RECORDS OF BOLETI AND NOTES ON THEIR TAXONOMIC POSITION: III

ROY WATLING

Boletus aereus Bull. ex Fries, Systema Mycologicum I: 393 (1821). Fig. 1 A–C.

Much confusion exists over the identification of members of *Boletus* Section *Edules* as has already been shown (Watling, 1963). Frequently the name *Boletus aereus* is used for a dark-capped fungus of the *B. edulis* complex but on closer inspection I have generally found this name to have been applied to specimens which should have been identified as *Boletus pinicola*. Judging from the joint forays held with continental colleagues a similar misconception is common in the continent of Europe.

Although Pearson (1946) describes *B. aereus* in his notes he adds 'doubtful if in Britain though recorded'. It was placed with some hesitation in the list of British Agarics and Boleti (1948) and the New Check List (1960). For some time now, however, E. E. Green has been sending me from the south of England collections of a large, dark bolete with the general facies of *B. edulis*. These collections have been determined as *B. aereus* and during the last few years I have had the opportunity of examining both dried material and fresh specimens sent by mail, and during the season 1968 the pleasure of collecting what must be one of our less colourful yet most beautiful boletes.

I offer the following description to substantiate the position of this fungus in our British flora:—

Pileus 50–120 mm, convex then becoming more flattened, soft, dark umber to vandyke-brown with yellow 'lights', flushed more rich red-brown towards the disc and different sides of the pileus may be different shades of brown especially if only half the pileus has been covered by leaves during some part of its development, minutely cracked throughout although only obvious when examined closely or with the aid of a lens, smooth, moist but not viscid, where more deeply cracked pallid flesh showing through. *Stipe* 60–80 × 11–20 (16–38 base) mm, clavate to slightly swollen at midway, white at apex passing into tan then dark buff background, with dark red-brown net to half-way, network white at very apex then pale buff, base covered in minutely tomentose, white mycelial development. *Tubes* whitish, pallid then rich sulphur-yellow, flushed pale ochraceous and rust where bruised; *pores* small, at first white becoming lemon, then sulphur-yellow, becoming pinkish on handling and with age rust or reddish brown. *Flesh* pure white throughout, unchanging or slightly ochraceous pinkish if changing at all, especially where bruised or on cutting but not when split open, often showing a watery or a pale lemon-yellow line above the tubes; *taste* and *smell* fairly strong, not unpleasant but slightly aromatic when dry; with NH_4OH & KOH pale reddish buff; Phenol and HCHO very pale reddish and yellowish respectively; $FeSO_4$ hardly greenish; Melzer's reagent red brown (-ve).

Basidiospores subfusoid in side view, frequently distinctly tapered towards

the apex in face view, 13·5–15·5 × 4·0–5·5μm, pale straw-colour in NH_4OH, only slightly darker in Melzer's reagent. *Basidia* 4-spored, clavate-cylindric, hyaline in NH_4OH. *Pleurocystidia* 25–40 × 7·5–12·5μm, ventricose to fusiform, infrequent and very scattered, hyaline or pale straw-colour in NH_4OH: *cheilocystidia* similar in shape and size, often only few in number, less frequently more numerous. *Pileal surface* of cylindric, hyaline to pale vinaceous hyphae when mounted in NH_4OH and distinctly brown-vinaceous in mass, arranged at first in a palisade but soon becoming repent, 5–8μm broad. *Stipe surface* with hymenial elements in palisades which form an interconnecting network. *Clamp-connections* not seen. *Hymenophoral trama* of hyaline, floccose, slightly gelatinised hyphae divergent from a slightly darker, straw-coloured, central strand. *Pileus trama* of floccose, interwoven hyphae hyaline in NH_4OH & Melzer's reagent, only slightly darker beneath 'cuticle' pileus. Under *Fagus*. Windsor Great Park & Silwood Park, Berkshire: 8 vii 1967 *Watling* 5110; 9 vii 1967 *Watling* 5088; 17 ix 1967 *Watling* 5331; 31 vi 1968 *Watling* 5986; 29 ix 1968 *Watling* 6717; 27 x 1968 *Watling* 6754.

Boletus amabilis Peck in Bull. Torrey Club 27: 612 (1900). Fig. 2 C–E, I & J.

Whilst examining the dried material of British boleti housed in the Kew Herbarium I happened to come across a collection named *Boletinus cavipes* Opat. which did not appear to have the characters of that species. Although the fungus was undoubtedly closely related to *B. cavipes* in possessing a tomentose felty-scaly pileus and ring zone on the stipe, it had neither the sheathing ring typical of *B. cavipes* nor the very marked hollow (i.e. *cav–*) stipe (i.e. *pes*). Closer examination of the collection showed marked differences in cuticular structure of the pileus. Through the kindness of the collector, Dr. P. H. Gregory, who enthusiastically answered my questions, I was able to ascertain that although the fungus was collected under beech (*Fagus sylvatica*), old stumps of conifers and some standing mixed conifers including *Pseudotsuga menziesii*, were close by. It is now common knowledge that favourable conditions for fruiting often exist under quite different species of tree to that with which the fungus is mycorrhizal; this in the past has led to many misunderstandings as to the identity of the host tree, for the distance may be several metres from the feeding roots of the tree where the mycorrhiza is located to the place where the fruit-bodies are produced. Thus even though the collection under review was found under beech it could quite easily have been associated with the Douglas fir present. A. A. Pearson to whom the specimen was originally submitted had no hesitation in identifying the collection as *Boletinus cavipes* but as Pilát and Svreck (1949) pointed out in their account of *Suillus amabilis* (as *Boletinus tridentinus* ssp. *landkammeri* see below) *B. cavipes* and *S. amabilis* are very close. See fig. 2, F–H.

Unfortunately Dr. R. W. G. Dennis has been unable to find any field notes in Pearson's note-books; it is therefore difficult to comment on colour etc. However, comparison with Singer's description and plate (1965) indicates that there is some evidence to suspect that the Herefordshire material should be referred to *Suillus amabilis* (in the sense of Singer).

Much discussion has centred on this fungus, further comment on which would be out of place here; it is sufficient to report that the name is based on

Boletus amabilis collected by Bartholomew from Lakeside, Colorado, U.S.A. and named by Peck. The herbarium material is in a very bad state of preservation, from which only meagre information may be obtained.

Singer (1966) maintains that *Suillus lakei* (Murrill) Smith & Thiers is the same as *Boletus amabilis*. I have collected *S. lakei* in the Pacific North West of North America where it grows scattered to gregarious and is typically associated with *Pseudotsuga*. Comparison of my notes and Gregory's material show that the collections do not support the suggestion that *S. lakei* and *B. amabilis* s. Peck are one and the same fungus. Singer (1966) and Chinková and Pouzar (1955) have also synonymised *Boletinus tridentinus* ssp. *landkammeri* Pilát & Svreck, 1949, with *S. amabilis*. The British material approaches the descriptions and figures of Landkammer (1950), Pilát and Svreck (1949) and Chinková and Pouzar (1955) fairly closely. Indeed it may be found necessary in the future to reintroduce Pilát and Svreck's name, for observations made by Smith and Thiers (1967) indicate that *S. amabilis* is close to *Suillus luteus*, as is in fact suggested by the original description.

Whatever comes out of these wrangles it is very evident that a bolete exists in the British Isles which, although not conspecific, is close to *B. cavipes;* careful search should be made for it in our well-established Douglas Fir and Spruce forests. The microscopic features of this fungus are:—

Basidiospores 11–12·5 × 4·5–5·5μm, subfusoid, slightly flattened in side view, slightly swollen towards base in face view, pale straw-colour in water and NH_4OH, red-brown in Melzer's reagent. *Basidia* 4-spored, clavate, with colourless or slightly coloured pedicel, 28–30 × 6–8μm. *Pileus trama* rich red-brown in Melzer's reagent, of rather swollen hyphae, up to 15μm broad towards the tube layer. *Hymenophoral trama* with central slightly gelatinised strand with hardly coloured divergent constituents. *Pileal surface* (damaged in part by insects) hardly coloured, of repent, parallel smooth-walled hyphae, up to 5μm broad, scales of similar hyphae intermixed with wider units (8–10μm broad or even wider), not constricted at septa, units often very short and resembling rows of bricks (about 8μm long). *Pleurocystidia* in fan-like fascicles, individual cells 4–6μm wide and filled with brown contents in KOH, up to 55μm long; *cheilocystidia* similar or with some coloured amorphous basal incrustation, cylindrical elongate-clavate. *Clamp-connections* not seen. Ashbridge Park, Ashbridge Common, Herefordshire legit P. H. Gregory 31 viii 1952 (K). Material examined:

Boletinus cavipes:(British) Under *Larix*, near Dunkey Point, Somerset, 27 viii 1954, *D. A. Reid* (K). (Foreign; all North America) under *Larix laricina*, nr. Joslin Lake, Washkenaw Co., Michigan, 15 xi 1965, S Mazzer, *Watling* A510/C1912; Marquette, Marquette Co., Michigan, ix 1964, legit I. Bartelli, *Watling* A1552/C1813: under *Larix occidentalis*, Mosquito Bay, Priest Lake, Bonner Co., Idaho, 10 ix 1966, *Watling* 2888; Beaver Creek, Bonner Co., Idaho 11 ix 1966, *Watling* 2960 (var. *aureus*); Benton Creek Road, Priest River Experimental Station, Bonner Co., Idaho, 12 ix 1966, *Watling* 2987; Beaver Creek, Bonner Co., Idaho, 12 ix 1966, *Watling* 2979; Benton Creek Road, Priest River Exp. Stat., Bonner Co., Idaho, *Watling* 2978 (var. *aureus*); Cusick, Washington, legit K. Harrison, 14 ix 1966, *Watling* 3125 (form with pale pileus scales): –all in E.

Suillus lakei: (Foreign: all N America) in humus under *Pseudotsuga;* Jackson

State Park, near Mendocino, Mendocino Co., California, 5 xi 1960, *Thiers* 8167; under *Pseudotsuga* & *Tsuga* Thor Creek, Pend Oreille Co., Washington, 15 ix 1966, *Watling* 3200; Delta, Shoshone Park, Idaho, 21 ix 1966, *Watling* 3382; Benton Creek Road, Priest River Experimental Forest, Idaho, 29 x 1966, *Watling* 3539.

Boletus flavus s. Bresadola in Iconographia Mycologia 19: 904 (1931). Fig. 1 H–J; Fig. 2 A & B. (as *Suillus nueschii*).

B. flavus is usually credited to the British botanist William Withering who recorded it from Edgbaston Park & Enville, Birmingham. However as Withering's publication was published in 1796 it is therefore dated before 1821, the starting point which has been adapted universally for the nomenclature of the Agaricales. The first person to use *Boletus flavus* validly was Fries himself in 1836 but agreement between details in the descriptions make it apparent that both authors were dealing with the same fungus, indeed Fries cites Withering in his description. The fungus has been interpreted in many different ways over the past century; generally the misidentifications can be placed either in *Suillus grevillei* (reticulate and non-glandular stipe) or *S. luteus* (with glandular stipe). Recently Smith, Thiers & Miller (1965) have reintroduced the epithet '*flavus*' for a fungus which they consider fits closest to Fries' description; the European interpretations have been discussed by Watling (1965).

One interpretation of the name *Boletus flavus* which stands out from all the others, is the interpretation by Bresadola. This fungus differs from *Suillus grevillei*, the common larch bolete, by its larger, greyer pores, the obvious white peronate ring and roll of veil at the pileus margin. So different is it that Singer gave this fungus a new name, *S. nueschii* and it is believed that this species was collected in Aberdeenshire in the 1968 season.

A description of the Aberdeenshire material stands as follows:—
Suillus nueschii Singer in Sydowia 15: 82 (1961).

Pileus up to 78 mm, convex, broadly umbonate with slightly incurved margin, expanding to become plano-convex or almost plane, dull ochraceous tawny or orange-ochraceous with a paler margin and covered in a yellowish gluten beneath which is a blotchy or mottled aspect resembling scales, soon losing gluten to become dry and either more chrome-lemon or ochraceous as in very washed-out *S. luteus*, rust-brown, adpressed scaly towards disc, white or pallid zone at very edge. *Stipe* 10–34 × 10–13 mm, equal or slightly tapered towards the distinctly reticulate apex, short for size of pileus, pale lemon-yellow at apex becoming more and more chrome-yellow or even orange with age, flushing or spotted rust ochre extending down to the stipe base and then rust-brown, woolly-tomentose and rich sulphur yellow at base. *Veil* white or pale yellow forming both poorly developed ring and distinct marginal roll of tissue to the pileus margin, becoming brownish, sheathing the stipe for part of its length as a peronate ring. *Tubes* adnate-adnexed, depressed about the stipe apex but with a thin line down the apex as a raised reticulum, neither decurrent nor subdecurrent, quite short up to 8 mm in length when mature; *pores* about 3 mm or more wide when mature with several dissepiments and distinctly boletinoid in arrangement, ochraceous yellow to greyish yellow with age but never as bright as those of *S. grevillei*, finally dirty ochraceous. *Flesh* white in the pileus with only

a faint flush of yellow even in the mature fruit-body, pale yellow in the stipe, darker towards the base, gradually flushing rose in the stipe apex and base, but particularly in the pileus, flush of olive may be apparent in the stipe base; *taste* and *smell* pleasant.

Spore-print ochraceous clay to cinnamon buff; *basidiospores* 8–10 × 3–4μm subfusoid-elongate ellipsoid in side view, more ellipsoid in face view, pale straw-colour in NH_4OH, slightly darker in Melzer's reagent. *Cheilocystidia* cylindric-clavate, hyaline or straw-colour then darkening, covered in small granules, finally more strongly encrusted, 25–50 × 6·5–10μm, little or no development of coloured globules in Melzer's reagent; *pleurocystidia* not numerous, similar to those at the margin. *Pileal surface* of tangled, hyaline or pale coloured, flexuous, smooth, gelatinised, hyphae 3·5–5·5μm broad, intermixed with broader elements (up to 10μm broad). *Clamp-connections* not seen. *Hymenophoral trama* of pale coloured or straw-coloured, gelatinised, interwoven hyphae slightly divergent from a slightly more coloured, central strand. *Stipe surface* of subparallel to parallel hyphae mostly obscured by hyphal filaments from the veil.

Under *Larix europea*, Linn of Dee, Aberdeenshire 1 & 2 iv 1968, *Watling* 6909 & 6918 (E). The veil is floccose woolly forming a connecting membrane which is left on the stipe as a peronate ring and as a persistent roll of veil at the pileus margin as in *Suillus hirtellus* (Peck) Kunze and *S. albidipes* (Peck) Singer. This roll finally disappears from the fruit-body at maturity leaving only small floccules at the margin and hardly more than a ring line on the stipe although the stipe base is covered in smooth, silky veil tissue.

Chroogomphus helveticus (Singer) Moser in Gam's Kleine Kryptogamenflora 28/2: 51, 1967. Fig. 3, G–K.

A member of the Gomphidiaceae collected by Mrs. D. Fieldhouse in Leicestershire (45/536133) and sent to me for identification was determined as *Gomphidius helveticus* Singer. This appears to be a rare fungus even in continental Europe having only been described in full once by Kühner (1962) after the original collection was made by Singer (1950); Moser makes an entry in the 2nd edition of Gam's Kleine Kryptogamenflora (1955) later (1957) transferring it to *Chroogomphus*. It is the first time the fungus has been recorded for the British Isles.

From the copious field notes supplied with the material and a subsequent microscopic examination it is concluded that this fungus is not a true member of the genus *Gomphidius* but should be placed in *Chroogomphus*, close to *C. tomentosus* (Murr.) O. K. Miller, which it resembles in many ways. Moreover, because of the woolly surface to the pileus it should be placed in section *Floccigomphus*.

The Leicestershire collection deposited at Edinburgh is described below and all details support Moser's transfer to *Chroogomphus*.

Pileus up to 70 mm wide, dome-shaped then expanded with incurved wavy-irregular margin, copper-colour or ochraceous orange, with mixture of light red or brick-red, darker at the disc and darkening after picking, slightly greasy to the touch, but mat with fibrils giving it a woolly aspect.
Stipe firm, fleshy, central, thick, tapered downwards, up to 75 × 35 mm (5 mm at base), dry, connected to the pileus when young by an ochraceous then reddish ochre, arachnoid veil, which collapses on the stipe at maturity

to give darkening, ochraceous, fibrillose squamules, lower half reddish ochre darkening to brownish. *Gills* decurrent, fairly wide, not interveined, thick, grey-green at first then flushed more pinkish wine, 'frosted' at the margin. *Flesh* pale reddish ochre in the pileus, more strongly coloured when wet, similar in stipe except for the lower part which is very bright ochre or cadmium-yellow in places, flushed with olive green, when injured almost crimson, and orange about insect holes: *Smell & taste* pleasant; with $FeSO_4$ dark olive-green; Melzer's reagent deep indigo: C_2H_5OH red which is intensified by the addition of aniline; KOH amethyst; NH_4OH reddish buff to violaceous buff, redder on the pileus cuticle.

Spore-print grey green. *Basidiospores* cylindrical-subfusoid, 17·5–20·5 × 5·5–6·5 (7)μm, only faintly ashen in water or greyish in NH_4OH and in Melzer's reagent. *Basidia* 4-spored, cylindric to elongate clavate. *Cheilocystidia* cylindrical to elongate clavate, constricted at base, rounded at apex, prominent, up to 50μm in length × 12–20μm, hyaline, not markedly thick-walled. *Pleurocystidia* similar, numerous, hyaline or faintly coloured in NH_4OH, smooth or with encrustations. *Pileal surface* composed of thin, amyloid hyphae, 5–7·5μm broad, and covered in a thin, irregular layer of amyloid material, which may be accentuated by rugulosities. *Stem surface* of similar filamentous hyphae to those of pileus, 7–10μm broad, *Clamp-connections* not seen.

Under exotic pines, The Brand, Woodhouse Eaves, Loughborough, Leics. 19 ix 1968, legit Mrs. D. Fieldhouse, *Watling* 6953.

The texture of the pileus in the field and the amyloid hyphae in the pileus cuticle distinguish it immediately from *C. rutilus*, the only other British species of the genus. It is close to *C. tomentosus* and *C. leptocystis* both of which I have collected in the field; Kühner (1962) has fully discussed the differences between *C. helveticus* and these last two North American species.

Miller's key in Mycologia (1964) separates those members of section *Floccigomphus* which were discussed by him; it is here modified to include *C. helveticus*.

1.	Terminal cells of cuticular hyphae obtuse to cystidioid	*C. sibiricus*
1.	Terminal cells cylindric	2
2.	Hyphae of pileus cuticle amyloid	3
2.	Hyphae of pileus cuticle hyaline, non-amyloid and distinctly narrower than tramal hyphae; cystidia thin-walled .	*C. leptocystis*
3.	Cystidia thick-walled	*C. tomentosus*
3.	Cystidia thin-walled	*C. helveticus*

Illustrations of some British boletes (pp. 398–402).

The opportunity is here taken to figure some British boletes the microscopic details of which have not been illustrated before. Figures of basidiospores, cystidia and elements of the pileus surface are given of *Boletus citrinovirens* Watling, 1969 (type) Fig. 1, D–G; *B. satanoides* Smotlacha Fig. 3, A–F; *Leccinum quercinum* (Pilát) Green & Watling Fig. 4, E–G and Fig. 5, A–B; *L. roseotinctus* Watling, 1969 (type) Fig. 4, A–D; *L. variicolor* Watling, 1969 (type) Fig. 5, C–F and *L. vulpinum* Watling, 1960 type and other collections, Fig. 5, G–L.

References

CHINKOVÁ, C. & POUZAR, Z. (1955). Hřibovec Lakeův-Boletinus lakei (Murr.) Sing. roste v Československu. *Česk. Myk.* 9: 76–82.

DENNIS, R. W. G. & PEARSON, A. A. (1948). Revised list of Agarics and Boleti. *Trans. Brit. Mycol. Soc.* 31: 145–190.

DENNIS, R. W. G., ORTON, P. D. & HORA, F. B. (1960). New check list of British Agarics and Boleti. *Trans. Brit. Mycol. Soc.* 43 (2) *Suppl.*

FRIES, E. & HÖK, C. T. (1836). *Boleti fungorum generis illustratio*, Upsala.

KÜHNER, R. (1962). Notes Descriptives sur les Agaricales de France II, Boletacees. *Bulletin Mensul de la Societé Linneenee de Lyon*, 9: 270–279.

LANDKAMMER, V. (1950). Zaimavý nález hřibu, vázaného na Douglasovu jedli (Pseudotsuga Douglasii). *Česk. Myk.* 4, 6–7: 65–67.

MILLER, O. K. (1964). Monograph of Chroogomphus (Gomphidiaceae). *Mycologia* 56: 526–549.

MOSER, M. (1955). in Gam's *Kleine Kryptogamenflora* II, 3rd edition, Stuttgart.

PEARSON, A. A. (1946). British Boleti, *Naturalist*, *London.*

PILÁT, A. & SVRECK, M. (1949). Boletinus tridentinus (Bres) subsp. Landkammeri, subspecies nova Bohemica. *Acta Mus. Nat. Prague* 5 (B), 7: 1–8.

SINGER, R. (1966). The Type of Boletus amabilis. *Mycologia*, 58: 157.

——(1967). *Die Röhrlinge* I, *Die Pilze Mitteleuropas* VI, Bad Heilbrunn/Obb.

SMITH, A. H., THIERS, H. D. & MILLER, O. K. (1965). The Species of Suillus and Fuscoboletinus of the Priest River Experimental Forest and Vicinity, Priest River, Idaho. *Lloydia* 28, 2: 120–138.

SMITH, A. H. & THIERS, H. D. (1967). Comments on Suillus amabilis and Suillus lakei, *Mycologia* 59: 361.

WATLING, R. (1963). Notes on British Boleti II. *Trans. Bot. Soc. Edinb.* 39, 4: 414–431.

——(1965). Notes on British Boleti IV. *Trans. Bot. Soc. Edinb.* 40, 1: 100–120.

WITHERING, W. (1796). *Arrangement of British Plants*, Vol. IV, London.

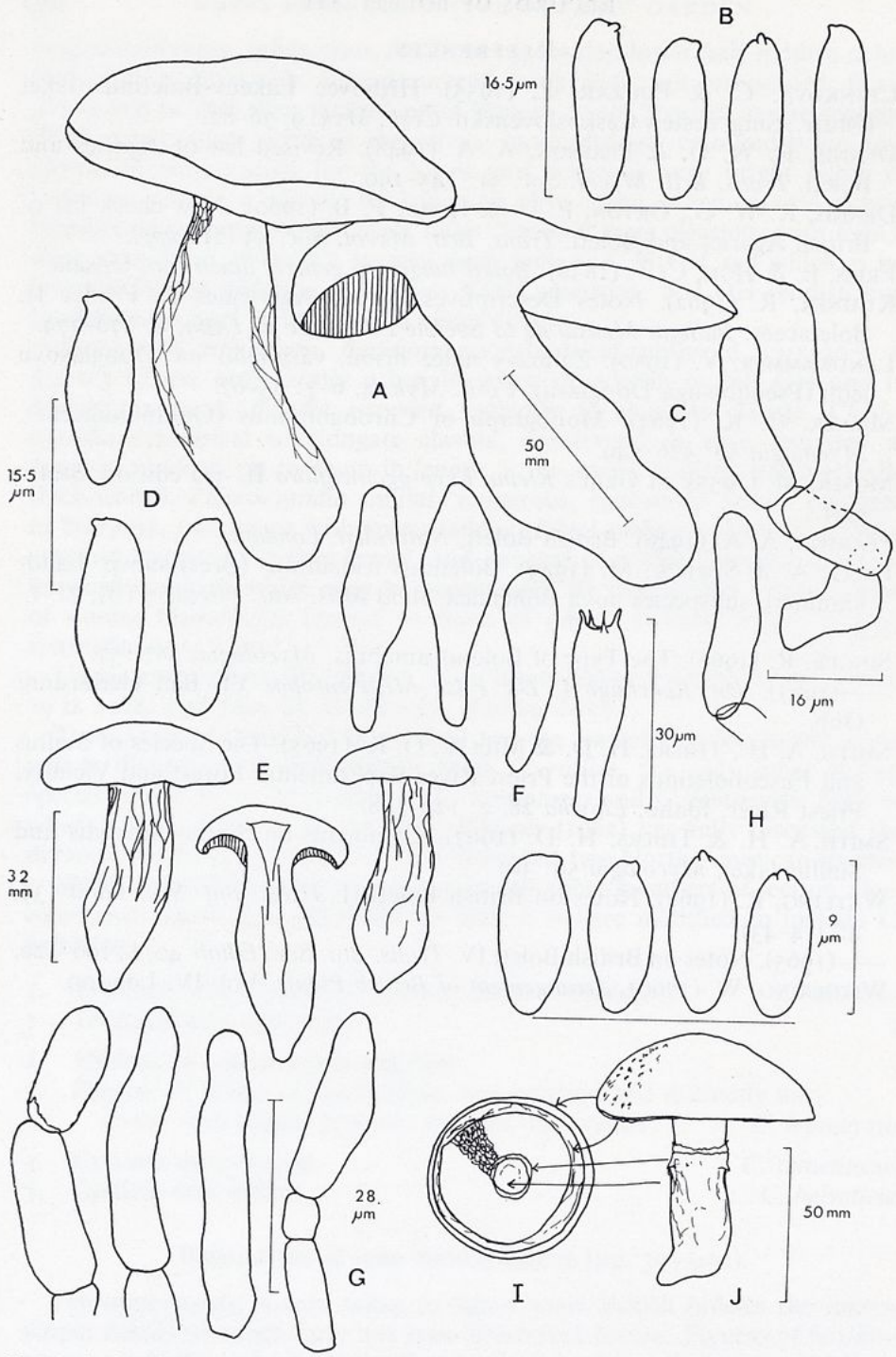

FIG. 1. A–C *Boletus aereus*, *Watling* 6717. A. habit sketch & section, B. basidiospores, C. cells of pileal surface: D–G *Boletus citrinovirens*, from type D. basidiospores, E. habit sketch & section, F. basidium and three cheilocystidia, G. cells of pileal surface; H–J. *Suillus nueschii*, *Watling* 6909, H. basidiospores, I. under surface of pileus showing pores covered in part by marginal roll of velar tissue, J. habit sketch. Magnification as indicated.

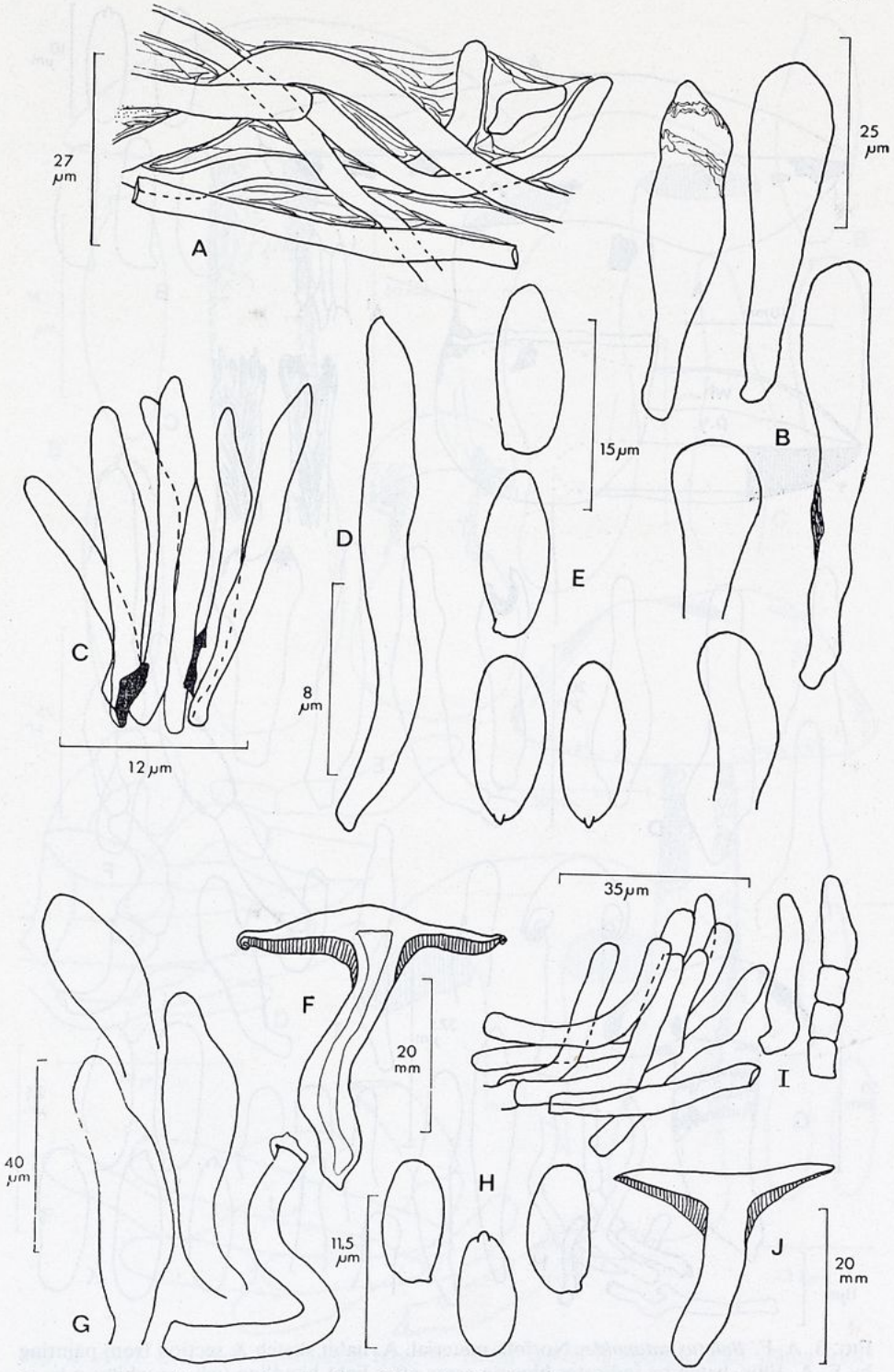

FIG. 2. A–B *Suillus nueschii*, *Watling* 6909. A. pileal surface, B. pleurocystidia; C–E, I & J *Suillus amabilis* Herefordshire material described in text C. group of pleurocystidia, D. pleurocystidium, E. basidiospores, I. cells of pileal surface, J. sketch to show solid stipe; F–H *Boletinus cavipes* legit D. A. Reid, Somerset F. sketch to show hollow stipe, G. cells of pileal surface, one broken at clamp-connection, H. basidiospores.
Magnification as indicated.

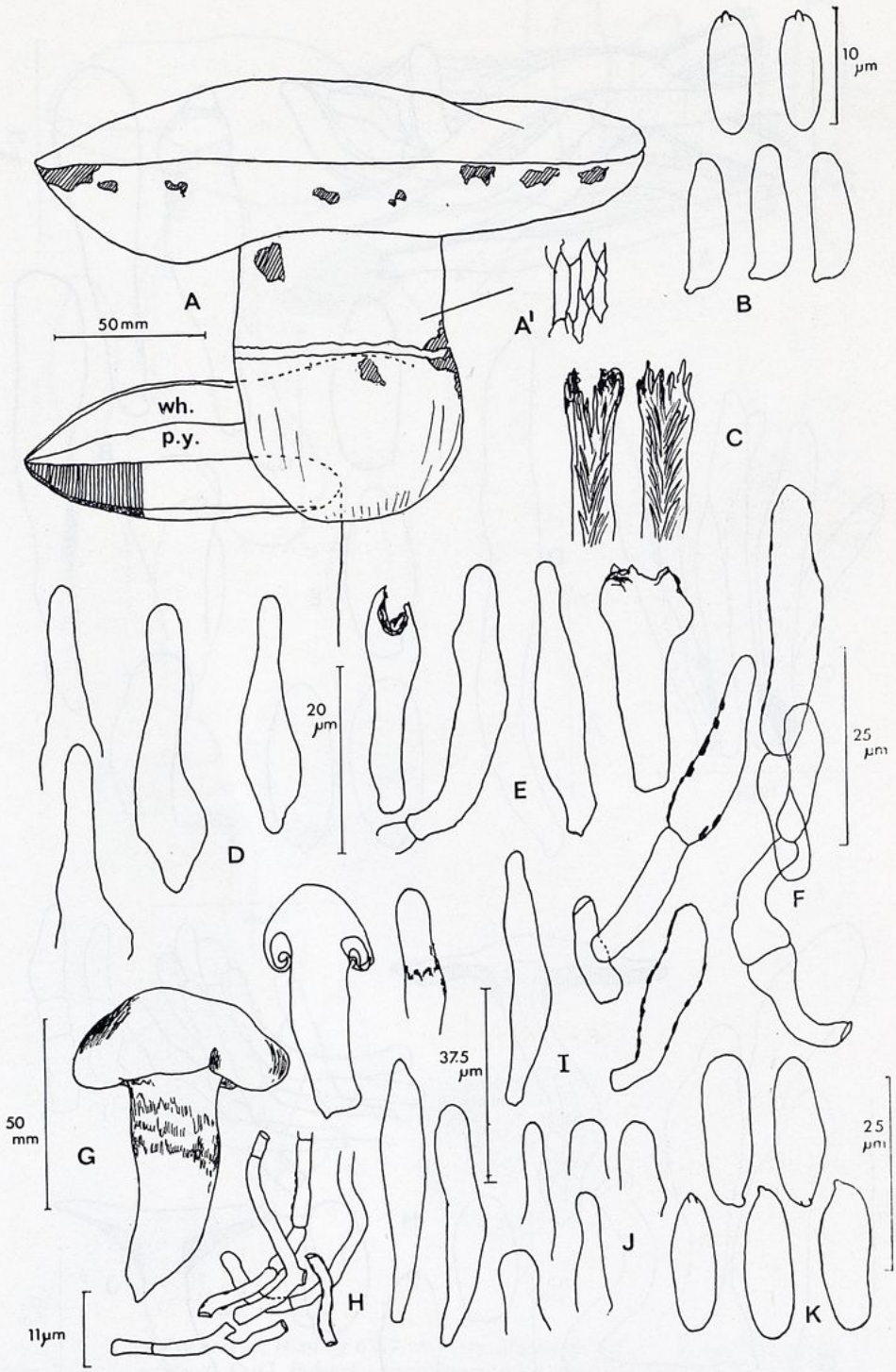

FIG. 3. A–F. *Boletus satanoides* Norfolk material. A. habit sketch & section from painting by E. A. Ellis, hatching indicates blueing areas after light handling (wh. = white; p.y. = pale yellow—flesh colours before changing blue); A′ enlarged portion of stipe reticulum, B. basidiospores, C. sketch of splayed ends of tubes, D. pleurocystidia, E. cheilocystidia, two with splayed apices, F. cells of pileal surface; G–K. *Chroogomphus helveticus*, Leicestershire material, G. habit sketch and section of young fruit-body, H. cells of pileal surface, I. two pleurocystidia, J. cheilocystidia showing variation in apex, K. basidiospores. Magnification as indicated.

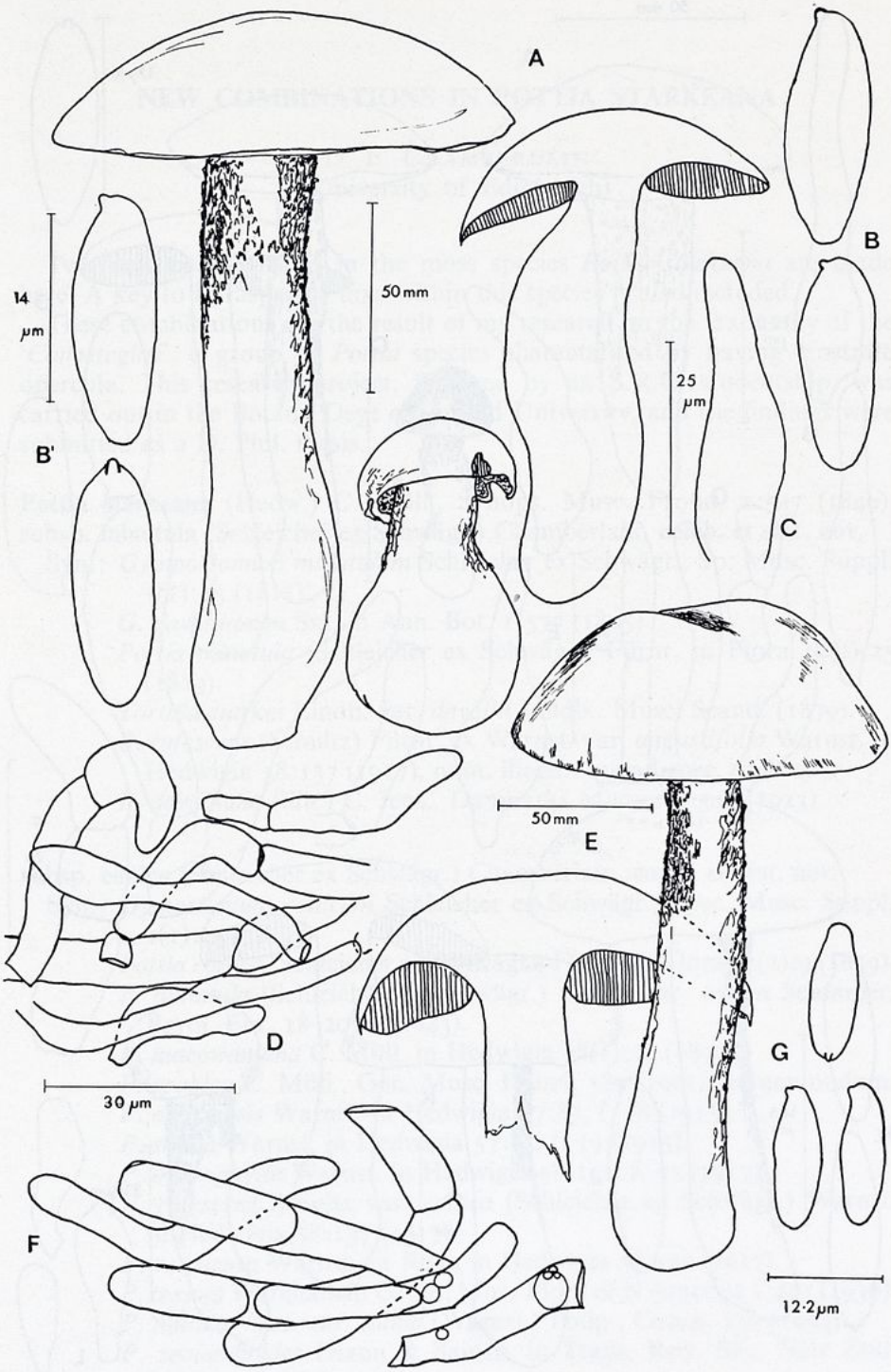

FIG. 4. A–D. *Leccinum roseotinctus* type, A. Habit sketch & section, with young fruit-body, B & B′, basidiospores, C. cheilocystidium, D. cells of pileal surface; E–G *Leccinum quercinum*, *Watling* 6749, E. habit sketch & section, F. cells of pileal surface, G. basidiospores.
Magnification as indicated.

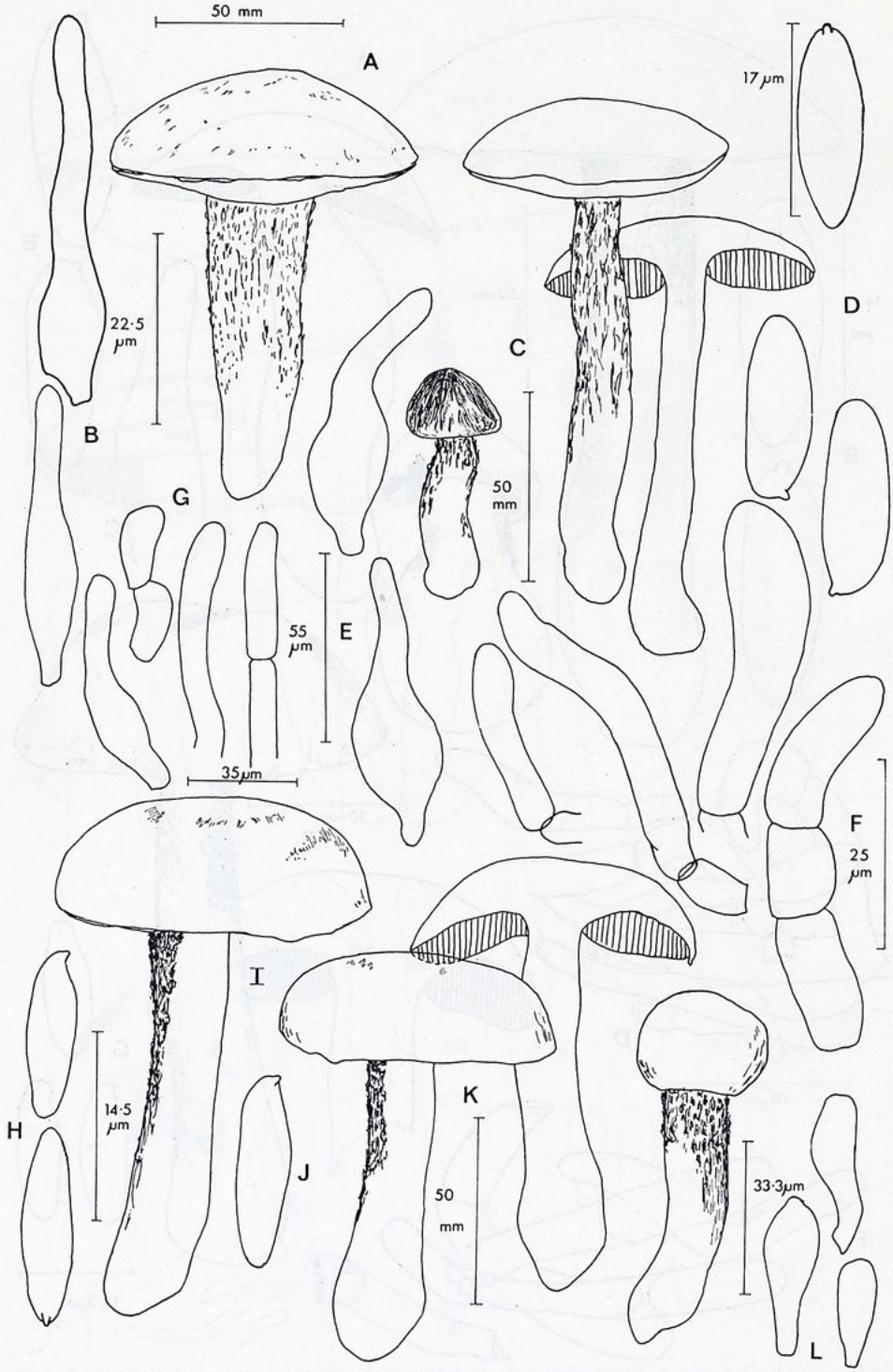

FIG. 5. A–B, *Leccinum quercinum*, A. habit sketch of young fruit-body, from painting by E. E. Green, B. cheilocystidia, *Watling* 6747, C–F *Leccinum variecolor* type, C. habit sketch, D. basidiospores, E. cheilocystidia, F. cells of pileal surface: G–L *Leccinum vulpinum* type, or as indicated, G. cells of pileal surface, H. basidiospores, *Watling* 266C, I. habit sketch of *Watling* 266C, J. basidiospores, *Watling* 264C, K. habit sketch of *Watling* 264C, L. cheilocystidia.
Magnification as indicated.