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HYDNACEOUS FUNGI OF THE EASTERN OLD WORLD

R. A. MAAS GEESTERANUS

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PREFACE

The present work is a revision of a selection of hydneous Basidiomycetes of the Asiatic-Australian region. It embraces most, but not all, pileate Hydnums, and includes the stipitate species, but contains also some forms that are not stipitate. It is far from complete, and probably cannot be for a long time. I have not scoured all herbaria in search of possible specimens, have thus far neglected the collections of the "Laboratoire de Cryptogamie" at Paris, have been unsuccessful in tracking down certain references which might yield records from the area under consideration and, finally, have failed to give a satisfactory answer to several problems posed by the material. Despite its shortcomings, however, there is probably little to be gained by postponing its publication. This paper should be seen as a preliminary guide, to be followed by further exploration in the field and more extensive studies in the laboratory and herbarium. It may be added, however, that the exploration should follow with as little delay as possible, for soon there will be no forests left to furnish the Hydnums for study.

It may be recalled that Hydnum in its broad sense is a name formerly given to any fungus with an aculeate hymenophore. Although it is universally recognized nowadays that fungi so constructed do not form a homogeneous group, the name Hydnum or hydneous fungus is nevertheless retained as a useful term familiar to taxonomist and collector alike.

A mere glance at the various hydneous genera listed by DONK (1964: 272-273) is sufficient explanation why at present a revision of all the diverse taxa and for so large an area is an impracticable undertaking. This task simply must be split up into smaller parts. The part I chose for myself is shaped after the conventional example of COKER & BEERS' work (1951), augmented with such genera of which the inclusion presented no serious difficulties.

I fully realize, however, that many pitfalls lie in wait for the beginner who hopefully and unsuspectingly tries to identify what he considers to be a hydneous fungus. Leaving aside the (probably slight) possibility of the expectant mycologist having found a spine-bearing heterobasidiomycetous fungus, there is a good chance that many a specimen is referable to some polyporeous species—often "*Irpex*" *flavus*. I must warn him, for hydneoid Polypores are not dealt with in this work. I am not at all conversant with Polypores and not bold enough to include the hydneoid or irpicoid forms in my key on the evidence of a description made by someone else. Besides, if I should include such forms, I could hardly bar the way to several more hydneoid Corticiaceae, to the hydneoid genus *Gyrodontium* (Coniophoraceae), and to some irpicoid Stereaceae. The reader, I am

afraid, will have to learn by trial and error whether his fungus belongs to a genus treated in this paper.

The reader no doubt will be surprised and disappointed to find that in *Steccherinum* no more than two species are dealt with. The reason is that this genus is long in need of monographic treatment. Some initial work has already been done, but I expect that I shall need a few more years for the completion of this revision. Thus far distinction of the species in *Steccherinum* depended on characters of which the value had not been investigated systematically. It would seem moreover that morphological characters alone may not suffice to prove or disprove relationships.

I am indebted to several persons and institutions for the help extended in the preparation of this paper. It virtually rests on two very important collections—Professor E. J. H. Corner's Hydnums, presented to the Rijks-herbarium, and Lloyd's Herbarium, lent by the Director of the National Fungus Collections (BPI). I gratefully acknowledge their generous contribution. Several of the coloured illustrations in this paper have been reproduced from paintings executed by Prof. Corner (in his possession) and Mrs. G. Stevenson Cone, Roxburgh, New Zealand (preserved at Kew). Special thanks are due to them for their kind permission. I am also grateful to the Director of the Herbarium, Kew, for his consent to borrow Mrs. Cone's water-colours. I am under obligation to Dr. S. Ahmad, Lahore, Dr. and Mrs. A. B. Cribb, Brisbane, Dr. E. Horak, Birmensdorf, Prof. Dr. J. A. Nannfeldt, Uppsala, Mr. J. H. Willis, South Yarra, Melbourne, and to the Directors and Keepers of the herbaria at Auckland (PDD), Bogor (BO), Ithaca (CUP), Kew (K), Manila (PNH), and München (M) for material, either lent or presented, as well as for information.

Some of the species treated in this paper are part of a mycological collection made by the author and Dr. C. Bas in NW India in 1964. Financial aid for this expedition was received from the "Netherlands Organization for the Advancement of Pure Research (Z.W.O.)."

GENERAL PART

THE AREA AND ITS NAME

As shown in the map below, the countries under discussion occupy an area roughly the shape of an inverted triangle with bulging sides (Fig. 1). They are West Pakistan, Jammu & Kashmir, India, Tibet, Nepal, Sikkim, East Pakistan, China, Japan, Ceylon, Thailand, "Indochina", Philippines, Sumatra, Malay Peninsula, Borneo, Java, New Guinea, Solomon Islands, Australia, New Caledonia, Tasmania, New Zealand, and the Samoa Islands.

I hasten to admit the inconsistency in this list, the inequality of its elements, since names like Borneo and New Guinea, which are geographical denominations, seem ill-placed among those of nations whose boundaries are of a political nature. The logical remedy would be to assign the politically different parts of the offending islands to their respective nations, but I doubt whether the resulting arrangement would be really convenient.

In botanical literature the denotation Australasia is often encountered, but cannot be used in this case. Australasia was confined by FERGUSON (1970: 5) within the following limits: "The area covered includes Australia, New Zealand, New Guinea, the Pacific islands west of 135° W to 105° E and northwards to the Tropic of Cancer i.e. including Micronesia, the Hawaiian Islands and Easter Island but excluding the Galapagos, San Fernandes and the islands of the east coast of Asia."

Clearly, the term in Ferguson's sense is meant to cover an area largely without Japan and the Asian continent, but it is well known that other authors, e.g. Dockrill (1967), restrict the term so far as to include only Australia and New Zealand.

Another name sometimes seen is Indo-Australia, but this is equally unsuitable as it excludes Japan. The possibility was then considered of introducing the name Asiaustralia, thereby indicating the geobotanical equality of the two components, but the idea was abandoned as the name seemed likely to create confusion, and somehow looked ungainly.

The name The Orient, as used in The Times Atlas (edit. BARTHOLOMEW, 1958: pl. 9), corresponds quite well with the area demarcated in the present paper, and certainly offers the advantage of an unambiguous denomination not being encumbered with geobotanical notions. The objection that could be raised, however, (if it is really an objection) is that on account of its historical roots and implications the name will always be in danger of being misunderstood.

Perhaps there is not a single completely satisfactory name, so it is not without some apprehension that the area under consideration is here finally indicated as The eastern Old World.

It may be asked whether the area is not too large really to be captured

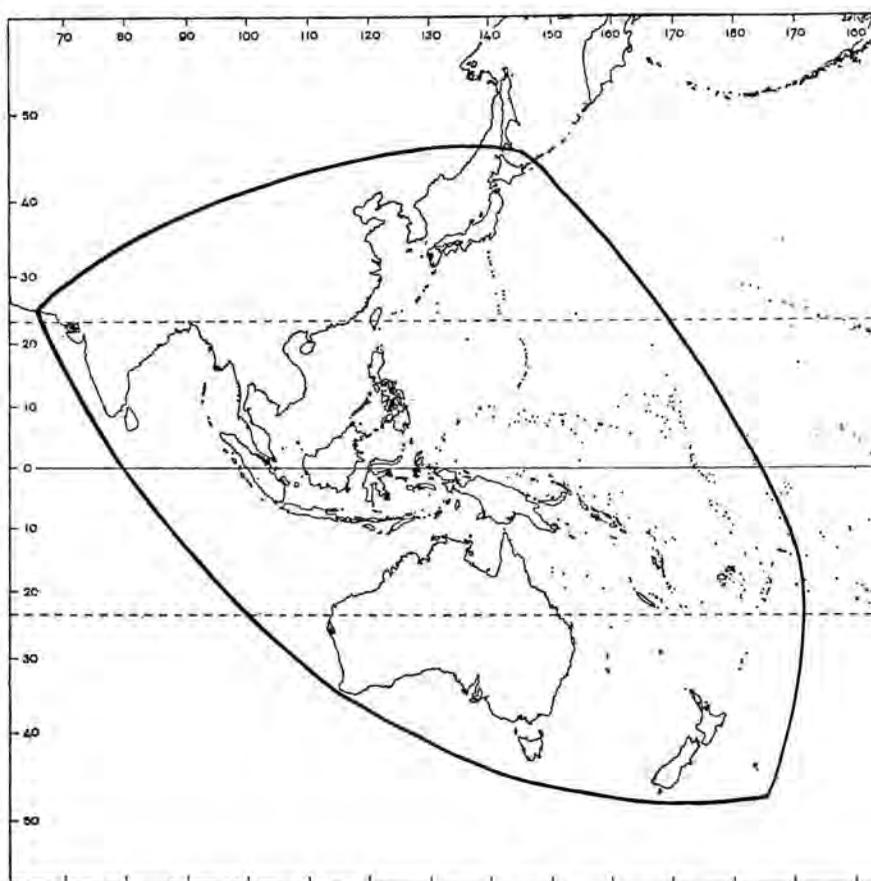


Fig. 1. The eastern Old World.

under one heading. The answer to this is that in the present stage of our knowledge of the Hydnums the exclusion of any country within the area would be felt as an undesirable omission. Thus far so little is known of the Hydnum flora of each country separately that, however great their physical, climatic, and vegetational differences, for the present these countries are best lumped together. A factor of considerable weight, moreover, is the realization that to see the material of a vast extra-European area is a healthy experience that does not fail to broaden one's views.

MATERIAL AND METHODS

The great majority of the material investigated consists of dried specimens. Professor Corner often took care also to preserve some fragments in liquid (25 % aethanol, 4 % formalin), but, given the choice between dried and wet, I always preferred the former. First, colour and texture of the dried specimen provide clues not to be dismissed. Secondly, some of the chemical reactions cannot be carried out in pickled material. Thirdly, no

matter how carefully the preparations are made, the quality of the hyphae taken from material preserved in liquid usually proved inferior to that of the hyphae of well dried specimens. Of course, badly dried material offers a problem in itself, but it is nearly always possible to extract at least some information.

The method here used to gain an insight in the hyphal make-up has remained unaltered since I first began studying the structure of Hydnum (MAAS GEESTERANUS, 1962) and is based on the procedure elaborated by CORNER (1932). An undamaged part of the margin of the pileus is selected, preferably a portion that was in full growth when the specimen was collected. A fairly thick radial section of the tissue is cut and removed, gently heated in a dilute alkaline solution (KOH 8 %), rinsed in tap water, stained in 1 % ammoniac Congo red solution, rinsed, frayed out with needles, and mounted in slightly alkaline water. Sealing of the edges of the cover glass with glycerol prevents evaporation of the water. Preparations so treated require less precautions than permanent mounts, are quickly made, and remain unchanged for at least several days. It is advisable to study the context of the pileus at several points starting at the margin and proceeding to the centre in order to see what changes the hyphae undergo. The same procedure is followed when investigating the hymenium and the context of the spines. The trouble with spines, however, is that often considerably more manipulation is required before a satisfactory mount is obtained.

Principally two mountants have been used in the study of the spores, Melzer's solution and lactophenol-methylblue.

Melzer's reagent must be used in all cases of white-spored species since it will answer the diagnostically important question whether the spore-wall is amyloid or not. It is besides a very convenient medium that because of its viscosity reduces spore-movement.

The use of lactophenol-methylblue¹⁾ is required to demonstrate the cyanophilous character of the spore-wall. The term cyanophily was coined by KOTLABA & POUZAR who, working with what they called cotton blue, published an account of the procedure and their results (1964: 131-142).

Although I do not underestimate the value of this reagent for taxonomic purposes, I would like to point out that the measure of bluing of the spore-wall, deciding whether the spore is to be called cyanophilous or not, seems to be subject to considerable variation. There can be no difference of opinion about the cyanophily of the spores in Gomphaceae, but some words must be said in connection with the reaction of various other species mentioned by Kotlaba & Pouzar. These authors found that either the spore-wall or the ornamentation is acyanophilous in *Bondarzewia* (1964: 133) and in non-polyporaceous Aphyllophorales like Corti-

¹⁾ The recipe for the preparation of this colorant is essentially the same as Mme LE GAL'S (1947: 79), but instead of her "bleu-coton C⁴B", "Bleu de Méthyle, Produits R.A.L." of the "Etablissements Kuhlmann" is used.

ciaceae, *Clavaria argillacea*, and *Clavulinopsis helvola* (op. cit.: 137). However, I am very positive in my observation that the spores of the two last-named species do become stained, albeit weakly, while *Bondarzewia montana* and *Cristella fastidiosa* (one of the Corticiaceae here chosen at random) show a very marked cyanophily. The different intensity with which the spores of the species mentioned become stained in lactophenol-methylblue may be explained by differences in the thickness of the spore-wall, although precise data are not available. But the discrepancy between my results and those of the Czechoslovak authors strongly suggests that the staining capacity very much depends on the make of the colorant used. A firm support of this view is, in my eyes, the comparative table published by GUÉGUEN (1905: 44-45).

If, as I think it is, the absorption of methylblue by the spore-wall is beset with complexities of which we do not know the significance, we should take care to use the term cyanophilous only in the most pronounced cases. In the case of *Bankera* and *Phellodon* for example, genera which DONK (1964: 246) did not state to have cyanophilous spores, the spore-ornamentation becomes fairly stained by methylblue, but I am very uncertain whether such spores should actually be rated as cyanophilous.

Spores are always measured without the apiculus and, except in the thelephoraceous genera *Hydnellum* and *Sarcodon*, always without the ornamentation. The size of a spore always refers to the length and breadth of the spore-body seen in side view. When taking measurements it is usually no problem to omit the apiculus, but the decision where to draw the line between apiculus and spore-body in *Hydnellum* and *Sarcodon* is often arbitrary. As a consequence the length of the spores in these two genera yields a more reliable character than the breadth.

In order better to see the ornamentation of all non-amyloid spores, the following technique has been used. One or two spines are gently heated in lactophenol-methylblue on a slide. All hymenial elements thus softened and stained are scraped off the central core of the spine, which is then removed. Before the cover glass is applied the rest is spread out to avoid concentration of tissue and spores. If the context of the spine is soft, spreading out of the hymenial elements may be effected by merely tapping the cover glass. Observation of the sporal ornamentation is greatly facilitated by using a light filter of complementary colour.

In general practice only two reagents have been used for identification purposes. Melzer's reagent stains the context in species of *Hericiium* blue and is thus important in cases of doubt. A KOH solution is the reagent par excellence for a sure recognition of *Hydnellum scrobiculatum* and its relatives. Members of this section are characterized by the possession of a chemical substance which makes a thin slice of the context, plunged in a drop of KOH, first turn deep violet, then olive. It is worth remembering, however, that the reaction is weak in young, uncoloured tissues of the pileus and often absent in the long dead context of the stipe.

It is realized, of course, that these two reagents are as crude a means to identification as those used in lichenology in the distant past. Lichenologists meanwhile have refined their methods, turned to microchemical tests, then to paper chromatography. A similar development is to be expected in mycology in the near future. It gives good promise that work on the chemical constituents in fungi is in full progress, as is shown by the following random list of references: GRIPENBERG (1956, 1958), SHIBATA & al. (1964), EULER & al. (1965), MONTFORT & al. (1966), and SULLIVAN & al. (1967). However, I suppose it is a long way from the specialized chemical investigation of 100–200 g of fresh material of a fungus to the foolproof routine test applied by the non-specialized herbarium mycologist to a precious specimen weighing a bare 2 g.

THE TERM BASIDIOME

In his thesis VAN BRUMMELEN (1967: 25) reintroduced Wallroth's term "ascoma" as "an unambiguous term for any sporocarp producing asci . . ." Wallroth, it may be pointed out here, regarded Ascomycetes and Basidiomycetes alike as asciferous. In analogy of this term for the Ascomycetes, DONK (1969: 666) and MAAS GEESTERANUS (1970: 27) used the term basidiome for the Basidiomycetes. It is realized, of course, that this is yet another addition to an already sizable list. In the English language alone an author can choose from as many as ten terms (basidiocarp, carpophore, fructification, fruitbody, fruiting body, hymenophore, plant, receptacle, sporocarp, sporophore), while he is also at liberty, of course, to avoid the use of any of these, which properly speaking counts as an eleventh possibility. The objection that can be raised to several of the terms, however, is that they either suggest a connection with a fruit (which the basidiome is not) or fail to tell what kind of spores they bear.

CYSTIDIA

In recent times cystidia in all their diversity have been given a great deal of attention, e.g. by ROMAGNESI (1944), SINGER (1951: 41–47), LENTZ (1954), DONK (1964: 229–233), REID (1965: 28–33), and DONK (1967: 48–50). Several authors proposed a progressively more detailed classification of cystidia and contributed new terms, but Lentz and Reid contented themselves with merely reviewing the literature, while the last-named showed himself reluctant to use any but the most conservative terms. In view of the remarkable polymorphism of the cystidia in some species of *Climacodon* and *Steccherinum*, even within a single specimen, I am inclined to adhere to Reid's example. I believe that certain genera or groups just do not lend themselves to a rigid classification of their organs. It is often not possible to draw a sharp line between empty and oil-filled thick-walled cystidia, between oil-filled thick-walled cystidia and thin-walled gloeocystidia, between gloeocystidia and gloeocystidial hyphae,

between gloeocystidial hyphae and generative hyphae. Realization that these various elements so to speak all lie on a continuum seems very much opposed to SINGER's definition of gloeocystidia in Agaricales (1962: 42); his concept does not obtain for the groups discussed in the present paper. The hyphae that form the tips of the spines in some collections of *Climacodon pulcherrimus* may serve as an example. These hyphae are densely filled with an oily matter which stains blue in cresyl blue, whereas the cell-walls remain pinkish. According to Singer's concept, this is the criterion which would determine these hyphae as true gloeocystidia and indicate that they form part of the gloeo-system. But some 200 μ farther back from the tip of the spine the oily contents have petered out, with the result that a metachromatic reaction is no longer visible. This observation would lead to the acceptance of a peripheral gloeo-system in *C. pulcherrimus* (as no doubt in many other Aphyllophorales more) and, ultimately, of a gloeo-system that is constantly moving away from its origin. From the above it is clear that Singer's characterization of gloeo-cystidia is completely unacceptable for a case like *Climacodon*. The probable explanation is that gloeo-cystidia in Agaricales and Aphyllophorales are incomparable structures.

No smell of fenugreek:	<i>Terenodon</i> ,	45
13. Spores smooth:	<i>Hydnum</i> ,	64
8. Basidia globose when young:	<i>Sistotrema</i> ,	42

AURISCALPIACEAE Maas G.

Auriscalpiaceae Maas G. *in* Proc. K. Ned. Akad. Wet. (Ser. C) 66: 426. 1963.
— TYPE: *Auriscalpium* S. F. Gray.

For synonymy, see MAAS GEESTERANUS (l.c.).

Basidiome effused or effused-reflexed or made up of a pileus with or without a stipe, tomentose to hispid, glabrescent with age or glabrous from the first. Hymenophore aculeate or lamellate, in the latter case the gills lacerate-dentate. Context tough to fairly soft, white to brownish, toward the upper surface of the pileus sometimes bounded by a black-brown line, amyloid or inamyloid, or entirely consisting of a dark brown tomentum, made up of generative and skeletal hyphae or the latter infrequent to absent. Basidia clavate, with basal clamp-connection, 4-spored. Spores subglobose to ellipsoid, minutely spinulose, verrucose or smooth, colourless, white in mass, amyloid. Gloeocystidia present.

On fallen pine-cones, wood, gramineous root-stocks, among moss.

Of the three genera primarily accepted in this family, only the two that possess spines (*Auriscalpium* and *Gloiodon*) are treated in the present paper; the third genus, *Lentinellus* P. Karst., is excluded because of its gills. A fourth genus, *Gloeodontia* Boid., recently erected (BOIDIN, 1966: 22) to accommodate *Irpex discolor* Berk. & Curt., is so far not known to be represented in the area under discussion.

AURISCALPIUM S. F. Gray

Auriscalpium S. F. Gray, Nat. Arrang. Brit. Pl. 1: 650. 1821; P. Karst. *in* Meddn Soc. Fauna Fl. fenn. 5: 41. 1879. — TYPE SPECIES: *Auriscalpium vulgare* S. F. Gray (see DONK, 1956: 71).

For further synonymy, see MAAS GEESTERANUS (1959: 115).

Basidiome pileate and stipitate. Pileus hairy to glabrous, cuticulate or not. Stipe hairy to glabrous, cuticulate or not, attached to the pileus subapically from a notch on the side of the latter, or excentrally to the back of the pileus, or centrally. Hymenium covering spines on the underside of the pileus. Spines brownish in various shades, acquiring a whitish bloom from the ripe spores. Context of the pileus not zoned, soft and spongy to coriaceous, white to brown, in some species covered by a tough blackish cuticle, imperfectly dimitic and made up of generative and skeletal-like hyphae or true skeletals, or monomitic. Generative hyphae more or less thin-walled, branched, with clamp-connections at all septa. Skeletals thick-walled to almost solid, sometimes branched and apparently forming transitions to generative hyphae. Oleiferous hyphae little apparent to numerous. Context of the spines made up of generative hyphae and skeletals or generative hyphae only. Basidia clavate, 4-spored, with basal clamp-connection. Spores subglobose to ellipsoid, minutely spinulose to verrucose or smooth, colourless, white in mass, amyloid. Gloeocystidia

numerous, their contents staining wine-red in sulpho-anisaldehyde or remaining unchanged.

On fallen pine-cones, wood, gramineous root-stocks or among moss.

KEY TO THE SPECIES

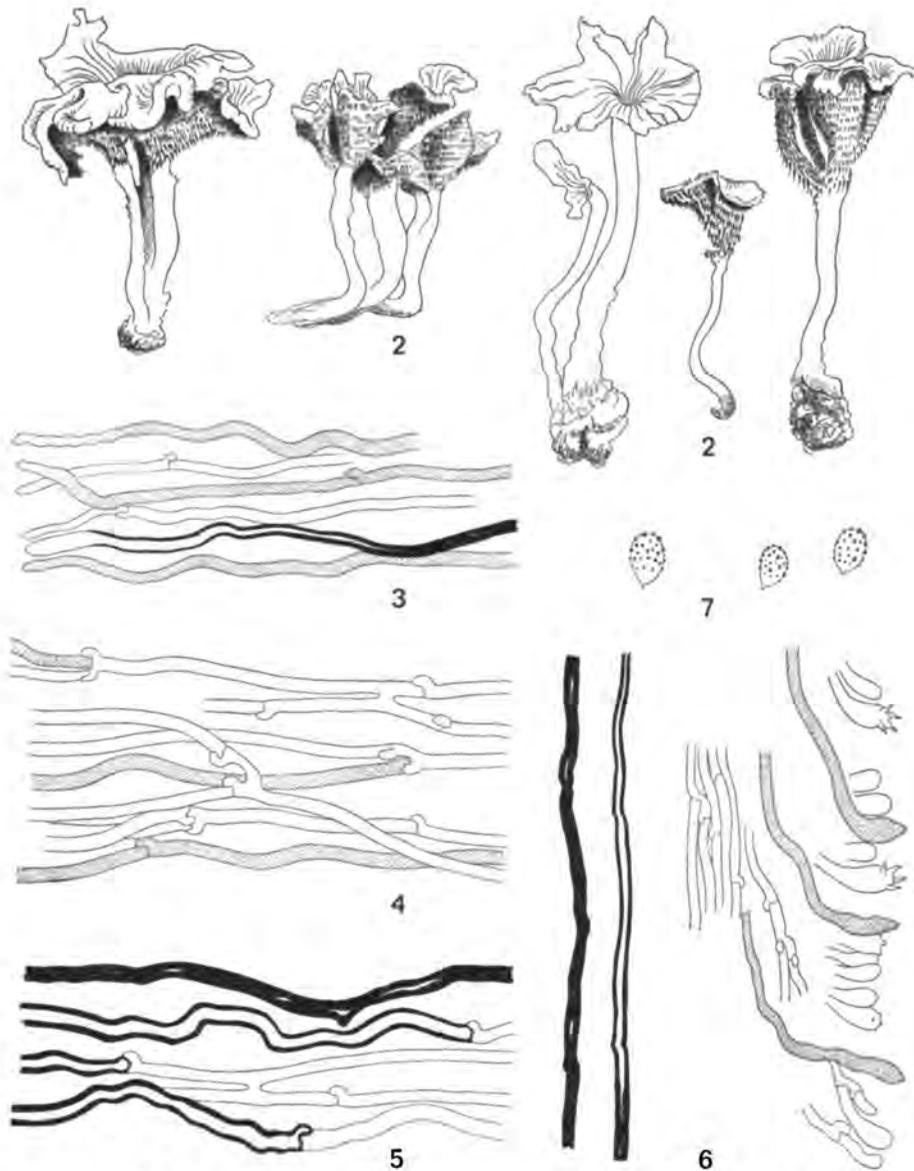
1. Context dimitic with skeletal. Generative hyphae not inflating. Spores up to 5.6μ long.
 2. Pileus umbilicate to cyathiform, sparingly pilose to glabrous:
 2. Pileus plano-convex, villose with a few scattered bristle-like hairs or densely hispid, glabrescent only in old age: *A. vulgare*
1. Context monomitic. Generative hyphae inflating. Spores $5.5-6.7(-7.2) \mu$ long:
 2. Pileus *A. umbella*

AURISCALPIUM FIMBRIATO-INCISUM (Teng) Maas G. — Figs. 2-7

Hydnum fimbriato-incisum Teng in Contrib. biol. Lab. Sci. Soc. China 8 (Bot. Ser. 1): 25. 1932. — *Auriscalpium fimbriato-incisum* (Teng) Maas G. in Proc. K. Ned. Akad. Wet. (Ser. C) 69: 28. 1966. — AUTHENTIC MATERIAL: "Ling-ku-Sze Woods, Nanking/May 24, 1933/S. C. Teng 943/Det. S. C. Teng" (BPI 1254); TYPE: Teng 944, not seen.

The material examined consists of several specimens which are either solitary or clustered, with the bases of the stipes united. In one of the specimens the upper half of the stipe is forked into several arms which together bear some partly confluent pilei. Pileus up to 15 mm across, simple and orbicular or complicated with the individual component parts spathulate to reniform, umbilicate to cyathiform, smooth or finely radially rugulose, not zoned, sparingly pilose to glabrous, dull to somewhat shiny, fulvous, in some specimens blackish brown in the centre, in others yellow-brown towards the margin; margin deeply lacinate or fringed. The pileus in some specimens has a horny appearance. Stipe $10-20 \times 0.5-1.5$ mm, cylindrical below, flattened above, laterally attached to the pileus or seemingly centrally through coalescence, straight to flexuous, either covered with hairs (plushy to hirsute) and yellowish brown, or glabrous and then black-brown, woolly-tomentose to matted towards the base. Spines up to 1 mm long, decurrent, crowded, subulate, brownish flesh colour, with a whitish bloom from the spores. Context of pileus up to about 0.5 mm thick, tough, pale brownish but with a conspicuous, black-brown cuticular zone under the entire upper surface and also at the under surface towards the stipe, not amyloid.

Context of the pileus dimitic, consisting of generative and skeletal hyphae. Generative hyphae $1.8-4 \mu$ wide, not inflating, thin-walled or with slightly thickened cell-walls, branched, septate, with a clamp-connection at the septa, infrequently anastomosing, particularly towards the margin producing side-branches filled with an oily matter. Skeletals $1.8-4.5 \mu$ wide, infrequently seen at the extreme margin (which may be accidental), but occurring in great abundance towards the centre of the pileus, straight to flexuous or kinked, thick-walled (cell-walls up to 2μ thick) to solid, with colourless to yellowish cell-walls in the interior of the context, with brownish cell-walls in the cuticular zone of the upper surface. Hairs of pileus and stipe predominantly or solely made up of skeletal hyphae. Context of the spines dimitic, made up of generative hyphae and



Figs. 2-7. *Auriscalpium fimbriato-incisum* (Teng 943). - 2. Habit sketch of several basidiomes. - 3. Detail of the extreme margin of the pileus, showing one skeletal and a number of generative hyphae, three of which are filled with oily matter. - 4. Generative hyphae at c. 350 μ distance from the margin, some filled with oily matter. - 5. Generative and skeletal hyphae 7 mm away from the margin. - 6. Detail of a spine, showing skeletals, subhymenial tissue, basidia, and gloeocystidia. - 7. Spores. (Fig. 2, $\times 2$; Figs. 3-6, $\times 700$; Fig. 7, $\times 1400$.)

skeletals. Generative hyphae 1.8–2.7 μ wide, thin-walled, branched, septate, with a clamp at the septa, producing outwardly gloeocystidial hyphae, characterized by oily contents that become strongly stained in sulpho-anisaldehyde and in Sudan Black. Skeletals 1.8–2.5 μ wide, confined to the axis of the spines, thick-walled to solid. Basidia 13.5–18 \times 5–6 μ , clavate, with a clamp at the base, 4-spored. Spores 4.4–5 \times 3–3.7 μ , ellipsoid-ovoid, minutely spinulose, colourless, strongly amyloid, with an oblique apiculus of somewhat less than 1 μ long. Gloeocystidia numerous, curved outwards at their tips, projecting slightly beyond the basidia, the apices 3.6–4.5 μ wide, more or less fusiform.

COLLECTION EXAMINED:

CHINA

Nanking, Ling-ku-Sze Woods, 24 May 1930, *S. C. Teng 943*, "on root-stocks of grass in ground" (BPI 1254).

***Auriscalpium umbella* Maas G., spec. nov. ²⁾**—Figs. 8–11, Pl. I fig. 4

Basidiomata solitaria. Pileus 15–35 mm diam., orbicularis, hemisphaericus vel applanatus, centro depressus vel umbilicatus, laevis usque ad radiatim rugulosus vel sulcatus, innato-fibrillosus, fere glaber, e ochraceo-brunneo fuscus, pallidior in sicco, margine lacerato atque in aculeos producto. Stipes 20–45 \times 2–3 mm, centralis, solidus vel cavus, flexuosus, aequalis, lanatus vel fibrillis fasciatis vel laxis obtectus, basi pilosus. Aculei usque ad 5 mm longi, haud decurrentes, plus minusve conferti, subulati, fulvi in vivo, griseo-albi in sicco. Caro homogenea, sordide crenea, brunnescens, in pileo mollis, in stipite cartilaginea; monomitica, e hyphis generatoriis oleiferisque formata. Hyphae generatoriae 6–12.5 μ latae, inflatae, tenuiter tunicatae, ramosae, anastomosantes, septatae, fibulatae. Hyphae oleiferae perlongae, an septatae? Basidia 27–34 \times 6–7 μ , clavata, fibulata, quadrispora. Sterigmata 5.4–7.2 μ longa. Sporae 5.5–6.7(–7.2) \times 4.9–5.6 μ , ellipsoideae vel obovoideae, crebre vel parce verrucosae vel laeves, incolores, amyloideae, apiculo obliquo usque ad 1 μ longo munitae. Gloeocystidia apice usque ad 5.5 μ lata, numerosa, parum e hymenio prolata, tenuiter tunicata.

HOLOTYPE: New Zealand, North Island, Wellington, Silverstream, 19 July 1949, *Mrs. G. Stevenson Cone 725* (K).

Basidiomes solitary. Pileus 15–35 mm across (fresh), orbicular, hemispherical to flattened, depressed to umbilicate, smooth to radiately rugulose or sulcate, innately fibrillose, almost glabrous, with occasional processes which might be interpreted as rudimentary spines, yellowish brown to dark brown, drying paler; the margin lacerated and running out into spines. Stipe 20–45 \times 2–3 mm (fresh), central, solid to stuffed or becoming hollow, flexuous, equal, woolly or covered with fibrillose tufts or loose fibrils, glabrescent, brown to dark brown, the base attached to mosses by a dense mass of long, wavy, pale brown strands. Spines up to 5 mm long (fresh), not decurrent, more or less crowded, subulate, fawn when fresh, grey-white when dried, but the brown colour showing through where bruised. Context of pileus and stipe homogeneous, yellowish fawn (fresh; dingy cream in the painting), becoming brown, fairly soft in the pileus, stated to be somewhat cartilaginous in the stipe.

Context of the pileus monomitic, consisting of generative and oleiferous hyphae. Generative hyphae 6–12.5 μ wide, inflating, thin-walled

²⁾ Etymology: *umbella*, a sunshade.

or with slightly thickened cell-walls, branched, anastomosing, septate, with clamp-connections. Oleiferous hyphae up to 5 or 6 μ wide, difficult to trace, some recorded to be devoid of septa over a distance of about 700 μ , straight or flexuous or strongly tortuous, rarely branched, more numerous near the underside of the pileus. Context of the spines similar. Hymenium somewhat thickening. Basidia 27–34 \times 6–7 μ , clavate, with basal clamp-connection, 4-spored. Sterigmata 5.4–7.2 μ long. Spores 5.5–6.7(–7.2) \times 4.9–5.6 μ , ellipsoid to obovoid, densely to sparsely verrucose or smooth, colourless, amyloid, with oblique apiculus up to 1 μ long. Gloecystidia up to 5.5 μ wide at the apex, numerous, not or little projecting beyond the hymenium, thin-walled, their contents not stained in sulpho-anisaldehyde.

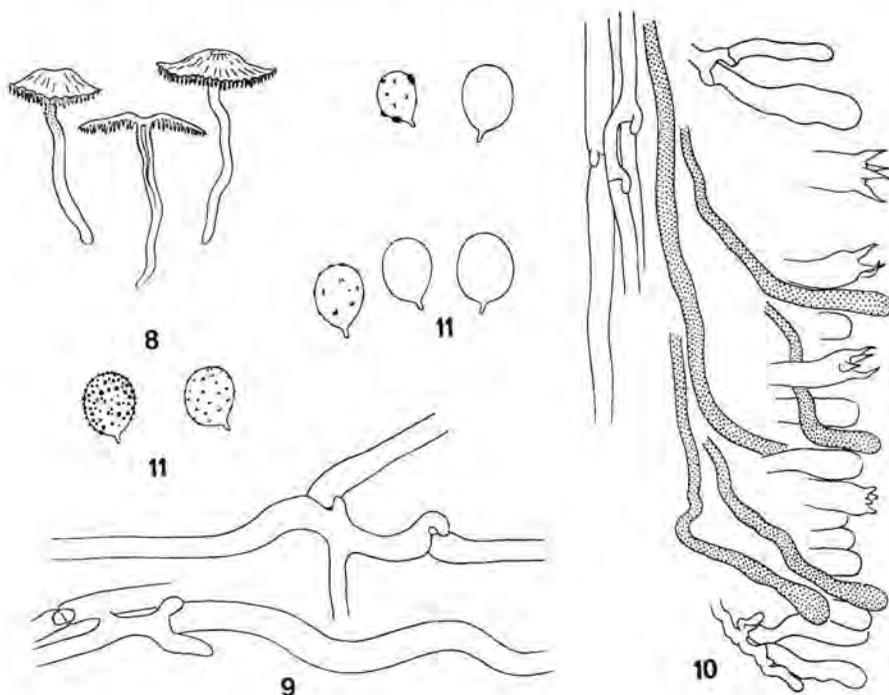
COLLECTIONS EXAMINED:

NEW ZEALAND

North Island: Wellington, Silverstream, 21 July 1948, *F. Duguid* 367 (with pen-drawing, K); 19 July 1949, *Mrs. G. Stevenson Cone* 725, rooting in moss under *Nothofagus solanderi*, holotype (with water-colour, K).

South Island: Westland, Kopara, 8 Dec. 1967, *E. Horak* 67/219, under *Nothofagus fusca* and *N. menziesii* (L).

This description is exclusively drawn up from the holotype which, although slightly better than the other two collections, still leaves rather



Figs. 8–11. *Auriscalpium umbella* (Fig. 8: *Horak* 67/219; Figs. 9–11: holotype). – 8. Habit sketch of three basidiomes, copied from Dr. E. Horak's drawing. – 9. Generative hyphae taken from the pileus. – 10. Detail of a spine, showing basidia and gloecystidia. – 11. Spores. (Fig. 8, $\times \frac{1}{2}$; Figs. 9, 10, $\times 700$; Fig. 11, $\times 1400$.)

much to be desired. The additional description given below has been taken from the notes accompanying *Duguid 367* and *Horak 67/219*. The latter proved of particular interest in that the collector lent me his colour slide, showing fresh specimens.

Pileus hygrophanous, "midbrown" to dark brown, drying light tan, becoming silky, margin grooved and splitting on expanded pileus. Stipe simple or connate, tough, cartilaginous, smooth, velvety, hirsute apically and often with long hairs at the base. Spines fawn. Odour strong, sweetish. Taste sour, pungent, acrid to the tip of the tongue.

Auriscalpium umbella seems an anomalous member of the genus, differing from the type species in several of its features. In the following discussion, however, it will be shown that these differences do not warrant a generic separation. In support of the arguments used some demands have had to be made on the related genus *Lentinellus*.

The present species differs from *A. vulgare* in having a practically glabrous pileus, but it may be remembered that the pileus is known to be glabrous also in *A. fimbriato-incisum* and to lose all its hairs even in *A. vulgare* in old age. Also in *Lentinellus* the pileus is densely hairy in some species and perfectly glabrous in others.

The black-brown cuticular zone under the upper surface of the pileus, so characteristic of *A. vulgare* and *A. fimbriato-incisum*, is absent from *A. umbella*. The South American *Auriscalpium villipes* is in an intermediate position, having a black line only near the junction of the pileus and the stipe. A similar situation occurs in *Lentinellus cochleatus*.

The context in *A. vulgare* is dense and tough, being made up of non-inflating generative hyphae and skeletal, thus differing widely from the construction in *A. umbella*. In *A. villipes*, however, skeletal are rare in the context of the pileus, hence its softness. To compensate for the deficiency of skeletal in that species, the generative hyphae of the pileus context show numerous anastomoses, while those of the spines are inflated. The situation in *A. umbella* apparently shows the complete suppression of the skeletal. Whether these various types of hyphal construction should be regarded as the expression of a phylogenetic series and, if so, in what direction the development should be seen, the interested reader is at liberty to answer himself.

Apparently the context turns dark brown with age in *A. umbella* and the stipe becomes hollow. Both are features as yet not known in other species of *Auriscalpium*, but these differences cannot be considered to have generic significance.

The odour in *A. umbella* is said to be "obtrusive", sweetish, whereas to my knowledge no odour has ever been noticed in the other species of the genus. Here again, it may be remembered that there are species with a strong aromatic odour and odourless species in *Lentinellus*.

As regards the taste, this is stated to be pungent, acrid to the tip of the

tongue in *A. umbella*, "slightly acrid" in *A. vulgare* (COKER & BEERS, 1951: 11), and "often acrid" in *Lentinellus* (SINGER, 1962: 300).

The disposition of warts on the spores in *A. umbella* is most unusual in that some spores are densely verrucose, others only sparsely so, while a great many are devoid of warts (a phenomenon which was checked in the three collections available). In some cases the warts stain dark blue in Melzer's reagent, and are easily visible on that account, in others they are scarcely discernible. Usually the warts are small and narrowly conical, but much broader and rounded warts are also seen. While a satisfactory explanation cannot be given, the fact remains that the development of warts on the spores appears to be an unstable characteristic. This was unknown for *Auriscalpium*, but some indication of the irregular nature of the sporal ornamentation in *Lentinellus* is given by SINGER (1962: 299) who described the spores as "finely rough, verruculose, or almost smooth to smooth."

Thus far the remarkable colouration of the oily contents of the oleiferous hyphae in sulpho-anisaldehyde was held to be a character common to *Auriscalpium* and *Lentinellus*, stressing their close relationship. It is unfortunate that this colour-reaction fails to appear in *A. umbella*, or at least is so weak as to be very doubtful, but it seems hardly reasonable to expect a priori that the members of a genus should all have the same chemical characteristic, if otherwise they do show great diversity in morphological and anatomical features.

The impression given by the present species is that it undoubtedly belongs to *Auriscalpium*. No one would seriously consider to place it in the Hericiaceae, and yet, on account of its lack of microscopic *Auriscalpium*-characters it is dangerously near establishing the link between that family and the Auriscalpiaceae. Whether these two families should actually be merged is not a question that can be answered just now. Much depends on finding further links, not only in the Auriscalpiaceae but also in the Hericiaceae.

AURISCALPIUM VULGARE S. F. Gray

Hydnum auriscalpium L., Spec. Pl. 2: 1178. 1753; ex Fr., Syst. mycol. 1: 406. 1821. — *Scutigera auriscalpium* (L.) Paul., Traité Champ., Atl. pl. 33 fig. 4. 1812–1835. — *Auriscalpium vulgare* S. F. Gray, Nat. Arrang. Brit. Pl. 1: 650. 1821 (name change); P. Karst. in Meddn Soc. Fauna Fl. fenn. 5: 41. 1879 (name change). — *Pleurodon auriscalpium* (L. ex Fr.) P. Karst. in Revue mycol. 3 / No. 9: 20. Jan. 1, 1881; in Acta Soc. Fauna Fl. fenn. 2 (1): 34. 1881; in Meddn Soc. Fauna Fl. fenn. 6: 16. 1881 ("Quél."). — *Leptodon auriscalpium* (L. ex Fr.) Quél., Ench. Fung. 192. 1886. — *Auriscalpium auriscalpium* (L. ex Fr.) Banker in Mem. Torrey bot. Club 12: 178. 1906. — TYPE LOCALITY: Sweden, "... copiosus adhuc per Westrobothniam" (Linn., Fl. lappon. 368. 1737).

For further synonymy, see MAAS GEESTERANUS (1959: 115).

Basidiomes solitary or proliferating and then several springing from common base. Pileus up to 20 mm across, supported subapically by a stipe

from a notch on its side, more rarely seemingly with a central stipe, reniform, plano-convex or at the most shallowly depressed, not zoned, villose with a few scattered bristle-like hairs or densely hispid, glabrescent with old age, pale yellowish brown, pinkish brown, dark brown, finally blackened. Stipe 10–60 × 1–2 mm, straight or flexuous, equal or tapering above, hispid, dark brown, the base swollen 4–7 mm, and generally of a lighter brown. Spines 0.5–3 mm long, fairly distant, subulate, brownish flesh-colour, acquiring a whitish bloom from the ripe spores. Context of the pileus up to 0.5 mm thick, tough, not zoned, white, bounded by a black line at the upper surface and covered with tomentum and bristles.

Context of the pileus dimitic, consisting of generative and skeletal hyphae which have colourless walls in the white part of the context, dark walls in the black part and in the tomentum. Generative hyphae (of the white context) 1.8–2.2 μ wide, thin-walled (cell-walls less than 0.5 μ thick), branched, septate, occasionally anastomosing, with clamp-connections. Skeletals 2.2–3.6 μ wide, thick-walled to almost solid, undulating, often somewhat kinked and irregular through abortive side-branches. Context of the spines made up of generative hyphae, skeletals and oleiferous hyphae, the latter bending outwards in the distal part to form the gloeocystidia. Generative hyphae with clamps at all septa. Skeletals less irregular than in the context of the pileus. Basidia 18–24 × 6–6.5 μ , clavate, with basal clamp (inconspicuous with age), 4-spored. Spores 4.5–5.6 × 3.5–5 μ , broadly ellipsoid, adaxially flattened, minutely spinulose, colourless, amyloid, with oblique apiculus. Gloeocystidia numerous, projecting beyond the basidia, the distal part fusiformly swollen, up to 6 μ wide, thin-walled.

COLLECTIONS EXAMINED AND REPORTED:

WEST PAKISTAN

Murree Hills, Patriata, 20 Aug. 1953, *S. Ahmad 7085*, on rotten cones of *Pinus excelsa* (L).

INDIA

Assam: Khasi Hills, Myrong (VASUDEVA, 1960: 156).

Uttar Pradesh: Dehra Dun, date and collector unknown, on cones and decaying needles of *Pinus* (L).

CHINA

Localities not specified (TENG, 1964: 434, fig. 265).

JAPAN

Honshu: Prov. Owari, near Nagoya, Nov. 1915, *J. Umemura*, on pine cone (Lloyd Mycol. Coll. 4914, BPI); several further localities (KAWAMURA, 1954: 607; ITO, 1955: 192).

GLOIODON P. Karst.

Gloiodon P. Karst. in Meddn Soc. Fauna Fl. fenn. 5: 42. 1879. — TYPE SPECIES: *Hydnum strigosum* Sw. ex Fr.

Basidiome effused, effused-reflexed, or sessile, made up of a dark brown, dense tomentum embedding more solidly constructed ramifying processes or strands, of which the lowermost produce the spines. Strands sometimes reduced to mere veins. Spines very dark but acquiring a whitish or bluish

bloom from the ripening spores. Tomentum consisting of generative hyphae, a large proportion of which gradually passes into skeletal-like hyphae. Generative hyphae thin-walled, branched, with clamps at all septa. Skeletal-like hyphae long retaining their generative nature even after having become quite thick-walled. Strands tough, mainly consisting of skeletal-like hyphae which have colourless walls in the interior (hence the pale colour of the strands internally) and very dark walls on the exterior (hence the blackish colour of the strands externally). Context of the spines made up of generative and skeletal-like hyphae. Basidia clavate, 4-spored, with basal clamp. Spores broadly ellipsoid, minutely spinulose, colourless, amyloid. Gloeocystidia numerous.

On wood.

The present genus comprises two species, of which thus far the type species, *G. strigosus* (Sw. ex Fr.) P. Karst., is not known to occur in the region under consideration. However, since it has been collected in Europe and North America, its occurrence in temperate parts of Asia may be expected. The two species may be distinguished as follows.

KEY TO THE SPECIES

1. Spines springing directly from a matted surface. Reflexed portions of the basidiome showing a matted upper surface with few or no stiff hairs at all: . *G. nigrescens*
1. Spines springing from ramifying processes which remain clearly visible as they are raised above the surface of the underside of the pileus. Reflexed portions strongly strigose (Not dealt with here.): *G. strigosus*

GLOIODON NIGRESCENS (Petch) Maas G. — Figs. 12–16

Hydnum nigrescens Petch in Ann. R. bot. Gdns Peradeniya 7: 288. 1922. — *Gloiodon nigrescens* (Petch) Maas G. in Persoonia 3: 165. 1964. — TYPE: "*Hydnum nigrescens* Petch / 5110 / [Ceylon] Hakgala, April 1917" (K).

Basidiome effused, effused-reflexed, or with well-developed sessile pileus. Effused parts up to 20 mm across, originally more or less orbicular, coalescing laterally and forming larger patches, plushy, becoming matted and shiny, light brown. Upper side of the reflexed parts rough, pitted, in places with fasciculate 'hairs', the surface matted and fairly soft, brown. Pileus, if well-developed, up to 30 mm long and wide, dimidiate to spatulate. Spines up to 6 mm long, springing directly from the matted underside of the reflexed portions or the pileus, crowded, subulate, dark brown or with a bluish bloom. Context consisting of a homogeneous brown tomentum traversed by occasional black veins, up to 4 mm thick.

Context imperfectly dimitic, made up of generative and skeletal-like hyphae. Generative hyphae 2.2–2.7 μ wide, thin-walled (cell-wall less than 0.5 μ thick), branched, septate, with clamp-connections. Skeletal-like hyphae (differing from true skeletals in their occasional branching and the lack of a predominantly radial alignment deeper inside the tomentum) 2.7–3.6 μ wide, thick-walled to solid. Context of the spines made up of the same elements and of oleiferous hyphae. Hymenial elements badly preserved. Basidia probably 4-spored. Spores 4.2–5.4 \times 3.6–4.5 μ , subspherical to broadly ellipsoid, adaxially flattened, minutely rough to asperulate, colourless to pale brownish, with oblique apiculus and central oil drop,

amyloid. Gloeocystidia up to $9\ \mu$ wide, cylindrical to fusiform, very thin-walled, colourless, projecting well beyond the collapsed hymenium.

COLLECTIONS EXAMINED:

CEYLON

Central Prov.: Hakgala, April 1914, *T. Petch 3961*; *T. Petch 5582*; April 1917, *T. Petch 5110*, type (K).

ENGGANO

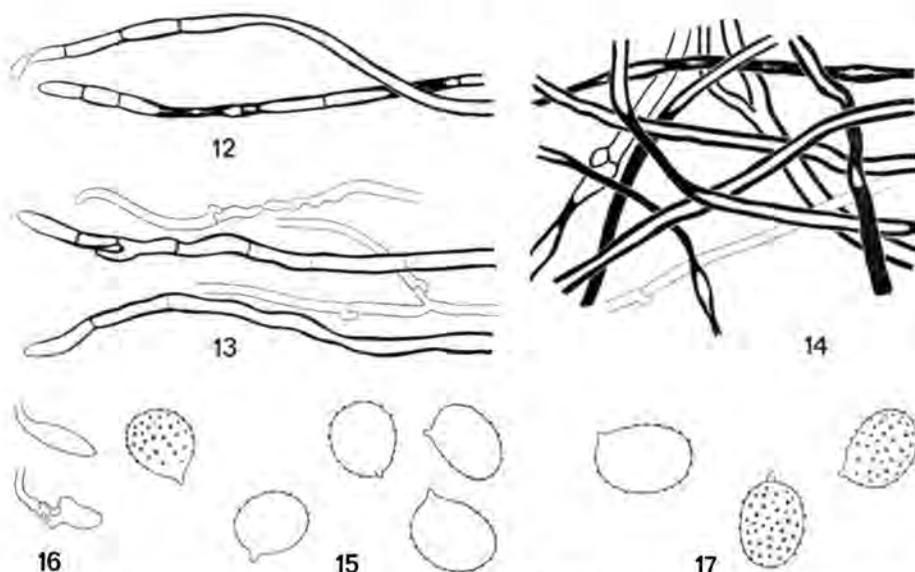
Buah-buah, 3 June 1936, *W. J. Lütjeharms 4136*, on decayed wood, c. 100 m alt. (L).

This species and *G. strigosus* (Fig. 17) cannot be distinguished by their spores.

BANKERACEAE Donk

Bankeraceae Donk in *Persoonia* 1: 405. 1961. — TYPE: *Bankera* Coker & Beers ex Pouz.

Basidiome pileate and stipitate. Pileus initially tomentose, the surface changing in various ways with age, coloured in a wide variety of tints. Stipe tomentose to glabrous, concolorous with the pileus or darker. Hymenophore aculeate. Spines grey at maturity. Context either fleshy,



Figs. 12-16. *Gloiodon nigrescens* (type). — 12. Skeletal-like hyphae from the plushy subiculum. — 13. Generative and skeletal-like hyphae from a "hair" of the upper surface of the basidiome. — 14. Elements from the tomentum of which the basidiome is made up. — 15. Spores, seen in Melzer's reagent. — 16. Tips of two gloeocystidia. (Figs. 12-14, 16, $\times 700$; Fig. 15, $\times 2100$.)

Fig. 17. *Gloiodon strigosus* (European material, L). — Spores, seen in Melzer's reagent ($\times 2100$).

not zoned, and white to somewhat coloured, or fibrous, more or less leathery to woody, zoned, and more pronouncedly coloured; monomitic, made up of generative hyphae. Generative hyphae inflating or not, usually thin-walled, branched, septate, without clamp-connections. Basidia clavate, 4-spored, without basal clamp, known to be chiasitic in two species. Spores broadly ellipsoid to subglobose, finely tubercular to spinulose, colourless, white in mass, not amyloid. Cystidia absent. Odour of fenugreek when dried.

Terrestrial.

There are two genera, *Bankera* and *Phellodon*, which are distinguished by the nature of their context.

BANKERA Coker & Beers ex Pouz.

Bankera Coker & Beers, Stip. Hydn. east. U.S. 33. 1951 (not validly published, lacking Latin description); ex Pouz. in *Česká Mykol.* 9: 95. 1955. — TYPE SPECIES: *Hydnum fuligineo-album* Schmidt ex Fr.

Basidiome pileate and stipitate. Pileus covered with tomentum which on collapse turns into a smooth pellicle or breaks up into scales, white to brownish or purplish brown. Stipe thinly felted, glabrescent, concolorous with the pileus. Hymenium covering spines on the underside of the pileus. Spines eventually greyish. Context of the pileus fleshy, homogeneous, not zoned, white or somewhat coloured, monomitic, made up of generative hyphae. Generative hyphae inflating, thin-walled or with slightly thickened cell-walls, branched, septate, without clamp-connections. Basidia clavate, 4-spored, lacking a basal clamp. Spores subglobose, finely tubercular, white in mass. Cystidia absent. Odour of fenugreek when dried.

Terrestrial.

BANKERA FULIGINEO-ALBA (Schmidt ex Fr.) Pouz.—Fig. 18

Hydnum fuligineo-album Schmidt in Kunze & Schmidt, *Mykol. Hefte* 1: 88. 1817; ex Fr., *Syst. mycol.* 1: 400. 1821. — *Tyrodon fuligineo-albus* (Schmidt ex Fr.) P. Karst. in *Bidr. Känn. Finl. Nat. Folk* 37: 91. 1882. — *Sarcodon fuligineo-albus* (Schmidt ex Fr.) Quél., *Ench. Fung.* 189. 1886. — *Sarcodon violascens* var. *fuligineo-albus* (Schmidt ex Fr.) Quél., *Fl. mycol.* 447. 1888. — *Bankera fuligineo-alba* (Schmidt ex Fr.) Coker & Beers, Stip. Hydn. east. U.S. 34. 1951 (not validly published). — *Bankera fuligineo-alba* (Schmidt ex Fr.) Pouz. in *Česká Mykol.* 9: 96. 1955. — TYPE LOCALITY: Germany, "... in Fichtenwäldungen bey Bernstadt (im Nonnenwalde) und bey Kauffungen in Sachsen." (Schmidt, l.c.).

For further synonymy, see MAAS GEESTERANUS (1958: 56).

Basidiomes simple. Pileus about 40 mm across, plano-convex, in places tomentose to woolly-tomentose, but tomentum for the greater part collapsed and turned into a smooth pellicle (in which are embedded fragments of pine-needles, moss-stems and various other plant remains), flesh-coloured yellow-brown, somewhat more sepia towards the centre, paler towards the margin (which now shows a fulvous discolouration in places); margin involute. Stipe about 15 mm long and up to 13 mm thick, central, solid, stocky, finely felted and cream above, glabrous or somewhat fibrillose and brownish farther down, dark brown at the base. Spines up to 1.5 mm long, very little decurrent, distant (the usual indication that the basidiome is

immature), subulate, cream to yellow-fulvous. Context about 3 mm thick, fleshy, firm, homogeneous, not zoned, now ochraceous. Odour of fenugreek.

Context of the pileus monomitic, made up of generative hyphae. Hyphae 2.7–18 μ wide, inflating, thin-walled to slightly thicker-walled, branched, septate, without clamp-connections. Context of the spines made up of narrow hyphae of about 5 μ wide. Basidia about 25×4.5 – 6.3μ , narrowly clavate, without basal clamp-connection. Spores 4.5–4.7 \times 3.3–3.6 μ , ellipsoid with somewhat irregular outline, adaxially flattened, finely tubercular, colourless, with oblique apiculus.

COLLECTIONS EXAMINED AND REPORTED:

JAPAN

Kyushu: Prov. Bungo, 14 Oct. 1923, *A. Yasuda 711* (Lloyd Mycol. Coll. 35983, BPI).

Listed without locality by *IMAZEKI & HONGO* (1965: 131).

LLOYD reported the present species under the name *Hydnum rufescens* (1925: 1345), although Yasuda had added some notes that seem sufficiently admonitory: "Upper surface of the pileus brown with white margin, under surface white; stipe brownish on the lower portion. Spores globose, tuberculate, hyaline, 3–4 μ in diameter."

The description given above is entirely based on Yasuda's collection which consists of a single immature specimen. It is clear that with better specimens to hand such as depicted in *IMAZEKI & HONGO's* book (1965: pl. 42 fig. 254), several details in this description would have been different.

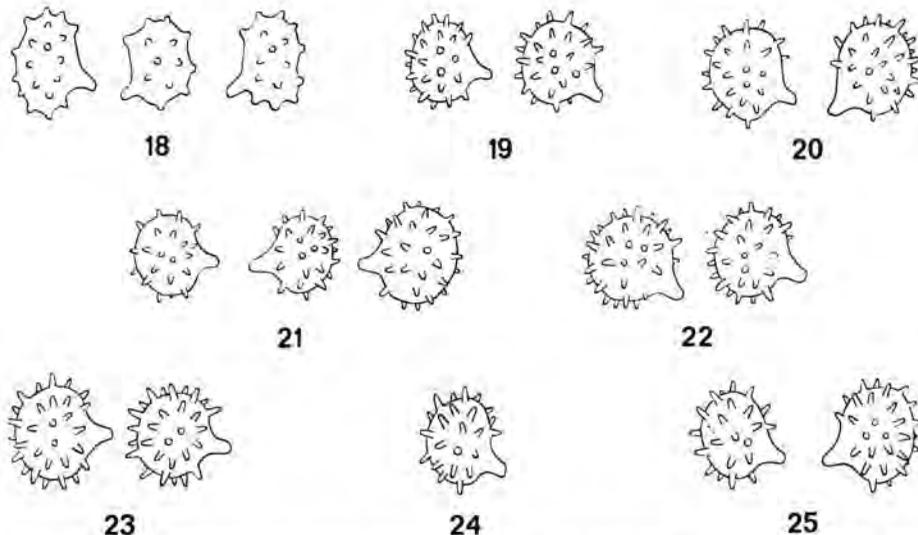


Fig. 18. *Bankera fuliginoso-alba* (Japan, Lloyd Mycol. Coll. 35983). – Spores ($\times 2800$).
Figs. 19–25. *Phellodon confluens* (Fig. 19: British Isles, *Green & Maas G. 15314*, L; Fig. 20: India, *Maas G. 14288*; Fig. 21: India, *Maas G. 14616*; Fig. 22: Japan, Lloyd Mycol. Coll. 4903; Fig. 23: Japan, Lloyd Mycol. Coll. 22789; Fig. 24: Malay Peninsula, *Corner*; Fig. 25: Borneo: *Corner*). – Spores ($\times 2800$).

PHELLODON P. Karst.

Phellodon P. Karst. in *Revue mycol.* 3 / No. 9: 19. Jan. 1, 1881 & in *Meddn Soc. Fauna Fl. fenn.* 6: 15. 1881. — *Hydnum* [sect.] *Phellodon* (P. Karst.) J. Schroet. in *KryptogFl. Schles.* 3 (1): 465. 1888. — *Calodon* subgen. *Phellodon* (P. Karst.) P. Karst. in *Bidr. Känn. Finl. Nat. Folk* 48: 357. 1889. — TYPE SPECIES: *Hydnum nigrum* Fr. ex Fr.

Basidiome pileate and stipitate. Pileus initially covered with tomentum which later becomes radiately fibrillose or ridged or passes into a matted to scrobiculate surface, white to yellow-brown or grey-brown in various hues or olivaceous to black. Stipe covered with thick tomentum and binding vegetable debris, or apparently glabrous and clean, concolorous with the pileus or darker. Hymenium covering spines on the underside of the pileus. Spines grey at maturity. Context fibrous, soft or firm to woody, homogeneous or duplex, zoned, monomitic, made up of generative hyphae. Generative hyphae not inflating, thin-walled, branched, septate, without clamp-connections. Basidia clavate, 4-spored, without basal clamp. Spores broadly ellipsoid to subglobose, spinulose, white in mass. Cystidia lacking. Odour of fenugreek when dried.

Terrestrial.

POUZAR (1956:74) proposed a grouping of the four European species according to the presence or absence of a tomentose cover of the stipe. This subdivision at first seemed to me (MAAS GEESTERANUS, 1958: 48) to be natural and acceptable. Gradually, however, more and more examples were found of species that failed to keep within the bounds set for them. To name only one example, *Phellodon tomentosus* in Europe can be found with the stipe glabrous as well as thickly tomentose. The instability of this feature renders it useless as a differential character, which is a serious loss in a genus where the species are often hard to tell one from another.

In this genus distinction is made between concentric corrugations and concentric colour zones of the pileus. The pileus in some species seems to be zoned by alternate rings of light and dark colour, but closer observation shows that the pileus is actually unicoloured, the impression of rings being deceptively produced by the varying incidence of the light on the corrugated surface. One soon learns to distinguish reflection rings from true colour zones, and it is the latter that count when trying to decide on the identity of a specimen.

A character extensively used in the key is the colour of the context both of the pileus and the stipe. It should be emphasized that the colour in the dried basidiome is meant, but it should also be pointed out that this character loses all value in old and weathered or badly preserved material. Whatever the original colour, the context turns brown in too old specimens and these can usually be recognized at sight by the poor appearance of their spines.

Phellodon tomentosus (L. ex. Fr.) Banker has been recorded, under the synonym *Calodon cyathiforme* Schaeff., from China (TENG, 1964: 438) and

Japan (Ito, 1955: 178), but not a single collection has come to my notice. Consequently a description is omitted, but the species is included in the key to facilitate recognition in case it is found.

The eight species of *Phellodon* treated below probably do not exhaust the number known to occur in the area. Two collections seem to be different from the species thus far known, but cannot be described for lack of information. One collection consists of old, weathered specimens which have lost all their spores, while the other is represented only by a water-colour. A third is temporarily accommodated under *P. putidus*, but may turn out to be misplaced.

KEY TO THE SPECIES

1. Context of the pileus nearest the spines and the core of the stipe firm to woody, very dark slate grey to black.
 2. Context of the stipe distinctly duplex, at least near the base; tomentum of the pileus originally ash grey: *P. niger*
 2. Context of the stipe homogeneous; tomentum of the pileus originally whitish: *P. sinclairii*
1. Context of the pileus and the stipe rather soft, not very dark slate grey to black.
 3. Context of the pileus not warm brown.
 4. Context of the pileus not olivaceous.
 5. Base of the stipe reddish brown and conspicuously different from the colour of the pileus.
 6. Surface of the pileus, except for a few humps, smooth and featureless. Core of the stipe brown: *P. putidus*
 6. Surface of the pileus radiately fibrillose, more or less scrobiculate in the centre. Core of the stipe slate grey: *P. rufipes*
 5. Base of the stipe either not reddish brown or, if so coloured, not conspicuously different from the colour of the pileus.
 7. Pileus yellow-brown to brown, usually with numerous colour zones, but without concentric, narrow, black lines; stipe glabrous or very nearly so; context pallid to pale grey-brown (not treated in the present paper, see p. 26): *P. tomentosus*
 7. Not these characters combined.
 8. Stipe, at least in its basal part, covered with a thick tomentum; context pale grey-brown to slate grey: *P. confluens*
 8. Stipe fibrillose to glabrous; context dark grey-brown to fuscous: *P. melaleucus*
 4. Context of the pileus olivaceous: *P. maliensis*
 3. Context of the pileus warm brown: *P. plicatus*

PHELLODON CONFLUENS (Pers.) Pouz. — Figs. 19–25

Hydnum **confluens* Pers., Mycol. europ. 2: 165. 1825. — *Phellodon confluens* (Pers.) Pouz. in Česká Mykol. 10: 74. 1956. — LECTOTYPE: "*Hydnum confluens*, var. pileis concretis. Prope Clamar" (L 910. 256–1608).

For detailed synonymy, see MAAS GEESTERANUS (1958: 49).

Basidiomes simple or conerescent, frequently very complex. Pileus up to 60 mm across, orbicular, plane to depressed or umbilicate; at first uniformly velutinous or woolly-tomentose, then undergoing a complete

change in that the tomentum collapses to form either a smooth, glabrous, and somewhat shiny surface, or a surface with appressed radial fibrils or occasional ridges, or again a surface that is pitted all over or coarsely scrobiculate in the centre, more or less distinctly concentrically corrugated, white to dingy cream when clothed in tomentum, in later stages greyish, grey-brown, yellowish grey-brown, ochraceous grey, with or without a faint lilaceous tint, without or with few concentric darker zonex, or darker zones faint and incomplete. Stipe 10–40 × 2–6 mm, sometimes connate and up to 15 mm broad, central or lateral, terete to flattened but, more commonly, flaring upward and with bulbous base (not infrequently the adjoining bases confluent); originally velutinous to cottony, but tomentum soon collapsed to form a matted or smooth and somewhat shiny surface, concolorous with the pileus, base long remaining cottony. Spines up to 5 mm long, decurrent, crowded, subulate, grey, white towards the margin. Context 2–3 mm thick in the centre of the pileus, thinning out towards the margin, more or less clearly duplex as long as the tomentum is not collapsed, consisting of a soft-coriaceous to firm inner part and a soft outer tissue; the former zoned and pale grey-brown to pale slate grey, the latter concolorous with the surface of the pileus. A thin slice of the context immediately staining olive green in KOH solution. Odour of fenugreek when dry.

Context of the pileus monomitic. Generative hyphae 2.5–5 μ wide, not inflating, thin-walled, branched, septate, without clamp-connections. Hyphae of the context of the spines similar, up to 3.6 μ wide. Basidia 23–30 × 5.5–7 μ , clavate, without basal clamp, 4-spored, with sterigmata 3–4.5 μ long. Spores 3.5–4.5 × 2.8–3.8 μ (measured without the spinulae), subglobose, spinulose (spinulae c. 0.8 μ long), colourless, with oblique apiculus.

COLLECTIONS EXAMINED:

INDIA

Punjab: Kulu Valley, Manali, 19 Aug. 1964, *R. A. Maas Geesteranus 14288*, on loamy soil in *Cedrus deodara* forest, 1850 m alt. (L).

Uttar Pradesh: near Mussoorie, 21 Sept. 1964, *R. A. Maas Geesteranus 14616*, in forest of *Quercus incana* and *Rhododendron arborea*, c. 1700 m alt. (L).

JAPAN

Honshu: Prov. Ise, Nagoya, Yagoto, 17 Oct. 1913, *J. Umemura 101* (Lloyd Mycol. Coll. 4915, BPI); Yagoto-yama, Nov. 1914, *J. Umemura 110* (Lloyd Mycol. Coll. 4916, BPI). Prov. Kozuke, 13 Oct. 1912, *A. Yasuda 142* (Lloyd Mycol. Coll. 4908, BPI). Prov. Rikuzen, Sendai, 15 Oct. 1915, *A. Yasuda 358* (Lloyd Mycol. Coll. 4903, BPI); 14 Oct. 1917, *A. Yasuda* (Lloyd Mycol. Coll. 22789, BPI); 18 Sept. 1921, *A. Yasuda 668* (Lloyd Mycol. Coll. 22794, BPI). Prov. Settsu, Kobe, no date, *J. E. A. Lewis 056* (Lloyd Mycol. Coll. 7664, BPI).

MALAY PENINSULA

Singapore: Reservoir Jungle near Selitar, 29 Dec. 1940, *E. J. H. Corner*, under *Lithocarpus* sp. (L).

BORNEO

Brunei: Brunei, Ulu Belalong, 15 Feb. 1959, *E. J. H. Corner*, on the ground in forest (L).

Phellodon confluens is a highly variable species which is often misidentified even in Europe. Little wonder therefore it was not recognized by Lloyd, but to his justification it may be added that I myself was at first misled into thinking that two collections in his herbarium and another collected by myself represented undescribed species. *Lloyd 4915* and *4916* were both reported under the name *Hydnum melaleucum* (1914, Lett. 53: 7 and 1915, Lett. 56: 4); *Lloyd 4908*, which contains also a specimen of an unidentified *Sarcodon*, was mentioned as *H. nigrum* (1913, Lett. 44: 8), as was *Lloyd 7664* (1924: 1320), with the identification of which I am not quite satisfied myself; *Lloyd 4903* and *Lloyd 22789* finally, were recorded as *Hydnum conrescens* (1916, Lett. 63: 9 and 1918, Lett. 67: 11).

The collection that caused severe doubts is *Maas Geesteranus 14616* from Mussoorie. It deviates from the usual forms in the striking aspect of the pileus: total lack of marginal tomentum, strongly developed concentric corrugations, almost silky surface, ochraceous-grey colour. Its spores, however, are not different from those of other collections of *P. confluens*, while two collections (*Lloyd 22789* and, more particularly, one South European collection in L) with approximately intermediate characters finally settled the identity.

In view of the apparent difficulty of recognizing the present species, such records as have not been checked by me are disregarded. A case in point is among others TENG's mention of the name *Calodon amicus* (1964: 437).

PHELLODON MALIENSIS (Lloyd) Maas G. — Figs. 26–30

Hydnum maliense Lloyd, Mycol. Writ. 6: 1002, pl. 166 fig. 1829. 1920. — *Phellodon maliensis* (Lloyd) Maas G. in Proc. K. Ned. Akad. Wet. (Ser. C) 69: 34. 1966. — TYPE: “[comm. T. F. Chipp] No. 5096 / Singapore / Bukit Timah / 1 Dec. 1919 / M. Noor / Grey coloured, pileus cap with a dark zone. On ground.” (Lloyd Mycol. Coll. 4921, BPI).

Basidiomes simple or in small groups or connate, with the pilei fused to form complex units. Pileus up to about 50 mm across, plane with depressed centre or shallowly infundibuliform, with or without a few shallow concentric corrugations, hirsute to serpouse in the centre, radiately fibrillose farther outwards, sometimes with darker striae which are either flush with the surface or somewhat raised, silky, yellow-green with an olivaceous shade or olivaceous grey-green to fairly dark olive, with few or several to numerous, usually narrow, dark brown to blackish concentric zones; the margin thinly tomentose, glabrescent. Stipe 15–30 × 1–5 mm, more or less rooting, sometimes connate, or branched from the base, or proliferating, straight to flexuous, terete or flattened, finely fibrillose, silky, more or less thickly tomentose at the base, concolorous with the pileus, olivaceous grey-green, blackened on handling and with age. Spines up to 2 mm long, decurrent or not, crowded, subulate, ash grey at maturity. Context less than 0.5 mm over the spines, homogeneous in the pileus, more or less distinctly duplex in the basal region of the stipe, not or faintly zoned, dingy olivaceous or with dark grey streaks in the pileus, concolorous or darker in the stipe. A slice of the context placed in a KOH solution exuding a cloud of the same colour. Odour of fenugreek when dry.

Context of the pileus monomitic. Generative hyphae 2.7–5.4 μ wide, not inflating, thin-walled, branched, septate, without clamp-connections. Hyphae of the context of the spines similar, sometimes with slightly thickened cell-walls. Basidia 30–50 \times 6–8 μ , slender-clavate, without basal clamp, 4-spored. Sterigmata 3.6–5.4 μ long. Spores 3.8–4.7 (–5.4) \times (2.8–) 3.1–4 μ (measured without spinulae), broadly ellipsoid to subglobose, spinulose (spinulae up to 1 μ long), colourless, with oblique apiculus.

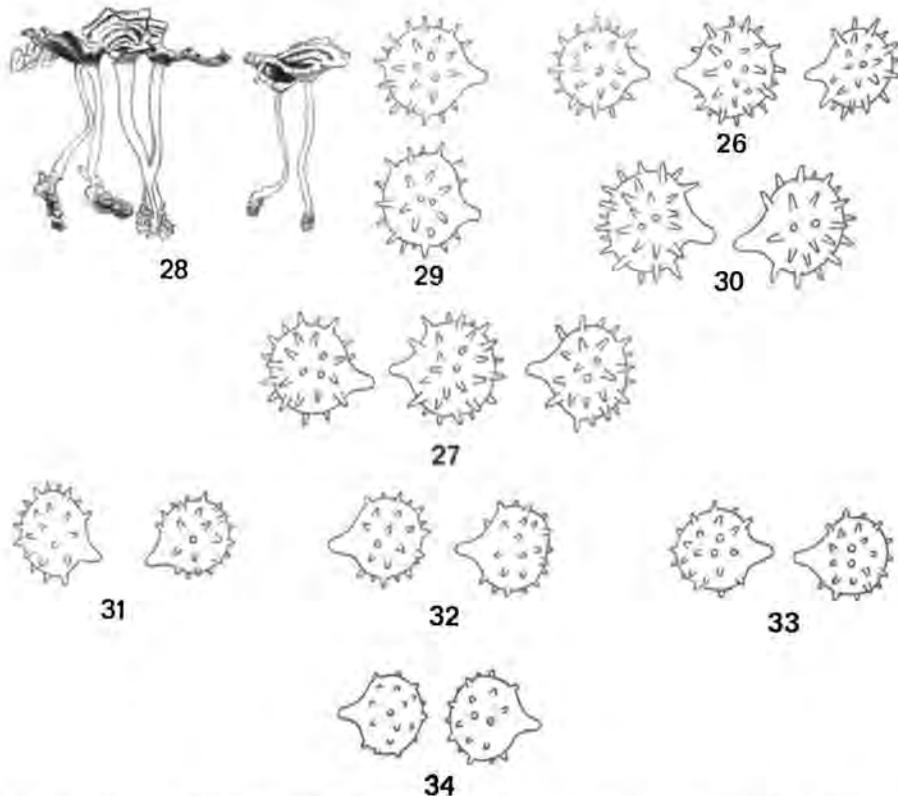
COLLECTIONS EXAMINED:

MALAY PENINSULA

Singapore: Bukit Timah, 1 Dec. 1919, *M. Noor*, type of *Hydnium maliense* (Lloyd Mycol. Coll. 4921, BPI).

AUSTRALIA

South Australia: Adelaide, no date, *J. B. Cleland* 770 (Lloyd Mycol. Coll. 26217, BPI).



Figs. 26–30. *Phellodon maliensis* (Fig. 26: type; Fig. 27: Australia, Lloyd Mycol. Coll. 26217; Figs. 28, 29: Australia, *Willis & Beaglehole*; Fig. 30: New Zealand, *Horak 68/466*). – 28. Habit sketch of several basidiomes. – 26, 27, 29, 30. Spores. (Fig. 28, \times 1; Figs. 26, 27, 29, 30, \times 2800.)

Figs. 31–33. *Phellodon melaleucus* (Fig. 31: Czechoslovakia, *Kubička & Pouzar*, L; Fig. 32: Japan, Lloyd Mycol. Coll. 22792; Fig. 33: Australia, Lloyd Mycol. Coll. 4902). – Spores (\times 2800).

Fig. 34. *Phellodon niger* (Australia, Lloyd Mycol. Coll. 26216). – Spores (\times 2800).

Victoria: Dandenong Ranges, Kalorama, Inverness Road, 26 May 1946, *J. H. Willis*, amongst leaf litter on the ground (L, MEL); Lower Glenelg River area, sources of Little Moleside Creek, 2.5 mls. W. of Johnstone Swamp, 14 June 1964, *J. H. Willis & A. C. Beauglehole*, in loose sandy soil under *Euc[alyptus] baxteri*, at edge of dried out pond (L, MEL).

TASMANIA

Hobart, no date *L. Rodway 1208* (Lloyd Mycol. Coll. 22797, BPI).

NEW ZEALAND

South Island: Nelson Distr., Whanganui Inlet, 16 May 1968, *E. Horak 68/466*, under *Nothofagus fusca*, *N. truncata*, *Metrosideros umbellata*, *Dacrydium cupressinum*, etc. (L).

LLOYD recorded a collection from Adelaide as *Hydnum melaleucum* (1923:1186) and another from Hobart, Tasmania, as *H. nigrum* (1922:1162). The identity of the latter is not quite certain since the hymenium is not developed.

The colour change of the basidiome of the present species appears rather unusual. *Horak 68/466* from New Zealand which now is of a yellow olive colour was stated to be "silber braun" (silvery brown) when fresh. The specimens of this collection are optimally developed so that it is no surprise to find that their fully ripe spores are larger than the best I could find in the type specimen, which in my eyes gave the impression of being barely mature.

PHELLODON MELALEUCUS (Sw. apud Fr. ex Fr.) P. Karst. — Figs. 31–33

Hydnum melaleucum Sw. apud Fr., Obs. mycol. 1: 141. 1815; ex Fr., Syst. mycol. 1: 406. 1821. — *Phellodon melaleucus* (Sw. apud Fr. ex Fr.) P. Karst. in Revue mycol. 3 / No. 9 : 19. Jan. 1, 1881 & in Meddn Soc. Fauna Fl. fenn. 6: 15. 1881. — TYPE LOCALITY: Sweden ("In pinetis, Smolandiae, V. Gothiae in Râda ås, prope Holmiam."—Lindblad, Syn. Fung. Hydn. Suec. nasc. 12. 1853).

Hydnum pygmaeum Yasuda in Bot. Mag. Tokyo 35: (220). 1921. — *Sarcodon pygmaeus* (Yasuda) S. Ito, Mycol. Fl. Japan 2(4): 184. 1955. — ISOTYPE: "No. 203,091 / *Hydnum pygmaeum* Yasuda / Japan, Kyushu, Ooita Pref., Arita-mura, Hida-gun, Nov. 2, 1919, leg. *Nakayama-N.*" (TNS).

For further synonymy, see MAAS GEESTERANUS (1958: 50).

Basidiomes simple to confluent. Pileus up to about 25 mm across, orbicular, plano-convex, the centre depressed to umbilicate, thinly tomentose-fibrillose, soon collapsed to form a shiny or polished surface made up of adnate or slightly raised radial fibrils, with a few concentric corrugations, the centre asperate to lamellate-scaly, grey-brown to black-brown or blackish-olive, with indistinct colour zones, the margin long remaining whitish or greyish. Stipe 10–20 × 1–4 mm, simple or connate, more or less central, straight to flexuous, terete to flattened, fibrillose, shiny, at times somewhat cottony at the base, concolorous with the pileus or darker. Spines up to about 1 mm long, little decurrent, crowded, subulate, whitish. Context of the pileus up to 1 mm thick in the centre, not duplex, indistinctly zoned, light to dark grey-brown. Context of the stipe similar or darker.

A thin slice of the grey-brown context staining olive green in KOH solution, the darker context staining blue-green. Odour faintly of fenugreek.

Context of the pileus monomitic. Generative hyphae 2.7–4.5 μ wide, not inflating, thin-walled, branched, septate, without clamp-connections. Context of the spines similar, hyphae narrower. Basidia 21–27 \times 5–6 μ , clavate, without basal clamp, 4-spored, with sterigmata up to 3.6 μ long. Spores 3.6–4 \times 3.1–3.6 μ (measured without spinulae), subglobose, spinulose (spinulae up to c. 0.5 μ long), colourless, with oblique apiculus.

COLLECTIONS EXAMINED:

JAPAN

Kyushu: Prov. Bungo, Hida-gori, 2 Nov. 1919, *A. Yasuda 620* (Lloyd Mycol. Coll. 22792, BPI). Ooita Pref., Arita-mura, Hida-gun, 2 Nov. 1919, *Nakayama-N.*, isotype of *Hydnum pygmaeum* (TNS).

AUSTRALIA

Victoria: Kinglake West, Flowerdale Road, 24 May 1966, *G. A. Crichton* (uncertain; L, MEL); locality not specified, no date, *J. Wilson 14* (Lloyd Mycol. Coll. 4902, or 4901?, BPI).

LLOYD listed the present species from Japan as *Hydnum melaleucum* (1915, Lett. 56:5) but I failed to find the material, and as *H. pygmaeum* (1922:1107). He also recorded the species as having been collected by J. Wilson in Australia (1917, Lett. 65:6), but there are two collections under that name, one (No. 4902) being *P. melaleucus* all right, while the other (No. 26216) represents *P. niger*.

The Australian material collected by G. A. Crichton is referred here, but with considerable doubt, since the base of the stipe is thickly covered in coarse reddish brown fibers, a feature unknown to me to occur in *P. melaleucus*.

IMAZEKI & HONGO (1968: pl. 49 fig. 276) gave some illustrations under the name *Calodon graveolens*, but I am unable to accept these as representing *P. melaleucus*.

PHELLODON NIGER (Fr. ex Fr.) P. Karst. — Fig. 34

Hydnum nigrum Fr., Obs. mycol. 1: 134. 1815; ex Fr., Syst. mycol. 1: 404. 1821. — *Hydnellum nigrum* (Fr. ex Fr.) P. Karst. in Meddn Soc. Fauna Fl. fenn. 5: 41. 1879. — *Phellodon niger* (Fr. ex Fr.) P. Karst. in Revue mycol. 3 / No. 9: 19. Jan. 1, 1881; in Meddn Soc. Fauna Fl. fenn. 6: 15. 1881. — *Calodon niger* (Fr. ex Fr.) Quél., Ench. Fung. 191. 1886. — TYPE LOCALITY: Sweden ("In pinetis passim, Smolandiae, Ostrogothiae, Uplandiae etc."—Lindblad, Syn. Fung. Hydn. Suec. nasc. 11. 1853).

Hydnum olidum Berk. in J. Linn. Soc. (Bot.) 16: 51. 1877. — *Calodon olidus* (Berk.) S. Ito, Mycol. Fl. Japan 2(4): 177. 1955. — *Hydnellum olidum* (Berk.) Imazeki apud Imazeki & Hongo, Col. Ill. Fungi Japan 2: 193. 1965. — TYPE: "*Hydnum olidum* B. / Japan / F. V. Dickins" (K).

Hydnum cuneatum Lloyd, Mycol. Writ. 7: 1345. 1925 (nomen nudum). — TYPE: "No. 703. July 8, 1923 / *Hydnum*- / Berg Akaru, Prov. Shinano, Japan / *A. Yasuda* (Lloyd Mycol. Coll. 22793, BPI).

For further synonymy, see MAAS GEESTERANUS (1958: 53; 1960: 351, 375, 382).

Basidiomes simple, in small groups, or confluent, sometimes springing from the shrivelled remains of the previous growth period. Pileus up to 55 mm across, plane, becoming depressed to infundibuliform; at first thickly plushy or tomentose, gradually becoming finely pitted all over, then scrupose to lamellate in the centre and radiately ridged to striate farther outwards, in the end finely fibrillose, smooth, and shiny, in that stage more or less distinctly concentrically corrugated and with or without darker zones; initial tomentum pale to dark ash grey, darkening with age and from centre outwards, surface of the pileus in old, dried specimens fuscous to blackish with or without an olivaceous tint, or of a dingy yellowish olive grey sometimes conspicuously marked with dark brown concentrical zones and radial fibrils or streaks; margin sometimes lacerate with age. Stipe 10–40 × 3–12 mm, terete or flattened or irregular when connate, usually slender in the upper part, either ventricose or with a bulbous base, often springing from a common mycelial mat; surface similar to that of the pileus, passing through the same stages, and acquiring similar, but usually darker, colours. Spines up to 3 mm long, decurrent, crowded, subulate, grey or tinged violaceous when fresh, ash grey when dry. Context up to 3 mm thick in the centre of the pileus, duplex, more particularly towards the base of the stipe, consisting of a woody inner part and a soft outer tissue; the former zoned and bluish black to dark slate grey, the latter concolorous with the surface. A thin slice of the dark core of the context stains immediately olive green in KOH solution. It gradually exudes a yellow-brown cloud into the surrounding fluid, while at the same time a blue, floccose precipitate appears. Odour of fenugreek when dry.

Context of the pileus monomitic. Generative hyphae 2.7–5.4 μ wide, not inflating, thin-walled, branched, septate, without clamp-connections. Hyphae of the context of the spines similar, 2.7–4.5 μ wide. Basidia 22–34 × 5–8 μ , clavate, without basal clamp, 4-spored, with sterigmata 4–4.5 μ long. Spores 3.6–4 × 2.7–3.1 μ (measured without spinulae), ellipsoid, spinulose (spinulae c. 0.5 μ long), colourless, with oblique apiculus.

COLLECTIONS EXAMINED AND REPORTED:

WEST PAKISTAN

Lahore: Lahore, no date, *Shiv Ram Kashyap* (Lloyd Mycol. Coll. 4898, BPI).

Swat: Bahrain, 17 Aug. 1952, *S. Ahmad 4966a* (L).

INDIA

Punjab: Kulu Valley, Manali, 19 Aug. 1964, *R. A. Maas Geesteranus 14287a, b*, on loamy soil in *Cedrus deodara* forest, 1850 m alt. (L); 23 Aug. 1964, *R. A. Maas Geesteranus 14362*, among mosses in forest of *Picea smithiana* and *Pinus wallichiana*, 1850 m alt. (L).

Uttar Pradesh: Mussoorie, Khata Pani, 17 Sept. 1964, anonymous, in *Cedrus deodara* forest, c. 2000 m alt. (L); Mussoorie, no date, anonymous, in *Cedrus deodara* forest, 1800 m alt. (L); Ranikhet, 27 Aug. 1934, comm. C. E. Parkinson, round living Deodar (K).

SIKKIM

Darjeeling, Ramam, 7 May 1960, *H. Furukawa 91*, 2400 m alt. (IMAZEKI, KOBAYASI & AOSHIMA, 1966:612).

JAPAN

Honshu: Prov. Shinano, Mt. Akaru, no date, *A. Yasuda 703*, type of *Hydnum cuneatum* (Lloyd Mycol. Coll. 22793, BPI). Prov. Rikuzen, Sendai, 15 Sept. 1909, *A. Yasuda 29* (Lloyd Mycol. Coll. 23131, BPI).

Locality not specified, no date, *F. V. Dickins*, type of *Hydnum olidum* (K).

Listed without locality by IMAZEKI & HONGO (1968: 105, pl. 48 fig. 274).

SUMATRA

Sumatra West Coast: Batang Palupuh (N. of Padang), July 1924, *E. Jacobson*, in the forest, 1000 m alt. (BO 7406).

BORNEO

Sabah: Mt. Kinabalu, Bembangan River, 28 Feb. 1964, *E. J. H. Corner*, *RSNB 5534*, in humus in the forest, 1600 m alt. (L); 3 March 1964, *E. J. H. Corner*, *RSNB 5632*, in humus in the forest, 1600 m alt. (L); Mt. Kinabalu, Mesilau River, April 1964, *E. J. H. Corner*, in humus in the forest, 1600 m alt. (L); Mt. Kinabalu, below Kamboranga, no date, *Mrs. M. S. Clemens*, between 1800 m and 2400 m alt. (K, L).

AUSTRALIA

Victoria: Healesville, 5 June 1954, *Jagdishwar Nath 4546*, in wet forest (K; also listed by REID, 1956: 637); Melbourne, South Yarra, no date, *Miss E. J. Turner 09411* (Lloyd Mycol. Coll. 23142, BPI); locality not specified, no date, *J. Wilson* (Lloyd Mycol. Coll. 26216, BPI).

Recorded without locality by CUNNINGHAM (1958: 590).

LLOYD (1917, Lett. 65:4, 8) reported this species from Lahore under the name *Hydnum olidum*. Under the same name, however, there is a gathering in Lloyd's collection (No. 4925) which represents *Hydnellum earlianum*, see there.

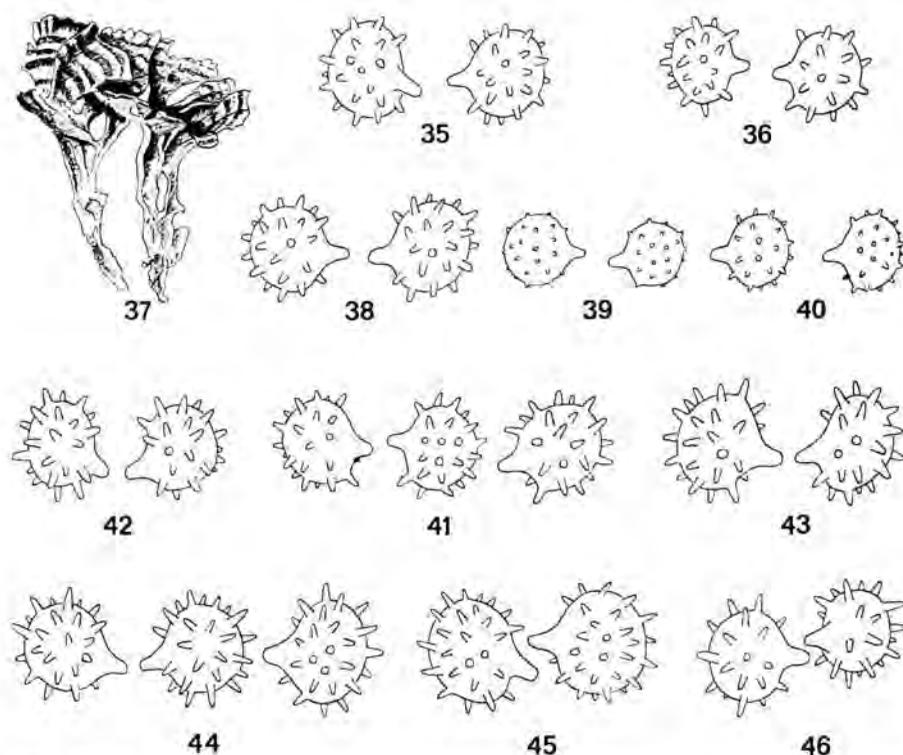
LLOYD also mentioned two Australian collections, one collected by Miss Turner and left unnamed as *Hydnum* sp. (1910, Lett. 27:4), the second collected by Wilson and misidentified *H. melaleucum* (1917, Lett. 65:6).

The collections from India and Sabah look different from what is usual in Europe, and one case in particular (*Maas Geesteranus 14287b*) gave rise to prolonged and serious doubts. The tomentum of pileus and stipe appears less developed in these collections than in most European material. The matted surface of the stipe, so often seen in certain stages of *P. niger* in Europe, is absent from the Indian and Sabah collections. The olivaceous tinges, so often observed in dried European specimens, seem unknown in those from India and Sabah. In addition to these differences, *No. 14287b* looks even more aberrant in that the pileus is distinguished by dark brown radial markings and concentric zones. However, these differences occur neither with any regularity, nor are they invariably linked up with each other. The Rijksherbarium, moreover, possesses several European, notably French, collections which now this way now that show some of the characteristics of the Indian and Sabah material. These and other examples finally convinced me that the extra-European specimens cannot be separated specifically from *Phellodon niger*.

Particular care is needed to distinguish some of the South Australian collections of *P. niger* from *P. sinclairii*. A gathering of *P. niger* from Healesville, Victoria (K) has very thin-fleshed pilei and thin and hard stipes, deceptively resembling *P. sinclairii*. It differs from that species in that at the extreme base the stipes are somewhat swollen from the tomentose cover, while remnants of the tomentum along the margin of the pileus are ash grey.

PHELLODON PLICATUS (Lloyd) Maas G. — Figs. 35–38

Hydnum plicatum Lloyd, Mycol. Writ. 7: 1360, pl. 340 fig. 3227. 1925. — *Phellodon plicatus* (Lloyd) Maas G. in Proc. K. Ned. Akad. Wet. (Ser. C) 69: 321, figs. 8–10. 1966. — TYPE: “*Hydnum plicatum* / On buried dead wood / N. Hobart, Tasmania / Prof. L. Rodway, May 1924” (Lloyd Mycol. Coll. 22796, BPI).



Figs. 35–38. *Phellodon plicatus* (Fig. 35: type; Fig. 36: Australia, unknown collector, No. 470; Figs. 37, 38: New Zealand, Mrs. Cone 734). — 37. Habit sketch. — 35, 36, 38. Spores. (Fig. 37, $\times 1$; Figs. 35, 36, 38, $\times 2800$).
 Figs. 39, 40. *Phellodon tomentosus* (Fig. 39: Czechoslovakia, Kottaba, L; Fig. 40: Switzerland, Peter, L). — Spores ($\times 2800$).
 Figs. 41–43. *Phellodon putidus* (Fig. 41: type; Fig. 42: Japan, Lloyd Mycol. Coll. 4900; Fig. 43: New Guinea, Vink 16410, identity not certain). — Spores ($\times 2800$).
 Fig. 44. *Phellodon rufipes* (holotype). — Spores ($\times 2800$).
 Figs. 45, 46. *Phellodon sinclairii* (Fig. 45: Morris Jones 546; Fig. 46: Butler & Cunningham). — Spores ($\times 2800$).

Basidiomes simple or conerescent, forming small but complex groups. Pileus up to 35 mm across, occasionally very much torn up into laciniae, sometimes developing excentrically, plane with depressed centre to infundibuliform, not concentrically corrugated, radiately folded or ridged or striate near the centre, fibrillose towards the margin, somewhat shiny to beautifully silky, warm brown or with a slightly rufous tinge in the centre and more yellowish brown near the margin, with few and little conspicuous darker zones to clearly zoned (in the same collection), darkening with age; the margin entire or lacerate, thinly tomentose, becoming fibrillose. Stipe up to at least 25 mm long, 1–4 mm wide, somewhat rooting or springing from a mycelial pad in the soil, sometimes proliferating or connate, up to 7 mm wide, straight to flexuous, terete to irregularly contorted and flattened, at times very strangely shaped, finely fibrillose to glabrous (in the type), or finely to coarsely fibrillose above and cottony or with a matted surface below, more or less shiny, concolorous with the pileus or somewhat darker. Spines up to 2 mm long, decurrent, crowded, subulate, yellowish grey. Context thin, less than 1 mm in the pileus, homogeneous throughout (in the type), or more or less distinctly duplex in the basal part of the stipe, not visibly zoned, warm brown, darkening in the stipe with age, staining olivaceous in KOH solution. Odour of fenugreek when dry.

Context of the pileus monomitic. Generative hyphae 3–5.4 μ wide, not inflating, thin-walled, branched, septate, without clamp-connections. Hyphae of the context of the spines similar. Basidia 5.5–7 μ wide, clavate, without basal clamp, 4-spored, with sterigmata about 3.5 μ long. Spores 3.6–5.3 \times 3.1–3.6 μ (measured without the spinulae), subglobose, spinulose (spinulae 0.5–0.9 μ long), colourless, with oblique apiculus.

COLLECTIONS EXAMINED:

AUSTRALIA

Victoria: Dandenong Ranges, Kalorama, Inverness Road, 26 May 1946, *J. H. Willis*, "amongst leaf litter on the ground" (L, MEL); Lower Glenelg River area, sources of Little Moleside Creek, 2½ mls. W. of Johnstone Swamp, 14 June 1964, *J. H. Willis & A. C. Beaulehole*, "in loose sandy soil under *Euc[alyptus] Baxteri*, at edge of dried-out pond" (L, MEL); Tarwin, June, collector unknown, 470 (K); Tonimbuk, c. 4 mls. E. of Gembrook, 11 June 1934, *J. H. Willis*, "amongst leafy mould in mountain eucalypt forest" (L).

Locality not specified, no date, Rev. *James Wilson* (Lloyd Mycol. Coll. 22778, BPI).

TASMANIA

Hobart, 1919, *L. Rodway* (Lloyd Mycol. Coll. 22800, BPI); May 1924, *L. Rodway*, type of *Hydnum plicatum* (Lloyd Mycol. Coll. 22796, BPI); no date, *L. Rodway* (Lloyd Mycol. Coll. 22798, 22799, 39440, BPI).

NEW ZEALAND

North Island: Butterfly, 20 Aug. 1947, *Mrs. G. S. Cone 205* (K); 10 July 1949, *Mrs. G. S. Cone 712*, along beech roots (K); Wellington, Silverstream, 19 July 1949, *Mrs. G. S. Cone 734*, under *Nothofagus solandri* (K).

LLOYD (1920: 979, 980) reported the present species from Australia as *Hydnum graveolens*, but seems to have changed his mind later on, for there is a second slip of paper which mentions *Hydnum subzonatum*, and

it is under this name that the box has been filed. The box also contains two pileus fragments of a second species, *Phellodon tomentosus*. It seems hard to believe that Lloyd should not have noticed these fragments when he wrote his note "This is no doubt the plant on which the record in the Handbook was based and fits the description exactly." In this Handbook (1892:171) COOKE described *H. graveolens* with a dark brown pileus, whereas the two fragments of *P. tomentosus* are strikingly pale yellow-brown. It would seem, therefore, that these must have entered the box accidentally and at a later date. Consequently, I am not prepared to accept these fragments as an evidence of *P. tomentosus* being indigenous to Australia.

I have not seen "the plant on which the record in the Handbook was based," but there is an excellent collection at Kew, from Tarwin, Victoria, and filed as *Hydnum graveolens*, which also represents *P. plicatus*. It is not impossible, therefore, that what Cooke thought to be *H. graveolens* actually is the present species.

Rodway who collected *P. plicatus* several times in Tasmania sent his material to Lloyd, but the latter gave practically every collection a different name. Nos. 22799 and 22800 were reported under the name *Hydnum cyathiforme* (1922: 1162), No. 22798 as *H. nigrum* (1922: 1162), and No. 22796 only as *H. plicatum*, while No. 39440 remained unnamed.

In the Herbarium at Kew there are two very rich collections from New Zealand which had both been named *Phellodon tomentosus*. From this species *P. plicatus* differs in the often more complex habit of the basidiome, the warm colour of the context (dried), the somewhat larger spores which have slightly longer spines. One of these collections, *Cone 734*, is accompanied by a water-colour which, surprisingly, shows much paler specimens than the dried material would lead to believe. The colour approaches that of fresh specimens of the average *P. tomentosus* (although lacking the bright white margin), and this may explain the erroneous identification. For the sake of comparison Figs. 39 and 40 are given, illustrating the spores of two European collections of *P. tomentosus*.

PHELLODON PUTIDUS (Atk.) Banker—Figs. 41–43

Hydnum putidum Atk., Mushrooms 199, pl. 69 fig. 188. 1900. — *Phellodon putidus* (Atk.) Banker in Mem. Torrey bot. Club 12: 170. 1906. — *Calodon putidus* (Atk.) S. Ito, Mycol. Fl. Japan 2(4): 180. 1955. — TYPE: "No. 4334 / *Hydnum putidum* Atk. / G. F. Atk. N. Carol." [partly covered by a second label, stating: "Collected by Geo. F. Atkinson at Blowing Rock, Watauga and Caldwell Cos., N. C., Aug. 19th–Sept. 22nd, 1901"] (CUP).

Pileus up to 55 mm across, irregularly orbicular, lobed (or perhaps made up of two confluent pilei), plano-convex to depressed in centre, slightly colliculose-uneven and locally finely wrinkled (probably owing to drying), otherwise smooth, tomentose and dingy cream at the margin, matted or glabrescent and yellowish grey-brown towards the centre, not zoned or

with a fairly broad, incomplete, and vaguely delimited darker zone, somewhat shiny; margin thick, reflexed in places. Stipe 15–25 × 6–13 mm, single or confluent, stout, ventricose, tomentose, then matted with a shiny surface, hence seemingly glabrous, cottony at the base, dingy orange-brown to fulvous. Spines up to 2 mm long, somewhat decurrent, crowded, subulate, dingy yellowish, the older ones with a slight greyish tint. Context up to about 3 mm thick in the centre of the pileus, not clearly duplex, but soft and tomentose above, gradually passing into firmer flesh below, yellowish grey-brown; context in the stipe conspicuously duplex, the core being darker than and of a different colour from the tomentum.

Context of the pileus monomitic. Generative hyphae up to 5.4 μ wide, not inflating, thin-walled to slightly thicker-walled, branched, septate, without clamp-connections. Basidia about 27 × 6–7 μ , clavate, without basal clamp, 4-spored, with sterigmata 2.7–3.6 μ long. Spores 3.6–4.5 × 3.1–3.5 μ (measured without spinulae), subglobose, spinulose (spinulae up to 0.9 μ long), colourless, with oblique apiculus.

COLLECTIONS EXAMINED:

JAPAN

Honshu: Prov. Owari Kakuōzan near Nagoya, Nov. 1915, *J. Umemura 174* (Lloyd Mycol. Coll. 4900, BPI). Prov. Kozuke, 24 Sept. 1915, *A. Yasuda 361* (Lloyd Mycol. Coll. 4909, BPI).

LLOYD mistook *Umemura 174* for *Hydnum amicum* (1916, Lett. 63: 9, 14), and *Yasuda 361* for *Hydnum albo-niger* (1916, Lett. 63:9).

Ito (1955:180) recorded the species for his country under the generic name *Calodon*, but instead of drawing his (Japanese) redescription from the indigenous collection, he faithfully copied Atkinson's data, thus avoiding possible control.

It would seem appropriate to range under the present species a collection from New Guinea for want of a better place:—

The material, although very poor, is well dried; it consists of three contorted bits, two of which show small pilei. Pileus up to 20 × 8 mm, ligulate, radiately rugose, rough and dull near the base, smoother and shiny towards the margin, (dark grey-brown) black-brown at the base, (isabella) dingy ochraceous at the margin, (yellowish brown) dark fulvous to tawny in between, without colour zones but mottled with a few collapsed and blackened patches. Stipe apparently none, the pileus springing laterally from an ochraceous to orange-brown, cottony basal pad which encloses bits of decayed wood and soil. Spines immature, up to 0.7 mm long, 0.2 mm thick, blunt, white. Context up to 3 mm thick, indistinctly duplex in the pileus, very clearly so in the basal pad, dingy white to isabella near the margin, passing into grey-brown to warm brown farther back, conspicuously zoned with dark lines, staining olivaceous in KOH. Odour of fenugreek when dry.

Context of pileus monomitic. Generative hyphae 3.6–5.8 μ wide, not inflating, thin-walled, branched, septate, without clamp-connections. Basidia 4-spored, without clamp at the base. Spores (taken from a greyish patch on the underside of the pileus) 4.9–5.2 × 3.6–4.2 μ (measured without spinulae), broadly ellipsoid, spinulose, colourless, with oblique apiculus.

COLLECTION EXAMINED:

NEW GUINEA

East New Guinea: Western Highlands, Kubor Range, Uinba, Nona-Minj Divide, 26 Aug. 1963, *W. Vink 16410*, in depleted primary *Lithocarpus-Castanopsis* forest, 2000 m alt. (L).

The colours mentioned between brackets are those noted by the collector.

The attempt at identifying a collection from New Guinea with a species thus far only known from the southeastern part of the United States is apt to raise the strongest doubts, but the following facts should be considered.

(i) *Phellodon putidus*, as appears from the foregoing, is also known to occur in Japan. (ii) It is stated (COKER & BEERS, 1951:25) to be a species of deciduous and mixed woods, which is borne out by the find of the New Guinea material in *Lithocarpus-Castanopsis* forest. (iii) Although the spores of the material from New Guinea are rather larger than those of the Japanese specimen ($3.6-4.5 \times 3.1-3.5 \mu$) or of the type ($4-4.7 \times 3.3-4 \mu$), it should be pointed out that the difference is most probably due to difference in age, neither the Japanese specimen nor the type being anywhere mature when they were collected. It is significant that *L. R. Hesler 12382*, cited by COKER & BEERS (1951:26), and compared by me with the type, has the spores $4.5-5.4 \times 3-3.8 \mu$ (measured without spinulae).

In the surface and the colour pattern of the pileus the New Guinea collection resembles *P. plicatus*, but differs from it in the thicker and conspicuously zoned context, in the presence of a thick basal pad, and in the somewhat larger spores.

***Phellodon rufipes* Maas G., spec. nov.** ³⁾—Fig. 44

Basidiomata simplicia vel confluentia. Pileus usque ad 20 mm diam., orbicularis, e convexo planus, depressus vel umbilicatus, e velutino tomentosus atque radiatim fibrillosus, centro subscrobiculatus, subnitidus, haud corrugatus et azonatus, initio albus, deinde griseo-brunneus, interdum colore flavo admixto, margine vulgo involutus. Stipes 12-28 \times 2-7 mm, simplex vel connatus, excentricus vel centralis, strictus vel curvatus vel inflexus, teres vel supra in pileum dilatatus, infra vulgo ventricosus, subradicatus, lanatus vel tomentosus, subnitidus, basi saepe lanato-floccosus, supra brunneus vel griseo-brunneus, infra ferrugineus. Aculei (immaturi) usque ad 1.7 mm longi, paulo decurrentes, conferti, subulati, sordide flavo-albi. Caro usque ad 2 mm crassa in pileo, haud duplex, zonata, pallide griseo-brunnea vel ardesiaca, in stipite infra distincte duplex, ardesiaca, tomento ferrugineo dispar, odore imperceptibile; monomitica, e hyphis generatoriis formata. Hyphae 3.6-5.4 μ latae, haud inflatae, tenuiter tunicatae, ramosae, septatae, fibulis carentes. Aculei e hyphis tenuioribus constructi. Basidia immatura, 5-7 μ lata, efbulata. Sporae 4.3-4.7 \times 3.4-3.6 μ , subglobosae, spinulosae (spinulae c. 1 μ longae), hyalinae, apiculo obliquo munitae.

HOLOTYPE: "Japan, *J. E. A. Lewis*" (Lloyd Mycol. Coll. 56653, BPI).

³⁾ Etymology: rufus, rufous, and pes, foot, in allusion to the reddish brown base of the stipe.

Basidiomes simple to confluent. Pileus up to 20 mm across, orbicular, plano-convex to plane, becoming depressed to umbilicate (a single funnel-shaped specimen possibly anomalous), at first velutinous, then matted and finely radiately fibrillose, more or less scrobiculate in the centre, somewhat shiny, not concentrically corrugated, originally white, then grey-brown with or without a yellowish hue, without concentric colour zones, the margin usually involute. Stipe 12–28 × 2–7 mm, simple or connate, excentric to central, straight or curved to crooked, terete or flaring upwards into the pileus, the lower part ventricose in most specimens, somewhat radicating, woolly-tomentose or matted, somewhat shiny, the base often woolly-floccose, brown to grey-brown above, ferruginous below. Spines (immature) up to 1.7 mm long, little decurrent, crowded, subulate, dingy yellowish white. Context of the pileus up to 2 mm thick in the centre, not or indistinctly duplex, zoned, pale grey-brown to slate grey. Context of the stipe distinctly duplex in the lower part, the slate grey contrasting with the red-brown tomentum. A thin slice of the grey context staining olive green in KOH solution, the red-brown tomentum remaining practically unchanged. Odour no longer perceptible.

Context of the pileus monomitic. Generative hyphae 3.6–5.4 μ wide, not inflating, thin-walled, branched, septate, without clamp-connections. Context of the spines similar, hyphae narrower. Basidia immature and hard to separate, 5–7 μ broad, without basal clamp. Spores 4.3–4.7 × 3.4–3.6 μ (measured without the spinulae), subglobose, spinulose (spinulae c. 1 μ long), colourless, with oblique apiculus.

COLLECTION EXAMINED:

JAPAN

Locality not specified, no date, *J. E. A. Lewis*, [apparently under *Pinus*] (Lloyd Mycol. Coll. 56653, BPI).

This species is exceedingly close to *P. confluens*, but can be told from it by the differently coloured stipe base, the slightly larger spores, and their longer spinulae. Considering that the specimens are not mature, it is possible that the ripe spores grow even somewhat larger.

Phellodon sinclairii (Berk. apud Hook.) G. Cunn. — Figs. 45, 46

Hydnum sinclairii Berk. apud Hook., Handb. New Zeal. Fl. 756. 1867. — *Phellodon sinclairii* (Berk. apud Hook.) G. Cunn. in Trans. R. Soc. N.Z. 85: 590. 1958. — TYPE: "*Hydnum sinclairii*, B. / New Zealand / 1860 / Dr. Sinclair" (K).

Basidiomes simple or conerescent, sometimes forming dense complex groups characterized by several of the stipes being arrested in their growth. Pileus up to about 30 mm across, up to 70 mm in complex groups, sometimes developing excentrically, plane with depressed centre or umbilicate to infundibuliform, sometimes concentrically corrugated, finely radiately fibrillose to striate (also radiately rugulose or ridged when dry, not sulcate), rough to scrupose-squamulose in the centre, somewhat shiny to silky, olive green to dark olive grey, with blackish concentric zones; the margin thinly tomentose, dingy whitish to olivaceous yellow, glabrescent. Stipe up to 35 mm long, 1–5 mm wide, straight to flexuous, terete or flattened, finely fibrillose, nowhere covered by a thick tomentum, silky, concolorous with the pileus to blackish, with a tendency to produce processes which

remain awl-shaped and sterile, or broaden into flattened divisions bearing spines on the underside. Spines up to 2 mm long, decurrent, crowded, subulate, whitish, becoming ash grey. Context up to 1.5 mm thick, homogeneous both in the pileus and the stipe, firm to almost hard, inconspicuously zoned, very dark slate grey to blackish. A thin slice of the context placed in KOH solution producing a granular to floccose blue-green precipitate in the surrounding fluid and exuding a yellow-brown cloud. Odour of fenugreek when dry.

Context of the pileus monomitic. Generative hyphae 2.7–5.4 μ wide, not inflating, thin-walled to moderately thick-walled (cell-walls up to 0.8 μ thick), branched, septate, without clamp-connections. Hyphae of the context of the spines similar. Basidia about 33×5.5 –7 μ , clavate, without basal clamp, 4-spored, with sterigmata about 3.6 μ long. Spores 3.6–4.5 \times 3.1–3.8 μ (measured without spinulae), broadly ellipsoid, spinulose (spinulae up to about 1 μ long), colourless, with oblique apiculus.

COLLECTIONS EXAMINED AND REPORTED:

NEW ZEALAND

North Island: Wellington, Butterfly, 27 June 1948, *J. McCann* (K); [Wellington?] Catchpole, 3 May 1958, *Mrs. G. S. Cone* & Wellington Bot. Soc. 1301, associated with *Nothofagus* litter (K); Wellington, Gollans Valley, 20 May 1949, *A. Morris Jones* 546 (K); Wellington, Wairarapa, 2 Dec. 1950, *Mrs. G. S. Cone* 787 (K); Wellington, York Bay, 27 July 1923, *E. J. B[utler]* & *G. H. Cunningham*, in scrub land (K); various other localities listed by CUNNINGHAM (1958: 590, 591).

South Island: Otago, Maungatua, 1860, *Dr. Sinclair*, type of *Hydnum sinclairii* (K).

CUNNINGHAM (1958:591) stated that the fungi are "purple when they first emerge from the humus under beech trees. . . ." The interesting point is that in *Phellodon niger* the young pileus may also be clad in a tomentum of the most vivid violet, a colour which is soon lost afterward. Cunningham's beech trees, of course, are *Nothofagus*, and it is of interest to note that *P. niger*, if it leaves its usual habitat – coniferous woods – is found under *Fagus*. These two features combined with the black context strongly suggest a close affinity of *P. sinclairii* with *P. niger* and *P. alboniger*. It cannot be denied that the acceptance of such a relationship weakens the significance thus far attributed to the tomentose covering of the stipe; obviously the nature of the covering of the stipe can be used only for the distinction of species, not of groups of species, and even so this character should be treated with some care.

CORTICIACEAE Herter

Corticaceae Herter in *KryptogFl. Brandenb.* 6: 70. 1910. – TYPE: *Corticium* "Pers."

For synonymy, see DONK (1964: 255).

Basidiome generally effused (more rarely effused-reflexed or even pileate and stipitate). Hymenophore typically smooth, but also meruloid to tubulate when dry (edges of dissepiments fertile), or granular (granules

fertile) to aculeate (tips of spines sterile), or with variously effigured, sterile tissue protruding beyond the hymenial surface. Context not typically stereoid (that is, showing abhymenial crust-like layer, intermediate layer, hymenium). Hyphae with or without clamps. Eu- or catahymenium. Basidia usually clavate, or urniform to more or less strongly utriform, 2-8-spored, stichic, chiasitic, or hemichiasitic. Spores even in general outline, smooth or not very distinctively ornamented, colourless to variously coloured (pink, lilac, violaceous, bluish, greenish), usually not amyloid. Tramal and hymenial cystidia and/or hyphidia of various types may be present. Setae lacking.

Lignicolous, humicolous, herbicolous, terrestrial, saprobic or rarely parasitic (description adapted from DONK, 1964: 257).

Of the numerous genera considered to belong to this family only *Sistotrema* is dealt with here.

SISTOTREMA Fr.

Sistotrema Fr., Syst. mycol. 1: 426. 1821; emend. Donk in Fungus 26: 4. 1956; not *Sistotrema* Pers. ex Pers., Mycol. europ. 2: 191. 1825. — TYPE SPECIES: *Sistotrema confluens* Pers. ex Fr.

For further synonymy, see DONK (1956b: 4).

Basidiome effused or effused-reflexed, rarely consisting of pileus and stipe, arachnoid, subwaxy, or thinly to thickly membranous, white to pale. Hymenial surface smooth, poroid, or hydroid. Context monomitic, consisting of generative hyphae. Hyphae branched, septate, thin-walled, with or without clamp-connections, sometimes with onion-shaped inflations at the septa. Basidia globose when young, growing out urniform, (4-)6-8-spored. Spores subglobose to almost cylindrical, smooth, colourless, not amyloid. Cystidia absent.

Growing on dead vegetable matter.

The only species treated here is the type species of the genus.

SISTOTREMA CONFLUENS Pers. ex Fr.

Sistotrema confluens Pers. in Neues Mag. Bot. 1: 108. 1794; *Sistotrema confluens* Pers. ex Fr., Syst. mycol. 1: 426. 1821. — *Hydnotrema confluens* (Pers. ex Fr.) Link, Handb. Erkenn. Gewächse 3: 298. 1833. — *Irpex confluens* (Pers. ex Fr.) Kummer, Führ. Pilzk. 49. 1871. — TYPE: "*Sistotrema confluens*. Prope Gottingam lectam" (L 910. 270-681).

For further synonymy, see MAAS GEESTERANUS (1959: 141).

Basidiomes simple or confluent, pileate, not always clearly stipitate. Pileus up to 10 mm wide, flabelliform, wrinkled, glabrous, somewhat shiny, yellow-brown to fulvous, margin more or less involute. Stipe 0-12 × 0-3 mm, lateral, sometimes hardly differentiated from the pileus, more or less flattened, glabrous, concolorous with the pileus, springing from a mycelial pad. Spines up to 1.5 mm long, decurrent, subdistant, subulate or flattened to lamellate, concolorous with the pileus. Context about 1 mm thick, homogeneous, not zoned, soft, fragile, whitish. Smell imparticular when fresh.

Context of the pileus monomitic, consisting of generative hyphae. Generative hyphae 3.5-7 μ wide, somewhat inflating, sometimes inflated

at the septa, thin-walled, branched, septate, with clamp-connections. Context of the spines similar. Basidia immature or collapsed, 4.5–7 μ wide, with a basal clamp. Spores 3.6–4 \times 2.2–2.7 μ , ellipsoid, adaxially flattened, smooth, colourless, with an oil-drop, with oblique apiculus. Cystidia absent.

COLLECTION EXAMINED:

NEPAL

Khumbu, near Tutkosi Valley, S. of Thangpoche, Sept. 1962, *J. Poelt P 207*, among moss and vegetable debris, in *Abies-Rhododendron* forest, c. 3500 m alt. (M).

The collection cited above is in bad shape, hence the poor description.

DONK (1956b:4) explained that the generic name *Sistotrema* Pers. ex Pers. is different from *Sistotrema* Fr., as the two genera are typified by different species which besides are not related taxonomically. He consequently regarded *Sistotrema confluens* (Pers.) ex Fr. as an epithet transferred by Fries to his own *Sistotrema* and validated in the process. I understand his reasoning but do not share his opinion that the use of brackets is necessary. The specific epithet of *Sistotrema confluens* Pers. (1794) remained ineligible for considerations of priority until it was validated by FRIES (1821). By this operation the species at once became a member of the Friesian genus *Sistotrema*. Although technically a recombination, I feel that Fries' manipulation should not be rated as such; a recombination, in my opinion, suggests an act in which two equivalent elements – that is, two validly published names – are involved.

GOMPHACEAE Donk

Gomphaceae Donk in *Persoonia* 1: 406. 1961. – TYPE: *Gomphus* (Pers. ex Fr.) S. F. Gray.

For synonymy, see DONK (1964: 267).

Basidiome effused, pileate and stipitate, or coralloidly branched, the pileate species with flabelliform, turbinate to infundibuliform pileus. Hymenophore smooth, aculeate, or folded. Context thin and loose to usually more or less fleshy and brittle to toughish, rarely gelatinous, white to pallid, monomitic or rarely rather imperfectly dimitic with skeletal. Generative hyphae thin- to rather thick-walled, inflating or not, or with onion-like swellings in the mycelium, branched, septate, with clamp-connections. Skeletals imperfectly developed. Hymenium thickening. Basidia clavate, 2–4-spored, with or without basal clamp, chiasitic (as far as known). Spores variously formed (subglobose, ellipsoid, amygdaliform, subcylindrical, subsigmoid), ornamented with ridges or warted, spinulose, granular to rough, rarely smooth, cyanophilous (absorbing cotton blue), not amyloid. Cystidia rare.

Lignicolous or terrestrial (description adapted from DONK, 1964: 267).

This family includes a wide variety of basidiome forms, a disposition which CORNER (1970: 11, 224) finds unacceptable. He combined the genera *Kavinia*, *Lentaria*, *Ramaria*, and the new genus *Delentaria* to form the

family Ramariaceae, which would leave the Gomphaceae with only the cantharelloid and pileate forms. Among these forms two genera have an aculeate hymenophore: *Beenakia*, recently recognized to belong to the family (MAAS GEESTERANUS, 1963: 437), and *Terenodon*, a new genus.

BEENAKIA D. Reid

Beenakia D. Reid in Kew Bull. 1955: 635. 1956. — TYPE SPECIES: *Beenakia dacostae* D. Reid.

Basidiome pileate and stipitate. Pileus covered with tomentum which on collapse becomes matted, smooth, not zoned, white to ochraceous, drying brownish. Stipe excentric or lateral or central, covered with tomentum, arising from a subiculum or with cottony base, concolorous with the pileus. Hymenium covering spines on the underside of the pileus. Spines beige to olivaceous. Context of the pileus soft, spongy, homogeneous, not zoned, white, drying yellowish brownish, staining olive in ferric sulphate solution, monomitic, made up of generative and connecting hyphae. Generative hyphae moderately inflating, thin-walled, branched, septate, with clamp-connections. Basidia clavate, 4-spored, with basal clamp. Spores pip-shaped, verrucose, yellowish brownish, cyanophilous. Cystidia none.

Lignicolous.

Excellently dried recent collections of *B. dacostae* allowed me to rectify an error. In a previous paper (MAAS GEESTERANUS, 1963: 437) I stated that the basidia lack clamps, but REID's observation (1956: 637) that clamps are present is correct.

BEENAKIA DACOSTAE D. Reid

Beenakia dacostae D. Reid in Kew Bull. 1955: 635. 1956. — TYPE: Australia, Victoria, Beenak (K).

Basidiome pileate and stipitate. Pileus up to about 23 mm across (fresh), orbicular to reniform, plano-convex to plane, the surface smooth, cottony, becoming matted (heavily wrinkled and glabrescent in some dried specimens), not zoned, white, ochraceous to yellow-brown when dry; the margin entire to somewhat lobed. Stipe up to 10 mm long, 1 mm broad, usually excentric, but also lateral or central, sometimes poorly developed, somewhat curved, cottony or felted and white, glabrescent and becoming yellow-brown above, springing from a white-cottony subiculum. Spines up to 3 mm long (fresh), more or less decurrent, crowded, subulate, beige to pale olive brown (fresh), in dried condition with a distinct greenish shade. Context up to 1 mm thick (dried), soft, spongy, homogeneous, although the part nearest the spines somewhat firmer, not zoned, yellowish brownish, not staining greenish in KOH solution. Odour none. Taste mild.

Context of the pileus monomitic, made up of generative and connecting hyphae. Generative hyphae up to 11.5 μ wide, moderately inflating, flaccid, thin-walled, branched, anastomosing, septate, with clamp-connections at all septa and ampullaceous swellings at some (these swellings being much more pronounced in the subiculum), filled with oily matter towards their tips. Context of the spines similar, hyphae more compacted.

Basidia 25–33 × 5–7 μ , slender-clavate, with basal clamp (which disappears with age), with 4 sterigmata up to 4.5 μ long. Spores 7.2–10.7 × 3.4–4 μ , pip-shaped, often fairly irregularly so, warted (warts numerous, low, rounded or slightly elongate), yellowish brownish, with large oblique apiculus, cyanophilous.

COLLECTIONS EXAMINED AND REPORTED:

AUSTRALIA

Victoria: Beenak, 16 July 1948, *E. W. B. Da Costa*, on rotten limbs and branches in wet forest, type (K); Cumberland Falls track near Marysville, 28 May 1963, *G. A. Crichton*, c. 900 m alt., on dry woody debris under fallen logs of *Eucalyptus regnans* (L, MEL); Dandenong Ranges, Sherbrooke Forest, 8 Sept. 1956, *J. H. Willis*, c. 500 m alt., on dry woody debris under an old log of *Eucalyptus regnans* (L, MEL).

NEW ZEALAND

South Island: Nelson, Collingwood, Aorere Valley, 15 May 1968, *E. Horak 68/448*, on dead stipes of *Dicksonia* sp. (L); Otago, Dunedin, Filter Station, 30 May 1968, *E. Horak 68/510*, on decayed wood (L). Several further localities (CUNNINGHAM, 1958: 592).

Part of the macroscopical description is based on a colour slide kindly sent on loan by Dr. E. Horak and showing ten basidiomes, some taken from below others from above.

***Terenodon* Maas G., gen. nov. ⁴⁾**

Basidioma humicola, e pileo et stipite constans. Pileus orbicularis, tomentosus, haud zonatus, laete coloratus. Stipes centralis, deorsum bulbosus, tomentosus, pileo concolor. Hymenium inferum, aculeos vestiens. Aculei decurrentes, subulati, apicibus subpubescentes. Caro mollis, haud zonata in pileo, subzonata in stipite, pallida, monomitica, e hyphis generatoriis sarmentosisque formata. Hyphae generativae haud inflatae, tenuiter tunicatae, fibulatae, fibulis etsi haud ubique praesentibus. Caro aculeorum e hyphis generatoriis efibulatis constructa. Basidia clavata, efibulata, quadrispora. Sporae late ellipsoideae vel subglobosae, spinosae, hyalinae (an in cumulo subochraceae?), inamyloideae, manifeste cyanophilae. Cystidia gloeocystidiaque nulla. — TYPUS GENERIS: *T. serenus*.

Basidiome humicolous, pileate and stipitate. Pileus orbicular, tomentose, without concentric zones, light coloured. Stipe central, bulbous below, tomentose, concolorous with the pileus. Hymenium covering spines on the underside of the pileus. Spines decurrent, subulate, subpubescent towards the apex. Context soft, not zoned in the pileus, obscurely zoned in the stipe, pale coloured, stained olive green in ferric sulphate solution, monomitic, made up of generative and tendril hyphae. Generative hyphae not inflating, thin-walled, clamped but clamp-connections not found at the margin and not occurring at all septa. Context of the spines consisting of clampless generative hyphae only. Basidia clavate, without basal clamp, 4-spored. Spores broadly ellipsoid to subglobose, spinous, colourless (or

⁴⁾ Etymology: *τέργην*, *τεργεος*, tender, soft; *ὀδών*, tooth; the name referring to the soft flesh of this Hydnum.

possibly subochraceous in mass?), not amyloid, clearly cyanophilous. Cystidia and gloecystidia lacking. — TYPE SPECIES: *T. serenus*.

The above characters readily mark the present genus as a member of the Gomphaceae, but it should be pointed out that its inclusion in the family introduces one new element — the subglobose form of the spores.

***Terenodon serenus* Maas G., spec. nov.⁵⁾ — Figs. 47–54**

Basidiomata simplicia vel confluentia. Pileus usque ad 15 mm diam., orbicularis, depressus, velutinus vel tomentosus, hinc inde glaber nitidusque (an squamosulus?), haud zonatus, cremeus, in partibus glabris ochraceo-brunneus vel avellaneus vel spadiceus. Stipes usque ad 9 mm latus, deorsum bulbosus, valde tomentosus, pileo concolor. Aculei usque ad 1 mm longi, decurrentes, modice conferti, subulati vel subapplanati, apicibus subpubescentibus, cremei vel ochracei. Caro pilei usque ad 1 mm crassa, haud zonata, mollis, fibrillosa, pallide avellanea, caro stipitis firmior, subzonata, basi obscurior, odore et sapore ignotis; monomitica, e hyphis generatoriis sarmentosisque formata. Hyphae generatoriae 2.2–6.3 μ latae, haud inflatae, tenuiter tunicatae, ramosae, septatae, a margine distantia aliqua (120–140 μ) tantum fibulatae, margine ipso materia oleosa repletae, ceterum vacuae. Hyphae sarmentosae irregulariter ramosae, flexuosae vel tortuosae, hyphas adjacentes adhaesae. Aculei e hyphis generatoriis solum, 2.7–3.6 μ latis et efibulatis constructi. Basidia 28.5–31 \times 6.5–8 μ , clavata, efibulata, quadrispora. Sterigmata 2.7–3.6 μ longa. Sporae 3.6–4.3 \times 3.1–3.5 μ , late ellipsoideae vel subgloboae, adaxialiter applanatae, spinosae, hyalinae (an in cumulo subochraceae?), inamyloideae at contra manifeste cyanophilae, apiculo crasso munitae, spinis c. 0.9 μ longis. Cystidia gloecystidiaque nulla. Aculeorum apices omnino e hyphis generatoriis materia oleosa repletis constructi.

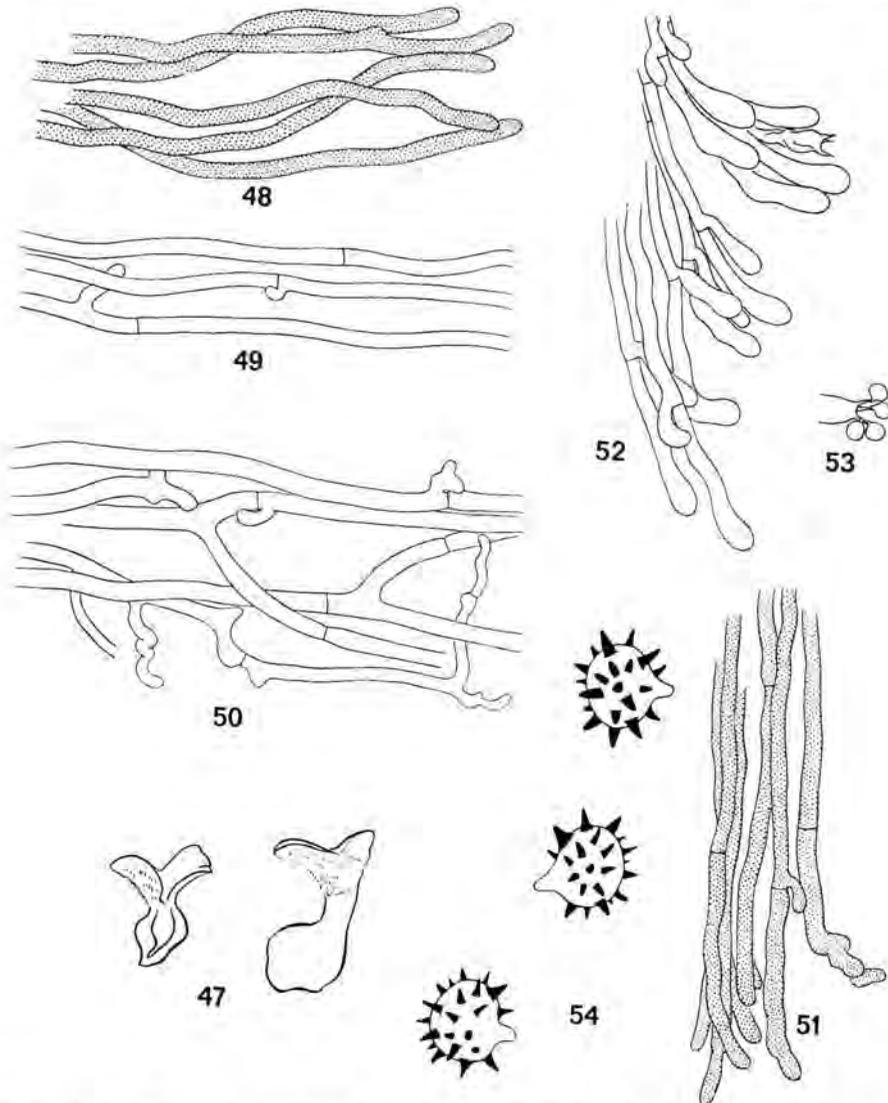
HOLOTYPE: Japan, Prov. Mikawa, 24 Sept. 1913, *A. Yasuda 229* (BPI).

Basidiomes simple to confluent. Pileus up to about 15 mm across, orbicular, depressed, velvety to tomentose, the tomentum locally collapsed to form a glabrous and shiny surface, locally with traces of incipient scalliness, without concentric zones; dingy cream, the glabrous parts yellow-brown to avellaneous or date brown, dark where bruised. Stipe up to about 9 mm thick, bulbous below, thickly tomentose, concolorous with the pileus. Spines up to about 1 mm long, decurrent, moderately crowded, subulate or somewhat flattened, slightly pubescent towards the apex, cream to ochraceous. Context of the pileus up to about 1 mm thick, homogeneous, not zoned, soft, fibrillose, pale avellaneous, dingy olive green in a strong and freshly made aqueous solution of ferric sulphate; context of the stipe with a somewhat harder core, obscurely zoned, darker towards the base. Smell and taste unknown.

Context of the pileus monomitic, consisting of generative and tendril hyphae. Generative hyphae 2.2–6.3 μ wide, not really inflating, thin-walled, branched, septate, with clamp-connections (but these not on all septa and only appearing at some 120–140 μ distance from the margin), in the terminal part all filled with some oleaginous matter, empty farther back. Tendril hyphae irregularly branched, flexuous to tortuous, producing short excrescences with which they fasten themselves to adjacent hyphae.

⁵⁾ Etymology: serenus, clear (of the colour).

Context of the spines lacking tendril hyphae and, as far as can be made out, without clamps. Generative hyphae $2.7\text{--}3.6\ \mu$ wide terminally and all filled with oleaginous matter. Basidia $28.5\text{--}31 \times 6.5\text{--}8\ \mu$, clavate, without clamp-connection, 4-spored. Sterigmata $2.7\text{--}3.6\ \mu$ long. Spores $3.6\text{--}4.3 \times 3.1\text{--}3.5\ \mu$ (measured without the spines), broadly ellipsoid to subglobose, adaxially flattened, spinous, colourless but possibly subochraceous in mass, not amyloid but conspicuously cyanophilous, with comparatively



Figs. 47–54. *Terenodon serenus* (holotype). – 47. Habit sketch of two basidiomes. – 48. Hyphae of the margin of the pileus. – 49. Hyphae at $150\ \mu$ distance from the margin, showing one incipient clamp. – 50. Generative hyphae and one tendril hypha at 5 mm distance from the margin. – 51. Tip of spine, made up of oleiferous hyphae. – 52. Detail of hymenium, showing mostly immature basidia. – 53. Apical portion of basidium with four immature spores. – 54. Three spores. (Fig. 47, $\times 1$; Figs. 48–53, $\times 700$; Fig. 54, $\times 2800$.)

large apiculus. Spines about 0.9μ long. Cystidia or gloecystidia none, but the tip of the spine entirely made up of oleiferous hyphae, the contents of which do not stain wine red with sulpho-anisaldehyde.

COLLECTIONS EXAMINED:

JAPAN

Honshu: Prov. Shinano, 27 Oct. 1912, *A. Yasuda 158* (Lloyd Mycol. Coll. 23130, BPI); Prov. Mikawa, 24 Sept. 1913, *A. Yasuda 229*, holotype (Lloyd Mycol. Coll. 23134, BPI).

The specific description has been exclusively based on the holotype which in microscopical respect is the better of the two collections. Although the basidiomes do not seem full-grown, and indeed most basidia appear immature, numerous spores are sufficiently ripe for their ornamentation to be well developed.

To judge from the vegetable debris adhering to the specimens, the habitat of the species is in deciduous wood with scattered pines.

HERICIACEAE Donk

Hericiaceae Donk *in* Persoonia 3: 269. 1964. — TYPE: *Hericum* Pers. ex S. F. Gray.

Basidiome effused, effused-reflexed, pileate, or branched with a more or less outspoken tendency of the spines to grow downward, but also typically clavarioid and strictly growing upward. Stipe sometimes present as a rooting base. Hymenophore smooth or aculeate. Context membranous to fleshy, white or pallid, amyloid in one genus, monomitic or imperfectly dimitic with skeletals. Generative hyphae inflating or not, thin- to thick-walled, branched, septate, with clamp-connections. Basidia clavate, 4-spored, with basal clamp, chiasitic (as far as known). Spores globose to broadly ellipsoid or ovoid, smooth or finely to coarsely ornamented, colourless, amyloid. Gloecystidia present.

Lignicolous (description adapted from DONK, 1964: 269).

In the area under consideration, the family comprizes also two genera of hydroid habit, that is, with spines underneath — *Hericum* and *Stecchericum*. Just to show how much the limits of the family are still in a state of flux, it is interesting to read CORNER'S comments (1970: 9).

HERICIUM Pers. ex S. F. Gray

Hericum Pers. *in* Neues Mag. Bot. 1: 109. 1794. — *Hydnum* [sect.] *Hericum* (Pers.) Pers., Syn. meth. Fung. 563. 1801. — *Hericum* Pers. ex S. F. Gray, Nat. Arrang. Br. Pl. 1: 652. 1821. — *Hydnum* sect. *Hericum* (Pers. ex S. F. Gray) L. March. *in* Bijdr. natuurk. Wetensch. 3(1): 268. 1828. — *Hydnum* sect. *Hydnoidis* [subsect.] *Hericum* (Pers. ex S. F. Gray) Duby, Bot. gall., Ed. 2, 2: 777. 1830. — TYPE SPECIES: *Hydnum coralloides* Scop. (see DONK, 1956a: 79).

For further synonymy, see MAAS GEESTERANUS (1959: 118).

Basidiome attached to the substratum by a lateral (sometimes stipe-like) root and consisting of a massive body or a much branched mass, white when fresh. Hymenium covering spines which are white when fresh.

Context fleshy-tough, homogeneous, not zoned, amyloid, monomitic, made up of generative hyphae. Hyphae inflating, thin- to thick-walled, branched, septate, with clamp-connections, amyloid. Basidia slender-clavate, 4-spored, with basal clamp-connection. Spores subglobose to broadly ellipsoid or ovoid, smooth or minutely verrucose, colourless, amyloid. Gloeocystidia present.

Arboricolous or lignicolous.

The following key is based on normally developed specimens. I have as yet not succeeded in taking into account the changes that result from variability of the species or from environmental influence. These changes sometimes reduce a specimen to unrecognizability.

KEY TO THE SPECIES

1. Basidiome much branched.
 2. Spines evenly distributed, hanging down from the underside of the branches like teeth of a comb. Spores $3.5-4.5 \times 2.6-3.4 \mu$: *H. clathroides*
 2. Spines unevenly distributed, borne in terminal tufts or on short lateral processes. Spores $5.6-6.3 \times 4.4-5.4 \mu$: *H. coralloides*
1. Basidiome a massive body. Spores $5.2-6.1 \times 4-5 \mu$: *H. erinaceus*

HERICIUM CLATHROIDES (Pall. ex Fr.) Pers. — Figs. 55–60

Hydnum clathroides Pall., Reise versch. Prov. russ. Reichs 2(2): 744, pl. K fig. 3. 1773. — *Hericium clathroides* (Pall.) Pers., Comm. Fung. clav. 23. 1797. — *Hydnum coralloides* var. β ? *Hydnum clathroides* (Pall.) Pers., Syn. meth. Fung. 563. 1801. — *Hydnum clathroides* Pall. ex Fr., Syst. mycol. 1: 409. 1821. — *Hericium clathroides* (Pall. ex Fr.) Pers., Mycol. europ. 2: 151. 1825; Fr., Syst. Orb. veg. 1: 88. 1825. — *Merisma clathroides* (Pall. ex Fr.) Spreng., Syst. Veg., Ed. decima sexta, 4(1): 496. 1827. — *Dryodon clathroides* (Pall. ex Fr.) P. Karst. in Bidr. Känn. Finl. Nat. Folk 37: 239. 1882. — TYPE: represented by Pall., Reise versch. Prov. russ. Reichs 2(2): pl. K fig. 3. 1773.

Hydnum laciniatum Leers, Fl. herb. 276. 1775. — *Hericium laciniatum* Leers ex Banker in Mem. Torrey bot. Club 12: 114. 1906. — TYPE LOCALITY: Germany, Nassau, Herborn, "in der Hörre."

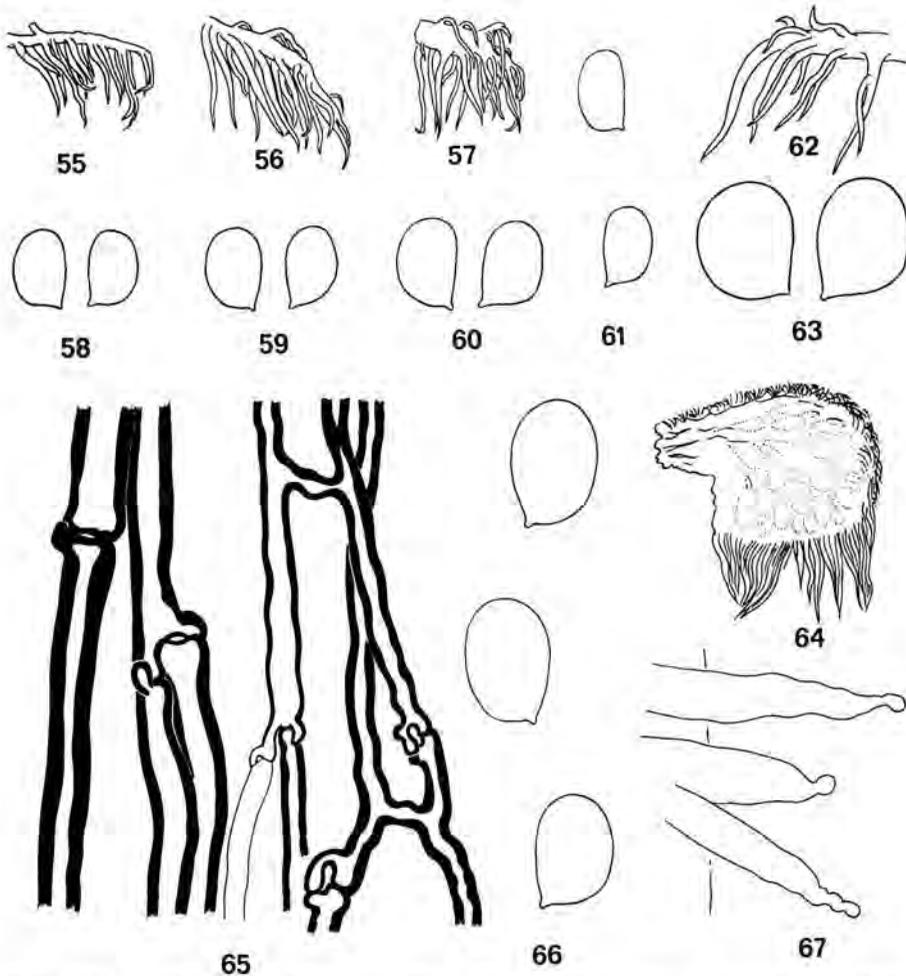
Hydnum ramosum Bull., Herb. France pl. 390. 1788; Hist. Champ. France 305. 1791; ex Mérat, Nouv. Fl. Envir. Paris, 2 éd., 1: 37. June 1821; not *Hydnum ramosum* Schw. in Schr. naturf. Ges. Leipzig 1: 104. 1822. — *Hericium ramosum* (Bull. ex Mérat) Letellier, Hist. Deser. Champ. 43. 1826. — TYPE: represented by Bull., Herb. France pl. 390. 1788.

Hydnum novae-zealandiae Colenso in Trans. Proc. N.Z. Inst. 21: 79. 1889. — TYPE: "761 / *Hydnum Novae-Zealandiae* Col." (part of type, K).

For further synonymy, see MAAS GEESTERANUS (1959: 126).

Basidiome of variable size and shape, consisting of few to several main branches springing from a rooting base which enters the wood of a tree. Main branches up to about 10 mm thick, ramified into progressively thinner branches, undulated, drooping, tomentose to felted, glabrescent, white when fresh, drying ochraceous to reddish brown. Spines up to 9 mm long (dry), hanging down from the lateral and ventral (rarely the dorsal) sides of the thinner branches, subulate, concolorous with the branches when fresh, but drying darker. Context tough when dry, not zoned, white when fresh, drying yellowish to reddish brown, amyloid.

Context monomitic, consisting of generative hyphae. Generative hyphae $3.5\text{--}18\ \mu$ wide, thin-walled to moderately thick-walled or even solid, inflating, branched, septate, with clamp-connections at the septa. Context of the spines similarly made up, with hyphae up to $22.5\ \mu$ wide. Basidia $16\text{--}20 \times 3.6\text{--}4.5\ \mu$, clavate, with clamp-connection at the base, with 4 sterigmata up to $3\ \mu$ long. Spores $3.5\text{--}4\text{--}(4.5) \times 2.6\text{--}3.4\ \mu$, ellipsoid, adaxially flattened, smooth, colourless, amyloid, with an oil-drop, with small apiculus. Conidia very similar, without apparent apiculus, sometimes occur-



Figs. 55-60. *Hericium clathroides* (Figs. 55, 58: Tasmania, Lloyd Mycol. Coll. 55547; Figs. 56, 59: New Zealand, PDD 18120; Figs. 57, 60: France, Barkman, L). - 55-57. Tip of branch with spines. - 58-60. Spores. (Figs. 55-57, $\times 2$; Figs. 58-60, $\times 2800$.)

Fig. 61. *Hydnum novae-zealandiae* (type). - Spores ($\times 2800$).

Figs. 62, 63. *Hericium coralloides* (India, Bas 4086). - 62. Tip of branch with spines. - 63. Spores. (Fig. 62, $\times 2$; Fig. 63, $\times 2800$.)

Figs. 64-67. *Hericium erinaceus* (Borneo, Corner, RSNB 8002). - 64. Section through basidiome. - 65. Generative hyphae from context of spine. - 66. Spores. - 67. Gloecystidia. (Fig. 64, $\times \frac{1}{2}$; Figs. 65, 67, $\times 700$; Fig. 66, $\times 2800$.)

ring abundantly. Gloeocystidia 5–9 μ wide, not or slightly projecting beyond the hymenium, thin-walled, the apical part more or less strongly bent, fusiform or gradually tapering towards the tip which sometimes is constricted and capitate; the oily contents staining dark purplish brown in sulpho-anisaldehyde.

COLLECTIONS EXAMINED AND REPORTED:

WEST PAKISTAN

Reported by AHMAD (1956: 67) from various localities under *H. coralloides*.

INDIA

Uttar Pradesh: Mundali, Chakrata (VASUDEVA, 1962: 48).

JAPAN

Hokkaido: Prov. Iburi, Tomakomai, 17 Oct. 1904, *K. Miyabe & T. Hanzawa* (Lloyd Mycol. Coll. 56528, BPI).

Honshu: Prov. Rikushu, 26 Oct. 1915, *A. Yasuda 589*, on *Quercus glandulifera* (Lloyd Mycol. Coll. 24008, BPI).

Also recorded by IMAZEKI & HONGO (1968: 135, as *H. laciniatum*).

AUSTRALIA

New South Wales: Sydney, no date, *J. B. Cleland 61* (Lloyd Mycol. Coll. 55548, BPI); Blue Mountains (CLELAND & CHEEL, 1919: 304).

Queensland: Imbil, 13 April 1963, *A. B. Cribb*, on dead tree in rain forest (L).

TASMANIA

Hobart, no date, *L. Rodway 1107* (Lloyd Mycol. Coll. 55547, BPI).

NEW ZEALAND

North Island: Auckland Distr., Huia, May 1957, *K. Wood* (PDD 18120); Karekare, Feb. 1966, *A. D. Mead* (PDD 25054); Orakei-Korako, 29 July 1965, *R. F. R. McNabb* (PDD 24663); Waikaretu, May 1956, *E. E. Chamberlain*, on *Metrosideros robusta* (PDD 15906). Waipawa County, Dannevirke, 1888, *W. Colenso*, type of *Hydnum novae-zealandiae* (K). Wellington Distr., Manawatu Gorge, June 1934, *E. E. Chamberlain* (PDD 3990); Weraroa, March 1925, *J. C. Neill*, on *Beilschmiedia tawa* (PDD 2013); further localities recorded by CUNNINGHAM (1958: 600, as *H. coralloides*).

South Island: Otago Distr., Horse Shoe Bay, Feb. 1954, *Miss J. M. Dingley*, on *Weinmannia racemosa* (PDD 14167).

Locality not specified, no date, *J. Dall* (K).

While assessing the numerous synonyms in *Hericiium* (MAAS GEESTERANUS, 1959) and trying to allocate them to the correct species, I erred in assuming that *Hydnum clathroides* and *Hericiium coralloides* should be the same species. At that time Pallas' itinerary was not available to me, but redescriptions of *H. clathroides* were found in the works of PERSOON (1797: 23) and WEINMANN (1836: 361). Feeling somewhat uncertain as to how to interpret the description of the spines, I allowed the following passage help decide my choice: "Inventa specimina plurima ad truncos

putridos in Pineto . . ." in the assumption that (i) Pinetum might have been used in a broad sense meaning coniferous wood in general, and (ii) *H. ramosum* (the name I then used for *H. clathroides*) is not known to grow on conifers. Consequently I reduced *H. clathroides* to the synonymy of *H. coralloides*, but when, during my visit to Uppsala, Prof. Nannfeldt kindly showed me the illustration of *Hydnum clathroides* in Pallas' book, I had to admit that it undoubtedly represents what I used to call *Hericium ramosum*, and in American literature is known as *Hericium laciniatum*. This leaves us with the problem of how to reconcile Pallas' statement with the general experience that *H. clathroides* is exclusively reported from deciduous trees. The only solution I can think of is to realize that Pallas did not explicitly state he found his specimens on a conifer, and to assume that his Pinetum may have contained some scattered stumps of deciduous trees.

As regards the hosts now known to be attacked by *H. clathroides*, they appear to pertain to various families, of which some are closely related but others stand widely apart. These are *Betula* (Betulaceae), *Fagus* and *Quercus* (Fagaceae), *Carya* (Juglandaceae), *Populus tremula* (Salicaceae), *Beilschmiedia tawa* (Lauraceae), *Weinmannia racemosa* (Cunoniaceae), and *Metrosideros robusta* (Myrtaceae).

The name given to collections from Australia and New Zealand is without exception *Hericium coralloides*, as was also the rule for European material. Thus far, however, no records of the genuine *H. coralloides* from these regions have come to my knowledge. I have little doubt therefore that *Hydnum coralloides* reported by COOKE (1892: 171) from Australia (Queensland) and New Zealand refer to *H. clathroides*, although I have not seen this material. LLOYD also mentioned *H. coralloides* from Australia (1915, Lett. 59: 1) and Tasmania (1922: 1162); both collections turn out to be *H. clathroides*. As far as I have seen the collections from New Zealand enumerated by Cunningham as *H. coralloides* all are referable to the present species. The type of *Hydnum novae-zealandiae*, too, is nothing else but *H. clathroides*.

A photograph of a specimen found in the Darlimurla area, Victoria, and published by E. LYNDON (1969: 350) very probably represents *H. clathroides*, not *H. coralloides*.

The only author to use the name *Hydnum clathroides* for a collection from New Zealand was HOOKER (1867: 611) but I am rather inclined to think that his description, which indicates the colour of the basidiome as ashy-grey, applies to some species of *Gloiodon*.

In Lloyd's herbarium there are two gatherings from Japan under the name *Hydnum coralloides*, but it is probably not possible to ascertain whether these collections are actually those reported (LLOYD, 1920: 980; 1924: 1265).

Hericium clathroides in Australia and New Zealand sometimes seems different from what one is used to in Europe in that the spines are less regularly hanging down from the underside of the branches, while the

spores are found to be somewhat narrower (mature spores in European material are known to measure $4-5 \times 3-4 \mu$). These two features are particularly noticeable in the type of *Hydnum novae-zealandiae* (Fig. 61), so that for some time I was tempted to regard this as an independent species. It was only after I had seen many more collections that I became convinced that the various deviating forms in the Australian area are an expression of the variability of a single species, *Hericium clathroides*.

HERICIUM CORALLOIDES (Scop. ex Fr.) S. F. Gray — Figs. 62, 63

Hydnum coralloides Scop., Fl. carniol., Ed. 2, 2: 472. 1772. — *Hericium coralloides* (Scop.) Pers. in Neues Mag. Bot. 1: 109. 1794 (misapplied); Comm. Fung. clav. 23. 1797. — *Hydnum coralloides* Scop. ex Fr., Syst. mycol. 1: 408. 1821 (misapplied). — *Hericium coralloides* (Scop. ex Fr.) S. F. Gray, Nat. Arrang. Br. Pl. 1: 652. 1821. — *Medusina coralloides* (Scop. ex Fr.) Chev., Fl. gén. Envir. Paris 1: 279. 1826 (misapplied). — *Merisma coralloides* (Scop. ex Fr.) Spreng., Syst. Veg., Ed. 16, 4(1): 496. 1827. — *Friesites coralloides* (Scop. ex Fr.) P. Karst. in Meddn Soc. Fauna Fl. fenn. 5: 41. 1879. — *Dryodon coralloides* (Scop. ex Fr.) P. Karst. in Meddn Soc. Fauna Fl. fenn. 6: 15. 1881. — *Manina coralloides* (Scop. ex Fr.) Banker in Mycologia 4: 276. 1912. — TYPE LOCALITY: Austria, Krain.

For further synonymy, see MAAS GEESTERANUS (1959: 119).

Basidiome of variable size and shape, made up of a rooting base and several main branches springing from it. Main branches up to about 8 mm thick, ramified into progressively thinner branches, patent or curved to drooping, minutely tomentose to felted, glabrescent, white when fresh, drying ochraceous to reddish brown. Spines up to about 10 mm long (dry), curving out solitarily or in small fascicles from the thinner branches, subulate, concolorous with the branches when fresh, drying darker. Context tough when dry, not zoned, white when fresh, drying yellowish to reddish brown, amyloid.

Context monomitic, consisting of generative hyphae. Generative hyphae $3.5-18 \mu$ wide, thin-walled to thick-walled (cell-walls up to 4.5μ thick, the narrower hyphae frequently solid), inflating, branched, septate, with clamp-connections at the septa. Context of the spines similarly constructed. Basidia $27-40 \times 5.5-7 \mu$, slender-clavate, with clamp-connection at the base, with 4 sterigmata up to 4.5μ long. Spores $5.6-6.3 \times (4.4-4.6-5.4 \mu)$, broadly ellipsoid, smooth or minutely verrucose (the minute dots and somewhat coarser warts showing up only when stained in Melzer's reagent), colourless, amyloid, with an oil-drop, with small apiculus. Conidia very similar, without apparent apiculus. Gloeocystidia $5-9 \mu$ wide, not or slightly projecting beyond the hymenium, thin-walled, the apical part more or less strongly bent, fusiform or cylindrical, the tip sometimes constricted and capitate; the oily contents staining dark purplish brown in sulpho-anisaldehyde.

COLLECTIONS EXAMINED AND REPORTED:

WEST PAKISTAN

Recorded by AHMAD (1956: 67) under *H. caput-ursi*.

INDIA

Himachal Pradesh: Narkanda, Mt. Hattu, 8 Aug. 1964, *C. Bas 4086*, on log (probably coniferous wood), c. 3000 m alt. (L).

TIBET

S. E. Tibet, Kongbo, valley above Sang, 20 June 1938, *Ludlow, Sherriff & Taylor 4988*, 3150 m alt. (BM). Reported as *H. caput-ursi* (BALFOUR-BROWNE, 1955: 192).

CHINA

Recorded without specification of locality by TENG (1964: 432).

JAPAN

Honshu: Prov. Kozuke, 10 Aug. 1919, *A. Yasuda 599*, on wood of *Cryptomeria japonica* (Lloyd Mycol. Coll. 39444, BPI); further records by Ito (1955: 191). Tochigi Pref., Nikko Nat. Park, west end of Lake Chuzenji, 5 Oct. 1957, *S. Imai, R. P. Korf & al.*, 30 (CUP).

LOMBOK

Mt. Rindjani, Segara anak, 16 June 1936, *C. N. A. de Voogd 2664*, on *Casuarina* trunk, 2000 m alt. (BO 15746).

The failure in Europe to recognize more than one species of the much branched kind of *Hericium* has resulted in an almost endless confusion, which was perpetuated in other parts of the world except North America. Consequently, records in the literature which fail to give proper information cannot be interpreted. In some cases where the host tree is mentioned the possible identity of the fungus may be indicated. VASUDEVA (1962: 48) reported "*H. coralloides*" from two localities in Uttar Pradesh, India, adding the information "On dead branches of a green oak," To my knowledge, true *H. coralloides* in north-temperate regions has been found only on conifers, so that the Indian record probably refers to *H. clathroides* (see p. 51). On the other hand *H. coralloides* was once collected on Mt. Rindjani, Lombok, on the trunk of a *Casuarina*, and Balfour-Browne, listing the species (as *Hericium caput-ursi*) for Tibet, added the collectors' annotation "in wet leaf mould under evergreen oak." I have seen this material and it certainly represents genuine *H. coralloides*. If that particular forest did not also contain conifers and if the fungus had not been discarded by some local mushroom-collector, who dropped it under the oak where it was subsequently found by the British party, there would be little else but to admit that the host range of *H. coralloides* is wider than I now think it is.

HERICIUM ERINACEUS (Bull. ex Fr.) Pers. — Figs. 64–67

Hydnum erinaceus Bull., Herb. France pl. [34]. 1780; Hist. Champ. France 304. 1791. — *Clavaria erinaceus* (Bull.) Paul., Traité Champ. 2: Index. 1793 ("*erinacea*"). — *Hericium erinaceus* (Bull.) Pers., Comm. Fung. clav. 27. 1797. — *Hydnum erinaceus* Bull. ex Fr., Syst. mycol. 1: 407. 1821. — *Steccherinum quercinum* S. F. Gray, Nat. Arrang. Br. Pl. 1: 651. 1821 (name change). — *Hericium erinaceus* (Bull. ex Fr.) Pers., Mycol. europ. 2: 153. 1825. — *Hericium commune* Roques, Hist. Champ. comest. vén. 47. 1832; idem, ed. 2, 107. 1841 (name change). — *Dryodon erinaceus* (Bull. ex Fr.) P. Karst. in Bidr. Känn. Finl. Nat. Folk 37: 92. 1882 ("Quélet"). — TYPE: represented by Bulliard, Herb. France pl. [34]. 1780.

For further synonymy, see MAAS GEESTERANUS (1959: 123).

Basidiome of variable size and shape, pendent from a lateral thick rooting stem, massive, subglobose to obovoid, more or less distinctly lobed, bearing dense masses of spines on the outside. Spines up to 25 mm long, very crowded, subulate, white when fresh, drying dingy brownish yellow to dark reddish brown; the spines covering the upper side of the basidiome shorter and irregularly flexuous. Context characterized by elliptic to circular patches, or lacunose and showing cavities, white when fresh, drying dingy yellowish to red-brown, amyloid.

Context monomitic, consisting of generative hyphae. Generative hyphae 3.5–20 μ wide, thin-walled to thick-walled (cell-walls up to 4.5 μ thick, the narrower hyphae often solid), inflating, branched, septate, with clamp-connections. Context of the spines similar. Basidia 25–36 \times 6–8 μ , slender-clavate, with clamp-connection at the base, with 4 sterigmata up to 4.5 μ long. Spores 5.2–6.1 \times 4–5 μ , broadly ellipsoid to ovoid, fairly thick-walled, smooth or minutely verrucose (the warts showing up only when stained in Melzer's reagent), colourless, amyloid, with an oil-drop, with small apiculus. Gloeocystidia 6–12.5 μ wide, the apical part more or less strongly bent, projecting beyond the hymenium, thin-walled, fusiform or cylindrical, the tip sometimes constricted and capitate; the oily contents staining purplish brown in sulpho-anisaldehyde.

COLLECTIONS EXAMINED AND REPORTED:

WEST PAKISTAN

Changla Gali (AHMAD, 1956: 67).

INDIA

Recorded by VASUDEVA (1960: 156; 1962: 48).

NEPAL

Above Sauwala Khola and Chinggaon, Kali Gandaki (BALFOUR-BROWN, 1968: 122).

SIKKIM

Recorded by BERKELEY (1854: 168) and VASUDEVA (1960: 156).

CHINA

Prov. Honan: bought at an inn at Lo-yang and said to have been collected in the surrounding woods, 1965 (L). Also recorded by TENG (1964: 431).

JAPAN

Honshu: Tochigi Pref., Nikko, between Shobu ga Hama (on Lake Chuzenji) and Acanuma, 5 Oct. 1957, *S. Imai, R. P. Korf & al.*, 104 (CUP); also reported from Prov. Kawachi by HENNINGS (1900: 267).

Further records published by KAWAMURA (1954: 610), ITO (1955: 191), and IMAZEKI & HONGO (1965: 253).

BORNEO

Sabah: Mt. Kinabalu, Mesdan Caves, 31 March 1964, *E. J. H. Corner*, *RSNB 8002*, on living oak in oak-forest, c. 2000 m alt., old and beginning to decay (L).

If well-developed, *Hericium erinaceus* is unmistakable. In some cases, however, it is by no means easy to differentiate certain growth forms of this species from *H. coralloides*, which has spores of the same size. As a rule *H. coralloides* is a much branched species, but greatly contracted forms are known to exist in which the basidiome, instead of forming long and graceful branches, consists of a massive body very much like that of *H. erinaceus*. In such cases it is a great help to know the host, for, although my experience is still somewhat limited, it would seem correct to state that *H. coralloides* is a parasite of conifers, *H. erinaceus* of deciduous trees. Consequently, I am inclined to think that the species recorded by BALFOUR-BROWNE (1955: 192) from Tibet as *Hydnum erinaceus* actually refers to *Hericium coralloides* because it was found to grow on a conifer.

In Lloyd Mycological Herbarium (No. 45863, BPI) there is a fragment from Hobart, Tasmania, collected by L. Rodway, which to judge from its properties is a true *Hericium*. The spores are $4.9-5.3 \times 3.8-4.3 \mu$, amyloid and rather strongly warted; they are probably too large for *H. clathroides*, rather narrow for *H. erinaceus*, but possibly immature. Since the general appearance seems unlike that of *H. coralloides*, the specimen is very doubtfully referred to *H. erinaceus*. Masee had named it *Hydnum caput-medusae*, which is nothing else but a growth form. Properly speaking, Lloyd was right in stating on the label: "Too frustular to name."

STECCHERICIUM D. Reid

Stecchericum D. Reid in Kew Bull. 17: 270. 1963. — TYPE SPECIES: *Steccherinum fistulatum* G. Cunn.

Basidiome pileate. Pileus sessile or attached to the substratum by its vertex, becoming effused-reflexed, expanding laterally, velutinous, then fibrillose, with age becoming concentrically zoned or sulcate, yellowish to brownish. Hymenium covering spines on the underside of the pileus. Spines subulate, flesh-colour. Context of the pileus fibrous, thin, tough, indistinctly zoned, whitish, monomitic to imperfectly dimitic with skeletal-like hyphae. Generative hyphae not inflating, branched, septate, with clamp-connections, thin- to thick-walled. Connecting hyphae few to numerous, thin- to moderately thick-walled, with clamp-connections. Skeletal-like hyphae thick-walled, filled with oily matter. Context of the spines dimitic, made up of generative and oleiferous skeletal-like hyphae. Basidia clavate, 4-spored, with basal clamp. Spores ellipsoid, colourless, finely asperulate to fairly coarsely warted, amyloid, with oblique apiculus. Gloeocystidia not encrusted, their oily contents staining reddish in sulpho-anisealdehyde.

Arboricolous.

KEY TO THE SPECIES

1. Spines very crowded, straight, with acute tips, looking very trim. Spores finely asperulate, the ornamentation when viewed in Melzer's reagent often only visible at the contours of the spores: *S. seriatum*
1. Spines moderately crowded, often strangulated, with blunt tips, more or less irregularly arranged. Spores when viewed in Melzer's reagent with comparatively few but conspicuous warts: *S. rusticum*

Stecchericum rusticum Maas G., *spec. nov.*⁶⁾—Figs. 68–74

Basidiomata lateraliter confluentia. Pileus vertice substrato affixus, deinde effuso-reflexus, circa 25 mm latus et diametro, conchatus vel flabelliformis, lente coriaceus, velutinus in partibus recentioribus, radiatim ruguloso-fibrillosus vel fibrilloso-spiculosus atque tuberculato-inaequalis in partibus veterioribus, sulcis concentricis munitus, subnitidus, pallide brunneo-ochraceus, in aetate fulvescens vel fuscescens, unicolor vel obscuratus in sulcis. Aculei usque ad 3 mm longi et 0.3 mm lati, decurrentes, subconferti, subirregulariter dispositi, conico-subulati, substrangulati, obtusi, pallide ochracei vel brunnei. Caro usque ad 1 mm crassa, firma, albida, superne mollior et brunneola, inferne in stratum angustum corneum converta, odore nullo in sicco; dimitica e hyphis generatoriis et nonnullis commutatis formata. Hyphae generatoriae 2.2–3.6 μ latae, haud inflatae, ramosae, septatae, fibulatae, pilei marginem versus materia oleosa expletae, retrorsum vacuae, in pilei parte superiore tenuiter tunicatae, in parte inferiore crasse tunicatae vel solidae. Hyphae commutatae hyphis skeletalibus similes sed oleiferae. Aculeorum contextus dimiticus, e hyphis generatoriis tenuiter tunicatis et hyphis oleiferis hyphas skeletales aemulantibus formatus. Basidia collapsa (alibi clavata, fibulata, 4-spora). Spores 3.1–3.6 \times 2.3–2.6 μ , ellipsoideae, adaxialiter applanatae, sparse sed conspicue verrucosae, hyalinae, forte amyloideae, apiculo parvo praeditae. Gloecystidia usque ad 16 μ lata, abundantia, varie inflata, laevia, hymenium parum superantia.

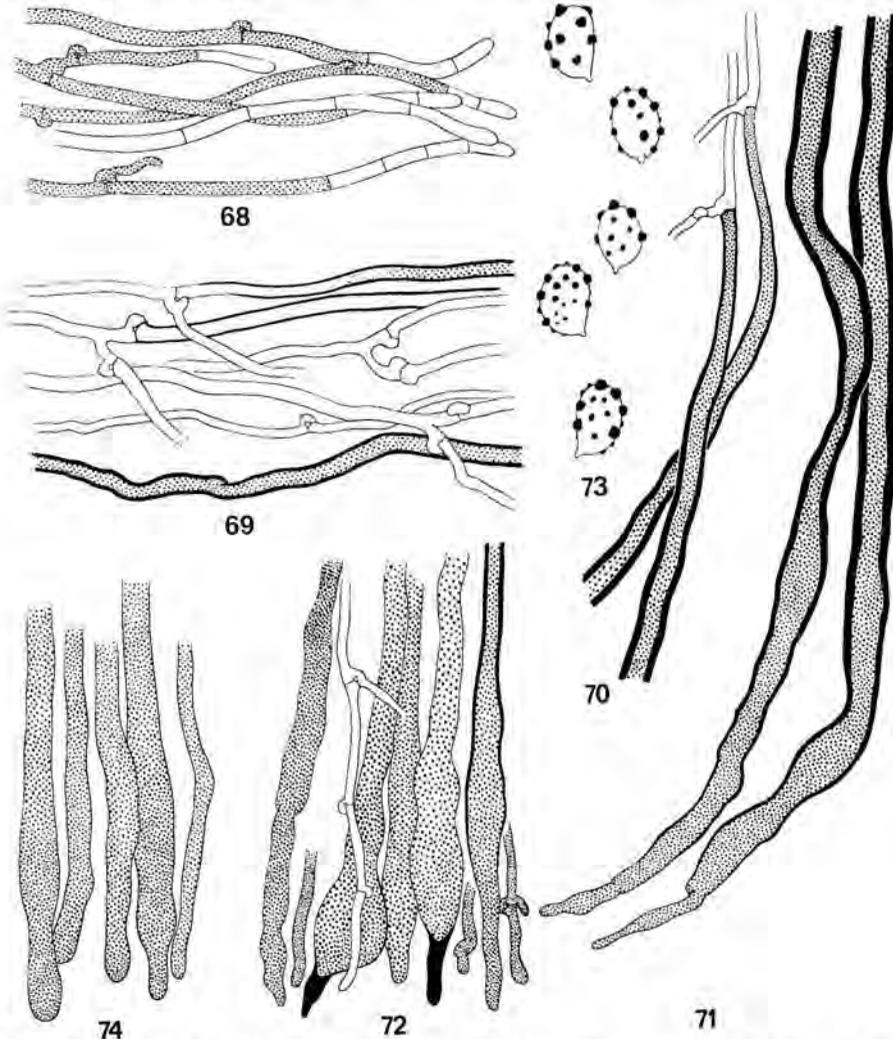
HOLOTYPE: Singapore, Mandai Road, 20 Oct. 1929, *E. J. H. Corner* (L).

Basidiomes confluent at the sides. Pileus attached to the substratum by its vertex, subsequently becoming effused-reflexed, about 25 mm wide and 25 mm radius, conchate to flabelliform, tough-coriaceous, plushy in the younger parts, radiately rugulose-fibrillose or fibrillose-spiculose and tuberculate-uneven in the older parts, with several concentric grooves, dull to somewhat shiny, fairly pale brownish ochraceous when young, warm yellow-brown or fulvous to tawny when old, unicolorous or darkened in the grooves. Spines up to 3 mm long, up to 0.3 mm thick, decurrent, moderately crowded, somewhat irregularly arranged, conical-subulate, often somewhat strangulated, usually blunt-tipped, pale ochraceous to brownish. Context up to 1 mm thick, firm and whitish below, somewhat softer and slightly brownish above, with a narrow, horny and somewhat brownish zone towards the hymenium. Odour none when dry.

Context of the pileus imperfectly dimitic, consisting of generative hyphae, many of which increasingly filled with oily matter towards their tips, and skeletal-like oleiferous hyphae. Generative hyphae 2.2–3.6 μ wide, thin-walled in the upper part of the context, not inflating, branched, septate, with clamp-connections at the septa, their oily contents gradually disappearing with growing distance from the margin. Among the generative hyphae, some modified hyphae may be found, which are somewhat wider (up to 4.5 μ), thicker-walled (cell-walls up to 1 μ), without cross-walls and, except near their origin, somewhat more densely filled with oily matter. The lowermost part of the context looks very different in that the generative hyphae are thick-walled to solid, while the modified hyphae are much more skeletal-like and occur in great abundance. Context of the spines dimitic, consisting of generative hyphae and skeletal-like oleiferous hyphae. Generative hyphae similar to those of the pileus, thin-walled. Skeletal-like hyphae all oleiferous, longest and best developed

⁶⁾ Etymology: rusticus, ponderous, clumsy, coarse, referring to the stout spines and the coarsely warted spores.

in the axis of the spine, shorter towards its sides. Hymenium, except for the gloecystidia, collapsed. Spores $3.1-3.6 \times 2.3-2.6 \mu$, ellipsoid, adaxially flattened, beset with comparatively few, but conspicuous and prominent warts, colourless, strongly amyloid, with small apiculus. Gloecystidia abundant, variously shaped and inflated, up to 16μ wide at the tip of the spine, up to 9μ at the sides, thin- to thick-walled, little projecting beyond the hymenium, not encrusted, the oily contents staining dingy red-brown in sulpho-anisaldehyde.



Figs. 68-73. *Stecchericium rusticum* (holotype). - 68. Generative hyphae of the margin of the pileus, mostly with oily contents. - 69. Detail of the pileus 500μ back from the margin, showing empty generative hyphae, and some modified hyphae filled or partly filled with oily matter. - 70. Origin of the skeletal-like oleiferous hyphae in a spine. - 71. Two gloecystidia from the side of a spine. - 72. Tip of a spine with variously shaped gloecystidia and generative hyphae. - 73. Spores. (Figs. 68-72, $\times 700$; Fig. 73, $\times 2800$.)

Fig. 74. *Stecchericium rusticum* (Borneo, Corner). - Tip of a spine with more conventionally shaped gloecystidia ($\times 700$).

The species is somewhat more variable than can be inferred from the above account, which is a description of the type collection. Also, in this description only the colours of the dried material have been given. Supplementary details are to be found in the following lines, most of them taken from Prof. Corner's notes:

Pileus up to 120 mm wide, separable, tawny ochraceous to fawn brown. Margin whitish. Spines up to 5 mm long, pallid to wood brown. Odour somewhat of fenugreek. Hymenium up to 250 μ thick. Basidia 25–30 \times 4 μ , clavate, with clamp-connection at the base, with 4 sterigmata up to 4.5 μ long. Spores 3.3–4 \times 2.3–2.7 μ , 3.6–4.2 \times 2.5–2.7 μ in the collection from Borneo. Gloeocystidia, more particularly those at the tip of the spines, not always of the shape as depicted in Fig. 72, those in the Borneo collection for example being of a more conventional form (Fig. 74).

COLLECTIONS EXAMINED:

MALAY PENINSULA

Pahang: Tembeling, 15 Nov. 1930, *E. J. H. Corner* (L).

Singapore: Singapore, Mandai Road, 20 Oct. 1929, *E. J. H. Corner*, holotype (L); 6 May 1934, *E. J. H. Corner* (L).

BORNEO

Sabah: Ranau, 10 Aug 1960, *E. J. H. Corner*, 900 m alt. (L).

A conspicuous feature of the dried specimens is the strong downward inflexion of the margin of the pileus. The anatomical basis for this phenomenon is that there is a predominance of thick-walled elements in the lower portion of the context.

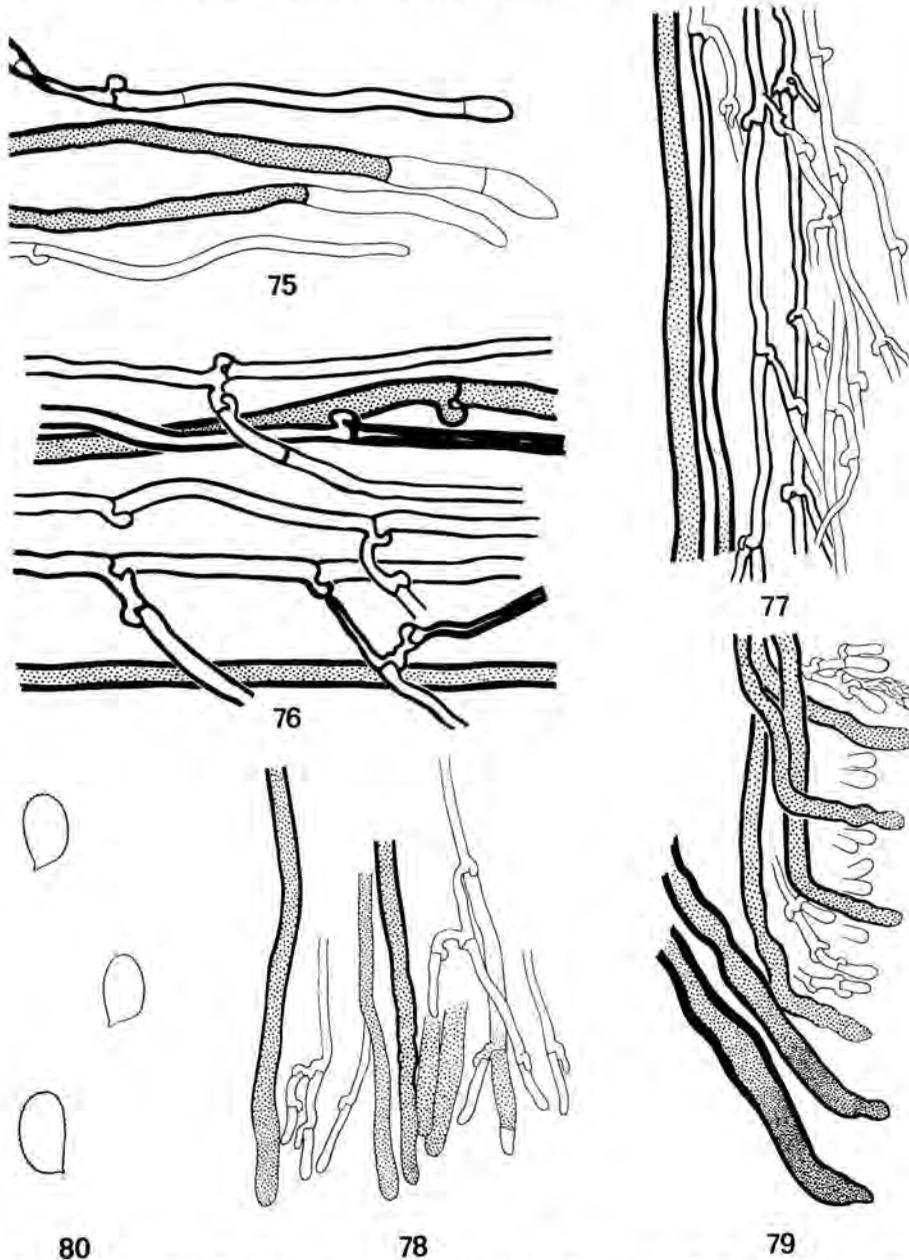
Apart from the differences indicated in the key, it would seem that *S. rusticum* and *S. seriatum* may also be differentiated by features of the pileus, but the correctness of this supposition will have to be confirmed by further observation. The surface of the pileus in *S. rusticum* seems to become very knobby and uneven, and a fairly dark brown is the predominant colour in an advanced age; in *S. seriatum*, on the contrary, the pileus remains comparatively smooth and pale.

STECCHERICIUM SERIATUM (Lloyd) Maas G.—Figs. 75–80

Hydnum seriatum Lloyd, Mycol. Writ. 7: 1196, pl. 242 fig. 2438. 1923. — *Steccherium seriatum* (Lloyd) Maas G. in Proc. K. Ned. Akad. Wet. (Ser. C) 69: 325, figs. 15–19. 1966. — TYPE: "Flora of British North Borneo / Sandakan and vicinity / Sept.-Dec. 1920 / *M. Ramos* No. 2059" (Lloyd Mycol. Coll. 4876, BPI); part of type (BO).

Steccherinum fistulatum G. Cunn. in Trans. R. Soc. N.Z. 85: 598, fig. 6. 1958. — *Steccherium fistulatum* (G. Cunn.) D. Reid in Kew Bull. 17: 270. 1963. — TYPE: Australia, North Queensland, Stony Creek, June 1955, *W. Pont* (PDD 17709).

Basidiomes isolated or grouped together, sometimes imbricate or confluent at the sides. Pileus either at first attached to the substratum by its vertex, subsequently becoming effused-reflexed, or effused-reflexed from



Figs. 75–80. *Stecchericium seriatum* f. *seriatum* (Singapore, 2 Jan. 1941). – 75. Generative hyphae of the margin of the pileus, some with oily contents. – 76. Detail of the pileus 500 μ back from the margin, showing moderately thick-walled to thick-walled generative hyphae, some empty, others filled with oily matter. – 77. Detail of the region near the axis of a spine, showing skeletal-like oleiferous hyphae, moderately thick-walled generative hyphae and, towards the subhymenium, thin-walled generative hyphae. – 78. Tip of a spine with straight to flexuous gloeocystidia, generative hyphae, and a hypha of intermediate kind. – 79. Detail of a spine with immature basidia and sharply bent gloeocystidia. – 80. Spores. (Figs. 75–79, $\times 700$; Fig. 80, $\times 2800$.)

the beginning, up to 50 mm wide and 30 mm radius, conchate to flabelliform, coriaceous, finely plushy in the younger parts, subtomentose to radiately fibrillose in the older parts, sometimes radiately wrinkled, with few to numerous shallow concentric grooves, dull to somewhat shiny, unicolorous or with darker concentric zones. Spines up to 2.5 mm long, decurrent, very crowded, subulate, slender, occasionally flattened or a few connate, with acute tips. Context less than 1 mm thick, homogeneous. Odour slight, none when dry.

Context of the pileus imperfectly dimitic, consisting of generative hyphae, many increasingly filled with oily matter towards their tips. Generative hyphae 2.7–5.4 μ wide, originally thin-walled, becoming moderately thick-walled to nearly solid (cell-walls up to 1.8 μ), not inflating, branched, septate, with clamp-connections at the septa, their oily contents, so conspicuous at their tips, petering out farther back from the margin. Many of the hyphae near the margin more than others resembling skeletal hyphae in being wider, thicker-walled, and having fewer septa. Farther back from the margin, however, and more particularly in older specimens, the difference disappears completely, since all hyphae are equally wide and thick-walled. Context of the spines dimitic, consisting of generative hyphae and skeletal-like oleiferous hyphae. Generative hyphae similar to those of the pileus but narrower (2.7–3 μ wide) and generally thinner-walled. Skeletal-like hyphae oleiferous in the distal part, longest and best developed in the axis of the spine, shorter and frequently passing into ordinary side-branches towards the sides of the spine. Hymenium slightly thickening. Basidia (either immature or collapsed) about 18×4.5 μ , clavate, with clamp-connection at the base, 4-spored. Spores 2.6–3.5 \times 2.1–2.5 μ , ellipsoid, adaxially flattened, finely asperulate (often only visible at the contours of the spore and only when fully developed and stained in Melzer's reagent), colourless, strongly amyloid, with small apiculus. Gloeocystidia 3.6–5.4 μ wide, thin-walled to moderately thick-walled and straight to flexuous at the tip of the spine, up to 8 μ wide, thicker-walled, and often sharply bent at the sides, not or little projecting beyond the hymenium, not encrusted with crystalline matter, the contents staining wine-red in sulpho-anisaldehyde (see remarks).

Forma SERIATUM — Pl. III, figs. 1, 2

Pileus alba, in aetate pallide bubalinus vel pallide alutaceo-ochraceus vel pallide hinnuleus. Aculei albi, deinde pallide ochracei, siccis sordide incarnati. Contextus albidus.

Pileus white becoming pale buff, pale biscuit-colour, pale tan ochraceous or pale fawn. Spines white then pale ochraceous, dingy flesh-colour when dry. Context whitish.

COLLECTIONS EXAMINED AND REPORTED:

PHILIPPINES

Luzon: Laguna, Los Baños, 1 Sept. 1917, *R. Reyes 3373* (Lloyd Mycol. Coll. 16708, BPI); Mt. Maquiling, Nov. 1920, *U. Marilao* (Lloyd Mycol. Coll. 16707, BPI).

SUMATRA

East Coast, no date, *H. S. Yates 12* (Lloyd Mycol. Coll. 4896, BPI).

MALAY PENINSULA

Pahang: Tembeling, 5 and 7 Nov. 1930, *E. J. H. Corner* (L); 15 Nov. 1930, *E. J. H. Corner* (also in liquid, L).

Perlis: Bukit Chupeng, 24 Nov. 1929, *E. J. H. Corner* (L).

Selangor: Kuala Lumpur, Weld Hill, 16 Jan. 1920, *M. Noor 5557* (K).

Singapore: Singapore, Bukit Timah, 2 Jan. 1941, *E. J. H. Corner* (also in liquid, L); 18 March 1941, *E. J. H. Corner* (also in liquid, L).

BORNEO

Sabah: Sandakan, between Sept. and Dec. 1920, *M. Ramos 2059*, type of *Stecchericum seriatum* (Lloyd Mycol. Coll. 4876, BPI).

JAVA

West Java: Buitenzorg [now Bogor], no date, *W. M. Docters van Leeuwen 3587* (Lloyd Mycol. Coll. 16710, BPI).

AUSTRALIA

New South Wales: Sydney, no date, *J. B. Cleland 391* (Lloyd Mycol. Coll. 16702, BPI).

North Queensland: Stony Creek, June 1955, *W. Pont*, type of *Stecchericum fistulatum* (PDD 17709).

NEW ZEALAND

Various localities (CUNNINGHAM, 1958: 599).

Forma *vitellinum* Maas G., *f. nov.*⁷⁾—Pl. III, fig. 3

Pileus ochraceus, hinnuleo-ochraceus vel pallide cinnamomeo-fuscus, luteolus in partibus recentioribus, margine luteo-alba. Aculei luteoli, deinde pallide cinnamomeo-bubalini vel ochraceo-bubalini apicibus cremeis. Contextus pallide cinnamomeo-bubalinus.

HOLOTYPE: Singapore, Bukit Timah, 3 Aug. 1940, *E. J. H. Corner* (L).

Pileus ochraceous to fawn ochraceous or light cinnamon fuscous, clear pale yellow in the younger parts, the margin pallid yellowish-white. Spines pale yellow, becoming pale cinnamon buff or ochraceous buff with cream-coloured tips. Context pale cinnamon buff. All colours disappearing on drying, leaving the specimens indistinguishable from *f. seriatum*.

COLLECTION EXAMINED:

MALAY PENINSULA

Singapore: Singapore, Bukit Timah, 31 Aug. 1940, *E. J. H. Corner*, on logs, holotype (L).

Examination of the comparatively rich collections from the Malay Peninsula and Singapore have made it clear that a specific separation of *S. seriatum* and *S. fistulatum* can no longer be upheld. The characters I once thought to have distinctive value (1967c: 86) proved to have no significance. The darker zones on the surface of the pileus indicate that the growth was temporarily stopped, probably influenced by some unfavourable climatic condition, for in these zones all hyphae are collapsed. Con-

⁷⁾ Etymology: vitellinus, egg-yolk yellow.

centric grooves are typical of the species, because they are an expression of its mode of growth. The dark zones, however, have an external cause. Hence they cannot be used as a character to distinguish specimens specifically.

Professor J. Boidin, Lyon, in a letter expressed his surprise at the positive reaction of the gloeocystidia of *Stecchericium seriatum* in sulpho-anisealdehyde. In his opinion, this behaviour would be new to the Hericiaceae. In order to verify my observations, I checked the reaction in all collections available, with the following results.

1. The non-oleaginous part of the contents of the gloeocystidia in *S. seriatum* stains wine-red in sulpho-anisealdehyde.

2. The colour is strongest in the distal portion of the gloeocystidia.

3. The colour is absent or weak in the gloeocystidia of very young or underdeveloped spines, strong in old and well-developed spines.

4. The oily matter in the gloeocystidia remains completely unaffected.

I then proceeded to check the reaction of the contents of the gloeocystidia in *Hericium clathroides*, *H. coralloides*, and *H. erinaceus*. This yielded the following results.

1. Apart from some fluctuation in the intensity of the colour, the reaction is strongest in *Hericium erinaceus*.

2. It takes longer in the species of *Hericium* than in *Stecchericium seriatum* for the reaction to show up.

3. It is the oily matter in the gloeocystidia that becomes stained.

If any conclusion at all is permissible from the foregoing, I would remind that in the present stage of mycological taxonomy and with the badly felt lack of precise knowledge of the chemical substances in Aphyllophorales, chemical reactions should be used and interpreted with discretion to prove or disprove relationships. The cogency of this admonishment becomes all the more apparent when it is realized that the gloeocystidia in *Stecchericium rusticum* and *S. seriatum* show a different behaviour towards sulpho-anisealdehyde.

The number of localities enumerated suggests that *S. seriatum* is a fairly common species in the area under discussion. I have no doubt moreover that a revision of all collections named *Steccherinum ochraceum* will bring several more localities for *Stecchericium seriatum* to light, for the two species have frequently been confused. LLOYD listed *S. seriatum* as *S. ochraceum* from Los Baños (1920:971), Sumatra (1921:1096), Java (1920:965), and New South Wales (1918:4).

HYDNACEAE Chev.

Hydnaceae Chev., Fl. Env. Paris 1: 270. 1826. — TYPE: *Hydnum* L. ex Fr.
For synonymy, see DONK (1964: 272).

Basidiome pileate and stipitate. Pileus initially tomentose, white to yellow or orange in various shades. Stipe central or not, finely tomentose, paler than the pileus or concolorous. Hymenophore aculeate. Spines paler

than the pileus or concolorous. Context fleshy, brittle, homogeneous, not zoned, white or slightly coloured, monomitic. Generative hyphae inflating, thin-walled, branched, septate, with clamp-connections. Basidia slender-clavate, 2-6-spored, with basal clamp, stichic. Spores subglobose to obovoid, smooth, colourless. Cystidia absent.

Terrestrial.

HYDNUM L. ex Fr.

Hydnum L., Sp. Pl. 2: 1178. 1753. — *Hypothele* Paul., Mycétol. 43, 47. about 1812 (avowed name change); ex Banker in *Torreyia* 4: 113. 1904. — *Hydnum* L. ex Fr., Syst. mycol. 1: lvi, 397. 1821; not *Hydnum* S. F. Gray, Nat. Arrang. Brit. Pl. 1: 650. 1821 ("Dill.") [= *Sarcodon* P. Karst.]. — TYPE SPECIES: *Hydnum repandum* L. ex Fr. (see DONK, 1956a: 97).

For further synonymy, see MAAS GEESTERANUS (1959: 132).

Basidiome pileate and stipitate. Pileus covered with tomentum which, when collapsed, may form a matted or glabrous surface, but is not known to develop scales; whitish to yellow or orange in various shades. Stipe finely tomentose, glabrescent, paler than the pileus or concolorous. Hymenium covering spines on the underside of the pileus. Spines whitish to paler or darker salmon. Context of the pileus fleshy, homogeneous, not zoned, monomitic, made up of generative hyphae. Hyphae inflating, thin-walled, branched, septate, with clamp-connections. Basidia cylindrical-clavate, (3-)4-5(-6)-spored, with basal clamp-connection. Spores subglobose to obovoid, smooth, colourless.

Terrestrial, occasionally also on decayed wood.

KEY TO THE SPECIES

1. Spines leaving a bare area around the apex of the stipe or little decurrent.
 2. Pileus ochraceous orange-yellow to orange-brown or red-brown when fresh.
 3. Pileus not umbilicate. Spores $6.3-8.1 \times 5.4-6.3 \mu$: *H. rufescens*
 3. Pileus umbilicate. Spores $8.1-9.5 \times 7.2-7.8 \mu$: *H. umbilicatum*
 2. Pileus pallid ochraceous to yellowish flesh-colour when fresh: *H. repandum*
1. Spines far decurrent (see, however, final observation under *H. repandum*, p. 71) or, if moderately decurrent, basidiome characterized by uncommonly elongate stipe (e.g. 60-120 mm long).
 4. Pileus ochraceous yellow to pale ochraceous brownish when fresh.
 5. Basidiome simple, consisting of a single pileus supported by a stipe: *H. species 1*
 5. Basidiome multipileate: *H. species 2*
 4. Pileus buff-rufescent inclining to cinnamon or pale ochraceous when fresh: *H. elatum*

HYDNUM ELATUM Masee - Pl. II

Hydnum elatum Masee in Bull. misc. Inf., Kew 359. 1914. — TYPE: "*Hydnum elatum* / Singapore / Botanic Gardens / on ground in garden jungle / colour above yellowish salmon / colour below dirty cream / 9 Oct. 1913 / Ethel M. Burkill / No. 183" (K).

Hydnum ferreum Lloyd, Mycol. Writ. 6: 1003, pl. 166 fig. 1830. 1920 ("*ferreus*"). — TYPE: No. 183 / Singapore, Botanic Gardens / on ground in garden jungle / colour above yellowish salmon / colour below dirty cream / 9 Oct. 1913 / Ethel M. Burkill" (Lloyd Mycol. Coll. 4922, BPI).

Hydnum holttumii Lloyd, Mycol. Writ. 7: 1227, pl. 256 fig. 2541. 1923. — TYPE: "No. 9647 / Malay Peninsula, Negri Sembilan, Selong F [orest] R[eserve] / 24-11-1922 / R. E. Holttum / On ground. Upper surface dull yellow or cream; stipe and spines cream. Edge of upper surface thin lacinate" (Lloyd Mycol. Coll. 22788, BPI).

Hydnum pleuropodium Lloyd, Mycol. Writ. 7: 1360, pl. 340 fig. 3230. 1925. — TYPE: "Malay Peninsula / State of Johore / Ulu Kahang / 1-6-1923 / R. E. Holttum 10887 / Deep cream colour. On ground in jungle / 450 ft." (Lloyd Mycol. Coll. 16728, BPI).

Basidiomes simple, in small troops. Pileus 50–105 mm across, convex then plane, becoming lobed, smooth, dry, minutely scabrous or sub-floccose to thinly villose over the centre, glabrescent, buff-rufescent inclining to cinnamon or pale ochraceous and often faintly zoned when fresh, yellowish salmon to deep ochraceous when dried; margin entire, involute when young, becoming straight to wavy. Stipe 60–120 × 7–20 mm, central, solid, slender, cylindrical or somewhat enlarged below, straight to somewhat flexuous, shortly villose-strigose at the apex or even reticulately scrupose, felted to glabrescent farther down, white becoming paler concolorous. Spines up to 11 mm long, decurrent, crowded, subulate, rarely flattened, becoming hollow, pale buff-rufescent with white tips. Context 6–10 mm thick in the centre of the pileus, fleshy, firm, pallid buff.

Context of the pileus monomitic, made up of generative hyphae. Hyphae 3–25 μ wide, inflating, thin-walled, branched, septate, with clamp-connections. Basidia 36–40 × 8–12 μ , cylindrical-clavate, with 4 sterigmata 4.5–6 μ long, with clamp-connection at the base. Spores 7.2–7.6 × 5.4–6.7 μ , broadly ellipsoid to subglobose, smooth, colourless with cloudy-granular contents, with oblique apiculus. Cystidia lacking.

COLLECTIONS EXAMINED:

MALAY PENINSULA

Negri Sembilan: Selong Forest Reserve, 24 Nov. 1922, R. E. Holttum, type of *H. holttumii* (Lloyd Mycol. Coll. 22788, BPI).

Singapore: Singapore, Botanic Gardens, 9 Oct. 1913, E. M. Burkill 183, types of *H. elatum* (K) and *H. ferreum* (Lloyd Mycol. Coll. 4922, BPI); 23 Aug. 1920, F. Flippance 6180 (K; Lloyd Mycol. Coll. 57345, BPI); 11 Dec. 1930, E. J. H. Corner (L).

Plate II has been reproduced from a water-colour which depicts some specimens collected at Bukit Timah, a short distance outside Singapore. No material seems to have been preserved, but there can be no doubt as to its identity (compare also MAAS GEESTERANUS, 1964:160, fig. 8).

Prof. Corner made the following observations on the development of the basidiomes, which because of their general interest are here reproduced in full:

"This fungus used to come up in the same places in the jungle of the Singapore Botanic Gardens. In May 1931 I managed to find it while the fruit-bodies were still young. I measured 8 fruit-bodies daily for three days when, unfortunately, I was taken ill for ten days, and on my return to their study I found them fully grown and could record only their longevity. However, I came to the following conclusions.

The pileus grows in width at a rate of 2 to 3 mm per 24 hours from a diameter of 15 to 28 mm. Then the rate increases to 3, 4, or 5 mm per 24 hours for pilei 28 to 55 mm in diameter. The largest of the eight reached 62 mm diameter and stood 73 mm high. When fully grown the fruit-bodies persisted for 2 to 3 weeks. It is probable that they take at least 14 days to reach a pileus diameter of 25 mm, after which they will take another week, at least, to reach full size. The full life-span of the fruit-body must, therefore, be five to six weeks. For a humicolous fungus in the tropics with inflating hyphae this is slow and prolonged. In Singapore the fruit-bodies were to be found during the second or third month of a period of rainy weather."

HYDNUM REPANDUM L. ex Fr. — Figs. 81–97, Pl. I, figs. 2, 3

Hydnum repandum L., Sp. Pl. 2: 1178. 1753. — *Hypothele repanda* (L.) Paul., Icon. Champ. pl. 35 fig. 1–2. 1812–35. — *Hydnum repandum* L. ex Fr., Syst. mycol. 1: 400. 1821. — *Dentinum repandum* (L. ex Fr.) S. F. Gray, Nat. Arrang. Brit. Pl. 1: 650. 1821. — *Tyrodon repandus* (L. ex Fr.) P. Karst. in Revue mycol. 3 / No. 9: 19. Jan. 1, 1881; in Acta Soc. Fauna Fl. fenn. 2(1): 33. 1881; in Meddn Soc. Fauna Fl. fenn. Förh. 6: 15. 1881. — *Sarcodon repandus* (L. ex Fr.) Quél., Ench. Fung. 189. 1886. — *Hypothele repanda* (L. ex Fr.) Banker in Torreya 4: 113. 1904. — TYPE LOCALITY: Sweden, "Habitat in vastis sylvis rarius." (Linn., Fl. suec. 383, No. 1098. 1745).

Hydnum ambustum Cooke & Massee apud Cooke in Grevillea 16: 32. 1887. — TYPE: "*Hydnum* (*Mesopus*) *ambustum* C & M / [Australia] Victoria, Harkaway Range, 6/87. C. French" (K).

Hydnum crocidens Cooke in Grevillea 19: 45. 1890; Handb. Austr. Fungi 170, pl. 10 fig. 69. 1892. — *Dentinum crocidens* (Cooke) G. H. Cunn. in Trans. R. Soc. N.Z. 85: 589. 1958. — TYPE: "*Hydnum crocidens* Cke / [Australia] Port Philip [C.] French / on ground / Aug. / [18]90" (K).

Hydnum crocidens var. *subexcentricum* Pat. in Bull. Soc. mycol. Fr. 24: 8. 1908. — TYPE: "No. 13 / *Hydnum crocidens* Cooke var. *subexcentricum* / [Nouvelle-Calédonie] / Pic Malaoui / Juin 1906" (FH).

Hydnum wellingtonii Lloyd, Mycol. Writ. 7: 1200, pl. 247 figs. 2468, 2469. 1923. — TYPE: "New Zealand, Distr. Wellington, York Bay, E. H. Atkinson 623" (Lloyd Mycol. Coll. 27122, BPI).

For further synonymy, see MAAS GEESTERANUS (1959: 134).

Basidiomes scattered to gregarious, simple or with confluent pilei and the stipes connate at the base. Pileus up to 50 mm across (up to 100 mm when fresh), plano-convex to plane, depressed in the centre, smooth, velutinous to finely felted, glabrescent from centre outwards, buff white or pale delicate apricot buff or pallid ochraceous or pale tan ochraceous to yellowish flesh-colour or pale orange buff when fresh, deeper ochraceous to fulvous yellow-brown when dry. Margin involute when young, straightening with age. Stipe 10–40 × 1–4(–10) mm, central to excentric, solid, slender, cylindrical (but sometimes flattened, divaricate, and widened near the apex), straight to somewhat flexuous, tomentose becoming glabrous, white or whitish to pale yellowish when fresh, concolorous with the pileus or darker when dry. Spines up to 4 mm long, leaving a bare area round the apex of the stipe or shortly decurrent, more rarely decurrent to the very base of the stipe, moderately crowded, subulate, sometimes flattened or divaricate, yellowish flesh-colour to deep ochraceous when fresh, orange-brown to fulvous when dry. Context up to 2 mm thick,

fleshy, firm, homogeneous, without zones, cream-white to pallid ochraceous, staining ochraceous or orange to brown when cut or bruised fresh.

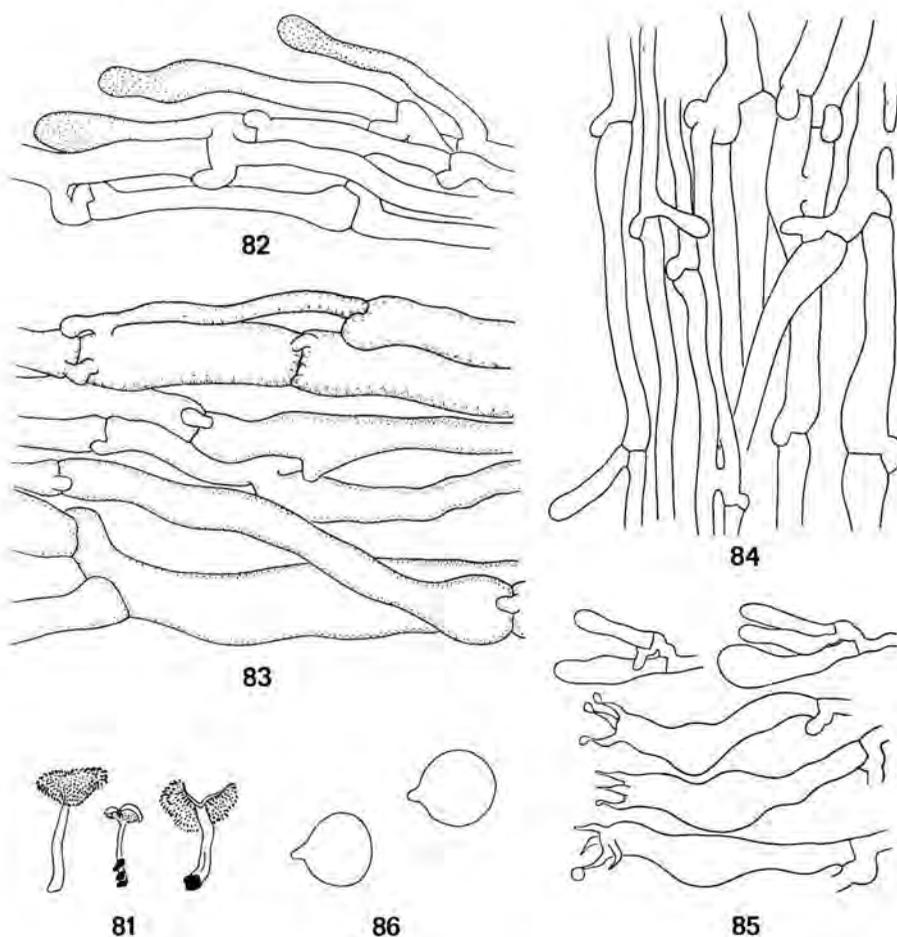
Context of the pileus monomitic, made up of generative hyphae. Hyphae up to $25\ \mu$ wide, inflating, thin-walled, branched, septate, with clamp-connections. Basidia $35\text{--}50 \times 5\text{--}8\ \mu$, cylindrical-clavate, with 4 (–5) sterigmata up to $5\text{--}6\ \mu$ long, with basal clamp-connection. Spores $6.4\text{--}8.3 \times 5.4\text{--}6.3\ \mu$, broadly ellipsoid to subglobose, smooth, colourless, with granular contents or a large oil-drop, with oblique apiculus about $1\ \mu$ long.

COLLECTIONS EXAMINED AND REPORTED:

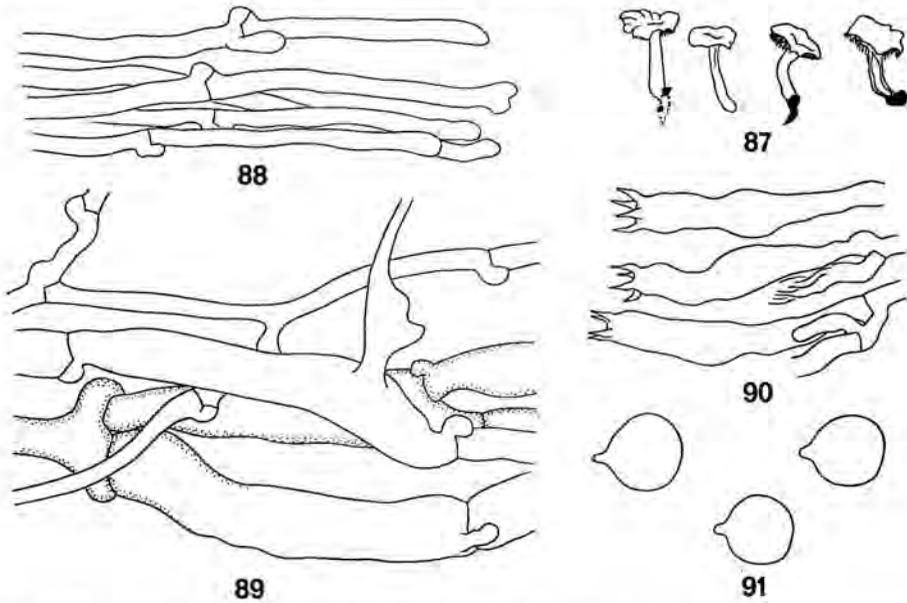
WEST PAKISTAN

Lun Bagla, 4 Sept. 1955, *Sultan Ahmad 13053*, in forest of *Pinus excelsa*, 2100 m alt. (L).

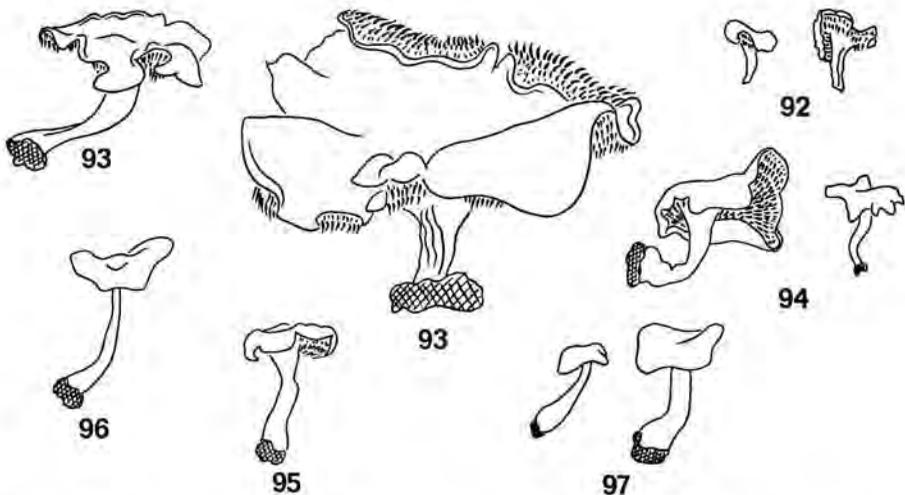
Listed from two localities by AHMAD (1956:68).



Figs. 81–86. *Hydnum repandum* (Borneo, Corner, *RSNB 8694*). – 81. Habit sketch of three basidiomes. – 82. Hyphae of the upper surface of the pileus taken near the margin. – 83. Hyphae of the pileus. – 84. Hyphae of a spine. – 85. Basidia. – 86. Two spores. (Fig. 81, $\times \frac{1}{2}$; Figs. 82–85, $\times 700$; Fig. 86, $\times 1400$.)



Figs. 87-91. *Hydnum repandum* (Borneo, Corner, RSNB 8695). - 87. Habit sketch of four basidiomes. - 88. Hyphae of the margin of the pileus. - 89. Hyphae of the pileus. - 90. Basidia. - 91. Three spores. (Fig. 87, $\times \frac{1}{2}$; Figs. 88-90, $\times 700$; Fig. 91, $\times 1400$.)



Figs. 92-97. *Hydnum repandum* (Fig. 92: Norway, Befringsdalen, 27 Sept. 1966, O; Fig. 93: Denmark, Løgumkloster, Maas G. 15191, L; Fig. 94: Netherlands, Amersfoort, Reynders, L; Fig. 95: Switzerland, Schlierental, Leeb & Breitenbach, L; Fig. 96: India, Mussoorie, Maas G. 14615; Fig. 97: Australia, Mansfield, Ivory). Variation in size of the basidiome ($\times \frac{1}{2}$).

INDIA

Himachal Pradesh: Solan, Aug. 1962, *P. K. Seth* (SOHI & AL., 1965:320, as var. *album*).

Uttar Pradesh: Mussoorie, 21 Sept. 1964, *R. A. Maas Geesteranus 14615*, in forest of *Quercus incana* and *Rhododendron arborea*, c. 1700 m alt. (L); date unknown, Forest Research Institute Ag. 104 (L); Arnigadh (P. HENNINGS, 1901:325; VASUDEVA, 1960:156).

CHINA

Several provinces without specification of the localities (TENG, 1964:435).

JAPAN

Hokkaido: Prov. Iburi, Tomakomai, 17 Oct. 1904, *K. Miyabe & J. Hanzawa 593* (Lloyd Mycol. Coll. 3015, BPI).

Honshu: Prov. Owari, Gifu, Mt. Inaba, Nov. 1916, *J. Umemura 179* (Lloyd Mycol. Coll. 4918, BPI); Yagoto near Nagoya, Nov. 1914, *J. Umemura III* (Lloyd Mycol. Coll. 4913, BPI); Prov. Rikuzen, Sendai, 13 Sept. 1914, *A. Yasuda 272* (Lloyd Mycol. Coll. 4907, BPI); Shiogama, 16 Oct. 1909, *A. Yasuda 97* (Lloyd Mycol. Coll. 16725, BPI); Prov. Settsu, Kobe, no date, *J. E. A. Lewis* (Lloyd Mycol. Coll. 27979, BPI).

VIETNAM

Yunnanfou, Pagode du Cuivre (DEMANGE, 1919:603); Plateau du Lang-Bian, Dalat (JOLY, 1969:532)

MALAY PENINSULA

Johore: Gunong Panti, 16 April 1931, *E. J. H. Corner*, on the ground in forest, 500 m alt. (L); Ulu Tiram, 4 Nov. 1934, *E. J. H. Corner* (in liquid, L); [Singapore: Reservoir Jungle, 27 Aug. 1940, *E. J. H. Corner*, painting.]

BORNEO

Sabah: Mt. Kinabalu, 10 June 1961, *E. J. H. Corner*, *RSNB 546*, 1100 m alt. (L); 15 June 1961, *E. J. H. Corner*, 1600 m alt. (L); 24 Jan. 1964, *E. J. H. Corner*, *RSNB 5084*, 1700 m alt. (also in liquid, L); 24 Feb. 1964, *E. J. H. Corner*, *RSNB 5495*, 1700 m alt. (in liquid, L); 6 May 1964, *E. J. H. Corner*, *RSNB 8694*, *RSNB 8695*, 1600 m alt. (also in liquid, L).

AUSTRALIA

Queensland: Brisbane, no date, *J. M. Bailey 757* (K).

Victoria: Harkaway Range, June 1887, *C. French*, type of *Hydnum ambustum* (K); Lower Glenelg River region, Learmouth Creek, 14 June 1964, *J. H. Willis & A. C. Beauglehole*, in forest of *Eucalyptus baxteri* (L, MEL); Mansfield, Timbertop, 10 Sept. 1967, *B. Ivory*, among fallen *Eucalyptus* leaves on sandy humus (L); Port Philip, Aug. 1890, *C. French*, type of *Hydnum crocidens* (K).

Locality unknown, no date, *J. Wilson 33* (Lloyd Mycol. Coll. 4833, BPI).

NEW CALEDONIA

Pic Malaoui, June 1906, [probably *Le Rat*] type of *Hydnum crocidense* var. *subexcentricum* (FH).

NEW ZEALAND

North Island: Wellington, Days Bay, 19 July 1967, *Mrs. G. Stevenson Cone 197* (K); Wellington, Silverstream, 17 Sept. 1949, *Mrs. G. Stevenson*

Cone 726, under *Nothofagus solanderi* and *Weinmannia racemosa* (accompanied by a water-colour under the same number, but executed two months previously, K); 21 July [year?], *F. Duguid* 368 (K).

South Island: Dunedin, Caversham, no date, *W. A. Scarfe* 83 (Lloyd Mycol. Coll. 4929, BPI).

Recorded from various further localities as *Dentinum crocidens* (CUNNINGHAM, 1958:589).

LLOYD recorded the present species as *Hydnum repandum* var. *album* from Shiogama in Japan (1912, *Lett.* 42: 15) and as *H. rufescens* from Caversham near Dunedin in New Zealand (1917, *Lett.* 66: 6). The collection from Brisbane is mentioned in COOKE's Handbook as *Hydnum laevigatum* (1892:170).

Although I felt very uncertain as to how Australian *Hydnum ambustum* would have to be distinguished from northern temperate *H. repandum* (MAAS GEESTERANUS, 1964: 156, 160) I long felt reluctant to draw the consequences. The main objections to lumping the two species then were, in my eyes, the consistently smaller size of the type specimens of *H. ambustum*, the unknown but possibly different colour of the pileus, and the extreme remoteness of its distributional area.

Since then many collections of *H. repandum* from intervening areas have come under my eyes, while I began to pay closer attention to the variation in size of the European specimens. Several of the latter here illustrated (Figs. 92-97) have been carefully chosen to ensure the specimens are mature. Two points emerge from these comparative figures: (i) the smallest and the largest size are interconnected by gradated steps, and (ii) the Australian material is not smaller than some of the European collections. Here again, difference in size as so often in hydnceous fungi has no taxonomic significance. It should be remembered that in the type of *Hydnum crocidens*, another species described from southern Australia, and to my mind in no way different from *H. ambustum*, the pileus is twice as large as in that species. Mrs. Stevenson Cone indicated the diameter of the pileus in her material from Wellington (*No.* 197) as 10 cm., which is large even for European standards.

With regard to the colour of the fresh fungus, information from various sides confirms that variation in Australian material is even less than in Europe. The most recent and precise colour designation comes from an amateur, Mr. B. Ivory, who, using the code of the Munsell Soil Color Chart, characterized the colour of the pileus in his collection from Mansfield (Victoria) as 10 YR 8/4, which is a yellowish flesh-colour. This is a very common shade in *Hydnum repandum*, and it may well be added that even much paler or much deeper colours in the pileus of European specimens never seem to have provoked a controversy among mycologists as to the homogeneity of the species.

Apart from giving an excellent description of his collection, Mr. Ivory found that the taste of the flesh is "dry and sharp, more or less mealy."

A similar taste has occasionally also been noticed in Europe: "saveur un peu poivrée ou amère." (JACCOTTET, 1948:172).

Taking into account that structurally *Hydnum repandum* and *H. ambustum* are identical, while besides there is no difference in their spores, it can only be concluded that there is but one species – *Hydnum repandum* – which appears to be distributed over an exceptionally wide area. The species, not surprisingly, is made up of various local populations, each differing from the others by degrees in size and colour. It would seem that the Vietnamese material collected by JOLY (1969:532) in spite of its rich colours falls entirely within the range of variability of *H. repandum*.

To the same species I also refer the collections from Mt. Kinabalu, North Borneo, of which the two following may be particularly mentioned.

One of these, No. RSNB 8694 (Figs. 80–85), described as "pale delicate apricot buff," I did not at first recognize as conspecific with *H. repandum* because of two very conspicuous and seemingly deviating features: (i) the margin of the pileus is very thin, dentate-fimbriate, deflexed in places, and running out into spines; (ii) the basidia, when mature, tend to develop a constriction in the upper third part, thus emphasizing the effect of the ventricose middle part. However, a search among European specimens, which belong incontestably to *H. repandum*, revealed that both features, albeit to a much lesser degree, and independent of each other, are known to occur there also.

The second collection, No. RSNB 8695 (Figs. 86–90), which possessed much more saturated colours when fresh, and may well have been found in close proximity of RSNB 8694, as specimens of both are shown in the same colour slide, appears to occupy an intermediate position relative to the features mentioned.

Under the name *Hydnum repandum* KAWAMURA (1954: fig. 606) gave an illustration of some specimens which I am not prepared to recognize as this species.

KAWAMURA (1954:609) also recorded *H. repandum* var. *albidum*, which no doubt refers to *H. albidum* as reported by LLOYD (1915, Lett. 54: 3; 1915, Lett. 56: 4; 1916, Lett. 61: 5; 1917, Lett. 66:7). I have seen the material which consists of three different collections numbered 4907, 4913, and 4918. Those collected by J. Umemura I have no doubt in referring to *H. repandum* because of the size of their spores, but I am less certain as to the identity of the specimens collected by A. Yasuda, since I failed to find any spores. The specimens in all three collections are unusually small, and this may have led Lloyd to think they belonged to *H. albidum*.

Very pale or almost white specimens have often been assigned a varietal epithet, var. *album* (Quél.) Rea. Under this name SOHI & al. (1965:320) reported the occurrence of the present species in the state Himachal Pradesh, India.

Hydnum repandum in the northern hemisphere is generally regarded as a species with the spines either leaving a bare area round the apex of the

stipe or only slightly decurrent. I am using this character in the key, knowing well enough of course that it is so variable as to be of little differential value. The collections of *H. repandum* from Wellington, Silverstream, New Zealand (K), exemplify the futility of trying to subdivide the species of *Hydnum* on the basis of the decurrence of the spines. I have to admit defeat here, for on the one hand I am as yet unable to accept *Hydnum* species 1 and 2 as conspecific with *H. repandum*, on the other hand the only difference I can find is in a character that apparently has no value in the southern hemisphere. It is an unsatisfactory situation which certainly requires further attention.

HYDNUM RUFESCENS Fr.

Hydnum rufescens Fr., Syst. mycol. 1: 401. 1821; not *Hydnum rufescens* Schaeff., Fung. Icon. 4: 95. 1774 (= *H. repandum*, acc. to Fr., l.c.); not *Hydnum rufescens* (Pers.) Poiret, Encycl. méth. (Bot.) 8: 206. 1808 (= *Heteroporus biennis*). — *Hydnum repandum* var. *rufescens* (Fr.) Barla, Champ. Prov. Nice xlviii, 81. 1859; Peck in Rep. N.Y. State Mus. 48: 406. 1896. — *Hydnum repandum* subspec. *H. rufescens* (Fr.) Fr., Hym. europ. 601. 1874. — *Tyrodon repandus* subsp. *T. rufescens* (Fr.) P. Karst. in Revue mycol. 3 / No. 9: 19. Jan. 1, 1881; in Acta Soc. Fauna Fl. fenn. 2(1): 33. 1881 & in Meddn Soc. Fauna Fl. fenn. 6: 15. 1881. — *Sarcodon repandus* var. *rufescens* (Fr.) Quél., Ench. Fung. 189. 1886. — *Tyrodon rufescens* (Fr.) P. Karst. in Bidr. Känn. Finl. Nat. Folk 48: 349. 1889. — *Dentinum rufescens* (Fr.) Pouz. in Česká Mykol. 10: 76. 1956; not *Dentinum rufescens* Schaeff. ex S. F. Gray, Nat. Arrang. Brit. Pl. 1: 650. 1821. — *Sarcodon rufescens* (Fr.) Heim, Champ. Europe 2: 62. 1957 (incomplete reference to basionym). — *Hydnum repandum* f. *rufescens* (Fr.) Nikol. in Fl. Pl. cryptog. URSS 6(Fungi 2): 305. 1961. — TYPE: non-existing; TYPE LOCALITY: Germany.

For further synonymy, see MAAS GEESTERANUS (1959: 135).

Basidiomes scattered or in small troops, simple or connate. Pileus up to 45 mm across (dry), convex to plane or depressed in the centre, tomentose to felted, glabrescent from centre outwards, varying ochraceous orange-yellow to salmon or orange-brown when fresh, pallescent and duller when dry. Margin at first involute, then straight. Stipe 10–45 × 1.5–10(–15) mm (dry), central to excentric, solid, slender to stocky, cylindrical or flattened, straight or flexuous, finely tomentose to felted, glabrescent, whitish to pale flesh-colour when fresh, staining a deep yellow when bruised, concolorous with the pileus or paler when dry. Spines up to 5 mm long, little or not decurrent, moderately crowded, subulate or flattened to divaricate, salmon. Context fleshy, firm, homogeneous, not zoned, pale flesh-colour, staining yellow when cut.

Context of the pileus monomitic, made up of generative hyphae. Hyphae up to about 20 μ wide, inflating, thin-walled, branched, septate, with clamp-connections. Basidia 36–45 × 8–9 μ , cylindrical-clavate, with 4 sterigmata 5–6 μ long, with basal clamp-connection. Spores 6.3–8.1 × 5.4–6.3 μ , broadly ellipsoid to subglobose, adaxially somewhat flattened, smooth, colourless, with granular contents or a large oil-drop, with oblique apiculus.

COLLECTIONS EXAMINED AND REPORTED:

WEST PAKISTAN

Lahore, no date, *Shiv Ram Kashyap* (Lloyd Mycol. Coll. 56591, BPI).

JAMMU AND KASHMIR

Muzaffarabad, Loon Bagla, 4 Sept. 1955, *S. Ahmad 13053* (L).

INDIA

Himachal Pradesh: Simla, 15 Aug. 1964, *R. A. Maas Geesteranus 14264*, in *Cedrus deodara* forest, 2200 m alt. (L).

Punjab: Kulu Valley, Manali, 19 Aug. 1964, *R. A. Maas Geesteranus 14290*, on loamy soil in *Cedrus deodara* forest, 1850 m alt. (L).

Uttar Pradesh: Mussoorie, 31 Aug. 1965, *C. L. Malhotra 222*, in *Cedrus* plantation (L); near Mussoorie, 21 Sept. 1964, *R. A. Maas Geesteranus 14614*, in forest of *Quercus incana* and *Rhododendron arborea*, c. 1700 m alt. (L); Mussoorie, Balansar, 18 Sept. 1964, *R. A. Maas Geesteranus 14573*, in forest of *Quercus incana* and *Rhododendron arborea*, 1800 m alt. (L).

Locality not specified (VASUDEVA, 1960: 156).

TIBET

Listed without indication of locality by PATOULLARD (or possibly from China?) (1895: 197).

JAPAN

Honshu: Prov. Harima, 20 Oct. 1918, *A. Yasuda 559* (Lloyd Mycol. Coll. 54821, BPI).

Hydnum rufescens has variously been regarded as a variety of *H. repandum* or a species of its own. As is so often the case, points in favour of both views can be found. But against the view of *H. rufescens* being subordinated as a variety the objection can be raised that as yet there is no proof of any such genetic interrelation. Rather than postulating such a relationship it seems preferable to resort to the conventional method of distinguishing *H. repandum* and *H. rufescens* as two separate species. This solution may appeal to many mycologists, but it can hardly be called a satisfactory one, for a closer acquaintance of this *repandum/rufescens*-complex over a wider area than dealt with in the present paper (and, more particularly, including southern Europe) would soon reveal that not a single feature, not even the colour of the pileus, can be used as a clear-cut distinguishing character.

CLELAND & CHEEL (1919: 304) reported the present species from several localities in New South Wales. It remains to be seen, however, whether their material really belongs here, for the size of the spores, recorded as "3.5 to 5.5 μ , spherical to oval," would seem to be far too small.

HYDNUM UMBILICATUM Peck — Figs. 98–100, Pl. I, fig. 1

[Undescribed form, Peck in Rep. N.Y. St. Mus. 54: 171. 1901. —] *Hydnum umbilicatum* Peck in Bull. N.Y. St. Mus. 54: 953. pl. K figs. 14–18. 1902. — *Dentinum umbilicatum* (Peck) Pouz. in Česká Mycol. 10: 76. 1956. — TYPE: not seen (NYS).

Basidiomes solitary. Pileus 20–30 mm across, plano-convex to hemispherical, slightly to deeply umbilicate, smooth, fibrillose to more or less

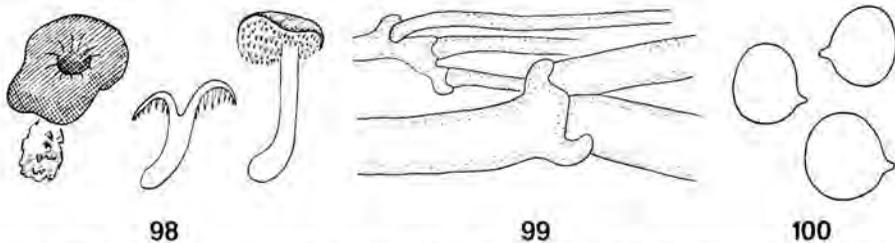
fibrillose-scaly, orange-brown to red-brown. Stipe 20–40 × 4–7 mm, central or excentric, solid, cylindrical, curved and more or less enlarged to bulbous below, somewhat felted to glabrescent, pink-fawn to orange-brown. Spines up to 5 mm long, free from the stipe or slightly decurrent, moderately crowded to subdistant, subulate, creamy. Context of the pileus up to about 3 mm thick, creamy.

Context of the pileus monomitic. Generative hyphae up to 18 μ wide, inflating, thin-walled, branched, septate, with clamp-connections to all septa. Context of the spines similar, hyphae narrower. Basidia at least 35–45 × 9 μ , but either immature or collapsed and many anomalous, cylindrical-clavate, with basal clamp-connection. Spores 8.1–9.5 × 7.2–7.8 μ , broadly ellipsoid to subglobose, smooth, colourless, with granular contents, with oblique apiculus.

COLLECTION EXAMINED:

NEW ZEALAND

South Island: Nelson Distr., Nelson, 6 July 1949, *Miss A. Crawford* 722, under *Nothofagus truncata* (with a water-colour, K).



Figs. 98–100. *Hydnum umbilicatum* (*Crawford* 722). – 98. Habit sketch of three basidiomes (after original water-colour). – 99. Generative hyphae of the pileus. – 100. Three spores. (Fig. 98, × ½; Fig. 99, × 700; Fig. 100, × 1400.)

The above New Zealand collection once again illustrates the difficulty of drawing dividing lines between the taxa of the *Hydnum repandum*-complex.

Peck's description of *H. umbilicatum* runs thus: "Pileus fleshy, convex, glabrous, umbilicate, reddish buff or burnt sienna color, flesh white, taste mild; aculei plane in the mass [which, of course, is a printer's error], fragile, nearly equal, a little paler than the pileus; stem nearly equal, glabrous, solid, whitish; spores globose, .0003–.0004 of an inch in diameter [which equals 7.6–10.2 μ]."

BANKER (1906: 109) subdividing *H. repandum* into three forms thought that his form A would correspond to *H. umbilicatum*, but he added that "In all of the above forms none of the characters ascribed appear to be constant, while intermediate forms are readily found that connect them most intimately."

MILLER & BOYLE (1943: 58) simply merged *H. umbilicatum* with what they called *Dentinum repandum*, probably because that was in keeping with Banker's later concept in an unpublished manuscript (COKER & BEERS, 1951: 18).

COKER & BEERS (1951: 18) reintroduced *H. umbilicatum* on the grounds that the specimens they had described "agree so well with Peck's description and are so conspicuously different from *repandum* . . ." and "differ in darker color, consistently slender stature (thinner flesh and relatively longer stems), redder and usually umbilicate cap, larger spores, no trace of acrid taste, and when dry in the more delicate and flexuous spines."

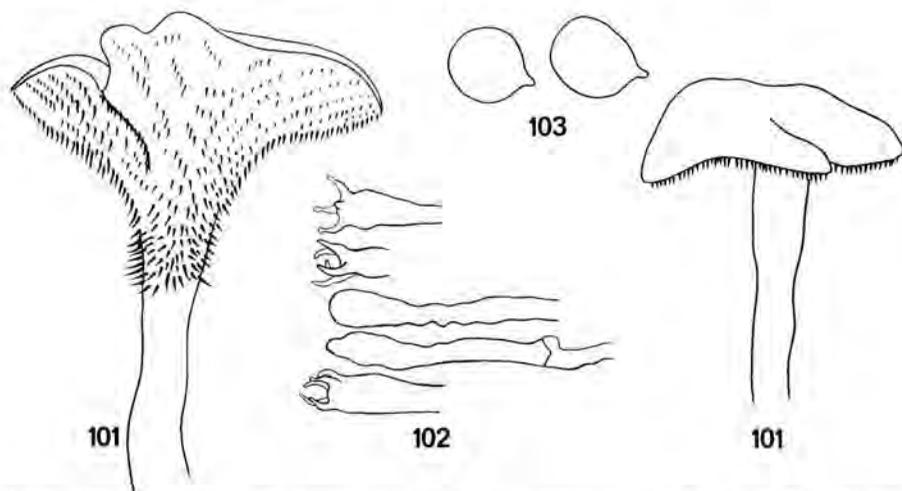
HARRISON (1961: 19) also treated *H. umbilicatum* as a separate species, differing from *H. repandum* in being smaller and having an umbilicate pileus, but allowing it to be "similar in color."

I am inclined to follow Coker & Beers who tried hard to find characteristics convincingly to separate *H. umbilicatum* from *H. repandum*, but I am not blind to Banker's words quoted above.

HYDNUM species 1—Figs. 101–103

Basidiomes simple. Pileus 65–90 mm across, plano-convex, apparently glabrous, dull orange-yellow in the smaller specimen, fairly dark rufous brown in the larger ("the whole plant ochraceous yellow" when fresh). Stipe 70–90 × 10–15 mm, excentric, solid, equal or gradually widened above, glabrous (or perhaps glabrescent), the upper part bristly from numerous patent spines, concolorous with the pileus. Spines up to 6 mm long, far decurrent, the lowermost sterile, moderately crowded, simple and subulate, or flattened and divided above, or connate, orange-brown to fulvous. Context badly preserved, fleshy.

Context of the pileus monomitic, made up of generative hyphae. Hyphae 6.3–13.4 μ wide, inflating, thin-walled, branched, septate, with clamp-connections. Basidia 40–50 × 8–10 μ , cylindrical-clavate, 4–5-spored, with basal clamp-connection. Spores 7.8–8.3 × 6.8–7.6 μ , globose to subglobose, smooth, colourless, with granular contents, with prominent apiculus, not amyloid. Cystidia absent.



Figs. 101–103. *Hydnum* species 1 (*van Zanten 587*). — 101. Habit sketch of two basidiomes (after van Zanten's drawing). — 102. Basidia. — 103. Spores. (Fig. 101, $\times \frac{1}{2}$; Fig. 102, $\times 700$; Fig. 103, $\times 1400$.)

COLLECTION EXAMINED:

NEW GUINEA

West New Guinea [now Irian Barat]: Ok Sibil, base camp, 18 Aug. 1959, *B. O. van Zanten 587*, on decayed tree stump in forest, 1260 m alt. (L).

Hydnum neo-guineense P. Henn., discussed in a former paper (MAAS GEESTERANUS, 1966a: 35), resembles the present species in having a fairly large pileus (7–8 cm across when fresh) and decurrent spines. Even if Henning's species should prove to belong to the genus *Hydnum*, it would differ from the fungus under discussion in its unusually small spores, which were stated to measure 3–4 μ .

As pointed out under the next species, it is by no means certain that the present fungus and *Hydnum* spec. 2 are specifically different.

Concerning the distinction from *H. repandum*, see under that species, p. 72.

HYDNUM species 2

Basidiome simple and solitary, consisting of a single pileus supported by a stipe, or complex and multipileate, the pilei forming a mass of up to 14 cm wide and arising from a common trunk 30–50 \times 25–35 mm. Pilei up to 80 mm across (the single pileus measuring 90 mm across), many abortive, often more or less pleuropodal, imbricate, smooth, even, minutely subtomentose, dry, dull, pale ochraceous brownish to biscuit-colour; the margin deflexed, running out into the marginal spines and becoming dentate-lacerate, subvillose, white. Stipes of the individual pilei 5–20 \times 8–15 mm, stout, often compressed, firm, occasionally hollow, subvillose, papillate upwards with abortive spines (or the latter interconnected by raised membranes, thus producing a conspicuous network), pale ochraceous white or pallid bistre. Spines 5–9 mm long, far decurrent, crowded, subulate, pale ochraceous bistre. Context 3–8 mm thick at the base of the pileus, firm, putrescent, paler concolorous.

Context of the pileus monomitic, made up of generative and tendril hyphae. Hyphae 3–25 μ wide, variously inflating, thin-walled or cell-walls slightly thickened, branched, septate, with clamp-connections. Hymenium up to 80 μ , thickening slightly. Basidia 40–47 \times 10 μ , (3–)4-spored, the sterigmata 5–7 μ long. Spores 6.5–8 μ , globose. Cystidia absent.

COLLECTION EXAMINED:

MALAY PENINSULA

Trengganu: Kemaman, Bukit Kajang, Ulu Bendong, 31 Oct. 1935, *E. J. H. Corner*, on the ground in forest (also in liquid, L).

The present fungus probably merits recognition as a separate species, but the material is in poor condition and would make an unsatisfactory type, as very little of the above description, which is entirely adapted from the collector's notes, is capable of being verified.

The occurrence side by side of a simple basidiome with a single pileus and a complex one with many imbricate pilei supported by a common trunk

may well be an expression of the great variability in outward appearance. This renders the distinction from *Hydnum* species 1 very awkward, particularly since microscopical differences seem to be non-existent. To give a name to both or only one of the two would serve no useful purpose for the moment.

STECCHERINACEAE Parm.

Steccherinaceae Parm., Consp. Syst. Cortic. 169. 1968. — TYPE: *Steccherinum* S. F. Gray.

Basidiome effused, effused-reflexed, or pileate, white or yellow to brown in various hues. Hymenophore smooth, granular, aculeate, or poroid. Context leathery to corky, whitish to pallid, more or less distinctly dimitic with skeletal. Generative hyphae not inflating, branched, septate, with clamp-connections. Basidia clavate or slightly utriform, 2–4-spored. Spores cylindrical, ellipsoid, or subglobose, smooth, colourless, not amyloid. Cystidia lacking or present, thin- to thick-walled, encrusted or not.

Arboricolous or lignicolous (description adapted from Parmasto, l.c.).

STECCHERINUM S. F. Gray

Steccherinum S. F. Gray, Nat. Arrang. Brit. Pl. 1: 651. 1821 (“*Steccherina*”). — TYPE SPECIES: *Hydnum ochraceum* Pers. apud Gmel. ex Fr. (see DONK, 1956a: 112).

Basidiome effused, effused-reflexed, or pileate. Pileus tomentose or glabrescent, white or ochraceous to brown. Hymenium covering spines which are cylindrical or flattened, and more or less tinged pinkish to flesh-colour. Context tough to rigid, obscurely zoned, white to pallid, dimitic, consisting of generative and skeletal hyphae. Generative hyphae not inflating, branched, septate, thin-walled, with clamp-connections. Basidia 4-spored, with basal clamp-connection. Spores obovoid-oblong to ellipsoid, smooth, colourless, neither amyloid nor cyanophilous. Cystidia of tramal or hymenial origin, thin-walled and filled with oleaginous matter (gloeocystidia) or thick-walled to solid, smooth or encrusted.

Lignicolous.

In the huge area treated in the present paper there are surely more species of *Steccherinum* than the two described below. The genus is in need of a revision, however, for which material is now being accumulated. In the meantime it seems advisable to content oneself with two easily identifiable species.

KEY TO THE SPECIES

1. Pileus of one colour. Cystidia encrusted: *S. ochraceum*
 1. Pileus banded with one or more zones of a darker colour. Cystidia smooth:
 *S. rawakense*

STECCHERINUM OCHRACEUM (Pers. apud Gmel. ex Fr.) S. F. Gray

Figs. 104–109

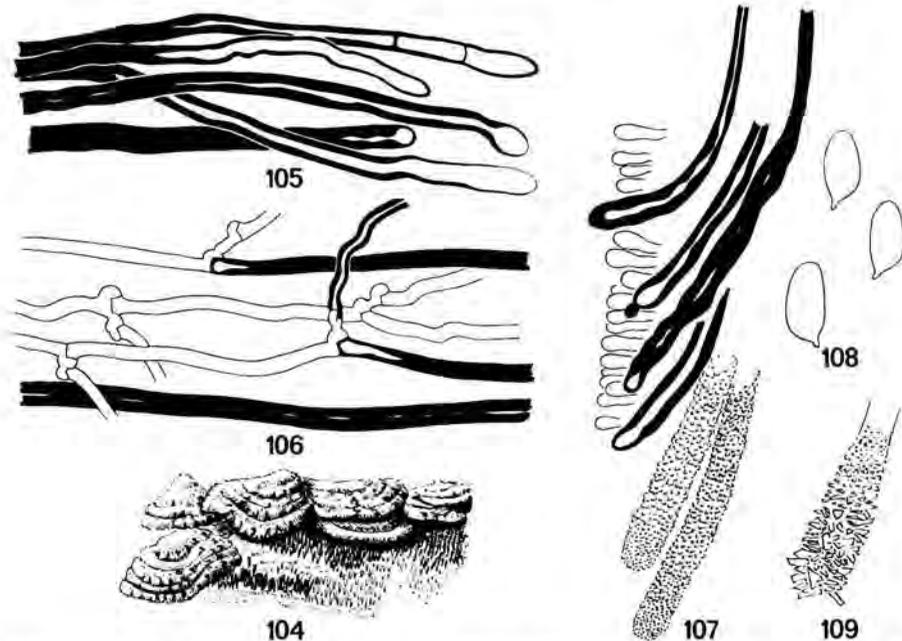
Hydnum ochraceum Pers. apud Gmel., Syst. Nat. 2: 1440. 1792; Pers., Obs. mycol. 1: 73. 1796; Syn. meth. Fung. 559. 1801; ex Fr., Syst. mycol. 1: 414. 1821.

— *Steccherinum ochraceum* (Pers. apud Gmel. ex Fr.) S. F. Gray, Nat. Arrang. Brit. Pl. 1: 651. 1821. — *Climacodon ochraceus* (Pers. apud Gmel. ex Fr.) P. Karst. in Bidr. Känn. Finl. Nat. Folk 37: 98. 1882. — *Leptodon ochraceus* (Pers. apud Gmel. ex Fr.) Quél., Fl. mycol. 441. 1888. — *Mycoleptodon ochraceus* (Pers. apud Gmel. ex Fr.) Pat., Essai tax. Hym. 116. 1900. — TYPE LOCALITY: Germany.

For further synonymy, see BANKER (1906: 125) and TALBOT (1951: 55).

Basidiomes solitary or several growing imbricately, often also confluent laterally, sometimes remaining effused, but as a rule effused-reflexed or pileate from the beginning. Pileus (or pileate portion) up to 15 mm radius, either originally attached to the substratum by the narrowed vertex or broadly sessile, decurrent behind along the substratum, conchiform or flange-shaped, concentrically furrowed, somewhat rugose, plushy to hirsute, white to pale dingy ochraceous, dingy cream in the herbarium. Spines up to 1.5 mm long, decurrent, crowded, subulate, often compressed, slender, rigid when dry, finely pubescent, cream-buff tinged pink, with fimbriate tip. Context of the pileus less than 1 mm thick, more or less distinctly duplex, fairly tough, fibrous, indistinctly zoned, whitish.

Context of the pileus dimitic, consisting of generative and skeletal hyphae. Generative hyphae 1.8–4 μ wide, not inflating, thin-walled, branched, septate, with clamp-connections. Skeletal hyphae 3–4.5 μ wide,



Figs. 104–108. *Steccherinum ochraceum* (New Guinea, *Corner*). — 104. Habit sketch of some basidiomes. — 105. Skeletal hyphae from the margin of the pileus. — 106. Detail of the context 1 mm back from the margin, showing skeletal and generative hyphae. — 107. Detail of the hymenium near the tip of a spine, showing immature basidia and six cystidia, two of which with their distal part still covered with crystalline matter. — 108. Spores (Fig. 104, $\times 3$; Figs. 105–107, $\times 700$; Fig. 108, $\times 2800$.) Fig. 109. *Steccherinum ochraceum* (Australia, *Beaulehole*). — Cystidium with a more coarsely crystalline covering ($\times 700$).

thick-walled to solid. Context of the spines similar, hyphae usually somewhat narrower. Basidia (only seen immature) $10.5-13.5 \times 3.6 \mu$, with a clamp-connection at the base. Spores (possibly not quite mature) $3.8-4.2 \times 1.8-2 \mu$, obovoid-oblong, adaxially flattened, smooth, colourless, neither amyloid nor cyanophilous, usually with a small oil-drop, with oblique apiculus. Cystidia $5-10 \mu$ wide (measured without the crystalline sheath), particularly abundant towards the apical portion of the spines, immersed in the hymenium or protruding, clavately to fusiformly swollen, thick-walled to almost solid, heavily encrusted in the distal part.

COLLECTIONS EXAMINED AND REPORTED:

WEST PAKISTAN

Changla Gali, 12 Aug. 1954, *S. Ahmad 2869*, on dead tree (L); also reported from other localities (AHMAD, 1969: 40).

SIKKIM

Yoksam, 17 May 1960, *H. Furukawa 36a*, 1700 m alt. (recorded by IMAZEKI, KOBAYASI & AOSHIMA, 1966: 614).

CHINA

Stated to occur in several provinces (TENG, 1964: 433).

JAPAN

Reported by IMAZEKI & HONGO (1965: 129) without mention of localities and by FURUKAWA & AOSHIMA (1969: 140).

CEYLON

Central Province (BERKELEY & BROOME, 1873: 59).

PHILIPPINES

Luzon: Mt. Maquiling (TEODORO, 1937: 289).

SUMATRA

West Coast, Gadut [near Padang], Feb. 1924, *E. Jacobson* (BO).

JAVA

West Java, Mt. Patuha, July 1939, *K. B. Boedijn 3510* (BO); reported without locality by MORITZI (1845-46: 123), VAN OVEREEM c.s. (1922: 60).

NEW GUINEA

Papua: Woitapi, 23 Aug. 1960, *E. J. H. Corner*, on fallen stick, c. 1900 m alt. (L).

AUSTRALIA

New South Wales: without locality and date, *J. B. Cleland 685* (Lloyd Mycol. Coll. 56461, BPI).

Victoria: Dandenong Ranges, 15 Jan. 1935, *J. H. Willis*, on decaying sticks in forest (L, MEL); Lower Glenelg River region, Learmouth Creek, 25 July 1964, *A. C. Beaughole*, on bark and rotting wood in fern gully (L, MEL); further localities recorded by CLELAND & CHEEL (1919: 304) and REID (1956: 639).

TASMANIA

Hobart, no date, *L. Rodway 1202* (Lloyd Mycol. Coll. 44616, BPI).

NEW ZEALAND

Various localities enumerated by CUNNINGHAM (1958: 594–596).

Several synonyms of this species are on record but, pending a monographic treatment of the genus, none of these have as yet been checked. Acceptance of one or more names as synonyms of *S. ochraceum* may result in some gaps in the distributional area being filled up. The following example should serve as an explanation. BERKELEY (1854: 168) reported a *Hydnum flabelliforme* from Lebong, West Bengal. BANKER (1906: 126) regarded this species as identical with *Steccherinum rhois*, but MILLER & BOYLE (1943: 47) and CUNNINGHAM (1958: 594) held the view that both *S. rhois* and *H. flabelliforme* are the same as *S. ochraceum*. If that should prove correct or if at least the particular collection from Lebong should turn out to be *S. ochraceum*, India would nicely close the ranks between West Pakistan and China.

Some of the countries enumerated above have been cited from literature, without proper access to a description for control. Although it is quite probable that *S. ochraceum* will eventually be found there, its occurrence in these areas should be accepted with some reserve. CUNNINGHAM (1958: 594–596) did give a description but from it can be gathered that he must have mixed two species, for *S. ochraceum* never has the pileus "with bands of brown hairs." It is clear that his material requires re-examination.

Some of the skeletal hyphae running along the underside of the pileus may be seen to have a most irregular course, being deflected by sharp kinks, or even to produce side-branches. To the casual observer they give the impression of having become disorientated before entering the spines. In all probability it is one of the devices of the fungus to ensure a rigid orientation of its very slender spines. It is this ramification which made some think that *S. ochraceum* is trimitic, but I believe that the original distinction between skeletal and binding hyphae (CORNER, 1932) should not be obscured by determining such skeletal that happen to show occasional side-branches inflexibly as binding hyphae.

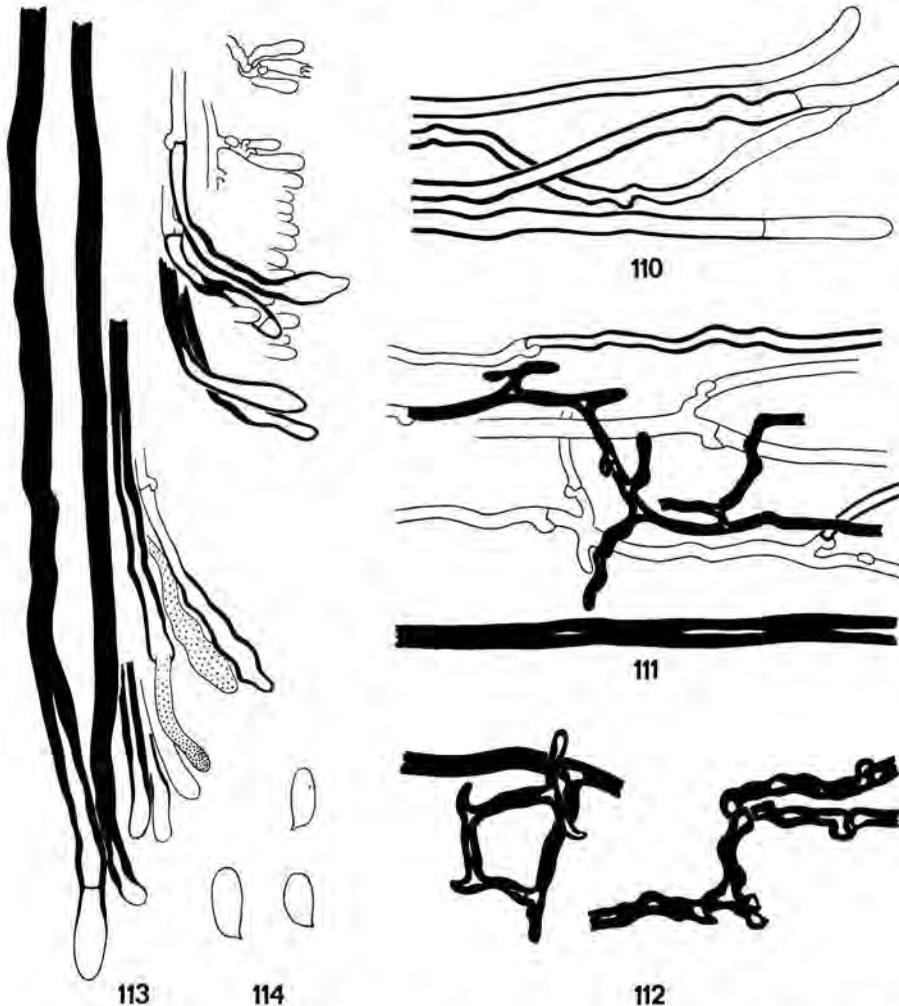
One of the characteristic features of *S. ochraceum* is the crust or crystalline sheath covering the distal portion of the cystidia. It should be pointed out that there may be some variation in the thickness of the crust, the size and shape of the crystals, and the tenacity with which the sheath clings to the cystidial wall. In some cases the sheath appears easily detachable, in others no amount of tapping on the cover-glass is capable of removing it. In yet other cases there is reason to believe that the cystidia were devoid of any crystalline cover from the start.

STECCHERINUM RAWAKENSE (Pers. apud Gaud.) Banker — Figs. 110–115

Hydnum rawakense Pers. apud Gaud. in Freyc., Bot. Voy. Monde 175. 1827. —
Mycoleptodon rawakensis (Pers. apud Gaud.) Pat., Essai tax. Hym. 117. 1900. —
Steccherinum rawakense (Pers. apud Gaud.) Banker in Mycologia 4: 312. 1912. —

TYPE: "*Hydnum rawakense* / Ded. Gaudichaud" (L 910. 262-648; part in PC).
For further synonymy, see MAAS GEESTERANUS (1964: 171).

Basidiomes solitary or several growing imbricately, often confluent laterally, in their youngest stage effused-reflexed, the reflexed part subsequently growing out to form the pileus. Pileus up to 30 mm radius, horizontal, flabelliform, smooth or with numerous concentric furrows, finely tomentose, soon glabrescent, radiately innate-fibrillose in the glabrous parts, ochraceous or pallid tan to dull fawn brown, marked by numerous concentric zones of a darker to ferruginous brown, frequently also darker at the base; margin acute, white when fresh, yellow-brown



Figs. 110-114. *Steccherinum rawakense* (Malay Peninsula, Padang Piol, Corner).
- 110. Skeletals taken from the margin of the pileus. - 111. Detail of the context 3 mm back from the margin, showing generative and skeletal hyphae and an almost solid tendril hypha. - 112. Portions of two tendril hyphae. - 113. Detail of a spine, showing skeletal, cystidia, and basidia. - 114. Spores (Figs. 110-113, $\times 700$; Fig. 114, $\times 2800$.)

when dry. Spines extending right to the base, up to 1.5 mm long, crowded, subulate or compressed or angular to fluted, slender, rigid when dry, drab white or greyish white, then pale wood colour or pale tan, with acute or obtuse tip. Context of the pileus up to 1.5 mm thick at the base of the pileus, tough, not duplex, fibrous, indistinctly zoned, white to pale dingy yellow-brown.

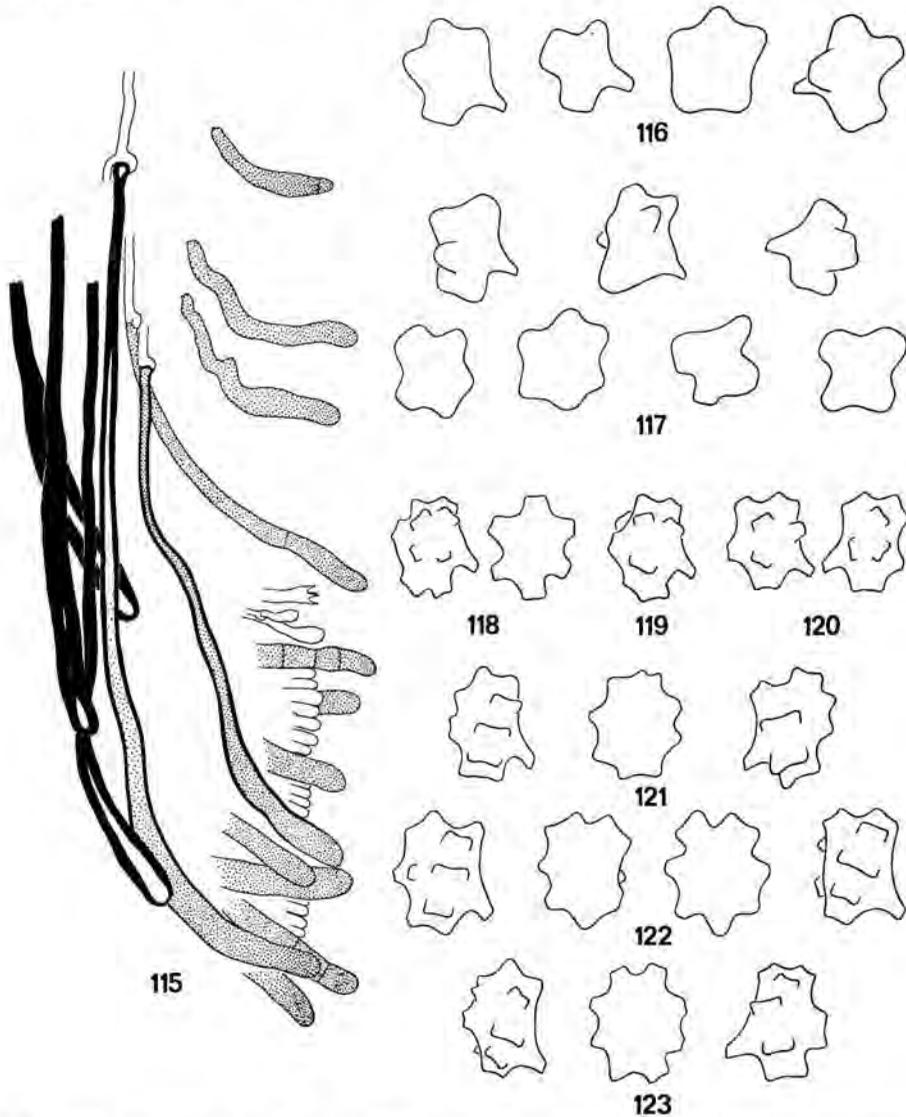


Fig. 115. *Steccherinum rawakense* (Borneo, Corner). — Detail of a spine, showing skeletal elements, gloeocystidia, and basidia ($\times 700$).

Figs. 116, 117. *Hydnellum cruentum* (Fig. 116: Nepal, Poelt; Fig. 117: Japan, Lloyd Mycol. Coll. 4899). — Spores ($\times 2800$).

Figs. 118–120. *Hydnellum auratile* (Fig. 118: France, Huijsman; Fig. 119: India, Maas G. 14266; Fig. 120: Japan, Lloyd Mycol. Coll. 23132). — Spores ($\times 2800$).

Figs. 121–123. *Hydnellum caeruleum* (Fig. 121: France, Maas G. 12873; Fig. 122: India, Manali, Maas G. 14284; Fig. 123: India, Khata Pani). — Spores ($\times 2800$).

Context of the pileus dimitic, consisting of generative, tendril, and skeletal hyphae. Generative hyphae $2.7-4.5 \mu$ wide, not inflating, thin-walled, branched, septate, with clamp-connections, at their tips all filled with oily matter, farther back with side-branches which produce tendril and skeletal hyphae. Tendril hyphae tortuous, profusely branched, usually solid, with occasional clamp-connections. Skeletal hyphae $2.7-7 \mu$ wide. Context of the spines similar, but lacking the tendril hyphae. Basidia $14-16 \times 3-4 \mu$, clavate, with a clamp-connection at the base, with 4 sterigmata up to 3μ long. Spores $2.8-3.5 \times 1.3-1.7 \mu$, cylindrical-ellipsoid, adaxially flattened, smooth, colourless, neither amyloid nor cyanophilous, with small oblique apiculus. Cystidia only occurring in the apical part of the spines, of two main types which are not strictly separated: (i) cylindrical, thin-walled, filled with oily matter, with obtuse tips (gloeocystidia), (ii) clavate to ventricose, thick-walled, apparently empty, more or less pointed. The cystidia close to the apex of the spine are of tramal origin, those farther back of hymenial origin. The contents of the gloeocystidia do not stain in sulpho-anisaldehyde.

COLLECTIONS EXAMINED AND REPORTED:

CEYLON

No locality, no date, *G. H. K. Thwaites 385* (K); also listed by BERKELEY & BROOME (1873: 59).

MALAY PENINSULA

Pahang: Padang Piol, 4 Dec. 1930, *E. J. H. Corner* (L); Tembeling, 16 Nov. 1930, *E. J. H. Corner*, on fallen *Oncosperma* (L); 20 Nov. 1930, *E. J. H. Corner* (L).

BORNEO

Brunei: Ulu Belalang, 15 and 16 Feb. 1959, *E. J. H. Corner* (L).
Sarawak (recorded by CESATI (1879: 9), but probably in error for Rawak).

JAVA

Listed by VAN OVEREEM c.s. (1922: 60).

NEW GUINEA

Rawak, N. of Waigeo, *Ch. Gaudichaud*, type of *Hydnum rawakense* (L).
North-East New Guinea [formerly Kaiser Wilhelmsland]: Gogol River (SCHUMANN & LAUTERBACH, 1901: 41).

AUSTRALIA

New South Wales: Tweed River [near Brisbane], *W. R. Guilfoyle*, type of *Hydnum mülleri* (K); a further locality listed by CLELAND & CHEEL (1919: 304).

NEW ZEALAND

Various localities enumerated by CUNNINGHAM (1958: 597).

The two types of cystidia of *S. rawakense* have already been discussed in an earlier paper (MAAS GEESTERANUS, 1964: 172), but a short characterization may be given here to stress their remarkable behaviour. Both the gloeocystidia and the thick-walled cystidia, as viewed from the tip of the spine towards its sides, represent progressively shortened and deformed

skeletal hyphae, curving sideways and outwards. The origin of the cystidia near the tip of the spine appears to be situated in the context, and in the hymenium farther away from the tip, the transition being gradual. The occurrence of some skeletal with oily contents and of oil-filled and thin-walled outgrowths from the apex of otherwise empty and thick-walled skeletal suggests that there is no fundamental difference between the two types of cystidia. It is not known what factor determines the development of either type. All that can be said at present is that the extremes of the two types occur in geographically widely separated areas, New Zealand and South America, while the area covered by the present paper is particularly interesting in that here types of an intermediate nature are to be found.

THELEPHORACEAE Chev.

Thelephoraceae Chev., Fl. Env. Paris 1: 84. 1826. — TYPE: *Thelephora* Ehrh. ex Willd. = *Thelephora* Ehrh. ex Fr.

For synonymy, see DONK (1964: 295).

Basidiome effused, effused-reflexed, pileate and stipitate, or coralloidly branched, variously coloured. Hymenophore smooth, verrucose, aculeate, poroid, folded, or imperfectly lamellate. Context floccose to fibrillose, leathery, corky, woody, or fleshy, dry to sappy, in at least several species containing a substance that turns green in KOH solution, monomitic. Generative hyphae inflating or not, thin- to moderately thick-walled, branched, septate, with or without clamp-connections. Hymenium more or less thickening. Basidia clavate, 2-4-spored, with or without basal clamp, chiasitic. Spores subglobose to ellipsoid, often of irregular outline, in addition often spinulose or tubercular, brown to (almost?) colourless, not amyloid. Cystidia usually absent.

Terrestrial, humicolous, or lignicolous (description adapted from DONK, 1964: 295).

CORNER (1968: 27) gave a diagram to show the generic relationships in Thelephoraceae. Later (1970: 12) he came to doubt whether the inclusion of so diverse genera in one family would be the correct solution: "It would be better to raise this family to an order if such great differences in the form of the fruit-body are to be included." Man in his impatience to know nature sometimes reaches to as yet unattainable depths.

Hydnellum and *Sarcodon*, in this alphabetical order, are the two thelephoraceous genera dealt with in the present paper.

HYDNELLUM P. Karst.

Hydnellum P. Karst. in Meddn Soc. Fauna Fl. fenn. 5: 41. 1879. — TYPE SPECIES: *Hydnum suaveolens* Scop. ex Fr. (see DONK, 1956a: 96).

Basidiome pileate and stipitate. Pileus initially velutinous, becoming felted, matted, scrobiculate, squamulose, or lamellate, ranging from white, yellow, orange to brown in various shades, more rarely with bluish colours.

Stipe covered with more or less thick tomentum, usually binding vegetable debris, concolorous with the pileus or darker or differently coloured. Hymenium covering spines on the underside of the pileus. Spines brown to chocolate brown with maturity. Context fibrous, soft to corky or woody, more or less duplex, zoned, monomitic, made up of generative hyphae. Generative hyphae as a rule not inflating, thin- to moderately thick-walled, branched, septate, with or without clamp-connections. Basidia clavate, 4-spored, with or without basal clamp. Spores broadly ellipsoid or almost isodiametric, of irregular outline, tubercular, brown in the mass, with oblique apiculus. Cystidia none. Odour not of fenugreek when dried. Terrestrial.

The genus as represented in the area under discussion embraces the sections *Hydnullum*, *Aurantiaca*, and *Velutina*, described on p. 86, 87, and 97, respectively. These sections play no part in the key to the species.

KEY TO THE SPECIES

1. Hyphae without clamp-connections.
 2. Context purplish brown to ferruginous brown, staining immediately dark violet in KOH solution, discolouring equally quickly to olive green.
 3. Spores 4.5–6.5 μ long.
 4. Spore length clearly exceeding the breadth.
 5. Pileus radiately fibrillose or ridged, or pitted to lamellate, or bearing numerous processes. Stipe as a rule thickly tomentose only in the basal portion.
 6. Pileus with numerous concentric zones. Spores with very coarse tubercles, which are often crest-like and elongated: *H. concrescens*
 6. Pileus without or with few and inconspicuous concentric zones. Spores with much smaller, more isodiametric tubercles: *H. scrobiculatum*
 5. Pileus covered with an almost featureless tomentum. Stipe very thickly tomentose along its entire length: *H. species 1*
 4. Spores practically isodiametric: *H. staurastrum*
 3. Spores 7–8 μ long: *H. papuanum*
 2. Context not with these characters combined.
 7. Context of the pileus without blue zones.
 8. Context of the pileus not orange over the spines.
 9. Stipe orange to orange-brown.
 10. Pileus smooth, ochraceous yellow, turning a rich red-brown in age or when bruised: *H. humidum*
 10. Pileus very uneven to colliculose, at first white, then orange, finally dull brown (not treated in this paper): *H. aurantiacum*
 9. Stipe fulvous to bay: *H. crustulinum*
 8. Context of the pileus orange-yellow, orange, orange-brown over the spines.
 11. Pileus always concentrically zoned, nearly always marked by dark radiating fibrils or scale-like threads: *H. auratile*
 11. Pileus not zoned or with a solitary and inconspicuous concentric zone; radiating fibrils, if any, not dark: *H. earlianum*
 7. Context of the pileus zoned with blue-grey bands: *H. fraudulentum*
1. Hyphae with clamp-connections.

12. Context of stipe some shade of blue. Spores up to 5.5μ long.
 13. Odour of cumarine shortly after collecting and persisting for many years when well dried. Dried pileus not dotted with crystalline excretions (not treated in this paper): *H. suaveolens*
 13. Odour not of cumarine. Dried pileus with numerous dots of excreted matter: *H. cruentum*
 12. Context of stipe orange-brown. Spores over 5.5μ long: *H. caeruleum*

HYDNELLUM sect. HYDNELLUM

TYPE SPECIES: *Hydnum suaveolens* Scop. ex Fr.

Hydnevellum group 4 Maas G. (pro parte) in *Fungus* 27: 51. 1957.

Hydnevellum stirps Caeruleum K. Harrison in *Mich. Bot.* 7: 224. 1968 (nomen nudum).

Context in the base of the stipe blue, at least when young. Odour penetrating. Hyphae with clamp-connections. Spores with few and broadly rounded tubercles.

POUZAR (1956: 76) attributed to this taxon the rank of subgenus.

The section comprizes the species *Hydnevellum suaveolens* (Scop. ex Fr.) P. Karst. and *H. cruentum*. Of *H. suaveolens* I did not see any collection, but there is an unmistakable illustration of this fungus from Japan (IMAZEKI & HONGO, 1968: pl. 48 fig. 275) so that I have no hesitation to include the species in the key.

HYDNELLUM CRUENTUM K. Harrison — Figs. 116, 117

Hydnevellum cruentum K. Harrison, *Stip. Hydn. Nova Scotia* 37, pl. 3 fig. 3. 1961.

— TYPE: "Cape Breton Island, Highland National Park, KM 3289" (DAOM 53376).

Basidiomes simple to conrescent. Pileus up to 60 mm across, plano-convex to depressed, uneven to scrobiculate or scrupose in the centre, radiately ridged or wrinkled farther outward, smooth at the margin, obscurely concentrically zoned except sometimes in youth, at first plushy, then tomentose, tomentum in places turning into a shiny glabrous surface with darker streaks of innate fibrils, or tomentum passing into a fibrillose surface with some of the fibrils raised and united to form slender, scale-like processes; in the youngest stages yellow-brown or pale grey-brown, near the margin with yellowish and pinkish shades, near the centre verging towards blue-grey; in older specimens avellaneous to tawny or dark umber, intermixed with patches of lilaceous grey to leaden grey, blackish where bruised; with scattered to crowded dots and pustules of yellowish crystalline matter. Stipe about $30-40 \times 3-6$ mm, tapering below, plushy, glabrescent with age or when handled, at first white, then violet-blue or violet-grey, finally grey-brown to dark brown, long remaining white at the base. Spines up to 3.5 mm long, little decurrent, crowded, subulate, entirely violaceous grey or violet-blue when immature, finally purplish brown. Context of the pileus not duplex, pale grey-brown, streaked and zoned with blue-grey (entirely blue-grey in the Nepalese material), also zoned with some dark brown lines, full of grey-brown to whitish pockets of excreted matter; context of the stipe violet-blue or violet-grey, becoming marbled with brown with age. A thin slice of the context immediately

staining blue-green in KOH solution, the pockets of excreted matter remaining yellowish.

Context of the pileus monomitic. Generative hyphae 2.7–6.3 μ wide, not inflating, thin-walled or moderately thick-walled, branched, septate, with clamp-connections. Context of the spines similar. Basidia 31–34 \times 5–6 μ , clavate, with basal clamp, 4-spored. Sterigmata 3.6–4.5 μ long. Spores 4.6–5.4 \times 3.6–4 μ , of irregular outline, tubercular (tubercles few, strongly prominent, rounded), brownish.

COLLECTIONS EXAMINED:

NEPAL

East Nepal, East of Jumbesi, 11 Sept. 1962, *J. Poelt P 206* in *Abies-Rhododendron* forest (M).

JAPAN

Honshu: Prov. Rikuzen, Sendai, 9 Sept. 1914, *A. Yasuda 275* (Lloyd Mycol. Coll. 23129, BPI); 1 Oct. 1916, *A. Yasuda 448* (Lloyd Mycol. Coll. 4899, BPI).

The first collection sent by Yasuda met with an uninspiring fate, for Lloyd answered by saying: "Not European nor American and unnamed I think," and filed it away as *Hydnum* sp. When Yasuda dispatched the second gathering of the present species to Lloyd, he must have been convinced he had found something new to science, as indeed he had. In anticipation of Lloyd's approval he labelled his collection *Hydnum sendaiense* Lloyd et Yasuda, a name which to my knowledge has never been published. LLOYD disdained the suggestion and reported the species as *Hydnum violascens* (1917, Lett. 66: 7, 10).

Judging from the few coniferous needles in the litter, Yasuda collected his material under some species of *Abies*, and the same association was noted for the Nepalese collection.

Hydnellum cruentum would appear to be allied to *H. suaveolens*. They have several unrelated characters in common, such as small spores not exceeding 5–5.5 μ and with few and broadly rounded tubercles, blue to violet-blue colour to the base of the stipe both within and without, and strong smell. The differences between the two species, however, are clear and, apart from those mentioned in the key, there is the highly characteristic concentric configuration of the surface of the adult pileus in *H. suaveolens*, lacking in *H. cruentum*.

HYDNELLUM sect. AURANTIACA Pouz.

Hydnellum subgen. *Phaeohydnum* Pouz. sect. *Aurantiaca* Pouz. in *Česká Mykol.* 10: 76. 1956. — TYPE SPECIES: *Hydnellum aurantiacum* (Batsch ex Fr.) P. Karst.

Hydnellum group 2 Maas G. in *Fungus* 27: 51. 1957.

Hydnellum stirps *Humidum* K. Harrison in *Mich. Bot.* 7: 223. 1968 (nomen nudum).

Hydnellum stirps *Aurantiacum* K. Harrison in *Mich. Bot.* 7: 226. 1968 (nomen nudum).

Context in the stipe orange-brown or brown in various other shades but not purplish brown and not staining dark violet in KOH. Odour not particular. Hyphae without or with clamp-connections.

Pouzar subordinated this section, together with section *Velutina*, to his subgenus *Phaeohydnellum*. This would imply that Pouzar assumed a closer relation between the two sections than I am prepared to accept. In the colour pattern and odour of their context the species of both sections are too far apart.

The species considered to belong to section *Aurantiaca* are *Hydnellum aurantiacum*, *H. auratile*, *H. caeruleum*, *H. crustulinum*, *H. earlianum*, *H. fraudulentum*, and *H. humidum*.

Of these species *Hydnellum aurantiacum* (Batsch ex Fr.) P. Karst. has been listed as indigenous for their country by authors like Ito (1955: 176) and TENG (1964: 438), but I have not come across any material. Yet, it is quite possible that the species occurs in China and Japan, consequently it is included in the key.

LLOYD reported *H. aurantiacum* from Australia (1917, Lett. 65: 2). In his collection (No. 22787) there are two small specimens and some fragments of a fungus which deceptively resembles immature *Hydnellum earlianum*. It is not this species, however, but a polypore with incipient pores, with a dimitic context with skeletal-like hyphae, and with the hymenial surface covered with thick-walled chlamydospores. Cleland suggested: "an *Polystictus cinnamomeus*?" but Lloyd dismissed the suggestion, stating: "There is no *Polystictus* with this color."

HYDNELLUM AURATILE (Britz.) Maas G. — Figs. 118–120, Pl. IV, fig. 2

Hydnum auratile Britz., Hym. Südbayern 8: 14, pl. 681 fig. 40. 1891; in Beih. bot. Zbl. 26(2): 214. 1910. — *Hydnellum auratile* (Britz.) Maas G. in Persoonia 1: 111. 1959. — TYPE: represented by Britz., Hym. Südbayern 8: pl. 681 fig. 40. 1891.

Basidiomes closely grouped or coalescent to form complex groups. Pileus up to 50 mm across, entire or deeply slit, simple or proliferating, depressed to infundibuliform, also more or less flabelliform, comparatively smooth to radiately uneven or rugulose and, besides, concentrically zoned with few to several shallow depressions, at first finely plushy, then tomentose to radiately fibrillose, nearly always marked by radiately aligned, dark brown to blackish innate to raised fibrils which unite to form slender streaks or scale-like threads, infrequently also becoming locally matted and shiny, the centre smooth to rough or scrupose; pale sulphur yellow in the youngest stage, then orange or of a vivid orange-brown, finally dark red-brown, with few and vague colour zones or closely zoned with bands of contrasting colours; margin undulate when dry. Stipe 10–40 × 2–7 mm, usually enlarged below into a bulbous base up to 12 mm broad, plushy to tomentose, becoming matted to glabrous, passing from orange-yellow or orange-brown to dull reddish brown. Spines up to 4 mm long, decurrent, crowded, subulate, pallid, soon turning tawny to purplish brown. Context of the pileus not duplex, obscurely zoned, dingy yellow, becoming dingy yellow-brown, under the upper surface and over the spines

bright orange-brown; context of the stipe very little duplex, even in the base, orange-brown. A thin slice of the orange context immediately staining dark olive green in KOH solution.

Context of the pileus monomitic. Generative hyphae 2.7–5 μ wide, not inflating, thin-walled or with slightly thickened cell-walls, branched, septate, without clamp-connections. Context of the spines similar. Basidia 26–31 \times 7–8 μ , clavate, without basal clamp, 4-spored. Sterigmata 3.6–4.5 μ long. Spores 5–5.4 \times 3.6–4 μ , of irregular outline, tubercular (tubercles fairly numerous, prominent, flat-topped to exsculptate), brownish, with oblique apiculus.

COLLECTIONS EXAMINED:

INDIA

Himachal Pradesh: Simla, 15 Aug. 1964, *R. A. Maas Geesteranus 14266*, in *Cedrus deodara* forest, 2200 m alt. (L).

Punjab: Kulu Valley, Manali, 19 Aug. 1964, *R. A. Maas Geesteranus 14286*, on heavy loam in *Cedrus deodara* forest, 1850 m alt. (L); 23 Aug. 1964, *R. A. Maas Geesteranus 14363*, among moss in wood of *Picea smithiana*, 1850 m alt. (L); no date, unknown officer of the Forest Research Institute, "in Deodar forest" (L).

Uttar Pradesh: Mussoorie, no date, unknown officer of the Forest Research Institute (L); Mussoorie, Khata Pani, 17 Sept. 1964, unknown officer of the Forest Research Institute, in *Cedrus deodara* forest, c. 2000 m alt. (L).

JAPAN

Honshu: Prov. Iwashiro, 28 Aug. 1914, *A. Yasuda 294* (Lloyd Mycol. Coll. 23133, BPI); Prov. Kozuke, 13 Oct. 1912, *A. Yasuda 155* (Lloyd Mycol. Coll. 23132, BPI).

Locality not specified, no date, *K. Masui* (Lloyd Mycol. Coll. 26801, BPI).

AUSTRALIA

Victoria: Dandenong Ranges, Kalorama, Inverness Road, 26 May 1946, *J. H. Willis*, amongst leaf litter on the ground (MEL).

LLOYD recorded the present species from Japan as *Hydnum* spec. (No. 23132; 1913, Lett. 45: 5), *Hydnum* spec. (No. 23133, also containing *Hydnellum earlianum*; 1915, Lett. 56: 5, 8), and *Hydnum aurantiacum* (No. 26801; 1924: 1296).

HARRISON (1968: 232), discussing "*H. auratile* Britzelmeyer," advocated against its use because "... the type of *H. auratile* has not been found and in our experience it is unwise to identify any species in the *Hydnellum aurantiacum* complex without specimens."

This I feel obliged to counter with the following remarks. The correct spelling of the name of the author of *Hydnum auratile* is Britzelmayer, not Britzelmeyer. This author gave a description and an illustration of a fungus which in Europe, a continent poor in specific diversity, cannot be mistaken.

It is true that Britzelmayer was the author of a great many unnecessary names, but some of his species have received, and do merit, recognition, *Rhodophyllus aprilis* (Britz.) Romagn. and *Russula paludosa* Britz. being a few among the Agarics, and the present species being one of the Aphylo-

phorales. Identification of species published in earlier times is one of the occupations of the taxonomist. To disdain the value of this kind of work is certain to lead to several more unnecessary names. To dismiss, in a particular case, the outcome of painstaking research, would seem only capable of being explained by complete ignorance of European conditions.

If it is thought unwise to identify any species in the *H. aurantiacum* complex without specimens, one might just as well abolish the very name *Hydnum aurantiacum*. The type of this species is represented by the description and illustration given by Batsch since there is no material, and some benevolence is certainly required to recognize the species from the illustration.

HYDNELLUM CAERULEUM (Hornem. ex Pers.) P. Karst. — Figs. 121–123

Hydnum caeruleum Hornem. in Fl. dan. 8 (Fasc. 23): 7. 1808; ex Pers., Mycol. europ. 2: 162. 1825. — *Hydnum suaveolens* *H. caeruleum* Hornem. ex Fr., Syst. mycol. 1: 402. 1821. — *Hydneillum caeruleum* (Hornem. ex Pers.) P. Karst. in Meddn Soc. Fauna Fl. fenn. 5: 41. 1879. — *Calodon caeruleus* (Hornem. ex Pers.) P. Karst. in Bidr. Känn. Finl. Nat. Folk 37: 106. 1882; Quéf. in C. r. Ass. franç. Av. Sci. 11: 399. 1883. — TYPE: represented by Hornem. in Fl. dan. 8(Fasc. 23): pl. 1374. 1808.

For further synonymy, see MAAS GEESTERANUS (1957: 54; 1960: 348).

Basidiomes simple or conerescent. Pileus up to 60 mm across, flat to depressed, comparatively even to rough or colliculose, originally velutinous, then felted, finally the tomentum collapsed to form a surface characterized by often sharply raised, reticulately connected fibrils and radiately aligned wrinkles or ridges, not or very indistinctly concentrically zoned; the youngest stages delicately blue-grey (fresh), then whitish to pale buff, from centre outwards with age turning greyish yellow or yellow-brown and finally dark dull brown; the margin remaining whitish for some time, but stained blackish where bruised. Stipe 10–35 × 4–15 mm, simple or connate, cylindrical or with a bulbous base or ventricose, usually very much covered with debris and dirt, plushy, becoming matted, orange-brown. Spines up to 3 mm long, decurrent, crowded, subulate, purplish brown. Context of the pileus up to 5 mm thick in the centre of the pileus, little or not duplex, in young specimens alternately zoned with delicately blue-grey and pallid bands, the latter becoming progressively flushed with orange in age. Context of the stipe duplex, at least in the basal portion; the firmer part blue-grey when young, with age becoming increasingly mottled with orange-brown, finally entirely dingy orange-brown; the tomentum orange to orange-brown. A thin slice of the bluish context staining blue-green in KOH solution, immediately changing to olive green; a slice of the orange context staining olive brown.

Context of the pileus monomitic. Generative hyphae 3–5.5 μ wide, not inflating, thin-walled or with slightly thickened cell-walls, branched, septate, with occasional clamp-connections in the firmer part. Context of the spines similar, hyphae narrower. Basidia 30–33 × 6–7 μ , clavate, with basal clamp only visible in very young stage, 4-spored. Sterigmata 2.7–4.5 μ long. Spores 5.8–6.3 × 4.3–4.5 μ , of irregular outline, tubercular

(tubercles numerous, prominent, fairly coarse, flat-topped to somewhat exsculptate), brownish, with oblique apiculus.

COLLECTIONS EXAMINED AND REPORTED:

WEST PAKISTAN

Swat: Bahrain, 17 Aug. 1952, *S. Ahmad* 4966 (L); see also AHMAD (1956: 67).

INDIA

Himachal Pradesh: Simla, 15 Aug. 1964, *R. A. Maas Geesteranus* 14265, in *Cedrus deodara* forest, 2200 m alt. (L).

Punjab: Kulu Valley, Manali, 19 Aug. 1964, *R. A. Maas Geesteranus* 14284, on loamy soil in *Cedrus deodara* forest, 1850 m alt. (L).

Uttar Pradesh: Mussoorie, date?, Forest Research Institute, "deodar forest, 6000 ft." (L); Mussoorie, Khata Pani, 17 Sept. 1964, Forest Research Institute, c. 2000 m alt. (L); Ranikhet, date?, Forest Research Institute (L); Ranikhet, 27 Aug. 1934, Comm. C. E. Parkinson, "under Deodar" (K).

JAPAN

Kyushu: Prov. Bungo: locality not specified, 12 Oct. 1919, *A. Yasuda* 663 (Lloyd Mycol. Coll. 22791, BPI).

IMAZEKI & HONGO (1965: pl. 42 fig. 256) gave an illustration of the present species which is not characteristic. In fact, I am not convinced the illustration really represents *H. caeruleum*. Yet, the species does occur in Japan, but LLOYD, who had received some material from Yasuda, did not recognize it, recording the find as *Hydnum fragile* (1922: 1162). This collection also contains one half of a specimen of *Hydnellum humidum*, which see.

***Hydnellum crustulinum* Maas G., nov. spec.⁸⁾**—Fig. 124

Basidiomata conrescentia (an adulta?). Pileus usque ad 30 mm diam., planus vel subdepressus, centro inaequabilis vel leviter reticulatim rugulosus, marginem versus passim fibrilloso-squamulosus, margine velutinus vel tomentosus, pallide et sordide cremeus in partibus junioribus, laesus purpureo-ater, aetate crustulinus, partim ad colorem ochraceum partim ad badium vergens. Stipes 4–10 × 3–5 mm, plus minusve cylindraceus, tenuiter tomentosus, asper, fulvus vel badius. Aculei usque ad 2 mm longi, subdecurrentes, conferti, subulati, demum purpureo-brunnei. Caro in pilei centro usque ad 5 mm crassa, haud duplex, zonata, pallida, in stipite similis, deorsum fusca; monomitica, e hyphis generatoriis formata. Hyphae 3.6–5.8 μ latae, haud inflatae, parietibus tenuibus instructae, ramosae, septatae, efibulatae. Basidia 27–30 × 5.5–6.5 μ , clavata, efibulata, quadrispora. Sterigmata 3.6–4.5 μ longa. Sporae 4.5–5 × 3.1–3.6 μ , tuberculatae (tubercula haud numerosa, parum prominentia, apicibus planis vel subexsculptatis), brunneolae.

HOLOTYPE: India, Punjab, Kulu Valley, Manali, 19 Aug. 1964, *R. A. Maas Geesteranus* 14285 (L).

Basidiomes conrescent (probably not full-grown). Pileus up to about 30 mm across, plane to somewhat depressed, uneven to delicately and

⁸⁾ Etymology: crustulinus, having the colour of toast.

reticulately wrinkled in the centre, in places with appressed fibrillose squamules farther outwards, velutinous to tomentose at the margin, pale dingy cream in the younger parts, purplish black where bruised, of a rich yellow-brown in the centre, partly with more ochraceous shades, partly tending towards a deeper brown, in several specimens densely covered with minute, glistening, orange-red particles. Stipe 4–10 × 3–5 mm, broader when fused, more or less cylindrical, thinly tomentose, rough, fulvous to bay. Spines up to 2 mm long, somewhat decurrent, crowded, subulate, finally purplish brown. Context of the pileus up to 5 mm thick in the centre, not duplex, zoned, pallid. Context of the stipe similar, grey-brown to dark brown in the base. Taste neither bitter nor acrid. A thin slice of the context staining green in KOH solution, but immediately discolouring to a pale, non-descript brown.

Context of the pileus monomitic. Generative hyphae 3.6–5.8 μ wide, not inflating, thin-walled, branched, septate, without clamp-connections. Context of the spines similar, hyphae narrower. Basidia 27–30 × 5.5–6.5 μ , clavate, without basal clamp, 4-spored. Sterigmata 3.6–4.5 μ long. Spores 4.5–5 × 3.1–3.6 μ , of irregular outline, tubercular (tubercles not numerous, little prominent, flattened or somewhat exsculptate), brownish.

COLLECTIONS EXAMINED:

INDIA

Punjab: Kulu Valley, Manali, 19 Aug. 1964, *R. A. Maas Geesteranus 14285*, on loamy soil in forest of *Cedrus deodara*, 1850 m alt. (holotype, L); 25 Aug. 1964, *R. A. Maas Geesteranus 14383*, among moss in forest of *Picea smithiana* and *Cedrus deodara*, 1850 m alt. (L).

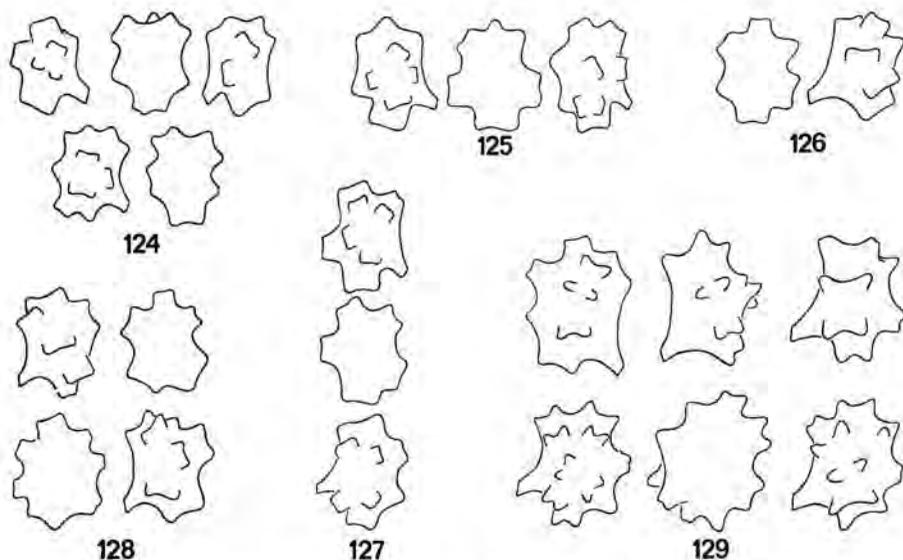


Fig. 124. *Hydnellum crustulinum* (holotype). – Spores (× 2800).
 Figs. 125–128. *Hydnellum earlianum* (Fig. 125: U.S.A., *Hesler 18668*, L; Fig. 126: Japan, Lloyd Mycol. Coll. 23133; Fig. 127: Japan, Lloyd Mycol. Coll. 4897; Fig. 128: Japan, Lloyd Mycol. Coll. 4905). – Spores (× 2800).
 Fig. 129. *Hydnellum fraudulentum* (holotype). – Spores (× 2800).

Both collections were not mature when they were collected. Drying may have forced the ripening process, so that perhaps size and shape of the spores may not be characteristic.

Whether the minute reddish particles on the upper surface of the pileus have diagnostic value is not known, but they were never noticed in any other species. They dissolve in KOH without leaving a trace.

The affinities of the present species are not quite obvious. To judge from its colour pattern and lack of clamp-connections it would seem to be related to *Hydnellum compactum* (Pers. ex Fr.) P. Karst. and *H. mirabile* (Fr.) P. Karst., but it deviates from these at least in chemical respect in that it lacks the acrid taste and shows reddish crystals.

A superficially somewhat similar species, but actually belonging to the *H. aurantiacum* group, is *H. humidum*, differing from *H. crustulinum* in its duplex context and more orange-brown stipe.

A species that on account of its somewhat similar colours, lack of clamps, and mild taste, may well be mentioned here is *Hydnum montelicum* Sacc., discussed in an earlier paper (MAAS GEESTERANUS, 1960:369). It still awaits identification and all that I am prepared to state about this species for the present is that it has no true relation with *H. crustulinum* as its spores are appreciably larger while their tubercles are more numerous, coarser, and of a different shape.

HYDNELLUM EARLIANUM Banker — Figs. 125–128, Pl. III, fig. 4

Hydnellum earlianum Banker in Mem. Torrey bot. Club 12: 161. 1906. — *Hydnum earlianum* (Banker) Sacc. & Trott. in Sacc., Syll. Fung. 21: 371. 1912; not *Hydnum earleanum* Sumstine in Torrey 4: 59. 1904. — ISOTYPE: "Tallahassee, Aug. 1887, L. M. Underwood 411" (NY).

MISAPPLIED NAMES: *Hydnellum aurantiacum sensu* Coker and *Hydnellum complacatum sensu* Coker *apud* Coker & Beers, Stip. Hydn. east. U.S. 67, 69. 1951 (see MAAS GEESTERANUS, 1964a: 151).

Basidiomes simple or coalescent to form complex groups. Pileus up to 40 mm across, depressed to infundibuliform, smooth or somewhat colliculose or radiately uneven, uniformly plushy, then tomentose to radiately fibrillose, with age glabrescent in places, pale sulphur yellow in the younger parts, gradually passing into dingy orange or orange-brown, occasionally with an inconspicuous concentric zone of a deeper colour, finally dull dark brown. Stipe 10–17 × 4–7 mm, tapering downwards, sharply delimited from the abruptly swollen base, up to 11 mm, tomentose, becoming matted and shiny with age, orange-yellow, dingy orange to orange-brown, finally dull brown to blackish. Spines up to 2 mm long, decurrent, crowded, subulate, cream to pale sulphur yellow when immature, with age becoming tawny. Context of the pileus not clearly duplex, zoned only in the harder part, orange-yellow near the margin, orange elsewhere, passing into reddish orange in the stipe, faded to drab orange-brownish when old; context of the stipe duplex in the basal portion. A thin slice of the context immediately staining olive green in KOH solution.

Context of the pileus monomitic. Generative hyphae 2.7–5.4 μ wide, not inflating, thin-walled or with slightly thickened cell-walls, branched,

septate, without clamp-connections. Context of the spines similar, hyphae somewhat narrower. Basidia $26-31 \times 6-7 \mu$, clavate without basal clamp, 4-spored. Sterigmata $2.7-3.6 \mu$ long. Spores $5.4-5.8 \times 3.6-4 \mu$, of irregular outline, tubercular (tubercles fairly numerous, prominent, somewhat angular to exsculptate), brownish, with oblique apiculus. Cystidia none.

COLLECTIONS EXAMINED:

WEST PAKISTAN

Lahore: Lahore, no date, *Shiv Ram Kashyap 4* (Lloyd Mycol. Coll. 4925, BPI).

JAPAN

Honshu: Prov. Iwashiro, 28 Aug. 1914, *A. Yasuda 294* (Lloyd Mycol. Coll. 23133, BPI); Prov. Ise, Kuwana, Nov. 1916, *J. Umemura 199* (Lloyd Mycol. Coll. 4897, BPI); Prov. Mikawa, Sendai, 15 Sept. 1913, *A. Yasuda 207* (Lloyd Mycol. Coll. 4905, BPI).

The collection listed above for West Pakistan was recorded by LLOYD under the name *Hydnum olidum* (1917, Lett. 65: 4, 8), but it should be pointed out that there are two collections from Lahore under that name, the other being *Phellodon niger*, see there.

LLOYD also recorded the present species from Japan, once as *Hydnum aurantiacum* (1914, Lett. 51: 4), the second time as "*Hydnum* (should be renamed)" (1915, Lett. 56: 5, 8), a species he considered quite close to *H. aurantiacum* of Europe. The first collection gives but a poor idea of the species, although there can be no doubt as to its identity. I compared the spores with those of a North American gathering. The second collection consists of several small, beautifully developed, and excellently preserved specimens of *H. earlianum* and three much broken specimens of *H. auratile*.

Lloyd 4905 comprizes a second fungus, which with some doubt is referred to *H. humidum*, see there.

A partial redescription of *H. earlianum* was given on an earlier occasion (MAAS GEESTERANUS, 1964a: 151), mainly based on the excellent collections in Coker's herbarium. Banker's description, it should be pointed out once again, gives an incomplete impression since it was drawn up after old, nearly decayed material.

HARRISON (1961: 36) was of the opinion that *H. earlianum* "is a synonym of *Hydnellum complicatum* Banker." This is an error, but for an explanation, compare the misapplied names. Later HARRISON (1968: 230) corrected his view in so far as he restored *H. earlianum* as a species of its own, but he was silent about *H. complicatum*.

A noteworthy character of *H. earlianum* is the fragility of the tomentum of the pileus when dry: it clings to the fingers as an orange dust when handled. HARRISON's expression (1968: 230) aptly describes this character "as though dusted with orange powder." The feature is lost, however, once the tomentum is collapsed in old material.

Hydnellum fraudulentum Maas G., *spec. nov.*⁹⁾ – Fig. 129

Basidiomata concretescentia. Pileus usque ad 35 mm diam., depressus, praecipue in centro scrobiculatus, aliis locis processibus asperis munitus vel squamuloso-fibrillosus, margine hinc inde velutinus, azonatus, albus in partibus junioribus; aetate flavo-cinereus, argillaceus, gilvus, centro purpureo-brunneus vel umbrinus; margine laesus purpureo-ater. Stipes 15–25 × 8–14 mm, cylindraceus, basi bulbosus, rudis obtectus, velutinus vel tomentosus, aurantio-ferrugineus. Aculei usque ad 2.5 mm longi, decurrentes, conferti, subulati, purpureo-brunnei. Caro in pilei centro usque ad 5 mm crassa, haud distincte duplex, zonis alternis caesiis aurantiacisque instructa et lineis obscuris notata, in stipite deorsum duplex, sordide aurantiaco-brunnea, passim tenuiter caesio-zonata, tomento aurantiaco oblecta; monomitica, e hyphis generatoriis formata. Hyphae 3.6–5.4 μ latae, haud inflatae, parietibus tenuibus vel parum incrassatis instructae, ramosae, septatae, fibulis carentes. Basidia 30–36 × 6–7 μ , clavata, efibulata, quadrispora. Sterigmata 3.6–4.5 μ longa. Sporae 6.3–7 × 4.5–4.7 μ , grosse tuberculatae (tubercula numerosa, prominentia, apicibus exsculptis), brunneolae.

HOLOTYPE: Australia, Victoria, Revd. *James Wilson 047* (Lloyd Mycol. Coll. 27964, BPI).

Basidiomes concretescent. Pileus up to about 35 mm across, depressed, deeply pitted, particularly in the centre, with jagged processes or squamulose-fibrillose farther outwards, velutinous in some places at the margin, not zoned, white in the youngest parts, gradually passing into yellowish grey with or without a slight orange flush, pale buff, dingy yellow-brown, and purplish brown to dark dull brown in the centre; the margin purplish black where bruised. Stipe 15–25 × 8–14 mm, (probably made up of two or three completely fused single stipes), cylindrical with bulbous base, covered with debris and dirt, plushy in places, matted in others, orange-brown. Spines up to 2.5 mm long, decurrent, crowded, subulate, purplish brown. Context of the pileus about 5 mm thick in the centre, not distinctly duplex, alternately zoned with blue-grey and dingy orange bands, besides marked with several dark concentric lines. Context of the stipe duplex in the lower portion, dingy orange-brown, in places with a trace of faintly bluish bands, the tomentum orange-brown. A thin slice of the bluish context staining blue-green in KOH solution, quickly passing into olive green in presence of whatever slight proportion of orange-brown hyphae; the orange-brown context staining olive brown.

Context of the pileus monomitic. Generative hyphae 3.6–5.4 μ wide, not inflating, thin-walled or with slightly thickened cell-walls, branched, septate, without clamp-connections. Context of the spines similar, hyphae somewhat narrower. Basidia 30–36 × 6–7 μ , clavate, without basal clamp, 4-spored. Sterigmata 3.6–4.5 μ long. Spores 6.3–7 × 4.5–4.7 μ , of irregular outline, tubercular (tubercles numerous, prominent, fairly coarse, exsculptate), brownish.

COLLECTION EXAMINED:

AUSTRALIA

Victoria: locality and date unknown, Revd. *James Wilson 047* (holotype, Lloyd Mycol. Coll. 27964, BPI).

⁹⁾ Etymology: *fraudulentus*, deceiving, that is, deceivingly looking like *Hydnellum caeruleum*.

The present species has a most extraordinary resemblance to *H. caeruleum*, but several points of difference warrant a distinction. In *H. fraudulentum* the pileus is characterized by radiately aligned jagged processes, while both hyphae and basidia lack clamps. Contrasted with this the pileus in *H. caeruleum* is under no circumstances harsh with jagged outgrowths, the hyphae possess occasional clamp-connections, and there is a clamp to the base of the basidia. A further difference probably lies in the spores, those of *H. fraudulentum* seeming to be somewhat more sharply angular than in *H. caeruleum*.

It ought to be possible to find out from Lloyd's correspondence where Revd. James Wilson lived, and it is to be hoped that the area, if not completely urbanized, be searched for additional material.

HYDNELLUM HUMIDUM (Banker apud V. S. White) Banker

Hydnum humidum Banker apud V. S. White in Bull. Torrey bot. Club 29: 553. 1902. — *Hydnellum humidum* (Banker apud V. S. White) Banker in Mem. Torrey bot. Club 12: 162. 1906. — TYPE: "*Hydnum humidum* Bank. / Maine. Miss White" (NY).

For further synonymy, see MAAS GEESTERANUS (1969: 216).

Pileus 28 mm across, plano-convex, smooth, neither zoned nor with radiate markings, the surface felted to matted, ochraceous yellow-brown, with innate fibrils and blotches of a rich red-brown; the margin, where not bruised or damaged, somewhat incurved, velutinous. Stipe felted, dingy orange-brown. Spines up to 3 mm long, decurrent, crowded, subulate, purplish brown. Context of the pileus up to 3 mm thick in the centre, duplex, the firmer part woody, sepia brownish because of bad drying, white-spotted, the tomentum soft, almost orange-brown. A thin slice of the dark layer of the context staining an indistinct olive green in KOH solution.

Context of the pileus monomitic. Generative hyphae 3.5–5.5 μ wide, not inflating, thin-walled to moderately thick-walled, branched, septate, without clamp-connections. Context of the spines similar, hyphae narrower. Basidia up to 7 μ broad, inseparable. Spores 4.7–5.4 \times 3.6–4.5 μ , malformed, damaged or collapsed, irregular in outline, tubercular (tubercles fairly numerous, prominent, coarse, flat-topped or exsculptate), brownish, with oblique apiculus.

COLLECTION EXAMINED:

JAPAN

Kyushu: Prov. Bungo, 12 Oct. 1919, *A. Yasuda* 663 (Lloyd Mycol. Coll. 22791, BPI).

The material available constitutes less than one half of the pileus and only the upper part of the stipe, hence the description is of necessity fragmentary. Moreover, the description cannot be expected to be characteristic of the species since the specimen shows signs of bad drying.

The material described above was an unrecognized element in a collection of *Hydnellum caeruleum* reported by LLOYD as *Hydnum fragile*

(1922:1162). ITO (1955:201) entered that name under the heading Doubtful Species, whereafter *H. fragile* disappeared from Japanese literature.

A collection from Japan, Honshu, Prov. Mikawa (Lloyd Mycol. Coll. 4905), that Lloyd had doubtfully named *Hydnum aurantiacum* and which subsequently turned out to be in part *Hydnellum earlianum*, also contained some weirdly contorted and malformed broken bits of a fungus which, to judge by its colours, might well represent *H. humidum*.

HYDNELLUM sect. VELUTINA Pouz.

Hydnellum subgen. *Phaeohydnellum* sect. *Velutina* Pouz. in *Česká Mykol.* 10: 76. 1956. — TYPE SPECIES: *Hydnellum velutinum* (Fr.) P. Karst.

Hydnellum group 1 Maas G. in *Fungus* 27: 51. 1957.

Hydnellum stirps *Scrobiculatum* K. Harrison in *Mich. Bot.* 7: 237. 1968 (nomen nudum).

Context for the greater part red-brown to purplish brown, immediately staining dark violet in a KOH solution, equally quickly turning olive green. Odour mealy or of water-melon (*Citrullus vulgaris*). Hyphae without clamp-connections.

The sectional name *Velutina* is inadmissible if used to indicate the type section of subgenus *Phaeohydnellum* (see Art. 22 of the Code, 1966). It is the correct name, however, in the present context since I do not accept a subdivision in subgenera.

Hydnellum velutinum is the name I once (MAAS GEESTERANUS, 1957: 61) used as a convenient notion to cover such micro-species as *H. spongiosipes*, *H. scrobiculatum*, *H. concrescens* (then known as *H. zonatum*), between which I often believed to see intermediate forms. The solution at which I arrived then was to accept varietal rank for these taxa. This inevitably necessitated the acceptance of the type variety *velutinum*, the weak link in the chain, for I had not seen, and there does not exist, Swedish material of that name.

Much has changed since. I have learned to distinguish the species by their spores, and learned to see the value of certain other features, but *Hydnum velutinum* remains the weak link. Or, rather, it is not a link at all, for surely it is significant that there is not a single collection in either Stockholm or Uppsala, which answers to Fries' description of *H. velutinum* and, at the same time, differs specifically from the known species.

LUNDELL (1954:4) held the opinion that *H. velutinum* "only represents a form of *H. ferrugineum* with an unusually marked velutinous cover not only on the pileus but also on the stem." I am now inclined to agree. It follows that the type species of sect. *Velutina* is identical with *Hydnellum ferrugineum* (Fr. ex Fr.) P. Karst.

The species of this section found in the area under discussion are *Hydnellum concrescens*, *H. papuanum*, *H. scrobiculatum*, *H. staurastrum*, and *H. species 1*. It may cause some surprise that *H. ferrugineum* is not mentioned,

as it has been reported by CESATI (1879:9) from Ceylon and Borneo (Sarawak) and by IMAZAKI & HONGO (1965: 131, pl. 42 fig. 255) and KAWAMURA (1954: 605, fig. 603) from Japan. The reason of its omission is that perhaps no other member of the genus *Hydnellum* has so often been mistaken for and confused with other species than exactly *H. ferrugineum*. Several factors contributed to create and maintain this confusion, and the only way to stop it appears to indicate a neotype. This is here formally presented as *Hydnellum ferrugineum* (Fr. ex Fr.) P. Karst. — NEOTYPE: Sweden, Småland, Femsjö parish, "NO. om Metesjön, nära gångstigen mot Stubbebo," 16 Sept. 1939, S. Lundell, "I stenig barrskog bland mossor" (UPS). A redescription must be reserved for a future occasion.

In the key to the species *H. ferrugineum* would come next to *H.* species 1 in the same line. For the difference from that species, see there.

HYDNELLUM CONCRESCENS (Pers. ex Schw.) Banker — Figs. 130–140

Hydnum concrescens Pers., Obs. mycol. 1: 74. 1796; Syn. Fung. 556. 1801; ex Schw. in Schr. naturf. Ges. Leipzig 1: 103. 1822. — *Hydnellum concrescens* (Pers. ex Schw.) Banker in Mem. Torrey bot. Club 12: 157. 1906. — TYPE LOCALITY: Germany.

[*Hydnum cyathiforme* b. Fr., Syst. mycol. 1: 405. 1821. —] *Hydnum zonatum* Fr., Epicr. Syst. mycol. 509. 1838. — *Hydnellum zonatum* (Fr.) P. Karst. in Meddn Soc. Fauna Fl. fenn. 5: 41. 1879. — *Calodon zonatus* (Fr.) P. Karst. in Bidr. Känn. Finl. Nat. Folk 37: 108. 1882. — *Phaeodon zonatus* (Fr.) J. Schroet. in KryptogFl. Schles. 3(1): 458. 1888. — *Hydnellum velutinum* var. *zonatum* (Fr.) Maas G. in Fungus 27: 64. 1957. — *Hydnum scrobiculatum* **zonatum* (Fr.) Lundell apud Lundell & Nannf., Fungi exs. suec. praes. upsäl., Fasc. 53–54: 17. 1959 (meant as a subspecies). — *Hydnellum scrobiculatum* var. *zonatum* (Fr.) K. Harrison, Stip. Hydn. Nova Scotia 43. 1961. — TYPE: Batsch, El. Fung. Cont. 2: pl. 40 fig. 224. 1789.

Hydnum vespertilio Berk. in J. Bot. Kew Gdns Misc. 6: 167. 1854. — *Hydnellum vespertilio* (Berk.) Banker in Mycologia 5: 198. 1913. — *Hydnellum zonatum* f. *vespertilio* (Berk.) Coker & Beers, Stip. Hydn. east. U.S. 80. 1951. — TYPE: "*Hydnum vespertilio* Berk. / Nunklow / July 10, 1850" (K).

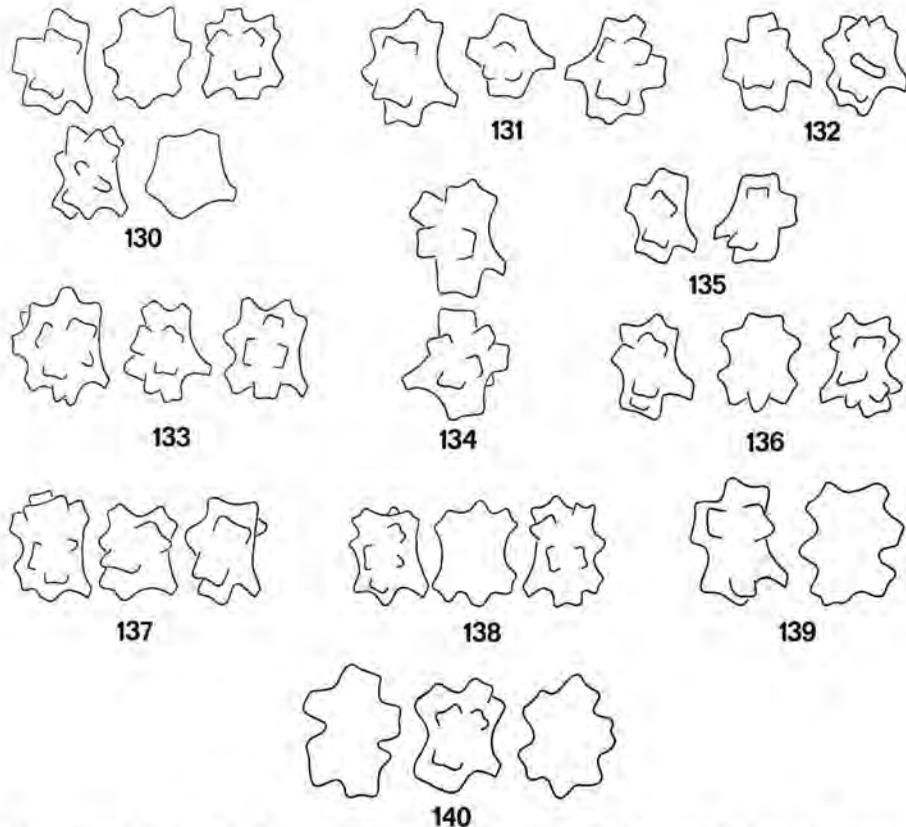
Hydnum spathulatum Lloyd, Mycol. Writ. 6: 878, pl. 124 fig. 1501. 1919. — TYPE: "Java / Dr Ch. Bernard" (Lloyd Mycol. Coll. 4927; BPI).

For further synonymy, see under *Hydnum fasciatum* (MAAS GEESTERANUS, 1966a: 27).

Basidiomes simple to conrescent. Pileus up to some 50 mm across, umbilicate to infundibuliform, thin, tough-pliant; originally velutinous to thinly felted, with age becoming radiately fibrillose, in addition adorned with raised scale-like fibrils or ridges, the tomentum behind the margin collapsed to form concentric zones, these zones sometimes corrugating the surface, the surface otherwise even (except in the centre which may be pitted to lamellate), on drying becoming shiny and liberally sprinkled with minute, whitish pustules of excreted matter; yellowish brown to pinkish brown in the youngest parts, dingy yellowish fulvous or orange-brownish to dull brown towards the centre, sometimes darkened by leaden grey hues, the concentric zones with alternating bands of yellowish brown and tawny or fuscous, the very centre sometimes very dark. Stipe 10–30 × 2–5 mm, simple or connate, flaring upward into the pileus, terete to flattened in the middle, enlarged below to form a more or less conspic-

uously bulbous base, originally plushy, then matted, often with a somewhat shiny surface, concolorous with the pileus. Spines up to 2 mm long, decurrent, crowded, subulate, purplish brown. Context of the pileus up to about 1 mm thick in the centre, very soon thinning out, not duplex, obscurely zoned, lighter or darker purplish brown, over the spines sometimes with leaden grey or slate grey streaks. Context of the stipe duplex at least in the lower portion, with less or no grey at all. A thin slice of the context immediately staining dark violet in KOH solution, discolouring to olive green equally quickly.

Context of the pileus monomitic. Generative hyphae 3–6 μ wide, not inflating, thin-walled to moderately thick-walled, branched, septate, without clamp-connections. Context of the spines similar, hyphae somewhat narrower. Basidia 27–36 \times 5.5–6.5 μ , clavate, without basal clamp, 4-spored. Sterigmata 3.6–4.5 μ long. Spores 5.2–6.3 \times 3.6–4.3 μ , of irregular outline, tubercular (tubercles fairly numerous, prominent, very coarse, often in the shape of angular crests, more or less exsculptate), brownish, with oblique apiculus.



Figs. 130–140. *Hydnum concrescens* (Fig. 130: Sweden, Billuden, *Fåhræus*, UPS; Fig. 131: Sweden, Kummelön, *Svensson*, UPS; Fig. 132: Netherlands, Vogelenzang, *Bas 2420*, L; Fig. 133: Netherlands, Denekamp, *Maas G. 15290*, L.; Fig. 134: India, *Maas G. 14576*; Fig. 135: Japan, Lloyd Mycol. Coll. 4917; Fig. 136: Japan, Lloyd Mycol. Coll. 4906; Fig. 137: Japan, Lloyd Mycol. Coll. 22795; Fig. 138: Japan, Lloyd Mycol. Coll. 2728; Fig. 139: Malay Peninsula, *Corner*; Fig. 140: type of *Hydnum spathulatum*). – Spores ($\times 2800$).

COLLECTIONS EXAMINED:

WEST PAKISTAN

Murree, 20 Aug. 1948, *S. Ahmad* (L).

INDIA

Punjab: Kulu Valley, Manali, 20 Aug. 1964, *C. Bas 4188*, in *Castanea sativa* plantation, 2150 m alt. (L).

Uttar Pradesh: Mussoorie, Balansar, 18 Sept. 1964, *R. A. Maas Geesteranus 14576*, in forest of *Quercus incana* and *Rhododendron arborea*, 1800 m alt. (L).

Assam: Khasi Hills, Nunklow, 10 July 1850, *Dr. Hooker*, type of *Hydnum vespertilio* (K).

JAPAN

Honshu: Prov. Mikawa, Okazaki, 26 Oct. 1912, *J. Umemura 102* (Lloyd Mycol. Coll. 4917, BPI); locality not specified, 1 Nov. 1913, *A. Yasuda 208* (Lloyd Mycol. Coll. 4906, BPI); Prov. Rikuzen, Shiogama, 21 Oct. 1917, *A. Yasuda 500* (Lloyd Mycol. Coll. 22795, BPI); Prov. Settsu, Kobe, 1925, *J. E. A. Lewis* (Lloyd Mycol. Coll. 2728, BPI); Osaka, no date, *M. Gono* (Lloyd Mycol. Coll. 4919, BPI).

MALAY PENINSULA

Pahang: Fraser's Hill, 27 and 29 Nov. 1930, *E. J. H. Corner*, 1200 m alt. (L).

BORNEO

Sabah: Mt. Kinabalu, Bembangan River, 20 Aug. 1961, *E. J. H. Corner*, *RSNB 1899*, c. 1700 m alt. (L).

JAVA

West Java, Mt. Malabar [S. of Bandung], Oct. [probably 1839], *F. W. Junghuhn*, on the ground in forest, 1500–1800 m alt. (L); Tjibodas, April 1938, *K. B. Boedijn 3251* (BO 16656); locality and date unknown, *Ch. Bernard*, type of *Hydnum spathulatum* (Lloyd Mycol. Coll. 4927, BPI).

Time and again the species around *Hydnellum velutinum* have created confusion and disharmony. I deeply regret that in trying to solve the problems connected with these species (1957: 61–70) I myself committed two errors which may have made a steady nomenclature seem as remote as ever. It is clear, however, that these mistakes cannot be allowed to remain uncorrected, and the best way to erase them is first to relate how they came about.

One error concerns the word "fasciato" in Persoon's diagnosis of *Hydnum conrescens* which I did not look up in the dictionary and assumed to mean "bundled." This, in my eyes, left the pileus surface undescribed, but the supposed omission was made good in the subsequent description where the pileus is stated to be "striis vero & sulcis rugosus". Since there seemed no particular reason to assume that these elements of the pileus were concentrically arranged, it was taken for granted they were meant as being radiately aligned. This conclusion automatically brought *Hydnum conrescens* in connection with *Hydnum scrobiculatum*. It is true that

Persoon referred to Bulliard's Plate 156 (which clearly represents the species Fries called *Hydnum zonatum*), but that indication was counterbalanced by his simultaneous reference to Batsch's Plate 221 (which I then was prepared to recognize as *H. scrobiculatum*). Obviously, Persoon was very uncertain himself as to the delimitation of his species, as is evidenced by his query "[Batsch] Fig. 224 revera specie diversum?" and by the heterogeneity of his own material (see MAAS GEESTERANUS, 1957:67). As regards this material, here is where I committed the second error, as No. L 910. 262-598 should have been called a neotype, not lectotype. Persoon, on the label with his material, referred to the Synopsis, not to the Observationes. In the light of the following considerations, however, it may be questioned whether there is any sense in maintaining the qualification neotype for the material cited.

To return to the root of the trouble, the word "fasciato", this should be read to mean "girdled", by which Persoon wanted to indicate the *concentric* arrangement of the surface elements of the pileus. This, of course, links *Hydnum concrescens* with *H. zonatum*, a name with which mycologists have been familiar since the time of Fries. The epithet cannot be retained, however, since *Hydnum zonatum* was coined by Fries long after *Hydnum concrescens* had become a valid name.

The material Persoon left under the name *H. concrescens* consists of several specimens glued to three separate sheets of paper. As pointed out earlier, one of these, annotated "Prope Parisios", can be ruled out for consideration of typification. Nevertheless it is of interest in connection with the foregoing discussion, because it contains both *H. scrobiculatum* and *H. concrescens*. The second sheet, containing the so-called lectotype, consists of two specimens. The right hand specimen, showing the upper surface of the pileus, had formerly already been identified as *H. scrobiculatum*, and I still adhere to that view, although the hymenial side is so firmly glued to the paper that the spines and their adhering spores remain well out of reach. The left hand specimen very much against expectation yields spores of the *H. concrescens* kind but, unfortunately, the upper surface of the pileus is mutilated beyond recognition. The third sheet, finally, may or may not contain a specimen of genuine *H. concrescens*, but here again spores are not accessible to prove the point. Under these circumstances I prefer to refrain from selecting a neotype from among the material available. The necessity of indicating a neotype is fully admitted, but the material should come up to certain requirements.

PERSOON (1801: xxx) in a corrective note stated that "Hydni suberosi var. γ cinerea varietas vetusta nostri H. concrescens est, et Hydnum zonatum Batsch p. 111. f. 229. nostram speciem bene exprimit". He was in error with regard to the first half of his statement, but I fully agree with the illustration mentioned in the latter part, with the proviso that *Hydnum zonatum* was depicted in Fig. 224, not 229.

It is curious to note that Lloyd when confusing *Hydnum scrobiculatum*

and *H. zonatum* always mistook the former for the latter. Probably he was not alone, the general idea being that concentric zones are the exclusive character of *H. zonatum*, hence the name. In view of uncertain identifications it seems wise to disregard earlier reports (e.g. BERKELEY, 1854: 167; CLELAND & CHEEL, 1919: 304; IMAZEKI & HONGO, 1968: pl. 49 fig. 278; PATOUILLARD, 1893: 343 and 1928: 18) as long as the spores of these collections have not been checked. The same applies to the name *Hydnellum zonatum* f. *vespertilio* recorded by BALFOUR BROWNE (1968: 122).

The specimens Junghuhn collected on Mt. Malabar, Java, had been sent to Bresadola, in 1909, who thought they represented *Hydnum ferrugineum*, the usual error among European mycologists in those days. The material is so young, however, that the error is excusable.

***Hydnellum papuanum* Maas G., spec. nov. — Fig. 141**

Basidiomata solitaria. Pileus usque ad 60 mm diam., orbicularis (?), lobatus, margine undatus, rigidus, centro subscrobiculatus, pro maiore parte radiatim fibrillosus rugosusque, margine velutinus vel tomentosus sericeusque, fere unicolor, sat obscure purpureo-brunneus, zonis multis inconspicuis concentricis alternis

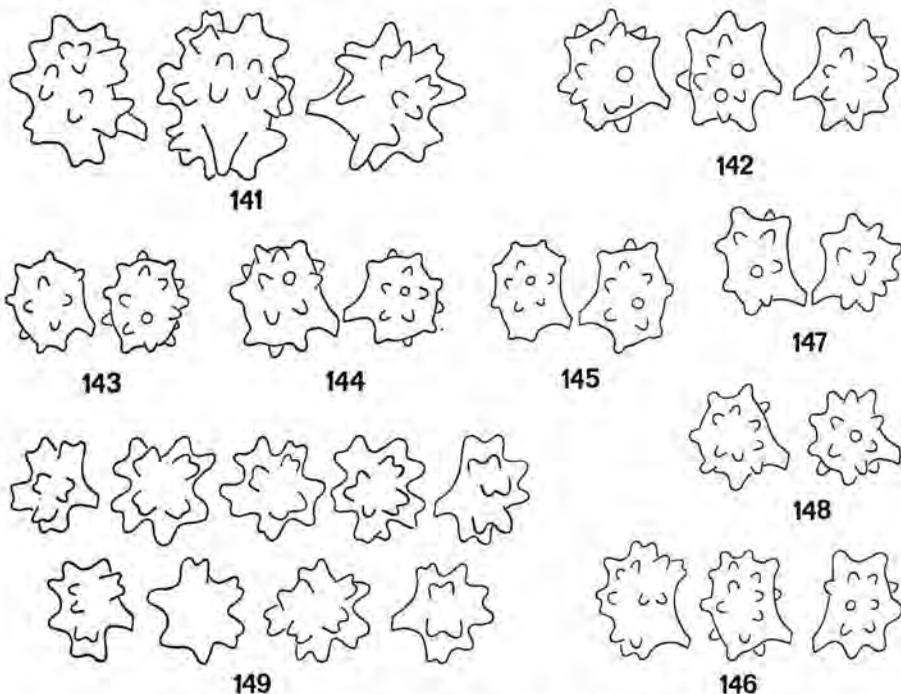


Fig. 141. *Hydnellum papuanum* (holotype). — Spores ($\times 2800$).

Figs. 142-148. *Hydnellum scrobiculatum* (Fig. 142: Czechoslovakia, Bohdanec, Kubička & Pouzar, L; Fig. 143: Australia, Lloyd Mycol. Coll. 22234; Fig. 144: Australia, Lloyd Mycol. Coll. 4869; Fig. 145: Australia, Lloyd Mycol. Coll. 56844; Fig. 146: Australia, Willis & Beaglehole, L; Fig. 147: Australia, Tonimbuk, Willis, L; Fig. 148: Australia, Lloyd Mycol. Coll. 22780). — Spores ($\times 2800$).

Fig. 149. *Hydnellum staurastrum* (holotype). — Spores ($\times 2800$).

clarioribus obscurioribusque ornatus, centro vix obscuriore. Stipes 15–35 × 8–20 mm, compactus, basi bulbosus, e velutino tomentosus, sordide fulvus vel purpureo-brunneus. Aculei usque ad 2.5 mm longi, parum decurrentes, conferti, subulati, purpureo-brunnei. Caro in pilei centro usque ad 2 mm crassa, haud duplex, inconspicue zonata, sat obscure purpureo-brunnea, in stipite subsimilis sed duplex atque manifeste zonata; monomitica, e hyphis generatoriis formata. Hyphae usque ad 5 μ latae, haud inflatae, parietibus tenuibus vel modice incrassatis instructae, ramosae, septatae, fibulis carentes. Basidia 30–36 × 7–8 μ , clavata, efibulata, quadrispora. Sporae 7.2–8.1 × 5.8–6.1 μ , grosse tuberculatae (tubercula numerosa, prominentia, apicibus exsculptis), brunneolae, apiculo obliquo.

HOLOTYPUS: New Guinea, Uinba, 26 Aug. 1963, *W. Vink 16408b* (L).

Basidiomes solitary. Pileus up to about 60 mm across, orbicular(?), lobed, with wavy margin, rigid, somewhat scrobiculate in the centre, radiately fibrillose and ridged farther outwards, velutinous to felted and silky at the margin, densely sprinkled with whitish pustules of excreted matter, almost unicolorous, fairly dark purplish brown, with numerous little conspicuous colour zones, their colour being somewhat lighter and slightly yellowish, the centre hardly darkened. Stipe 15–35 × 8–20 mm, stocky with a bulbous base, velutinous, becoming matted, dingy fulvous to purplish brown. Spines up to 2.5 mm long, little decurrent, crowded, subulate, purplish brown. Context of the pileus up to 2 mm thick in the centre, not duplex, obscurely zoned, fairly dark purplish brown, practically without pockets of excreted matter. Context of the stipe duplex, more clearly zoned in the harder part, otherwise similar. A thin slice of the context immediately staining dark violet in KOH solution, discolouring to olive green equally quickly.

Context of the pileus monomitic. Generative hyphae up to 5.5 μ wide, not inflating, thin-walled to moderately thick-walled, branched, septate, without clamp-connections. Context of the spines similar. Basidia 30–36 × 7–8 μ , clavate, without basal clamp, 4-spored, many secondarily septate. Spores 7.2–8.1 × 5.8–6.1 μ , of irregular outline, tubercular (tubercles numerous, prominent, coarse, exsculptate), brownish, with oblique apiculus.

COLLECTION EXAMINED:

NEW GUINEA

Territory of Papua and New Guinea: Western Highlands, Kubor Range, Uinba, Nona-Minj Divide, 26 Aug. 1963, *W. Vink 16408b*, on the ground in depleted primary *Lithocarpus-Castanopsis* forest, 2000 m alt. (holotype, L).

The collector told me that the material had been found in a wood which is daily scoured by pigs of the near-by village in search of their food. This would explain the mutilated and mud-caked appearance of the specimens.

HYDNELLUM SCROBICULATUM (Fr. ex Secr.) P. Karst.

Figs. 142–148

Hydnum scrobiculatum Fr., *Obs. mycol.* 1: 143. 1815; *ex Secr.*, *Mycogr. suisse* 2: 522. 1833. — *Hydnellum scrobiculatum* (Fr. ex Secr.) P. Karst. *in* *Meddn Soc. Fauna Fl. fenn.* 5: 41. 1879. — *Calodon scrobiculatus* (Fr. ex Secr.) P. Karst. *in* *Bidr. Känn. Finl. Nat. Folk* 37: 108. 1882. — *Calodon zonatus* var. *scrobiculatus*

(Fr. ex Secr.) Quél., Ench. Fung. 190. 1886. — *Phaeodon scrobiculatus* (Fr. ex Secr.) P. Henn. in Nat. PflFam. 1(1**): 148. 1898. — *Hydnellum velutinum* var. *scrobiculatum* (Fr. ex Secr.) Maas G. in Fungus 27: 63. 1957. — TYPE LOCALITY: Sweden, Småland, Femsjö (cf. Lindblad, Syn. Fung. Hydn. Suec. nasc. 10. 1853). — NEOTYPE: Småland, Femsjö parish, "invid S. timmervägen mot Abborsjön, ca 300 m NO. om landsvägen", 20 Sept. 1949, S. Lundell (n. 6173) & J. Stordal (UPS).

Hydnum suberosum var. α *spongiosa* Batsch, Elench. Fung. Cont. 2: 99. 1789. — TYPE: represented by Batsch, Elench. Fung. Cont. 2: pl. 40 fig. 221. 1789.

Hydnum cyathiforme a. Fr., Syst. mycol. 1: 405. 1821; ex St-Amans, Fl. agen. 545. Apr. 1821 ("Bull.", misapplied); not *Hydnellum cyathiforme* (Schaeff. ex St-Amans) P. Karst. in Meddn Soc. Fauna Fl. fenn. 5: 41. 1879 (= *Phellodon tomentosus*). — TYPE: represented by Bulliard, Herb. France pl. 156. 1783 ("*Hydnum cyathiforme* Schaeff.").

Hydnum queletii Fr. apud Quél. in Mém. Soc. Emul. Montbéliard II, 5: 293. 1872; Fr., Hym. europ. 605. 1874. — *Hydnellum queletii* (Fr. apud Quél.) P. Karst. in Meddn Soc. Fauna Fl. fenn. 5: 41. 1879. — *Calodon zonatus* var. *queletii* (Fr. apud Quél.) Quél., Ench. Fung. 191. 1886. — *Hydnum zonatum* var. *queletii* (Fr. apud Quél.) Cost. & Dufour, Nouv. Fl. Champ. 160. 1891. — *Phaeodon queletii* (Fr. apud Quél.) P. Henn. in Nat. PflFam. 1(1**): 149. 1898. — TYPE: *Hydnum queletii* Fr. / Jura / Quélet" (UPS).

Basidiomes more or less gregarious to confluent. Pileus up to about 35 mm across, rigid when dry, depressed or umbilicate to infundibuliform, the ornamentation ranging from merely scrobiculate in the centre and radiately rugulose to ridged farther outwards to consisting entirely of fairly short and rigid upright excrescences or a tumbled mass of deeply lacinate lamellae; concentric zones few and often not very conspicuous except in dried condition when they are usually accentuated by dingy whitish pustules of excreted matter; unmodified surface plushy to tomentose, pinkish brownish, with age and towards the centre becoming dull brown, reddish brown, purplish brown, or blackish brown. Stipe 10–25 × 2–10 mm, simple or connate, flaring upward into the pileus and usually enlarged below to form a more or less bulbous base, velutinous, becoming matted, concolorous with the pileus. Spines up to 3 mm long, decurrent, crowded, subulate, purplish brown. Context of the pileus up to about 2 mm thick, moderately or not duplex (depending on the age), zoned, purplish brown, over the spines sometimes with decidedly slate grey streaks. Context of the stipe similar but lacking slaty colours. A thin slice of the context dropped in KOH solution immediately staining dark violet, equally quickly turning olive green, but the pockets of crystalline matter becoming reddish brown.

Context of the pileus monomitic. Generative hyphae 3–7 μ wide, not inflating, thin-walled or moderately thick-walled, branched, septate, without clamp-connections. Context of the spines similar. Basidia 27–31 × 6–7 μ , clavate, without basal clamp, 4-spored. Sterigmata up to 5.5 μ long. Spores 5.4–6.4 × 4–4.7 μ , subglobose to broadly ellipsoid, of more or less irregular outline, tubercular (tubercles fairly numerous, prominent, rounded or flat-topped or somewhat exsculptate), brownish, with oblique apiculus.

COLLECTIONS EXAMINED:

JAPAN

Hokkaido: Prov. Ishikari, Yamabe, 19 Sept. 1966, E. J. H. Corner, under *Picea* (L).

Honshu: Prov. Mikawa, Okazaki, Tosaki, Sept. 1912, *J. Umemura 81* (Lloyd Mycol. Coll. 4912, BPI).

AUSTRALIA

New South Wales: Sydney, no date, *J. B. Cleland 352* (Lloyd Mycol. Coll. 22234, BPI).

South Australia: Adelaide, no date, *J. B. Cleland 812* (Lloyd Mycol. Coll. 4869, BPI).

Victoria: Dandenong Ranges, Boronia, 28 July 1934, *Miss S. M. Fawcett*, in eucalypt forest (L, MEL); Dandenong Ranges, Inverness Road, Kalorama, 26 May 1946, *J. H. Willis*, amongst leafy litter under stringybark forest (L, MEL); East Caulfield, no date, *J. T. Paul 072* (Lloyd Mycol. Coll. 56844); Lower Glenelg River region, 2.5 miles W of Johnstone Swamp, 14 June 1964, *J. H. Willis & A. C. Beauglehole*, in loose sandy soil under *Eucalyptus baxteri* (L, MEL); Melbourne, 1875, *S. Berggren 366* (UPS); Mount Clay near Portland, 7 June 1953, *A. C. Beauglehole 3085*, numerous in heathy country (L, MEL); Tonimbuk, c. 4 miles E of Gembrook, 11 June 1934, *J. H. Willis*, amongst leafy mould in mountain eucalypt forest (L, MEL); Upper Yarra River, no date, *C. Walter (K)*; locality not specified, no date, *J. Wilson 069* (Lloyd Mycol. Coll. 4901, BPI).

State unspecified: no locality, no date, *J. T. Paul 068* (Lloyd Mycol. Coll. 22781, BPI); *J. T. Paul 070* (Lloyd Mycol. Coll. 22780, BPI); no locality, no date, *J. Wilson 034* (Lloyd Mycol. Coll. 26800, BPI).

NEW ZEALAND

South Island: Nelson Distr., Nelson, 6 July 1949, *A. Crawford 723* (K); Whanganui Inlet, 16 May 1968, *E. Horak 68/465*, on the ground under *Nothofagus fusca*, *N. truncata*, *Metrosideros umbellata*, *Dacrydium cupressinum*, etc. (L).

LLOYD recorded the present species from Australia under *Hydnum scrobiculatum* (1920: 969, leg. Paul; 1920: 979, leg. Wilson) and *H. zonatum* (1918, Lett. 67: 4; 1924: 1294). In each case, however, there are two separate collections which, since they are not dated, cannot be correlated with certainty with Lloyd's references. *Hydnum zonatum* reported by LLOYD from Australia (1922: 1126, leg. Paul) and Japan (1913, Lett. 45: 4) both represent *Hydnellum scrobiculatum*.

To distinguish *H. scrobiculatum* from *H. concrescens* it has long been customary to use such features as the thickness of the flesh, the rigidity of the pileus, or the roughness and zonation of the surface. These characters have to be used with considerable caution, however, as they are subject to variation, thus rendering a correct interpretation often exceedingly difficult. It is not surprising that mistakes were made, and there is little reason for me to trust that I escaped making them myself. These will have to be amended in due time, but for the present it should suffice to realize that the long neglected spores provide the best character for the distinction of the two species under discussion. By using the ornamentation of the spores as differential character it was found that the two exsiccati Lundell & Nannfeldt, Fungi exs. suec. praes. upsal. 2208 and 2209, both

issued under *Hydnum scrobiculatum*, actually represent *Hydnellum conrescens*.

***Hydnellum staurastrum* Maas G., spec. nov.** — Fig. 149, Pl. IV, fig 1

Basidiomata gregaria, saepe conrescentia. Pileus 30–100 mm diam. (in vivo), planiusculus, centro umbilicatus, tenuis, flexibilis, primo leviter tomentosus, postea radiatim fibrillosus, siccus vix nitens, rubro-brunneus vel sordide purpureo-brunneus, zonis concentricis alternis clarioribus obscurioribusque ornatus, centro obscurior, margine pallide vinoso-ochraceus (in vivo). Stipes 30–70 × 3–10 mm, cylindraceus vel infra suprave incrassatus, e velutino tomentosus, vinoso-brunneus (in vivo). Aculei usque ad 1.5 mm longi (in sicco), parum decurrentes, creberrimi, subulati, purpureo-brunnei. Caro in pilei centro usque ad 1.5 mm crassa, haud duplex, zonata, purpureo-brunnea, in stipite hinc inde duplex, parte media mollis, obscure purpureo-brunnea; monomitica, e hyphis generatoriis formata. Hyphae 3.5–6 μ latae, haud inflatae, parietibus tenuibus vel modice incrassatis instructae, ramosae, septatae, fibulis carentes. Basidia 20–27 × 6–7 μ , clavata, efibulata, quadrispora. Sporae 4.5–5.4 × 3.5–4.5 μ , grosse tuberculatae (tubercula sat numerosa, prominentia, apicibus exsculptis), brunneolae, apiculo obliquo.

HOLOTYPE: Singapore, Selitar Reservoir, 29 Dec. 1940, *E. J. H. Corner* (L).

Basidiomes gregarious, often conrescent. Pileus 30–100 mm across (fresh), more or less plane with umbilicate centre, thin, pliant, thinly tomentose, after collapse of the tomentum becoming radiately fibrillose, scarcely shiny when dry, with scattered whitish pustules of excreted matter, vinaceous brown (fresh), reddish brown to dingy purplish brown (dry), with numerous concentric colour zones, broader and lighter zones alternating with narrower and darker to fuscous zones, darker in the centre, the margin pale vinous ochraceous (fresh). Stipe 30–70 × 3–10 mm, cylindrical or gradually enlarged above or below, thinly velutinous, more thickly velutinous in the enlarged parts, becoming matted, dull, vinaceous brown (fresh), fulvous with a yellowish tint (dry). Spines up to 1.5 mm long (dry), little decurrent, notably crowded, subulate, purplish brown. Context of the pileus up to about 1.5 mm thick in the centre (dry), not duplex, zoned, lighter or darker purplish brown, without slate grey streaks. Context of the stipe duplex in places, the core fairly soft, dark purplish brown, the tomentum concolorous with the surface. A thin slice of the context immediately staining dark violet in KOH solution, discolouring to olive green equally quickly.

Context of the pileus monomitic. Generative hyphae 3.5–6 μ wide, not inflating, thin-walled to moderately thick-walled, branched, septate, without clamp-connections. Context of the spines similar, hyphae slightly narrower. Basidia 20–27 × 6–7 μ (Corner), clavate, without basal clamp, 4-spored. Spores 4.5–5.4 × 3.5–4.5 μ , of irregular outline, tubercular (tubercles fairly numerous, prominent, coarse, exsculptate), brownish, with oblique apiculus.

COLLECTION EXAMINED:

MALAY PENINSULA

Singapore: Selitar Reservoir, 29 Dec. 1940, *E. J. H. Corner*, under *Lithocarpus* sp. (holotype, L).

The specific epithet has been chosen in view of the remarkable likeness of the spores to species of the desmidiaceous genus *Staurastrum* Meyen.

HYDNELLUM species 1

The material consists of two fragments, possibly of a single specimen. Pileus probably about 30 mm across, depressed, uneven, faintly concentrically zoned by a few shallow depressions, showing a matted surface, slightly shiny, with some scattered whitish dots of excreted matter, reddish brown. Stipe up to 25 mm long, 14 mm broad, cylindrical, the surface matted, dull to somewhat shiny, concolorous with the pileus. Spines up to 0.5 mm long, hardly decurrent, moderately crowded, subulate, reddish brown. Context of the pileus 1–2 mm thick, thicker in the centre where it is clearly duplex, inconspicuously zoned, purplish brown. Context of the stipe duplex, the tomentum very thick, concolorous with the surface of the stipe. A thin slice of the context immediately staining dark violet in KOH solution, equally quickly turning olive green.

Context of the pileus monomitic. Generative hyphae 3.5–6 μ wide, not inflating, thin-walled to moderately thick-walled, branched, septate, without clamp-connections. Context of the spines similar, hyphae narrower. Basidia about 5–6 μ wide, clavate, without basal clamp. Spores (immature) 5.4–5.6 \times 3.8–4.5 μ , of irregular outline, tubercular (tubercles fairly numerous, prominent, exsculptate), brownish, with oblique apiculus.

COLLECTION EXAMINED:

MALAY PENINSULA

Pahang: Fraser Hill, upon the Selangor border, 16–30 Sept. 1922, *I. H. Burkill & R. E. Holttum*, Singapore Field No. 8914, about 1200–1300 m alt., "on dead wood" (Lloyd Mycol. Coll. 30178, BPI).

On the original label it is stated that the material was collected "on dead wood". No wood fibers are to be seen, however, the mycelium enveloping particles of loam, grains of quartz sand, and some torn rootlets.

Unfortunately the material was collected immature and in its present state it is very incomplete. It is not advisable to draw any conclusions even if it seems different from the other members of section *Velutina*. It certainly comes nearest *H. ferrugineum* which, however, differs in having a much thicker context of the pileus, and in lacking concentric zones and dots of excreted matter on its surface.

SARCODON P. Karst.

Sarcodon P. Karst. in *Revue mycol.* 3 / No. 9: 20. 1881 & in *Meddn Soc. Fauna Fl. fenn.* 6: 16. 1881. — TYPE SPECIES: *Hydnum imbricatum* L. ex Fr. (see DONK, 1956a: 111).

Basidiome pileate and stipitate. Pileus at first velutinous to felted, then glabrescent and the cuticle becoming areolately cracked, or tomentum breaking up into scales, or pileus scaly from the first, variously coloured, predominantly yellow and brown in various shades. Stipe thinly tomentose, concolorous with the pileus or paler, the base in some species greenish or bluish. Hymenium covering spines on the underside of the pileus.

Spines whitish or pallid when young, chocolate brown when mature. Context fleshy, soft to firm, without zonation produced by structural differences in the hyphae, not duplex, monomitic, made up of generative hyphae. Generative hyphae inflating, thin-walled, branched, septate, with or without clamp-connections. Basidia clavate, 4-spored, with or without basal clamp. Spores roughly subglobose to ellipsoid, but mostly of a most irregular outline, tubercular, brown in the mass, with oblique apiculus. Cystidia none. Odour not of fenugreek when dried.

Terrestrial, or on decayed wood.

The following sections of *Sarcodon* are represented in the area under investigation: sect. *Sarcodon* (p. 109), sect. *Scabrosi* (p. 114), sect. *Violacei* (p. 116), sect. *Virescentes* (p. 119), while the position of an unnamed species, species 2, remains uncertain. No key is given to the sections.

KEY TO THE SPECIES

1. Hyphae with clamp-connections.
 2. Context of fresh specimen without purplish tints. Pileus never dark grey, dark purple or black.
 3. Context not drying olive green. Spines decurrent.
 4. Pileus surface forming an areolately cracked pellicle or becoming innately squamulose.
 5. Spores $6.3-7.2 \times 4.5-5.4 \mu$. Pileus purplish grey when fresh: *S. species 1*
 5. Spores $(6-7)7.2-8 \times 5.4-6 \mu$. Pileus fuscous, lacking purplish shades: *S. humilis*
 4. Pileus surface coarsely scaly: *S. imbricatus*
 3. Context drying olive green. Spines not decurrent: *S. atroviridis*
 2. Context of fresh specimen with purplish tints to deep purple, or pileus dark grey, dark purple or black.
 6. Spines of a rich orange-ochre when not fully mature. Context pale buff or pale olive before turning vinaceous purple on exposure. Stipe solid: *S. conchyliatus*
 6. Spines whitish to pink or purple when not fully mature. Context grey before turning greyish purple to purple on exposure. Stipe hollow or becoming hollow; *S. thwaitesii*
1. Hyphae without clamp-connections.
 7. Context not blackened on exposure, not staining ink blue when soaked in KOH solution.
 8. Context of fresh specimen pallid, retaining this colour or vinescent on exposure.
 9. Tomentum broken up into equally large, appressed squamules. Found under fagaceous trees: *S. species 2*
 9. Tomentum broken up into scales which are very coarse and upright in the centre of the pileus, smaller and decumbent towards the margin. In coniferous forest: *S. scabrosus*
 8. Context of fresh specimen pinkish lilac to violet from the first.
 10. Pileus with age of a peculiar blackish leaden colour. Spores $5.4-6.3 \mu$ long. In coniferous forest: *S. fuligineo-violaceus*
 10. Pileus remaining pinkish brown or red-brown. Spores $6.3-7.2 \mu$ long. In fagaceous forest: *S. joeides*
 7. Context blackening on exposure, staining ink blue in KOH solution: *S. wrightii*

SARCODON sect. SARCODON

TYPE SPECIES: *Sarcodon imbricatus* (L. ex Fr.) P. Karst. (see MAAS GEESTERANUS, 1967: 10).

Sarcodon group 3 Maas G. in *Fungus* 26: 46. 1956.

Tomentum of the pileus developing into coarse scales with the tips upturned or turning into a pellicle, which becomes areolately cracked and may form appressed scales. Context of the pileus white or pallid, on exposure sometimes becoming flushed with reddish or vinaceous tints. Context in the base of the stipe concolorous or somewhat darker. Odour when cut not farinaceous, not of water-melon. Hyphae with clamp-connections.

Within the boundaries of the area investigated the following species belong to this section: *Sarcodon imbricatus*, *S. humilis*, and *S. species 1*.

Another member of this section is the species that in Europe for long has been known as *Sarcodon laevigatus*. In a recent paper (MAAS GEESTERANUS & NANNFELDT, 1969: 415) it was shown that the correct name of this species is *Sarcodon leucopus*, while the possibility was left open for the existence of a very closely related species that would have to be called *S. colosseus* (Bres.) Bat. With regard to this *Hydnum laevigatum*/*Sarcodon laevigatus*, it is known that the literature contains some records of its occurrence in the Australian-Asiatic area. There is, however, no definite proof that the identifications, taken in the sense formerly attached to that name, are correct.

In Berkeley's herbarium (K) there are two packets labelled "*Hydnum laevigatum*, Swartz / Tasmania". They contain one specimen each, both very probably representing the same species. Both are in poor condition owing to bad drying methods, and lack notes on the colours of the fresh material, hence their only value is that they prove *Sarcodon* to be a genus represented in Tasmania. I have little doubt that these specimens constitute the material on which COOKE (1892: 170) based his record.

Cooke's Handbook also listed Queensland as a locality for *Hydnum laevigatum*. This record probably refers to a collection in K consisting of three badly dried specimens labelled "757 / *Hydnum laevigatum* Fr. / Brisbane / J. M. Bailey". The colour of the specimens is still visible in a few unaffected places, the hyphae possess clamps, and the spores although scarce and collapsed are clearly subglobose, thin-walled, and smooth. These features identify the specimens as belonging to *Hydnum repandum*.

Ito (1955:182) stated that *Sarcodon laevigatus* is indigenous to Japan, but omitted to indicate the source of his information. The occurrence there is quite probable, but certainty can be had only from the examination of properly annotated material.

The Rijksherbarium possesses several more gatherings of *Sarcodon* species (from New Guinea, Australia, Tasmania, and New Zealand) which must remain unnamed because of insufficient, or complete lack of, notes on the colours.

***Sarcodon humilis* Maas G., spec. nov.¹⁰**—Figs. 150–152, Pl. VI, fig. 1

Basidiomata solitaria. Pileus 40–60 mm latus, depressus, laevis, inornatus, siccus, subtomentosus, centro plus minusve innato-squamulosus, opacus, fusco-hinnuleus vel pallide sepiaceus. Stipes 60–70 × 8–10 mm, solidus, subteres, basi attenuatus, laevis, superne aculeis brevibus punctatus, subtomentosus, pileo concolor sed pallidior. Aculei 2–3.5 mm longi, longe decurrentes, conferti, subulati, pileo concolores sed pallidiores, apicibus albis. Contextus in pilei centro 7–9 mm crassus, carnosus, subcoriaceus, pallide sepiaceus, basi haud obscurior, monomiticus, e hyphis generatoriis formatus. Odor saporque ignoti. Hyphae 4.5–15 μ latae, inflatae, tenuiter tunicatae, ramosae, septatae, fibulatae. Basidia 28–36 × 7–8 μ , clavata, quadrispora, sterigmata 5.4–6.3 μ longa gerentia, ad basin fibulata. Spores (6–)7.2–8 × 5.4–6 μ , grosse tuberculatae, fuscidulae, apiculo obliquo. Cystidia nulla.

HOLOTYPE: Singapore, 25 Aug. 1940, *E. J. H. Corner* (L).

Basidiomes solitary. Pileus 40–60 mm across, depressed, smooth, without concentric zones or radiate structures, dry, subtomentose, more or less innately squamulose in the centre, opaque, fuscous-fawn or pale sepia. Stipe 60–70 × 8–10 mm, solid, almost terete, narrowed at the base, smooth but at least in the upper third verrucose from rudimentary spines, subtomentose, concolorous with the pileus but paler. Spines 2–3.5 mm long, decurrent to more than half way down on one side of the stipe, crowded, subulate, concolorous with the pileus but paler and with white tips. Context 7–9 mm thick in the centre of the pileus, fleshy, slightly coriaceous, pale sepia throughout, not darker in the base of the stipe. Smell and taste unknown.

Context of the pileus monomitic. Generative hyphae 4.5–15 μ wide, inflating, thin-walled, branched, septate, with clamp-connections at all septa. Hyphae of the context of the spines similar, less wide. Basidia 28–36 × 7–8 μ , clavate, with basal clamp-connection, with 4 sterigmata 5.4–6.3 μ long. Spores (6–)7.2–8 × 5.4–6 μ (warts included), coarsely tubercular, brownish, with oblique apiculus. Cystidia none.

COLLECTION EXAMINED:

MALAY PENINSULA

Singapore: Singapore, Reservoir Jungle, 25 Aug. 1940, *E. J. H. Corner*, on the ground in the forest (holotype, in liquid, L).

On account of its features, *Sarcodon humilis* falls in section *Sarcodon*, but is unlike any European species of that group. As far as I have studied the North American members of *Sarcodon* it is not related to any species of that continent either.

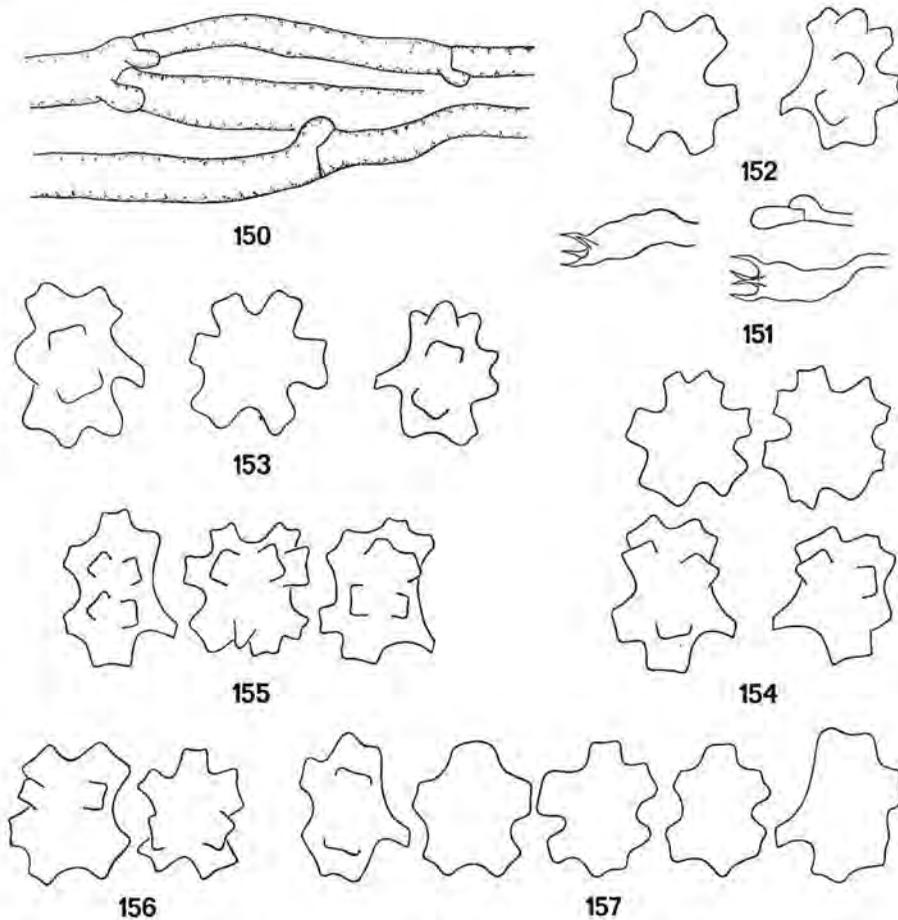
The following collection is doubtfully referred to the present species (Fig. 153).

Pileus 30–40 mm across, somewhat reniform, plane, somewhat radially rugulose or smooth, glabrous, dingy fuscous, darker and fuscous umber with age. Stipe 30 × 7–8 mm, tapering downwards, 4 mm wide below, excentric to nearly or quite lateral, smooth, thinly felted, glabrescent,

¹⁰ Etymology: humilis, humble, in allusion to the insignificant colouring of the fungus.

concolorous with the pileus, blackening with age, dingy olive when dried. Spines 2–3 mm long, not decurrent, crowded, subulate, concolorous with the pileus, with a cinnamon or vinaceous tinge. Context 6–7 mm thick in the centre of the pileus, cottony-tough, concolorous with the pileus, drying pallid, staining blue-green in a KOH solution. Smell slight, inarticulate.

Context of the pileus monomitic. Generative hyphae 5–15 μ wide, inflating, thin-walled, branched, septate, with clamp-connections. Hyphae in the spines similar, narrower. Basidia (28–)34–40 \times (7.5–)8–9 μ , clavate, with clamp-connection at the base, with 4 sterigmata up to 5.4 μ long. Spores 7.2–8.1 \times 5.4–5.8 μ , of irregular outline, flattened adaxially, tubercular (tubercles fairly numerous, prominent, coarse, with exsculptate apex), brownish, with oblique apiculus.



Figs. 150–152. *Sarcodon humilis* (holotype). – 150. Hyphae of the pileus. – 151. Basidia. – 152. Spores. (Figs. 150, 151, \times 700; Fig. 152, \times 2800.)

Fig. 153. *Sarcodon* cf. *humilis* (Malay Peninsula, *Corner*). – Spores (\times 2800).

Figs. 154–156. *Sarcodon imbricatus* (Fig. 154: China, Lloyd Mycol. Coll. 22784; Fig. 155: Japan, Lloyd Mycol. Coll. 4910; Fig. 156: Japan, Lloyd Mycol. Coll. 4904). – Spores (\times 2800).

Fig. 157. *Sarcodon* species 1 (*Cone* 974). – Spores (\times 2800).

COLLECTION EXAMINED:

MALAY PENINSULA

Johore: Gunong Panti, 7 Sept. 1930, on the ground in the forest, c. 500 m alt., *E. J. H. Corner* (L).

The above description is almost entirely Prof. Corner's. Unfortunately, no water-colour sketch was made, while there is no common basis for comparison of the dried fragments of this collection with the type of *S. humilis* in liquid.

SARCODON IMBRICATUS (L. ex Fr.) P. Karst. — Figs. 154–156

Hydnum imbricatum L., Sp. Pl. 2: 1178. 1753; ex Fr., Syst. mycol. 1: 398. 1821. — *Sarcodon imbricatus* (L. ex Fr.) P. Karst. in Revue mycol. 3 / No. 9: 20. 1881 & in Meddn Soc. Fauna Fl. fenn. 6: 16. 1881. — *Phaeodon imbricatus* (L. ex Fr.) J. Schroet. in KryptogFl. Schles. 3(1): 460. 1888. — TYPE LOCALITY: Sweden.

Hydnum aspratium Berk. apud Cooke in Grevillea 10: 121. 1882. — *Phaeodon aspratium* (Berk. apud Cooke) P. Henn. in Nat. PflFam. 1(1**): 149. 1898. — *Sarcodon aspratium* (Berk. apud Cooke) S. Ito, Mycol. Fl. Japan 2(4): 183. 1955; Nikol. in Z. Pilzk. 24: 72. 1958 (without reference to basionym). — TYPE: "Japan / *Hydnum aspratium* B." (K).

Basidiome simple. Pileus up to about 150 mm across, more or less regularly orbicular or lobed, plano-convex with depressed or umbilicate centre, eventually becoming infundibuliform and occasionally with a central hole which may extend to the base of the stipe; scaly from the beginning but losing its scales with advancing age; scales in concentric rings, coarse and thick and upright in the centre, imbricate and flat and decumbent farther outwards, passing into appressed fibrils near the margin, more or less dark brown on a yellow-brown ground. Stipe 50–120 × 7–20 mm, central to somewhat excentric, stocky to slender, equal or somewhat enlarged below, usually with attenuate base, fibrillose, glabrescent, solid at first but becoming hollow under certain conditions, whitish, becoming progressively brown with age, base covered with white mycelium. Spines up to about 9 mm long, decurrent, crowded, subulate, finally dark chocolate brown. Flesh brownish pallid in the pileus, somewhat darker in the stipe, neither blackish nor greenish in the base.

Context monomitic, consisting of generative hyphae. Hyphae up to 21.5 μ wide, inflating, thin-walled, branched, septate, with large clamp-connections. Context of the spines similar, but hyphae narrower, up to 9 μ . Basidia 30–40 × 7–8 μ , clavate, with basal clamp, 4-spored, with sterigmata 3.6–5.4 μ long. Spores (7.2–)7.6–8.8 × 4.6–5.2 μ , of irregular outline, tubercular (tubercles numerous, strongly prominent, coarse, flat-topped to exsculptate), brownish, with oblique apiculus. Cystidia absent.

COLLECTIONS EXAMINED AND REPORTED:

WEST PAKISTAN

Kalam and Swat (AHMAD, 1956: 67).

CHINA

No locality, no date, *H. H. Hu* (Lloyd Mycol. Coll. 22784, BPI); also reported but without specification of localities (TENG, 1964: 436).

JAPAN

Honshu: Prov. Rikuzen, Sendai, 14 Sept. 1906, *A. Yasuda 98* (Lloyd Mycol. Coll. 4910, BPI); 16 Oct. 1920, *A. Yasuda*, without number (Lloyd Mycol. Coll. 4904, BPI).

Listed by HENNINGS (1905: 160), KAWAMURA (1954: 603), and S. ITO (1955: 181).

The above description is based mainly on the few dried collections available.

LLOYD recorded the Japanese collections under two names, *Yasuda 98* as *Hydnum imbricatum* (1912, Lett. 42: 15), and Yasuda's unnumbered collection as *Hydnum aspratium* (1921: 1095), although he did not fail to observe that he saw little merit in their specific distinction.

The interesting point about Yasuda's collections is that the former—consisting of two young basidiomes—was said to have no odour, whereas the latter—a very old and weathered specimen, having lost most of its scales and spores—was stated to be fragrant.

This reintroduces the problem of the identity of *Hydnum aspratium*. As pointed out earlier (MAAS GEESTERANUS, 1960: 344), I regarded the type of that species as conspecific with *S. imbricatus* and, until I am shown to be wrong, I see no reason to change my mind. But I am now prepared to believe that there exists a second species which the Japanese continue to call *Sarcodon aspratius*, although it would seem to represent a different but closely allied species. This would differ from *S. imbricatus* in the narrower scales on the pileus and the all pervading smell. The latter character, however, does not seem to be entirely reliable, judging from Yasuda's error of mistaking a weathered *S. imbricatus*, with most of its characteristic features gone, for *S. aspratius*.

The consequence of the above is that the various Japanese records for "*Sarcodon aspratius*" have been left out of consideration, as they may refer to a species different from *S. imbricatus*.

In Lloyd's collection there are also, from China, a specimen and a fragment of the pileus of a second one, which were recorded (LLOYD, 1924: 1320) under *Hydnum subsquamosum*. Both specimens represent *S. imbricatus*.

VASUDEVA (1962: 48) reported the present species from Mawphlong, Assam, adding that it had been found growing on coniferous wood. This sounds like some error, but since I fail to make out from what source the author had his information, I prefer to ignore the record.

The specimen in Lloyd 4904 used for investigation appeared to have an excess of undersized spores, frequently measuring only 6.5 μ in length or even less. It should be observed, however, that the spores in this weathered specimen remain only near the tips of the spines. It is possible that these spores are generally somewhat smaller than those of the earlier generations produced in the middle and nearer the base of the spines.

SARCODON species 1 — Fig. 157

Basidiomes growing in clumps. Pileus up to about 50–150 mm across, plano-convex, smooth, fibrillose, the tomentum collapsing to form a somewhat cracking, peeling pellicle, purplish grey (water-colour), “light red-mauve brown” (collector’s note). Stipe up to 40 × 10–18 mm, excentric to lateral, cylindrical or broadened below, curved, irregularly covered with darker fibrils, paler than the pileus. Spines up to 5 mm long (dry), decurrent, crowded, subulate, concolorous with the pileus, finally chocolate brown. Context of pileus and stipe firm, “somewhat punky” (collector’s note), pale cream, darkening slightly when cut. Odour “sweet peppery” (collector’s note).

Hyphae with clamp-connections, but not to all septa. Spores 6.3–7.2 × 4.5–5.4 μ , of irregular outline, tubercular (tubercles not numerous, more or less prominent, flattened to slightly exsculptate), brownish.

COLLECTION EXAMINED:

NEW ZEALAND

South Island: Nelson, Totaranui, rimu ridge, 12 April 1955, *Mrs. G. S. Cone 974*, under *Nothofagus truncata* (accompanied by a water-colour, K).

It is probable that this constitutes a new species. Judging by the aspect of the blackened specimens, however, I have the impression that the material has been treated with some preservative, possibly sublimate. In any case this has ruined the specimens and made them unsuitable to serve as possible type material. This is why I refrain from formally describing the species.

The description given above is drawn up from the collector’s notes and her water-colour, while only the microscopic details are my own.

Sarcodon species 1 is very closely related to what used to be called *S. laevigatus*, but probably had better be regarded as representing two species, *S. leucopus* and *S. colosseus* (see MAAS GEESTERANUS & NANNFELDT, 1969: 417–418). The present species differs from both in that (i) the spores have fewer, less prominent, and more flattened tubercles, (ii) the pileus is stated to be fibrillose at first, (iii) the odour is said to be “sweet peppery”. A feature that should also be mentioned, although its implication is not yet understood, is the irregularity of the occurrence of clamps to the hyphae. Finally, there may be diagnostic value in the apparent association of the present species with *Nothofagus*, a genus of Fagaceae, whereas *S. leucopus* and *S. colosseus* grow under conifers.

SARCODON sect. *Scabrosi* Maas G., *sect. nov.*

Sarcodon group 4 Maas G. *in* Fungus 26: 46. 1956.

Sarcodon sect. *Amarescentes* Maas G. *in* Persoonia 5: 11. 1967.

Pileus squamosus. Contextus pilei pallidus, fractus interdum rubescens vel vinaceo-suffusus. Contextus stipitis fuscidulus, ad basin atrovenetus vel atro-ardesiacus. Odor farinaceus vel eximie *Citrullum vulgarem* in mentem revocans. Hyphae efibulatae. — TYPUS SECTIONIS: *S. scabrosus* (Fr.) P. Karst.

Pileus scaly. Context of the pileus pallid, sometimes becoming flushed with reddish or vinaceous tints on exposure. Context of the stipe brownish, blackish green or dark slate blue in the base. Odour when cut mealy or strongly of water-melon (*Citrullus vulgaris*). Hyphae without clamp-connections. — TYPE SPECIES: *S. scabrosus* (Fr.) P. Karst.

The sectional name *Amarescentes* turns out to have been ill founded. Although *Sarcodon amarescens* (Quél.) Quél. was described as having a green base to the stipe, it cannot be proven that the material from which the original description had been drawn possessed a green base (MAAS GEESTERANUS & NANNFELDT, 1969: 409). Consequently *S. amarescens*, being a nomen ambiguum, had to be withdrawn, and with it the name of the section.

The only member of section *Scabrosi* in the area is *Sarcodon scabrosus*.

SARCODON SCABROSUS (Fr.) P. Karst. — Fig. 158, Pl. VII

Hydnum scabrosum Fr., Anteckn. Sverige väx. ätl. Svamp. 62. 1836. — *Sarcodon scabrosus* (Fr.) P. Karst. in Revue mycol. 3 / No. 9: 20. 1881 & in Meddn Soc. Fauna Fl. fenn. 6: 16. 1881. — *Phaedon scabrosus* (Fr.) P. Henn. in Nat. Pflfam. 1(1**): 149. 1898. — TYPE LOCALITY: Sweden, Småland, Femsjö, "in pinetis montanis raro" (LINDBLAD, 1853: 5). — NEOTYPE: Småland, Femsjö, 6 Sept. 1945, *S. Lundell* (UPS; see MAAS G. & NANNFELDT, 1969: 426).

Basidiomes simple or, more commonly, conrescent. Pileus up to 120 mm across (fresh), plano-convex, more or less deeply depressed in the centre, coarsely scaly, the scales erect in the centre, decumbent farther outwards,

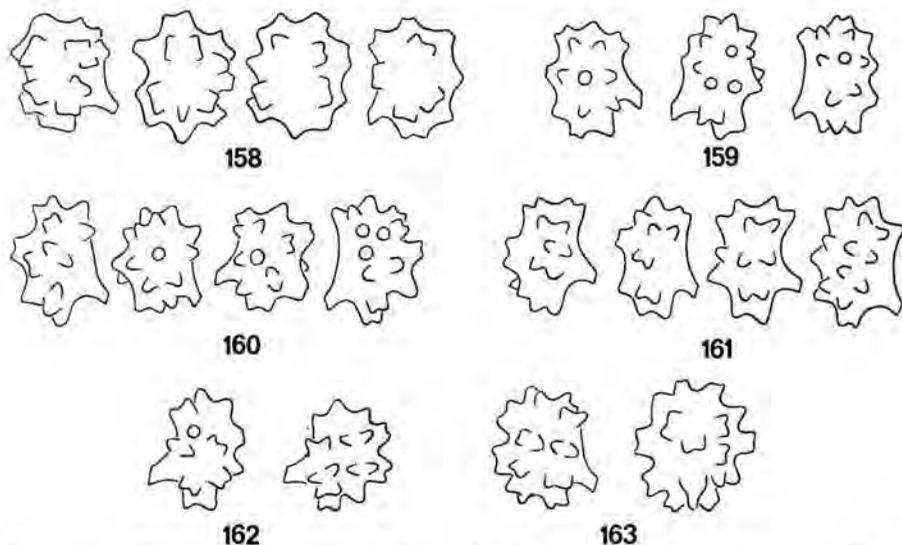


Fig. 158. *Sarcodon scabrosus* (India, *Maas G. 14289*). — Spores ($\times 2800$).
Figs. 159–161. *Sarcodon fuligineo-violaceus* (Fig. 159: Greece, *Pantidou, L*; Fig. 160: India, *Maas G. 14364*; Fig. 161: New Guinea, *Vink 16408a*). — Spores ($\times 2800$).
Figs. 162, 163. *Sarcodon joeides* (Fig. 162: Netherlands, *Masselink*; Fig. 163: New Zealand, *Cone 972*). — Spores ($\times 2800$).

adnate and woolly near the margin, brown in various shades (brick-colour, fulvous, ferruginous, bay) on a fairly pale yellow-brown ground, in some specimens passing into a delicate lilac at the margin, with age becoming very dark purplish brown, and the scale-tips even blackish, somewhat shiny when dried. Stipe 20–120 × 10–60 mm (fresh), tapering downwards, usually with pointed base, felted to subfibrillose, pinkish brown to brick-colour, becoming concolorous with the pileus, the lower part or the base grey-green, when young covered with white mycelium. Spines up to 5 mm long (dry), slender (up to 0.3 mm), decurrent, crowded, subulate, long remaining yellowish brown, finally purplish brown. Context dingy whitish in the pileus and the top of the stipe, vinescent, brownish-marbled with age, grey-green in the base of the stipe. Greenish mycelium from the base of the stipe staining dingy pinkish brown to reddish brown in KOH solution. Odour of water-melon (*Citrullus vulgaris*) when cut fresh.

Context of the pileus monomitic. Generative hyphae 4.5–25 μ wide, inflating, thin-walled, branched, septate, without clamp-connections. Context of the spines similar, hyphae narrower. Basidia 35–42 × 7–9 μ , clavate, without basal clamp, 4-spored. Sterigmata 4.5–5.5 μ long. Spores 5.8–6.5 × 4–5 μ , of irregular outline, tubercular (tubercles fairly numerous, prominent, starting as pairs of isolated warts which grow out to exsculptate crests), brownish.

COLLECTIONS EXAMINED:

INDIA

Punjab: Kulu Valley, Manali, 19 Aug. 1964, *R. A. Maas Geesteranus* 14289, on loamy soil in *Cedrus deodara* forest, 1850 m alt. (L); 25 Aug. 1964, *R. A. Maas Geesteranus* 14431, among moss in forest of *Picea smithiana* and *Cedrus deodara*, 1850 m alt. (L).

LLOYD recorded the present species with a question mark from Japan (1914, Lett. 51: 4), but the material in his herbarium (Lloyd Mycol. Coll. 4911, BPI) seems to consist of two species. Because of the lack of notes on their colours I fail to identify either.

The specimen depicted may not be readily recognizable as *Sarcodon scabrosus* to mycologists in Europe. I never suspected the identity myself until back home. Failure on my part to recognize the species was due to the unusual colours, particularly the lilac colour of the margin of the pileus. But how much do we know of the colour range of the species in Europe? CORNER (1968: 24) very aptly said that "a great deal of botany is based on herbarium sheets . . ." and it is on very rare occasions indeed that a simple water-colour gives a glimpse of the natural colours of the living fungus. To this can be added that a water-colour recently executed after a juvenile specimen freshly collected in England, Berkshire, shows pileus colours which are almost identical with those in the Indian fungus.

SARCODON sect. VIOLACEI Maas G.

Sarcodon group 1 Maas G. in *Fungus* 26: 46. 1956.

Sarcodon sect. *Violacei* Maas G. in *Persoonia* 5: 11. 1967. — TYPE SPECIES: *Sarcodon joeides* (Pass.) Bat.

Pileus scabrous to scaly. Context of the pileus either pink turning violet or violet from the beginning. Context in the stipe reddish to violet. Odour farinaceous when cut. Hyphae without clamp-connections.

Two species of this section are known to occur in the area under consideration, *S. fuligineo-violaceus* and *S. joeides*.

SARCODON FULIGINEO-VIOLACEUS (Kalchbr. apud Fr.) Pat.

Figs. 159–161

Hydnum fuligineo-violaceum Kalchbr. apud Fr., Hym. europ. 602. 1874; Kalchbr., Icon. sel. Hym. Hung. 4: 58, pl. 32 fig. 2. 1877. — *Sarcodon fuligineo-albus* var. *fuligineo-violaceus* (Kalchbr. apud Fr.) Quél., Ench. Fung. 189. 1886. — *Sarcodon fuligineo-violaceus* (Kalchbr. apud Fr.) Pat., Essai taxon. Hym. 118. 1900. — TYPE: "*Hydnum fuligineo-violaceum* Kalchbr. n. sp. / In pinetis Carpatorum ad Olaszi / Sept. 1870 C. Kalchbrenner" (herb. E. Fries, UPS).

Sarcodon talpa Maas G. in Persoonia 5: 9, figs. 8, 9. 1967. — TYPE: "*Hydnum fuligineo-violaceum* Kalchbr. / In sylva conifera Tertiolasii – Val di Sole – 1881 / Leg. G. Bresadola" (S).

Basidiomes simple to conerescent. Pileus up to 55 mm across, plano-convex to depressed, velutinous to woolly-felted when young, tomentum later for the greater part collapsed to form a smooth shiny pellicle, but partly also with the longer fibrils converged into appressed scales, yellowish brown to date brown, sometimes distinctly violet-grey in the centre and lilac-brown towards the margin, darkening with age and assuming a peculiar dull blackish leaden colour, more or less sprinkled with yellowish dots of excreted matter. Stipe 17–30 × 2–10 mm, equal with pointed base, straight or curved, felted to fibrillose, glabrescent, lilac-brown to purplish brown, turning dark brown, the extreme base greyish or blackened, more or less covered with white mycelium. Spines up to 5 mm long, decurrent, crowded, subulate, finally chocolate brown. Context at first pinkish lilac in the pileus, passing into violet, finally a dark dull leaden blue or leaden grey; dingy purplish in the stipe, becoming mottled with brown in age, blackish in the base. A thin slice of both the pink and violet context staining blue-green in a KOH solution.

Context of the pileus monomitic. Generative hyphae 3–18 μ wide, inflating, thin-walled, branched, septate, without clamp-connections. Context of the spines similar. Basidia 30–36 × 7–8 μ , clavate, without basal clamp, 4-spored. Sterigmata 3.5–5.4 μ long. Spores 5.4–6.3 × 3.6–4.5 (–4.9) μ , of irregular outline, tubercular (tubercles numerous, prominent, originally consisting of fairly small, rounded warts occurring in pairs, then growing out to form exsculptate tubercles), brownish.

COLLECTIONS EXAMINED:

INDIA

Punjab: Kulu Valley, Manali, 23 Aug. 1964, R. A. Maas Geesteranus 14364, among moss in forest of *Picea smithiana* and *Cedrus deodara*, 1850 m alt. (L).

NEW GUINEA

East New Guinea: Western Highlands, Kubor Range, Uinba, Nona-Minj Divide, 26 Aug. 1963, W. Vink 16408a, in depleted primary *Lithocarpus-Castanopsis* forest, 2000 m alt. (L).

The colour change in the context described above is in part a reconstruction, but entirely based on observations made on the several specimens available and, moreover, checked with some recent European collections. It is, indeed, through these European collections that my eyes were opened to the changes that take place in *S. fuligineo-violaceus*. It is regrettable that cognition was acquired only after I had made the error of publishing the superfluous name *S. talpa*.

From the European experience now accumulated, *S. fuligineo-violaceus* appears to be a species of coniferous forests. This is also borne out by the find at Manali in India, so that the occurrence of the species in New Guinea "in depleted primary *Lithocarpus-Castanopsis* forest" (both genera being members of the Fagaceae) seems very much against the rule. However, the collector afterwards commented that the presence of an occasional *Podocarpus* tree may have been overlooked.

SARCODON JOEIDES (Pass.) Bat. — Figs. 162, 163, Pl. VI, fig. 2

Hydnum joeides Pass. in Nuovo G. bot. ital. 4: 157. 1872. — *Sarcodon joeides* (Pass.) Bat. in Bull. Soc. mycol. Fr. 39: 205. 1924 ("ionides"). — TYPE: "*Hydnum jonides* Pass. / In castaneto Collecchio / Pass." (Herb. Saccardo, PAD).

Sarcodon commutatus Bourd. & Galz. in Bull. Soc. mycol. Fr. 40: 109. 1924. — *Sarcodon ionides* subsp. *commutatus* (Bourd. & Galz.) Bourd. & Galz., Hym. Fr. 451. 1928. — *Hydnum commutatatum* (Bourd. & Galz.) Pouz. in Česká Mykol. 10: 67. 1956. — TYPE: "Champignons de l'Aveyron, *Sarcodon commutatatum*, sur humus, sous des châtaigniers, Evès; Galzin 20559, IX 1916" (Herb. H. Bourdot, No. 18304, PC).

Sarcodon inopinatus Donk in Meded. Nederl. mycol. Ver. 22: 62. 1933. — *Hydnum inopinatus* (Donk) van der Lek apud Cool & van der Lek, Paddestoelenboek, 3 Ed., 2: 206. 1935; 4 Ed., 2: 221. 1943; Pouz. in Česká Mykol. 10: 67. 1956. — TYPE: "*Sarcodon inopinatus*, Overijssel, Delden, IX 1929, M. A. Donk 1698" (Herb. Donk).

Pileus 25–100 mm across, plano-convex when young, finally deeply concave, velutinous at first, then breaking into scales, pinkish brown then lavender brown to red-brown. Stipe 20–40 × 8–10 mm, simple or connate, equal with somewhat pointed base, velutinous then fibrillose or glabrescent, concolorous with the pileus, the base white-cottony. Spines up to 3 mm long, decurrent, crowded, subulate, pale pink buff, finally chocolate brown. Context of the pileus stated to be dull purplish pink, this colour completely lost in the dried material.

Context of the pileus monomitic. Generative hyphae 3.5–27 μ wide, inflating, thin- to thick-walled (cell-walls up to 2 μ thick), branched, septate, without clamp-connections. Context of the spines similar, hyphae narrower. Spores 6.3–7.2 × 4–4.7 μ , of irregular outline, tubercular (tubercles numerous, prominent, exsculptate), brownish.

COLLECTION EXAMINED:

NEW ZEALAND

South Island: Nelson, Lake Rotoiti peninsula, 2 April 1955, Mrs. G. Stevenson Cone 972, under *Nothofagus* (with water-colour, K).

Part of the above description is drawn up from the notes and water-colour by Mrs. G. Stevenson Cone.

The occurrence of the material under *Nothofagus* is well in accordance with the ecology of the fungus in the Netherlands where it is associated with *Quercus*, also a member of the Fagaceae.

SARCODON sect. *Virescentes* Maas G., sect. nov.

Pileus velutinus vel tomentosus vulgo glabrescens, interdum squamis fibrillosis gracilibus instructus. Fungus exsiccatus virescens vel olivascens. Odor ignotus vel nullus. Hyphae fibulis munitae vel efibulatae. — TYPUS SECTIONIS: *Sarcodon atroviridis* (Morgan) Banker.

Pileus velvety to tomentose, usually glabrescent, sometimes developing slender fibrillose scales. The entire fungus turning green to olive on drying. Odour unknown in some species, stated to be none in others. Hyphae with or without clamp-connections. — TYPE SPECIES: *Sarcodon atroviridis* (Morgan) Banker.

The species belonging to this section are *Sarcodon atroviridis*, *S. conchyliatus*, *S. thwaitesii* and, with some doubt, *S. wrightii*.

SARCODON ATROVIRIDIS (Morgan) Banker — Figs. 164, 165

Hydnum atroviride Morgan in J. Cincinn. Soc. nat. Hist. 18: 38, pl. 1 fig. 5. 1895. — *Phaeodon atroviridis* (Morgan) Earle apud Mohr, Pl. Life Alabama 205. 1901 (not seen). — *Sarcodon atroviridis* (Morgan) Banker in Mem. Torrey bot. Club 12: 148, 1906. — TYPE: in Herb. Morgan (not seen).

Hydnum blackfordae Peck in Bull. Torrey bot. Club 33: 218. April 1906. — *Sarcodon blackfordae* (Peck) Banker in Mem. Torrey bot. Club 12: 142. June 1906; S. Ito, Mycol. Fl. Japan 2(4): 183. 1955. — TYPE: "Ellis, Massachusetts, August 1904, Mrs. E. B. Blackford" (NYS, not seen).

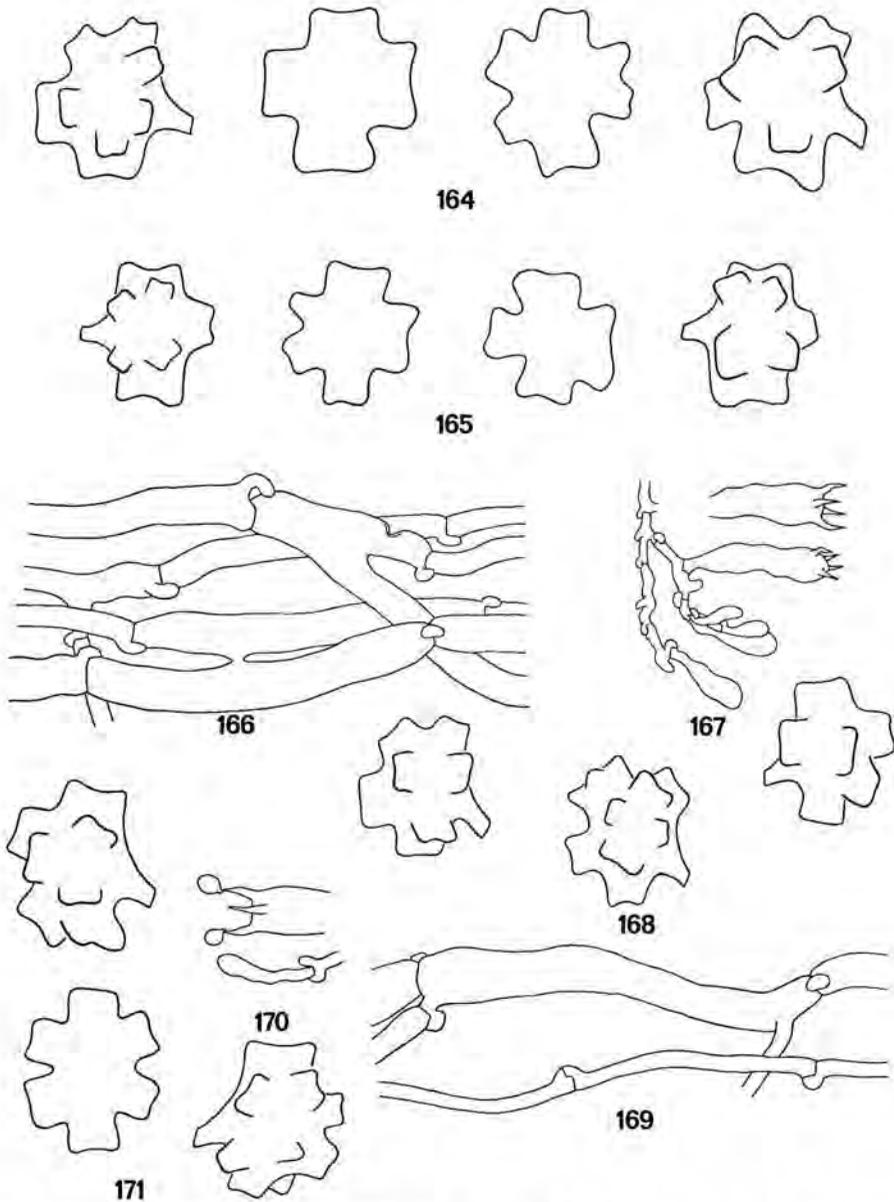
Pileus tomentose to felted, glabrous in places, dingy yellow-brown to dull olive, black where glabrous. Stipe felted in places, glabrous for the greater part, almost entirely black. Spines about 2 mm long, not decurrent, crowded, subulate, olive green to olive brown. Context up to about 2 mm thick in the centre of the pileus, fairly firm, homogeneous, not zoned, olivaceous yellow-green, darker green under the surface; a thin slice staining blue-green in a KOH solution and exuding a brown cloud into the fluid.

Context of the pileus monomitic, made up of generative hyphae. Hyphae 2–9 μ wide, inflating, thin-walled, branched, septate, with clamp-connections. Context of the spines similar, but hyphae narrower. Basidia 31–34 \times 7–8 μ , clavate, with basal clamp-connection, with 4 sterigmata 4.5–6.3 μ long. Spores 7.2–8.9 \times 5.5–5.8 μ , of irregular outline, tubercular (tubercles fairly numerous, strongly prominent, coarse, flat-topped to exsculptate), brownish, with oblique apiculus. Cystidia none.

COLLECTION EXAMINED:

JAPAN

Honshu: Prov. Rikuchu, 3 Oct. 1917, A. Yasuda 501 (Lloyd Mycol. Coll. 4829, BPI).



Figs. 164, 165. *Sarcodon atroviridis* (Fig. 164: U.S.A., Hessler 11729, L; Fig. 165: Japan, Lloyd Mycol. Coll. 4829). - Spores ($\times 2800$).

Figs. 166-168. *Sarcodon conchylatus* (holotype). - 166. Hyphae of the pileus. - 167. Detail of a spine, showing basidia. - 168. Spores. (Figs. 166, 167, $\times 700$; Fig. 168, $\times 2800$.)

Figs. 169-171. *Sarcodon conchylatus* (Solomon Islands, Corner). - 169. Hyphae of the pileus. - 170. Basidia. - 171. Spores. (Figs. 169, 170, $\times 700$; Fig. 171, $\times 2800$.)

I have but rarely seen a poorer scrag than the specimen in Lloyd's herbarium, which explains my failure to give the usual macroscopic measurements. Fortunately, however, the condition of the material is satisfactory, hampering in no way the examination of the microscopical elements. Another fortunate circumstance is that the collector added fairly detailed notes which are here reproduced in full.

Pileus with a central stipe, fleshy, brittle, turbinate, tomentose, yellowish-ochraceous, 2.5–7 cm in diameter. Flesh concolor. Stipe short, thick, blackish in drying, 3 × 1.2 cm. Spines grayish yellow; spores globose, tubercular, 5–8 μ .

The most noteworthy piece of information in this description is the colour of the pileus which seems to be rather aberrant as compared with the statements by the two American authors who saw fresh material. Peck described the pileus of what he called *Hydnum blackfordae* as "grayish or greenish-gray," while COKER (as *Sarcodon blackfordae*, 1942:96) found the pileus "in youth whitish fawn-drab . . . older plants dark smoky buff towards margin." Taking into account that an allowance should be made for some variability in the colouring of the specimens of the same species but coming from two widely separate parts of the world, and that the colours in some species do change quickly when handled—and there is no doubt but that both Peck and Coker were only able to make a description of their material after it had had its inevitable share of handling and bruising—, perhaps not too much weight should be given to the colour difference of the young basidiome. In any case, the Japanese specimen agrees with *S. atroviridis* in (i) the colour change, (ii) the ultimate colour assumed in drying, and (iii) the size and the shape of the spores.

LLOYD (1918, Lett. 67: 11; Lett. 68: 8) reported the Japanese specimen under the synonym *Hydnum blackfordae*. Later (1921: 1083) it occurred to him that *H. blackfordae* and *H. atroviride* might be identical.

***Sarcodon conchyliatus* Maas G., spec. nov.¹¹⁾—Figs. 166–171, Pl. V**

Basidiomata gregatim proveniunt. Pileus 40–90 mm latus, e convexo planus, plus minusve late umbonatus, laevis, inornatus, minute subtomentosus, languidus, variegatus, initio griseo-fuscus vel dilute sordideque ochraceus, in aetate violaceo-purpurascens, in sicco olivaceus. Stipes 40–80 × 10–23 mm, solidus, teres, deorsum incrassatus, laevis, minute subvillosus, pileo concolor sed dilutior, deorsum violaceo-suffusus vel omnino violaceus, in sicco obscure olivaceus. Aculei 3–6 mm longi, haud decurrentes, conferti, subulati, e stramineo vel murino aurantiaci, demum fuliginiei. Contextus crassus, carnosus, firmus, pallidus in pileo, subvinosus in stipite, laesus omnino purpurascens, in sicco umbrinus, inodorus, monomiticus, e hyphis generatoriis formatus. Hyphae 3.5–13.5 μ latae, inflatae, tenuiter tunicatae, ramosae, anastomosantes, septatae, fibulatae. Basidia 30–36 × 8–10 μ , clavata,

¹¹⁾ Etymology: conchyliatus, stained with purple.

quadrispora, sterigmata $5.4-7.2 \mu$ longa gerentia, ad basin fibulata. Sporae $7-8.5 \times 5.8-6.5(-7.5) \mu$, grosse tuberculatae, dilute brunneae, apiculo obliquo. Cystidia nulla.

HOLOTYPE: Singapore, Bukit Timah Forest, 30 Aug. 1940, *E. J. H. Corner* (L).

Basidiomes gregarious. Pileus 40-90 mm across, convex then plane, more or less broadly umbonate, smooth, without concentric zones or radiate structures, finely subtomentose, dull, greyish-bistre to pale drab ochraceous or pale dingy olive, sometimes more or less purplish, yellowish-olive to dark olive when dried; margin deflexed or incurved, narrow, entire, whitish. Stipe 40-80 \times 10-23 mm, solid, cylindrical but more or less swollen in the lower part, dilating rather abruptly into the pileus, smooth, wholly minutely subvillose, paler concolorous or pale buff, more or less suffused with violaceous or purplish-greyish colours in the lower half, sometimes wholly purplish, dark olive green to blackish green when dried; the extreme base tapered and thinly white-villose. Spines 3-6 mm long, stopping abruptly at the apex of the stem, crowded to subdistant, simple, subulate, at first pale yellowish or pale grey-buff, then of a rich orange-ochre, with pale tips, finally dark brown with a slight yellow tint. Context 12-20 mm in the centre of the pileus, putrescent fleshy, firm, homogeneous, pale buff or pale olive in the pileus, becoming purplish in the stipe, wholly vinaceous purple on bruising or cutting, dull brown when dried. Yellow to purple colour of the pileus caused by an amorphous yellow to purple-brown resinous excretion round some of the hyphae. A small portion of the dried context dropped in a KOH solution immediately exudes a yellow-brown cloud. The same colour is produced by a shaving of the blackish-green surface of the pileus, but along the border of the cloud there is a fringe composed of green patches and minute ink blue particles. Taste not noted, smell none.

Context of the pileus monomitic. Generative hyphae $3.5-13.5 \mu$ wide, inflating, thin-walled, branched, anastomosing, septate, with clamp-connections at all septa, with brownish cytoplasm. Surface of the pileus made up of subclavate hyphal ends $4-9 \mu$ wide, not arranged in a palisade. Hyphae of the context of the spines similar to those of the pileus. Basidia $30-36 \times 8-10 \mu$, clavate, with basal clamp-connection, with 4 sterigmata $5.4-7.2 \mu$ long. Spores $7-8.5 \times 5.8-6.5(-7.5) \mu$, of irregular outline, coarsely tubercular (tubercles prominent, coarse, rounded-exsculptate), brownish, with oblique apiculus. Cystidia none.

COLLECTION EXAMINED:

MALAY PENINSULA

Singapore: Singapore, Bukit Timah Forest, 30 Aug. 1940, *E. J. H. Corner*, on the ground (holotype, dried and in liquid, L).

Although the following collection, from Guadalcanal, is believed to represent the same species, a brief description is given separately for precautionary reasons. It throws an interesting light on the variability of the species.

Pileus 110 mm across, plano-convex, with broad umbo, smooth, without concentric zones or radiate structures, cottony, mat, pale orange, fading greyish olivaceous drab, yellowish olive when dried. Stipe 70×24 mm, hollow, subcylindrical, baggy, white, olive green when dried. Spines up to

9 mm long, free from the stipe, pale orange then drab ochraceous, finally dark brown. Context thick, firm, rather dry, homogeneous, white, grey-green when dried. All parts turning pink to violaceous or purplish, subsequently blackish on bruising and exposure. Smell none.

Context of the pileus monomitic. Generative hyphae 3.5–13.5 μ wide, with clamp-connections at all septa. Basidia 34–40 \times 10–11 μ , 4-spored. Spores 7.3–9 \times 6.3–6.5 μ . Cystidia none.

Shavings of the surface of the pileus and the stipe instantaneously produce a yellow-brown cloud in KOH solution, but the green fringe and the blue particles seem to develop slowly and weakly.

COLLECTION EXAMINED:

SOLOMON ISLANDS

Guadalcanal: Tsuva, 7 Nov. 1965, *E. J. H. Corner*, RS (BSIP) 1741, in humus in lowland forest (dried and in liquid, L).

There is no doubt that the present species stands widely apart from all other members of the genus on account of its unusual colours in the fresh condition. Once it has been dried, however, it is practically indistinguishable from *S. atroviridis*. This resemblance should not lead to the conclusion that both species are closely related, for *S. atroviridis* lacks purple colours to the pileus when fresh. Instead, it seems more natural to regard *S. thwaitesii* as its closest ally, a disposition clearly expressed in the key.

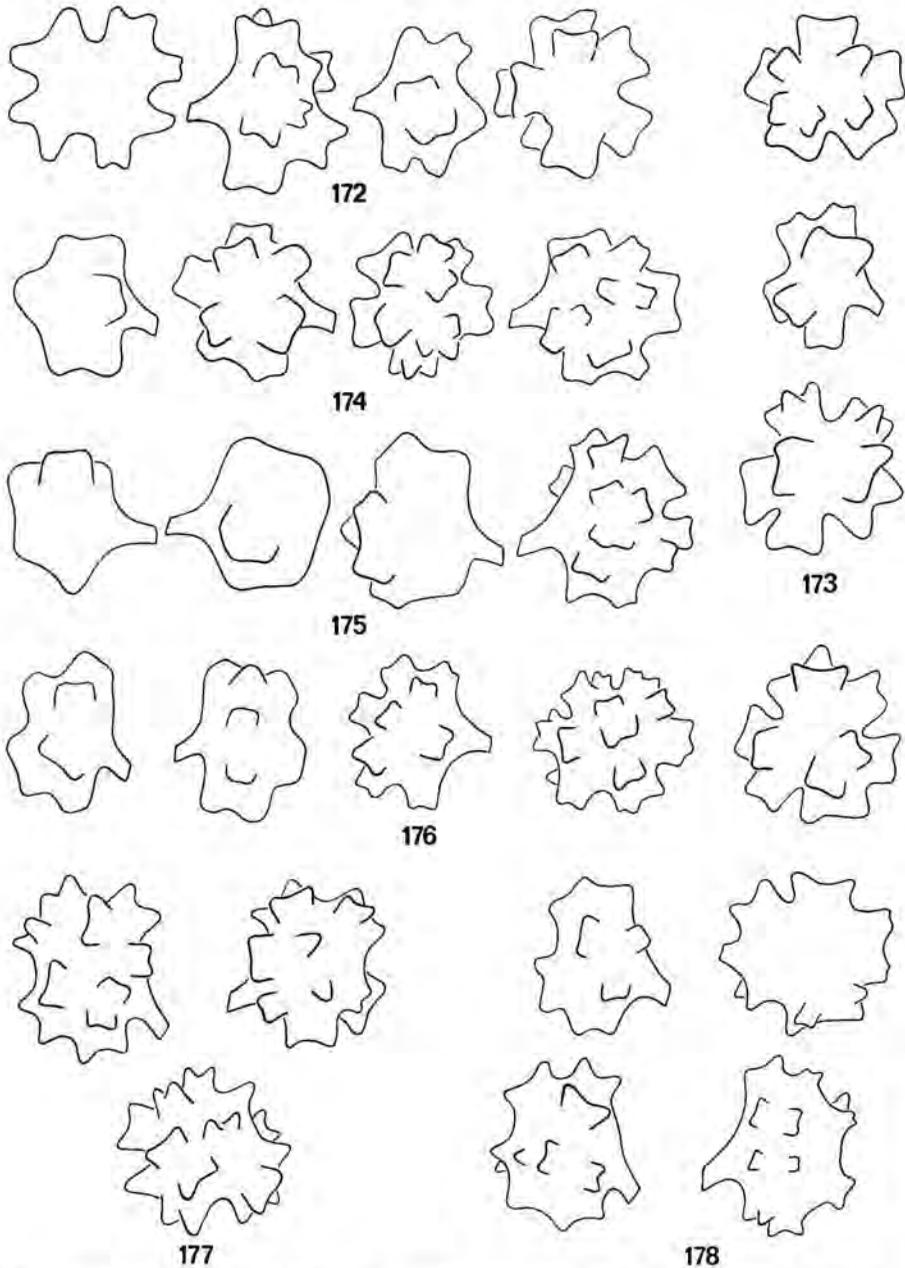
SARCODON THWAITESII (Berk. & Br.) Maas G.— Figs. 172–178,
Pl. VIII, figs. 2, 3

Hydnum thwaitesii Berk. & Br. in *J. Linn. Soc. (Bot.)* 14: 58. 1873. — *Phaeodon thwaitesii* (Berk. & Br.) P. Henn. in *Nat. Pflfam.* 1(1**): 149. 1898. — *Sarcodon thwaitesii* (Berk. & Br.) Maas G. in *Persoonia* 3: 185, figs. 61–65. 1964. — LECTOTYPE: “*Hydnum thwaitesii*, B. & Br. / [Ceylon] Peradeniya / Aug. 1868 / [*Thwaites*] 735” (K).

Hydnum carbonarium G. Cunn. in *Trans. R. Soc. N.Z.* 85: 591, text-fig. 2, 2a, pl. 40 fig. 2. 1958; not *Hydnum carbonarium* Peck in *Rep. N.Y. St. Mus. nat. Hist.* 40: 55. 1887. — *Sarcodon carbonarius* (G. Cunn.) Maas G. in *Persoonia* 3: 157. 1964. — TYPE: “*Hydnum carbonarium* G. H. Cunn., [New Zealand] Otago Distr., Half Moon Bay, Stewart Island, Febr. 1948, *J. M. Dingley*” (Herb. Pl. Diseases Div., Auckland 17707).

Basidiomes simple. Pileus up to 65 mm across (*Cone 812*), convex then plano-convex, smooth, without concentric zones, velutinous to felted, glabrescent, blackish olive when dried. Stipe 38 \times 12 mm (*Thwaites 735*) or 35–55 \times 10–22 mm (*Cone 812*), becoming hollow, central, tapering downwards (*Thwaites 735*) to enlarged below (*Cone 812*), straight or curved, smooth, tomentose, glabrescent, dried dark brown (*Thwaites 735*) or blackish olive or brownish olive with white cottony base (*Cone 812*). Spines up to 3 mm long (*Cone 812*), not decurrent, crowded, subulate, dried dark brown with a slightly reddish shade. Context dried up to 5–7 mm thick, homogeneous, brownish to dark brown. A thin slice of the context staining dingy blue-green in KOH solution and exuding a brownish cloud.

Context of the pileus monomitic. Generative hyphae 2–12.5 μ (*Thwaites 735*) or 2.5–16 μ wide (*Cone 812*), inflating, thin-walled, branched, septate, with clamp-connections. Hyphae in the spines similar, narrower. Basidia



Figs. 172–178. *Sarcodon thwaitesii* (Fig. 172: lectotype; Fig. 173: Philippines, Conklin & Buwaya; Fig. 174: Borneo, Sabah, Corner, RSNB 5036; Fig. 175: Borneo, Sarawak, Corner; Fig. 176: Enggano, Lütjeharms; Fig. 177: type of *H. carbonarium*; Fig. 178: New Zealand, Cone 812). – Spores, those with little differentiated, rounded outline being immature ($\times 2800$).

28–30 × 10–11 μ (*Thwaites 735*) or 36–50 × 10–12.5 μ (*Cone 812*), clavate, with basal clamp-connection, with 4 sterigmata 5.4–9 μ long (*Cone 812*). Spores 8.1–9.4 × 5.8–7.2 μ (*Thwaites 735*) or 8.5–8.8 × 6.3–6.5 μ (*Cone 812*), of irregular outline, tubercular (tubercles numerous, strongly prominent, coarse, deeply exsculptate), brownish.

COLLECTIONS EXAMINED:

CEYLON

Peradeniya, Aug. 1868, *G. H. K. Thwaites 735*, lectotype of *Hydnum thwaitesii* (K).

PHILIPPINES

Luzon: Mountain Province, Ifugao, Banaue, Bayninau, 19 July 1963, *H. C. Conklin & Buwaya* (PNH 80701).

MALAY PENINSULA

Singapore: Singapore, Botanic Gardens, 8 Feb. 1914, *Ethel M. Burkill 335*, on mossy bank (K); 29 Dec. 1919, *Sappan, No. 5478* (Lloyd Mycol. Coll. 4920, BPI); 4 May 1920, unknown collector, *No. 5702* (K); 8 Dec. 1941 and 22 Nov. 1943, *E. J. H. Corner*, gregarious, often among grass under trees (in liquid, L).

BORNEO

Sabah: Mt. Kinabalu, 21 Jan. 1964, *E. J. H. Corner, RSNB 5036* (also in liquid, L); 10 March 1964, *E. J. H. Corner, RSNB 5699* (L); 10 Apr. 1964, *E. J. H. Corner, RSNB 8226* (also in liquid, L); 26 Apr. 1964, *E. J. H. Corner, RSNB 8461, RSNB 8549* (L); 5 May 1964, *E. J. H. Corner, RSNB 8662*, all c. 1600 m alt. (L).

Sarawak: Kuching, Semangkoh Forest Reserve, 26 Jan. 1959, *E. J. H. Corner*, on rotten wood (L).

ENGGANO

Buah-buah, 2 June 1936, *W. J. Lütjeharms 4081*, on wood, c. 100 m alt. (L); 5 June 1936, *W. J. Lütjeharms 4274*, on the ground, c. 100 m alt. (L).

NEW ZEALAND

North Island: Hutt Valley, Keith George Park near Wellington, 26 May 1951, *Mrs. G. Stevenson Cone 812*, under *Beilschmiedia tawa* (with water-colour, K).

Stewart Island: Otago, Half Moon Bay, Feb. 1948, *Miss J. M. Dingley*, under *Dacrydium cupressinum*, type of *Hydnum carbonarium* (Herb. Pl. Diseases Div., Auckland).

Based on Cunningham's *Hydnum carbonarium* I once proposed the recombination under *Sarcodon*, but was well aware that this transfer was of no help in establishing the identity of the species. What was needed then was a description drawn up from fresh material (MAAS GEESTERANUS, 1964b: 158; 1967b: 97). It would seem that through the collection *Cone 812* and its accompanying water-colour as well as through the numerous collections made by Prof. Corner now a solution has been reached that in spite of some remaining open questions is far more satisfactory. Not only does it account for the unknown entity *H. carbonarium*, but it also brings the connection with an earlier name, given to a fungus almost

equally badly understood — *H. thwaitesii*. In order to discuss and compare these species, the types of both and several other collections are tabulated below. The collections are numbered 1–12, their various characteristics indicated a–k.

No. 12 consists of four and a half reasonably well dried specimens which on account of their darkened context, large basidia ($36-50 \times 10-12.5 \mu$), and the features mentioned under 12a, h, i, k, readily key out as *Hydnum carbonarium*. Comparison of such sporal characters as number, prominence, and angularity of the tubercles dispels any possible doubt. Thus, we know at last the colours of *H. carbonarium* through the accompanying painting by Mrs. G. S. Cone. As will be shown in the following, however, these colours very probably only occur during a certain stage in the development of the basidiome.

The same characters that helped in the identification of No. 12 can be used to prove that Nos. 11 and 1 are identical. Here again the non-numerical sporal characters play an important part. Thus the identity is established between *Hydnum thwaitesii* from Ceylon and *H. carbonarium* from New Zealand, while at the same time supplementary information on the colour change of the pileus is gained.

Berkeley & Broome, describing the pileus as "of a cinereous dingy lilac," apparently took this colour from the illustration accompanying *Thwaites 735*. This must have been a young specimen for the spines were stated to be "about a line long, white," whereas mature spines grow out to be 4–6 mm long and turn dark (Nos. 4–6). The colour change that takes place in the ageing pileus is described in No. 4, and corresponds well with the supposition that Nos. 1 and 12 represent young and final (or penultimate) stages, respectively.

From the information given with Nos. 1, 4–6, and 12 it is clear that there is practically always some purplish component in the colour of the pileus, but I have long hesitated to accept the dark purple or vinaceous purple colours of Nos. 2, 3, and 9 as having any association with the present species. It must seem incredible that these collections should be conspecific with No. 12, but the evidence now available leaves no room for doubt. Tentatively the following sequence of the colour changes in the basidiome is given: (i) the whole basidiome of a greyish colour when young and moist; (ii) gradually assuming a purplish to deep purple colour (possibly through oxidation of the vacuolar sap?); sometimes the pileus changing colour at an earlier date and/or more intensely than the stipe; (iii) with age gradually becoming more fuscous or even black, the pileus from centre outwards, the stipe from base upwards; (iv) the spines after their initial whitish colour becoming pinkish, then purple, finally brown from the ripening spores.

In the above description of the species only the colours of the dried material are given, but although the olive green to blackish green shades are very similar to those in dried material of *S. atroviridis* (see p. 119) and *S.*

		1	2	3	4	5	6	7	8	9	10	11	12
		<i>Hydnum thwaitesii</i>	Singapore 5702	Corner 17	Corner RSNB 5036	Corner RSNB 5699	Corner RSNB 8461, 8549	Corner RSNB 8662	Corner 37	Lütjeharms 4081	Lütjeharms 4274	<i>Hydnum carbonarium</i>	Cone 812
a	pileus surface	smooth, tomentose, glabrescent	smooth, tomentose, glabrescent	smooth,	smooth, tomentose, glabrescent	smooth, subtomentose, glabrescent	smooth, tomentose, glabrescent	smooth, minutely furfuraceous, tomentose	smooth, tomentose, glabrescent	smooth, tomentose, glabrescent	smooth, tomentose, glabrescent	smooth, glabrous	smooth, velvety, tomentose
b	pileus colour fresh	"of a cinereous dingy lilac" (B. & Br.)	dark purple	vinaceous purple	pale greyish vinaceous darkening to vinaceous fuliginous and blackish	violaceous fuliginous	vinaceous fuscous darker with age	fuliginous fuscous	fuscous fuliginous	fairly dark purple	dark grey, nearly black		dark purplish black
c	pileus colour dry	blackish olive	blackish olive	"pale" (Corner)	brown olive	blackish olive	brown olive to blackish olive	blackish olive	yellowish olive	blackish olive	blackish olive	black	dark olive
d	stipe	tapering downwards, "... cavo" (B. & Br.)	slightly tapering downwards, solid	tapering downwards, hollow	somewhat enlarged below	lost from the specimen	enlarged below, hollow	tapering downwards, hollow	equal, becoming, hollow	equal	slightly tapering downwards	equal, solid (?)	enlarged below, hollow
e	stipe colour fresh		dark purple	vinaceous purple	as pileus	darker concolorous	as pileus	pale vinaceous drab, fuliginous downwards and on bruising	fuscous fuliginous		somewhat purple		purplish grey
f	context colour fresh		greyish	vinaceous purple	as pileus	pale fuliginous tinted violaceous in places	vinaceous drab	pinkish white, fuliginous on exposure		purple	greyish		purplish grey
g	spines length & colour fresh	"about a line" (B. & Br.) white	1 mm greyish	3-4 mm vinaceous purple	-4 mm as pileus	-5 mm dirty greyish isabelline	-6 mm pinkish flesh colour, then concolorous	-2 mm pale pinkish, then fuscous vinaceous drab	-4 mm	purple	brown		1-3 mm "oyster greyish" (C)
h	clamps	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
i	spore length	8.1-9.4 μ	7.6-8 μ	7-9 μ		8.5-9.5 μ	7-9 μ	7.2-8 μ	8-9 μ	6.3-8.1 μ	7-8.1 μ	8.1-9(-9.8) μ	8.5-8.8 μ
k	spore breadth	5.8-7.2 μ	5.4-6.3 μ	6-8 μ				5.2-6.3 μ	6-7.5 μ	4.9-5.4 μ	5.4-6.1 μ	6.3-7.2(-7.6) μ	6.3-6.5 μ
		Ceylon	Singapore	Singapore	Mt. Kinabalu	Mt. Kinabalu	Mt. Kinabalu	Mt. Kinabalu	Kuching	Enggano	Enggano	New Zealand	New Zealand

quietus (MAAS GEESTERANUS, 1967: 95), *S. thwaitesii* is distinguished by its purple colours when fresh and its different spores. For distinction from *S. conchyliatus*, compare the key.

It was hoped that Prof. Corner's *Hydnum* collections from Singapore would give some clue to the identification of *Calodon ridleyi* Masee. It may be remembered that Masee's characterization "Pileus suberosus" led me to think that the species belonged to *Hydnellum* (MAAS GEESTERANUS, 1964b: 177). However, evidence is growing against the assumption of *C. ridleyi* being a *Hydnellum*, for Prof. Corner never found a member of this genus with the colouring as described by Masee. He suggested, instead, that his Singapore material here assigned to *S. thwaitesii* represented *Calodon ridleyi*. This assumption is not improbable, in which case the name would be a further synonym of *Sarcodon thwaitesii*. I would prefer to reserve judgment, however, as long as I have not seen the type (see MAAS GEESTERANUS, 1964b: 177).

Some words must be said about the spore drawings of *Hydnum thwaitesii* published in a former paper (MAAS GEESTERANUS, 1964b: 185, figs. 63, 65). It is probable that the choice of a not fully mature spine, combined with insufficient technique, has resulted in the somewhat misleading picture. Spores with such smoothly rounded warts do occur, but they are immature. In some of the present illustrations examples are given of such immature spores. On the whole, however, the spores of *S. thwaitesii* are sharply angular.

SARCODON WRIGHTII (Berk. & Curt.) Maas G.

Hydnum wrightii Berk. & Curt. in Proc. Am. Acad. Arts Sci. 4: 122. 1858. — *Sarcodon wrightii* (Berk. & Curt.) Maas G. in Proc. K. Ned. Akad. Wet. (Ser. C) 70: 70. 1967. — TYPE: (label inside:) "22.1.5 / Fungi *Hydnum wrightii*, B. & C. / Oosima / Shady hillsides / Dark brown / On earth"; (label outside:) "Herbarium of the U.S. North Pacific Exploring Expedition under Commanders Ringgold and Rodgers, 1853-56. *Hydnum wrightii* Berk. & Curt. / C. Wright Coll. Japan" (FH).

Pileus smooth or somewhat uneven, velvety or felted at the margin, finely reticulately virgate farther back from the margin, with the fibrils innate to slightly raised, occasionally their tips united to form slender fibrillose scales which become more conspicuous towards the centre of the pileus; surface greyish brown, in places somewhat more yellowish brown and with a slight purplish hue, contrasting with the darker brown fibrils. Stipe 20 × 5-6 mm, with pointed base, fibrillose above, felted below, like the pileus dotted all over with excretions of crystalline matter, blackened for the greater part but grey-brown where untouched, grey-brown also at the extreme base. Spines up to 2 mm long, decurrent, crowded, subulate, blackened but with a brownish pruina from the spores. Context of the pileus pressed papery thin, black, staining ink blue in a KOH solution.

Context of the pileus monomitic. Generative hyphae 4.5-12.5 μ wide, inflating, thin-walled, branched, anastomosing, septate, without clamp-connections. Context of the spines similar, hyphae 2-5.4 μ wide. Basidia 36 × 5.4-7.2 μ, either immature or collapsed, slender clavate, without

basal clamp. Spores approximately $6.3 \times 5.4 \mu$, of irregular outline, roughly tubercular, brownish.

COLLECTION EXAMINED:

JAPAN

Hokkaido: Oshima, date?, *C. Wright* (FH).

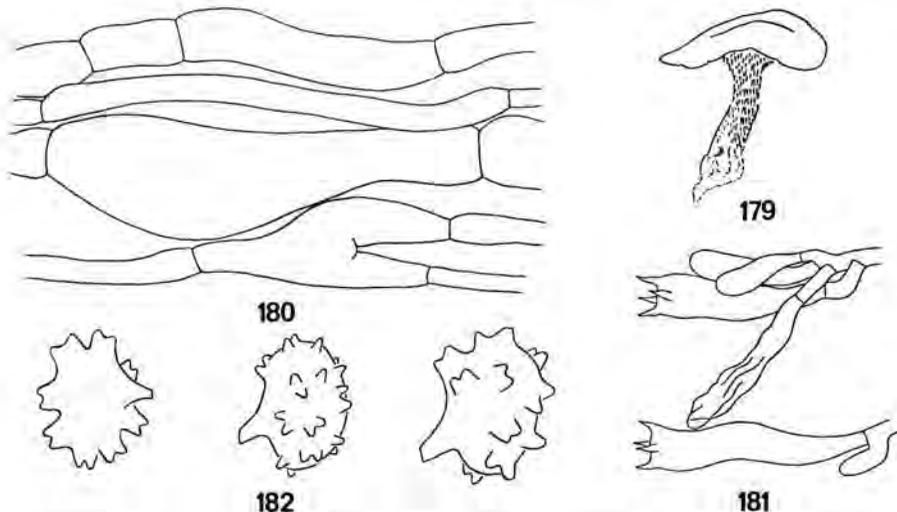
The above is a redescription of the type. No further collections seem to have been made. It is unfortunate that a better illustration of the spores than the one published in 1967 is not available.

APPENDIX

The only species left, about whose position I feel uncertain, is *Sarcodon* species 2. Its features would place it in Group 2 (MAAS GEESTERANUS, 1956: 46), but I still hesitate to make the choice between merging this group with section *Sarcodon* or describing it as a section on its own.

SARCODON species 2 – Figs. 179–182

Pileus up to 70 mm across, plano-convex to depressed, subtomentose, the tomentum breaking up into tufts and these turning into fibrillose squamules which are more or less radiately appressed, particularly near the margin, not zoned, somewhat shiny (when dried), lilaceous greyish to fuscous vinaceous, the squamules (when dried) darker to black-brown on a paler ground; the margin incurved, minutely fibrillose-pubescent. Stipe 40–60 \times 7–11 mm, solid, tapering downwards, wholly covered with fertile spines 1–3 mm long (the spines being shorter and abortive on the upper side of oblique stipes and at the base), concolorous with the pileus, the



Figs. 179–182. *Sarcodon* species 2 (Borneo, *Corner*). – 179. Habit sketch. – 180. Hyphae of the pileus. – 181. Basidia. – 182. Spores. (Fig. 179, $\times \frac{1}{2}$; Figs. 180, 181, $\times 700$; Fig. 182, $\times 2800$.)

base attenuate, white-cottony, somewhat dirty greenish on handling, rather more grey when dried. Spines up to 3 mm long, decurrent to near the base, crowded, subulate, fuscous vinaceous with white tips. Context 5–7 mm thick in the centre of the pileus, rather soft when fresh, firmer in the stipe, pallid buff-white, slowly vinescent on exposure. Smell of fenugreek. Taste slowly bitter.

Context of the pileus monomitic. Generative hyphae 3.6–22.5 μ wide, inflating, thin-walled to moderately thick-walled (-0.9μ), branched, anastomosing, septate, without clamp-connections. Hyphae in the spines similar, less wide. Basidia 32–45 \times 8–9 μ , clavate without clamp-connection, with 4 sterigmata up to 5.4 μ long. Spores 7.2–8.1 \times 5.4–6 μ , of irregular outline, tubercular (tubercles fairly numerous, prominent, developing from pairs of short spines, growing out to form exsculptate crests, giving the spores a desmidiaceous appearance), fuscous vinaceous.

COLLECTION EXAMINED:

BORNEO

Sabah: Mt. Kinabalu, Liwagu River, 2 Sept. 1961, *E. J. H. Corner*, RSNB 2672, in humus under a stand of *Trigonobalanus* Forman (Fagaceae), 1300 m alt. (L).

Except for the microscopical details, the description is drawn up after the collector's notes. Although these notes leave very little to be desired and the material is in reasonable condition, I feel reluctant formally to propose the species as new. Particularly in *Sarcodon* ample material from several localities is needed to be quite safe.

Prof. Corner stated that the smell was of fenugreek, which is the characteristic smell of a dried *Phellodon*. It is possible, of course, that the odour of the fresh material reminded him of that substance, but it is hardly conceivable that members of two completely unrelated genera — *Phellodon* and *Sarcodon* — should possess the same chemical compound. It may be pointed out moreover that, whereas Prof. Corner noticed the fenugreek odour in fresh material, this smell in *Phellodon* only comes after the specimens have been dried.

GENERA OF UNKNOWN AFFINITY

It may be possible to force the genera *Climacodon*, *Mycoleptonoides*, and *Mycorrhaphium* into one of the existing families or to give one or two the fictitious security of a newly created family. It is obvious, however, that such action would be premature and short-lived.

CLIMACODON P. Karst.

Climacodon P. Karst. in *Revue mycol.* 3 / No. 9: 20. Jan. 1, 1881 & in *Meddn Soc. Fauna Fl. fenn.* 6: 15. 1881. — TYPE SPECIES: *Hydnum septentrionale* Fr.

Donkia Pilát in *Bull. Soc. mycol. Fr.* 52: 328. 1936. — TYPE SPECIES: *Hydnum pulcherrimum* Berk. & Curt.

Basidiome simple or consisting of a voluminous mass of imbricate pilei. Pileus sessile (sometimes with effused base), pleuropodal, or frankly stipitate, fibrillose, velutinous, or strigose, retaining this hyphal cover or glabrescent, either in concentric zones or over the entire surface (in one case more or less covered with prominent bunches of agglutinated hairs, in another — which may well be an anomaly — with spines), white, pink, or blood red when fresh. Hymenium covering spines on the underside of the pileus (exceptional cases excluded), white or blood red, drying brownish flesh colour. Context pliable when fresh, drying tough to rigid, obscurely to clearly zoned, whitish or reddish, monomitic, consisting of generative and tendril hyphae, in some cases also of a very much shortened version of the latter which may conveniently be called connecting hyphae. Generative hyphae not inflating, branched, septate, thin- to thick-walled or solid, with clamp-connections only in the older portions of the pileus. Basidia clavate, 4-spored, without basal clamp. Spores ellipsoid, smooth, colourless, neither amyloid nor cyanophilous. Cystidia of tramal to hymenial origin, thin- to thick-walled or nearly solid, with or without oleaginous contents, glabrous or with encrusted tips.

Lignicolous.

Thus far *Climacodon* and *Donkia* had seemed to me to be two distinct genera, the former being characterized by hymenial, fusiform, thick-walled cystidia, often with encrusted tips, and the latter by tramal, elongate, thin-walled, smooth gloeocystidia. However, as more species, and of *Donkia pulcherrima* more collections, became known, the traditional demarcation by which *Climacodon septentrionalis* and *Donkia pulcherrima* used to be told from each other began to fade away. Thick-walled cystidia appear to be no longer a feature characteristic of *Climacodon*, they are equally known to occur in *D. pulcherrima* (Fig. 205) and *D. sanguinea*.¹²⁾

Encrusted cystidia are also to be found in *C. efflorescens*, a species I initially regarded as a member of the genus *Donkia*, while on the other hand the crystalline cap is very often deficient in the cystidia of *C. septentrionalis*, particularly in those near the tip of the spines. The cystidia in *C. septentrionalis* are not exclusively of hymenial origin, as is shown by the Japanese material described on p. 147, and those in "*Hydnum*" *roseomaculatum* have for the greater part their origin deep in the trama. In short, nothing remains to distinguish *Donkia* from *Climacodon*.

NIKOLAJEVA (1961: 190) also came to the conclusion that *Donkia* cannot be maintained, although her grounds seem to have a rather more conjectural quality: "In this genus [*Climacodon*], apart from *C. septentrionalis*, we have also placed *C. pulcherrimus* which shows considerable similarity, although it is rather clearly distinct in the character of its context and in some microscopic features" and "... but it would seem to us hardly

¹²⁾ Realizing that this species, too, will have to be transferred to *Climacodon*, the correct name now reads *Climacodon sanguineus* (Beeli) Maas G., *comb. nov.* — *Hydnum sanguineum* Beeli *in* Bull. Soc. r. Bot. Belg. 58: 210. 1926 (basionym). — *Donkia sanguinea* (Beeli) Maas G. *in* Bull. Jard. bot. natn. Belg. 37: 101. 1967.

possible to distinguish these two closely related genera, which more than once were confused by mycologists" (translated from Russian).

KEY TO THE SPECIES

1. Hyphae nowhere with more than one clamp per septum.
 2. Basidiome bright rose pink to deep carmine when fresh.
 3. Basidiome effused-reflexed or pileus sessile with a narrowed base, rarely pleuropodal. Spores 4.3–5.7 μ long: . . . "*Hydnum*" *roseo-maculatum*
 3. Basidiome consisting of pileus and central stipe. Spores 4–4.5 μ long (not treated here): . . . *C. sanguineus*
 2. Basidiome white to dingy white or creamy when fresh.
 4. Cystidia smooth or encrusted with crystalline matter which dissolves in KOH.
 5. Cystidia thin-walled or with somewhat thickened cell-walls, at the most thinly encrusted. Spores 3.7–4.5 μ broad: . . . *C. efflorescens*
 5. Cystidia moderately to very thick-walled, the latter often with thickly encrusted tips. Spores (measured in European material) 2.5–3.5 μ broad: . . . *C. septentrionalis*
 4. Cystidia, at least those that remain enclosed in the hymenium, covered with a conspicuous oily sheath which does not dissolve in KOH: . . . *C. chlamydocystis*
1. Hyphae in the older parts of the pileus with two or three, occasionally four, clamps per septum; oily masses occurring in abundance: . . . *C. pulcherrimus*

***Climacodon chlamydocystis* Maas G., spec. nov.¹³⁾ — Figs. 183–189**

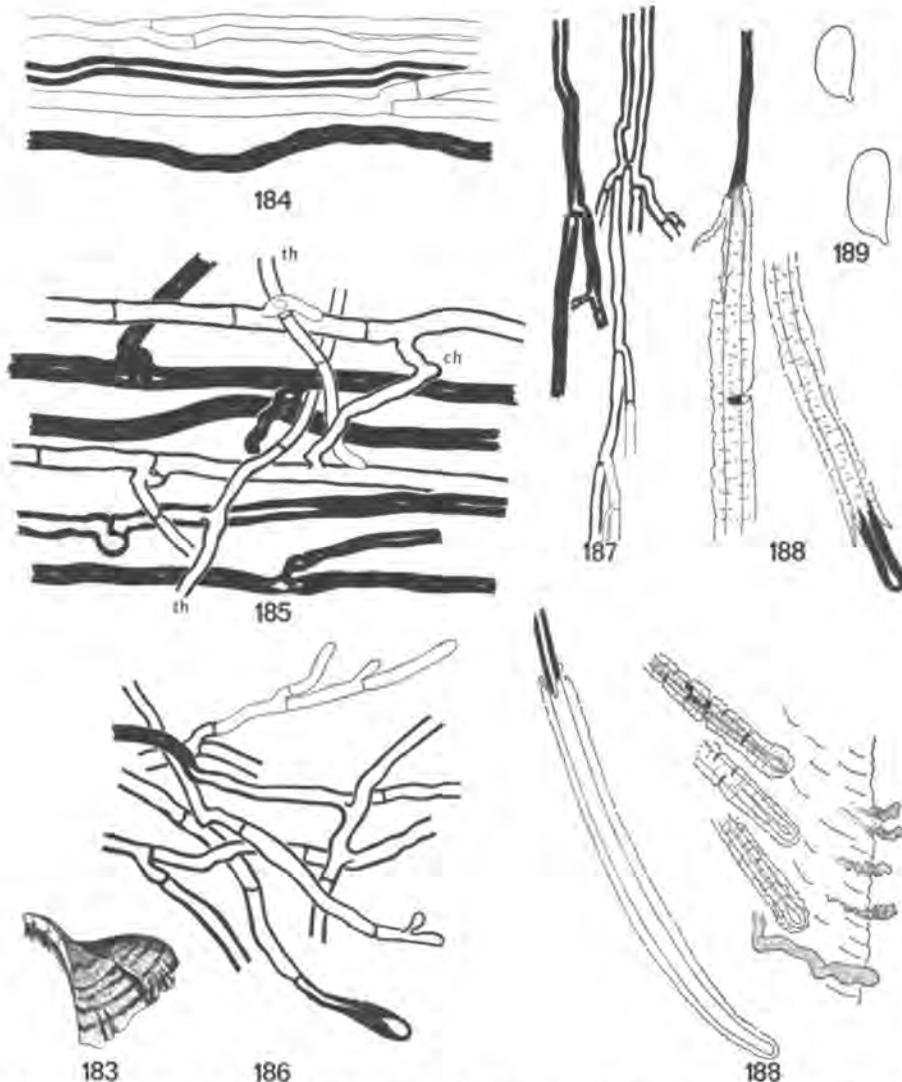
Basidioma usque ad 12 cm latum, effuso-reflexum. Pileoli 10–25 mm diam., lateraliter concrecentes, imbricati, plano-convexi, initio velutinosi, glabrescentes, innato-fibrillosi, in vivo albi, in sicco ochracei vel flavobrunnei, striis zonisque brunneorufis obducti, margine integro sublobato. Aculei usque ad 2.5 mm longi, decurrentes, conferti, graciles, subulati, in vivo ceriacei et albi, in sicco corneacei et roseobrunnei vel fulvi, hinc inde conglutinati. Caro usque ad 1–2 mm crassa, in vivo molliter coriacea et alba, in sicco tenax, zonata et striata, odore vix sensibili polyporoideo; monomitica, e hyphis generatoriis, connexivis et sarmentosis formata. Hyphae generatoriae 2.7–7.3 μ latae, haud inflatae, tenuiter tunicatae vel subsolidae, ramosae, anastomosantes, septatae, a margine distantia aliqua tantum fibulatae, margine ipso materia oleosa repletae, ceterum vacuae. Basidiomatis pars effusa e hyphis ramosissimis formata, quarum nonnullae apice cystidioideo terminantur. Aculei e hyphis generatoriis 1.5–4.5 μ latis e fibulatis constructi. Basidia collapsa. Sporae 3.6–4.3 \times 1.8–2 μ , ellipsoideae, adaxialiter applanatae, laeves, hyalinae, haud amyloideae, apiculo obliquo praeditae. Gloeocystidia tenuitunicata, in aculeorum partem apicalem reperta, usque ad 4 μ lata. Cystidia parietibus crassis instructa aculeorum partem basalem versus obvia, e hymenio haud prolata, pallio oleoso crasso oblecta, usque ad 8–10 μ lata.

HOLOTYPE: Singapore, Mandai Road, July 1929, *E. J. H. Corner* (L).

Basidiome up to 12 cm wide, effused-reflexed, developing several pileoli. Margin of effused portion minutely plushy, ochry yellow when dry. Pileolus 10–25 mm radius and wide, laterally crescent, imbricated, plano-

¹³⁾ Etymology: *χλαμύς-ύδος*, a cloak, and *κυστις*, a cavity, a pouch; referring to the conspicuous mantle of oily matter covering the distal end of the thick-walled cystidia.

convex; at first smooth and minutely plushy or scurfy, then glabrescent, innately fibrillose, radiately rugulose when dry, more or less clearly zoned by widely spaced darker lines, dull when fresh, somewhat shiny when dry; white when fresh, ochry yellow or ochraceous yellow-brown when dry, with orange-brown to reddish brown streaks and zones. Margin entire, somewhat lobed, revolute when dry. Spines decurrent, up to 2.5 mm long, crowded, slender, subulate, waxy and white when fresh, horny and pinkish



Figs. 183–189. *Climacodon chlamydocystis* (holotype). – 183. Fragment of the pileus. – 184. Generative hyphae close to the margin of the pileus. – 185. Generative, connecting (ch), and tendril hyphae (th) at 1 mm distance from the margin. – 186. Detail taken from the effused portion of the basidiome. – 187. Generative hyphae of the context of a spine. – 188. Detail of the collapsed hymenium, showing thin-walled gloeocystidia and several thick-walled cystidia with their distal part wrapped up in a mantle of oily matter. – 189. Spores. (Fig. 183, $\times 1$; Figs. 184–188, $\times 700$; Fig. 189, $\times 2800$.)

brown to fulvous when dry, in places glued together by a syrupy mass. Context 1–2 mm thick at the base, soft-coriaceous and white when fresh, tough when dry, zoned, streaked with darker longitudinal lines, staining reddish in KOH. Smell slight, polyporoid.

Context of the pileoli monomitic, consisting of generative hyphae, farther back from the margin increasingly mixed with connecting (ch, Fig. 185) and tendril hyphae (th, Fig. 185). Generative hyphae 2.7–7.3 μ wide, not inflating, branched, anastomosing, septate, thin-walled to almost solid and without clamps at the margin, predominantly solid and with one clamp-connection per septum farther back. The thin-walled hyphae with dense oleaginous contents at the margin, empty farther back. Connecting and tendril hyphae developing at some distance from the margin. Margin of the effused portion of the basidiome made up of generative hyphae which are 2.7–4.5 μ wide, profusely branched, anastomosing, septate, thin-walled to thick-walled, without clamp-connections, more or less filled with oily droplets. Some of the hyphae resembling cystidia in that their apical part is somewhat broadened and very thick-walled, the cell-wall being distinctly roughened. Context of the spines monomitic; the generative hyphae 1.5–4.5 μ , as a rule narrower than those of the pileus, without clamp-connections, predominantly thin-walled and with oily contents at the apex of the spine, thick-walled to solid and empty near the base of the spine. Basidia collapsed, indistinguishable. Spores 3.6–4.3 \times 1.8–2 μ , ellipsoid, adaxially flattened, smooth, colourless, not amyloid, with oblique apiculus. Gloeocystidia (i.e. the terminal ends of thin-walled oleiferous hyphae) up to about 4 μ wide, projecting beyond the collapsed basidia, thin-walled, smooth, shrivelled up, occurring only in the apical part of the spines, from about the middle of the spines upwards replaced by very different-looking, thick-walled cystidia. Thick-walled cystidia (i.e. the terminal ends of thick-walled hyphae) up to 4.5 μ wide, covered over the distal 100–300 μ by a most conspicuous oily mantle and then up to 8–10 μ wide, not protruding beyond the hymenium, usually ending in the subhymenium.

COLLECTIONS EXAMINED:

MALAY PENINSULA

Singapore: Singapore, Mandai Road, July 1929, *E. J. H. Corner*, on the base of a living tree in the forest (holotype, L); 14 April 1930, *E. J. H. Corner* (L).

Although the hymenial characters are better preserved in the second collection, the presence of several mouldy patches renders it less desirable to designate this gathering as the type. It is in all respects identical with the type and conforms to Prof. Corner's notes, from which the following additional data are taken:

Hymenium thickening, up to 40 μ . Basidia 14–18 \times 3–4 μ , bearing 4 sterigmata 3 μ long, without clamp-connection at the base (checked in the second collection). Spores without oil drops when fresh.

A characteristic feature which the present species shares with *C. pulcherrimus* is the abundance of oily matter within and without the hyphae. Remarkable quantities of this matter are to be found in the spines, where

their presence can be demonstrated by soaking a whole spine in gently heated sulpho-anisaldehyde. From the resulting discoloration the impression is gained that practically no hyphae are free from oil. Incidentally, it is worth noticing that the reagent stains the oily matter a deep red-brown, very different from the wine red discoloration produced in e.g. *Auriscalpium vulgare* (which I use for testing the liquid). The different discoloration in *Auriscalpium* and *Climacodon* suggests that chemically different substances are involved.

***Climacodon efflorescens* Maas G., spec. nov.¹⁴⁾**

Figs. 190–196, Pl. VIII, fig. 1

Basidioma usque ad 30 cm latum altumque, multipileatum, interdum subradicans. Pileus usque ad 12 cm longus et 14 cm latus, spathulato-cuneatus vel flabelliformis, ascendens, saepe connatus atque proliferans, initio tomentosus vel velutinus paene zonatus, dein strigosus concentricè sulcato-zonatus, demum glabrescens, albidus vel cremeus, aetate cinerascens vel subvinoso-tinctus, in sicco sordide ochraceus, zonis glabris badiis instructus, margine primo integro postea lobato vel subcrenato. Aculei 1–1.5 mm longi, conferti, subulati vel compressi quare irpicoidei, interdum connati, pilei marginem versus in rugas transientes, in vivo cerei et pileo concolores, in sicco fragiles et brunneo-incarnati. Caro ad pilei basin 2–7 mm crassa, e friabili tenax, zonata, aquose alba, odore forti; e hyphis generatoriis et sarmentosis formata. Hyphae generatoriae 2.7–4.5 μ latae, haud inflatae, tenuiter usque ad crasse tunicatae, ramosae, anastomosantes, septatae, a margine distantia aliqua tantum fibulatae, margine ipso materia oleosa repletae, ceterum progressive vacuae. Hymenium crassescens. Basidia 22–35 \times 6–7(–8) μ , clavata, efibulata, quadrispora. Sterigmata 4–5 μ longa. Sporae 4.5–6 \times 3.7–4.5 μ , late ellipsoideae, adaxialiter applanatae, laeves, hyalinae, haud amyloideae, uniguttatae, apiculo obliquo munitae. Gloeocystidia partem apicalem versus usque ad 5–7 μ lata, clavata vel ventricosa, immersa vel hymenium superantia usque ad 40 μ , proxima parietibus crassioris instructa et incrustata, ultima tenuiter tunicata sensim in hyphas oleiferas transientia.

HOLOTYPUS: Malay Peninsula, Negri Sembilan, Pasoh Forest, 30 Sept. 1966, E. J. H. Corner (L).

Basidiome forming large merismatoid masses up to 30 cm high and wide, beginning as a crustaceous patch up to 25 cm wide and 0.5–1 cm thick, becoming coralloid from numerous incipient pilei, which subsequently expand and become imbricated, sometimes with a short central rooting trunk, 2–3.5 cm long and wide.

Pileus up to 12 cm radius and up to 14 cm wide, spathulate-cuneate to flabelliform, ascending, often connate and proliferating from the margin or from the older basal parts; at first tomentose to velutinous and scarcely zoned, then becoming strigose and concentrically furrowed and zoned, finally glabrescent; dingy white to cream-white, tinged greyish or subvinaceous in the older parts, when dry dingy ochraceous, the glabrous parts orange-brown to reddish brown, zoned with very dark reddish brown lines; margin at first entire and obtuse, then becoming lobed or subcrenate and fairly thin. Spines 1–1.5 mm long, crowded, subulate or flattened and irpicoïd, sometimes connate, near the margin of the pileus passing into interrupted radial ridges, puberulous towards the tip, waxy and concolorous with the pileus when fresh, brittle and brownish flesh-colour when

¹⁴⁾ Etymology: effloresco, to flourish, blossom forth.

dry. Context 2–7 mm thick at the base of the pilei, cheesy-friable, becoming tough-fibrillose, zoned, watery white. Smell strong, of *Ganoderma applanatum* when fresh, sweetish but also reminiscent of horse urine when dry.

Context of the pileus monomitic, consisting of generative hyphae and tendril hyphae. Generative hyphae 2.7–4.5 μ wide, not inflating, thin-walled to thick-walled, branched, anastomosing, septate, without clamp-connections and all filled with oily matter at the margin, with one clamp per septum and becoming progressively empty in the older tissue farther back, very compact and somewhat agglutinated in the zonal areas. Tendril

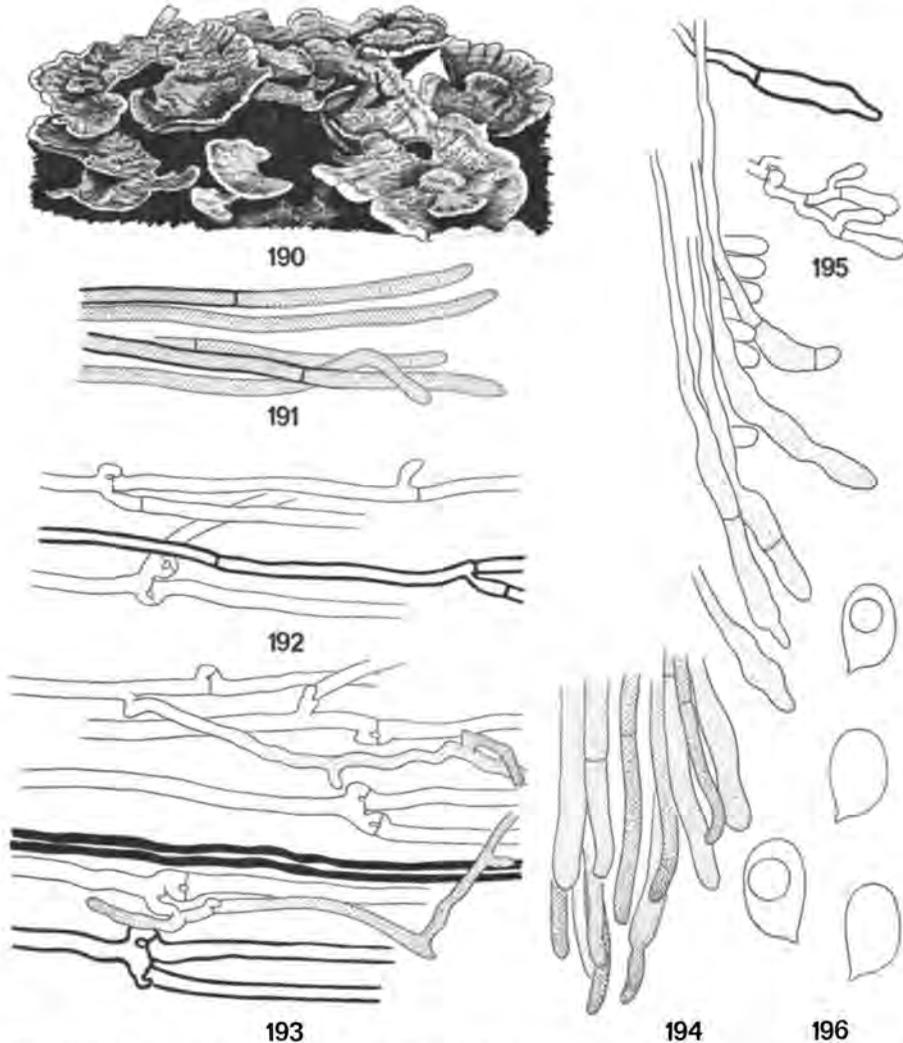


Fig. 190. *Climacodon efflorescens* (after a photograph of a specimen that does not seem to have been preserved). Small portion of the basidiome.

Figs. 191–196. *Climacodon efflorescens* (holotype). – 191. Generative hyphae at the margin of the pileus. – 192. Generative hyphae 100 μ away from the margin. – 193. Generative and tendril hyphae 5 mm back from the margin. – 194. Detail of a spine. – 195. Immature basidia. – 196. Spores. (Figs. 191–195, $\times 700$; Fig. 196, $\times 2800$.)

hyphae developing some distance away from the margin, in places forming dense knots. Context of the spines monomitic, but elements difficult to discern. Hymenium thickening up to $100\ \mu$. Basidia $22-35 \times 6-7(-8)\ \mu$, clavate, without clamp-connection, 4-spored. Sterigmata $4-5\ \mu$ long. Spores $4.5-6 \times 3.7-4.5\ \mu$ (all spores I have seen were immature, the largest measuring $4.7 \times 3.6\ \mu$), broadly ellipsoid, adaxially flattened, smooth, colourless, not amyloid, with moderately large oil-drop, with oblique apiculus. Gloeocystidia $5-7\ \mu$ wide in the apical part, which is clavate to ventricose, remaining immersed in the hymenium or projecting up to $40\ \mu$ beyond the basidia, thin-walled towards the tip of the spine, frequently somewhat thicker-walled farther upwards and usually thinly encrusted; the tip of the spines made up exclusively of oleiferous hyphae which, towards the sides of the spines, gradually pass into gloeocystidia.

COLLECTIONS EXAMINED:

MALAY PENINSULA

Negri Sembilan: Pasoh Forest, 30 Sept. 1966, *E. J. H. Corner* (holotype, also in liquid, L).

Pahang: Tembeling, 3 Nov. 1930, *E. J. H. Corner* (L).

Singapore: Singapore, 4 Oct. 1931, *E. J. H. Corner* (in liquid, L).

SOLOMON ISLANDS

Guadalcanal: Tenaru Valley near Honiara, 1 June 1964, *E. J. H. Corner* (in liquid, L).

San Cristóbal: Warahito Camp, 3 Aug. 1965, *E. J. H. Corner*, *RS (BSIP) 944*, on the ground by a rotten stump (also in liquid, L).

Ysabel Island: Tetamba, 28 Sept. 1965, *E. J. H. Corner*, *RS (BSIP) 1460*, on the ground in secondary forest (also in liquid, L).

The following notes made by Prof. Corner are appended here in order to show the range of variation of the species:

RS (BSIP) 944 from San Cristóbal: "Pleuropodal, merismatoid, wholly white to drab white, cheesy, brittle. Trunk up to 6×5 cm. Pilei spreading, more or less horizontal, irregularly flabelliform, proliferating, the largest up to 34 cm long and 25 cm wide. Spines slowly elongating to 17 mm and becoming conjoint through most of their length with only the last 1-2(-3) mm free. Flesh watery-marbled."

RS (BSIP) 1460 from Ysabel Island: "Up to 50 cm wide, merismatoid, imbricating, with ascending flabelliform pilei becoming lobed, with a short stout, rather woody rooting base (? from buried wood). Upperside white, then drab, becoming subfuscous from the base, irregularly pulvinate-tuberculate, matt, not zoned. Spines up to 6 mm long, crowded, connate in their older parts, white to pale cream. Flesh up to 12 mm thick at the base of the pilei, white, cheesy-fibrous. Smell strong, cheesy and of *Clitocybe nebularis*."

The holotype, which is superior in several respects to the other collections examined, is so badly dried that the macroscopical and part of the microscopical description would have been very incomplete indeed without Prof. Corner's notes. To these notes were added observations on the development of "a single fructification which grew in the Gingerwort Rockery of the Singapore Botanic Gardens." These are given here in full:

Fructifications appear rather late in the fungus season and are not fully grown until near the end of it.

13 Jan. 1930. A nodulose crust on the ground, 10–15 cm wide, 5–10 mm thick.

4 Feb. Pilei –2 cm long; dry spell begins.

11 Feb. Pilei 2–3.5 cm long, 2–2.5 cm wide, cuneate or narrowly flabelliform; watered once daily for the last week; sporing.

21 Feb. Pilei 4–5 cm long, 4 cm wide; still watered daily.

10 March. Pilei 5–6 cm long, fusing laterally; rains begin.

28 April. Pilei –11 cm long, sprouting many new vigorous pilei as the result of 6 weeks rain.

6 June. Still with vigorous growth of new pilei, but one side of the fructification dying back; began daily watering again.

8 July. Fructification collapsed, eaten by beetles and snails; possibly overwatered in my absence for three weeks.

These measurements, which could not be exact because of the irregular form of the fructification, give the rate of marginal growth of the pileus as 1 mm in 24 hours, with a possible maximum of 2 mm in full vigor. On a previous occasion I observed the increase in size of the pilei from 1–2 cm to 4–6 cm in one month. I then lifted the whole fructification with another younger one, with as much attendant soil as possible, and put it under a bell-jar in the laboratory for close study. However, both failed to develop any further and decayed. This has usually been my experience with massive terricolous fungi in the tropics.

Climacodon efflorescens differs in chemical respect from *C. chlamydocystis* and *C. pulcherrimus* in that the oily matter is much less abundant and seems to be of a different nature. As noted by Prof. Corner the contents of the gloeocystidia is “more or less vitreous-opalescent or watery vacuolate.” The oleiferous hyphae and gloeocystidia, unlike those of the two other species, fail to show up in sulpho-anisaldehyde, and the oily matter dissolves in the reagent with a flaming orange-brown colour.

CLIMACODON PULCHERRIMUS (Berk. & Curt.) Nikol. — Figs. 197–206

Hydnum pulcherrimum Berk. & Curt. in J. Bot. Kew Gdn Misc. 1: 235. 1849. — *Steccherinum pulcherrimum* (Berk. & Curt.) Banker in Mem. Torrey bot. Club 12: 129. 1906. — *Creolophus pulcherrimus* (Berk. & Curt.) Banker in Mycologia 5: 294. 1913. — *Dryodon pulcherrimus* (Berk. & Curt.) Pilát in Bull. Soc. mycol. Fr. 49: 315. 1934. — *Donkia pulcherrima* (Berk. & Curt.) Pilát in Bull. Soc. mycol. Fr. 52: 328. 1937. — *Climacodon pulcherrimus* (Berk. & Curt.) Nikol. in Fl. Pl. cryptog. URSS 6(2): 194. 1961. — TYPE: “*Hydnum pulcherrimum* B. & C. / No. 1648 / Santee River” (not seen, K).

Hydnum gilvum Berk. in Lond. J. Bot. 3: 168. 1851. — TYPE: “*Hydnum gilvum* Berk. / Darjeeling” (K).

Hydnum duriusculum Lloyd, Mycol. Writ. 6: 1002, pl. 166 fig. 1828. 1920. — TYPE: “No. 88 / Singapore, Botanic Gardens / 1 Sept. 1913. / In clusters of horizontal brackets. Colour cream / E. M. Burkill” (Lloyd Mycol. Coll. 4923, BPI).

Hydnum singaporense Lloyd, Mycol. Writ. 7: 1107, pl. 188 fig. 2035. 1922. — *Hydnum rawakense* var. *singaporense* (Lloyd) Rick in Iheringia (Bot.) No. 5: 143. 1959 (misapplied?). — TYPE: “No. 5836 / Singapore / Botanic Gardens, Jungle /

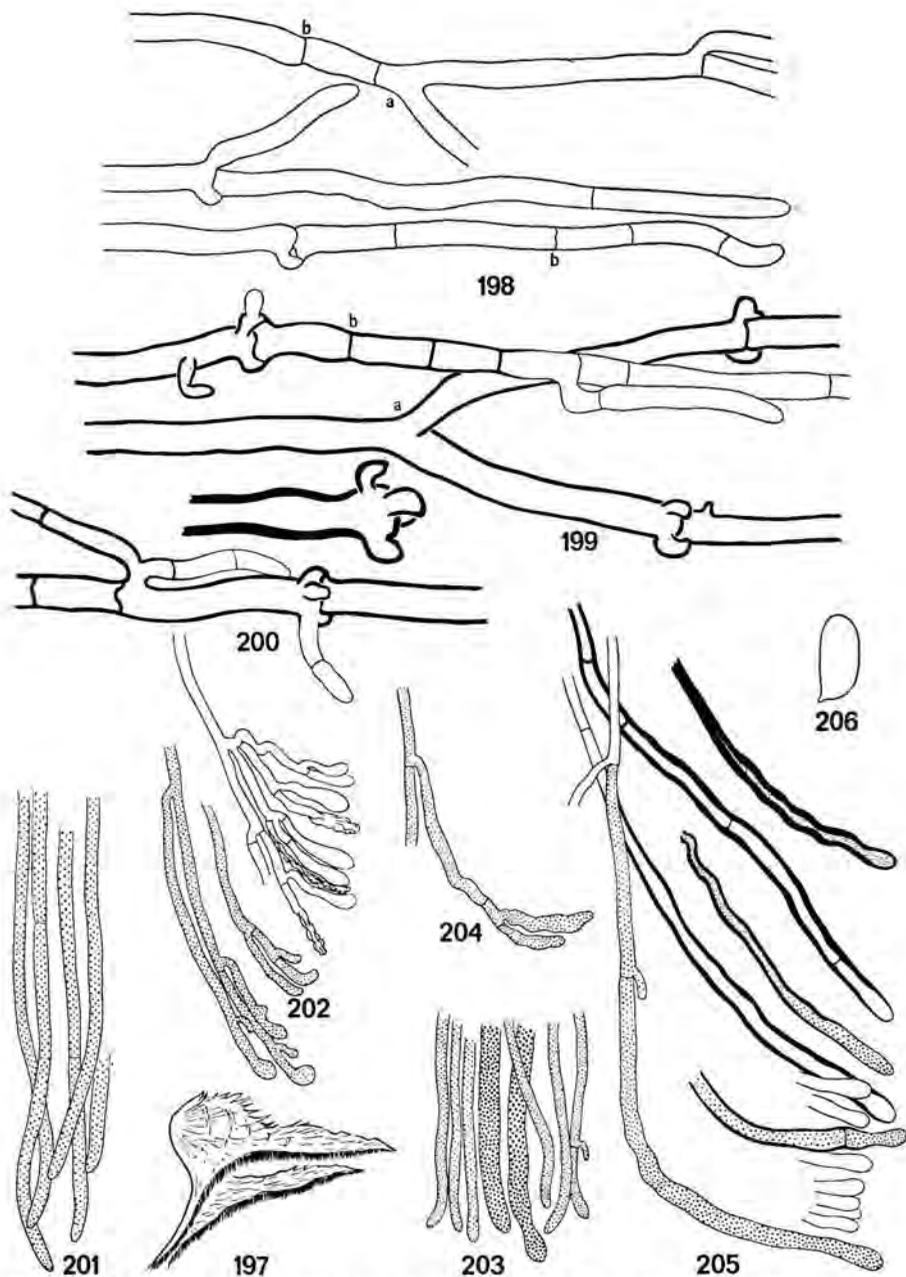


Fig. 197. *Climacodon pulcherrimus* (Malay Peninsula, Singapore, March 1931, Corner). Section of portion of basidiome, somewhat diagrammatic ($\times 1$).
 Figs. 198-202. *Climacodon pulcherrimus* (Malay Peninsula, Corner, Singapore Field No. 24184). - 198. Hyphae from extreme margin. - 199. Hyphae 1 mm back from the margin. - 200. Hyphae 4 mm back from the margin, showing the development of tendril hyphae and a fragment of a hypha with four clamps. - 201. Oil-filled generative (gloecystidial?) hyphae at the tip of a spine. - 202. Gloecystidial (?) hyphae and immature basidia at some distance from the tip. (All figs., $\times 700$.)
 Figs. 203-206. *Climacodon pulcherrimus* (Malay Peninsula, Johore, Corner). - 203. Oil-filled generative hyphae and two slightly wider gloecystidia at the tip of a spine. - 204. Gloecystidial hypha, intermediate between generative hypha and true gloecystidium. - 205. Detail of a spine, showing various intermediates between gloecystidium and tramal cystidium. - 206. Spore. (Figs. 203-205, $\times 700$; Fig. 206, $\times 2800$.)

4 July 1920 / *T. F. Chipp* / Pileus + context white. Teeth white slightly brown. Spore print white. Spores hyaline, oblong, smooth, $3 \times 5 \mu$ " (Lloyd Mycol. Coll. 4864, BPI).

Hydnum deceptivum Lloyd, Mycol. Writ. 7: 1125. 1922 (nomen nudum); 7: 1170, pl. 225 figs. 2309, 2310. 1923. — TYPE: "Flora of the Philippines / Herbarium, Bureau of Science No. 15932 / Mt. Maquiling, Prov. of Laguna, Luzon / Feb. 23–28, 1912, P. W. Graff" (Lloyd Mycol. Coll. 4858, BPI).

Sarcodon salmoneus R. Heim in Revue Mycol. 27: 128, pl. 4 "1962" [1963] (not validly published, lacking Latin description); *Hydnum salmoneum* R. Heim in Revue Mycol. 30: 235. 1966. — Type: "*Hydnum salmoneum* (Heim) nov. comb. / Sur le tronc, resté debout, d'un arbre feuillu, carbonisé. / Au-dessus du village thaï de Maow, vers 1300 m d'altitude. / Thaïlande—5 décembre 1957—Leg. & det. R. Heim. No. Th. 44" (PC).

Further synonyms are left out of consideration, as they have no bearing upon the region treated in this paper.

Pileus up to 75 mm radius, sessile or with an effused basal portion, at first descending, then more or less horizontal and appanate, often imbricated; strigose-spiculose with processes up to 3 mm long at the base of the pileus, fibrillose-strigose towards the margin with processes shorter, rather scattered, and more or less appressed; at first white, then pale fawn tan, cinnamon to orange-brown or reddish brown when dried. Margin fimbriate to entire, thin or obtuse. Spines up to 4 mm long, decurrent, crowded, subulate, rarely flattened, smooth, concolorous with the pileus with whitish tips, horny and dark reddish brown when dried, often glued together as if suffused by some sticky matter. Context 6–16 mm thick at the base of the pileus, fibrous-cheesy, slightly tough, faintly zoned, fibrillose, not lacunose, whitish, usually staining pinkish-rufescent in dilute KOH. Smell not particular.

Context of the pileus monomitic, consisting of generative hyphae, towards the base of the pileus increasingly mixed with connecting and tendril hyphae. Generative hyphae 3–10 μ wide, not inflating, branched (sometimes irregularly so), septate; thin-walled and without clamp-connections near the margin; thin-walled to thick-walled (cell-wall up to 2.5 μ) and with 1–4 clamps per septum farther back from the margin; all hyphae at the margin with dense oleaginous contents, which become progressively less apparent the farther away from the margin. Generative hyphae with frequent excrescences, which develop into connecting or tendril hyphae usually thinner than the parent hyphae. Context of the spines monomitic, its hyphae usually narrower than those of the pileus, without clamps. Oleiferous hyphae abundant in the core of the spines, unbranched at the apex, becoming more and more branched towards the sides, gradually passing into basidiferous hyphae towards the middle of the spines. Basidia 17–22 \times 3–4 μ , clavate, without clamp-connection, 4-spored. Sterigmata 2.5–3 μ long. Spores 3.5–4.5 \times 1.5–2 μ , ellipsoid, adaxially flattened, smooth, colourless, with 1–2 guttules, not amyloid, with oblique apiculus. Gloeocystidia 2.7–4.5 μ wide, projecting but little beyond the basidia, thin-walled to thick-walled, not encrusted, sometimes not developed.

COLLECTIONS EXAMINED AND REPORTED:

WEST PAKISTAN

Swat: Sharhan, 24 Aug. 1959, *S. Ahmad*, on decayed log (L).

SIKKIM

Darjeeling, date and collector unknown, type of *Hydnum gilvum* (K).

EAST PAKISTAN

Bogra, Powta, 19 Dec. 1920, collector unknown, on dead fallen mango tree (Lloyd Mycol. Coll. 26554, BPI).

JAPAN

Hokkaido: Prov. Ishikari, Sapporo, Sept. 1919, *T. Hemmi* (Lloyd Mycol. Coll. 55565, BPI).

Honshu: Prov. Kozuke, 10 June 1915, *A. Yasuda 366* (Lloyd Mycol. Coll. 4861, BPI); 12 Dec. 1916, *A. Yasuda 451* (Lloyd Mycol. Coll. 23128, BPI); 20 Nov. 1917, *A. Yasuda 495*, on *Pinus densiflora* (Lloyd Mycol. Coll. 26571, BPI); Mt. Akagi, 24 April 1916, *A. Yasuda 374* (Lloyd Mycol. Coll. 26572, BPI).

THAILAND

[? Ban Um] Maow, 5 Dec. 1957, *R. Heim*, on charred tree trunk, type of *Hydnum salmoneum* (PC).

PHILIPPINES

Basilan Island: Isabella, Nov.-Dec. 1919, *H. S. Yates* (Lloyd Mycol. Coll. 36219, BPI).

Luzon: Laguna Prov., Mt. Maquiling, 23-28 Feb. 1912, *P. W. Graff*, type of *Hydnum deceptivum* (Lloyd Mycol. Coll. 4858, BPI).

MALAY PENINSULA

Johore: Mawai, 2 Sept. 1934, *E. J. H. Corner* (L).

Pahang: Fraser's Hill, 16-30 Sept. 1922, *I. H. Burkill & R. E. Holttum*, Singapore Field No. 8837, on dead wood (Lloyd Mycol. Coll. 45867, BPI); Tembeling, 7 Nov. 1930, *E. J. H. Corner*, Singapore Field No. 24162 (L); 17 Nov. 1930, *E. J. H. Corner*, Singapore Field No. 24184 (L); Sungei Cheka, 12 June 1931, *E. J. H. Corner* (L).

Singapore: Singapore, Botanic Gardens, 1 Feb. 1913, *E. M. Burkill*, type of *Hydnum duriusculum* (Lloyd Mycol. Coll. 4923, BPI); 1 Sept. 1913, *E. M. Burkill 88* (K, L); 4 July 1920, *T. F. Chipp*, Singapore Field No. 5836, type of *Hydnum singaporense* (Lloyd Mycol. Coll. 4864, BPI); March 1931, *E. J. H. Corner* (in liquid, L); 16 Feb. 1932, *E. J. H. Corner* (L).

JAVA

West Java: near Pasir Datar on SSW slope of Mt. Gedeh, 24 Aug. 1924, *D. F. van Slooten*, c. 1200 m alt. (BO 7214); Sukamantri near Bogor, 23 Nov. 1894, *J. G. Hallier*, on dead tree (BO 3354).

Apart from the type of *H. duriusculum* Lloyd's collections contain a second packet labelled with the same name (Lloyd Mycol. Coll. 4865). This was collected by E. M. Burkill in the "Economic Gardens" at Singapore, 15 June 1914, at the base of a living *Hevea brasiliensis*. Unfortunately, the material was treated with mercury chloride, which is the surest way of ruining a fungus and of annihilating the possibility of re-examination.

In addition to the records under the names *Hydnum deceptivum*, *H. duriusculum*, *H. singaporense*, LLOYD also listed two Japanese collections

as *Hydnum discolor*. These are *Yasuda 366* (1916, Lett. 63: 9) and *Yasuda 495* (1918, Lett. 68: 7). It is not clear why he decided on giving the specimens this name for there is a note in the packet of the second collection which reads: "I do not know that there is any real difference between this & *Hyd. pulcherrimum* . . ." This piece of information may have come to the knowledge of ITO, since this author (1955: 196), hesitatingly to be sure, placed *H. discolor* in the synonymy of the present species. The basionym of *H. discolor* Fr. is *H. agaricoides* SWARTZ (1788: 149; 1806: 1927), a name which Fries apparently considered unsuitable. The description in Swartz's second publication is the more detailed one and is notable in that, although the surface of the pileus is specifically mentioned, not a word is said of the fibrillose-strigose cover which is such a striking feature in fresh specimens. Therefore, since original material is lacking, *Hydnum discolor* is rejected as a possible earlier name for *C. pulcherrimum* unless it is proved beyond doubt that in the type locality — Jamaica — no other kind of epiphytic *Hydnum* is to be found (or has been found) that tallies with Swartz's description.

Prof. Nannfeldt kindly informed me that the material in Fries' herbarium under the name *H. discolor* has no nomenclatural value, as it was collected by an unknown North American collector and of a relatively recent date.

One of the Japanese collections belonging to the present species (*Yasuda 374*) was mentioned by LLOYD as *Hydnum helvolum*. He regarded this as conspecific with another collection (*Yasuda 340*), on which he had reported earlier (1916, Lett. 61: 6, 7). The latter, however, turns out to represent *Mycocleptonoides aitchisonii*, which see.

AHMAD (1969: 40) recorded *C. pulcherrimum* from the Kaghan Valley, West Pakistan, but listed *C. septentrionalis* as a synonym. This raises the question to what species his collection actually refers, a question that cannot be answered without examination of the material.

The material of *Climacodon pulcherrimum* from Tembeling (Singapore Field No. 24184), which happened to be examined first because it looked more promising than the others, proved somewhat anomalous. First, the hyphae of the pileus develop clamps very close to the margin, a phenomenon that, to a lesser extent, was also noted to occur in the type of *Hydnum salmoneum* R. Heim (MAAS GEESTERANUS, 1967b: 68). Secondly, ramification is often irregular in that the main branch after developing a side-branch often fails to produce a septum (indicated in the figure by the letter a). Thirdly, secondary septa are unusually frequent (indicated in the figure by the letter b). Fourthly, gloeocystidia are lacking altogether. Instead, there are, near the tip of the spines, hyphae with dense oleaginous contents, which might be called oleiferous hyphae.

A collection like the one discussed above is likely to be called "deviating from the normal," but I have since seen so many minor deviations of one kind or another that it is their sum total that eventually opened my mind for the acceptance of a broader species concept. This in turn led me to

abandon the gloeocystidia as a differential character. Instead, *Climacodon pulcherrimus* can be recognized by (i) the regular occurrence of two to three clamps per septum in the widest hyphae, (ii) the abundance of oily matter in the hyphae of the younger parts, and (iii) the pinkish to rufous discoloration of the context in a KOH solution, which is manifest even in dried material.

An interesting observation was made by Burkill & Holttum who found that the original colour of their specimen collected at Fraser's Hill was "bright tomato red." They further supplied the information that the substratum was "dead wood." The third important fact in connection with this specimen is the presence of sharp-edged grains of quartz sand, some of which are deeply embedded in the tissue of the fungus. From this it would seem not too bold to assume that the specimen grew from the side of a log which had been lifted by the rising waters of a river in spate and rolled over, whereupon the specimen was detected by Burkill & Holttum. Perhaps it is admissible further to assume that the fungus had responded to the anomalous conditions by a chemical change (oxidation or decomposition?) of its oleaginous contents, resulting in a reddening of the entire basidiome. If this is what really happened, then perhaps the bright orange colour of *Hydnum salmoneum* may also be explained as the response to an abnormal condition. It may be recalled that Heim found his fungus on a charred tree trunk.

As regards the development of the basidiome, Prof. Corner's notes on the subject are here reproduced in full:

"In 1931 I studied the development of eight fruit-bodies which came up on a log that I kept in the 'fungarium' in the Singapore Botanic Gardens. Growth was very rapid for a fungus with little inflation of the hyphae. For measurements I took the radius of the fruit-body (that is its length from insertion to the margin of the pileus) and the width of the pileus.

Fruit-bodies begin as a strigoso-spicular knob with descending growth. The hymenium begins to form over the centre of the descending apex which then spreads peripherally on the free side, away from the substratum, and becomes more or less horizontal.

At about 48 hours age, the rate of marginal growth, measured radially, is 6-8 mm in 24 hours. It may increase in the next 48 hours to 10 mm in 24 hours, which was the maximum that I observed. It then declines till the fruit-body is fully grown in 10-17 days. The rate of increase in width of the fruit-body is about 1.5-2 times as great from the third to the fifth day, after which it declines rather more rapidly.

The total life of the fruit-body from inception to death was about 17 days for fruit-bodies 42 × 62 mm (radius × width) and up to 27 days for larger fruit-bodies (57 × 100 mm to 100 × 125 mm). Sporing began when the first spines appeared at about 48 hours old. During the last 4-6 days the white or cream colour of the fruit-body changed to pale fawn tan.

The fruit-bodies do not develop sporadically but in regular crops which follow heavy rain after a fairly dry spell. Four crops came up on the logs during the year Feb. 1931 to Feb. 1932. *Fomes levigatus* Corner grew on the same logs, and their fruit-bodies grew intermixed, often in very close

proximity. Those of the *Hydnum* were not eaten by snails or beetles or by the white termites that eventually devoured the logs."

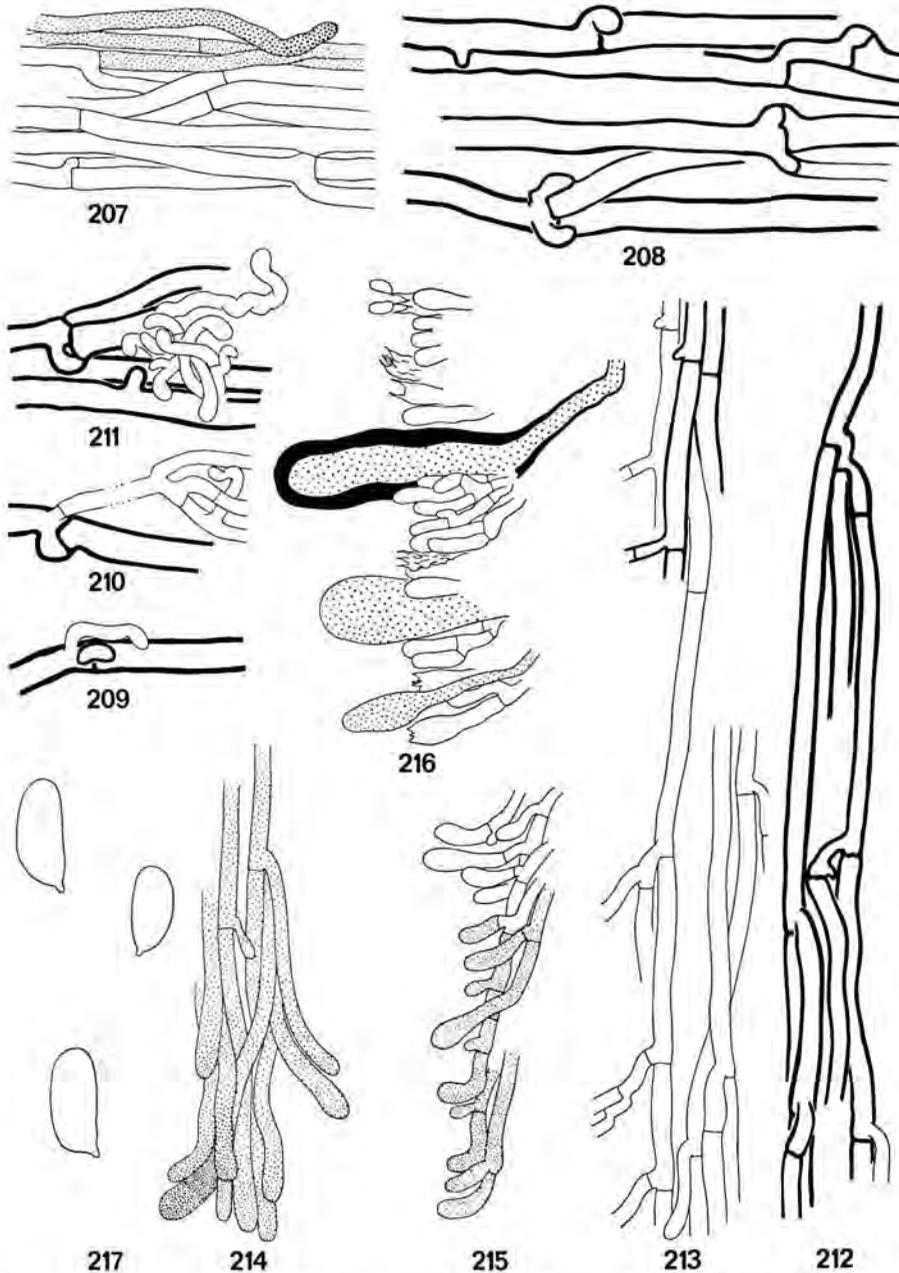
"HYDNUM" ROSEO-MACULATUM P. Henn. & E. Nym. apud P. Henn.

Figs. 207-217

Hydnum roseo-maculatum P. Henn. & E. Nym. apud P. Henn. in Warburg, *Monsunia* 1: 10. "1900" [1899]. — TYPE LOCALITY: JAVA, Bogor, Botanical Garden.

Basidiome effused-reflexed or with sessile pileus, rarely stipitate. Pileus up to 45 mm radius and up to 65 mm wide overall (fresh), flabelliform with a narrowed base, radiately fibrillose, with the fibrils frequently united to form raised veins, especially near the margin, villose to hirsute towards the base (or the stipe), rarely covered with scattered spines or more or less extensive tufts of spines, more or less distinctly concentrically zoned by alternating darker and lighter areas, faintly shiny in places, wholly bright rose pink to deep carmine when fresh, the margin and spine-tips at first more richly coloured, with age fading to brownish pallid or ochraceous, drying pale dingy yellow-brown, sometimes suffused with a pinkish or reddish tint. Margin thick at first, becoming lacerate-dentate or running out into deflexed spines. Stipe (once observed) up to 20 × 8 mm (fresh), lateral, villose, becoming matted, concolorous with the pileus. Spines up to 10 mm long, 0.5 mm wide, decurrent, moderately crowded, simple and subulate or connate, or flattened and irpicoid to branched, and then up to 1.5 mm wide, often of unequal length, not infrequently arranged in rows and interconnected by low ridges, deeply coloured at first, fading to pale pink to yellowish flesh colour, drying brownish. Context of the pileus 3-8 mm thick at the base, firm, fibrillose, homogeneous, whitish to paler concolorous and watery-zoned when fresh, yellowish to pale yellowish brown when dry. Smell and taste unknown.

Context of the pileus monomitic, consisting of generative and tendrill hyphae. Generative hyphae 3.6-5.4 μ wide at the extreme margin of the pileus, up to 10.7 μ wide farther back, not inflating, thin-walled to fairly thick-walled (cell-walls up to 2 μ), branched, occasionally anastomosing, septate, with clamp-connections only appearing at some distance from the margin of the pileus, with oil-like contents. Hyphae in the lower part of the context strictly radiately aligned, firmly adherent, difficult to separate, those near the upper surface more loosely arranged, with side-branches which grow out into dense hyphal knots, eventually to develop into intricately interwoven tendrill hyphae. Context of the spines monomitic, made up of generative hyphae, 2.7-6.3 μ wide, moderately thick-walled in the axis, thin-walled towards the sides, branched, septate, without clamp-connections, filled with oily matter near their tips. Hymenium somewhat thickening. Basidia 18-21 × 4.5-5.5 μ , clavate, without basal clamp, 4-spored, with sterigmata 3.6-4.5 μ long. Spores 4.3-5.7 × 2-2.7 μ , ellipsoid, adaxially flattened, smooth, colourless, not amyloid, with oblique apiculus. Gloeocystidia up to 80 μ long and 5-20 μ wide, projecting up to 40 μ beyond the hymenium, occurring halfway between the tip and the base of the spines, sparse, subcylindric to clavate, usually thin-walled but occasionally very thick-walled (cell-walls up to 3.5 μ thick), with broadly rounded apex, smooth or with a thin cover of crystalline matter disappearing in KOH, with contents that are granular when fresh, more oil-like when dried and subsequently treated with KOH, not stained in sulpho-anisaldehyde.



Figs. 207-217. "*Hydnum*" *roseo-maculatum* (Borneo, Corner, RSNB 5229). - 207. Generative hyphae of the upper surface of the pileus close to the margin. - 208. Generative hyphae farther back from the margin. - 209-211. Tendril hyphae in various stages of development. - 212. Generative hyphae in the axis of a spine. - 213. Generative hyphae bordering the subhymenium. - 214. Oil-filled generative hyphae at the tip of a spine. - 215. Detail of a spine with incipient basidia. - 216. Detail of the hymenium. - 217. Spores. (Figs. 207-216, $\times 700$; Fig. 217, $\times 2800$.)

Colour of the basidiome caused by the pink cytoplasm of the hyphae including the basidia.

COLLECTIONS EXAMINED:

BORNEO

Sabah: Mt. Kinabalu, Pinosuk Plateau, 26 Aug. 1961, *E. J. H. Corner*, *RSNB 1966*, 1500 m alt. (also in liquid, L); 5 Feb. 1964, *E. J. H. Corner*, *RSNB 5118a*, 1500 m alt. (also in liquid, L); 10 March 1964, *E. J. H. Corner*, *RSNB 5811*, 1600 m alt. (also in liquid, L); 4 April 1964, *E. J. H. Corner*, *RSNB 5118b*, 1700 m alt. (also in liquid, L); 14 April 1964, *E. J. H. Corner*, *RSNB 5118c*, 1600 m alt. (L); Mt. Kinabalu, Mesilau River, 5 Feb. 1964, *E. J. H. Corner*, *RSNB 5229*, in humus in the forest, 1600 m alt. (also in liquid, L).

JAVA

West Java: Mt. Gedeh complex, Tjibodas, Nov. 1923, *M. L. A. Bruggeman* (BO 5570); 27 March 1936, *W. J. Lütjeharms 2409* (L); 7 April 1936, *W. J. Lütjeharms* (L); jungle trail between Tjibodas and Tjibeureum waterfall, 9 Dec. 1961, *M. A. Rifai*, *R. Nasoetion*, *Nurta & R. P. Korf*, No. 97 (CUP); Mt. Panggerango, Puntjak Pass, 1955, *M. A. Donk 12698* (BO); Tjisarua, SE of Bogor, 18 Sept. 1938, *K. B. Boedijn 3405* (BO 16455).

Kediri: Mt. Wilis, 1938 or 1939, *M. A. Donk 9030* (Herb. Donk).

There seems to be very little chance that the type of the present species will ever be located. It has now been reported absent from BO, BR, BRLU, FH, PC, S, and UPS.

Since I first reported on this species (MAAS GEESTERANUS, 1967b: 63), I have seen several more collections which were important in that they permitted a broader view on the variability, thereby solving the problem as to where the species should be placed. It is now obvious that "*H.*" *roseo-maculatum* is a member of *Climacodon*. However, the recombination under that name still cannot be made as long as the identity of *Hydnum javanicum* Pat., also a red species and published two years earlier, is uncertain (MAAS GEESTERANUS, 1967a: 60).

"*Hydnum*" *roseo-maculatum*, once admitted in the circle of *Climacodon* species, appears extremely close to *C. sanguineus*. The gap that formerly existed between the two species now seems partly closed by Corner's collection *RSNB 5229* which stands out against all other collections of "*H.*" *roseo-maculatum* on account of its lateral stipe and the occasional occurrence of very thick-walled cystidia. For the present, however, I prefer to maintain *C. sanguineus* as an independent species.

CLIMACODON SEPTENTRIONALIS (Fr.) P. Karst. — Figs. 218–221

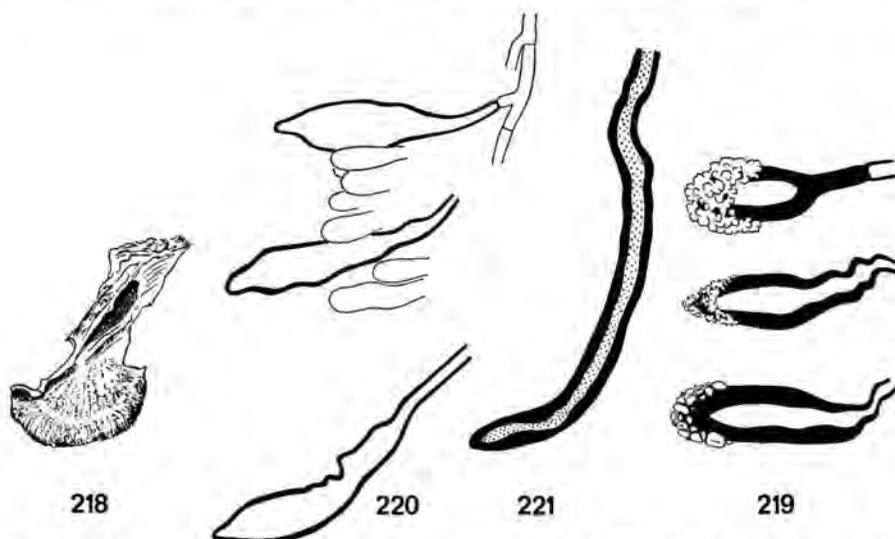
Hydnum septentrionale Fr., Syst. mycol. 1: 414. 1821; Icon. sel. Hym. 1: 10, pl. 9. 1867. — *Climacodon septentrionalis* (Fr.) P. Karst. in Revue mycol. 3 / No. 9: 20. Jan. 1, 1881 & in Meddn Soc. Fauna Fl. fenn. 6: 15. 1881. — *Steccherinum septentrionale* (Fr.) Banker in Mem. Torrey bot. Club 12: 130. 1906. — *Creolophus septentrionalis* (Fr.) Banker in Mycologia 5: 293. 1913. — TYPE SPECIMEN: non-existing. — TYPE LOCALITY: North Sweden.

? [*Hydnum* sp. P. Henn. in Bot. Jb. 31: 736. 1902. —] *Hydnum ikenoi* Sacc. apud P. A. Sacc. & D. Sacc., Syll. Fung. 17: 147. 1905 ("ikenii"). — TYPE LOCALITY: Japan, Prov. Musashi, Mt. Takao, Ikeno 91.

Of the three collections available the Japanese gathering, consisting of a single specimen, was selected for the following description.

Material consisting of a part-pileus with some of its basal portion still attached, but torn from the main body of the basidiome. Pileus about 30 mm radius, dimidiate or probably narrowed behind, horizontal, plane, with an obscure concentric zone near the margin, pitted-strigose to reticulately hirsute, the junctions of the reticulum formed by strongly prominent, tubercle-like bunches of agglutinated hairs, ochraceous yellow; margin strongly involute. Spines 4–5 mm long, decurrent, crowded, subulate, smooth, whitish, the tips brownish flesh colour and often whitish-fimbriate. Context up to about 10 mm thick towards the base of the pileus, stringy, tough and rigid, obscurely zoned, whitish, remaining unchanged in dilute KOH. Taste and smell, no information.

Context (difficult to examine as its elements withstand every attempt at disentanglement) apparently monomitic, consisting of generative hyphae and numerous connecting or "bridge" hyphae (TEIXEIRA, 1961:38). Generative hyphae 3–7 μ wide, not inflating, branched, frequently anastomosing, septate, thin- to moderately thick-walled at the margin, and there without clamp-connections, thick-walled to solid and with clamps farther back, all containing some oleaginous matter which with increasing distance from the margin becomes progressively less apparent. Context of the spines similar, but with fewer hyphae as wide as those in the pileus. Basidia all immature, clavate, without clamp-connection. Spores not seen. Cystidia 36–45 \times 9–12 μ , comparatively scarce, lacking in the apical portion of the



Figs. 218–221. *Climacodon septentrionalis* (Japan, Lloyd Mycol. Coll. 55565). — 218, Habit sketch of a single pileus. — 219, Typical, thick-walled, encrusted cystidia from the basal part of a spine. — 220, Thinner-walled cystidia from near the tip of a spine. — 221, Thick-walled oil-filled structure intermediate between gloecystidium and thick-walled generative hypha. (Fig. 218, $\times \frac{1}{2}$; Figs. 219–221, all taken from the same spine, $\times 700$.)

spine, in general originating subhymenially (but see remarks), fusiform and with pointed tip, moderately thick-walled and with a long stalk nearer the tip of the spine, very thick-walled and with a short stalk farther back, and usually with a conspicuously encrusted tip, the excreted matter remaining unaltered in alkaline solution. Tip of the spines made up entirely of generative hyphae, the oily contents of which do not stain in sulphoanisealdehyde.

COLLECTIONS EXAMINED AND REPORTED:

CHINA

Reported from several provinces (TENG, 1964:432).

JAPAN

Hokkaido: Prov. Ishikari, Sapporo, Sept. 1919, *T. Hemmi* (Lloyd Mycol. Coll. 55565, BPI).

Reported by KAWAMURA (1954:614, fig. 611) and ITO (1955:195).

PHILIPPINES

Luzon: Sorsogon Prov., Gubat, Bo. Villa, 13 June 1964, *B. Reyes* (PNH 94261).

MALAY PENINSULA

Singapore: Singapore, Botanic Gardens, 14 May 1920, *Kiah*, Singapore Field No. 5711 (Lloyd Mycol. Coll. 57335, BPI).

As pointed out earlier (MAAS GEESTERANUS, 1966a: 31) *Hydnum ikenoi* is almost certainly a synonym of *C. septentrionalis*. In view of the features mentioned in the original diagnosis, the identity is plausible. In any case the occurrence of the species in Japan is an established fact.

LLOYD (1920:1012), listing Hemmi's collection as *Hydnum septentrionale*, failed to recognize that one of the two specimens represents *Climacodon pulcherrimus*, which see.

The Japanese material of the present species is an illustrative example of the relative value of terms like subhymenial cystidia, tramal cystidia, gloeocystidia, to say nothing of an even narrower subdivision. Fig. 219 shows some characteristic subhymenial cystidia such as usually found in that part of the spine between its base and the middle. These cystidia are short-stalked and thick-walled with encrusted tips. Those farther towards the tip of the spine have increasingly longer stalks, are thinner-walled, and usually lack a crystalline cap (Fig. 220), but possess the same highly colourable contents as the generative hyphae, which for want of a better term are here called oleaginous. Those cystidia with very long stalks may conveniently be called gloeocystidia; surely they originate somewhere deep in the context of the spine. Occasionally, however, structures are found (Fig. 221) which appear intermediate between gloeocystidia, subhymenial cystidia, and generative hyphae. They differ from equally thick-walled generative hyphae in being somewhat wider, curving outward, and having their first septum much farther back from the apex.

A great surprise is the find of *C. septentrionalis* in the tropics: Singapore and Luzon.

Although the material from Singapore is in such poor condition as to reduce microscopic examination to almost nil, it yields the indispensable information that the (extremely scarce) cystidia are fusiform, moderately thick-walled, and encrusted at the tips. Supplementary data are found in the notes that accompany the collection: "Pileus rather brittle, white when fresh. Spores minute $3.5 \times 7 \mu$ [I found a few which were about $4.5 \times 3 \mu$ but these may have been immature], ovoid, hyaline. A big tuft in superimposed brackets on dead wood." These data combined suffice for the identification of the specimen.

The material from Luzon, consisting of several atrociously maltreated pilei, is recognizable by its numerous cystidia (fusiform, thin- and moderately thick-walled, with and without encrusted tips) and the characteristic hyphal tufts on the upper surface of the pileus. Spores were not seen.

MYCOLEPTODONOIDES Nikol.

Mycoleptonoides Nikol. in Bot. Mater. (Not. syst. Sect. cryptog. Inst. bot. Acad. Sci. URSS) 8: 117. 1952. — TYPE SPECIES: *Mycoleptonoides vassiljevae* Nikol.

Basidiome complex, made up of imbricate pilei. Pileus fan-shaped, narrowed into a lateral base, glabrous, innate-fibrillose, without concentric zonation, smooth or radiately rugulose, white drying yellow to brown. Hymenium covering spines on the underside of the pileus, concolorous with the pileus. Context pliable when fresh, drying tough to rigid, homogeneous, not zoned, pallid, monomitic, consisting of generative and connecting hyphae. Generative hyphae inflating in the older parts of the pileus, branched, septate, thin- to thick-walled or even solid, with clamp-connections. Basidia clavate, 4-spored, with basal clamp. Spores narrowly ellipsoid, more or less curved, smooth, colourless, neither amyloid nor cyanophilous. Gloeocystidia lacking, the oil-filled terminal ends of generative hyphae taking their place.

Lignicolous.

KEY TO THE SPECIES

1. Hyphae of the context up to 15μ wide, moderately tortuous. Spores $5.4-6.5 \mu$ long *M. aitchisonii*
1. Hyphae of the context up to 30μ wide in places, excessively tortuous. Spores $4-5 \mu$ long (unrecorded from the area under discussion, not treated here) *M. vassiljevae* Nikol.

MYCOLEPTODONOIDES AITCHISONII (Berk.) Maas G.

Hydnum aitchisonii Berk. in Grevillea 4: 137. 1876. — *Mycoleptonoides aitchisonii* (Berk.) Maas G. in Persoonia 1: 411, figs. 1-10. 1961. — TYPE: "*Hydnum Aitchisonii* Berk." (K).

Hydnum tapeinum Massée in Bull. misc. Inf., Kew 171. "1899" [1901] ("*tapienum*"). — TYPE: "*Hydnum tapeinum* Mass. / Malay Peninsula / State of Selangor / Aug. 1897 / 75 / H. N. R[idley]" (K).

Hydnum cucullatum Har. & Pat. in Bull. Mus. Hist. nat. 8: 130. 1902. — TYPE: "*Hydnum cucullatum* Pat. & Har. / Japon" (FH).

?? *Hydnum pergamenium* Yasuda in Bot. Mag., Tokyo 33: (75). 1919 (Japanese text). — *Steccherinum pergamenium* (Yasuda) S. Ito, Mycol. Fl. Japan 2(4): 197. 1955. — *Creolophus pergameneus* (Yasuda) Imazeki apud Imazeki & Hongo, Col. Ill. Fungi Japan 2: 129, pl. 41 fig. 250. 1965. — *Mycoleptonoides pergamenea* (Yasuda) Aoshima & Furukawa in Trans. mycol. Soc. Japan 7: 140. 1966. — ISOTYPE: "No. 203,151 / *Hydnum pergamenium* Yasuda / Japan, Gunma Pref., Mt. Agaki, May 12, 1918, leg. K. Tsunoda" (TNS).

Creolophus spathulatus Imazeki apud Imazeki & Hongo, Col. Ill. Fungi Japan 135. pl. 63 fig. 361. 1957 (not validly published, lacking Latin description). — ISOTYPE: "No. 5298 / *Creolophus spathulatus* Imaz. / Japan, Pref. Yamanashi, Mt. Fuji, Oct. 21, 1956, on dead trunk of *Fagus crenata*, ca. 1500 m alt., Imazeki, R." (L).

Basidiome complex, consisting of imbricate pilei, which may arise from an extensive effused base. Pileus up to 60 mm long and 65 mm wide, fan-shaped, convex, depressed towards the place of attachment, glabrous, finely innate-fibrillose and minutely radiately rugulose, not concentrically zoned, clean or holding dirt and grains of sand, fissured near the margin, dull or faintly shiny, stated to be white when fresh, drying ochraceous yellow-brown (between Yellow Ocher and Buckthorn Brown), locally streaked with deeper colours or becoming fulvous to reddish brown, particularly towards the margin (Ochraceous Tawny to nearly Cinnamon-Brown); margin involute, lacinate or running out into flattened spines. Stipe if present probably only representing the narrowed part of the pileus with which the latter is attached to the effused base. Spines up to 7 mm long, decurrent, crowded, subulate to flattened, dried horny and reddish brown. Context up to 4 mm thick in the base of the pileus, firm, fibrous, homogeneous, not zoned, pale yellow-brown, not staining in KOH solution, non-amyloid. Odour and taste none.

Context of the pileus monomitic, made up of generative hyphae. Generative hyphae 3.6–14.5 μ wide, inflating in the older parts of the pileus, frequently branched, septate, with clamp-connections at the septa, thin-walled to thick-walled or partly even solid, the side-branches often forming intricate knots. Context of the spines similarly made up of clamped generative hyphae, those in the core being thick-walled to solid, those towards the sides thin-walled and, towards the tip of the spines, increasingly filled with oily matter. Basidia (possibly only seen immature) 20–24 \times 3.5–6 μ , with a clamp-connection at the base, with 4 sterigmata up to 3 μ long. Spores 5.4–6.3 \times 1.9–2.7 μ , narrowly ellipsoid, tapering towards the base, more or less curved, smooth, colourless, with oblique apiculus, non-amyloid. Gloeocystidia-like elements up to 5 μ wide, thin-walled, numerous near the tips of the spines, representing the terminal ends of the generative hyphae, the contents of which do not stain in sulpho-anisaldehyde.

COLLECTIONS EXAMINED AND REPORTED:

KASHMIR

Gulmarg, Sept. 1875, J. E. T. Aitchison, type of *Hydnum aitchisonii* (K).

CHINA

Kiangsu: Spirit Valley, E. of Nanking, 6 April 1922, A. N. Steward II, on bark and decaying wood of *Quercus* (Lloyd Mycol. Coll. 26547, BPI).

JAPAN

Hokkaido: Prov. Iburi, Tomukomai, 17 Oct. 1904, *K. Miyabe 830*, on *Acer palmatum* (Lloyd Mycol. Coll. 26564, BPI).

Honshu: Prov. Kozuke, Mt. Akagi, 28 Sept. 1915, *A. Yasuda 340* (Lloyd Mycol. Coll. 26572, BPI). Tochigi Pref., Nikko Nat. Park, West end of Lake Chuzenji, 5 Oct. 1957, *S. Imai, R. P. Korf & al. 45* (CUP). Yamanashi Pref., Mt. Fuji, 21 Oct. 1956, *R. Imazeki*, on *Fagus crenata*, c. 1500 m alt., isotype of *Creolophus spathulatus* (L); also reported without specification of locality (IMAZEKI & HONGO, 1968:135).

"Chuizuipei [?], Sept. 1898, ad truncos," type of *Hydnum cucullatum* (FH).

MALAY PENINSULA

Selangor: locality not specified, Aug. 1897, *H. N. Ridley*, type of *Hydnum tapeinum* (K).

LLOYD recorded the collection from Mt. Akagi as *Hydnum helvolum* (1916, Lett. 61: 6, 7). The packet contains another specimen, labelled *Yasuda 374*. Probably it is this specimen on which LLOYD reported some time later (1916, Lett. 63: 9), also as *H. helvolum*. The colours are similar and the two collections come from the same locality, but *Yasuda 374* represents a different species—*Climacodon pulcherrimus*. LLOYD (1922: 1126) also listed the material from Tomukomai (Hokkaido)—again as *H. helvolum*. An altogether different name—*Hydnum decurrens*—was given to the collection from China (LLOYD, 1922: 1162), but this identification is equally wrong.

Continued search for a fungus that would fit the description of *Hydnum cucullatum* and a broader experience with *M. aitchisonii* combined to open my eyes for the identity of both species. Correlation of Hariot & Patouillard's original account with my own redescription (MAAS GEESTERANUS, 1967a: 53) satisfies me that there is no obstacle to the reduction of *H. cucullatum* to the synonymy of the present species.

In a former paper (MAAS GEESTERANUS, 1967b: 62) I came to the conclusion that *Hydnum pergamenium* Yasuda should be considered identical with the present species. The conclusion was based on (i) the study of an isotype that "seems to have been singularly maltreated" and lacked practically every microscopic detail, (ii) LLOYD's (1919: 878) description of a collection sent him by Yasuda, and (iii) Imazeki's opinion (IMAZEKI & HONGO, 1965: 129), according to which *H. pergamenium* and *Creolophus spathulatus* are synonymous.

Now that I have seen the material of *H. pergamenium* sent to Lloyd (Lloyd Mycol. Coll. 4867), which incidentally is not an isotype, having been collected by Yasuda himself and in a different locality, I very much doubt the correctness of my conclusion. The material seems well dried and certainly does not show any signs of ill-treatment, and yet it has exactly the same lack of microscopic detail, the one outstanding feature being a few branched and tortuous massive hyphae in the context of the pileus.

Hydnum pergameneum is here still being maintained in the synonymy, but the question marks indicate that I would rather prefer to see the name placed somewhere else, possibly in some heterobasidiomycetous group.

MYCORRHAPHIUM Maas G.

Mycorrhaphium Maas G. in *Persoonia* 2: 394. 1962. — TYPE SPECIES: *Hydnum adustum* Schw.

Basidiome simple or complex. Pileus laterally to centrally stipitate, more or less clearly marked by concentric zones and grooves, smooth to uneven, velutinous when young, glabrescent, white to buff when fresh. Stipe simple to connate, velutinous at first, concolorous with the pileus or darker. Hymenium covering spines on the underside of the pileus, concolorous with the pileus when fresh, drying brownish flesh colour. Context of the pileus tough, weakly duplex to homogeneous, more or less zoned, somewhat spongy to fibrous, white, monomitic, consisting of generative and tendrill hyphae. Generative hyphae little or not inflating, branched, anastomosing, septate, thin-walled to solid, with or without clamp-connections (clamp-less forms not known to occur in the area). Context of the spines dimitic with skeletal or monomitic. Basidia clavate, 4-spored, with basal clamp (in the area under discussion). Spores cylindrical to broadly ellipsoid, smooth, colourless, neither amyloid nor cyanophilous. Gloeocystidia absent or numerous, in the latter case cylindrical to fusiform, thin-walled, glabrous.

Lignicolous.

KEY TO THE SPECIES

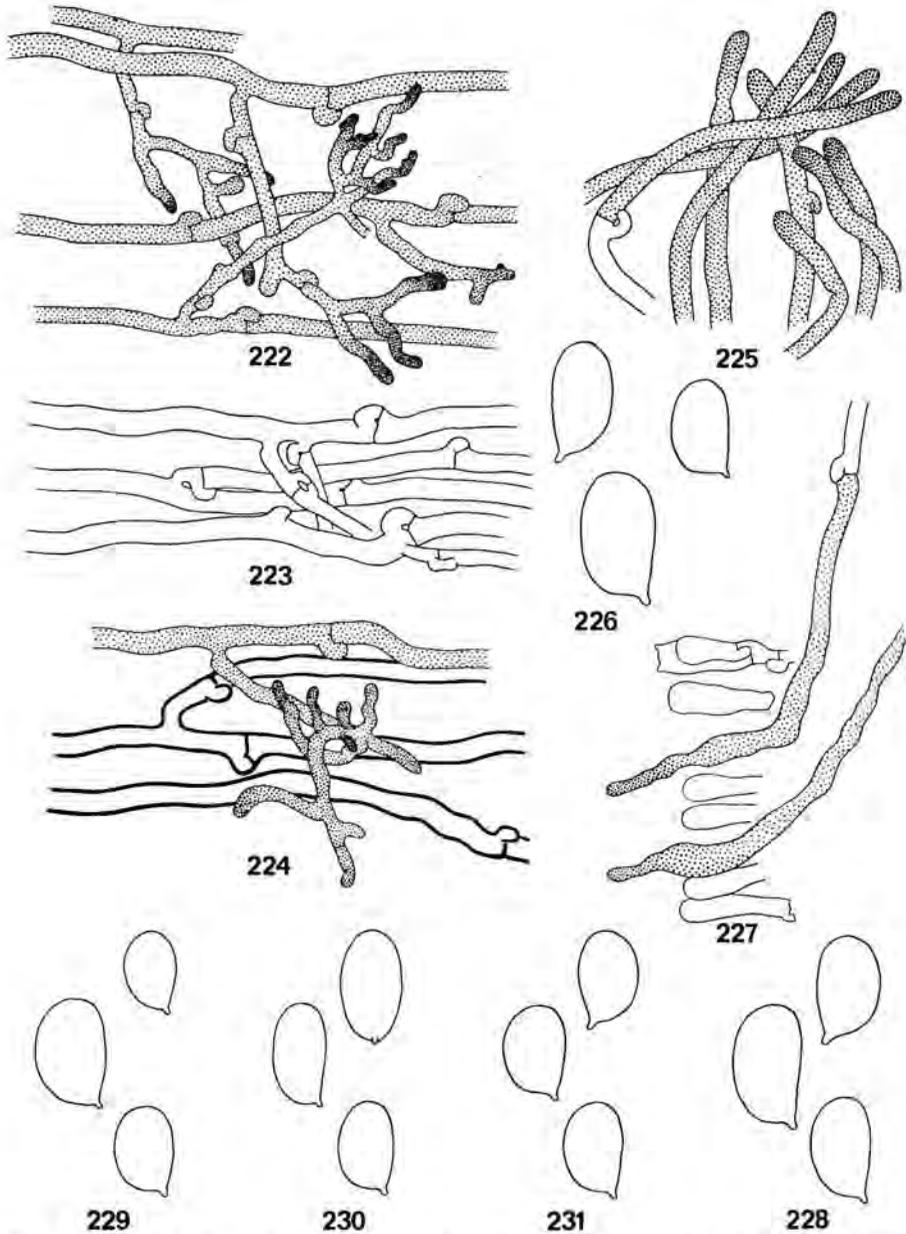
1. Spores broadly ellipsoid *M. stereoides*
 1. Spores cylindrical *M. species 1*

Mycorrhaphium stereoides (Cooke) Maas G., *comb. nov.* — Figs. 222–239

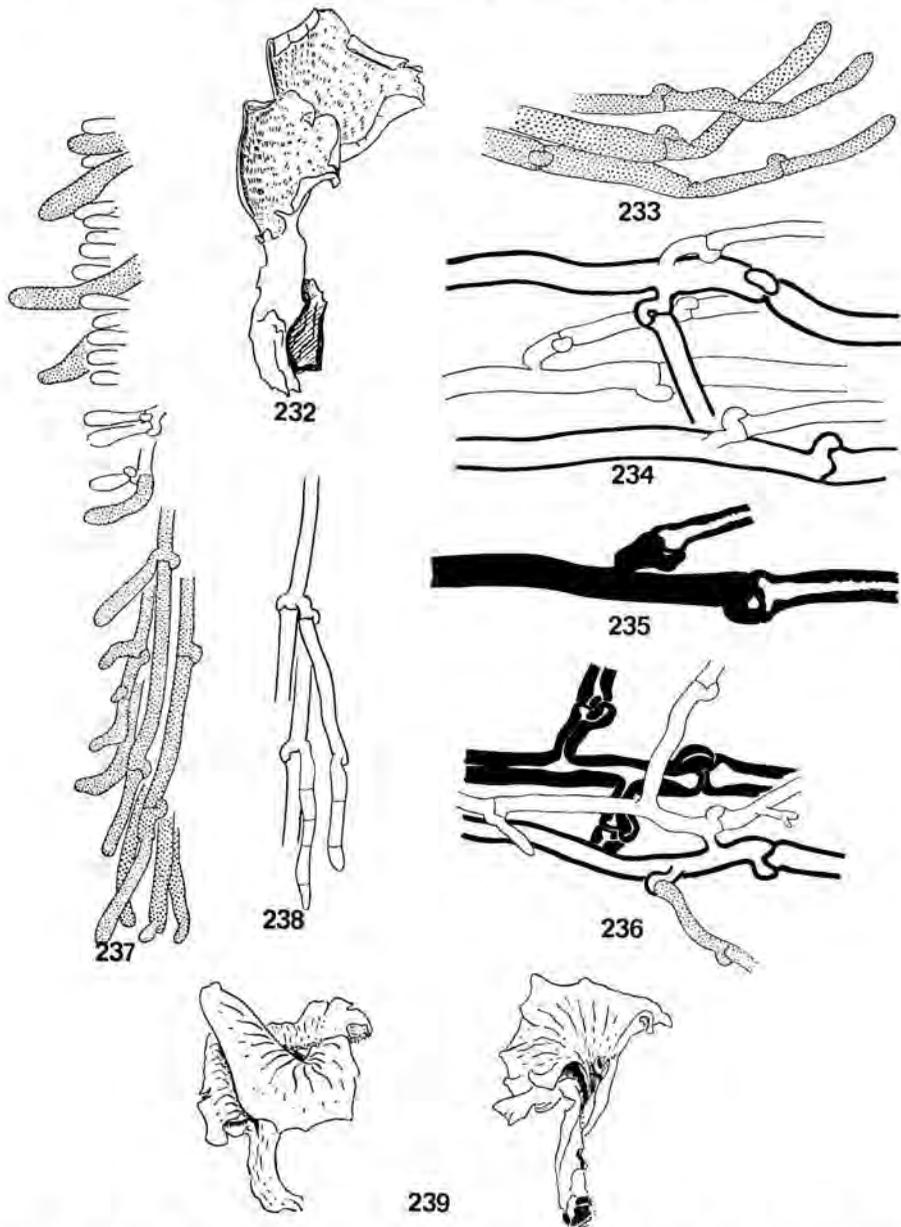
Hydnum stereoides Cooke in *Grevillea* 20: 90. 1892. — TYPE: "No. 1660 / [*Stereum* crossed out] *Hydnum stereoides* / [Malaya, Perak] Gunong Batu Puteh / 1891 / L. Wray Jr." (K).

Hydnum insulare Pat. in *Leafl. Philipp. Bot.* 6: 2251. 1914. — *Mycorrhaphium insulare* (Pat.) Maas G. in *Proc. K. Ned. Akad. Wet. (Ser. C)* 70: 55. 1967. — TYPE: "[Baker] 1567 / *Hydnum insulare* Pat. / On dead *Tamarindus indicus* / Los Banos, P. I. Aug. 5 [19]13 / Evaristo" (FH); ISOTYPE (Lloyd Mycol. Coll. 26574, BPI).

Basidiome simple or compound and consisting of several pilei inserted imbricately on the stipe, the largest uppermost. Pileus up to 25 cm across, almost circular to flabelliform, sometimes deeply lobed with cuneate segments, plano-convex to wavy, more or less depressed over the insertion of the stipe or colliculose, smooth or uneven or, in thin-fleshed specimens, more or less concentrically zoned and shallowly grooved, pubescent to minutely velvety at the margin, felted farther back, glabrescent in places or in concentric areas with growing age and after being handled; chalk white when fresh and young, becoming light buff or Tawny (Ridgway) to Russet (R) when drying in the field, becoming cream to pale dingy ochraceous in the herbarium, bruised spots and glabrous places discoloured a rich ochraceous yellow, yellowish red-brown or purplish brown; margin



Figs. 222–226. *Mycorrhaphium stereoides* (West Pakistan, Ahmad 19880). – 222. Generative hyphae close to the margin of the pileus, all filled with oily matter, and showing ramified side-branches: tendril hyphae. – 223. Hyphae from the lower part of the pileus, 2 mm back from the margin. – 224. Generative and tendril hyphae 15 mm back from the margin. – 225. Sagging hyphae from the upper surface of the pileus near the margin. – 226. Spores. (Figs. 222–225, $\times 700$; Fig. 226, $\times 2800$.)
 Figs. 227, 228. *Mycorrhaphium stereoides* (West Pakistan, Murree, Ahmad). – 227. Detail of spine, showing gloeocystidia and immature basidia. – 228. Spores. (Fig. 227, $\times 700$; Fig. 228, $\times 2800$.)
 Figs. 229–231. *Mycorrhaphium stereoides* (Fig. 229: West Pakistan, Ahmad 3090; Fig. 230: West Pakistan, Ahmad 9040; Fig. 231: West Pakistan, Ahmad 15733). – Spores ($\times 2800$).



Figs. 232–238. *Mycorrhapium stereoides* (Malay Peninsula, Pahang, *Corner*). – 232. Habit sketch of two imbricate pilei (seen from the underside) inserted obliquely on a stipe-like base. – 233. Oil-filled generative hyphae close behind the margin of the pileus. – 234. Hyphae 4 mm back from the margin. – 235. Partially solid generative hypha. – 236. One of the simpler examples of a hyphal knot. – 237. Detail of a spine, showing oleiferous generative hyphae, incipient basidia, and gloeocystidia. – 238. Empty cystidia-like side-branches from the apical part of a spine. (Fig. 232, $\times \frac{1}{2}$; all others, $\times 700$.)

Fig. 239. *Mycorrhapium stereoides* (Samoa, Lloyd Mycol. Coll. 58929). – Habit sketch of two basidiomes ($\times \frac{1}{2}$).

at first somewhat drooping to involute, becoming straight to more or less turned upward, thick and entire or thin and easily torn. Stipe 30–80 × 10–40 mm, more or less central or excentric to lateral, simple or connate or several springing from a common base, straight or crooked or variously contorted, often ventricose, at first velvety then felted, tomentum eventually turning into a glabrous surface, originally chalk white, then turning dingy ochraceous to brownish. Spines up to 10 mm long, little or not decurrent, crowded, often several connate, subulate or flattened, very slender, 0.2–0.4 mm wide, rigid, finely fimbriate, concolorous with the pileus when fresh, dingy yellowish to brownish flesh colour when dry, with acute undivided tip. Context of the pileus up to 20 mm thick, weakly duplex to practically homogeneous, somewhat spongy to fibrous, cheesy-coriaceous when fresh, friable when dry, faintly to distinctly zoned, white or Light Ochraceous Buff (R), the lower and firmer layers drying more brownish than the upper layers. Smell and taste not noted.

Context of the pileus monomitic, consisting of generative and tendril hyphae. Generative hyphae 2.7–9 μ wide, little or not inflating, thin-walled to moderately thick-walled, occasionally even solid, branched, sometimes anastomosing, septate, with clamp-connections at all septa, near their tips all filled with oily matter, gradually becoming empty farther back. The hyphae on the upper surface of the pileus sagging with age, thus enclosing minute air pockets. Thick-fleshed specimens predominantly made up of tissue containing such air pockets, this tissue gradually passing into firmer layers underneath. The hyphae in these layers mainly radiately aligned, more compacted, often moderately thick-walled, and (very probably) firmly tied together by the much ramified ends of the tendril hyphae which form inextricable knots. Context of the spines similar to that of the pileus, but lacking the tendril hyphae; generative hyphae 2.5–5.4 μ wide, many of them moderately thick-walled to almost solid in the axis of the spine, those farther towards the periphery thin-walled, terminally increasingly filled with oily matter, there being a gradual transition from generative hyphae to gloecystidia. Basidia (seen only immature) 18–26 × 5–7 μ , clavate, with clamp-connection at the base, 4-spored. Sterigmata about 3.6 μ long. Spores (4–)4.5–5.8(–6.3) × (2.5–)2.7–3.8 μ , broadly ellipsoid, adaxially flattened, smooth, colourless, not amyloid, with oblique apiculus. Gloecystidia 3–6.5 μ wide, numerous, usually thin-walled, the terminal part cylindrical or fusiform with obtuse apex, projecting beyond the hymenium, their oily contents gradually staining dingy vinaceous in sulpho-anisaldehyde.

COLLECTIONS EXAMINED:

WEST PAKISTAN

Lahore: Changa Manga forest, 29 Oct. 1950, *S. Ahmad* 3090, on the ground (L, LAH); 24 March 1951, *S. Ahmad* 9040 (K, LAH); 19 Oct. 1958, *S. Ahmad* 14271, on stump of *Morus alba* (L, LAH); 17 Sept. 1962, *S. Ahmad* 15733, on the ground (L, LAH); 21 Aug. 1966, *S. Ahmad* 19880, on the ground (L, LAH); Murree, 19 Aug. 1964, *S. Ahmad*, on *Dalbergia sissoo* (LAH).

INDIA

Uttar Pradesh: Dehra Dun, date and collector unknown, on *Shorea robusta*, 2000 ft alt. (L); Dehra Dun, Thajra range, date and collector unknown, on dead stump of *Mallotus philippinensis*, 2200 ft alt. (K).

PHILIPPINES

Luzon: Laguna, Los Baños, 5 Aug. 1913, *Evaristo*, [*Baker*] 1567, on dead *Tamarindus indicus*, type of *Hydnum insulare* (FH) and isotype (Lloyd Mycol. Coll. 26574, BPI). Camarines Sur, Mt. Isarog, 26 Sept. 1959, *R. Alagar* (PNH 41096).

Palawan: locality not specified, Aug. 1913, *L. Escritor*, No. 21590 (Lloyd Mycol. Coll. 16732, BPI).

MALAY PENINSULA

Pahang: Tembeling, 18 Nov. 1930, *E. J. H. Corner*, Singapore Field No. 24190 (also in liquid, L).

Perak: Gunong Batu Puteh, 1891, *L. Wray Jr.*, type of *Hydnum stereoides* (K).

Singapore: Singapore, Botanic Gardens, 10 Aug. 1920, *J. M. Chipp*, No. 6028, on the ground (K; Lloyd Mycol. Coll. 39448, BPI).

SAMOA ISLANDS

Locality not specified, 1904-1905, *C. G. Lloyd* (Lloyd Mycol. Coll. 58929, BPI).

The above description incorporates among others the collections sent from West Pakistan by Dr. S. Ahmad. This material has greatly extended my knowledge of the species.

Most of the Pakistan specimens differ from the type of *H. insulare* in the larger dimensions of the basidiome as a whole, the longer spines, the often weakly developed duplex nature of the context, the somewhat larger spores, and the more pronounced ramification of the tendril hyphae. It should be realized, however, that several of these differences are attributable to the inadequacy of the type specimen. This, it may be recalled here, consists of two pileus segments crudely severed from their support, and that may have led Patouillard to regard the fungus as sessile. The shortness of the spines and the paucity of spores strongly suggest that either the two segments represent immature portions of the basidiome or the latter as a whole was still immature when collected. This, then, would also explain the thinness of the context and the smaller size of the spores of the type.

The type of *Hydnum stereoides*, redescribed previously (MAAS GEESTERANUS, 1964b: 179), but then long considered of uncertain affinity, seems to deviate from all specimens that subsequently had passed through my hands and been called *Mycorrhaphium insulare* in the thick-walled or partly even solid gloeocystidia. Later experience with species of the genus *Climacodon* taught me the subordinate significance, taxonomically speaking, of the thickness of the cell-walls in gloeocystidia. Renewed investigation of the specimens from approximately the same area where the type of *Hydnum stereoides* had been collected revealed an intermediate form (the material of Corner, Singapore Field No. 24190 preserved in liquid) showing an occasional gloeocystidium with moderately thickened cell-walls among a majority of thin-walled ones. I have no doubt that

prolonged search will result in finding transitional forms of all kinds.

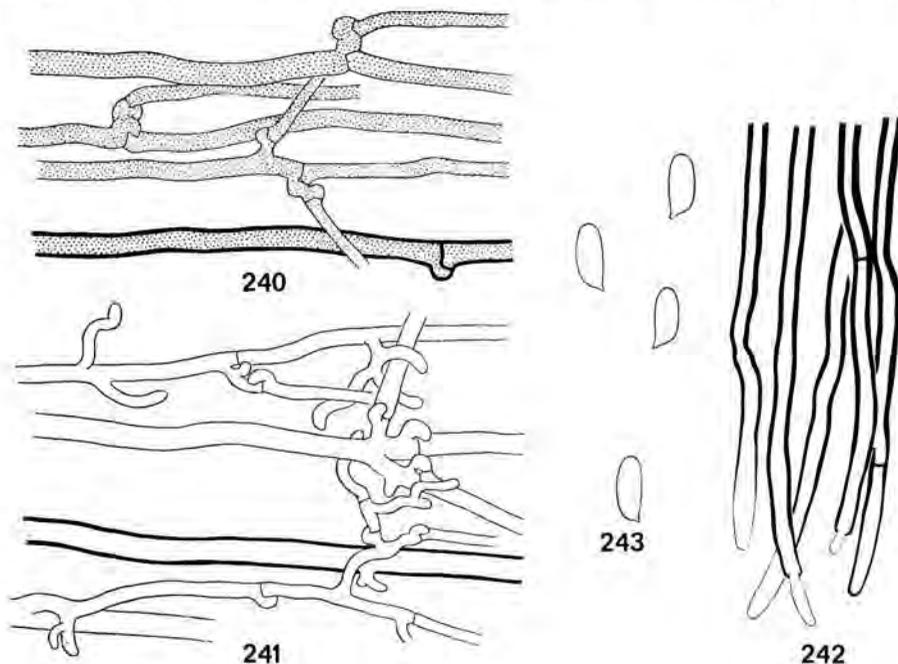
LLOYD (1924: 1296) recorded *Hydnum insulare* from the Philippines, but it is not clear whether he had in mind the isotype or the collection from Palawan.

The collection from Samoa does not seem to have been reported. Lloyd thought the material referable to *Hydnum neoguineense* (which to me remains a puzzle), but it is easily recognizable as the present species, although all of the four reasonably well-preserved specimens are immature; the largest spores recovered measured $4.3 \times 2.7 \mu$.

J. M. Chipp who had collected rather small specimens in the Botanic Gardens at Singapore, annotated the material as follows: "White, tinged green yellow in parts underneath. Cap slightly viscid. Context rubbery. Spores white, opaque, ovoid, smooth, $5 \times 4 \mu$."

MYCORRHAPHIUM species 1 — Figs. 240–243

Basidiomes simple or compound, consisting of partly confluent pilei. Pileus up to 50 mm radius, 90 mm wide, slightly ascending, reniform-flabelliform, smooth except for a few shallow concentric depressions, causing a faint zonation, minutely velvety to woolly-felted, the tomentum matting down to an obscurely fibrillose or glabrous surface, dull to slightly shiny, white to drab whitish buff, the extreme margin in places black-brown. Stipe $10\text{--}25 \times 3\text{--}6$ mm, lateral, simple, more or less dorsiventrally flattened,



Figs. 240–243. *Mycorrhaphium* species 1 (Japan, Corner). — 240. Generative hyphae from near the margin of the pileus. — 241. Generative and tendril hyphae at some distance from the margin. — 242. Skeletals from the tip of a spine. — 243. Spores. (Figs. 240–242, $\times 700$; Fig. 243, $\times 2800$.)

velvety becoming tomentose or nearly glabrous, concolorous with the pileus or dingy rufescent brownish. Spines about 2 mm long, little or not decurrent, crowded, often several connate, subulate, slender, rigid, drab white to subfuscous, discolouring dark brown when bruised. Context of the pileus 1–2 mm thick, homogeneous, inconspicuously zoned, white.

Context of the pileus monomitic, consisting of generative and tendrill hyphae. Generative hyphae up to 6 μ wide, not inflating, thin-walled to moderately thick-walled, branched, septate, with clamp-connections, filled with oily matter near the margin, empty farther back. Context of the spines dimittic, consisting of generative and skeletal hyphae. Generative hyphae similar to those of the pileus, but thinner, tendrils lacking. Skeletals up to 5.5 μ wide, thick-walled to solid. Basidia 15–18 \times 3.5–4.5 μ , clavate, with clamp-connection at the base, with 4 sterigmata up to 2 μ long. Spores 2.5–3.4 \times 1–1.3 μ , cylindrical, adaxially flattened, smooth, colourless, inamyloid, not cyanophilous, with oblique apiculus. Cystidia none.

COLLECTIONS EXAMINED:

JAPAN

Hokkaido: Prov. Ishikari, Shikotsuko near Sapporo, 14 Sept. 1966, *E. J. H. Corner*, on the ground in deciduous forest (also in liquid, L).

Honshu: Prov. Iwaki, 19 May 1913, *A. Yasuda 224* (Lloyd Mycol. Coll. 24015, BPI).

The above description is largely based on Prof. Corner's material and his notes. Macroscopically *Yasuda 224* agrees very well, but the specimen is so young that the hymenium has not even formed. LLOYD named this specimen *Hydnum adustum* and reported on the find (1914, Lett. 53: 8, 11). I doubt the correctness of the identification. For the present, however, I prefer to point out the differences, leaving it to future investigation to decide whether the Japanese material is really specifically different. The characters between brackets are those as noted for North American *M. adustum*.

1. Pileus for the greater part obscurely fibrillose to glabrous (*M. adustum*: long remaining velutinous).
2. Zonation faint (*M. adustum*: clearly visible).
3. Surface of the dried material chalk white to dingy white (*M. adustum*: ochraceous).
4. Stipe lateral, flush with the surface of the pileus (*M. adustum*: laterally attached at a notch and set at an angle, or central).

AOSHIMA & FURUKAWA (1966: 139) listed *M. adustum* for Japan, gave a description in Japanese, and indicated that material was preserved in the National Fungus Collections (Beltsville) and the National Science Museum (Tokyo). It is quite possible that they saw specimens of the true *M. adustum*, but their account seems to contain also some elements characteristic of Prof. Corner's collection. I feel unable to decide whether or not the discrepancies are an expression of the variability of a single species.

UNASSIGNED NAMES

Several poorly known taxa have been discussed on previous occasions. They still are poorly known. Until we know what they are, their names must be given periodical attention.

Affinis. — *Hydnum affine* Lloyd, Mycol. Writ. 7: 1296. 1924 (nomen nudum). — TYPE: "*Hydnum affine* / Kyoto, Japan / coll. K. Masui / No. 16729" (BPI).

As pointed out earlier (MAAS GEESTERANUS, 1960: 343) this is an unknown *Sarcodon*. On re-examining the material, ten years later and with wider experience with species of this genus, I still subscribe to my former opinion and am even less prepared to consider an indistinctive specimen that lacks proper notes.

Caperatus. — *Hydnum (Dryodon) caperatum* Pat. in *Annls Jard. bot. Buitenzorg* 1 (Suppl.): 114. 1897. — TYPE LOCALITY: Java, Priangan, forest near Tjibodas, south of Bogor.

Material of this species cannot be located in the herbaria PC, FH, and BO (MAAS GEESTERANUS, 1967a: 52). Since the collector of this fungus was J. Massart, Professor of Botany at Brussels, enquiries were sent to BR and BRLU, but the answer from these herbaria was equally negative.

Fimbrillatus. — *Hydnum fimbrillatum* Iwade in *Bull. Tokyo Univ. For.* 33: 53. 1944. — TYPE: 1941-VIII-24 (not seen).

"Fructificatione lignicola, cuneato-dimidiato, 10 × 6 cm. lata, 5 cm. crassa, pallida dein ochraceo-fulva, superne densissime fibrilloso-lacerata, intus carnosio-spongiosa (hyphis fibrillosis et aculeis fibroso-degeneratis inter ramulos contexti cartilaginorum intermixtis); aculeis subulatis, 1-1.5 cm. longis, 0.3-0.5 mm. crassis, albis demum ochrascentibus; sporis hyalinis, subglobosis, subtiliter verrucosis, 5.0-6.5 μ ."

A Xerox-copy of the page which contains the above description is all that is available to me. It is not sufficient to identify the species with certainty, but I am inclined to put down the fungus as a form of either *Hericiium erinaceus* or *H. coralloides*.

Fragilis. — *Hydnum fragile* Petch, see under *Hydnum scabrum*.

Helvolum. — *Hydnum helvolum* Zipp. ex Lév. in *Annls Sci. nat. (Bot.)* III, 2:204. 1844. — *Steccherinum helvolum* (Zipp. ex Lév.) S. Ito, Mycol. Fl. Japan 2 (4): 197. 1955. — HOLOTYPE: "*Hydnum helvolum* Zp." (L 910. 252-508).

This remains a puzzling species (MAAS GEESTERANUS, 1967a: 54).

Japonicus. — *Hydnum japonicum* Lév. in *Annls Sci. nat. (Bot.)* III, 2: 203. 1844. — TYPE LOCALITY: Japan.

This still remains an unknown species (MAAS GEESTERANUS, 1967a: 59).

Nauseo-foetidus. — *Hydnum nauseo-foetidum* Teng in *Contr. biol. Lab. Sci. Soc. China* 8 (Bot. Ser. no. 2): 111. 1932. — TYPE LOCALITY: China, I-wu-hsien.

MAAS GEESTERANUS (1967b: 61) regarded this fungus as a member of the genus *Sarcodon* but, owing to lack of information, failed to recognize the species.

CORNER (1968: 61) reduced the species to the synonymy of *Thelephora gelatinoidea* Lloyd, citing two Chinese collections, *S. C. Li* 318 and *S. C. Teng* 1974. It may be observed, however, that Corner did not see the type of *H. nauseo-foetidum*, *C. I. Shen* 405, and as may be gathered from the corresponding parts of the descriptions given by Corner for *T. gelatinoidea* and by Teng for *H. nauseo-foetidum* tabulated below, it seems very unlikely that the two species should have any close relationship.

Corner's description	Teng's description
[no information]	caespitosus
[pileus] flabelliform ascending	depresso ad infundibuliformi
[pileus] pliant, subcoriaceous	carnoso, fragili
waxy spines 100–400 μ long	aculeis farinosis . . .
flesh in two layers	usque ad 1 mm longis
spores 7–9.5 \times 6–9 μ	[no information]
[no information]	sporis . . . circ. 6–7 \times 5–6 μ
	odore forti nauseo-foetido

Phaeodon. — *Hydnum (Irpez) phaeodon* Lév. in *Annls Sci. nat. (Bot.)* III, 9: 125. 1849. — TYPE LOCALITY: Java.

An unknown species (MAAS GEESTERANUS, 1967b: 63).

Sarasinii. — *Hydnum sarasinii* P. Henn. in *Warburg, Monsunia* 1: 9. 1900. — TYPE LOCALITY: Celebes, Tomohon.

The suggestion that this species probably is a member of *Hericium* (MAAS GEESTERANUS, 1966b: 324) seems to be supported by the remarkably wide distribution of *H. clathroides* in the Orient. *Hericium clathroides*, it may be recalled, is a species with spores of approximately the same size as described for *H. sarasinii*. If in the course of time no further species turns up in this area, *H. sarasinii* will inevitably be synonymized with *Hericium clathroides*.

Scaber. — *Hydnum fragile* Petch in *Ann. R. bot. Gdns Peradeniya* 7: 287. 1922. — *Hydnum scabrum* Petch in *Ann. R. bot. Gdns Peradeniya* 10: 134. 1926 (name change). — TYPE: "*Hydnum fragile* Petch [*fragile*

crossed out and rewritten *scabrum*] / [Ceylon] Peradeniya, Dec. 1913, No. 3994" (K).

It still is not known to what genus this species might be assigned (MAAS GEESTERANUS, 1964b: 177), while no recent collections have been reported that would correspond to the description.

SURVEY OF LLOYD'S HYDNUM COLLECTIONS

Perhaps Lloyd's greatest significance for Mycology lay in his capacity of rousing in his correspondents a world-wide enthusiasm for co-operation. This enabled him to amass a unique herbarium, but it is a herbarium that does not easily impart the wealth of information it contains. It is hoped that the following list proves a useful guide to the pileate and/or stipitate Hydnums of this collection and a tribute to its originator.

Species	Country	Collector	Lloyd Mycol. Coll.	Reported in Mycol. Writings	Re-identification
<i>adustum</i>	Japan	A. Yasuda	24015	4 (Letter 53): 8, 11. 1914	<i>Mycorrhaphium</i> spec.
<i>affine</i>	Japan	K. Masui	16729	7: 1296. 1924	<i>Sarcodon</i> spec.
<i>albidum</i>	Japan	A. Yasuda	4907	4 (Letter 54): 3. 1915	<i>Hydnum repandum</i>
<i>albidum</i>	Japan	J. Umemura	4913	4 (Letter 56): 4. 1915; ? also: 4 (Letter 61): 5. 1916	<i>Hydnum repandum</i>
<i>albidum</i>	Japan	J. Umemura	4918	5 (Letter 66): 7. 1917	<i>Hydnum repandum</i>
<i>albonigrum</i>	Japan	A. Yasuda	4909	5 (Letter 63): 9. 1916	<i>Phellodon putidus</i>
<i>amicum</i>	Japan	J. Umemura	4900	5 (Letter 63): 9, 14. 1916	<i>Phellodon putidus</i>
<i>aspratium</i>	Japan	A. Yasuda	4904	6: 1095. 1921	<i>Sarcodon imbricatus</i>
<i>aurantiacum</i>	Japan	A. Yasuda	4905	4 (Letter 51): 4. 1914	<i>Hydnellum earlianum</i> + <i>Hydnellum</i> cf. <i>humidum</i>
<i>aurantiacum</i>	Japan	K. Masui	26801	7: 1296. 1924	<i>Hydnellum auratile</i>
<i>aurantiacum</i>	Australia	J. B. Cleland	22787	5 (Letter 65): 2. 1917	polypore
<i>auriscalpium</i>	Japan	J. Umemura	4914	5 (Letter 63): 9, 14. 1916	<i>Auriscalpium vulgare</i>
<i>blackfordae</i>	Japan	A. Yasuda	4829	5 (Letter 67): 11. 1918	<i>Sarcodon atroviridis</i>
<i>concrescens</i>	Japan	A. Yasuda	4903	5 (Letter 63): 9. 1916	<i>Phellodon confluens</i>
<i>concrescens</i>	Japan	A. Yasuda	22789	5 (Letter 67): 11. 1918	<i>Phellodon confluens</i>
<i>coralloides</i>	Japan	A. Yasuda	24008	?	<i>Hericium clathroides</i>
<i>coralloides</i>	Japan	K. Miyabe		7: 1265. 1924	material not seen
<i>coralloides</i>	Australia	J. B. Cleland	55548	4: (Letter 59): 1. 1915	<i>Hericium clathroides</i>
<i>coralloides</i>	Tasmania	L. Rodway	55547	7: 1162. 1922	<i>Hericium clathroides</i>
<i>cuneatum</i>	Japan	A. Yasuda	22793	7: 1345. 1925	<i>Phellodon niger</i>
<i>cyathiforme</i>	Japan	J. E. A. Lewis		7: 1345. 1925	material not seen
<i>cyathiforme</i>	Tasmania	L. Rodway	22799	7: 1162. 1922	<i>Phellodon plicatus</i>
<i>cyathiforme</i>	Tasmania	L. Rodway	22800	7: 1162. 1922	<i>Phellodon plicatus</i>

<i>deceptivum</i>	Philippines	P. W. Graff	4858	7: 1125. 1922	<i>Climacodon pulcherrimus</i>
<i>decurrens</i>	China	A. N. Steward	26547	7: 1162. 1922	<i>Mycoleptodonoides aitchisonii</i>
<i>delicatulum</i>	Japan	A. Yasuda	22794	not published	<i>Phellodon confluens</i>
<i>discolor</i>	Japan	A. Yasuda	4861	5 (Letter 63): 9. 1916	<i>Climacodon pulcherrimus</i>
<i>discolor</i>	Japan	A. Yasuda	26571	5 (Letter 68): 7. 1918	<i>Climacodon pulcherrimus</i>
<i>duriusculum</i>	Singapore	Mrs. E. M. Burkill	4923	6: 1002. 1920	<i>Climacodon pulcherrimus</i>
<i>duriusculum</i>	Singapore	Mrs. E. M. Burkill	4865	6: 1002. 1920	indeterminable
<i>ferreum</i>	Singapore	Mrs. E. M. Burkill	4922	6: 956, 1003. 1920	<i>Hydnum elatum</i>
<i>flavidum</i>	Singapore	M. Noor	4850	6: 956, 957. 1920	<i>Gyrodontium flavidum</i>
<i>fragile</i>	Japan	A. Yasuda	22791	7: 1162. 1922	<i>Hydnellum caeruleum</i> + <i>Hydnellum humidum</i>
<i>graveolens</i>					see under <i>H. subzonatum</i>
<i>helvolum</i>	Japan	A. Yasuda 340	26572	4 (Letter 61): 6, 7. 1916	<i>Mycoleptodonoides aitchisonii</i>
<i>helvolum</i>	Japan	A. Yasuda 374	26572	5 (Letter 63): 9. 1916	<i>Climacodon pulcherrimus</i>
<i>helvolum</i>	Japan	K. Miyabe	26564	7: 1126. 1922	<i>Mycoleptodonoides aitchisonii</i>
<i>henningsii</i>	Malay Penins.	R. E. Holttum	26566	7: 1187. 1923	<i>Gyrodontium spec.</i>
<i>holttumii</i>	Malay Penins.	R. E. Holttum	22788	7: 1227. 1923	<i>Hydnum elatum</i>
<i>imbricatum</i>	Japan	A. Yasuda	4910	4 (Letter 42): 15. 1912	<i>Sarcodon imbricatus</i>
<i>insulare</i>	Philippines	L. Escritor	16732	7: 1296. 1924	<i>Mycorrhaphium stereoides</i>
<i>insulare</i>	Philippines	Baker [?]	26574	7: 1296. 1924	<i>Mycorrhaphium stereoides</i>
<i>jacobsonii</i>	Java	C. van Overeem	4872	unpublished?	cf. <i>Steccherinum</i>
<i>maliense</i>	Singapore	Sappan	4920	6: 956. 1920	<i>Sarcodon thwaitesii</i>
<i>maliense</i>	Singapore	M. Noor	4921	6: 1002. 1920	<i>Phellodon maliensis</i>
<i>melaleucum</i>	Japan	J. Umemura	4915	4 (Letter 53): 7. 1914	<i>Phellodon confluens</i>
<i>melaleucum</i>	Japan	J. Umemura	4916	4 (Letter 56): 4. 1915	<i>Phellodon confluens</i>
<i>melaleucum</i>	Japan	A. Yasuda		4 (Letter 56): 5. 1915	material not seen
<i>melaleucum</i>	Australia	J. Wilson	4902	5 (Letter 65): 6. 1917	<i>Phellodon melaleucus</i>
			[or 4901?]		
<i>melaleucum</i>	Australia	J. Wilson	26216	5 (Letter 65): 6. 1917	<i>Phellodon niger</i>
<i>melaleucum</i>	Australia	J. B. Cleland	26217	7: 1186. 1923	<i>Phellodon maliensis</i>

Species	Country	Collector	Lloyd Mycol. Coll.	Reported in Mycol. Writings	Re-identification
<i>mucidum</i>	Tasmania	L. Rodway	44616	(det. Masee) unpubl. by Lloyd	<i>Steccherinum ochraceum</i>
<i>muelleri</i>	Australia	J. B. Cleland	22779	5 (Letter 65): 2. 1917	<i>Steccherinum</i> spec.
<i>muelleri</i>	New Zealand	G. H. Cunningham	4860	not published	polypore
<i>neo-guineense</i>	Samoa	C. G. Lloyd	58929	not published	<i>Mycorrhaphium stereoides</i>
<i>nigrum</i>	Japan	A. Yasuda	4908	4 (Letter 44): 8. 1913	<i>Phellodon confluens</i> + <i>Sarcodon</i> spec.
<i>nigrum</i>	Japan	J. E. A. Lewis	7664	7: 1320. 1924	<i>Phellodon</i> cf. <i>confluens</i>
<i>nigrum</i>	Tasmania	L. Rodway	22797	7: 1162. 1922	<i>Phellodon maliensis</i> ??
<i>nigrum</i>	Tasmania	L. Rodway	22798	7: 1162. 1922	<i>Phellodon plicatus</i>
<i>ochraceum</i>	Philippines	V. Masilao	16707	6: 971. 1920	<i>Stecchericium seriatum</i>
<i>ochraceum</i>	Philippines	R. Reyes	16708	6: 971. 1920	<i>Stecchericium seriatum</i>
<i>ochraceum</i>	Sumatra	H. S. Yates	4896	6: 1096. 1921	<i>Stecchericium seriatum</i>
<i>ochraceum</i>	Java	W. Docters van Leeuwen	16710	6: 965. 1920	<i>Stecchericium seriatum</i>
<i>ochraceum</i>	Australia	J. B. Cleland	16702	5 (Letter 67): 4. 1918	<i>Stecchericium seriatum</i>
<i>olidum</i>	"India"	S. R. Kashyap	4898	5 (Letter 65): 4. 1917	<i>Phellodon niger</i>
<i>olidum</i>	"India"	S. R. Kashyap	4925	5 (Letter 65): 4. 1917	<i>Hydnellum earlianum</i>
<i>pergameneum</i>	Japan	A. Yasuda	4867	6: 878. 1919	identity uncertain
<i>pexatum</i>	Tasmania	L. Rodway	44618	unpublished ?	crustaceous hydroid species
<i>pleuropodium</i>	Malay Penins.	R. E. Holttum	16728	7: 1360. 1925	<i>Hydnum elatum</i>
<i>plicatum</i>	Tasmania	L. Rodway	22796	7: 1360. 1925	<i>Phellodon plicatus</i>
<i>polymorphum</i>	Ceylon	T. Petch	37970	unpublished ?	<i>Gyrodontium</i> spec.
<i>pulcherrimum</i>	India	S. R. Bose	26554	6: 1069. 1921	<i>Climacodon pulcherrimus</i>
<i>pygmaeum</i>	Japan	A. Yasuda	22792	7: 1107. 1922	<i>Phellodon melaleucus</i>
<i>rawakense</i>	China	E. D. Merrill	22810	6: 1080. 1921	polypore

<i>rawakense</i>	Japan	J. E. A. Lewis	22815	5 (Letter 65): 5, 9. 1917	<i>Steccherinum</i> spec.
<i>rawakense</i>	Philippines	E. D. Merrill		6: 966. 1920	material not seen
<i>rawakense</i>	Guam	P. Nelson	22811	unpublished ?	cf. <i>Steccherinum</i> spec.
<i>repandum</i>	Australia	J. B. Cleland		5 (Letter 65): 2. 1917	material not seen
<i>repandum</i> var. <i>album</i>	Japan	A. Yasuda	16725	4 (Letter 42): 15. 1912	<i>Hydnum repandum</i>
<i>rufescens</i>	"India"	S. R. Kashyap	56591	5 (Letter 65): 4. 1917	<i>Hydnum rufescens</i>
<i>rufescens</i>	Japan	A. Yasuda	54821	5 (Letter 69): 10. 1919	<i>Hydnum rufescens</i>
<i>rufescens</i>	Japan	A. Yasuda	35983	7: 1345. 1925	<i>Bankera fuligineo-alba</i>
<i>rufescens</i>	Australia	J. Wilson	4833	unpublished ?	<i>Hydnum repandum</i>
<i>rufescens</i>	New Zealand	W. A. Scarfe	4929	5 (Letter 66): 6. 1917	<i>Hydnum repandum</i>
<i>sanchezii</i>	Philippines	Sanchez	26570	7: 1276. 1924	<i>Gyrodontium</i> spec.
<i>scabrosum</i>	Japan	A. Yasuda	4911	4 (Letter 51): 4. 1914	<i>Sarcodon</i> spec. (2 spec. ?)
<i>sclerodontium</i>	Japan	I. M. Chipp	32695	6: 931. 1920	crustaceous hydroid spec.
<i>scrobiculatum</i>	Australia	J. T. Paul	22781	6: 969. 1920 [?]	<i>Hydnullum scrobiculatum</i>
<i>scrobiculatum</i>	Australia	J. T. Paul	56844	6: 969. 1920 [?]	<i>Hydnullum scrobiculatum</i>
<i>scrobiculatum</i>	Australia	J. Wilson	4901	6: 969. 1920 [?]	<i>Hydnullum scrobiculatum</i>
<i>scrobiculatum</i>	Australia	J. Wilson	26800	6: 969. 1920 [?]	<i>Hydnullum scrobiculatum</i>
<i>septentrionale</i>	Japan	T. Hemmi	55565	6: 1012. 1920	<i>Climacodon septentrionalis</i> + <i>C. pulcherrimus</i>
<i>seriatum</i>	Borneo	H. A. Lee		7: 1188. 1923	material not seen
<i>seriatum</i>	Borneo	M. Ramos	4876	7: 1196. 1923	<i>Stecchericum seriatum</i>
<i>singaporense</i>	Singapore	T. F. Chipp	4864	7: 1107. 1922	<i>Climacodon pulcherrimus</i>
<i>spathulatum</i>	Java	Ch. Bernard	4927	6: 878. 1919	<i>Hydnullum conrescens</i>
<i>subsquamosum</i>	China	H. H. Hu	22784	7: 1320. 1924	<i>Sarcodon imbricatus</i>
<i>subzonatum</i>	Australia	J. Wilson	22778	6: 979, 980. 1920	<i>Phellodon plicatus</i> + <i>P. tomentosus</i>
<i>tenis</i>	Java	T. A. Tengwall	4862	unpublished	polypore
<i>violascens</i>	Japan	A. Yasuda	4899	5 (Letter 66): 7, 10. 1917	<i>Hydnullum cruentum</i>
<i>wellingtonii</i>	New Zealand	E. H. Atkinson	27122	7: 1200. 1923	<i>Hydnum repandum</i>
<i>zonatum</i>	Japan	M. Gono	4919	5 (Letter 63): 5. 1916	<i>Hydnullum conrescens</i>
<i>zonatum</i>	Japan	J. Umemura	4912	4 (Letter 45): 4. 1913	<i>Hydnullum scrobiculatum</i>

Species	Country	Collector	Lloyd Mycol. Coll.	Reported in Mycol. Writings	Re-identification
<i>zonatum</i>	Japan	J. Umemura	4917	4 (Letter 53): 7. 1914	<i>Hydnellum concrescens</i>
<i>zonatum</i>	Japan	A. Yasuda	4906	4 (Letter 51): 4. 1914	<i>Hydnellum concrescens</i>
<i>zonatum</i>	Japan	A. Yasuda	22795	5 (Letter 67): 11. 1918	<i>Hydnellum concrescens</i>
<i>zonatum</i>	Australia	J. B. Cleland	4869	5 (Letter 67): 4. 1918 [?]	<i>Hydnellum scrobiculatum</i>
<i>zonatum</i>	Australia	J. B. Cleland	22234	7: 1294. 1924 [?]	<i>Hydnellum scrobiculatum</i>
<i>zonatum</i>	Australia	J. T. Paul	22780	7: 1126. 1922	<i>Hydnellum scrobiculatum</i>
species	Japan	S. Arimoto	2967	unpublished	polypore
species	Japan	S. Imai	2966	unpublished	polypore
species	Japan	S. Imai	3016	unpublished	polypore
species	Japan	S. Kamei	3017	unpublished	polypore
species	Japan	J. E. A. Lewis	2728	unpublished	<i>Hydnellum concrescens</i>
species	Japan	J. E. A. Lewis	27979	unpublished	<i>Hydnum repandum</i>
species	Japan	J. E. A. Lewis	56653	unpublished	<i>Phellodon rustipes</i>
species	Japan	K. Miyabe & J. Hanzawa	3015	unpublished	<i>Hydnum repandum</i>
species	Japan	K. Miyabe & J. Hanzawa	56528	unpublished	<i>Hericium clathroides</i>
species	Japan	H. Nakamura	2707	unpublished	crustaceous hydroid spec.
species	Japan	A. Yasuda	22826	unpublished	crustaceous hydroid spec.
species	Japan	A. Yasuda	23128	unpublished	<i>Climacodon pulcherrimus</i>
species	Japan	A. Yasuda	23129	unpublished	<i>Hydnellum cruentum</i>
species	Japan	A. Yasuda	23130	unpublished	<i>Terenodon serenus</i> + polypore
species	Japan	A. Yasuda	23131	unpublished	<i>Phellodon niger</i>
species	Japan	A. Yasuda	23132	4 (Letter 45): 5. 1913	<i>Hydnellum auratile</i>
species	Japan	A. Yasuda	23133	4 (Letter 56): 5, 8. 1915	<i>Hydnellum auratile</i> + <i>H. earlianum</i>

species	Japan	A. Yasuda	23134	unpublished
species	Japan	A. Yasuda	39444	unpublished
species	"Indochina"	V. Demange	39456	unpublished
species	"Indochina"	V. Demange	39457	unpublished
species	Philippines	V. Masilao	14112	unpublished
species	Philippines	H. S. Yates	3298	unpublished
species	Philippines	H. S. Yates	36219	unpublished
species	Philippines	H. S. Yates	41526	unpublished
species	Sumatra	W. Docters van Leeuwen	38017	unpublished
species	Malay Penins.	I. H. Burkill & R. E. Holttum	30178	unpublished
species	Malay Penins.	I. H. Burkill & R. E. Holttum	45867	unpublished
species	Singapore	I. M. Chipp	39448	unpublished
species	Singapore	F. Flippance	57345	unpublished
species	Singapore	R. E. Holttum	19387	unpublished
species	Singapore	Kiah	57335	unpublished
species	Singapore	G. Ridout	39447	unpublished
species	Australia	J. B. Cleland	22787	unpublished
species	Australia	J. B. Cleland	22825	unpublished
species	Australia	J. B. Cleland	56461	unpublished
species	Australia	Miss E. J. Turner	23142	3 (Letter 27): 4. 1910
species	Australia	J. Wilson	27964	unpublished
species	Tasmania	L. Rodway	39440	unpublished
species	Tasmania	L. Rodway	45863	unpublished
species	New Zealand	G. H. Cunningham	41866	unpublished
species	New Zealand	W. K. Dallas	30183	unpublished
species	New Zealand	H. Hill	29031	unpublished
species	New Zealand	unknown	2742	unpublished

Terenodon serenus
Hericium coralloides
 polypore
Gyrodontium spec.
Steccherinum spec.
 polypore
Climacodon pulcherrimus
Gyrodontium spec.
 polypore

Hydnellum spec.

Climacodon pulcherrimus

Mycorrhaphium stereoides
Hydnum elatum
Gyrodontium spec.
Climacodon septentrionalis
 polypore
 polypore
 crustaceous hydroid spec.
Steccherinum ochraceum
Phellodon niger
Hydnellum fraudulentum
Phellodon plicatus
Hericium cf. *erinaceus*
 crustaceous hydroid spec.
Steccherinum spec.
 agaric
 polypore

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EXPLANATION OF THE PLATES

Plate I

Fig. 1. *Hydnum umbilicatum* ($\times 1$; No. 722, Miss A. Crawford, del. Mrs. G. Stevenson Cone). — Fig. 2. *Hydnum repandum* ($\times 1$; Singapore, Reservoir Jungle, 27 Aug. 1940, E. J. H. Corner, del. E. J. H. Corner). — Fig. 3. *Hydnum repandum* ($\times 1$; Mrs. G. Stevenson Cone 726, del. Mrs. G. S. Cone). — Fig. 4. *Auriscalpium umbella* ($\times 1$; Mrs. G. Stevenson Cone 725, del. Mrs. G. S. Cone).

Plate II

Hydnum elatum ($\times 1$; Bukit Timah, 6 Sept. 1940, E. J. H. Corner, del. E. J. H. Corner).

Plate III

Fig. 1. *Stecchericium seriatum* f. *seriatum* ($\times 1$, except the two specimens at right; Singapore, 2 Jan. 1941, E. J. H. Corner, del. E. J. H. Corner). — Fig. 2. *Stecchericium seriatum* f. *seriatum* ($\times 1$; Singapore, 18 March 1941, E. J. H. Corner, del. E. J. H. Corner). — Fig. 3. *Stecchericium seriatum* f. *vitellinum* ($\times 1$; holotype, del. E. J. H. Corner). — Fig. 4. *Hydnellum earlianum* ($\times 2$; Japan, Lloyd Mycol. Coll. 23133, del. Maas G.).

Plate IV

Fig. 1. *Hydnellum staurastrum* ($\times 1$; holotype, del. E. J. H. Corner). — Fig. 2. *Hydnellum auratile* ($\times 1$; India, R. A. Maas Geesteranus 14363, del. J. van Os).

Plate V

Sarcodon conchylitatus ($\times 1$; holotype, del. E. J. H. Corner).

Plate VI

Fig. 1. *Sarcodon humilis* ($\times 1$; holotype, del. E. J. H. Corner). — Fig. 2. *Sarcodon joeides* ($\times 1$; New Zealand, Mrs. G. Stevenson Cone 972, del. Mrs. G. S. Cone).

Plate VII

Sarcodon scabrosus ($\times 1$; India, R. A. Maas Geesteranus 14431, del. Maas G.).

Plate VIII

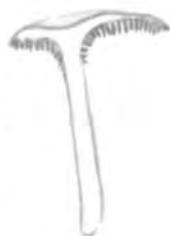
Fig. 1. *Climacodon efflorescens* ($\times 1$; Singapore, Botanic Gardens, 8 Sept. 1940, E. J. H. Corner, apparently not preserved, del. E. J. H. Corner). — Fig. 2. *Sarcodon thwaitesii* ($\times 1$; Singapore, 30 Cluny Road, 8 Dec. 1941, E. J. H. Corner, apparently not preserved, del. E. J. H. Corner). — Fig. 3. *Sarcodon thwaitesii* ($\times 1$; New Zealand, Mrs. G. Stevenson Cone 812, del. Mrs. G. S. Cone).

I



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III



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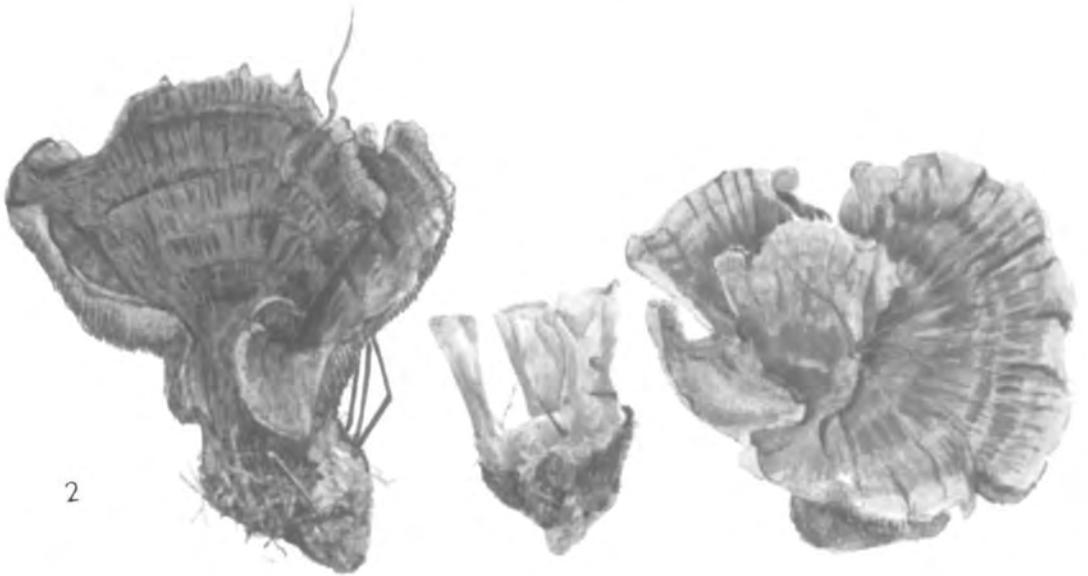


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IV

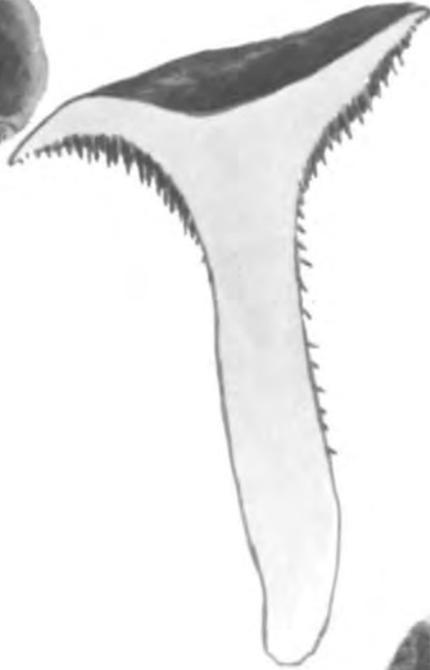




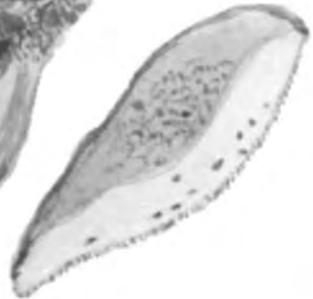
VI



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VIII

