Merulioid Fungi in Malaysia

by E. J. H. CORNER
Botany School, Cambridge, U.K.

Meiorganum (1 sp.), *Merulius* (8 sp.) and *Phaeophlebia* (1 sp.) are recognised. New species are *Merulius agathidis, M. irpicoides, M. luridochraceus, M. purpurascens* and *M. rubrotremellosus. Serpula* and *Gyrodontium* are placed under *Merulius.* A list of specific names in *Merulius* is supplied.

In preparing an account of Malaysian boleti I met the problem of *Meiorganum.* Heim considered it to represent a new family Meiorganaceae intermediate between Boletaceae and Polyporaceae. I have known the fungus for many years, for it is not uncommon in Southeast Asia, and I have always regarded it as a species of *Merulius.* Hence I have been lead to investigate the problem.

In recent years *Merulius* has been whittled down to an insignificant group of species about *M. tremellosus* with or without the small alliance of *M. corium* (Donk 1964, Parmasto 1967). The brown-spored species are separated as *Serpula* in Coniophoraceae (Cooke 1957, Donk 1964), and the remainder has been submerged in Corticiaceae. The evidence is not convincing. There are intermediates between *Serpula* and *Merulius* and, besides *Meiorganum,* there are other merulioid species in Southeast Asia with very much more complicated construction than occurs in other Coniophoraceae and Corticiaceae. The merulioid character is the continuous unthickened hymenium with gelatinous subhymenium, raised on folds, pores or spines the trama of which is also gelatinous or mucilaginous. That merulioid fungi may degenerate into corticioid states in the same way as clavarioid, stereoid and hydnoid fungi is clear. This state is generally assumed to be primitive because it is simple but to me the evidence points to the derivation of the corticioid by simplification (Corner 1968, 1970). The problem, therefore, is from what ancestry the more complicated merulioid fungi may have been derived. It is likely that yet others of more demonstrative nature may be found in the tropics, and the points needs development.

Merulius and Serpula

The main distinction is white spores for *Merulius* s. str. (Corticiaceae) and brown spores for *Serpula* (Coniophoraceae). Other details lie in the construction of the hymenium and subhymenium and in the cyanophilous character of the spores in cotton blue. The distinction in spore-colour is so obvious in many species that the generic separation has become customary. Yet, some species have spores that are described as white or yellowish, e.g. *M. byssoideus, M. crassus, M. fuscescens, M. molluscus, M. montanus* and *M. pseudomolluscus.* Of these *M. byssoideus* has been

considered to be very near to *M. tignicolus* with ferruginous spores, if not identical (Ginns 1968). Allied with *M. byssoideus* is the species described here as *M. luridochraceus* and its spores, under the microscope, vary from very pale yellowish to pale brownish ochraceous, and they are cyanophilous as in *Serpula*. *M. molluscus* has been transferred to *Serpula* independently by Karsten and Donk (1964 p. 209), though the spores have been described as white in the mass (Bourdot et Galzin 1927). *Leucogyrophana* Pouz. has been made for this species because of its white or yellowish cyanophilous spores, turning brown in Melzer's iodine; four other species have been added by Parmasto (1967). Donk reduces *Leucogyrophana* to *Serpula* and Ginns finds the amyloid reaction uncertain (as I find for *M. agathidis* p. 365). The hymenium and subhymenium in all three genera are exactly alike and in strong contrast with the dry and often loose hymenium with large projecting basidia of *Coniophora* (Lentz 1957). The distinction in spore-colour between *Merulius* s. str. and *Serpula* breaks down; they have the same general construction; only the uncertain significance of cyanophily remains. I find that the white spores of *M. rufus*, close to *M. tremellosus*, are slightly cyanophilous. Hence I prefer to use *Merulius* in the wide Friesian sense to include *Serpula*, and this fulfils the cogent need, often expressed by plant-pathologists, to preserve the name *Merulius lacrimans* as one of the most widely employed in practice (Harmsen 1956, 1960). There is an excessive tendency now to split up the genera of basidiomycetes on characters the universal applicability of which has not been established from world monographs. From the point of view of the general structure of the fruit-body I can see no difference between *Merulius* and *Serpula;* that they are related to *Coniophora* is conjecture. Specialists, of course, employ subgeneric categories as if they were genera, but botany requires the main ideas. It seems to me that, as with clavarioid, thelephoroid, boletoid and polyporoid fungi, the white spore is derived from the coloured which in the case of *Merulius* is not necessarily ferruginous; it may be olivaceous or pinkish (*Meiorganum*).

Gyrodontium

This genus was made for the common brown-spored *Merulius* with hydnoid spines, previously called *Hydnum henningsii* Bres., but with *H. versicolor* B. et Br. as an earlier name, as shown by Maas-Geesteranus. Instead of folds or pores covered by the hymenium, this species has long spines which, if occasionally connate, are never poroid. It certainly proves that *Serpula*, at least, is much more complicated than *Coniophoraceae*. The hyphae in the spines are longitudinal with mucilaginous walls, as in the gills of *Paxillus* but not inflated, and this direction indicates a positively geotropic growth of the spine as a special emergence of the merulioid hymenium. However, the brown-spored *M. irpicoides* (p. 367) has spines or irpiciform plates which are free or shortly connected at the base, and *M.* (*Serpula*) *pinastri* has pores which may become strongly irpiciform (Cooke 1957). Thus this hydnoid distinction fails and I treat *Gyrodontium* as part of *Merulius* s.l.

Meiorganum and Boletaceae

Meiorganum has the appearance of an upside-down boletus. The fruit-bodies grow from tree-trunks or branches, living or dead, and develop the pileus at the end of a shortly descending, but expanding stem; the pileus then flattens horizontally into a circular or spathulate form and develops tubes on the underside. The hyphae inflate and the tubes have a phylloporoid trama of strictly longitudinal, mucilaginous and scarcely inflated hyphae. Heim compared the one known species *M. neocaledonicum* with *Gyrodon merulioides* which, though erect, may be lignicolous with lateral pilei, but it has a bilateral boletoid trama, cyanescent flesh, ochraceous brown spores and, evidently, a very different struct to the surface of the pileus and stem (Singer 1945); to this one may add the African *G. intermedius* (Singer and Grinling 1967). On the other hand, the spores, hymenium, minutely lacunose flesh with short branching fascicles of hyphae, and the colouration of *Meiorganum* are typical of brown-spored *Merulius*. If *Serpula* is recognised, *Meiorganum* differs merely in the shape of the fruit-body, which is bridged by the pleuropodal *M. agathidis*, and in the colour of the spore-print which is dull vinaceous pink to fawn brown.

The pores of *Meiorganum* develop from the centre of the young discoid hymenium as fine reticulate wrinkles. Dried specimens collected in this state, which is fertile, pass exactly for blackened Merulius. Heim emphasized the fact that the tubes of *Meiorganum* are not separable from the flesh; they have a distinct mucilaginous construction, as in phylloporoid boleti, but the finely lacunose flesh breaks away with them and is the cause of the apparent difference.

I retain *Meiorganum* distinct from *Merulius* chiefly for convenience because it appears to be exactly intermediate between *Gyrodon* or *Paxillus* (as *P. panuoides*) and Meruliaceae and shows that the ancestry of this family must be sought in the origin of Boletaceae, not in Coniophoraceae or Corticiaceae. This is borne out by the spore-basidium relation $d = 0.48\ w$, as in many boleti. This relation reveals the pink-brown spore as an endospore in a mucilage sheath, developed through compression of the spore-circles (Corner 1971).

Meiorganum is the most elaborate merulioid fungus yet found. Its boletaceous affinity is clear. It shows how the resupinate merulioid fungi could have been derived by loss of form-factors in the development of the tubes and in loss of colour of the spore; if a young dorsifixed *Meiorganum* became resupinate with rudimentary tubes it would be *Serpula*. Thus it shows how the boletoid fruit-body, primitively terricolous, has become adapted to the lignicolous habitat and, in using the lignin as support, economised in construction. So many advanced merulioid fungi thrive all over

the world. On the upgrade theory from resupinate forms, *Meiorganum* must be the peak of evolution in Coniophoraceae, yet it is about the most uncommon. The upgrade theory has no biological support and, lacking this, will die of its own sterility.

The problem shifts to what may be the difference between Meruliaceae and Boletaceae. There is no difference in basidia and spores because *Boletus xylophilus* Petch, for instance, has as small structures (basidia 18–24 × 6–7.5μ, spores 4.5–6.7 × 3.3–4.3μ). It does not lie in the fertile edge to the pore, for many boleti have this character as well as *Paxillus*. It does not lie in the tramal structure of the tubes, the inflation of the hyphae or in the incurved margin of the pileus, for all these boletoid points occur in *Meiorganum*. It does not lie in the structure of the surface of the pileus because this is most variable in *Boletus* and *Paxillus*. It lies simply in the loss of the stem and the resupinate tendency which substitutes this; it lies, that is, in those major characters of the fruit-body over which the present attitude is to gloss.

Merulius agathidis and Hygrophoropsis

M. agathidis has sessile imbricate pilei with dichotomous merulioid gills the sides of which become strongly ribbed, making the gills appear phylloporoid, though they are not poroid-reticulate. It resembles *Paxillus panuoides* Fr. but the gill-trama of *M. agathidis* is composed of uninflated and laxly interwoven hyphae. In this respect it resembles *Hygrophoropsis flabelliformis* (B. et C.) Corner, which has white and slightly cyanophilous spores and dichotomous gills without ribbing. It is difficult to exclude *H. flabelliformis* from *Hygrophoropsis* and it is as difficult to exclude it from *Merulius*. I have discovered a second collection of mine from Singapore with pilei up to 6 cm wide, otherwise identical with *H. flabelliformis*, and I had placed it under *Merulius*. If tubes, spines and branching folds are admitted into *Merulius* because there are intermediates, then radial direction of the branching folds will give the dichotomous merulioid gill with its mucilaginous hymenium and subhymenium, as in *Hygrophoropsis*, the construction of which is as close to that of *Merulius* as to *Paxillus* with which it is placed in classification; and none of these has close affinity with *Coniophora*. Indeed, they have not the hymenium of *Coniophora* which comes like a red herring across the trail of *Merulius*. Loss of gills would result in *Podoserpula* Reid (Kew Bull. 1963, 437), which offers merely a stem as a distinction from *Merulius*, though it seemed to me that it had a thickening hymenium (Corner 1966, 6. 79, as *Cantharellus pusio* in error). Again there is little affinity with *Coniophora* though *Podoserpula* is placed in *Coniophoraceae* by Reid and Donk. If *Hygrophoropsis* and *Podoserpula* belong with *Merulius* s. str. with white spores, then there is evidence for the ancestral diversification of *Merulius* s.l. into species with coloured and colourless

spores, and this supposition supports the idea of the family Meruliaceae, divergent from Boletaceae and convergent in simplification with Coniophoraceae and Corticiaceae.

Phaeophlebia

This genus differs from white-spored *Merulius* in the absence of a compact, exposed layer of basidia. It is based on the single, almost cosmopolitan species first described as *Merulius strigoso-zonatus*. In other respects it is typical *Merulius* with the rufous orange, rugulose and mucilaginous hymenium, but the basidia are separated by and immersed among very narrow lobulate hyphal ends which build an epihymenium through which the maturing basidia project; it is the kind of hymenium that occurs in *Acanthophysium* (Cunningham 1963) and has been called a catahymenium (Lemke 1964). Cooke described the spores as yellowish to pale brown but, as observed by Cunningham and myself, the mature spores are hyaline and white in the mass; possibly the action of potash on dried specimens, which give then a brown solution, colours the spores. Cooke described, also, gloeocystidia which neither Cunningham nor I have observed; I suspect that they are the immature and immersed basidia.

Cunningham placed the species in *Stereum* where it is even more out of place than in *Merulius*. He seems not to have appreciated the mucilaginous structure of the flesh and hymenium; his illustration is rather diagrammatic and shows closely septate, branched but not lobulate, hyphal ends in the hymenium.

Donk has followed Talbot in considering *Phaeophlebia* as synonymous with *Punctularia*. They appear to have the same general construction but the very small and discrete fructifications of *Punctularia* seem different from the effuso-reflexed masses of *Phaeophlebia* with imbricate and tomentose pilei. Moreover, neither Cunningham nor I have seen the dark brown swollen dendrophyses or the fissured hymenium which Talbot described for *Punctularia*. Unless a fungus is discovered to bridge these differences, I prefer to distinguish the two genera. Nevertheless, if *Acanthophysium* can be reduced to *Aleurodiscus* and retained in Corticiaceae (Donk 1964), then *Phaeophlebia* goes back to *Merulius*.

Byssomerulius Parm. and Meruliopsis Bond

The white-spored species of *Merulius* without clamps in the hyphae of the fruit-body have been separated as *Byssomerulius*, based on *M. corium* Fr. (Parmasto 1967). It is difficult to see how it differs from *Meruliopsis* which has been reduced to *Merulius* s. str. (Donk 1964, p. 262), with the name *M. taxicolus* (Pers.) Duby for the type of *Meruliopsis*. I agree with Donk, and cite *M.*

purpurascens (p. 370) as a species intermediate between *Byssomerulius* and *Meruliopsis*. I have also collected in Venezuela a pileate ally of *M. corium* with short spines or papillae, instead of pores, and slightly cyanophilous spores; it has probably been described as a *Hydnum*, but it shows how much there is still to learn about merulioid fungi. Donk has shown, too, the uncertainty that may attend the definition on the absence of clamps. From a tropical viewpoint I regard these genera as merely series in the complex of *Merulius*.

Byssomerulius raises, also, the problems of *Caloporus* and *Gloeoporus* as transfers from Polyporaceae (Donk 1960, p. 192; 1962, p. 227); many other tropical species assigned to *Poria* become involved and I am unable to comment on them at present.

The merulioid hymenium

Thin resupinate species of *Merulius*, similar to *Corticium*, have such slight hymenial folds or reticulations that they suggest mere physical buckling under tangential stress. This effect hardly suits *Phaeophlebia* the excessive tangential growth of which throws the margin of the pileus into undulations with little or no effect on the underlying hymenium. It does not explain the long and narrow tubes (up to 6 × 0.5 mm) in *M. eurocephalus* with longitudinal hyphae in the dissepiments, or the phylloporoid trama of *Meiorganum* developing beneath merulioid wrinkles, or the long and discrete spines of *M. versicolor* with their longitudinal hyphae. These outgrowths are organised in a marginal pore-field (Corner 1932). They differ from the polyporoid in being covered from the first by the fertile hymenium. It seems that they develop by continual sympodial outgrowth of hyphae into the hymenium along the edges of the pores or at the tips of the spines; thus they have longitudinal tramal hyphae. Generalised intercalation of basidia may stretch the internal hyphae but not direct them because intercalation alone merely pulls hyphae apart as in the cantharelloid gill-fold (Corner 1966). Lines of feeble outgrowth, dichotomising as they radiate with marginal growth, produce the gill-folds of *M. agathidis*, but massive intercalary growth on the sides of the gills disaligns the internal hyphae. The exact method of contruction remains to be discovered but there must be some lamellate, poroid or hydnoid motivation that raises the merulioid fungi far above the corticioid level. Apart from *Meiorganum*, *Merulius agathidis*, *M. eurocephalus* and *M. versicolor* appear to me as descendants of the stock of *Paxillus* and *Boletus* which, in losing agaricoid form-factors, have become aphyllophoralean with uninflating hyphae.

This view of the descent of Meruliaceae from the boletoid stock differs widely from the current. I trust that mycologists who have so kindly sent me their papers on resupinate fungi will pardon the disagreement which arises from the effort to assimilate the merulioid fungi of the tropics.

Key to the merulioid fungi in Malaysia

1. Spores coloured, pinkish, olivaceous or yellow brown.
   2. Hymenium with spines or irpicoid plates –7mm long.
      3. Forming large thick brackets with or without a resupinate part; flesh 3–14mm thick, spongy-floccose. Sp. 3.5–4.7 × 2.5–7μ, fuscous olivaceous. Cystidia none. Hyphae without clamps ..... *M. versicolor* p. 373
      3. Resupinate on dead *Poria;* flesh 0.3mm thick. Sp. 4–4.7 × 3–3.5 μ. Cheilocystidia fusiform, thin-walled. Hyphae with clamps ..... *M. irpicoides* p. 367
   2. Hymenium lamellate or poroid.
      4. Hymenium lamellate with ridges on the sides of the dichotomous, yellow to orange gills –3mm wide, spuriously poroid. Pilei –7cm radius, imbricate, tomentose. Flesh 3–6mm thick. Sp. 3.3–4.2 × 1.7–2μ. Hyphae clamped. On wood of Agathis ..... *M. agathidis p.* 365
      4. Hymenium poroid or gyroso-plicate.
         5. Pendent, subungulate, then applanate and dorsifixed, –20cm wide. All parts turning pink or vinaceous, then fuliginous on bruising. Tubes –9mm long; pores 1–3mm wide, dull orange yellow, then fuscous or cinnamon. Flesh 3–5cm thick, minutely lacunose. Smell strong. Sp. 3.7–4.3 × 2.7–3μ, pinkish to vinaceous brown. Hyphae clamped, inflated ..... *Meiorganum* p. 362
         5. Not so. Pores yellow to ferruginous, –0.5mm wide.
            6. Effuso-reflexed with pilei –18cm radius. Flesh 5–20mm thick. Tubes –6mm long. Sp. 4–5.5 × 3–4μ, ferruginous ochraceous. Hyphae clamped; with many fine fibre-hyphae ..... *M. eurocephalus* p. 366
            6. Resupinate, very thin. Tubes –2mm long. Sp. 3.5–4.5 × 2–2.7μ, pale ochraceous s.m. Hyphae clamped; without fibre-hyphae ..... *M. luridochraceus* p. 369

1. Spores white.
   7. Effuso-reflexed with imbricate tomentose pilei –4cm radius, rufous sepia to purplish brown, thin, pliant. Hymenium rugulose, rufous orange, then umber to blackish. Sp. 5–7 × 3–4μ. Basidia immersed, then protruding singly through a layer of 1–2μ lobulate hyphae ..... *Phaeophlebia* p. 374
   7. Not so. Hymenium usually poroid. Basidia in a compact superficial layer.
      8. Hyphae without clamps in the fruit-body. Resupinate with narrow flange-like pilei. Sp. 3–3.5 × 1.2–1.5μ ..... *M. purpurascens* p. 370
      8. Hyphae with clamps.
         9. Floccoso-subcoriaceous, thin, resupinate. Hymenium lurid yellow to cinnamon ochre. Sp 3.3–4.2 × 2.3–2.7μ, pale ochraceous ..... *M luridochraceaus* p. 369
         9. Waxy subcoriaceous, subgelatinous. Sp. 3.5–5 × 2–2.5μ.
            10. Effuso-reflexed, wholly rose-red, –15mm radius. Without gloeocystidia ..... *M. rubrotremellosus* P. 371
            10. Resupinate. Hymenium ochraceous drab then brownish, pinkish or pale orange. Gloeocystidia frequent, clavate ..... *M. rufus* p. 372

Meiorganum

Heim, Rev. mycol. Paris 31 (1966) 157 (diagnosis); id. 30 (1965) 307 (illustrated).

Fruit-bodies lignicolous, substipitate, dorsifixed, descending, conical then ungulate to applanate, spathulate to flabelliform or eccentric, fleshy, putrescent; margin incurved. Tubes more or less inseparable, becoming compound with wide angular merulioid pores, waxy mucilaginous with phylloporoid trama, developing centrifugally from a small smooth hymenial disc at the apex of the primordium; pore-edges fertile; hymenium merulioid, not thickening. Flesh finely lacunose. Spores dull vinaceous pink to fawn brown, small, smooth. Cystidia present. Hyphae monomitic, thin-walled, inflating, clamped, minutely fasciculate-reticulate in the flesh. Sp. 1.

M. neocaledonicum Heim l.c.

Fig. 1, Plate 1

Sessile or substipiate, descending, subungulate, usually eccentric, then applanate with the horizontal limb –13 cm radius and 21 cm wide, with incurved margin and poroid hymenium on the underside, finally undulate or lobed, solitary to subcaespitose and imbricate, putrescent, all parts turning dingy pink or vinaceous, then fuliginous, on cutting or bruising, drying blackish. Upperside sterile, uniformly pallid fawn bistre to light fulvous fawn or rufous fawn, smooth or matt, somewhat appressedly inoderm-fibrillose towards the margin, somewhat rugulose when old, not zoned or sulcate, ferruginous fawn villous at the basal attachment; margin incurved, entire, pallid white to pallid yellowish, pruinoso-velutinate. Tubes – 9 mm long, waxy subgelatinous, dingy fawn orange or fuscous orange; pores becoming 1–3 mm wide, at first small and developing in more or less radial rows at the margin, angular, compound, with uneven entire edge, dull orange yellow, becoming fuscous orange or cinnamon fawn. Flesh 3–5 cm thick in the centre, spongy floccose, more or less finely lacunose but often minutely (especially near the surface and in the subhymenium over the tubes), pallid dingy white to dingy buff or pallid vinaceous. Smell strong of gas-tar and fenugreek, resembling *Hymenogaster*.

On stumps and fallen rotting trunks, also on living trees, in the forest. Singapore, Sumatra, Borneo, New Caledonia.

Spores 3.7–4.3 × 2.7–3 μ, dingy pinkish to dull vinaceous drab or fawn brown in the mass, smooth, broadly ellipsoid, with a thin mucilage sheath, with a small gutta 1.5 μ wide, cinnamon brown under the microscope, darkening to fuscous ferruginous in potash, the apiculus 0.2 μ; possibly slightly cyanophilous in cotton blue. Basidia 18–28 × 5.5–6.5 μ, clamped; sterigmata 4, 2.5–3.5 μ long. Cystidia 35–75 × 5–7 μ, narrowly fusoid, the obtuse to subacute apex 2–4 μ wide, thin-walled, colourless, projecting –40 μ, generally rather thickly granular encrusted in the immersed part,

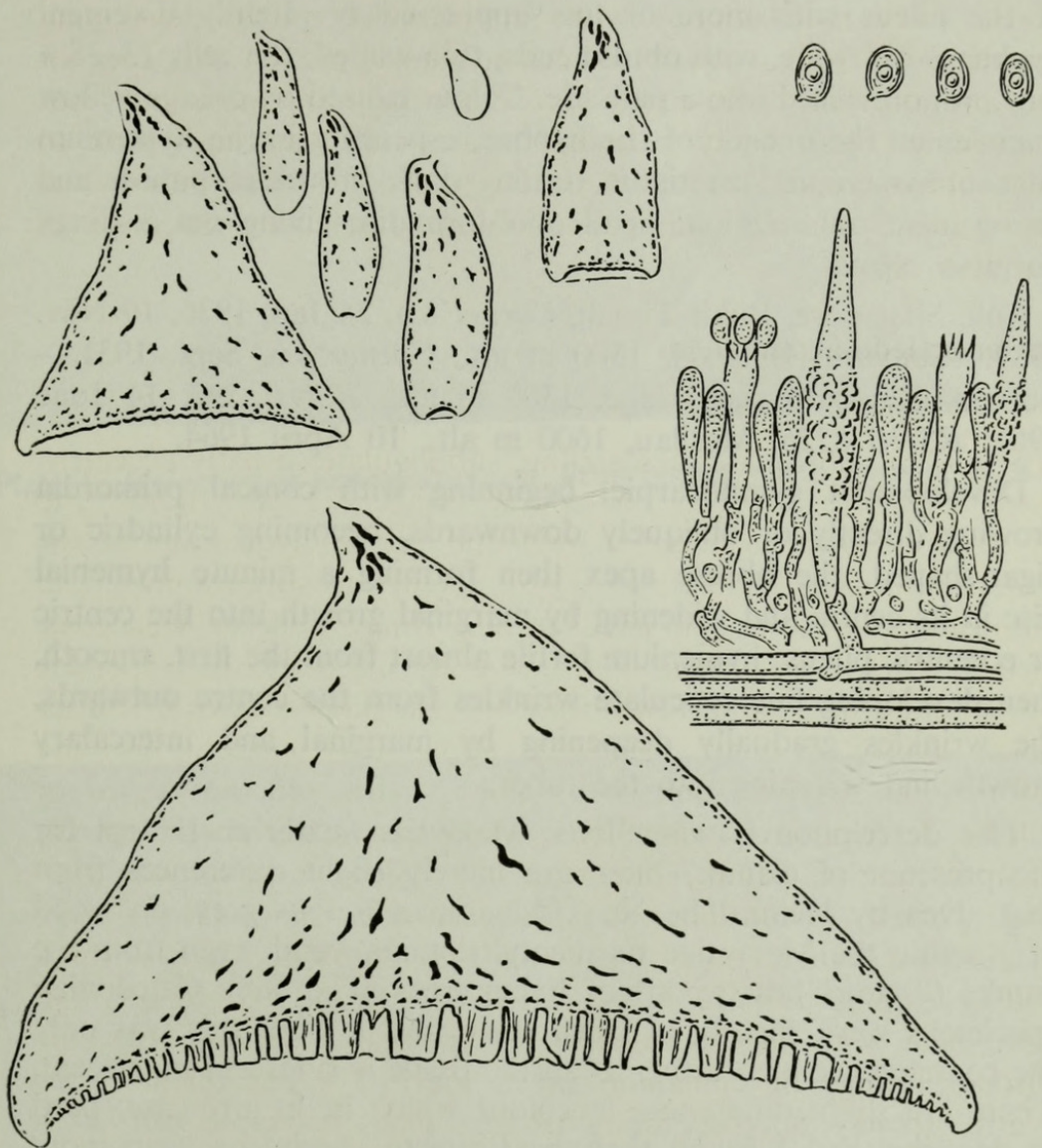

Fig. 1. *Meiorganum neocaledonicum*. Developing fruit-bodies in l.s., showing the lacunar flesh, x 1; spores, x 1000; part of the hymenium, x 500.

internally somewhat oleaginous, abundant, not forming a sterile edge. Hyphae 2.5–15 (–23) μ wide, clamped, the cells 60–220 μ long in the flesh, the walls thin or slightly thickened (subdiffluent in potash), more or less concrescent in short anastomosing microfibrils, branching at a wide angle, often with oleiferous hyphae –11 μ wide; in the tube-trama 2–6 μ wide, with thickened mucilaginous walls, strictly longitudinal, very compact, clamped; subhymenium 15–20 μ thick, compact, with hyphae 2–3 μ wide. Surface of the pileus with more or less appressed or slightly divergent hyphae 3–5 μ wide, with obtuse ends, thin-walled, the cells 13–38 μ long, not organised into a palisade. Colour caused by orange yellow granules on the outside of the hyphae, especially in the hymenium and subhymenium, the tissue turning dark brown in potash and giving a yellow solution; in alcohol-formalin, giving out a dingy purplish colour.

Coll. Singapore, Bukit Timah, *Corner* s.n. 24 Jan. 1936, 19 Nov. 1939.—Sumatra, Brastagi, 1500 m alt., *Corner* s.n. Sept. 1931.—Borneo, Kinabalu, east ridge, 1300 m alt., *RSNB 592*, 14 June 1961; *RSNB 8228*, Mesilau, 1600 m alt., 10 April 1964.

Development gymnocarpic, beginning with conical primordia growing directly or obliquely downwards, becoming cylindric or cigar-shaped, the obtuse apex then forming a minute hymenial disc in its centre and widening by marginal growth into the centric or eccentric pileus; hymenium fertile almost from the first, smooth, then developing fine reticulate wrinkles from the centre outwards, the wrinkles gradually deepening by marginal and intercalary growth and widening into the tubes.

This description is taken from Malaysian material. Except for the presence of clamps, there are merely slight differences from that given by Heim. The New Caledonian fungus grew on wood of *Agathis*, the Malaysian on dicotyledonous wood, even from the trunks (? dead heartwood) of living trees. The New Caledonian specimens were slightly blackish scaly, but I think this was only the consequence of bruising as all the tissue is rufescent-nigrescent. There are slight differences in colour which is, in any case, hard to describe, and I found that the Bornean specimens were more richly coloured than those from Singapore. The cystidia in the Malaysian specimens were encrusted in their immersed parts, but the incrustation dissolves in potash. The smell of the New Caledonian fungus was said to be 'fine odeur suave', whereas that of the Malaysian fungi was to me exceptionally noisome. With regard to the clamps, present in all the Malaysian material, Heim reported their absence from the New Caledonian, but I think that an error has crept in because in the centre of his Fig. 11 (Rev. mycol. 30, p. 316) a clamp is shown on an uninflated hypha, and the oblique septa that he emphasized are the septa of inflated clamps.

It is possible that this striking fungus reached Lloyd and might have been described by him, though I have not detected it in his publications.

Plate 1. *Meiorganum neocaledonicum*. Fruit-bodies, north Borneo, mt. Kinabalu.

Plate 2. *Merulius agathidis*. Fruit-bodies, north Borneo, mt. Kinabalu.

Merulius

Fr., Syst. Myc. 1 (1821) 326.—*Boninohydnum* Ito et Imai, Trans. Sapporo nat. Hist. Soc. 16 (1940) 127.—*Byssomerulius* Parmasto, Eesti NSV Tead. Akad. Toim. Biol. 16 (1967) 383.—*Gyrodontium* Pat., Ess. Tax. Hym. (1900) 117; Cooke, Gen. Homobas. (1953) 42; Donk, Taxon 5 (1956) 79.—*Gyrophora* Pat., Hym. Eur. (1887) 143.—*Gyrophana* Pat., Cat. rais. Pl. cell. Tunis (1897) 53.—*Leucogyrophana* Pouz., Ceska Mykol. 12 (1958) 32; Parmasto, Consp. Syst. Corticiacearum (1968) 77.—*Serpula* S. F. Gray, Nat. Arr. Brit. Pl. 1 (1821) 637; Cooke, Mycologia 49 (1957) 197.—*Trabecularia* Bonord., Bot. Ztg. 15 (1857) 211.—*Xylomizon* Pers., Mycol. europ. 2 (1825) 26.—*Xylophagus* Murr., Torreya 3 (1903) 7.

M. agathidis *sp. nov. Plate 2.*

Pilei –7cm applanati sessiles horizontales caespitosi imbricati, spathulati dein suborbiculares, aetate lobato-sinuati, villoso-tomentosi, flavidi dein cinnamomeo-olivacei, basim versus aurantio-brunnei; margine incurvato villosulo. Lamellae –3.5mm latae, confertae dichotomae rugosae (ut videtur poroideae sed non reticulatae), ceraceo-mucilaginosae obtusae integrae, luride flavae dein aurantiaceae, aetate fusco-cinnamomeae. Caro 3–6mm crassa, floccosa, mollis aquosa, fusco-brunneo-ochracea, tomento –1mm crasso. Odor fortis acidus. Sporae 3.3–4.2 × 1.7–2μ, pallide ochraceae leves. Hyphae fibulatae. Ad lignum *Agathidis* in silva. Borneo, Malaya (**typus** *RSNB 8123,* CGE).

Pilei –7 cm radius, sessile, applanate, horizontal, imbricate, forming masses –12 × 10 cm from a common trunk, semicircular, finally lobed and undulate, villous-tomentose, pale chrome yellow then cinnamon olivaceous, at the base dull orange brown; margin incurved, finely villous. Gills –3.5 mm wide, radiating, rather crowded, repeatedly dichotomous, developing vertical ridges on the sides and appearing subporoid (but not reticulate), rather waxy mucilaginous, the edge obtuse and entire, bright chrome yellow then bright orange, finally clouded fuscous cinnamon. Flesh 3–6 mm thick, softly floccose, watery, not gelatinous, fuscous brownish ochraceous, with a thick tomentum –1 mm. Smell sour, strong, rather fruity on drying.

On dead trunks of *Agathis* in the forest. Malaya, Borneo.

Spores 3.3–4.2 × 1.7–2 μ, pale ochraceous under the microscope, slightly darker in potash, smooth, subcylindric, straight with obtuse ends or suballantoid, the slightly thickened wall cyanophilous in cotton blue and often, but not in all cases, red-brown in Melzer's iodine. Basidia 15–17 × 4 μ; sterigmata 4. Cystidia none; gill-edge fertile. Hyphae 2–7 (–10) μ wide, clamped, scarcely inflated, radiating and much interwoven, branched at a wide angle, the walls thin or slightly thickened (0.5–1.5 μ and subdiffluent in potash); 2–3.5 μ wide in the gill-trama, laxly interwoven; 2–3.5 μ wide in the tomentum on the pileus, projecting irregularly. Colour evidently caused by a fine granular excretion in scattered patches on the hyphal walls, more or less soluble in potash.

Coll. Malaya, Negri Sembilan, Gunong Angsi, 700 m alt., *Corner* s.n. 3 July 1930.—Borneo. Kinabalu, Mesilau, 1600 m alt., 6 April 1964, *RSNB 8123.*

This is one of the few basidiomycetes that I have found on dead wood of *Agathis*. It recalls the north temperate *Paxillus panuoides* of coniferous wood and the tropical *Hygrophoropsis flabelliformis*. It is probably not uncommon and opportunity should be taken to obtain a spore-print. Old specimens of the Malayan collection had the older parts of the gill puberulous with excurrent cystidium-like hyphae –80 × 3–5 μ, aseptate, slightly tapering, with thin brownish walls; it seemed that they belonged to some mould but it was not possible to trace them.

M. eurocephalus (B. et Br.) Petch, Ann. r. bot. Gdn Peradeniya 4 (1910) 408.

Polyporus eurocephalus B. et Br., J. Linn Soc. Bot. 14 (1875) 48.—*Serpula eurocephala* (B. et Br.) W. B. Cooke, Mycologia 49 (1957) 212 (with full synonymy); Cunningham, Thelephoraceae of Australia and New Zealand (1963) 329.—*M. pseudolacrymans* P. Henn. (1901).—*Gyrophana pseudolacrymans* (P. Henn.) S. C. Teng, Fungi of China (1964) 761.—*M. insignis* Wakefield, Kew Bull. (1917) 107.—*M. consimilis* Lloyd, Myc. Writ. 7 (1922) 1122; Ginns, Mycologia 61 (1969) 363.

Sessile, applanate, often imbricate, effuso-reflexed varying resupinate, spreading laterally – 40 cm in extent, the pileate brackets –18 cm radius and 32 cm wide, slightly convex; upperside appressedly cottony fibrillose, nearly smooth, dry, soft, white or pale yellowish white, becoming golden ferruginous from the spores; margin entire, thick, obtuse, becoming subacute, white, the resupinate part with white villous-tomentose border; attached with white or yellowish mycelial strands. Hymenium polyporoid; tubes – 6 mm long, often of unequal length, soft, waxy, subdeliquescent, separable from the flesh, yellow then lurid ferruginous yellow, often tinged greenish; pores 0.2–0.5 mm wide, round or elongate, often 2–3 confluent, uneven with obtuse waxy edges, often toothed in the ascending parts of the fruit-body, concolorous. Flesh 5–20 mm thick at the base of the pilei, 2–10 mm at 5 mm from the margin, spongy, soft floccose, dry, white or pale yellowish. Smell slight, sour.

On dead fallen and standing trunks of trees, bamboos and palms, also on dead roots, in the forest. Pantropical; frequent in Malaya and Singapore, lowland.

Spores 4–5.5 × 3–3.7 (–4.2) μ, bright ferruginous ochraceous in the mass, broadly ellipsoid to ovoid or even subglobose, smooth, with slightly thickened walls and thin mucilaginous sheath (0.3 μ), aguttate, contents oleaginous. Basidia 30–40 × 6–8 μ, clamped; sterigmata 4, 3–6 μ long. Cystidia none. Hymenium not thickening, continuous over the pore-edges; subhymenium with mucilaginous hyphae 1.5–2.5 μ wide. Hyphae 2–6.5 μ wide, thin-walled, clamped, often branched from the clamp, rather loosely interwoven without conspicuous radiating hyphae (except at the margin), colourless, not encrusted, accompanied by copious slightly thick-walled oleaginous hyphae 1–3 mm long or more, –6 μ wide, occasionally

branched, apparently aseptate, tapering to long filiform tips. 0.5–1 μ wide, permeating the flesh in all directions as elastic fibrils, also in the tube-trama, and very abundant in the mycelium and rhizomorphs; hyphae in the tube-trama 2–4 μ wide, more or less longitudinal with mucilaginous walls.

Coll. Singapore, Gardens Jungle, Reservoir Jungle.—Malaya, Pahang, Tembeling, Kuala Tekai.—Borneo, Brunei.

This is a rather common, striking and omnivorous fungus. The Malayan fungus was described as *M. insignis* and it may be a variety. Petch said for the Ceylon fungus that the pileus turned red or purple when bruised or cut, which I have not noticed in the Malayan; he also gave the spores as 5–8 × 3–4 μ, which is larger than the Malayan.Cooke's description appears to have been drawn from dried specimens and he cites collections from Malaya, but he seems to have overlooked with others the very abundant oleiferous fibre-hyphae which are readily seen as long fibrils on teasing out the tissue of the pileus.These hyphae are the basis of the dimitic character assigned to the tissue by Ginns. The exact nature of these hyphae, similar to the fibre-hyphae of *M. lacrymans*, needs enquiry from young living primordia.

M. irpicoides *sp. nov. Fig. 2*

Resupinatus separabilis, subtus tomentosus, margine flavido-albo villoso; contextu 0.2–0.3mm crasso, flavido-albo. Hymenium irpicoideum, haud poroideum, ceraceo-subgelatinosum, luride ochraceo-flavum dein brunneo-aurantiacum; spinulis –7 × 0.5–1.5mm, subcylindricis obtusis liberis v. plus minus connexis, saepe applanatis, longitudinaliter rugosis. Sporae 4–4.7 × 3–3.5μ, brunneo-ochraceae s.m., leves, Hyphae fibulatae. Ad receptaculum *Poriae* emortuum. Borneo (**typus** *RSNB 8418*, Kinabalu, Mesilau, 1650m alt., 22 April 1964, CGE).

Resupinate with thin flesh 0.2–0.3 mm thick, tomentose on the underside, separable, yellowish white, margin villous. Spines –7 × 0.5–1.5 mm, odontioid-irpicoid, subcylindric or joined into flattened, often longitudinally ridged, plates, not poroid-anastomosing, obtuse, waxy subgelatinous, lurid ochre-yellow then brownish orange.

On the dead fructifications of *Poria* in the forest. Borneo, Kinabalu.

Spores 4–4.7 × 3–3.5 μ, brownish ochraceous under the microscope, ellipsoid, smooth, obtuse, with a thin mucilage sheath (0.3 μ). Basidia 26–32 × 5.5–6.5 μ, clamped; sterigmata 4, 5 μ long. Cheilocystidia –90 × 5–8 μ, projecting –40 μ, sometimes immersed, scattered along the fertile edge of the plates, fusiform, subacute or obtuse, thin-walled, often with a fine thin granular incrustation on the projecting part; pleurocystidia none. Hymenium not thickening, not encrusted, continuous over the spine-tips; subhymenium c. 30 μ thick, composed of mucilaginous hyphae 1–2.5 μ wide. Hyphae clamped, but some secondary septa without clamps; in the flesh and spines 3–12 (–18) μ wide with the cells –1000 μ long or more, with mucilaginous walls, not encrusted, fairly compact, regularly longitudinal in the spines; in the tomentum (0.5–0.6 mm thick) 2–3.5 μ wide, much interwoven, clamped, thin-walled, with a dark brown incrustation, often in annuli, soluble in potash.

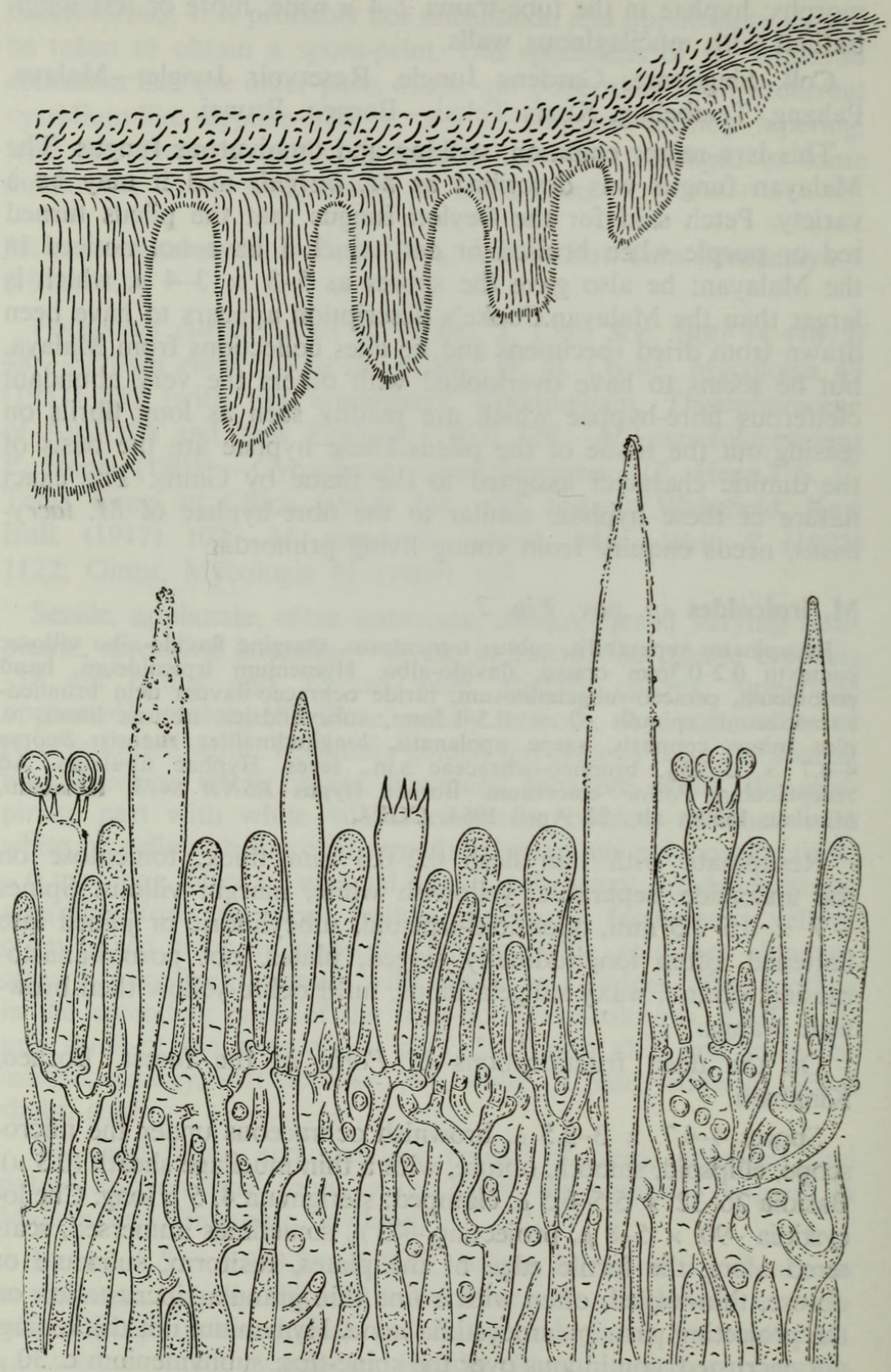

Fig. 2. *Merulius irpicoides*. Diagram of the structure of the fruit-body at the margin, in l.s., x 10; hymenium at the pore-edge, x 1000.

This may be near to the New Caledonian *M. chlorina* Pat., which also grew on a polypore, but its hymenium was olivaceous and shortly poroid; no cystidia were recorded for it; there is no mention of a tomentose undersurface; the spores, 3–4 × 2.5–3 μ, were described as white by Patouillard and yellow brown by Cooke.

M. irpicoides may also be related to *M. castaneus* Lloyd on *Chamaecyparis* and *Pinus* in Japan, but that species has thick-walled encrusted cystidia (Ginns 1969). For *M. castaneus* the genus *Cystidiophorus* Bond. et Ljub. has been proposed (Imazeki and Hongo, Fungi of Japan II, 1965, 125 n. 244); such generic distinction hardly applies to *M. irpicoides*.

M. luridochraceus *sp. nov.*

Resupinatus –12cm latus, floccoso-firmus separabilis; contextu 0.2–0.5mm crasso, albido; margine angusto albo-villoso. Hymenium mox gyroso-plicatum, demum irregulariter poroideum, tubulis –2mm longis, poris 0.2–0.5mm latis, ceraceo-gelatinosum, laete flavum, dein luride ochraceum, aetate fulvoferruginosum, sicco fusco-olivaceum nigricans. Sporae 4–4.5 × 2.2–2.7μ v. 3.3–4.2 × 2.3–2.7μ, pallide ochraceae s.m., leves. Hyphae fibulatae. Ad lignum putridum. Borneo (**typus** *RSNB 5837*, CGE).

Resupinate –12 cm in extent, floccose-firm, separable; context 0.2–0.5 mm thick, whitish; margin narrow, white villous. Hymenium soon gyrose-plicate, then irregularly poroid with tubes –2 mm long, pores 0.2–0.5 mm wide, waxy gelatinous, bright yellow then lurid ochraceous, in age fulvous ferruginous, drying fuscous olivaceous and blackening.

On rotten wood in the forest. Borneo, Kinabalu.

Spores 4–4.5 × 2.2–2.7 μ or 3.3–4.2 × 2.3–2.7 μ (*RSNB 5837*), pale ochraceous or brownish under the microscope, slightly darker in potash, smooth, ellipsoid, the wall slightly thickened, with a thin mucilage sheath, not amyloid, or merely slightly brownish, cyanophilous in cotton blue. Basidia 20–30 × 5–7 μ; sterigmata 4, 4–6 μ long. Cystidia none. Hymenium not thickening, continuous. Hyphae 1.5–5 μ wide, clamped, thin-walled or slightly thick-walled, scarcely encrusted, often branched from the clamp, more or less interwoven, subparallel in the basal part of the flesh, compact; in the tube-trama 1.5–3 μ wide, mucilaginous.

Coll. *RSNB 5837*, Pinosuk Plateau 1700 m alt., 17 March 1964; *RSNB 8489*, Mesilau 24 April 1964; *Corner* s.n., Mesilau, 1600 m alt., 5 Feb. 1964.

This appears to be frequent on Mt. Kinabalu and always resupinate. It seems to be near to *M. byssoideus* Burt with darker brown, wider spores 4.5–6 × 3.5–4.5 μ. The spores in the **type**, *RSNB 5837*, were so pale that I took them at first to be colourless, but re-examination and comparison with the other collections showed that they were slightly ochraceous. A spore-print is needed, for the species seems exactly intermediate between *Serpula* and *Merulius* s. str.

M. purpurascens *sp. nov.*

Resupinatus, 0.4mm crassus, subcoriaceus, margine saepe anguste reflexo pileiformi –5mm lato; superne flavidus, ochraceus v. subaurantiacus, anguste sulcatus, tomentosus v. subvillosus. Hymenium mucilaginosum rugulosum, poroideum v. gyroso-irpicoideum, poris 0.2–0.5mm latis, 0.5mm altis, aurantiacum dein cinnamomeum, vinaceum v. fuscum. Sporae 3–3.7 × 1.2–1.5μ, albae subarcuatae inamyloideae. Hyphae sine fibulis. Ad ramulos emortuos in silva. Borneo, Malaya, Solomon Isl. (**typus** *Corner* s.n. 29 Nov. 1930, Pahang, CGE).

v. **flavido-albus** *var. nov.*

Differt hymenio pallide flavido-albo, sicco incarnato, gloeocystidiis sparsis 20–35 × 6.5–9.5μ. Ad ramulos in silva. Malaya (**typus** *Corner* s.n. 8 Nov. 1930, Pahang, CGE).

Resupinate, rather closely adnate but separable, widely effused, often with narrow flange-like reflexed margin or pileus –5 mm wide; upperside pale yellow, ochraceous or orange buff, narrowly sulcate, tomentose or subvillous; margin yellow to pale buff, distinct, narrow. Hymenium mucilaginous, rugulose, poroid or gyrose-irpicoid with projections –0.5 mm high, pores 0.2–0.5 mm wide, orange then more or less cinnamon, vinaceous or fawn. Flesh –0.4 mm thick, felted, subcoriaceous, dry, pallid buff. Dried material with pale pinkish buff to vinaceous rose or fuscous purple hymenium; material in alcohol-formalin turning deep purple magenta.

On dead branches and twigs in the forest, chiefly montane. Borneo, Malaya, Solomon Isl. (? Australia, New Zealand).

Spores 3–3.7 × 1.2–1.5 μ, white, smooth, subcylindric or suballantoid, not amyloid, 2-guttulate. Basidia 15–18 × 3.5–4 μ, without clamps; sterigmata 4, 3μ long. Hymenium continuous; subhymenium 20–25 μ thick, mucilaginous, with hyphae 1.5–2.5 μ wide. Cystidia none, but ? small subfusiform basidioles 4–6 μ wide. Hyphae 2–5.5 μ wide, without clamps, long-celled, the branches often constricted at origin, cells –200 μ long, closely interwoven, the walls becoming 0.5–1.5 μ thick, smooth or thinly encrusted (RSS 585), often brownish; with abundant irregular small crystals and amorphous purplish brown matter in the hymenium and subhymenium, insoluble in potash but more or less soluble in Melzer's iodine.

Coll. Malaya, Pahang, Fraser's Hill, 1100 m alt., *Corner* s.n. 29 Nov. 1930.—Borneo, Kinabalu, 1650 m alt., 22 April 1964, *RSNB 8422*.—Solomon Islands, Guadalcanal, Gallego, 1000 m alt., 7 July 1965, *RSS 585;* Popomanasiu, 2200 m alt., 26 Oct. 1965, *RSS 1623*.

v. **flavido-albus** *var. nov.*

Differs in the pallid yellowish white hymenium, drying pinkish, and in the presence of very sparse gloeocystidia 20–35 × 6.5–9.5 μ, clavate, immersed or in the hymenium.

On sticks in the forest. Malaya, Pahang, Tembeling, *Corner* s.n. 8 Nov. 1930.

This species without clamps in the fruit-body is close to the almost cosmopolitan *M. corium* (Pers.) Fr., from which it differs in the more richly coloured hymenium, the smaller spores and

basidia (spores 5–8 × 2.5–4 μ, basidia 16–24 × 4–6 μ in *M. corium*), and perhaps in the way in which the whole tissue becomes deep purple in alcohol-formalin. The Australasian species described by Cunningham (1963) as *M. ravenelii* Berk. seems identical, though it has entirely resupinate fruit-bodies (as may happen in the Malaysian) and slightly longer and narrower spores 4–5 × 0.8–1 μ. Other exotic species without clamps, placed in *Byssomerulius* Parmasto, which seem very similar are these: —

M. glaucinus Bourd. et Galz., on pine-wood in France, pellicular with sparse cystidium-like organs.

M. hirtellus Burt, on dicotyledonous wood in North America, with cylindric cystidia (Ginns 1968).

M. rubicundus Litsch., on wood of *Alnus* in Siberia, with cylindric cystidia; described as *M. glaucinus.* v. *lutescens* Pilat (Bull. Soc. mycol. Fr. 49, 1933, 293).

Whether any of these show the purple colour in alcohol-formalin is not known. The very sparse gloeocystidia of *M. purpurascens* v. *flavio-albus* resemble those of *M. rufus* and are not comparable with the hymenial cystidia of the other species.

M. ravenelii Berk. is now interpreted as a synonym of *Poria taxicola* (Pers.) Bres., which has been given its own genus *Meruliopsis. M. purpurascens* differs in the less regularly poroid undersurface, the yellow to orange hymenium (pink to brownish in *P. taxicola*), and the narrower hyphae with long cells. I note also in specimens of *P. taxicola* that there are sterile, fusiform, obtuse basidioles frequently in the hymenium, which I have not seen for certain in *M. purpurascens.* Dried specimens, however, are very similar.

M. rubrotremellosus *sp. nov.*

Effuso-reflexus, pileis –18mm in radio flabelliformibus 1–2mm crassis, roseo-ruber, ceraceo-gelatinosus. Hymenium minute poroideo-reticulatum, alveolis 0.3–0.6mm latis, etiam 1–2mm radiatim elongatis, concolore. Sporae 4–5 × 2–2.3μ, albae suballantoideae inamyloideae. Hyphae fibulatae. Ad lignum putridum in silva. Borneo (**typus** *RSNB 2834,* CGE).

Effuso-reflexed; pilei –18 mm radius, flabelliform, 1–2 mm thick, wholly rose-red, waxy subgelatinous. Hymenium minutely poroid-reticulate with meshes 0.3–0.6 mm wide, sometimes elongate radially 1–2 mm, concolorous.

On a rotten branch in the forest. Borneo, Kinabalu, Tenompok, 1650 m alt., 6 Sept. 1961, *RSNB 2834.*

Spores 4–5 × 2–2.3 μ, white, smooth, ellipsoid-cylindric to suballantoid, not amyloid. Basidia 25–30 4.5–5 μ; sterigmata 4, 4–5 μ long. Cystidia none, the pore-edges becoming fertile but apparently with narrow, closely set, excrescent hyphae at first. Hymenium not thickening, ? not mucilaginous; subhymenium ? not mucilaginous, the hyphae 1.5–2.5 μ wide. Hyphae of the flesh 2–4 μ wide, clamped, thin-walled, rather long-celled, radiating and

interwoven, on the surface of the pileus compact and appressed; with pinkish amorphous granular matter among the hyphae, especially towards the upperside of the fruit-body; the tissue slightly pinkish in potash with the cytoplasm of the hyphae turning pinkish, scarcely changing colour in alcohol-formalin.

This seems at first to be an ally of *M. tremellosus* Fr., the tissue of which turns bright pink in alcohol-formalin, but neither hymenium nor subhymenium appear to be mucilaginous, and, as the edges of the hymenial outgrowths may be sterile at first, it is possible that this is not a *Merulius* but a poroid ally of the rose-red *Hydnum roseomaculatum* P. Henn. et Nym., which is not uncommon on Mt. Kinabalu; yet the hyphae of this *Hydnum* may lack clamps (Maas-Geesteranus, Proc. Kon. Nederl. Ak. Wet. Amsterdam, ser. C, 70, 1967, 63.).

M. rufus Fr., Syst. Myc. 1 (1821) 327; Bourd. et Galz., Hym. Fr. (1927) 349.

M. pilosus Burt, Mycologia 14 (1922) 184; Ginns, Mycologia 60 (1968) 1229, f.11.— *Phlebia merulioides* Lloyd, Myc. Writ. 4 (1915) 537; Ginns, Mycologia 61 (1969) 369.—*P. castanea* Lloyd, Myc. Writ. 7 (1922) 1108; Ginns, Mycologia 61 (1969) 361.— *P. rufa* (Fr.) Christiansen, Dansk Bot. Ark. 19 (1959–60) 164.—? *M. nothofagi* G.H. Cunningham, N. Z. Plant Diseases Div. Bull. 83 (1950) 7; Thel. Austral. N. Z. (1963) 324, f. 199.

Resupinate, separable, waxy coriaceous; flesh 0.3-0.7mm thick, tough, pallid white; margin determinate, white, minutely fimbriate or byssoid. Hymenium irregularly irpicoid-poroid, the irregular tubes —1 x 0.2-0.5 mm, with blunt fertile edges, white then pale ochraceous drab tinged brownish or pinkish, often pale pinkish orange when young. Smell rather fragrant.

On fallen trunks, branches and twigs, mainly of Fagaceae. North temperate, Borneo, (?Australia, New Zealand).

Spores 3.5–4.5 (–5) × 2–2.5 μ, white, subcylindric, obtuse, straight, smooth, not amyloid, slightly cyanophilous in cotton blue. Basidia 20–28 × 3.7–4.5 μ; sterigmata 4, 3 μ long. Hymenium not thickening; subhymenium –50 μ thick, the hyphae 1.5–2.5 μ wide. Gloeocystidia 28–45 × 6–8 μ in the hymenium, 28–75 × 6.5–15 μ when immersed, clavate, thin-walled, smooth, with dense oleaginous guttulate contents, sparse or frequent, immersed or slightly projecting, abundant at the margin before the development of the tubes. Hyphae clamped, often branching from the clamp; in the flesh 3–6 μ wide, radiating, longitudinal, compact, the walls somewhat thickened (toughly subgelatinous in potash), the tissue rather toughly waxy gelatinous; in the tube-trama 2–4 μ wide, with subgelatinous walls and oily contents, interwoven and longitudinal, fairly compact; basal hyphae 4–8 μ wide, the walls 1–2 μ thick. All the tissue, except the middle part of the flesh, turning bright red pink in alcohol-formalin, only slightly pinkish in potash, the pink colour caused by the slight reddening of the hyphal cytoplasm.

Coll. Borneo, Kinabalu, Mesilau, Pinosuk Plateau, Bembangan River, 1300–1800 m alt.; *RSNB 1763, 1831, 2635, 2643, 5786.*

The presence of gloeocystidia in this species has been noted by Ginns, but they seem to have escaped others. The Bornean material is identical with that which I have collected in Great Britain. I cannot detect any distinction in *M. nothofagi*. *M. rufus* is near to *M. tremellosus* but the fruit-bodies are much thinner, entirely resupinate, and with smaller spores.

M. versicolor (B. et Br.) *comb. nov.*

Hydnum versicolor B. et Br., J. Linn. Soc. Bot. 14 (1873) 59.— *Gyrodontium versicolor* (B. et Br.) Maas G., Persoonia 3 (1964) 190; Proc. Kon. Nederl. Ak. Wet. Amsterdam ser. C, 69 (1966) 323.— *Hydnum henningsii* Bres., Bull. Soc. mycol. Fr. 6 (1890) xlviii, pl. 9, f.2.— *G. henningsii* (Bres.) Pat., Ess. Tax. (1900) 117.— *Hydnum flavidum* Lloyd, Myc. Writ. 6 (1920) 957.— *G. flavidum* (Lloyd) Reid, Kew Bull. 17 (1963) 268.— *G. serpuloides* (P. Henn.) Reid, l.c. 268.—*Boninohydnum pini* Ito et Imai, Trans. Sapporo nat. Hist. Soc. 16 (1940) 127.—? *Hydnum boveanum* Mont., Ann. Sci. nat. Bot. Ser. 2, 4 (1835) 194; Maas Geesteranus, Persoonia 3 (1964) 157, 191 ut *G. boveanum* (Mont.) Maas G.

Sessile or effuso-reflexed, commonly with imbricate brackets, sometimes solitary or entirely resupinate. Pileus —12cm radius, 21cm wide, often much smaller, cottony subfloccose to nearly smooth, pale yellowish white to pale clear primrose yellow; margin obtuse, then subacute, entire, white. Spines 3–7 x 0.5–1mm, crowded, conical, subacute or obtuse, even subtruncate, discrete, often angular or somewhat longitudinally rugulose, waxy, brittle, clear primrose yellow then mustard yellow to fuscous olive or olivaceous cinnamon. Flesh 3–14mm thick at the base of the pileus, 0.5–6mm at 5mm from the margin, soft, spongy, floccose, not gelatinous, pale yellowish to bright primrose yellow. Smell aromatic, somewhat of caramel, slightly pungent, not sour.

On dead standing or fallen trunks, bamboos and palms in primary and secondary forest, frequent –1300m alt. Malaya, Singapore, Africa, Asia.

Spores 3.5–4.7(–5) × 2.5–2.7(–3)μ fuscous olivaceous in the mass (not ferruginous), ellipsoid, obtuse, smooth, with a fine mucilage sheath. Basidia 15–20 × 4–5μ; sterigmata 4, 2.5–3μ long. Cystidia none. Hymenium not thickening, continuous over the tips of the spines from the outset. Hyphae monomitic, without clamps, not or scarcely inflating long-celled; in the flesh 4–8μ wide, thin-walled, flexuous, longitudinal, without oleiferous or fibre-hyphae; in the spines 3–5μ wide, mucilaginous, longitudinal; in the subhymenium 2–3.5μ, mucilaginous.

This is the common bracket hydnum with yellow to olive brown spines that at once reveals itself as a *Merulius*. It is as omnivorous as *M. eurocephalus* and the two often cannot be distinguished from the upperside. *Gyrodontium capense* Reid seems to differ only in the slightly larger spores 4.8–5.8 x 3–3.8μ.

Phaeophlebia

W.B. Cooke, Mycologia 48 (1956) 401 (with full synonymy of 28 names); Donk, Taxon 6 (1957) 107; Lentz, Sydowia 14 (1960) 127.— *Auricula* Lloyd, Myc. Writ. 7 (1922) 1152 (non O.K. 1891); Donk l.c. 21.—? *Punctularia* Pat., Bull. Herb. Boiss. 3 (1895) 57; Talbot, Bothalia 7 (1958) 140, 164; Donk, Persoonia 3 (1964) 287.

P. strigosozonata (Schw.) W.B. Cooke l.c.

Merulius strigosozonatus Schw., Trans. Am. phil. Soc. n.s. 4 (1832) 160. *Fig. 3.*

At first conchate or pezizaeform and dorsifixed, then through marginal growth widely effuso-reflexed with the horizontal pileate part 1–4cm radius, spathulate-semicircular or joining in flanges, sometimes imbricate, becoming undulate and plicate from excessive tangential growth; upperside closely tomentose, zoned, subsulcate, dark rufous sepia, madder brown, purplish brown, bay brown or umber, with darker fuscous brown to blackish zones, finally wholly blackish umber and fuscous drab; margin yellowish or white, tomentose. Hymenium subgelatinous, closely and narrowly radiating rugulose with shallow obtuse folds, becoming very crowded in the central part of the hymenium but not poroid, bright orange near the margin, becoming rufous orange, then vinaceous umber, somewhat rufous on bruising, drying black. Flesh pliant coriaceous, in two layers; upper tomentose layer 0.8–1.2mm thick, dark brown; lower subgelatinous layer 0.5–0.8mm thick, paler. Smell sour, rank.

On fallen logs in the forest. Singapore, Malaya, New Guinea, Solomon Isl. Cosmopolitan (? Africa).

Spores 5–7 x 3–4μ (6–8μ long, Cunningham), white, smooth, ellipsoid to subcylindric, not amyloid, slightly cyanophilous in cotton blue. Basidia 28–34 x 5–5.5μ (30–50μ long, Cunningham), clavate; sterigmata 4, 4–5μ long. Cystidia none. Hymenium with the basidia in a more or less discontinuous layer separated by narrow, 1–2μ wide, profusely and irregularly branched, often lobulate, mucilage hyphae, overtopping the immature basidia as a mucilage layer –20μ thick, the mature basidia protruding through this layer; subhymenium –30μ thick, mucilaginous. Hyphae monomitic, clamped, not inflating; in the lower layer of the flesh 2–4μ wide, more or less radiating, rather compact, with mucilaginous walls, colourless, long-celled; in the tomentum 3–5μ wide, at first perpendicular to the surface then interwoven, with smooth brown walls –1.5μ thick, sparsely branched, the growing tips colourless and thin-walled, very dense and almost agglutinated in a thin layer c. 20μ thick at the junction with the gelatinous layer of the flesh. Hymenium and tomentum turning dark brown in potash, scarcely changing colour in alcohol- formalin.

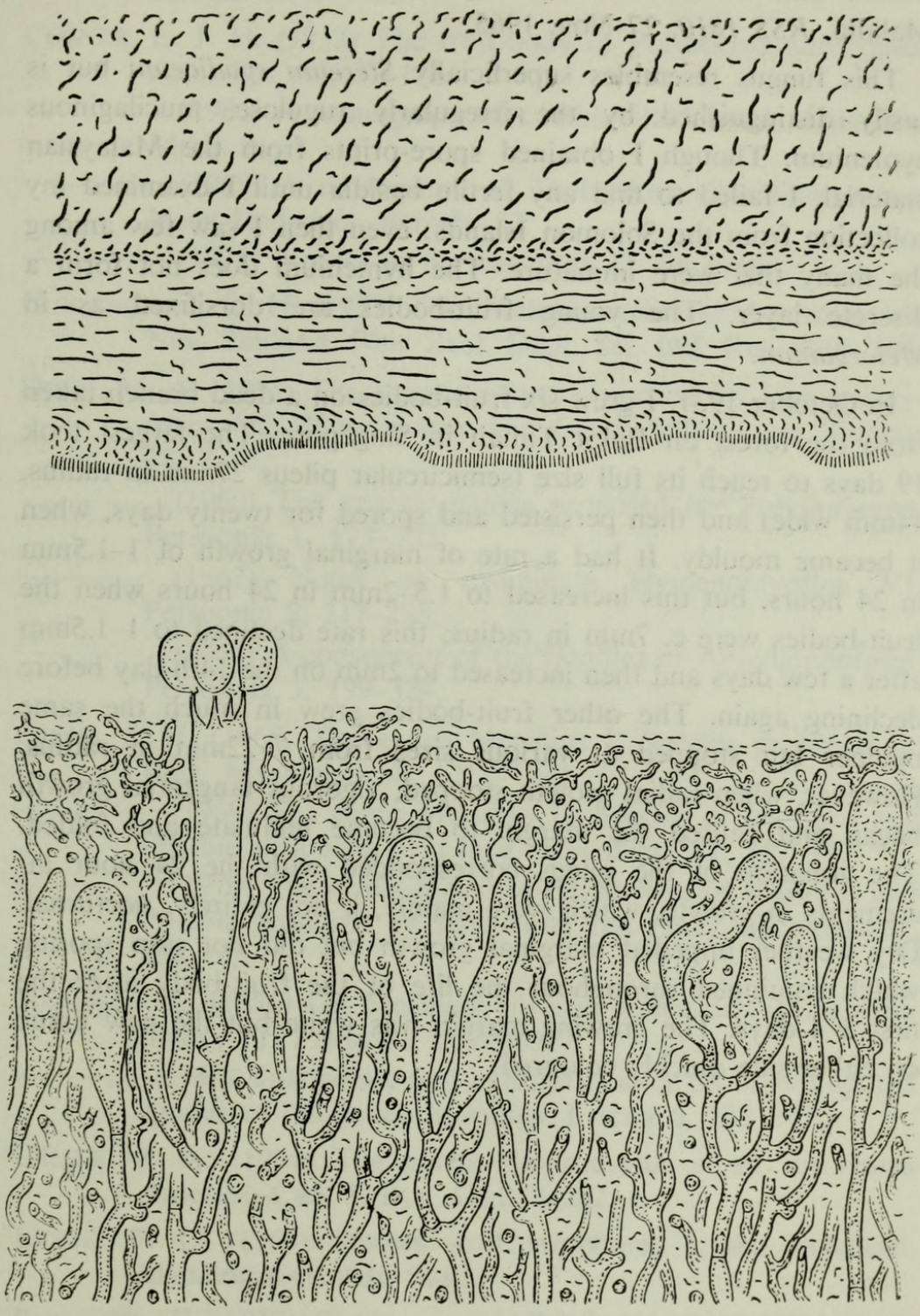

Fig. 3. *Phaeophlebia strigosozonata.* Diagram of the structure of the pileus in l.s., x 25; hymenium, x 1000.

Coll. Singapore, Bukit Timah, *Corner* s.n. April 1929, 29 March 1931.— Malaya, Johore, Corner s.n. Mawai-Jemaluang Rd., 30 March 1941; Pahang, Tembeling, *Corner* s.n. 6 June 1931; Kelantan, Sungei Ketil, *Corner* s.n. 1 June 1931.—New Guinea, Woitapi, 2000m alt., *Corner* s.n. 23 Aug. 1960.— Solomon Isl., Small Malaita, *RSS 1810*, 27 Nov. 1965.

This fungus resembles superficially *Stereum spadiceum* but is easily distinguished by the irregularly rugulose, mucilaginous hymenium. Though I obtained spore-prints from the Malaysian material, I failed to find any fertile basidia until I examined my collection from the Solomon Islands; even then I saw few among the many that were immature. The hymenium does not form a discrete layer. The young fruit-bodies are dorsifixed as in *Meiorganum*.

In October 1931, I grew six fruit-bodies on a dead branch taken from the forest on Bukit Timah in Singapore. The largest took 19 days to reach its full size (semicircular pileus 27mm in radius, 44mm wide) and then persisted and spored for twenty days, when it became mouldy. It had a rate of marginal growth of 1–1.5mm in 24 hours, but this increased to 1.5–2mm in 24 hours when the fruit-bodies were c. 7mm in radius; this rate declined to 1–1.5mm after a few days and then increased to 2mm on the 14th day before declining again. The other fruit-bodies grew in much the same manner but stopped at various sizes from 7–22mm in radius. However, when radial growth stopped, vigorous tangential growth began and caused the margin to become undulate and folded. The zonation of the pileus corresponded with the 24 hour increments in growth, which were mainly, if not entirely, nocturnal. Dry weather impeded marginal growth but did not stop sporing which continued throughout the life of the fruit-body after the first 3–4 days. The growing margin was white but the new tissue on either side quickly coloured.

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Index of species attributed to Merulius

Merulius Fr. (1821)

Merulius St.-Am. (1821) = *Cantharellus* Fr.

Merulius S. F. Gray (1821) = *Hygrophoropsis* Maire

affinis Jungh. (1838)

affinis Vel. (1922)

agathidis Corner

albidus Pers. (1825)

albostramineus Torrend (1913) = ? *M. porinoides* Fr.

albus Burt (1917) = *Poria cocos* (Schw.) Wolf

alveolaris Pers. (1925) = *Favolus*

ambiguus Berk. (1872)

americanus Burt (1917) = *M. himantioides* Fr.

armeniacus Berk. (1872)

atropurpureus W. B. Cooke (1943) = ? *M. taxicolus* (Pers.) Duby

atrovirens Burt (1917) = *M. pinastri* (Fr.) Burt

aurantiacus S. F. Gray (1821) = *Hygrophoropsis aurantiacus* (Fr.) Maire

aurantiacus Kl. (1836) = ? *M. molluscus* Fr.

aurantiacus Pers. (1822)

aurantius Lloyd (1922) = *M. corium* (Pers.) Fr.

aureus Fr. (1828)

auroreus Pers. (1825) = *Cantharellus lutescens* Fr. f. Donk (1969)

baileyi B. et Br. (1883) = an agaric f. Cunningham (1963)

bellus B. et C. (1872)

binominatus Mass. (1913) = *M. eurocephalus* (B. et Br.) Petch

borealis Rom. (1911) = *Athelia* f. Parmasto

brassicaefolius Schw. (1822) = *M. lacrimans* Fr.

bryophilus Pollini (1824) = *Leptoglossum bryophilum* (Fr.) Ricken

byssoideus Burt (1917)

byssinus Pers. (1825)

canaliculatus Pers. (1825)

candicans Pers. (1825) = *Leptoglossum muscigenum* (Fr.) Karst.

candicans Roum. (1886) = *M. pinastri* (Fr.) Burt

candidus Lloyd (1923) = *Poria calcicolor* Sacc. et Syd.

cantharelloides Pers. (1825) = *Cantharellus tubaeformis* Fr. f. Donk (1969)

cantharellus Pers. (1825) = *Cantharellus cibarius* Fr.

carbonarius Lloyd (1920) = *M. lacrimans* Fr. v. *carbonarius* (Lloyd) W. B. Cooke

carbonarius Pers. (1825) = *Geopetalum carbonarium* (Fr.) Pat.

carmichaelianus Berk. (1860)

castaneus Lloyd (1916) = *Cystidiophora castanea* (Lloyd) Imazeki

ceracellus B. et C. 1872)

cervinus Pers. (1825) = *Cantharellus lutescens* Fr. f. Donk (1969)

chilensis Speg. (1920)

chlorina Pat. (1908)

cinereus Pers. (1825) = *Cantharellus cinereus* Fr.

cladopus Pers. (1825)

clavatus Secr. (1833) = *Gomphus clavatus* S. F. Gray

collariatus Pers. (1825)

conchoides Lloyd (1922) = *M. corium* (Pers.) Fr.

confluens Schw. (1822) = *M. corium* (Pers.) Fr.

consimilis Lloyd (1922) = *M. eurocephalus* (B. et Br.) Petch

corium (Pers.) Fr. (1828)

cornucopioides Pers. (1825)

crassus Lloyd (1925)

crispatus Fr. (1821)

crispus Pers. (1825) = *Plicatura*

croceus Duby (1830) = *M. aureus* Fr.

crocicreas Ces. (1878)

crucibulum Pers. (1825)

cubensis Burt (1917) = *M. corium* (Pers.) Fr.

cupressi Schw. (1822) = a gall.

cupularis Pers. (1825)

cuticularis Lév. (1855)

cyatheus Vel. (1922)

debriscola Lloyd (1924) = not a fungus (Ginns 1969)

deliciosus Brig. jun. (1878) = *Cantherellus deliciosus* (Brig. jun.) Sacc.

demissus (Berk.) Pat. (1908)

densus Rick (1960)

destruens Pers. (1825) = *M. lacrimans* Fr.

dilatatus Pers. (1825) = *Cantharellus tubaeformis* Fr. f. Donk (1969)

diobensis Beeli (1929)

domesticus (Pers.) Falck (1907) = *M. lacrimans* Fr.

dubiosus Bres. (?)

dubius Burt (1917) = *Poria sanguinolenta* (Fr.) Cke.

elegans Pers. (1825)

elliottii Mass. (1892)

epiphyllus Pers. (1825)

erectus Lloyd (1921) = ? a clavarioid fungus (Ginns 1969)

eurocephalus (B. et Br.) Petch (1910)

fagineus Pers. (1825) = *Plicatura*

farlowii Burt (1917) = *M. serpens* Fr. (*Byssomerulius* Parmasto)

fissus Pers. (1825)

flavescens Bres. (1920)

foetidus Pers. (1825)

foliaceus Pers. (1825)

fugax Fr. (1821) = *M. molluscus* Fr.

fuligineus Pers. (1825) = *Cantharellus infundibuliformis* Fr.

fulvus Lasch (1829) = *Phlebia radiata* Fr.

fuscescens Bres. (1920)

fuscus Lloyd (1925)

fuscus Pers. (1828)

fusisporus Rom. (1911) = *Athelia* f. Parmasto

gelatinosus Lloyd (1922) = *M. himantioides* Fr.

gelatinosus Petch (1925)

giganteus Saut. (1877) = *M. lacrimans* Fr.

glaucinus Bourd. et Galz. (1923)

gloeoporus Rick (1960)

gossypinus Rick (1960)

guillemotii Boud. (1894) = *M. lacrimans* Fr.

gyrosus Burt (1917) = *M. borealis* Rom.

haedinus B. et C. (1872) = ? *M. corium* (Pers.) Fr.

helvelloides Pers. (1825)

hexagonoides Burt (1917)

himantioides Fr. (1821)

hirsutus Burt (1917) = *M. corium* (Pers.) Fr.

hirtellus Burt (1917) = ? *M. bellus* B. et C. (= *Byssomerulius* Parmasto)

hispidulus O. K. (1898)

hydnoides P. Henn. (1904)

hydrolips Merat (1821) = *Cantharellus cinereus* Fr.

imbricatus Balfour-Browne (1955)

incarnatus Schw. (1822)

incrassatus B. et C. (1849) = *Meruliporia incrassata* (B. et C.) Murr.

infundibuliformis Cke. et Mass. (1888) = *Rodwaya infundibuliformis* (Cke. et Mass.) Syd.

insignis Wakef. (1917) = M. *eurocephalus* (B. et Br.) Petch

interruptus Bres. (1925)

irpicinus Pk. (1894) = *M. pinastri* (Fr.) Burt

irpicoides Corner

lacrimans Fr. (1821)

lacrymans Pers. (1825)

laeticolor B. et Br. (1878) = *M. molluscus* Fr.

lamellosus Pers. (1825)

lepidus Rom. (1911)

leucophaeus Pers. (1825) = *Geopetalum carbonarium* (Fr.) Pat.

lichenicola Burt (1917) = *Poria mollusca* (Fr.) Cke.

lignosus Berk. (1854)

lividus Bourd. et Galz. (1923) = *Phlebia* f. Parmasto

lobatus Pers. (1825) = *Leptoglossum lobatum* (Fr.) Ricken

luridochraceus Corner

luteolus O. K. (1891)

macedonicus Pilat (1938)

melanoceras Mont. (1859)

miniatus Wakef. (1931)

minor Falck (1912) = ? nom. nud. (Harmsen 1952)

moelleri Bres. et P. Henn. (1896)

molluscus Fr. (1821) = *Leucogyrophana* Pouz.

molluscus Pers. (1825)

montanus Burt (1917)

muscigenus Pers. (1822) = *Leptoglossum*

muscigenus St.-Am. (1821) = *Leptoglossum muscigenum* (Fr.) Karst.

muscorum Pers. (1825)

nigripes Pers. (1825) = *Hygrophoropsis aurantiacus* (Fr.) Maire

niveus Fr. (1828) = ? *Plicatura* (f. Pilat, Bull. Soc. mycol. Fr. 49, 1933, 292)

nothofagi G. H. Cunningham (1950)