barnard Castle, *T. Hering*, 23 September 1967, *Watling G 425.* — Spore prints only; Orton collections: 18 September 1951; 17 and 19 September 1953; 3 October 1954; Mountain Wood, Surrey, 17 August 1953; 16 September 1959; Denny area, New Forest, Hants., 18 October 1958.

FRANCE

Type collection, and Boissy-Saint Leger, Paris 30 September 1932 (slides in E).

NETHERLANDS

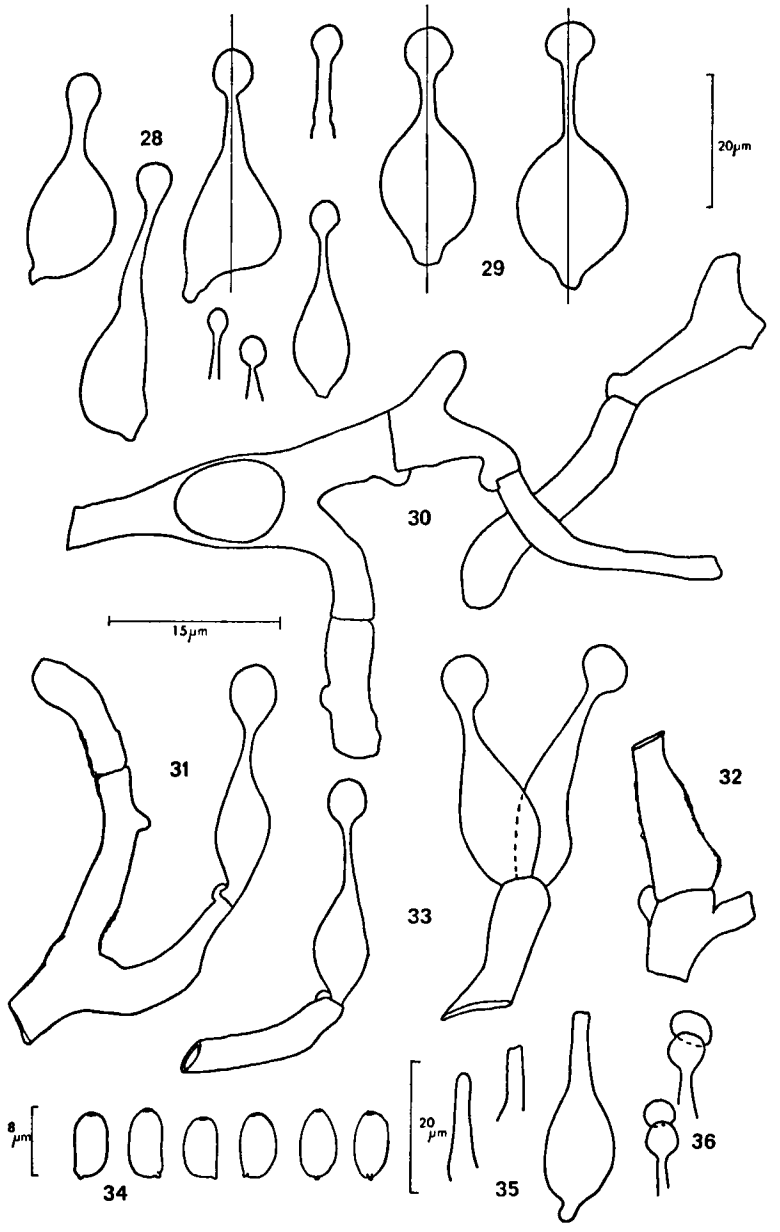
"Ada Hoeve", Ommen, *Kits van Waveren* 26 September 1964.

UNITED STATES

Michigan: Whitehouse, Emerson, Chippewa Co., 12 August 1965, *Watling A 263/G 772* & *A 326/G 811* (E); Hulbert, Chippewa Co., 25 August 1965. *Watling A 312/G 622, A 394/G 591* & *A 395/G 590* (E); Sugar Is., 23 August 1965 *Watling A 372/G 588* (E); Tahquamenon, Chippewa Co., 12 September 1969, *Watling G 865* (E).

Smith (personal communication) found a collection, Smith 41704, which had much brighter coloured ('raw sienna') gills than *C. intermedia* and a significant development of pileocystidia. However, on careful examination of many collections of fungi in this complex it has been observed that the development of pileocystidia occurs to some degree in all fruit-bodies; the presence of such structures is therefore considered of little taxonomic importance. It may be found subsequently that the environmental conditions prevailing in the field at the time of fructification may influence the abundance of pileocystidia as has been shown in experiments with members of the *Conocybe pubescens* group (Herregods, *1952;* Watling, unpublished data; *1964*). The gill-colour, however, is significant and Smith 41704 should be referred to *Conocybe brunnea.* There may even be a very slight difference in basidiospore-shape between this collections and those of *C. intermedia*, a fact noted after several score collections of both species had been examined.

The habitat of *C. brunnea* is a fairly reliable character in Western Europe; nevertheless although typically terrestrial it has to my knowledge been collected growing on wood by Orton (on *Alnus*, personal communication) and by Kits van Waveren (personal communication). I have made several collections on wood in North America of a fungus I consider this very same species. However, when considering growth on woody substrates it should be noted that the term lignicolous, when applied to certain American fungi, has a different meaning to that normally used and understood by West European mycologists. The woodlands of Europe in most cases have



FIGS. 28–36. Characters of *Conocybe* Section *Intermediae*. — 28. Cheilocystidia (*C. brunnea*, *C. fibrillosipes*, *C. intermedia*). — 29. Typical lecythiform cystidia of *Conocybe* subgenus *Conocybe* (*C. magnicapitata;* Watling G 207). — 30–36: *Conocybe brunnea*. 30–32. Hyphae of veil. 33. End-cells of hyphae of stipe-cortex. 34. Basidiospores. — 35. Cheilocystidia with capitulum (apex) broken off. 36. Cheilocystidia with apical droplet. (35 and 36 are often mistaken as entire cystidia). — (Magnification as indicated.)

been influenced by man for a very long time and so have been radically changed. In marked contrast the hardwood forests of North America have been highly modified by white man only in comparatively recent historic time. Unlike many West European wooded areas where the forest floor is cleared of the major amount of its woody debris very quickly, so that trunks and large branches do not litter the ground, American woodlands particularly those of the Great Lake Region, Appalachians, Great Smoky Mountains and New England are difficult to collect in because of the vast amount of woody detritus. Many areas formerly felled have now grown up with secondary growth timber, some of which although usually of poor quality is also being cut; this latter felling adds to the number of large trunks, stumps and branches already there forming a carpet of detritus in various stages of decay. Using Grainger's apparatus for testing woody substrates (*1946*) it is here suggested that wood under the conditions found in N. American slashings will support a typically terrestrial flora including *C. brunnea* when the maximum value of the spring balance registers as little as 21bs pressure.

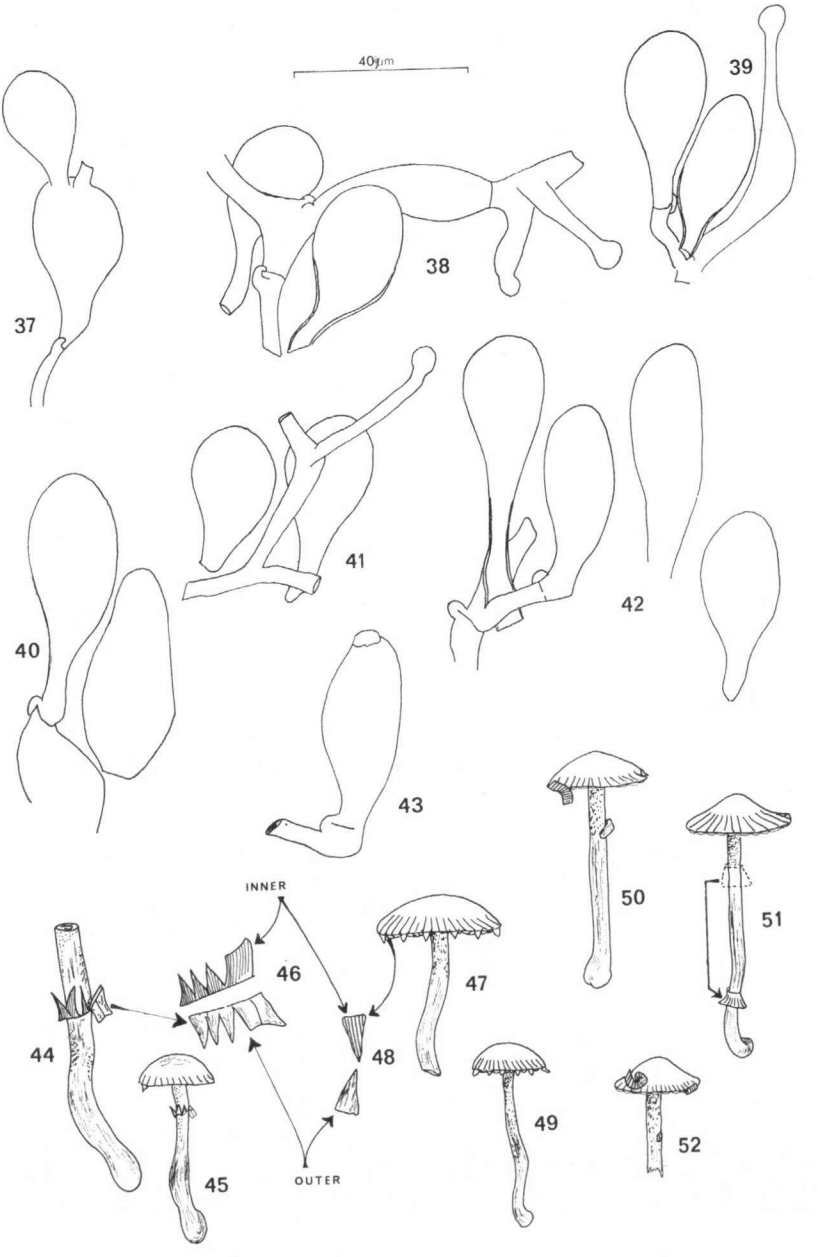
Singer (*1950*) believes that there is no evidence for any correlation between the two fungi described above and their geographical distribution but from my own observations, based on several score collections, this suggestion may not give an entirely true picture.

Although I have seen several examples in North America I have not found in Europe the development of a ring and a marginal veil interchangeable in the *Conocybe intermedia* group. Kits van Waveren (personal communication), however, has seen one example; it appears to be a rare phenomenon. Such an interchange of veil types is, neverthetess, commonly seen in the other annulate species of *Conocybe*, e.g. *C. aporos*. Therefore the distribution of velar remnants gives only a guide as to the species concerned.

Conocybe brunnea in Europe is fairly variable, indeed Orton (1957) in an unpublished provisional key to the group split British material into two groups distinguished on the basidiospore-size, the colour of the pileus and the dimensions of the cheilocystidia; later he withdrew this suggestion.

However, Lange's (*1939*) values for spore-dimensions of '*Galera brunnea*' are also at variance to those of Kühner's for '*Conocybe intermedia*' var. *brunnea* and support Orton's suggestion of the possibility of two species being involved. Graphs 1 and 2 show that the averages of sizes of basiodiospores of different collections do not fall into two distinct groups but show a continuous line. Lange comments after his description on the presence of a larger and paler variant. Slight differences in colour and in pileus-size, however, appear to parallel the phenomenon described in collections of *C. percincta* and other species by Kits van Waveren (*1970*); I believe the notes on pileus-colour discussed earlier is relevant here (Kits van Waveren, *1970;* Watling, *1971*).

The habitat for the two variants was thought by Orton also to be different but after careful observations it is concluded, however, that *C. brunnea* fruits irrespective of the neighbouring flowering plant-community.



Figs. 37–53

Florida and Caucasus variants.—As pointed out earlier I am unaware of any name having been given to the Florida 'variety' mentioned by Singer; I have not examined dried material. Nor am I familiar with the fourth 'variety' described by Singer from the Caucasus as *Pholiotina septentrionalis* subspecies *vasilievae* Sing. (*1945:* 98; *1950b:* 425) and refrain at the moment from validating this taxon. One character of this subspecies has been said to be its large size but the type variety can grow to 30 mm. Stature and size, as in many members of the Bolbitiaceae are variable; those of the *C. intermedia* group are usually small agarics 10–20 mm (rarely up to 30 mm; see Figs. 1–7).

It is highly possible that what we are experiencing in different parts of the world is differentiation of *C. intermedia* into a group of very closely related entities differing in only small features, some of which will allow formal description so separating one taxon from the other as autonomous e.g. *C. intermedia,* whilst others can not as yet be so treated. Although in the Coprinaceae and in some other members of the Bolbitiaceae experimentation has confirmed such a point of view unfortunately cultural studies have been unsuccessful in *C. intermedia* agg.

A NEW SPECIES

Conocybe fibrillosipes Watling, *sp. nov.*—Figs. 20–27

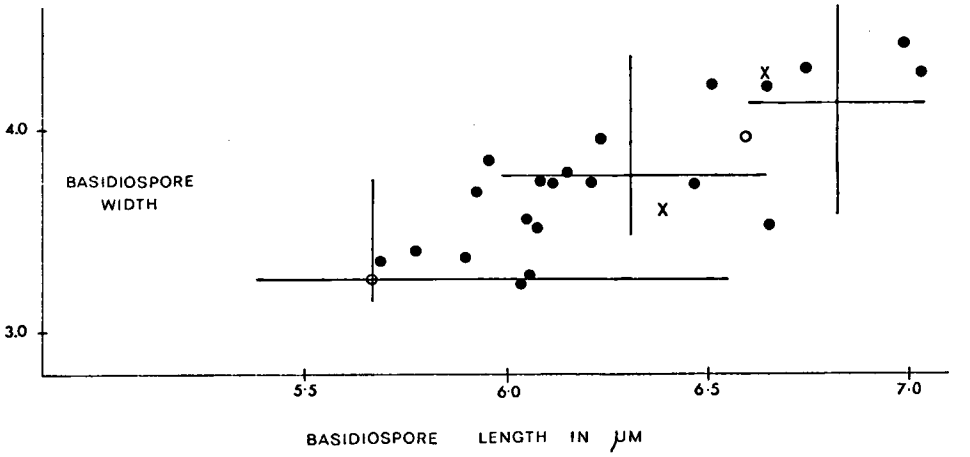
Pileus 10–17 mm, convexus vel semiglobatus, haud expansus, fulvo-luteolus, aurantius, ± badius, jove pluvio striatus. Stipes 18–32 × 3–5 mm, luteolo, ochraceo-mellinus vel flavido-ochraceus, fibrilloso-striatus, laneo-flocculosus. Lamellae pallido-ochraceae postremo ferrugineo-mellinae. Basidia 18.5–21 × 6.5–8 μ Basidiospores 6.5–8.5(–9) × 3–5 μ, phaseoliformes-ellipsoideae. Cheilocystidia capitata. Typus.—*Watling G. 102G* (E).

Pileus 10–17 mm, convex, semiglobate, hardly expanding, rich dark tawny orange, ('tawny') tinted with 'chestnut', particularly towards the disc, striate to half-way and covered particularly at margin in small, pale ochraceous fragments of appendiculate and marginal veil. *Stipe* 18–32 × 3–5 mm, distinctly 'yellow ochre', stout, fibrillose-streaky to woolly floccose, particularly towards the base; veil peronate or present as mere flecks of membranous material towards the stipe-apex, then fibrillose-woolly, matt, giving a rough appearance below, floccules finally yellow ochraceous. *Lamellae* pale ochraceous then rusty tawny, fairly close. *Flesh* dark brown in pileus when fresh, slightly ochraceous in stipe-cortex, dark buff in stipe-centre, umber brown ('Saccardo's umber') in stipe-base.

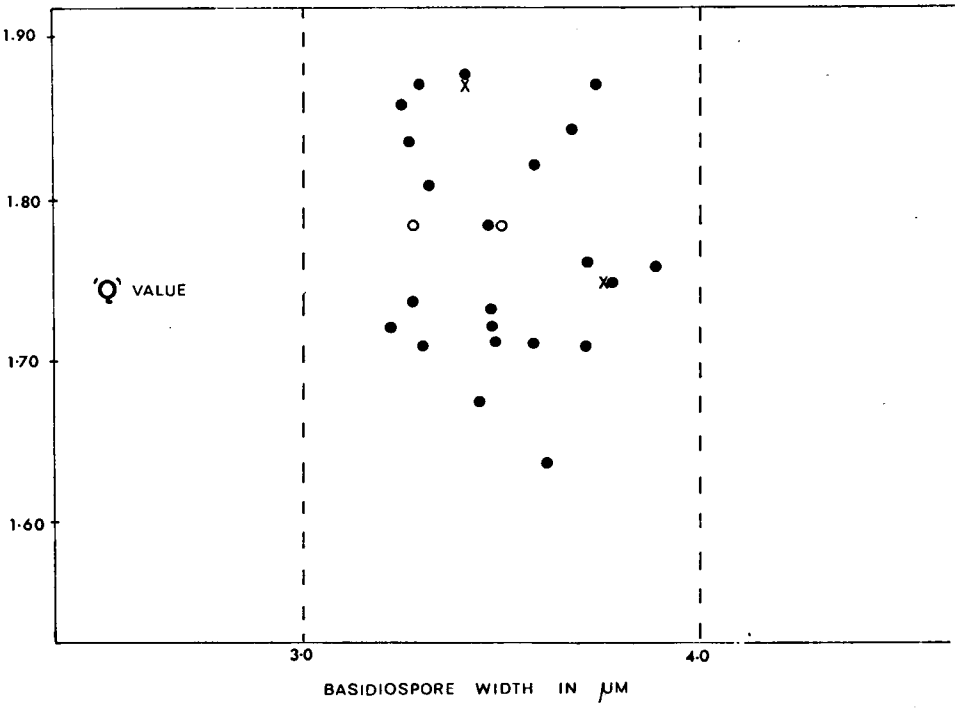
Basidia (2–)4-spored, 18.5–21 × 6.5–8 μ, clavate, hyaline in NH_4OH. *Basidiospores* 6.5–8.5(–9) × 3–5 μ, ellipsoid in face-view, flattened at on side in side-view and

EXPLANATION OF FIGURES 37–53

FIGS. 37–53. — Hymeniderm and veil characters of *Conocybe brunnea* compared with *C. aporos.* — 37–49: *Conocybe brunnea.* 37–43. Constituents of pileal hymeniderm (Watling G 828). — 44–49. Two members of a single population (Watling G 828). 45. Fruit-bodies exhibiting an annulate veil. 49. Fruit-body with appendiculate veil. Magnifications 44, 46 and 47, 48 show details of stipe, ring (both entwined and when straightened out), pileus-margin and appendiculate veil. — 50–52: *Conocybe aporos* (Watling G 1086). Carpophores with broken annulus in part attached to pileus-margin (50), mobile ring (51) and entire annulus distributed on pileus-margin (52). — (Magnification as indicated.)



GRAPH 1



GRAPH 2

faintly phaseoliform, thin-walled, smooth, pale ochraceous in NH_4OH and in Melzer's reagent; germ-pore just visible, approximately 1 μ broad. *Pleurocystidia* absent. *Cheilocystidia* skittle-shaped (tibiform), 16.5–25.5 μ, body 6–8 μ broad and head 2.5–4.5 μ broad. *Pileocystidia* frequent, skittle-shaped (tibiiform) 11.15 μ, body 4.5–9 μ broad, apex 2–3.5 μ broad. *Caulocystidia* at stipe-apex similar to the cheilocystidia, masked by intermixing hyphal filaments from veil. *Hymenphoral trama* of interwoven, swollen cells. *Pileus-surface* a regular hymeniderm of clavate, pedicellate cells.

On roadside amongst herbaceous debris in conifer woodland, Cusick, Pend' Oreille Co., Washington, 12 October 1966, *Watling G 1027* (typus, E).

An easily recognisable species by virtue of its stout stipe whose robustness gives the fungus more the appearance of *Galerina unicolor* (Vahl ex Sommerf.) Sing. than a species of *Conocybe*. The copious yellow-brown veil on the pileus-margin and particularly on the stipe, and the frequent occurrence of pileocystidia in the hymeniderm are also significant.

THE DESIRABILITY FOR A NEW SECTION WITHIN CONOCYBE SUBGENUS PHOLIOTINA

It is unfortunate that neither the basidiospores of *C. intermedia* or *C. brunnea* have been induced to germinate in pure culture, even though fresh spore-deposits have been available, nor have tissue-cultures survived long enough to induce the production of primordia. Thus the finer details of the development of *Conocybe intermedia* and *C. brunnea* are unknown. From the examination of very young fruit-bodies it would appear that there is no reason to suspect that *C. intermedia* and its allies differ in the sequence of stages during their paravelangiocarpic development from those observed in other species of *Conocybe*.

Although there may be a tendency for the larger number of any given population of a member of *Conocybe* subgenus *Pholiotina* to be annulate, dentate specimens may also occur within the same population (see Figs. 44–49). When the veil of a truly annulate species of *Conocybe* splits and adhers to the pileus margin it rarely displays the regular dentate pattern seen in *C. brunnea* (Figs. 50–52). However, when the veil of *C. brunnea* forms a ring its construction from closely adhering units can be easily observed (Figs. 44–49). Examination of herbarium material is deceptive because the very act of collecting may alter the position of the veil particles; indeed they may be even lost altogether by careless collecting and subsequent handling.

Specialised cystidia are to be found widespread on the stipe of many members of the genus *Conocybe*, but in *Conocybe* subgenus *Pholiotina* they appear to be lacking except at the very apex of the stipe and are replaced in the lower part by filamentous, adpressed hyphae which are not or hardly specialised at their apex. One group of

GRAPHS 1, 2. Biometrical data for basidiospores of *Conocybe brunnea*. — Graph 1. Length/width graph; average values in μ. — Graph 2. 'Q' values (numerical value for ratio of average length and width of basidiospores) plotted against spore-width. — X. Collections by R. Kühner, O. Collections of manuscript named segregate; for further details see text.

species appears to be an exception to the rule i.e. *C. intermedia* group, where the clamp-connected hyphae constituting the stipe cortex give rise to numerous skittle-shaped caulocystidia similar in shape to the cheilocystidia (Fig. 33). Similar cells are to be found on the pileus to some degree and on the veil; they are much more easily seen in fresh specimens. Although a few species of *Conocybe* e.g. *C. laricina* in subgenus *Ochromarasmius*, also possess such structures they are normally very uncommon or absent in the hymeniderm of the *C. tenera* group and absent or exceedingly rare in the *C. arrhenii* group.

Cystidial shape found in the *C. intermedia* complex (Fig. 28) is unique in *Conocybe* for although they are capitate they are not truly lecythiform; the capitulum is frequently asymmetric and seated on a thin, tapering neck. The body of the cystidium although generally inflated is rarely as extreme as in the cystidia found in *C. tenera* and related species, and may be even quite narrow and irregular. The variation of cystidial proportions and shape is greater even in a single pileus than in members of several populations of a typical member of sg. *Conocybe*.

The cells of the hymeniderm (Figs. 4 A–G) in *C. intermedia* and allies turn cinnamon brown in alkali and are covered in *C. intermedia* in a distinct, although thin, layer of hyaline gluten which soon disappears at maturity when the pileus becomes dry. Such a layer of gluten is common to many members of the *Bolbitiaceae* but often it is very thin and detectable only by staining with Alcian blue—Schiff's periodic acid (Disbrey and Watling, *1967*) or similar techniques; a truly viscid pileus in European members of the genus *Conocybe* is found in *C. coprophila* in subgenus *Piliferae*.

The *Conocybe arrhenii—C. blattaria* complex has long been considered a unit and the *C. appendiculata—C. vestita* group also show some homogeneity based on developmental studies. However, it would be absurd to place two taxa which are obviously so very closely related as *C. intermedia* and *C. brunnea* in two different sections of a genus the first with *C. blattaria* and the second with *C. appendiculata* simple because of the position of veil present.

I therefore propose to recognise the differences exhibited by *C. intermedia*, *C. brunnea* and *C. fibrillosipes* (representing a stirps in the sense of A. H. Smith) by erecting a special section based on the features discussed above and incorporated in the formal diagnosis below.

Conocybe subgenus *Pholiotina* sect. **Intermediae** Watling, *sect. nov.*

Pileus hygrophanus, aliquantum viscidus, subinde paulum humidus vel siccus, laevis vel subtiliter pubescens propter capitatas pileocystidias, sive interdum praeditus fibrillis vel squamis minutis ad aciem propter albidos vel ochraceos flocculos. Velo annulato vel appendiculato ad marginem pilei dentato. Pleurocystidia absentia; cheilocystidia subcapitata vel distincte capitata, irregulariter tibiiformia sed tum numquam lecythiformia; caulocystidia similia. Basidiosporae phaseoliformes e latere. Typus *C. intermedia* (A. H. Smith) Watling.

The section is therefore based on the tibiiform cells on the pileus, stipe and gill-margin, the rather thin-walled, phaseoliform basidiospores with small germ-pore and the presence of a veil which may be annuliform or dentate. Although distinct in

some characters the epithet *Intermediae* has been chosen for the group in order to reflect the intermediate position in the genus of some of the characters of members of the section and also the specific name by which one member of this group had been known by many in Europe for over twenty-five years.

The section *Vestitae* was described (Watling, *1965*), to cover the non-annulate members of subgenus *Pholiotina;* this section must now be modified in order to exclude *C. brunnea* and should read as follows:

Pileus hygrophanous, dry or at most humid, veil present either as appendiculate, fibrillose or membranous particles at margin; ring absent or exceptionally rare. Pleurocystidia absent; cheilocystidia irregularly branched or simple, cylindrical, fusiform, elongate ventricose, subcapitate or with obtuse apex, never truly tibiiform or lecythiform; caulocystidia similar to cheilocystidia and only at apex of stipe. Pileocystidia absent. Basidiospores ellipsoid to slightly amygdaliform, never phaseoliform.

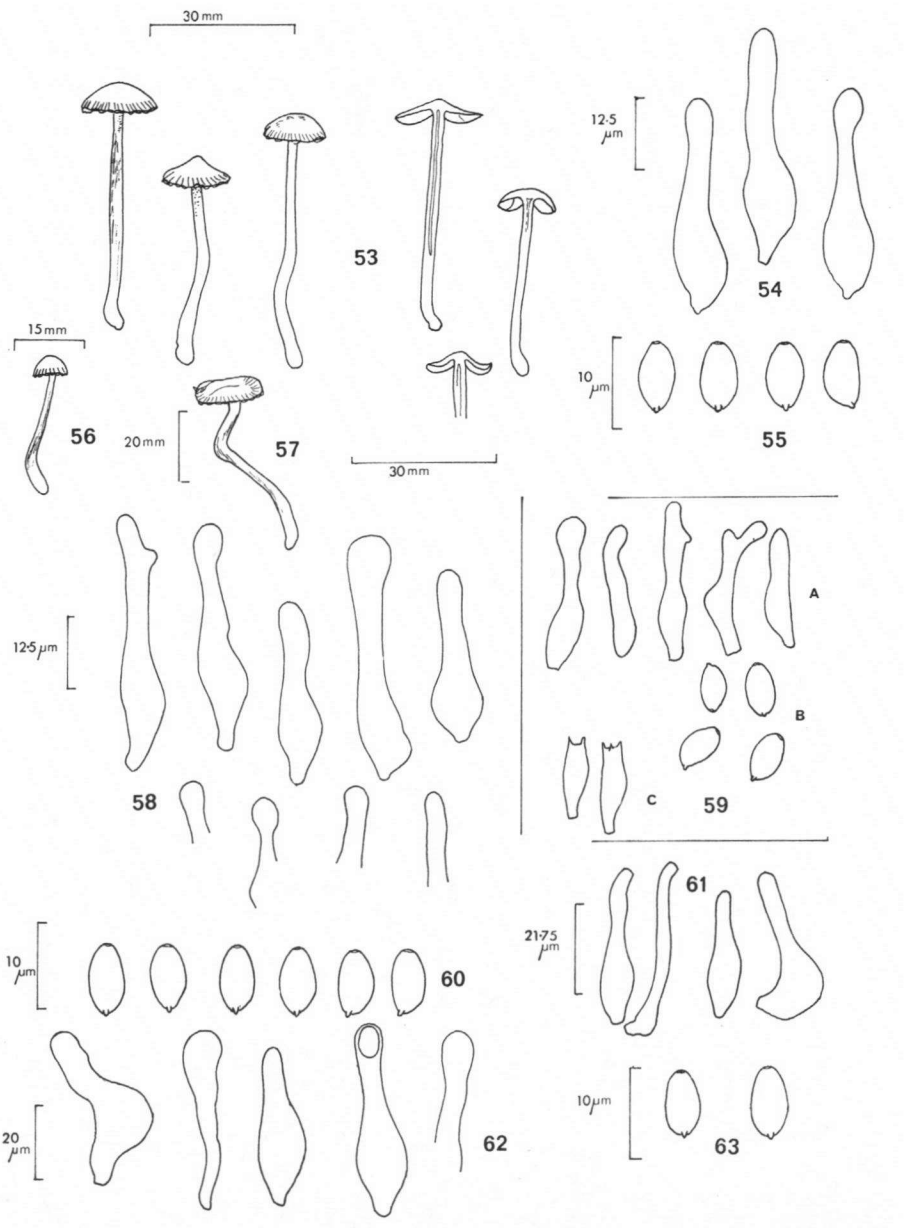
Observations on the Bolbitiaceae—VII
Validation of Conocybe appendiculata

Kühner's monograph dealing with all the European and North African agarics which up to that time had been included in the Friesian genus *Galera* is dated 1935. To effect valid publication all new taxa after December 31st, 1934 must be accompanied by a Latin description (see Art. 36 of the Code 1966). Therefore those taxa described for the first time in Kühner's work are unfortunately invalid. Rules are frequently made after the event and unfortunately it is because of such a decision that the importance of Kühner's work nomenclatorially has been considerably lessened. This is unfortunate for there is a wealth of observations of very high standard included in the study, indeed observations more searching than many of those found in works produced today—some thirty five years later.

Several new taxa were described and discussed in detail in Kühner's manual and through the kindness of Prof. R. Kühner I have been able to re-examine some of the material on which these descriptions were based. Singer *(1959)* has gone part-way in validating some of these taxa although is it debatable if on strict application of the rules these are even now validly published (Watling, *1964*). Of one fairly common species Singer did not include in his list I herewith validate the name. I have based the taxon on the excellent description of J. E. Lange and R. Kühner and the material they used when drawing up this description.

Conocybe appendiculata J. E. Lange & Kühner ex Watling, *nov. spec.*—Figs. 53–63

Conocybe appendiculata J. E. Lange & Kühner *apud* Kühner, Genre *Galera* 146. 1935 (not validly published, lacking Latin description). — *Pholiotina appendiculata* (J. E. Lange & Kühner) Sing. *in* Beih. bot. Zbl. (B) **56**: 170. 1936; *in* Trudy bot. Inst. Komar. (II, Spor. Rast.) **6**: 434. 1950; *in* Lilloa **22**: 487. 1951; (not validly published). — *Galera appendiculata* (J. E. Lange & Kühner) J. E. Lange *in* Dansk bot. Ark. **9** (6): 39. 1938 (not validly published).



FIGS. 53–63. *Conocybe appendiculata*, habit sketches and microscopic characters. — 53, 56, 57. Habit sketches (Watling G 534, G 228, G 221). — 54, 55 (Watling G 222). 54. Cheilocystidia. 55. Basidiospores. — 58. Cheilocystidia from collections illustrated in 53, 56, 57. — 59 (ex Kühner, 1935). A. Cheilocystidia. B. Basidiospores. C. Basidia. — 60, 62 (Watling G 221). 60. Cheilocystidia. 62. Basidiospores. — 61, 63 (collection Kits van Waveren). 61. Cheilocystidia. 63. Basidiospores.— (Magnification as indicated.)

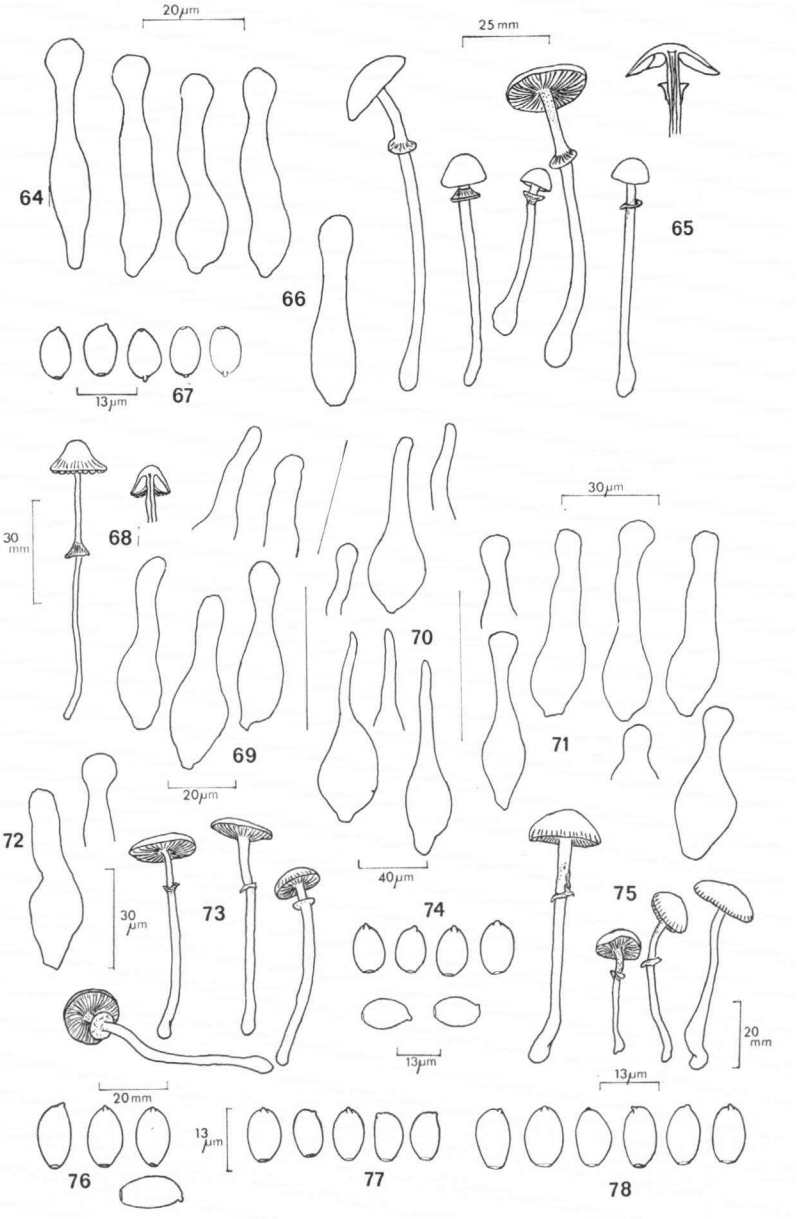
MISIDENTIFICATION.—*Galera ravida* Fr. *sensu* Ricken, Blätterp. 227. 1915, *fide* Kühner, Genre *Galera*. 1935.

Pileus 8–22 mm, e convexo vel conico-convexo expanso-convexus, vulgo leviter umbonatus, ochraceo-mellinus vel flavido-ochraceus, jove sicco flavido-ochraceus vel pallido-ochraceus, jove pluvio striatus, velo albo-appendiculato. Stipes 25–36 × 1.5–2.7 mm, aequalis, sursum leviter attenuatus vel deorsum incrassatus, albido-cremeus, pallido-flavidus vel argillaceo-mellinus, ad basim obscurior, brunnescens sericeo-striatus, ad apicem persistentiore albido-cremeus floccosus. Lamellae adnatae, ex albido-argillaceae, argillaceo-ochreae vel argillaceo-mellinae postremo ferrugineo-mellinae, L 22–32, l (1–)3–5(–7), ad aciem pallidiore flocculosae. Caro pilei concolor, stipitis deorsum obscure fusca. Odor leviter acidulosus. Sporae ellipsoideae non phaseoliformes, 6,5–8,5(–9.0) × 4–5(–5.5) μ, poro germinativo minuto. Basidia 4-sporigera, 15–25 × 5.5–7.5 μ. Cystidia aciei lamellarum curvata flexuosa, elongato-clavata vel subcapitata 25–45 × 5.5–10(–11) μ apicem 2.5–6 μ cervice 2.5–6 (–8) μ. Cellulae cuticulae pilei pyriformes, 10–25 μ diam.

TYPUS.—Bois de Vincennes, environs de Paris, France, 23 ix 1932, *R. Kühner*. (Herb. Kühner, Lyon, France).

Pileus 8—22 mm, convex or conico-convex then expanded, umbonate, deep ochraceous honey or yellowish ochreous ('ochraceous orange') slightly tawny towards disc, paler towards the margin, drying pale yellowish ochre ('yellow ochre') to dirty honey-yellow, slightly striate at edge, with white dentate remains of veil at margin. *Stipe* 25–36 × 1–1.5(–2.7) mm, equal or slightly attenuated upwards, flocculose-pruinose at apex, white, silky fibrillose below, soon discoloured, pale dirty yellowish then brownish, darkening from base up; *veil* very rarely forming an annulate zone, sometimes fragmentary on stipe. *Lamellae* adnate, ventricose or nearly so, fairly wide l 3–5, clay-colour flushed cinnamon then pale clay-ochreous, finally rusty tawny or rusty honey ('cinnamon rufous'), edge heteromorphic, white or paler, flocculose-denticulate. *Flesh* concolorous, drying paler in pileus, dark in stipe below whitish cortex particularly at base. *Smell* very slightly acidulous or absent; *taste* not distinct or insipid.

Basidiospores rusty ochreous in mass, 6.5–8.5(–9) × 4–5(–5.5) μ, ellipsoid in face-view not phaseoliform, slightly flattened on one face in side-view, with small germ-pore which is only just visible in some views, hardly truncate even in side-view, fairly thin-walled, honey-yellow in water, slightly darker in ammoniacal solutions. *Basidia* 4-spored, 15–25 × 5.5–7.5 μ, clavate to cylindric, particularly in upper part, hyaline or very slightly yellowish in ammoniacal solutions. *Pleurocystidia* not seen. *Cheilocystidia* ± subcapitate, vesiculose or not below, sometimes with sinuous or irregularly flexuous neck, 25–45 × 5.5–10(–11) μ neck 2.5–6(–8) μ broad and head 2.5–6 μ broad, less frequently laterally and shortly branched. *Caulocystidia* at apex of stipe, clavate or similar to cheilocystidia, replaced below by open net-work of hyaline, cylindric hyphae with little or no differentiation of end-cells. *Hyphae of veil* hyaline, hardly darkened in ammoniacal solutions, 4–7 μ broad, not constricted at septa. *Clamp-connections* present, particularly on hyphae of veil and stipe-cortex. *Pileal surface* a hymeniderm of pedicellate ellipsoid to pyriform or ovoid cells 10–25 μ broad. *Hymenophoral trama* of regular or of slightly irregular or tangled hyphae, ± constricted at septa, particularly in larger gills and intermixed with swollen subglobose to ellipsoid cells flanked by more filiform cells 4–6 μ broad; *subhymenium* consisting of 1—2 layers of subglobose to ellipsoid cells. *Ammonia-reaction*, negative. *Pileus trama* of openly arranged, floccose swollen hyphae, hyaline or slightly coloured in ammoniacal solutions and more tangled towards the apex of stipe.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20 mm
13 µm
76
77
78

Figs. 64–78

In copses, edges of woods, and in woodland clearings, on moss covered soil or on base rich soils under herbaceous plants, and amongst herbaceous debris.

TYPE.—On soil amongst herbaceous plants, Bois de Vincennes, Paris, France, 23 ix 1932, R. Kühner, in Herb. Kühner, Lyon, France (slide in E.).

COLLECTIONS EXAMINED (E).—

BRITISH ISLES

Durham: Middlestone Moor, 29 August 1962, *Watling G 308.* — Perthshire: Kindrogan, *J. T. Palmer*, 24 August 1968, *Watling G 1196.* — Somerset: Cleeve Coombe, 12 September 1955, *Orton 614.* — Surrey: Ashurst Valley, 22 September 1961, *Watling G 220* and *G 228;* Mickleham Downs, 22 September 1961, *Watling G 221* and *G 222.* — Yorkshire: Kingthorpe, 10 September 1960, *Watling G 26;* Throxenbury Mere, 12 September 1961, *Watling G 147;* Nun Appleton, 16 September 1961, *Watling G 174* and *G 196;* Newton Dale, 23 October 1964, *Watling G 534.*

Spore-prints only: Clumber Park, Nottinghamshire, 7 September 1956, *P. D. Orton.*

FRANCE

Bois de Vincennes, Paris, 23 September 1932, *R. Kühner.*

R. Kühner *(1935)* records this species from Ozour-la-Ferrière, environs Paris and Grande Chartreuse, (Isère) both in France. Lange *(1938)* records it from Hyallese, Denmark, and Singer in his notes on brown-spored agarics from Russia. Kits van Waveren has sent me material from Holland; Amsterdamse Bos, The Netherlands, 17 vii 1960.

The veil in *C. appendiculata* is typically appendiculate, hence the name, although collections have come to my knowledge (see Kühner, *1935:* 147; Kits van Waveren, personal communication) where the veil was annulate. Probably the same conditions which operate in the *C. brunnea* complex, are found here (see p. 321). It would indeed be extremely useful to examine in detail those collections with a ring, recorded at odd-times as members of the *C. arrhenii* group but reported as having aberrant features; they may represent annulate 'forms' of *C. appendiculata.*

Kühner (*1935*) also describes *C. appendiculata* forma *macrospora* based primarily on the overall similarity yet larger spores. This, however, I believe to be a distinct species and it will be dealt with in a future paper. It differs in the larger more

EXPLANATION OF FIGURES 64–78

FIGS. 64–78. New species of *Conocybe.* — 64–67. *Conocybe pinguis* (Smith 13260). 65. Habit sketch, from photograph. 64. Cheilocystidia. 67. Basidiospores. 66. Caulocystidium. — 68, 69, 74. *Conocybe flexipes* (Smith 41179). 68. Habit sketch, including section of immature pileus with ring shaded. 69. Cheilocystidia. 74. Basidiospores. — 70, 77. *Conocybe fimicola* (Smith 13856). 70. Cheilocystidia. 77. Basidiospores. — 71–73, 75, 76, 78. *Conocybe stercoraria.* 71, 75, 78. (Smith 13169, type). 71. Cheilocystidia. 75. Habit sketch, from photograph. 78. Basidiospores. 72, 73, 76 (Smith 2576). 72. Cheilocystidia. 73. Habit sketch, from photograph. 76. Basidiospores. — (Magnification as indicated.)

complex spores, cystidial shape, colours of the cap and stem and strong smell. A second closely related taxon with large, thin-walled spores also appears to be distinct although it too has been called forma *macrospora*. It may be this taxon to which Singer *(1962)* wished to refer when he made two entries under *Pholiotina, P. appendiculata* Singer and *P. appendiculata* (J. E. Lange & Kühner) Singer.

Observations on the Bolbitiaceae—VIII
Some extra-European annulate species of Conocybe

Several hundred collections of species of *Conocybe* from North America, made by Prof. A. H. Smith during the period 1938–1964 were made available to me through the kindness of their collector during a study of the Bolbitiaceae the author has undertaken. Amongst the large assemblage of species many annulate members of the genus were located and examined; this has resulted in the defining of four new species.

1. **Conocybe stercoraria** Watling, *sp. nov.*—Figs. 71–73, 75, 76, 78

Pileus 10–35 mm e convexo planus, humidus, hygrophanus, glabrus, fulvus vel ochraceo-brunneus, jove sicco pallido-flavidus vel incarnato-ochraceus; ad marginem interdum residuis veli obtectus. Stipes 50–60 × 1.5–2 mm, aequalis, cavus, fragilis, ochraceo-brunneus vel umbrinus, fibrilloso-striatus vel subglaber; annulus fugaceus, membranaceus, medius, albidus, instriatus infra flocculosus. Lamellae L 19–22, l 1–3 adnatae, albidae postremo ferrugineo-mellinae, subconfertae. Caro ochraceo-fulva vel ochraceo-brunnea jove sicco ochracea ad basim umbrinus. Basidia 4-sporigera, 17–20 × 6–7.5 μ. Basidiosporae ellipsoideae, laeves, 8–10(–11) × 5–6 μ, poro germinativo. Cystidia aciei lamellarum (28–)30–37 × 7–10 μ, cylindrico-flexuosa obtusate interdum subcapitata. Cellulae cuticulae pilei pyriformes.

TYPUS.—Hok River, near Spruce, Olympia National Park, Washington State, U.S.A., 17 May 1939, *Smith 13169* (MICH).

Pileus 10–35 mm, obtuse to convex, becoming plane, glabrous, margin ornamented occasionally with a few scattered veil-fragments when annulus fails to form, moist, hygrophanous, tawny to ochraceous brown ('buckthorn brown') minutely striate, fading to light ochraceous buff or 'pinkish buff'. *Stipe* 50–60 × 1.5–2 mm equal, hollow, fragile, dark ochraceous brown (near 'buckthorn brown') above, dark brown near 'bistre' below, darker overall with age, faintly fibrillose-striate, or glabrous; *annulus* very evanescent, median, membranous, fragile, whitish, with very broad often recurved margin, not striate, underside fluffy-cottony. *Lamellae* close, L 19–22 and l 1–3, moderately broad (3–4 mm), depressed adnate and soon seceding, whitish when young but soon concolorous with moist pileus-colour. *Flesh* ochraceous tawny to 'buckthorn brown' drying out more ochraceous, dark brown in stipe-base; *smell* and *taste* not distinct.

Basidia 4-spored, 17–20 × 6–7.5 μ; hyaline in KOH and NH_4OH. *Basidiospores* 8–10(–11) × 5–6 μ, ellipsoid or nearly so in face-view, very slightly flattened in side-view, smooth, bright tawny in alkali, little if any darkening in Melzer's reagent, distinctly truncate from broad germ-pore. *Pleurocystidia* none. *Cheilocystidia* (28–)30–37 × 7–10 μ, ventricose with an obtuse to capitate apex, hyaline, thin-walled, smooth. *Pileocystidia* absent. *Caulocystidia* at apex of stipe similar to those on the gill-margin or more distinctly capitate, below ring replaced by filamentous hyphae, with little differentiation of end-cells. *Hymenophoral trama* interwoven, pale ochraceous in alkali and flanked by more swollen units towards the hymenium.

Pileus-trama floccose, of interwoven hyphae, cinnamon buff in alkali. *Pileal surface* a hymeniderm of clavate cells with either hyaline, thin-walled or rust-coloured pedicels the latter with thick walls. *Clamp-connections* present on hyphae of stipe.

Scattered on horse dung, Hok River near Spruce, Olympia National Park, Washington State, U.S.A. 17 May 1939 (Smith 13169 TYPE). On dung Crescent Beach, Washington U.S.A., 24 September 1935, Smith 2576.

I am sure the second collection belongs to this species but the gills are thin, short and crowded and appear not to be fully developed. I have found on several occasions that the activity of invertebrates can upset the development of the fruit-body; in the case of agarics collembola and mites induce poorly developed gills. This may also account for the slightly different shape of the pileus.

2. **Conocybe fimicola** Watling, *sp. nov.*—Figs. 70, 77

Pileus 10–25 mm conico-convexus, expanso-convexus vel obtuso-umbonatus, glaber humidus, striatus, jove sicco exstriatus, hygrophanus, ferrugineus jove sicco ochraceofulvus. Stipes 30–40 × 2–3 mm, aequalis, farctus, cinnamomeo-bubalinus ad basim ex luteolo-bubalinus prostremo umbrinus, ad apicem fibrilloso-pruinosus ad basim appresso-fibrillosus; annulus medius, membranaceus, bubalinus, striatus, fugaceus. Lamellae adnatae, L 20–25, l 1–3, sordide fulvae, subconfertae. Caro tenuis, fragilis, ferruginea. Basidia 4-sporigera, clavata, 13–19 × 6–7 μ. Basidiosporae 7–9(–10) × 4–4.5 μ, ellipsoideae, laeves, fulvae vel cinnamommeae, poro germinatio parvo instructae. Cystidia aciei 24–32 × 7–10 μ. Cellulae cuticulae pilei pyriformes.

TYPUS.—Lake Crescent, Washington U.S.A. 29 May 1939, *Smith 13856* (MICH).

Pileus 10–25 mm, obtusely conical to obtusely umbonate expanding to broadly conical or with straight then flaring margin, glabrous, moist, minutely striate when fresh, although rapidly non-striate on drying, hygrophanous, entirely russet when fresh, fading to ochraceous tawny. *Stipe* 30–40 × 2–3 mm, equal, hollow, apex mealy, cinnamon buff, base more yellow then darkening bistre, densely fibrillose-pruinose above, more appressed fibrillose with buff-coloured fibrils below; *annulus* median, membranous, buff, striate above at times, evanescent. *Lamellae* adnate slightly ascending, close L 20–25 l 1–3, narrow to moderately broad (3–4 mm) broadest near the stipe, dull tawny ('ochraceous tawny'). *Flesh* thin, fragile, concolorous with pileus; *smell* and *taste* not distinct, mild.

Basidia 4-spored, clavate, 13–19 × 6–7 μ. *Basidiospores* 7–9(–10) × 4–4.5 μ, ellipsoid in face-view, hardly flattened in side-view, smooth, bright tawny to bright cinnamon in water, rust-colour in alkali, with a small apical germ-pore, wall not thickened. *Pleurocystidia* absent. *Cheilocystidia* 24–32 × 7–10 μ fusoid ventricose with narrow neck and ± acute apices, hyaline in KOH and NH_4OH, hardly coloured in Melzer's reagent. *Pileocystidia* absent. *Caulocystidia* at stipe-apex similar to cheilocystidia, below ring replaced by filamentous hyphae with little or no differentiation of the end-cells. *Hymenophoral trama* irregular to subregular, of filamentous central strand and more swollen units beneath and constituting the subhymenium. *Pileus-trama* of floccose, tangled hyphae, cinnamon-buff in KOH and NH_4OH. *Pileal surface* a hymeniderm consisting of clavate to pyriform cells when revived in alkali with rusty cinnamon ± thickned pedicels. *Clamp-connections* not seen in pileus-trama but present on hyphae of stipe.

TYPE.—Gregarious on mature pile of dung. Lake Crescent, Washington State, U.S.A., 29 May 1939, *Smith 13856*.

This species is characterised particularly by the habitat and ring characters; the cheilocystidial shape would place it close to *Conocybe filaris* (Fr.) Kühner.

3. **Conocybe flexipes** Watling, *sp. nov.*—Figs. 68, 69, 74

Pileus 5–15 mm, conicus, convexo-expansus vel campanulatus vix plano-umbonatus, glaber, humidus, hygrophanus, striatus, pallide ochraceo-fulvus vel incarnato-bubalinus. Stipes 50–70 × 1–1.5 mm, aequalis, saepe flexuosus, ad apicem pallido-bubalinus, ad basim pallide ochraceo-fulvo ad apicem pruinosus, ad basim appresso-fibrillosus vel glaber annulus apicalis, membranaceus, pallidus vel pallido-bubalinus ad marginem crassus et plumosus. Lamellae confertae, adnatae, pallido-bubalinae postremo ochraceo-fulvae vel fulvae. Caro delicatula, pallido-ochracea. Basidia 4-sporigera, 20–24 × 6.5–8 μ. Basidiosporae 9–11 5–5.5 μ, contracto ovoideae vel ellipsoideae, laeves, poro germinativo parvo instructae. Cystidia aciei lamellarum 26–38 × 6–12 μ, cylindrico-flexuosa, obtusata, subcapitata vel capitata, saepe lagenformia. Cellulae cuticulae pilei pyriformes.

TYPUS.—Mount Rainier National Park, Washington, 19 October 1952, *Smith* 41179 (MICH).

Pileus 5—15 mm, obtusely conical when young, convex to campanulate and expanding plano-umbonate, glabrous, moist, translucent striate, hygrophanous, dull 'ochraceous tawny' when moist fading to 'pinkish buff'. *Stipe* 50–70 × 1–1.5 mm, equal, often flexuous, usually fragile. pale buff above, pale 'ochraceous tawny' below, pruinose to glabrous above, appressed fibrillose to glabrous below the annulus; *annulus* superior, membranous, pallid to pale buff, striate on upper surface, with thick cottony margin. *Lamellae* close, moderately broad, adnate-seceding, pale buff, becoming 'ochraceous tawny' to near tawny, with edge minutely fimbriate with age. *Flesh* very delicate, pale ochraceous when dry; *smell* and *taste* not distinctive.

Basidia 4-spored, 20–24 × 6.5–8 μ, hyaline or nearly so in KOH. *Basidiospores* 9–11 × 5–5.5 μ, narrowly ovate to ellipsoid in face-view, subellipsoid to slightly ovate in side-view, smooth, cinnamon-rust in KOH, truncate from small apical germ-pore. *Pleurocystidia* not seen. *Cheilocystidia* 26–38 × 6–12 μ, hyaline, thin-walled, variable, ventricose near the base, narrowed to obtuse, with subcapitate or capitate apex, neck frequently quite long and up to 4 μ in diameter. *Pileocystidia* not seen; *caulocystidia* at stipe-apex similar to cheilocystidia or even more variable. *Pileus-trama* floccose-filamentous, pale tawny in KOH. *Pileal surface* a hymeniderm of clavate-pedicellate and inflated cells, pallid in KOH or NH_4OH, with little or no thickening of pedicel, cells often riding over each other particularly near disc. *Hymenophoral trama* of central filamentous strand with more swollen cells laterally distributed. *Clamp-connections* present.

TYPE.—On moss, decaying wood and detritus from herbaceous plants and shrubs, site of old avalanche, Greenlake, Mount Rainier National Park, Washington State, U.S.A., 19 October 1952, *Smith 41179*.

This species has slightly larger spores than the other annulate species of *Conocybe* which have a similar habit. The long, thin, flexuous, strikingly annulate stipe is characteristic. There is little doubt that the fungus described above is what Overholts *(1928)* in his monograph of North American species of *Pholiota* interpreted as *Pholiota mycenoides*. This concept has been followed by North American mycologists (A. H. Smith, personal communication) for the last half-century although there is no evidence that a direct comparison has ever been made between this fungus and the

European material of the same name. It is impossible to correlate the characters of *C. flexipes* with those of the much confused '*Pholiota mycenoides*' a name best considered a nomen ambiguum until further work is carried out in the type locality. Smith & Singer *(1964)* have already discussed some of the problems connected with the use of the epithet *mycenoides* and consider that *Agaricus mycenoides* Fries, 1821 should be referred to the genus *Conocybe* (as *Pholiotina*, according to Singer) thus preferring to reject the concept proposed by Kühner and long used in Europe. Kühner's concept of 1935 was incorporated into the new species *Galerina jaapi* Smith & Singer; Boudier's (1905–10) illustration was cited as representing the *Conocybe* element, but no formal combination was or has since been made.

Boudier's plate would appear to represent *Conocybe blattaria* (Fr.) Kühner as interpreted by Orton *(1960)*, but not that of Kühner *(1935)*. Dennis, Orton & Hora *(1960)* retain the epithet *mycenoides* in *Galerina* but do not mention *G. jaapii*. The epithet *jaapii* was taken up by Singer and Smith because the fungus is that distributed by Otto Jaap as No 10, VIII Fungi selectae exsiccati (1903) under *Pholiota mycenoides*. *Agaricus mycenoides* Fries to British mycologists of past generations would now be a member of the *Galerina praticola* group, a complex dealt with by Bas *(1960)*. Lundell & Nannfeldt in Fungi exsiccati suecici No. 2042 *(1950)* also refer the fungus to *Galerina* as a synomym of *G. paludosa* (Fr) Kühner but to this suggestion I cannot subscribe.

In the character of the ring the Friesian description of *Agaricus mycenoides* is indeed more in keeping with a member of the *Conocybe arrhenii* group (Kits van Waveren, *1970*) than with a species of *Galerina* for the latter are usually characterised by a rather thin, submembranous, fragile, annuliform veil when a ring as such is present. However, Orton (personal communication) points out that the fungus which be refers to *Galerina mycenoides* and which is the concept adopted in the "New Check List" often has a well-developed membranous veil. An illustration by Kreisel *(1961)* of *G mycenoides* also shows a well-developed ring.

The habitat of *A. mycenoides* i.e. on peat and in *Sphagnum* bogs, and the straight and non-ventricose gills would, however, not support the hypothesis that the fungus belongs to the Bolbitiaceae.

From numerous field-observations I am firmly convinced that habitat preferences are often important indicators as to the taxonomic position of an agaric. The base-status of the substrate in or on which the fruit-bodies of an agaric develop appears to be a very important factor in the initiation of these fruit-bodies. Many more pH readings have been analysed since the conspectus to the Bolbitiaceae was published (Watling, *1965*) and these results have confirmed the broad pattern expressed therein, i.e. that species of *Conocybe* are distinctive of base rich soils and substrates, e.g. valley-bottom meadows, protorendzina and rendzina soils, brown earths, fen detritus and alkaline dung (all of pH (5.5–)6–8), whilst species of *Galerina* are characteristic of acid-substrates, e.g. peat, moss-soaks, podsolic soils, poor hill-pasture, acidic glacial drift deposits etc. Fries' *(1857)* field-notes, i.e. peat and *Sphagnum* marshes, therefore would indicate the habitat of a species of *Galerina* rather

than that of a *Conocybe*. Although the ring was indicated as annuliform and has been illustrated well developed e.g. Kriesel *(1961)*, the character of the gills i.e. straight and not ventricose in the original description when coupled with habitat would support the hypothesis that Fries had a species of *Galerina*.

4. **Conocybe pinguis** Watling, *sp. nov.*—Figs. 64–67

Pileus 15—35 mm, convexus postremo planus, primo viscidus, striatus glaber, castaneus postremo ochraceo-fulvus vel sordido-fulvus. Stipes 70–90 × 3–4 mm, aequalis ad basim leviter incrassatus, farctus, ad apicem albidus, ad basim obscuriore ochraceo-brunneus ad apicem fibrillosus vel fibrilloso-squamulosus; annulus crassus, membranaceus, apicalis, supra striatus. Lamellae confertae L 30, l 1–3, adnatae, bubalinae vel ochraceo-fulvae. Caro tenuis, concolora. Basidia 4-sporigera, 18–20 × 7–8 μ. Basidiosporae 7–9 × 4–4.5 μ, subellipsoideae laeves, poro germinativo distincto munitae. Cystidia aciei lamellarum 34—45 × 7–9 μ, cylindrico-flexuosa, capitata vel subcapitata. Cellulae cuticulae pilei pyriformes.

TYPUS.—Clear Water River, Washington State, U.S.A., 9 May 1939, *Smith 13260* (MICH).

Pileus 15–35 mm, convex becoming plane, viscid when young, glabrous, chestnut, ('argus brown') throughout at first, becoming 'ochraceous tawny' at the margin, elsewhere fading to light buff more or less dingy tawny, minutely striate at margin. *Stipe* 70–90 × 3–4 mm, equal or slightly enlarged at base, hollow, whitish above, becoming dark ochraceous brown (near 'dresden brown') below, at first densely fibrillose and with a pale buff fibrillose coating, fibrillose-squamulose above annulus, fibrils evanescent and then darker colours showing through, particularly towards the base; *annulus* thick, membranous, apical, distinctly striate above. *Lamellae* crowded, L 30 1 1–3, narrow (3–4 mm), depressed adnate, soon seceding, pallid ('tilleul buff') becoming 'ochraceous tawny', thin, even or slightly crenulate at margin. *Flesh* thin, concolorous throughout, moderately brittle; *smell* and *taste* mild, not distinctive

Basidia 4-spored, 18–20 × 7–8 μ hyaline in KOH and NH_4OH. *Basidiospores* 7–9 × 4–4.5 μ, narrowly ovoid in face-view, subellipsoid in side-view, slightly flattened on one side, smooth, germ-pore small, indistinct in some views, not clearly truncate, cinnamon in KOH, very slightly darker in Melzer's reagent. *Pleurocystidia* not seen. *Cheilocystidia* abundant, 34–45 × 7–9 μ, narrowly ventricose with capitate to subcapitate apices 5–7 μ broad, at times nearly cylindric-capitate, smooth, hyaline in KOH and NH_4OH. *Pileocystidia* not seen. *Caulocystidia* in groups at apex, cylindric-capitate, 15–35 × 3.5–5 μ. *Hymenophoral trama* somewhat interwoven, of inflated cells 18–40 μ broad, pale cinnamon in KOH and NH_4OH, less swollen towards central floccose strand. *Pileus trama* of interwoven, tangled hyphae, rusty cinnamon in KOH. *Pileal surface* a hymeniderm of pedicellate, clavate cells with pale cinnamon, possibly slightly thickened pedicels. *Clamp-connections* present.

TYPE.—Gregarious on old rotten logs (*Alnus* or ?*Acer*), Clear Water River, Washington State, U.S.A., 9 May 1939. *Smith 13260.*

Distinguished by the viscid pileus, the very prominent ring, spore-size and the dimensions of the cheilocystidia.

REFERENCES

BAS, C. (1960). Notes on Agaricales—II. *In* Persoonia **1**: 303–314.

BOUDIER, E. (1905–10). Icones Mycologicae. Paris.

DENNIS, R. W. G., ORTON, P. D., & HORA, F. B. (1960). New check list of British agarics & boleti. *In* Trans. Br. mycol. Soc. **43** (Suppl.).

DISBREY, B. D. & WATLING, R. (1967). Histological & histochemical techniques applied to Agaricales. *In* Mycopath. Mycol. appl. **32**: 81–114.

FRIES, E. M. (1821). Systema mycologicum 1. Lundae.

—— (1857). Monographia Hymenomycetum suecicae **1**, **2** Upsala.

GRAINGER, J. (1946). Ecology of the larger fungi. *In* Trans. Br. mycol. Soc. **29**: 52–63

HERREGODS, M. (1952). La villosité chez les Conocybes de la section *Capitatae* (Kühner). *In* Bull. Soc. mycol. Fr. **68**: 258–262.

KITS VAN WAVEREN, E. (1970). The genus *Conocybe* subgen. *Pholiotina*—I. *In* Persoonia **6**: 119–165.

KREISEL, H. (1961). Pilze der Moore und Ufer Norddeutschlands. II. *In* Westfäl. Pilzbr. **3**: 1–6.

KÜHNER, R. (1935). Le genre *Galera*. Paris. (Encycl. mycol. **7**).

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

LANGE, J. E. (1938). Studies in the agarics of Denmark. Part XII, *Hebeloma*, *Naucoria*, *Tubaria*, *Galera*, *Bolbitius*, *Pluteolus*, *Crepidotus*, *Pseudopaxillus*, *Paxillus*. Additional descriptions & supplementary notes to Part I—XI. *In* Dansk bot. Ark. **9** (6): 1–104.

—— (1939). Flora agaricina danica **4**. Copenhagen.

LANJOUW, J. & STAFLEU, F. A. (1964). Index Herbariorum. (Regnum Veg. **31**).

LUNDELL, S. & NANNFELDT, J. A. (1950). Fungi exsiccati suecici, praesertim upsalienses Fasc. 39–41. Upsala.

MOSER, M. (1967). Die Röhrlinge und Blätterpilze (Agaricales). *In* Kl. Krypt. Fl., Pilze **b/2**.

ORTON, P. D. (1960). Notes on genera and species in the list. *In* Trans. Br. mycol. Soc. **43**: 159–439.

OVERHOLTS, L. O. (1927). A monograph of the genus *Pholiota* in the United States. *In* Ann. Missouri bot. Gdn **14**: 87–210.

REA, C. (1922). British Basidiomycetae. Cambridge.

RIDGWAY, P. (1912). Color standards & color nomenclature. Washington D.C.

SINGER, R. (1930). Pilze aus dem Kaukasus. Ein Beitrag zur Flora des südwestlichen Zentral Kaukasus. *In* Beih. bot. Zbl. **4** (2): 71–113.

—— (1950). New and interesting species of Basidiomycetes III. *In* Sydowia **4**: 130–157.

—— (1950b). *Naucoria* Fries in the USSR. *In* Trudy bot. Inst. Komar. (II, Spor. Rast.) **6**: 402–498.

—— (1959). New and interesting species of Basidiomycetes. VI. *In* Mycologia **51**: 375–400.

SMITH, A. H. (1934). New and unusual agarics from Michigan. *In* Annls mycol. **32**: 471–484.

—— (1935). A correction. *In* Mycologia **27**: 227.

SMITH, A. H. & SINGER, R. (1964). A monograph of the genus *Galerina* Earle. New York.

WATLING, R. (1964). The taxonomic characters of the Bolbitiaceae with particular reference to the genus *Conocybe*. PhD. thesis Edinburgh.

—— (1965). Observations on the Bolbitiaceae. 2. A conspectus of the family. *In* Notes R. bot. Gdn Edinb. **26**: 289–323.

—— (1971). Observations on the Bolbitiaceae—IV. Developmental studies on *Conocybe* with particular reference to the annulate species. *In* Persoonia **6**: 281–289.