# RECORDS OF BOLETI AND NOTES ON THEIR TAXONOMIC POSITION

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**Boletus (Xerocomus) parasiticus** Bulliard ex Fr. in Syst. mycologicum, 1821.

To find in such a familiar group of higher fungi as the boletes, generally considered characteristically mycorrhizal in nature, two members which are not only parasitic but parasitic on other fungi—on gasteromycetes, never fails to surprise me. *Xerocomus astereicola* was originally described from Japan (Imazeki, 1952) and grows on *Astraeus,* however the characteristic is probably best known in *Boletus parasiticus* which grows on earthballs. One thing which may become more evident as the European Mapping Scheme continues is whether *Boletus parasiticus* occurs on earthballs other than *Scleroderma aurantium.* Although Fries (1821) quoted Bulliard's record of this bolete on *Scleroderma verrucosum* it has already been intimated (Watling, 1964) that fresh material of *Boletus parasiticus* has neither been examined on this latter host nor in fact on any species of earthball other than *Scleroderma aurantium*; indeed Bulliard's illustrations are of a gastromycete which approaches *S. aurantium* very closely and may even be this fungus.

The opportunity has been taken to study further material particularly that included in several of our national herbaria; these specimens, but for one collection (see below) support the conclusion that *S. aurantium* is the only host of *B. parasiticus,* at least in Britain. *Scleroderma aurantium* has been delimited for the purposes of this study as having a carpophore lacking a stalk, with a thick peridium, a ± distinctly scaly outer surface, and umber coloured, ornamented spores. The spore-ornamentation is fairly variable ranging from a distinct although fine reticulation to an indistinct network made up of isolated warts with some interconnecting lines.

The mapped distribution for this species, accompanying Henderson's appeal to British mycologists to help in the European Mapping Scheme (1964) can now be expanded to include material from Flatford Mill (square 6/12) and from near Plymouth (square 2/0) a distribution again indicating a very probable southerly distribution of the species in the British Isles. The following material has been examined:—

British Collections.

(BM) Herb. C. E. Broome, near Bristol, 1845; Herb. C. E. Broome, Point Neath, *Vaughan*, ix 1867; Herb. Phillips from C. E. Broome, Point Neath, *Vaughan*, ix 1867 (not attached to earthball; no data concerning host); Herb. C. E. Broome, Beddgelert, North Wales, x 1861; Herb. Plowright, Wotton Heath, 27 viii 1871; Herb. C. E. Broome ex M. Terry, 5 x 1872; Herb. C. E. Broome, ix 1891; Herb. W. G. Smith separate collections of material and spore-print (no data); Knole Park near Sevenoaks, Kent, *J. Hall*, 26 x 1958; Vert Wood, Laughton, Sussex, *W. H. Spreadbury*, 13 x 1962.

Basidiospores from the receptacle of the parasitised *Scleroderma* in the last collection closely approach those of *Scleroderma verrucosum*; there is, however, a poor and irregular formation of network branches on the basidiospores, indicative of *S. aurantium* as here understood. We are at present ignorant of any changes which may take place in the structure or viability of spores of earthballs parasitised by this bolete. Spores in some carpophores appear to be formed normally in isolated areas of the gleba whereas in other carpophores they are irregularly developed, being replaced by what appears to be bolete hyphae.

(E.) Orton 1128, Cadover, Devon, 18 viii 1957 (no earthball is present but Orton informs me the host was *Scleroderma aurantium*). I have personally collected *B. parasiticus* on *Scleroderma aurantium* as follows:—Wathe Wood, Pately Bridge, Yorkshire, 26 ix 1958 (see *The Naturalist*, 1956 p. 115); Windsor Great Park, Berkshire, 4 viii 1958, *Watling* 210C (E); Luss Rossdhu, Dunbartonshire, 2 ix 1963, *Watling* 2657C (E).

(K) Herb. Berkeley, Kew, 1 ix 1859, two collections; Clifton, C. Broome, no further data; Herb. Cooke, Coombe Wood, 1862; Herb. Crossland, Hardcastle Crags, Hebden Bridge, Yorkshire, 16 ix 1905; Herb. Needham, same locality; Herb. Crossland, Mollicar Wood, Huddersfield, Yorkshire, ix 1906; Dunster, Somerset, 19 ix 1911; Haslemere, Surrey, *E. M. Wakefield*, 18 ix 1932; Saxonbury Hall, Sussex, 17 ix 1961; Hayes Common, Kent, *E. E. Green*, 30 vi 1965; Windsor Great Park, Berkshire, *E. E. Green*, 27 viii 1965, two collections; Woburn Sands, Buckinghamshire, 30 viii 1965, *D. A. Reid*; Herb. Cooke two collections no data.

E. E. Green (personal comm.) reports it is fairly frequent in the Windsor Park area where it has been always seen on *S. aurantium*. P. D. Orton similarly reports it on this host from Speed House, Forest of Dean, 13 ix 1951, Wootton Hatch, Surrey, 22 ix 1953 and Horner Water, Somerset, 17 ix 1960. Also a record from Holden Clough, Lancashire, 27 ix 1958, and from West Ardley, Yorkshire, 1 x 1967 (both on *S. aurantium*; the last collection by Dr. Ray Edwards).

Foreign Collections.

(BM) Sydow Mycotheca Marchica no. 809, viii 1885; Jaczewski, Komarov, Transzchel Fungi Rossiae Exs. no. 126, Pietrovo prope Smolensk, viii 1895; Jaap Fungi Selecti Exs. no. 342 Schleswig Holstein, 20 viii 1908; Lundell & Nannfeldt, Fungi Exs. Suecica no. 2610, Goteborg, 16 ix 1953 ex Fr. Karlvall (n. 514); Herb. Ravenel, material from North Carolina—mixture of two species of *Boletellus*. Although the sheet is labelled *Boletus parasiticus* the specimen capsules are labelled *Boletus betula* Schw.? *B. betula*, although it has been often regarded as synonymous with the present fungus in older works, is quite a different and unrelated bolete; it has ornamented spores.

(E) Fungi Schemnitzienses, Prenčow, *Andr. Kmět* 1892; Jaap Fungi Selecti Exs. no. 342 (see above); Flora Bohemicae et Moraviae, Exs. no. 2330 Petrak.

(K.) North American Fungi from Elizabeth, New Jersey, two collections *G. R. Gerrard*; New Jersey, coll. no. 6536, *Austin* 1185, two collections; Sydow Mycotheca Marchica 809, Berlin, ix 1885; Fungi Neerlandici, Warmond prov. Zuid Holland, 21 ix 1955, *J. E. Ferguson*.

(MICH.) Utica, New York State, 23 viii 1904; Waltham, Massachusetts, *Morris* 1909; Adirondack Mountains, New York State, 2 ix 1921, *Kauffman*; Pennsylvania 1932, *Stifler*; Great Smoky National Park, Tennessee, 3 ix 1937, *Hesler & Smith* 7338; Cades Cove, Tennessee, 24 viii 1938; Tahquamenon, Michigan, *Smith* 50406, 12 ix 1955; Upper Falls, Tahquamenon, Michigan, viii 1955; New Hampshire, Kelly, *J. Tray*, 2089; Lafayette, Indiana, *Nuttall* no. 1191. (It appears that all the earthballs connected with these collections have been examined by G. Guzman, Instituto Politecnico Nacional, Mexico, during the preparation of his monograph of *Scleroderma* —they are all *S. aurantium* as delimited in this paper).

Primordia of this bolete growing on *S. aurantium* have been observed in Cheboygan Co., Michigan, vii 1965.

**Xerocomus porosporus** Imler. Fig. 1, B, b, b′ and b″.

A full description of this interesting bolete is given based on British material, a record of which has already been noted in the Bulletin of the French Society (1964). Interest in this fungus has been recently aroused by a record from Czechoslovakia (Pouzar, 1964) of *Xerocomus truncatus* Snell, Dick & Singer (= *Boletus chrysenteron* sensu Coker & Beers, 1943) with similar spore structure, by a record of *Xerocomus porosporus* from North America (Smith, 1965) and an interesting essay on the spore morphology of *Xerocomus subtomentosus* by Parrot (1965).

The British collection of *Xerocomus porosporus* had the following characters:—

*Pileus* 35–75 mm, convex then plano-convex, finally slightly depressed at the disc, dark olive brown with paler margin, becoming olive brown with slight greyish appearance, at first with yellowish tomentum which on bruising darkens, particularly at the margin on handling, or where the tomentum is rubbed off, finally cracking either deeply or minutely at disc to show yellow flesh, 'cuticle' receding from margin. *Stipe* 40–60 × 11–15 mm, equal or tapering towards the base, apex lemon yellow becoming flushed chrome and with bay or purple to wine-coloured zone, fibrillose streaky below, slightly ribbed with olive brownish and covered by olive brown to grey brown flecks becoming darker towards the base. *Tubes* adnate with tooth to irregularly subdecurrent, lemon yellow finally olivaceous sulphur, bluing on exposure to the air; *pores* compound, angular, labyrinthinal at first, lemon yellow with flush of citron, never truly sulphur, becoming darker with age almost chrome but often with greyish cast, finally orifices greyish rust brown, bluing on bruising then changing olivaceous brown. *Flesh* pale yellow with faint brown line under pileus 'cuticle', chrome yellow in stipe apex, reddish brown or flushed purple bay at the base finally sepia brownish especially in base, becoming blue in some areas particularly above tubes but finally fading to olivaceous.

*Basidia* 4-spored, clavate, 30–40 × 12–13μ, with pale yellowish contents when mounted in water; *basidiospores* subfusoid, 13–15 × 4·5–5·5μ, exhibiting a variable reaction in Melzer's solution but never amyloid, some spores dextrinoid others not, if dextrinoid they may be completely so or only partially so, particularly in those areas about the germ-pore; if shed usually exhibiting a small, although distinct pore; the presence of this pore in spores from herbarium material is variable, even lacking, in much the same way as there is very great variation in the spores of herbarium material of *Strobilomyces floccopus*. *Cheilocystidia* uncommon, thin-walled, yellowish in KOH, fusoid, some with subcapitate apex; *pleurocystidia* similar, less frequent. *Pileus trama* of thin-walled hyphae 4–10μ broad; *hymenophoral trama* similar although constituent hyphae rarely as broad. '*Cuticle*' *of pileus* consisting of a trichoderm composed of brown hyphae up to 15μ broad, encrusted at first, particularly those cells back from the apex, becoming granular or roughened irregularly.

Under *Taxus*, *Cedrus* and *Tsuga*. Lawn West of Pond, Royal Botanic Garden, Edinburgh, 23 viii 1963, *Watling* 713C (E). Whilst preparing this paper a second collection of this fungus has been drawn to my attention: by roadside, mixed oak and beech woodland, Abinger Hammer, Somerset, 21 viii 1967, *Orton* 2924 (E).

Very careful observations have been carried out over the past few years in order to assess the importance of the so-called differences between *Xerocomus* and *Boletus* (=*Tubiporus*). *Suillus* and *Leccinum* are distinct enough particularly as delimited by Singer (1962) or more recently by Smith & Thiers (1965) and Smith, Thiers & Watling (1966) but much controversy has centred on the separation of *Xerocomus* from *Boletus*. Considered alone the European members do indeed form two discrete groups as Quélet showed as early as 1888. However, when North American, East African and Asiatic boletes are considered delimitation is hardly as distinct as one is led to believe from simply reading the available literature.

I am unable to place much emphasis on the structure of the hymenophoral trama in this group and so the xerocomoid boletes are replaced in the genus *Boletus*, a policy arrived at independently by Pouzar (1964 and 1966). I have been able to detect a tramal series parallel to that between *Xerocomus* and *Boletus* in other boletoid basidiomycetes e.g. *Suillus* spp. (Disbrey & Watling, 1967), and in the single genus *Boletochaete*. *B. brunneosetosa* Singer from Libya is reported as having hymenophoral trama of the *Boletus* subtype, those from Madagascar (Heim, 1938) and from Zambia, trama of the *Phylloporus* sub-type; this theme will be expanded in a further article, a theme supported by the fact that *Aureoboletus cramesinus*, *Gyrodon sulphureus* (=*Phlebopus*, *Pulveruloboletus*), *Boletus badius* and several other species have dodged between the *Xerocomoideae* and the *Boletoideae*. Imler's fungus therefore belongs to the genus *Boletus*.

I am also taking this opportunity to clear up problems which appear to have developed in the validation of the name proposed by Imler. Although Imler (1958) furnished the mycologist with an excellent latin description no type is designated; according to the International Code of Botanical Nomenclature the fungus name therefore is invalidly published. Even a later description by the same author (1964) which was accompanied by a full coloured plate, does not rectify this; Pouzar prefers not to use Imler's name because of these objections but in 1958 Imler refers back to his earlier account (1955) which notes a collection made '21 vii 1954 aux environs du Peerdsbos'. This surely is sufficient to warrant retention of the name.* The following new combination is proposed:—

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* L. Imler (personal communication) reports "Pour moi il est évident de regarder comme type de *Xer. porosporus* la récolte de Brasschaat 10.7.1963, figurée et décrite. Des fragments sont à la disposition des chercheurs; . . . J'ai aussi gardé toutes les autres récoltes."

**Boletus porosporus** (Imler) Watling **comb. nov.** Basionym: *Xerocomus porosporus* Imler in Bull. mycol. Soc. France 74: 97 1958.

After examining over one hundred and fifty North American specimens which have been assigned to *Xerocomus truncatus* it can only be concluded that this species and *Boletus porosporus* differ markedly from one another. The important characters are particularly those pertaining to the stature, flesh colours and coloration of the stipe.

It is also interesting to note that the spores in a spore sample from a single specimen of *Boletus* (*Xerocomus*) *truncatus* show that the pore may be prominent, small although distinct or absent; the percentage number of spores of these three categories differs one population from another. Some specimens therefore resemble *Boletus chrysenteron* very markedly regardless of the fact that the extremes in spore morphology are easily recognizable. From the anatomy of the fruit-body, particularly the structure and organisation of the pileus cuticle, it seems that both *B. porosporus* and *B. truncatus* are closely related to the *Boletus* (*Xerocomus*) *chrysenteron-subtomentosus* complex; Parrot's remarks (1965) are pertinent here.

I am unable to subscribe to the idea that by virtue of the presence of a germ-pore in the spore both these taxa are members of the genus *Boletellus.* It appears also to be quite illogical to place every bolete with ornamental basidiospores in the *Strobilomycetaceae*; *Boletellus* particularly seems to be just such a dumping ground. The family *Strobilomycetaceae* is hardly sufficiently different in developmental and anatomical details to be considered distinct from the *Boletaceae*. Much speculation has surrounded those boleti with spores possessing germ-pores, particularly now that Smith (1965) has described a further species.

In other groups of the *Basidiomycetes*, taxa with ornamented spores i.e. those with germ-pores, if this can ever logically be taken as ornamentation, and/or with surface markings, can be grouped on a fairly natural basis along with species lacking easily observable structural modifications. Thus in the genus *Conocybe* (*Bolbitiaceae*) typical members have smooth basidiospores with a large central germ-pore but those placed in the subgenus *Ochromarasmius*, of which *C. laricina* is a European representative, have finely to distinctly asperulate spores with an indistinct fairly specialised germ-pore. In *Galerina* (*Cortinariaceae*) also, one only has to examine Smith & Singer's latest monograph (1964) to see that the spore typical of members of this genus lacks a germ-pore and is slightly to distinctly rugulose; nevertheless some *Galerina* species have smooth spores and others porate spores. Many other examples can be given taken from a wide range of agaric genera such as *Mycena*, *Coprinus* etc.

Basidiospores of *Porphyrellus amylosporus*, of which type material has been examined, possess a germ-pore; they are also 'wood-brown' (Ridgway) coloured in mass. Spore-print colour still has great importance in the classification of the agarics and boletes and a spore-print colour of this shade indicated to the original author that the taxon was a species of *Porphyrellus* and acted as a bridge to *Xerocomus* through the less related *Boletus porosporus* and *B. truncatus* both of which possess an olive coloured spore-print. Herbarium material however of *P. amylosporus* is strongly similar to both the last species, particularly in hymenial characters and a re-assessment of the original placing may be necessary in the future.

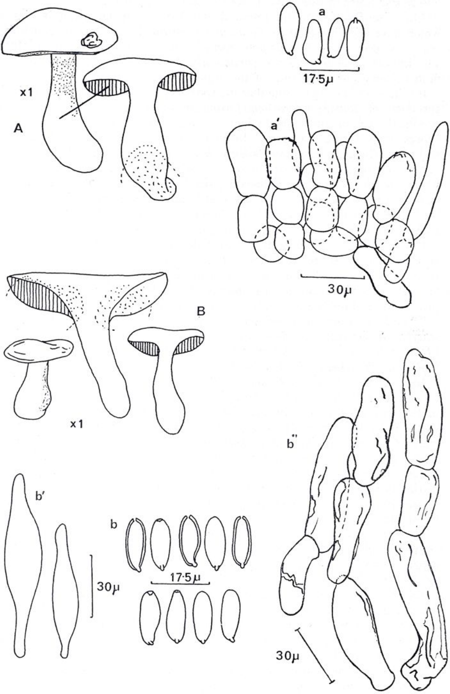

FIG. 1. A–a′ *Boletus pruinatus*, Watling 2715C: A, habit sketch; a, basidiospores; a′, section of pileus 'cuticle'. B–b″ *Boletus porosporus* Watling 713C: B, habit sketch; b, basidiospores; b′, pleurocystidia; b″, components of the trichoderm.

Hora (1960) mentions that the spores of collections of what he considered typical *Lepiota rhacodes* lack a germ-pore. This is contrary to other authors who consider it typical of *Macrolepiota*, a genus characterised by its members having spores with broad germ-pores. He doubts whether a fungus can exist in two forms one with and one without a germ-pore in the spore; even though they may turn out not to be the same taxon they are obviously closely enough related to support the suggestion that the character of the germ-pore must not be used indiscriminately throughout all the agaric groups. H. V. Smith (pers. comm.) and Thiers (pers. comm.) have independently or through students found a similar phenomenon in other *Lepiota* spp.

The genus *Boletellus* was erected by Murrill (1909); the type species of the genus is *Boletellus ananus* (Curt.) Murrill which has finely grooved spores. Murrill emphasised that the characters of his new genus were the pileus texture, the veil and the lignicolous habit i.e. not the ornamented spores; in fact he described them as smooth. After seeing herbarium material from widely separated countries, which has been assigned to the genus *Boletellus* as now understood, one can only conclude the genus is a very mixed taxon. This has been confirmed by the examination of fresh material of boletes currently placed in the genus; Coker & Beer's (1943) remarks in the discussion under *Boletus ananus* are very pertinent to the argument above.

The complete structure of the carpophore must always be taken into consideration when relating species, one should not rely entirely on a single character such as ornamentation of the basidiospore. There is every likelihood that electron microscope studies will assist in the future in a fuller understanding of the spore ornamentation and whether the infra-structure of the germ-pore is always homologous; after all Heim (1931), Singer (1951) etc. differentiate between germ-pore and callus but is this even too simple?

**Boletus pruinatus** Fr. & Hök in Boleti, Fungorum generis 1835. Diss. acad. Uppsala, 5. Fig. 1, A, a and a′.

In October 1949 the late A. A. Pearson collected what he called *Boletus pruinatus* growing in a troop under beech at Henley Hill, Sussex. Four years later he published a full macroscopic description (1952). Whilst on the autumn foray of the Edinburgh Natural History Society during August 1966 a single carpophore (*Watling* 2715C) of what could be assigned to the same taxon was collected growing under the shade cast by a mixture of frondose trees. Although being slightly smaller in over-all dimensions it agreed in every way with the Sussex material. Through the kindness of Dr. R. W. G. Dennis, Royal Botanic Gardens, Kew, I have examined Pearson's field notebook in which there is a description of the Henley collection accompanied by a painting; the likeness to our specimen is great. Orton passed on to me a duplicate of this painting and it has been compared directly with the specimen, and, just as Pearson's material, our collection differed from Fries' original description only in that the flesh was chrome yellow.

Little needs to be added to Pearson's account of the macroscopic features but it is of interest to note that the hoary bloom on the pileus is more prominent towards the margin, where the slightly incurved edge of the pileus is of a distinct purplish apricot colour; the bloom is rapidly lost with handling.

Where eaten by slugs the flesh exposed is rose or apricot, or darker red (blood red) if the marks have only just scratched the surface. The stipe is very pale tawny to tawny buff, yellow at apex, irregularly but minutely channelled and ornamented with very fine, not densely distributed, purple red punctae about the centre; the base which passes into an apricot coloured mycelium is more red and tardily blues on handling. The flesh similarly changes blue-green but takes up to half an hour to go to completion; it immediately greens on the application of Melzer's solution. Ammoniacal solutions on the pileus surface give no distinct colour change.

Microscopically the following details can be noted. The surface of the pileus is not truly hymeniform, although in section it at first appears to be composed of a palisade of sack-shaped cells. These cells are in fact the end-cells of chains of short, broad cells which form a trichoderm. The end-cells slightly disarticulate and like some of the penultimate ones are finally encrusted in places and brownish in colour when mounted in ammoniacal solutions. The pileus trama is composed of interwoven hyphae 7–11μ broad which are pale yellow in Melzer's solution and intermixed with similarly shaped cells, staining dark golden under the same conditions. When a shaving of the trama of the pileus, stipe or tubes is mounted in Melzer's solution a bluish olive colouration is observed which soon fades i.e. a fleeting reaction as noted in various boletes by Smith (1965), and unpublished observations by the author. Further extensive work on chemical colour reactions similar to that noted above are required; however the changes recorded assist in separating this species from *Boletus chrysenteron* and its allies.

The hymenophoral trama approaches that of the *Phylloporus* subtype being composed of hyaline, non-gelatinised, non-clamped hyphae 6–7μ broad. Basidia 4-spored, 30–35 × 10–12μ, hyaline in ammoniacal solutions. Prominent cheilocystidia and pleurocystidia appear to be lacking.

The basidiospores are characteristically boletoid in shape. Although Pearson states them to be 15 × 7μ in the Sussex material, the spores of the Edinburgh specimen gave a range of 11·5–14 × 4·5–5·5μ. A width of 7μ if constant would be a unique spore width for a member of the *Boletus chrysenteron—B. versicolor* complex and certainly assist in recognizing the taxon in future. However, examination of Pearson's material deposited at Kew show the spores in two separate mounts to be:

i) 12–14 × 4·5–5·5μ, only one spore over 14μ seen amongst hundreds
ii) 12–14 × 4·5–6μ, only 2 or 3 over 14·5μ amongst hundreds.

Comparing these ranges with similar measurements for *Boletus chrysenteron*, *B. versicolor* and *B. subtomentosus*, *B. pruinatus* as understood by Pearson appears to have only slightly longer and wider pores than other members of this perplexing group. It is probable that Pearson's measurements were those taken quickly on the first finding of the fungus and were therefore only a rough estimate; Pearson's work is usually extremely reliable. More collections of this fungus are required before a final judgement can be made on the distinction by spore size. The spores become similarly coloured to the hymenophoral trama on the application of Melzer's solution i.e. an olivaceous honey, and under the present system of mycological nomenclature of the iodine reactions the spores must be considered amyloid.

It is evident that in stature this fungus approaches *Boletus pulverulentus* and other boletes placed in *Tubiporus* Paulet by French authors. However the structure of the trama would support this fungus being placed in *Xerocomus*. Is this the *Boletus rubellus* pro parte of Singer (1951) and Moser (1953) for the bluing with Melzer's solution certainly suggests affinities to *Boletus* as the genus is emended by Singer? Whatever the result of this and similar discussions the Edinburgh collections supports Pearson's statement (1952) "It is certainly distinct from either *B. chrysenteron* or *versicolor*".

What the correct name should be is a perplexing problem for both the collections noted above are characterised by chrome yellow flesh, something not mentioned in the original description. It may be that a new taxon should be described to avoid confusion but this cannot be carried out on simply two British collections particularly in a group of boletes where chaos already exists and several epithets are available for careful consideration; one only has to look at the innumerable synonyms for *Boletus rubellus* to see where the hiding place of the present fungus may be! A North American taxon which approaches our material is *Boletus zelleri*; it is very close in stature and coloration and even certain anatomical details but it also lacks the richly coloured flesh. It is considered desirable to study more fungi of this group carefully before either a new name is given or another old name is resurrected; the name proposed by Pearson is therefore retained pending more critical studies.

**Leccinum** species.

As predicted (Watling, 1961) *Leccinum aurantiacum* has now been recorded both from the South of England and from Ireland (Reid, 1965). To this list can be added the record of a single carpophore from Rannoch, Perthshire, growing under *Populus tremula*. After examining carpophores of fresh and dried collections from all over the United States, Canada and Western Europe it is clear that the pigmentation in the cuticle of this species does not fully develop in the absence of direct sunlight. When the cuticular hyphae of the pileus are mounted in Melzer's solution the same pigment tends to form red brown globules or a single globule giving the hyphal cells the appearance of primitive polysporus or monosporus asci; this is in marked contrast to *L. testaceoscabrum* where the pigment develops normally under all conditions and does not react so with Melzer's solution. These observations further support the hypothesis that *L. percandidum* is an autonomous species for its pale colour remains unchanged even when in full sunlight (Watling 193C previously reported (1960), and material from Linn of Dee, Aberdeenshire, 17 vii 1964, Watling 955C); it may even turn out that these two collections represent a distinct taxon very close to *L. percandidum* differing in anatomical details. In some carpophores of this species (Watling 193C) at full maturity, the pileus becomes very slightly pinkish brown maculate as in *Collybia maculata*. The hyphae of the pileus cuticle in *L. testaceoscabrum* is much brighter when mounted in aqueous alkali solutions than similar hyphae of *L. aurantiacum*.

Flesh characters in *L. aurantiacum* appear to be far more variable than in *L. testaceoscabrum* unless we are dealing as might be the case with two or more distinct forms; some years ago (Watling, 1961) in a field key proposed for the identification of these boleti and related fungi flesh characters of the last species were taken from fresh material whilst those of *L. aurantiacum* were taken from field notes accompanying specimens collected by friends living in Europe and not from Kühner & Romagnesi's text. Hence the variance with these latter authors as noted by Reid (1965). It was decided in this same key for the time being to leave out of the specific description of *L. aurantiacum* the 'form' with the reddening flesh because it appeared then to be characteristic of a southern and eastern European element; it has been called *Boletus sanguinescens* by Velenovsky (1920) and more recently *L. aurantiacum* var. *sanguinescens* by Hlavacek (1958). The taxon was based originally on a collection bought at the Prague market (see Pilat 1962) and so no field data is available with any certainty but similarly colouring fruit-bodies may be found occasionally in this country (Reid, 1965). That a complex of taxa occurs in this country is now very evident; indeed E. E. Green (pers. comm.) who is carrying out interesting bolete studies in the Windsor area, indicates that many of his collections of *L. aurantiacum* occur under *Quercus*. I have personally collected an anomalous *L. aurantiacum* under *Quercus* at Dinnet, Aberdeenshire, indicating the problem is still far from clear and further careful observations are required.*

The question of colour changes in the boletes must be critically assessed for in some species if the flesh turns blue it is of the utmost importance e.g. *Boletus* sect. *Luridi*, whereas in others little attention is paid to the phenomenon. But does the bluing in all groups necessarily have the same significance? Field observations and chemical evidence now becoming available support the fact that several chemical substrates are involved in the bluing and/or greening of the flesh in members of the *Boletaceae* and this will be discussed in a forthcoming paper. However, it can be noted that a gallic aldehyde-caffeic acid series and a pulvinic acid-lactone series (pers. comm. R. Edwards and Edwards, 1967) have been recognized apart from the so much quoted anthraquinone reactions (Ramsbottom, 1953).

The most important field characters to separate *L. aurantiacum* and *L. testaceoscabrum* are the white stipe scales which change to orange brown, red brown and brownish buff on maturity as opposed to commencing black or dark brown, the immature pores being white gradually changing buff to dirty white coloured in contrast to their being distinctly coloured from the very beginning and the slightly buff, pallid to dirty white coloured, as opposed to silvery white, flesh.

Donk (1962) has already commented, from the nomenclatural standpoint, on the validity of Secretan's epithet *testaceoscabrum* for the common West European member of the *L. aurantiacum* group growing under birch. A paper in preparation will cover the correctness of the use of *L. testaceoscabrum*, that of *L. aurantiacum* and *L. carpini* from ecological and taxonomic points of view; the last species is a fungus whose name has caused much confusion

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* A collection in the Hooker Herbarium of a fungus recorded as common in the Highlands and now deposited at Kew under the name *Boletus scaber* is most certainly of this group. Although the preserved specimens are of *Leccinum testaceoscabrum* notes on the packet indicate a much broader concept; they are as follows:—

1. Pileo fulvo squamulis stipitis albus
2. Pileo subrufo squamulis nigris

This indicates that *L. testaceoscabrum*, *L. aurantiacum* and related taxa were all probably included under *Boletus scaber* in many early works. Classic Icones also indicate utter confusion in this group of boletes.

over the years. The differences which exist between the published microscopic details of the cuticular hyphae of these three boletes will, there is no doubt, be reconcilable after carpophores at all stages of development have been examined and the various taxa clearly recognized. Careful observations however show that the cuticular structure of the boletes in general is very important taxonomically as has been hinted at by the work of Yates (1916) and utilised by Vassilkov (1956).* This has been placed on a more fundamental basis recently by Smith, Thiers & Watling (1966) but changes in these structures also occur as the carpophores mature and must always be taken into consideration; the changes include gelatinization as in the *L. scabrum* group, disarticulation of elements as in the *L. oxydabile* group and deposition of granular material on the hyphae as in the *L. insigne* group.

During the 3rd European Mycological Congress two boletes belonging to the genus *Leccinum* previously unrecorded for the British Isles were collected, one at Rannoch, Perthshire and the other during the Post Congress excursion to Loch Maree. The latter has been met with before; both collections were in very good condition and allowed critical notes to be taken. These records draw attention to the fact that the bolete flora of the British Isles is by no means exhausted and further careful collecting is advocated.

**Leccinum oxydabile** (Singer) Singer in Schweiz. Zeitschr. Pilzk. 16: 136 (1938). Fig. 2 A, a, a′ and a″.

*Pileus* 90 mm, convex then slightly flattened, dry, buff to biscuit coloured or crust brown except for slightly darker ochraceous mosaiced disc, very minutely tomentose to smooth but irregularly mosaiced with small scales which are never greater than 0·75 mm and produced by the separation of cuticular elements; *margin* slightly overhanging tubes but not forming a 'skirt' raised into minute dark ridges so forming very small fibrillose scales only observable under a lens. *Stipe* 60 × 25(–30) mm, pallid slightly swollen towards the base (up to 30 mm), apex ornamented with high ridges covered in small, pale brown scales which gradually grade into darker, larger scales about mid-way, ridges gradually lost towards base being replaced by black floccose scales with radiating dark fibrils. *Flesh* firm, hard when fresh, white in both pileus and stipe but slightly changing pink, especially under the cuticle and stipe apex and flushing pale yellow green near the stipe base but not blue green in cortex; pink with formalin in both stipe and pileus, stronger coloured in the latter, yellow with NaOH but not with NH4OH, grey then green (bluish) with FeSO4; taste and odour not distinct, mild and pleasant. *Tubes* ventricose, about 10 mm deep, depressed about the stipe, white becoming pallid buff; *pores* minute, white then pale ochraceous, darker ochraceous on bruising. *Basidiospores* (17–)18–19 × (5·5–)6–6·5(–7)μ, smooth, in face view bluntly fusoid, distinctly swollen about centre and rapidly tapered towards the end which is slightly but distinctly flattened in profile, elongate-inequilateral, suprahilar depression distinct, pale dingy ochraceous in water and Melzer's solution, slightly darker in KOH. *Basidia*

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* My thanks to B. P. Vassilkov are here recorded for his help, encouragement and learned discussion on boleti particularly those taxa pertaining to this group. I am also grateful to him for arranging type material of *Boletus percandidus* Vassilkov and authenticated material of *Krombholzia oxydabile* Singer to be sent on loan.

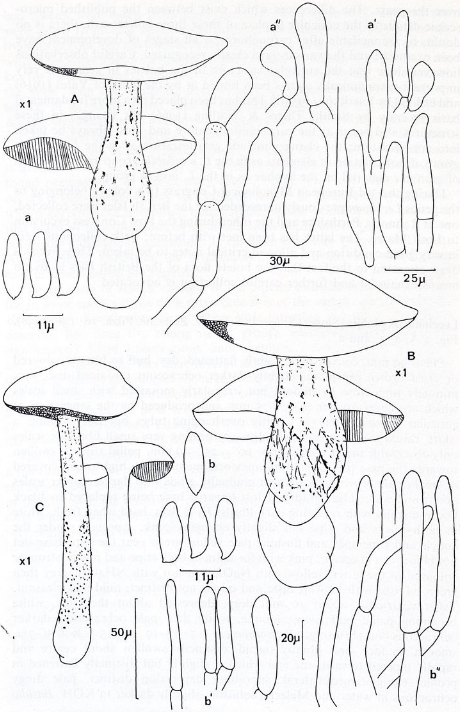

FIG. 2. A–a″ *Leccinum oxydabile*: A, habit sketch; a, basidiospores; a′, caulocystidia, a″, elements of the pileus trichoderm. B–b″ *L. roseofractum*: B, habit sketch; b, basidiospores; b′, caulocystidia; b″, elements of the pileus trichoderm. C, habit sketch of *L. scabrum*.

18–20 × 13–14μ, 4-spored, hyaline to only slightly coloured in KOH and Melzer's solution. *Pleurocystidia* scattered, infrequent, fusoid-ventricose with apical elongation, hyaline in KOH; *cheilocystidia* similar. *Caulohymenium* consisting of fascicles of caulocystidia, which are fusoid-ventricose with ± elongate neck and up to 70μ long × 15μ. *Pileus trichoderm* of ± disarticulating hyphae up to 17·5μ in diam., some hyaline, others ochraceous, smooth, constituent cells more or less inflated, end-cells clavate to elongate ellipsoid, less frequently subglobose or penultimate cells swollen, never forming an epithelium. *Pileus trama* of loosely interwoven, swollen hyphae coloured very little in Melzer's solution.

Under *Picea*, Rannoch School, Perthshire, 4 ix 1963, *Watling* 4946 (Scrub *Betula* was close by and could well have been the mycorrhizal associate).

P. D. Orton (pers. comm.) reports that he has also seen what is probably this same species in the locality noted above. This species is distinguished from *L. scabrum*, of which Vassilkov (1956) considers it only a form, primarily by the structure of the pileus trichoderm. There is little doubt the presence of inflated cells in the pileus trichoderm favours the splitting of the 'cuticle' into small frusta; this is seen to a greater extent in *L. carpini*, *Agrocybe* spp. and *Dermoloma* spp. where the pileus 'cuticle' is composed of more distinctly swollen cells. The material described above agrees in essential details with a specimen in the Komarov Bot. Institute (LE) identified by Singer as *Krombholzia oxydabilis*.

**Leccinum roseofractum** Watling **sp. nov.** Fig. 2, B, b, b′ and b″.

*Pileus* 115 mm latus, convexus late umbonatus, siccus demum subviscidus, fuscus, *Stipes* 60 mm longus/25 mm crassus, deorsum incrassatus (30 mm) ad apicem griseo-scabrosus et ad basim umbrino-scabrsous. *Contextus* albidus tactu incarnato-rubescens. *Tubuli* ventricosi albidi demum tactu ligni-brunnei; pori albidi tactu sordide ochracei. *Basidiosporae* 15·5–17·5(–18) × 5–5·5(–6)μ. Typus: *Watling* 4944 (E).

*Pileus* up to 115 mm, convex slightly expanding, dark umber to vandyke brown, paler to disc but then ochraceous, greasy then dry and splitting at disc into small scales; *margin* not overhanging as distinct appendiculate veil. *Stipe* 80 × 25 (40 at base) mm, white with dark grey scales which are pale and discreet at the apex but gradually become dark and more dense towards the centre and from there to the base fusing to form a distinct although irregular network of diamonds, brownish black scales at very base, lower third quite floccose with caulohymenial elements. *Flesh* pure white turning immediately reddish then sallow and slightly tinted greyish and violaceous but only slowly so; greyish with $FeSO4$, taste and odour not distinct. *Tubes* white becoming pallid and slightly flushed wood brown or ochraceous; *pores* similarly coloured but becoming more ochraceous on bruising.

*Basidiospores* 15·5–17·5(–18) × 5–5·5(–6)μ, smooth, in face view bluntly fusoid, in profile elongate-inequilateral, suprahilar depression shallow but distinct, pale dingy ochraceous in water and Melzer's solution, slightly darker in KOH and with a pale apical spot. *Basidia* 4-spored, hyaline to slightly coloured in KOH and Melzer's solution. *Pleurocystidia* scattered, fusoid ventricose, hyaline to slightly coloured in KOH with an apical prolongation; cheilocystidia similar. *Caulohymenium* consisting of fascicles of caulocystidia which are up to 35(−55)μ long × 3·5–7·5μ, clavate to fusiform. *Pileus trichoderm* of elongate hyphae, 58–70μ long × 5–8·5μ broad, smooth, dirty sepia in KOH and Melzer's solution, constricted at the septa but rarely disarticulating. *Pileus trama* rich red brown in Melzer's solution; subcutis hardly differentiated from the pileus trama, except for being more closely packed and thus less easily stained in Melzer's solution.

Under *Betula verrucosa*, Loch Maree, Ross and Cromarty, 12 ix 1963, *Watling* 4944 (Typus E).

Distinguished from *L. scabrum*, see Fig. 2C, by the more robust habit, dark coloured pileus and flesh changing distinctly red.

Although there are small discrepancies in habitat, there is little doubt that this is the same taxon as described by Vassilkov (1956) and originally mentioned by Singer (1942) as *Krombholzia scabrum* f. *roseofracta* and *K. scabrum* subsp. *roseofracta* respectively; on neither of these occasions was a latin description given nor type material cited. The species concept outlined in Smith, Thiers & Watling has been adopted and thus necessitates the erection of a new species. It differs from *L. scabrum* not only in the reddening flesh but the dark colour of the pileus, the dense black ornamentation towards the base of the stipe, and the stature; it must be pointed out however that some collections of typical *L. scabrum* may flush slightly pink under favourable conditions.

## POSTSCRIPT

Attention is drawn to a paper by Horak which has now been published (Ber. Schw. Bot. Gesellsch. 77, 367 dated Dec. 1967) yet only recently distributed. This article covers some of the points concerning *Boletochaete* which have been hinted at in the paper above and the conclusions drawn agree with our results obtained from the examination of collections not consulted by Horak.

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