Studies of Wood-Rotting Fungi: 1. Cultural Characteristics of some Common Species.

By

G. C. A. van der Westhuizen.

It is often essential to identify the organisms causing decay to timber. Since a sporophore is seldom present, diagnostic features other than those important ones usually provided by the sporophore must be sought. It has long been known that wood-rotting fungi grow readily on artificial media, but only comparatively recently have cultural characters been used as in aid in the identification of non-fruiting mycelium. A difficulty peculiar to the identification of these fungi in culture is that the morphological characters shown are applicable directly to the species only and cannot be used in the identification of other species in the same genus.

Among the first workers in this field were Long and Harsch (12) and Fritz (11), who established criteria for distinguishing wood-rotting fungi in pure culture. This work was followed by studies of fungi causing decay of a specific host, or the species of a single genus in artificial culture. Bavendamm (1) and Davidson, Campbell and Blaisdell (9) showed that the behaviour of decay fungi on media containing gallic acid and tannic acid is a valuable aid in the identification of the fungus. But the different workers followed different methods so that it was still difficult or impossible to identify a fungus from culture unless many different methods were followed. Recently, Nobles (16) made an exhaustive study of the various methods and incorporated many of these into a standard procedure. This procedure has been followed, with some modification, by da Costa, Matters and Tamblyn (8). The macroscopic features of the colony are described in terms defined by Long and Harsch (12). Colours are recorded according to Ridgway's Colour Standards or the Munsell Book of Colour. The behaviour of the fungus on 0·5 per cent gallic acid and tannic acid in malt agar, and the growth rate and appearance on 1·5 per cent malt agar are noted. These features, as well as the nature of the host plant, the presence of fructifications and the microscopic characters, are expressed by a system of numerals termed the key pattern. Each digit refers to a specific character. Digits are arranged in eleven columns in ascending numerical order. For workers to whom Nobles' (16) paper is not readily available, the list indicating the meaning of each digit is appended below.

In the present paper, the cultural characters of a number of fungi are described. Some of them have been described before by other workers, but are included here to emphasize the similarities or differences between specimens from South Africa and elsewhere. Others are South African species and their cultural characteristics are described here for the first time.

Methods and Materials.

The methods followed were those described by Nobles (16) and da Costa *et al.* (8) but with small modifications. The fungi were grown on 1·5 per cent Difco malt extract agar in three inch Petri dishes, each plate containing 30 ml. of medium. Inocula were cut out with a sterile cork borer of 10 mm diameter from the youngest part of an

actively growing colony and placed mycelium downwards near one side of the plate. Six plates of each fungus were incubated at 26° C., one plate being removed and placed in diffuse daylight at room temperature at weekly intervals. All cultures were examined at weekly intervals for changes of colour and other characteristics. All colours are described according to Ridgway's terminology (19).

The oxidase tests were carried out on media containing 1·5 per cent Difco malt extract agar and 0·5 per cent gallic acid and tannic acid, respectively, as described by Davidson, Campbell and Blaisdell (9). Incubation was at 26° C. for seven days or fourteen days for the slower growing species.

LIST INDICATING THE MEANING ATTACHED TO EACH DIGIT AS USED IN THE KEY PATTERN.

[NOBLES; (16) P. 291.]

First column: Host.

1. Occuring on broad-leaved trees.
2. Occuring on coniferous trees.

Second column: Colour of mycelial mat.

1. Mat remaining white, pale yellow or pale pink for six weeks.
2. Mat yellow or brown, at least when mature.

Third column: Reaction on media containing gallic acid and tannic acid.

1. Diffusion zone present.
2. Diffusion zone lacking.

Fourth column: Septation of phyphae.

1. Clamp connections present on all parts of mat but may be lacking on fibre hyphae.
2. Simple septa on all hyphae.
3. Hyphae of advancing zone with simple septa, those of older part of mat with clamp connections.
4. Multiple clamp connections present, at least in the advancing zone.

Fifth column: Special structures.

0. Contorted incrusted hyphae.
1. Cystidia or gloeocystidia.
2. Setae or setal hyphae.
3. Bulbils.
4. Rigid hyphae with right-angled branches.
5. Cuticular cells, forming a pseudo-paranchymatous layer.
6. Hyphae with numerous interlocking projections.
7. Swellings on hyphae.
8. Lactiferous cells.
9. No special structures.

Sixth column: Chlamydospores.

1. Chlamydospores present.
2. Chlamydospores absent.

KEY TO THE FUNGI DESCRIBED IN THIS PAPER.

Host.	Mat Colour.	Oxidase.	Septation.	Special Structures.	Chlamydospores.	Conidia.	Oidia.	Growth Rate.	Fruiting.	Reverse.	
1	1	1	1	1	2	2	2	1	1	2	S. purpureum.
1	1	1	1	1	2	2	2	1	1	3	S. purpureum.
1	1	1	1	9	1	2	2	1	1	3	T. cingulata.
1	1	1	1	9	1	2	2	1	2	3	T. cingulata. P. hirsutus.
1	1	1	1	9	1	2	2	2	1	2	S. commune.
1	1	1	1	9	1	2	2	2	1	3	S. commune.
1	1	1	1	9	1	2	2	2	2	2	S. commune.
1	1	1	1	9	1	2	2	2	2	3	S. commune.
1	1	1	1	9	2	2	1	2	2	3	L. palisoti.
1	1	1	1	9	2	2	2	1	1	3	P. hirsutus.
1	1	1	1	9	2	2	2	1	2	3	P. hirsutus.
1	1	1	4	9	2	2	2	1	2	2	S. hirsutum.
1	1	1	4	9	2	2	2	1	2	3	S. hirsutum.
1	1	2	1	9	1	2	2	2	1	2	S. commune.
1	1	2	1	9	1	2	2	2	1	3	S. commune.
1	1	2	1	9	1	2	2	2	2	2	S. commune.
1	1	2	1	9	1	2	2	2	2	3	S. commune.
1	1	2	1	9	2	2	2	1	1	2	P. vaillantii.
1	1	2	1	9	2	2	2	1	2	2	P. vaillantii.
1	1	2	1	9	2	2	2	2	1	2	P. vaillantii.
1	1	2	1	9	2	2	2	2	2	2	P. vaillantii.
1	1	2	4	9	2	2	2	1	2	2	C. arida.
1	2	1	1	0	2	2	2	1	1	3	T. proteus.
1	2	1	1	0	2	2	2	1	2	3	T. proteus.
1	2	1	1	6	2	2	2	1	1	3	P. arcularius.
1	2	1	1	6	2	2	2	1	2	3	P. arcularius.
1	2	1	1	7	2	2	2	1	2	3	A. rude.
1	2	1	1	9	1	2	2	1	1	2	P. sanguineus.
1	2	1	1	9	1	2	2	1	1	3	P. sanguineus.
1	2	1	1	9	1	2	2	1	2	1	L. sajor-caju.
1	2	1	1	9	1	2	2	1	2	2	P. sanguineus.
1	2	1	1	9	1	2	2	1	2	3	P. sanguineus.
1	2	1	1	9	2	2	2	2	2	2	G. colossum.
2	1	1	1	9	1	2	2	1	1	3	P. hirsutus.
2	1	1	1	9	1	2	2	1	2	3	P. hirsutus.
2	1	1	1	9	2	2	1	2	2	3	L. palisoti.
2	1	1	1	9	2	2	2	1	1	3	P. hirsutus.
2	1	1	1	9	2	2	2	1	2	3	P. hirsutus.
2	1	1	4	9	2	2	2	1	2	2	S. hirsutum.
2	1	1	4	9	2	2	2	1	2	3	S. hirsutum.
2	1	1	4	9	2	2	2	2	2	2	S. sanguinolentum.
2	1	2	4	9	2	2	2	1	2	2	C. arida.
2	2	1	1	9	1	2	2	1	1	2	P. sanguineus.
2	2	1	1	9	1	2	2	1	1	3	P. sanguineus.
2	2	1	1	9	1	2	2	1	2	2	P. sanguineus.
2	2	1	1	9	1	2	2	1	2	3	P. sanguineus.
2	2	2	1	9	2	2	2	2	2	2	G. colossum.

Seventh column: Conidia.

1. Conidia present.
2. Conidia absent.

Eighth column: Oidia.

1. Oidia present.
2. Oidia absent.

Ninth column: Rate of Growth.

1. Rapid growth, plates covered in one to two weeks.
2. Moderately rapid, plates covered in three to four weeks.
3. Slow, plates covered in five to six weeks.
4. Very slow, plates not covered in six weeks.

Tenth column: Fruiting.

1. Fruiting before the end of six weeks.
2. No fruiting.

Eleventh column: Effect on Agar.

1. Reverse brown, at least in part, before the end of six weeks.
2. Reverse unchanged, or not darker than honey yellow in six weeks.
3. Reverse bleached, at least in part, before the end of six weeks.

1. **Amauroderma rude** (Berk.) G. H. Gunn. (Pl. 1; Fig. 1, Pl. 4, Fig. 1.)

Key pattern: 1 2 1 1 7 2 2 2 1 2 3.

Growth characters: Growth is rapid, the colony reaching a radius of 40 mm in seven days and covering the plate in two weeks. The advancing zone is even, transparent, appressed for about 0·5 mm, then slightly raised. The mat is at first white, cottony, but after two weeks, thin strands of mycelium appear and the mycelium darkens to " pale brownish drab " in some places. The colour darkens gradually as the mat becomes more felty or sub-felty in places and dark " hairs " start growing out onto the side of the dish. After six weeks, the mat is mostly " buffy brown " and sub-felty to crustose in places with patches of " avellaneous ", " olive brown ", " wood brown " and " natal brown ". The mat is tough but separates readily from the agar and a faint, fragrant odour is given off. Reverse, bleached to " ochraceous buff " but later mottled with lines of " buckthorn brown " and " warm blackish brown " in the agar.

On gallic and tannic acid media there is good growth, the colonies reaching diameters up to 45 mm with strong diffusion zones up to 50 mm diameter after seven days.

Hyphal characters.

Advancing zone.—Hyphae hyaline, thin-walled, branched, septate with simple clamps of the " eyelet " type, 3–6 μ wide.

Aerial mycelium.—(*a*) Hyphae as in the advancing zone. (*b*) Fibre hyphae numerous, hyaline, without lumen and walls thick and refractive, 2–3 μ wide. (*c*) Hyphae with thick, refractive walls and narrow lumina which widen towards the tip and with deeply staining contents, 4–6 μ wide. (*d*) Wide hyphae, 4–6 μ wide, with slightly thickened, hyaline walls, clamp connections at the septa and wide lumina with deeply staining contents, with narrow thick-walled fibre hyphae, 2–3 μ, branching from them. (*e*) Narrow fibrelike hyphae, 2–3 μ, with thickened walls, at first hyaline, later brown, with inflated terminal or intercalary parts up to 20 μ wide, forming a tough, crustose skin on the mat.

Submerged mycelium.—Hyphae as in the advancing zone.

A. rude is very common in wattle plantations in South Africa and has been reported as the cause of decay of stumps and roots of *Acacia mollissima*. It has also been found on unspecified dead wood (10). With its unique key pattern and combination of readily recognizable microscopic features, the identification of this fungus from culture should be relatively easy.

2. **Coniophora arida** (Fries) Karst. (Pl. 1, Fig. 2; Pl. 4, Fig. 2.).

Key pattern: (1, 2) 1 2 4 9 2 2 2 1 1 2.

Growth characters.—Growth is fast, the colony reaching a radius of 38 mm after seven days and covering the plate in two weeks. The advancing zone is bayed and hyphae are raised right to the limit of growth. The mycelium is at first raised, silky, but becomes appressed after two weeks and thin rhizomorphs begin to appear and radiate from the inoculum over the surface of the agar. After 3–4 weeks the surface appears uneven or lacunose with hyphae thin and silky and the agar surface almost liquified. No further changes take place. The colour of the mat is at first hyaline, later turning pale greyish. The mat remains soft and adherent to the agar which is slightly bleached or remains unchanged. A faint odour is emitted.

On gallic and tannic acid media, no diffusion zones are found, while the colony reaches diameters of 60 mm on the former and 15 mm on the latter medium after seven days incubation.

Hyphal characters.

Advancing zone.—Hyphae smooth, branching, nodose-septate with multiple clamps arranged in a whorl, often with a whorl of branches from the clamps. Hyphae are usually 3–6 μ wide.

Aerial mycelium.—(*a*) Hyphae as in advancing zone, 2·5–10 μ. (*b*) Hyphae with simple clamps, 3–6 μ. (*c*) Wide hyphae with simple septa are present together with the ordinary hyphae in the rhizomorphs on the surface.

Submerged hyphae.—(*a*) Hyphae as in the advancing zone. (*b*) Knobbly, tortuous, branching hyphae with simple septa 2–6 μ wide.

Comparison with Nobles' key shows that *C. puteana*, to which *C. arida* is closely related, has an identical key pattern. There is indeed a very close resemblance between the cultures of these two species and only a few small characters separate them. In *C. arida* cultures, the advancing zone is bayed and the mat remains uncoloured while the mat of *C. puteana* may be coloured and the margin even. These differences are, however, so small as to suggest that the two fungi are probably different forms of the same species.

C. arida has been found to cause a brown rot of coniferous trees but also occurs saprophytically on deciduous trees such as *Acacia mollissima*.

3. **Ganoderma colossum** (Fr.) Bres. (Pl. 1, Fig. 3; Pl. 4, Fig. 3.).

Key pattern: (1, 2) 2 2 1 9 2 2 2 2 2 2.

Growth Characters.—Growth is moderately fast, the colony reaching a radius of 65 mm after 14 days. The advancing zone is even, slightly raised and is preceded by a zone of turbid agar about 8 mm wide. At first, the mat is silky but after two weeks, patches or tufts of cottony mycelium start to form on the sides of the dish. These

later become compacted into woolly or felty pads up to 5 mm wide around the edge of the mat. The young mat is white and remains so for longer than six weeks, but the dense mycelium on the sides of the dish turns to " cream color " or " buff yellow " after three to four weeks and darkens to " antimony yellow " and " cinnamon buff ". The mat remains soft and adherent to the agar, while the reverse remains unchanged.

On gallic and tannic acid media there is good growth, the colonies reaching diameters of about 35 mm after seven days but no diffusion zones are formed. On tannic acid medium, a clear zone is formed slightly larger in diameter than the colony.

Hyphal characters.

Advancing zone.—Hyphae thin-walled, branched, nodose-septate with simple clamps of the " eyelet " type, often with branches arising opposite clamps, 3–6 μ wide.

Aerial mycelium.—(*a*) Hyphae as in the advancing zone. (*b*) Thin-walled hyphae without clamps and few simple septa, 1·5–2 μ wide. (*c*) Hyphae as in advancing zone but with walls light brown. (*d*) Hyphae with deeply staining contents and simple septa, irregularly widened and distended, 5–8 μ diameter.

Submerged mycelium.—(*a*) Hyphae as in the advancing zone. (*b*) Much branched hyphae with simple septa.

G. colossum has been isolated from *Pinus hondurensis* and *Callitris robusta* in Natal on which it causes an extensive collar rot. It also attacks eucalypts (14).

There are no marked morphological features by which *G. colossum* can be identified in culture. The restricted host range, the absence of a diffusion zone on the oxidase media together with the colour of the mycelial mat, which so closely resembles the colour of the large fructifications, and the microscopic appearance of the hyphae, should allow the easy identification of a culture of this fungus.

4. **Lentinus sajor-caju** Fr. (Pl. 1, Fig. 4; Pl. 4, Fig. 4.).

Key pattern: 1 2 1 1 9 1 2 2 1 2 1.

Growth characters.—Growth is rapid, the colony reaching a radius of 55 mm in seven days and the plate being covered in ten days. The advancing zone is even to slightly bayed, appressed, silky for 2–3 mm behind the tips and then raised. The mat is at first cottony to woolly, turning felty to sub-felty with nodulose or granular bands over the surface. As the culture ages, some areas become sub-felty to crustose. At first, the mat is white, but, after three weeks, patches of " light quaker drab " appear, but some darken to " quaker drab " or " mouse grey " so that the culture assumes a grey, marbled appearance. The agar is bleached but then darkens to " warm buff " with dark brown wavy lines giving a mottled appearance.

After two weeks growth, the edge of the mat turns upward and inward and small hyaline papillae appear, growing out from the mat and appressing their ends against the glass side of the dish. A sweet, fragrant odour is emitted by the fungus.

On gallic and tannic acid media, there are strong diffusion zones of 25–40 mm on the two media respectively, after seven days, while the colonies reach diameters of 15 mm and 35 mm.

Hyphal characters.

Advancing zone.—Hyphae thin-walled, branching, nodose-septate with simple clamps of " eyelet " type, 3–5 μ wide.

Aerial mycelium.—(*a*) Hyphae as in advancing zone. (*b*) Fibre hyphae numerous, thick-walled, branched or unbranched, 1·5–2·5 μ. (*c*) Chlamydospores hyaline, elliptical, oval or short, cylindrical with rounded ends, 6–8 × 9–12 μ. (*d*) Hyphae with thin walls and bladderlike swellings and projections which later turn brown to form a crustose layer.

Submerged mycelium.—Hyphae as in the advancing zone but with occasional chlamydospores.

The most striking feature of this culture is the appearance of the papillae which seem to push the edge of the colony away from the sides of the Petri dish. This feature, together with the strong fragrant odour given off by the mycelium and the unique key pattern, should establish the identity of the culture with certainty.

L. sajor-caju causes a white rot of felled deciduous trees.

5. **Lenzites palisoti** Fr. (Pl. 1, Fig. 5; Pl. 4, Fig. 5.).

Key pattern: (1, 2) 1 1 1 9 2 2 1 2 2 3.

Growth characters.—Growth is moderately fast, the plate being covered in three weeks. The advancing zone is even, thin and closely appressed to the medium. The mat is at first thin, with a chamois texture and later slightly farinaceous with numerous tiny, clear droplets of liquid on it. Later it thickens, becoming compacted felty and slightly furrowed in the thicker parts. Thin, tough, smooth pads may develop over the surface. After six weeks the entire colony is farinaceous. The mat remains white throughout or a " cream color " on some of the thickened pads. The agar is bleached and the reverse is yellowish.

The mat is tough, adherent to the agar and emits a strong, sweetly fragrant, slightly musty odour.

On the oxidase test media, there are strong diffusion zones with growth up to 32 mm diameter on gallic acid and 10 mm diameter on tannic acid in seven days.

Hyphal characters.

Advancing zone.—Hyphae thin-walled, simple or branched nodose-septate with simple clamps often branching from the clamps, 1·5–4 μ diameter.

Aerial mycelium.—(*a*) Hyphae as in advancing zone. (*b*) Fibre hyphae numerous, thick-walled, with narrow lumina which widen characteristically at the tips, 3–4 μ diameter. Walls sometimes dilated into a vesicle as well. (*c*) Oidia elongate, cylindrical, with rounded ends or barrel-shaped to nearly globose, 4–9 × 2–4 μ.

Submerged mycelium.—Hyphae as in advancing zone but more tortuous and with more clamps, 2–4 μ diameter.

The strong, fragrant odour emitted by this fungus and the pure white mat with its dewy appearance, should give an indication of its identity which may be confirmed by the presence of the characteristic fibre hyphae and the unique key pattern. The digit denoting swellings on hyphae is not included in the key pattern because these swellings are only seen very occasionally.

The key pattern denotes the presence of clamps on the hyphae but this fungus has a tendency to revert to the haploid condition after repeated subculture. This is accompanied by loss of vigour as demonstrated by a retardation in the growth rate, an increased production of oidia and growth with a very strongly indented margin. As the characters otherwise remain unchanged and new isolates are invariably diploid, the key pattern is presented as applicable to new isolates.

L. palisoti is a very common cause of white rot on timber in use but occurs on a number of living trees as well (10).

6. **Polyporus arcularius** Batsch ex Fries (Pl. 1, Fig. 6; Pl. 4.).

Key pattern: 1 2 1 1 6 2 2 2 (1, 2) 3.

Growth characters.—Growth is rapid, the colony reaching a radius of 43 mm in seven days and covering the plate after 14 days. The advancing zone is even, thin, appressed for 2–3 mm, then raised. The aerial mycelium is at first white, cottony to woolly, soon becoming more compact and granulose to lacunose felty, with crustose or skinlike and brittle areas. The white mat soon shows irregular patches of " russet " to " cinnamon brown " with a thin brown zone line appearing where the mat meets the agar at the sides of the dish. With progressing age, the culture assumes a mottled appearance with white areas mingled with " russet ", " mars brown ", " Prouts brown " and " mummy brown " patches and lines. The crustose, dark-coloured patches often have raised edges where they meet the white areas. The mat is tough after six weeks and a faint, yeasty odour is noticeable. Stalks of pilei appear after 2–3 weeks on some cultures and elongate into numerous contortions but bear normal pilei at their ends. The reverse of the colony may be bleached or turn " honey yellow ". Lines of " antique brown " to " Prout's brown " appear in most cultures in the bleached agar.

On gallic and tannic acid media, strong diffusion zones of 55 mm diameter appear under colonies which reach diameters of 30 mm and 50 mm on the two media, respectively.

Hyphal characters.

Advancing zone.—Hyphae thin, branching, nodose-septate with simple clamps, 2–4 μ wide.

Aerial mycelium.—(*a*) Hyphae as in the advancing zone. (*b*) Fibre hyphae numerous, walls thick, refractive, branched, 1·5–2·5 μ. (*c*) Hyphae from dark skin-like areas, nodose-septate, thick-walled, often without lumina, buffy brown in KOH with numerous short side branches or knoblike projections, interlocked to form a tough, coherent mat which defies separation into single elements. Fruit body: Basidia hyaline, 14–16 $\times$ 4–5 μ with four sterigmata. Basidiospores: smooth, oblong-elliptical, hyaline, 6 $\times$ 2·5 μ.

Submerged mycelium.—Hyphae as in the advancing zone.

The above description corresponds closely with Nobles' description (16) except for colour, which in my cultures was always browner. No chlamydospores were observed in these cultures. The formation of normal fructifications with their characteristic large pores took place very readily on some of the cultures.

P. arcularius is found fairly frequently on decayed wood of broad-leaved trees in contact with the soil but does not seem to be important as a wood destroyer in South Africa.

7. **Polyporus sanguineus** Linn. ex Fries (Pl. 2, Fig. 1; Pl. 4, Fig. 7.).

Key pattern: (1, 2) 2 1 1 9 1 2 2 1 (1, 2) (2, 3).

Growth characters.—Growth is fast, the colony reaching a radius of 50 mm in seven days and covering the plate in twelve days. The advancing zone is even, appressed for 1–2 mm then raised, hyaline. The texture is at first cottony to woolly, lacunose in the denser parts and later granular, turning to velvety or chamois near the inoculum. From the inoculum, broad, shallow furrows radiate out to some distance behind the advancing edge. At about four weeks incubation, the dense parts of the colony become compacted into tough, felty to velvety pads, often raised above the level of the surrounding mat. On some of these, pores are developed which shed white spore deposits if the plate is inverted.

The mat is at first white but after one to three weeks, tinges of " pale salmon color " appear which later deepen to " salmon color ", " apricot orange ", " carnelian red " or " flame scarlet " in the older parts with occasional " cinnamon rufous " near the edge of the newest growth. The reverse is unchanged in some cultures and bleached in others. A faint, pleasant odour is present.

On gallic and tannic acid media, there are strong diffusion zones of up to 65 mm diameter, while colony diameters vary from 35–55 mm on gallic acid and 0–55 mm on tannic acid media.

Hyphal characters.

Advancing zone.—Hyphae thin-walled, smooth, branched, nodose-septate with simple clamps of the " eyelet " type, 2–5 μ wide.

Aerial mycelium.—(*a*) Hyphae as in the advancing zone. (*b*) Fibre hyphae with thick, refractive walls and no lumina, branching, very numerous, 2–4 μ wide. (*c*) Chlamydospores smooth, hyaline, terminal or intercalary, rare in some cultures, more numerous in others, with walls slightly thickened, 4–9 $\times$ 6–14 μ.

Fruit body.—(*a*) Basidia clavate, 4·5–6 μ wide with four spores. (*b*) Basidiospores hyaline, short, cylindrical, 4·5–6 $\times$ 2·5–3 μ.

Submerged mycelium.—(*a*) Nodose-septate hyphae, (*b*) fibre hyphae and (*c*) chlamydospores as above.

The cultures described here are very similar to those described by Nobles (16) and Matters *et al.* (15). Like those described by the latter authors, the South African fungi tend to bleach the medium but differ from them by having higher growth rates.

Bose (2) noticed that cultures of *P. cinnabarinus* differed from those of *P. sanguineus*, two species considered to be identical by Wakefield (2) and Lloyd (13), in that the hyphae of the latter develop a pigment on their walls so that the whole mat looks orange, while the hyphae of the former remain white and the characteristic orange-red colours only appear when basidia initials are formed in the cultures. Colour is consequently confined to poroid areas of cultures of *P. cinnabarinus*. It has been noticed that amongst the cultures described here, there are some which tend to form colour at a later stage of development and in localized patches only. In the others, colour is formed at an early stage and is more or less of an even hue over the whole surface of the culture. The sporophores from which these cultures were made were, however, identified as those of *P. sanguineus*. This phenomenon is considered to be caused by differences between different strains of the same organism.

P. sanguineus can be readily recognized in culture by the bright orange-red colours formed, without recourse to microscopic examination.

This fungus is widely distributed throughout South Africa and has been found on living trees (Doidge 10) and on dead wood in which it causes a white rot.

8. **Polystictus hirsutus** Wulf. ex Fries (Pl. 2, Fig. 2; Pl. 4, Fig. 8.).

Key pattern: (1, 2) 1 1 1 9 (1, 2) 2 2 1 (1, 2) 3.

Growth characters.—Growth is rapid, a radius of 55–60 mm being reached in one week, while the plates are covered in 9–10 days. The advancing zone is even, appressed or slightly raised. The mat is at first cottony but soon becomes woolly and compacted to felty or sub-felty in some places round the inoculum, but finally tough, dense, felty and slightly lacunose, with mounds of compact waxy mycelium over the surface.

Mycelium frequently grows out between the dish and cover to form poroid fructifications. The predominating colour is white but patches of " cream color " occur near the sides of the dish and on the poroid mounds. The reverse is rapidly bleached and cleared.

Growth on gallic acid medium does not occur or produces a mere trace of mycelium with a strong diffusion zone. On tannic acid, the colony may reach 40 mm diameter in seven days, while a strong diffusion zone, slightly wider, is formed. Odour is lacking or may be faint, sweetish.

Hyphal characters.

Advancing zone.—Hyphae hyaline, branched, nodose-septate with simple clamps, 3–5 μ wide.

Aerial mycelium.—(*a*) Hyphae as in the advancing zone. (*b*) Fibre hyphae very numerous, with walls thick and refractive, lumina narrow or lacking, aseptate, branched, 1·5–3 μ.

Fructication.—Basidia 4·5–6 μ diameter, having four spores. Basidiospores hyaline, even, cylindrical, 5–7 $\times$ 2–5 μ.

Submerged mycelium.—(*a*) Hyphae as in advancing zone. (*b*) Chlamydospores observed in one isolate, terminal and intercalary, thin-walled, smooth, hyaline, 10–15 $\times$ 4·5–7 μ.

The key pattern for *P. hirsutus* is identical with those of other fungi from which it can, however, be distinguished on the macroscopic appearance in culture. Nobles records, however, that the cultures of *Polyporus pubescens* and *P. zonatus* are closely similar to those of *P. hirsutus*. Although neither of these two species has been grown in culture by me yet, the former may not be a serious consideration in this respect as it is not at all common in this country. *P. zonatus* is more common and great care should be exercised in identification of cultures when there is the risk of confusing these two closely related species.

P. hirsutus causes a white rot of coniferous and hardwoods and has been reported on broad-leaved trees.

9. **Poria vaillantii** (D.C.) Fr. (Pl. 2, Fig. 3; Pl. 5, Fig. 1.).

Key pattern: 1 1 2 1 9 2 2 2 (1, 2) (1, 2) 2.

Growth characters.—Growth is moderately fast to fast, the plate being covered in twelve to twenty days. The advancing zone is even, appressed for 0·5 or 1 mm behind the extreme tips, than raised in a dense cottony or woolly mound but sinking again towards the inoculum. After three weeks, dense strands of hyphae form and radiate from the inoculum to the newer growth where their ends fan out into cottony plumes, which cling to the sides of the dish. With advancing age, the mycelium, clinging to the glass sides, is torn and becomes rather ragged through shrinkage of the agar. After two to four weeks, wide, shallow pores are formed on the dense mycelium of some cultures. Creamy spore deposits are formed if the plates are inverted.

The colour remains pure white throughout, except in the older parts of the fructification, which turn a pale cream colour. The aerial mycelium is easily stripped from a thin layer of mycelium which adheres to the agar. The reverse remains unchanged.

The fungus is negative for oxidase and no diffusion zones are formed. Growth on gallic acid may reach a diameter of 60 mm in one week, but no growth takes place on tannic acid.

Hyphal characters.

Advancing zone.—Hyphae thin-walled, branched, nodose-septate with simple clamps, often branching opposite a clamp, 2·5–6 μ diameter.

Aerial mycelium.—(*a*) Hyphae as in the advancing zone. (*b*) Fibre hyphae without lumina, refractive, unbranched, 2·5–3·5 μ. (*c*) Wide hyphae, irregularly swollen, 6–10 μ in diameter.

Fruit body.—(*a*) Hyphae as above. (*b*) Basidia: clavate with four sterigmata 6–8 × 16–20 μ. (*c*) Basidiospores hyaline, oblong-ellipsoid, slightly flattened on one side, 4·5–6 × 3·5 μ.

Submerged mycelium.—(*a*) Hyphae as in the advancing zone. (*b*) Crystals numerous.

The cultures described here agree very closely with the descriptions of Nobles (16) and Matters *et al.* (15). No chlamydospores were seen, though they were noted by Cartwright and Findlay (3) but fibre hyphae were numerous in both the fructification and the hyphal strands. This fungus may readily be recognised by the thin mat around the inoculum with its radiating strands of mycelium, which spread out into fan-shaped areas near the younger parts of the colony. In test tubes, these fan-shaped structures form a plug of hyphae near the edge of the slope, while the hyphal strands lead up to it over a thin mycelial mat.

10. **Schizophyllum commune** Fries. (Pl. 2, Fig. 4; Pl. 5, Fig. 2.).

Key pattern: 1 1 (1, 2) 1 9 1 2 2 2 (1, 2) (2, 3).

Growth characters.—Growth is moderately fast, the colony reaching a radius of 22–48 mm in seven days, while the plate is overgrown after 3–4 weeks. The advancing zone is bayed or almost even, thin, appressed or raised. The mat is at first cottony but soon denser patches of felty mycelium are formed. As growth proceeds, more or less fan-shaped areas of dense, felty mycelium may develop with shallow furrows radiating from the inoculum. From these compact, felty patches of mycelium, the normal fructifications usually develop. At this stage, the mat is usually tough and free from the agar. The colour remains white throughout, but fructifications may be "pale buff". There is a slight musty odour. The reverse remains unchanged or may bleach slowly.

On the oxidase reaction media, the colonies reach diameters of 35–65 mm on gallic acid and 35–50 mm on tannic acid, while a strong diffusion zone is produced on tannic acid medium only.

Hyphal characters.

Advancing zone.—Hyphae are thin branching, smooth, nodose-septate with simple clamps, 2·5–5 μ wide.

Aerial mycelium.—(*a*) Hyphae as in the advancing zone but more frequently septate. (*b*) Fibre hyphae unbranched, with thick, refractive walls and narrow lumina, 1·5–3 μ. (*c*) Thin-walled hyphae with short, narrow branches. (*d*) Chlamydospores: intercalary and terminal, hyaline, thick walled, sub-globose, oval or pyriform or elliptical, often divided by a single septum, 4–20 × 4–8 μ.

Fruit body.—Basidia: obovate or obclavate, often swollen at the top, with four sterigmata, 15–20 × 3–4 μ. Basidiospores: hyaline, cylindrical, rounded at the ends, obliquely apiculate, 2–3 × 5–7 μ.

Submerged mycelium.—(*a*) Hyphae as in the advancing zone. (*b*) Chlamydospores as above.

Schizophyllum commune is a very common saprophyte of timber (10) but has also been reported as a parasite of living trees (18). In culture, it is readily recognizable by the production of mature sporophores within a few weeks. Some cultures do not produce fructifications, but the presence of the thin-walled hyphae with the minute side branches, and the chlamydospores, which are usually present in large numbers, provide useful features for identification. The absence of a diffusion zone on gallic acid medium, in combination with these morphological characteristics, makes *S. commune* one of the easiest basidiomycetes to recognise in pure culture.

11. **Stereum hirsutum** (Willd.) Pers. (Pl. 2, Fig. 5; Pl. 5, Fig. 3.).

Key pattern: (1, 2) 1 1 4 9 2 2 2 1 2 (2, 3).

Growth characters.—Growth is rapid, the plate being covered in less than two weeks. The advancing zone is thin, even, appressed, but merges into the loose, cottony mycelium a few millimeters behind it. At two weeks, the culture has a thin, even cottony texture with little balls of dense compacted mycelium scattered through it. Gradually, the mycelium becomes denser and becomes compacted in some areas into smooth, felty or chamois areas.

The colour is at first hyaline, gradually turning creamy white to " cream color " with patches of " pinkish buff ", " light buff " to " ochraceous tawny " on thickened parts at the rim of the dish. On some of the cultures are thickened pads exuding drops of dark amber liquid.

The reverse of the colony turns to " ochraceous buff " after the agar is bleached. The mycelial mat is at first soft, but later toughens somewhat in the felty areas. A musty odour is given off by the growing colony.

Hyphal characters.

Advancing zone.—(*a*) Hyphae narrow, unbranched, with simple clamps over the septa, 1–2 μ wide. (*b*) Thin-walled hyphae 6–10 μ wide, with numerous, very conspicous clamps arranged in whorls at the septa, branched, sometimes with branches from the clamps, often with narrow or wide side branches similarly nodose-septate or with simple septa or simple clamps at the septa.

Aerial mycelium.—(*a*) Hyphae as in the advancing zone but slightly wider, up to 12 μ. (*b*) Fibre hyphae with thick, refractive walls, sometimes faintly yellow, 1·5–3 μ. (*c*) Narrow, helicoid hyphae, thin-walled, 2–3 μ wide.

Submerged mycelium.—Hyphae as in the advancing zone but more narrow hyphae, 1–2 μ wide and much branched, are present.

Stereum hirsutum has been described in pure culture by Cartwright and Findlay (3), but these authors do not mention the coiled hyphae which occur quite frequently in cultures, whose features otherwise agree closely with their descriptions and which were made from sporophores of undoubted *S. hirsutum*. This common fungus is probably one of the easiest to recognise in culture as the scattered compact balls of mycelium and the coarse hyphae with whorled clamp connections are characteristic.

12. **Stereum purpureum** (Pers. ex Fr.) Fries (Pl. 2, Fig. 6; Pl. 5, Fig. 4.).

Key pattern: 1 1 1 1 1 2 2 2 1 1 (2, 3).

Growth characters.—Growth is rapid, the mat attaining 70 mm in seven days and the plate being covered in about ten days. The advancing zone is even or slightly bayed and appressed in a zone about 1 mm wide, but the hyphae are then raised. The

texture is coarse, silky at first, becoming plumose to farinaceous in patches. The mycelium finally turns felty with nodules of compact mycelium against the glass sides of the dish. The colour remains white but a " pale buff ", thin rind of fructification may appear on the side of the dish. The reverse remains unchanged or may be slightly bleached before six weeks. The mat is at first soft and adherent but later becomes tougher. There is a slight, musty odour.

On gallic and tannic acid agar, there is good growth, the colony attaining 63 mm diameter on gallic acid and 42 mm on tannic acid. The diffusion zones are fairly strong but much smaller than the colony, being about 45 and 35 mm for the two media, respectively.

Hyphal characters.

Advancing zone.—Hyphae are smooth, thin-walled, simple or branching, nodose-septate with simple clamps, 4–6 μ wide.

Aerial mycelium.—(*a*) Hyphae as in the advancing zone but some are thinner, 2–6 μ wide. (*b*) Fibre hyphae narrow, thick-walled, sometimes branching. (*c*) Gloeocystidia vesicular, globose to almost pyriform, thin-walled, 8–12 μ diameter.

Fructification.—(*a*) Gloeocystidia as above. (*b*) Basidia clavate with four sterigmata, 3–5 $\times$ 18–24 μ. (*c*) Spores elliptical to almost cylindrical, hyaline, smooth, obliquely apiculate, 3 $\times$ 5 μ.

Submerged mycelium.—Hyphae as in the advancing zone, crystals octahedral or amorphous and numerous.

S. purpureum has been described in pure culture by Cartwright and Findlay (3) who noticed the swollen hyphae or vesicles which are characteristic of this fungus. Talbot (20) considers these structures to be gloeocystidia so that they are listed under the numeral for gloeocystidia in the key. *S. purpureum* has a key pattern unlike that of any other species so that it should be readily identifiable in this way. The rather conspicuous gloeocystidia are a valuable guide in this matter.

This fungus is best known in South Africa as a parasite of fruit trees where it causes a disease with readily recognizable symptoms. It has, however, been reported from *Populus* sp. and *Quercus* sp. (10), so that its inclusion here may aid its recognition on hosts other than fruit trees.

13. **Stereum sanguinolentum** (Alb. and Schw. ex Fr.) Fr. (Pl. 3, Fig. 1; Pl. 5, Fig. 5.).

Key pattern: 2 1 1 4 9 2 2 2 2 2 2.

Growth characters.—Growth moderately rapid, the colony reaching a radius of 50 mm after fourteen days. The advancing zone is even, appressed, with sparse, thin, cottony mycelium extending to the limit of growth. The mat is at first white and downy and may remain so for some weeks, then turning " chamois " while it thickens to become cottony-floccose. At six weeks, the oldest parts are felty and coloured " light buff " to " capucine buff " or " yellow ochre ". In some parts, especially near the edge, the mat is thin, skin-like and farinaceous or minutely granular. The mat remains soft and adherent to the agar and gives off a pleasant, sweet, mushroomy odour. The reverse remains unchanged or may turn " honey yellow ".

On gallic and tannic acid media the diffusion zones are strong and about 30 mm in diameter, while the colonies grow to diameters of about 15 and 30 mm on gallic and tannic acid media, respectively.

Hyphal characters.

Advancing zone.—Hyphae hyaline, thin-walled, branched with simple septa and occasional large, simple clamps or paired clamps on the wider hyphae, 2–6 μ.

Aerial mycelium.—(*a*) Narrow hyphae with deeply staining contents and inconspicuous, simple septa or simple clamps, 1·5–5 μ wide. (*b*) Wide hyphae with granular contents, often with simple septa and multiple clamps present on the same hyphae, 3–6 μ wide. (*c*) Helicoid hyphae are fairly numerous, 2–3 μ.

Submerged mycelium.—(*a*) Hyphae as in the aerial mycelium. (*b*) Crystals large, octahedral.

This fungus causes collar and root rot of *Pinus taeda* in South Africa (14) but is also well known in North America as a cause of heart rot in coniferous trees. The South African strain fits the description by Nobles (16) very well, but the " conducting hyphae " with the swollen tips were not seen in culture, although they are present in the sporophores.

The most striking characteristics in culture are the presence of simple septa and multiple clamps in the same hyphae, the slow rate of growth and the thin mycelial mat. Its exclusive occurence on coniferous trees, should aid in its identification from culture.

14. **Trametes cingulata** Berk. (Pl. 3, Fig. 2; Pl. 5, Fig. 6.).

Key pattern: 1 1 1 1 9 1 2 2 1 (1, 2) 3.

Growth characters.—Growth is moderately fast, the colony reaching a radius of 38 mm in seven days and covering the plate after two weeks. The advancing zone is even and appressed for 1 mm behind the extreme limit of growth, the hyphae then becoming raised. The mat is white and remains so. Texture is at first thin, downy or downy-cottony, becoming sub-felty or chamois near the inoculum. Later it becomes appressed, downy, cottony, with farinaceous areas near or round the inoculum. Fruiting areas first appear as white or " light buff " farinaceous or granular specks which soon turn dull pasty and grow together to form irregular masses which develop irregular pores near the inoculum or over the youngest growth. The mat becomes tough, remains free of the agar and does not emit any odour. The agar is quickly bleached to clear, transparent, milky white.

On gallic and tannic acid media, there is no growth but a strong diffusion zone about 50 mm diameter is found on gallic acid and a small, weak one on tannic acid.

Hyphal characters.

Advancing zone.—Hyphae narrow, branched, nodose-septate with simple clamps of " eyelet " type, often branching from the clamps, 2–4 μ.

Aerial mycelium.—(*a*) Hyphae as in the advancing zone. (*b*) Fibre hyphae with thick, refractive walls, unbranched and without lumina, numerous, 1·5–5 μ. (*c*) Chlamydospores ovate elliptical to sub-globose, thick-walled, terminal, 4–8 $\times$ 6–12 μ.

Fruit body.—Basidia pyriform with four sterigmata. Basidiospores hyaline, globose, 3·7–4 μ in diameter.

Submerged mycelium.—Hyphae as in the advancing zone.

Trametes cingulata could possibly be confused in culture with *Polyporus zonatus* which has the same key pattern in some forms. It appears, however, from Nobles' description that *P. zonatus* has a thicker, denser mat than *T. cingulata* in cultures of six weeks old or less. *T. cingulata* is distinguished from other forms in nature by possessing a matt, black, upper surface to the sporophores. Cultures of this fungus were seen to develop this matt, black colour after 10–12 weeks in minute spots on the mycelium but visible only under 25 $\times$ magnification.

15. **Tramentes meyenii** (Klotzsch) Lloyd. (Pl. 3, Fig. 3; Pl. 5, Fig. 7.).

Key pattern: 1 1 1 1 9 2 2 1 1 2 3.

Growth characters.—Growth is rapid, a radius of 65 mm being reached in seven days, while the plate is covered in ten days. The advancing zone is even, appressed for about 1 mm, then raised. The mat is at first cottony to woolly but soon becomes more dense and compact to felty, until at six weeks it is very tough, felty, slightly lacunose over parts of the surface and faintly striate with fine grains on some parts of the surface. By this time, it is leathery in appearance and consistency. At first, the mycelium is translucent white but turns pure white as the mat becomes denser. After 3–4 weeks, a " pale cream color " band, about 15 mm wide, appears over the surface about half-way across the Petri dish. The agar is rapidly bleached as growth proceeds, becoming colourless. The cream coloured reverse of the mat is visible through the agar after 4–5 weeks.

Good growth takes place on gallic and tannic acid, a diameter of 40 mm being reached on the former and 65 mm on the latter medium in seven days. Strong diffusion zones are present in both media.

Hyphal characters.

Advancing zone.—Hyphae thin-walled, simple or with short side branches or unbranched, often branching from clamps, nodose-septate, clamps simple, " eyelet " type, 2–5 μ wide.

Aerial mycelium.—(*a*) Hyphae as in advancing zone. (*b*) Fibre hyphae with thick, refractive walls, no lumina, branched, without clamps or septa, 2–5 μ wide, very numerous. (*c*) Oidia cylindrical with rounded ends, hyaline, 2–4 $\times$ 3–6 μ.

Submerged mycelium.—Hyphae branching profusely, thin-walled, nodose-septate with simple clamps as in advancing zone, 2–5 μ.

The key pattern of this fungus is unique so that there should be no difficulty in the identification of an otherwise featureless culture. The rapidly growing aerial mycelium, which becomes compacted into the white, tough mat, should hint at its identity. Although characteristic features are lacking, there should be no difficulty in recognizing the fast-growing, tough mat of this fungus if it has been seen previously.

In old cultures in tubes, fructifications were seen when the mat was placed in a vertical position for 2–4 months but no fructifications formed in less than six weeks.

T. meyenii has been reported on broad leaved trees and is a common saprophyte on hardwoods (10).

16. **Trametes proteus** (Berk.) Fr. (Pl. 3, Fig. 4; Pl. 5, Fig. 8.).

Key pattern: 1 2 1 1 0 2 2 2 1 (1, 2) 3.

Growth characters.—Growth is rapid, the colony covering 55 mm in seven days and the entire plate in less than two weeks. The advancing zone is even, raised, white and the mycelium cottony. The mat is at first cottony but soon becomes appressed and sub-felty with irregular translucent places on the surface. The sub-felty areas later turn farinaceous. About half-way across the mat, a raised band of cottony mycelium may form which turns brownish after 3–4 weeks. On the sides of the dish and other places, fructifications form which start as areas of compacted, white mycelium, which later turn brown, and develop large, incomplete pores. Some areas may remain white or the entire culture may become overgrown with the cottony, brown hyphae. The agar is quickly bleached and the mat gives off a pleasant, fragrant, mushroomy odour.

On gallic and tannic acid media, there are strong diffusion zones after one week. No growth takes place on gallic acid in seven days. On tannic acid medium, the colony may reach a diameter of 35 mm in seven days, or no growth may occur.

Hyphal characters.

Advancing zone.—Hyphae simple or branched, hyaline, septate with simple clamp connections of the " eyelet " type occasionally branching from the clamps, 2–5 μ wide.

Aerial mycelium.—(*a*) Hyphae as in the advancing zone. (*b*) Fibre hyphae brown with thick walls and narrow lumina, aseptate, often branching but mostly simple, numerous, long, 2–5 μ wide. (*c*) Hyphae encrusted with crystals but not very numerous; 4–6 μ.

Fruit body.—(*a*) Basidia clavate to obpyriform with four sterigmata, 18–24 $\times$ 6–10 μ. (*b*) Basidiospores hyaline, ovate to almost elliptical, obliquely apiculate, 3–4·5 $\times$ 7·5–10 μ.

Submerged mycelium.—Hyphae as in the advancing zone but more richly clamped and branched, often with numerous, short, lateral branches.

The key pattern for *T. proteus* is unique so that cultures may be identified by direct consultation of the key. Indeed, the rapid growth of the felty mat, with its brown, tangled overgrowth of fibre hyphae that soon tend to form fructifications, are so characteristic, that cultures may be identified without recourse to microscopic examination, if this species has been seen in culture previously.

Discussion.

It is evident that in identifying these fungi from culture, a very important consideration must always be their micromorphology. In the introduction to this paper, it was stated that identification from cultures must go directly to the species, because species in the same genus do not show common generic characters in culture. In the *Polyporaceae*, this is very noticeable if the fungi are named according to the traditional classification of Fries and others, based on external morphology. However, Cunningham (5), basing his work on the original observations of Corner (4), has recently proposed a classification of the polypores which groups the fungi according to the colour and morphology of the hyphae, and the type of basidium present. When Cunningham's system is applied, it is found that cultures of polypores do show certain microscopic features which characterise the genus. It was observed during the course of this work that the fungi described here as *Polyporus sanguineus Polystictus hirsutus*, *Trametes cingulata* and *Trametes meyenii* all have hyaline, generative hyphae with clamps at the septa, hyaline, long, narrow, thick-walled fibre hyphae (or " skeletal " hyphae) and clavate basidia. These species are all grouped by Cunningham (6) under the genus *Coriolus*. On the other hand, *Trametes proteus* differs from these in possessing brown fibre hyphae. These brown hyphae distinguish the genus *Trametes* from *Coriolus* in Cunningham's classification.

Binding hyphae, which characterise those polypores with trimitic hyphal systems, were never seen in culture so that it is impossible to distinguish between dimitic and trimitic genera with hyaline hyphae. Nevertheless, Cunningham's system of classification does help to group cultures of polypores with common generic features and thus aids in the identification of an unknown polyporoid culture.

In the lower Hymenomycetes, a similar system of classification based largely on microscopic features, is being worked out, (Cunningham 7). As in the *Polyporaceae*, fungi grouped according to this system should show common generic features in culture. It appears, however, that many of the structures present in the fructifications of wood-rotting fungi, are not formed in the cultures. For this reason, the work of Cunningham is unfortunately of limited use in the identification of unknown cultures.

More recently, Pinto-Lopes (17) also proposed a classification of the *Polyporaceae*, based on their hyphal characteristics. He stated (p. 116), that the same types of hyphae are produced in culture as are present in the fructifications. His descriptions are, unfortunately, not sufficiently detailed for use in the identification of unknown polyporoid cultures.

In this paper, the traditional nomenclature for the *Polyporaceae* was adhered to for the sake of uniformity with earlier work and because the South African species have not yet been revised in the light of the new approach.

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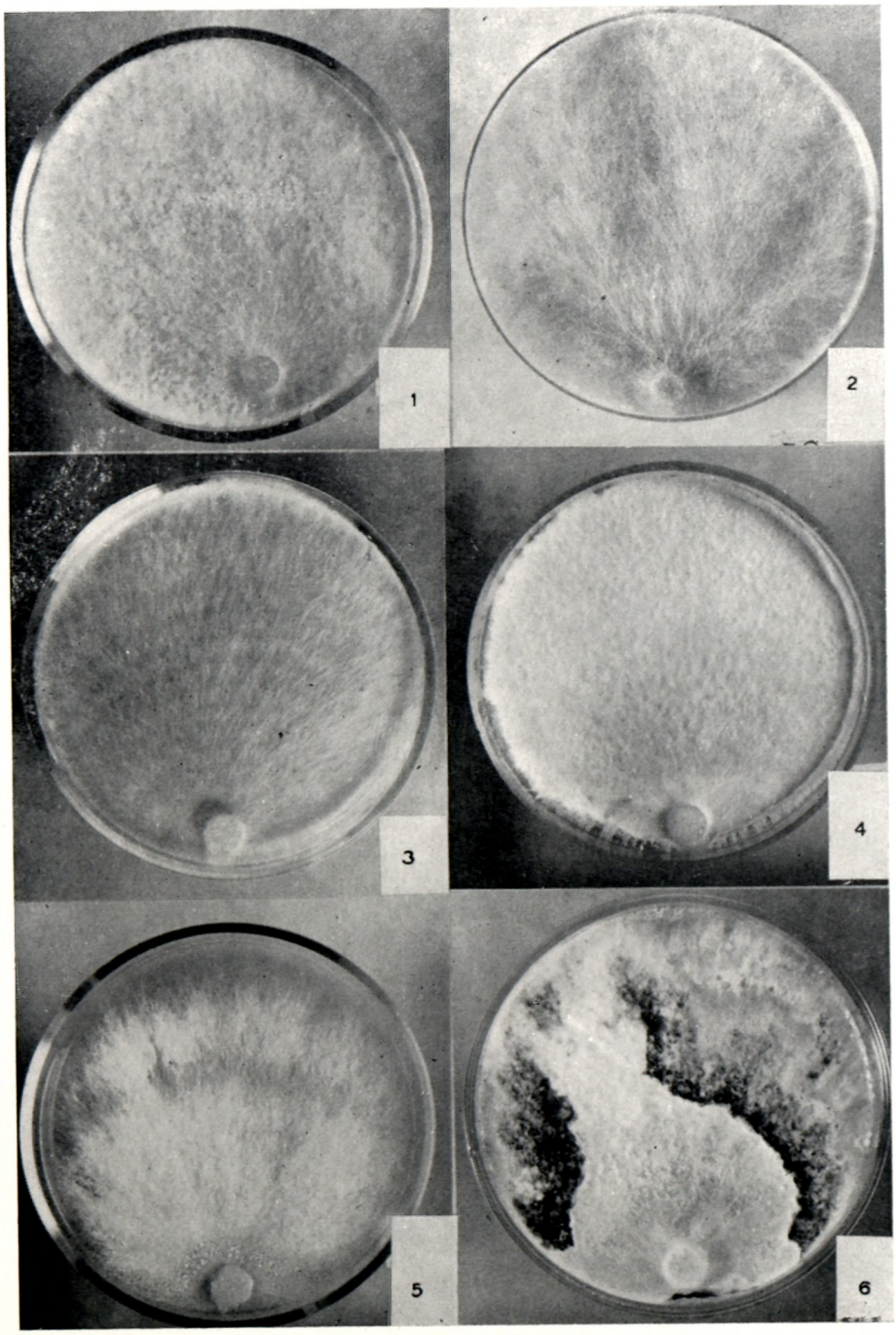

PLATE 1.—FIG. 1, *Amauroderma rude*, 2 weeks; FIG. 2, *Coniophora arida*, 3 weeks; FIG. 3, *Ganoderma colossum*, 3 weeks; FIG 4, *Lentinus sajor-caju*, 2 weeks; FIG. 5, *Lenzites palisoti*, 2 weeks; FIG. 6, *Polyporus arcularius*, 3 weeks.

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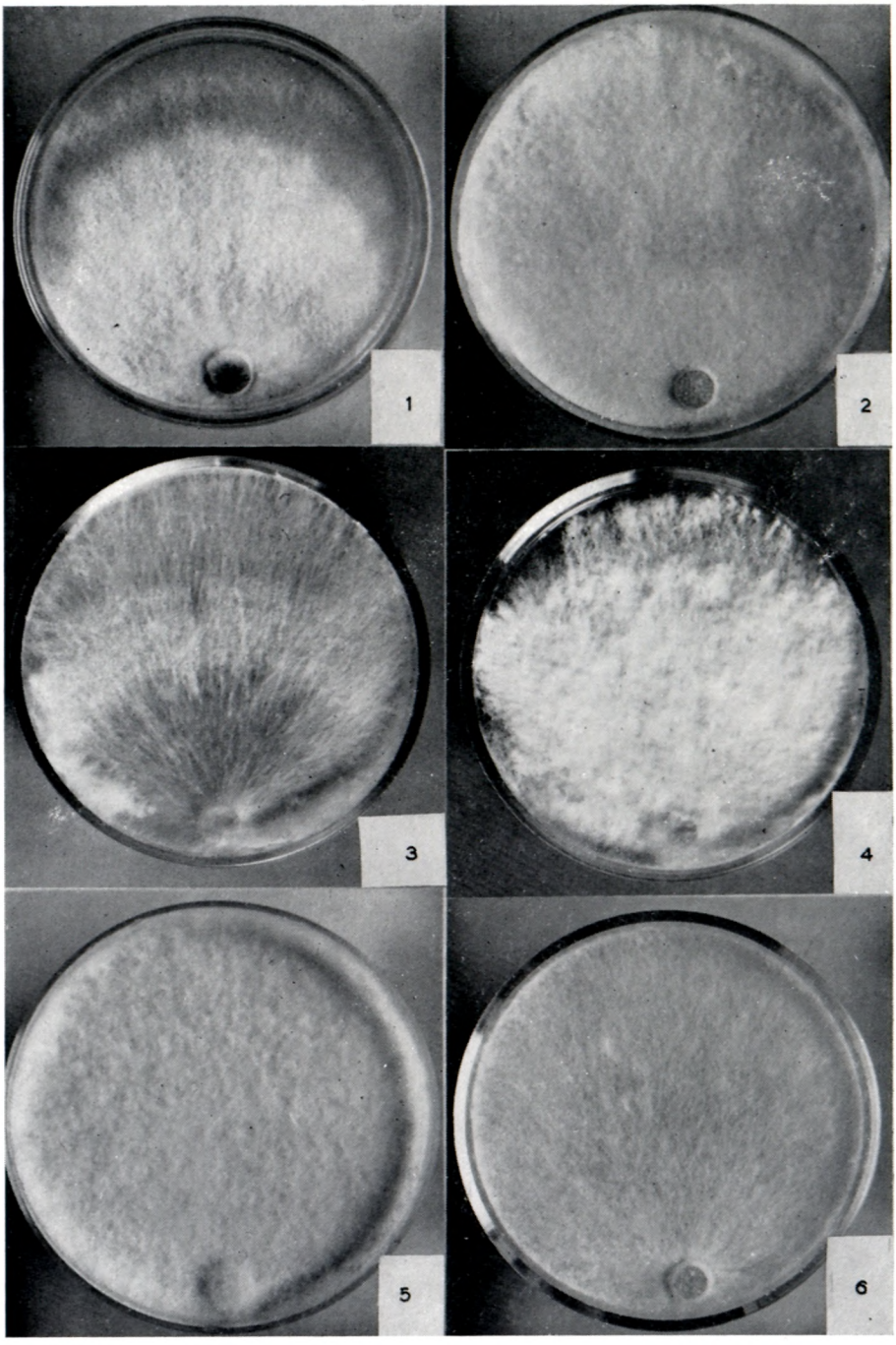

PLATE 2.—FIG. 1, *Polyporus sanguineus*, 2 weeks; FIG. 2, *Polystictus hirsutus*, 2 weeks; FIG. 3, *Poria vaillantii*, 3 weeks; FIG. 4, *Schizophyllum commune*, 3 weeks; FIG. 5, *Stereum hirsutum*, 2 weeks; FIG. 6, *Stereum purpureum*, 2 weeks.

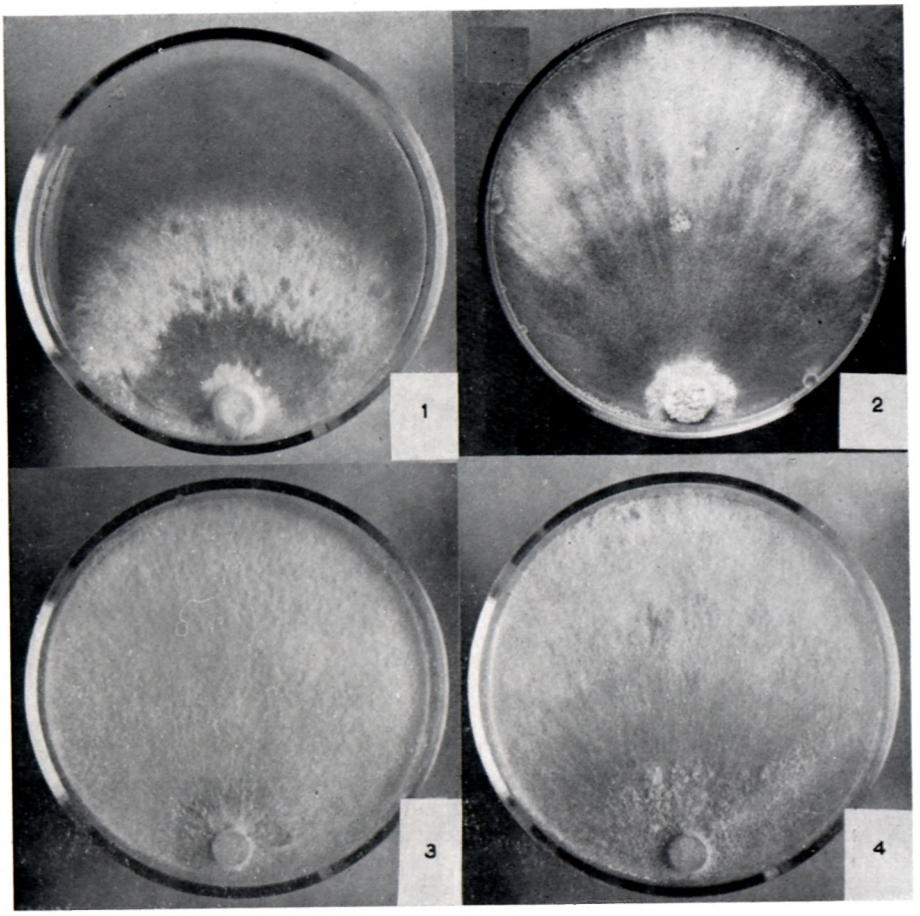

PLATE 3.—FIG. 1, *Stereum sanguinolentum*, 3 weeks; FIG. 2, *Trametes cingulata*, 3 weeks; FIG. 3, *Trametes meyenii*, 2 weeks, *Trametes proteus*, 2 weeks.

PLATE 4.

FIG. 1.—*Amauroderma rude:* (*a*) Advancing hypha. (*b*) Aerial hypha. (*c*) Fibre hyphae with swellings. (*d*) Wide hypha with thick walled fibre hyphae branching off. (*e*) Terminally inflated fibre hyphae from crustose areas.

FIG. 2.—*Coniophora arida:* (*a*) Advancing hyphae with multiple clamps and whorl of branches from clamps. (*b*) Aerial hypha with multiple clamps. (*c*) Aerial hypha with simple and multiple clamps. (*d*) Submerged hypha.

FIG. 3.—*Ganoderma colossum:* (*a*) Advancing and aerial hyphae. (*b*) Widened hyphae with simple septa and deeply staining contents. (*c*) Thin-walled narrow hyphae without clamps and few simple septa.

FIG. 4.—*Lentinus sajor-caju:* (*a*) Advancing and aerial hyphae with clamps. (*b*) Fibre hyphae. (*c*) Chlamydospores. (*b*) Thick-walled, swollen hyphae from crustose layer. (*e*) Submerged hypha with chlamydospore.

FIG. 5.—*Lenzites palisoti:* (*a*) Advancing and aerial hyphae. (*b*) Fibre hyphae. (*c*) Fibre hyphae with wide lumen at tips. (*d*) Oidia. (*e*) Chlamydospore. (*f*) Submerged hypha.

FIG. 6.—*Polyporus arcularius:* (*a*) Advancing and aerial hyphae. (*b*) Fibre hyphae. (*c*) Thick-walled brown hyphae from skinlike areas. (*d*) Basidia and basidiospores.

FIG. 7.—*Polyporus sanguineus:* (*a*) Advancing and aerial hyphae. (*b*) Fibre hyphae. (*c*) Chlamydospores. (*d*) Submerged mycelium with chlamydospores.

FIG. 8.—*Polystictus hirsutus:* (*a*) Advancing and aerial hyphae. (*b*) Fibre hyphae. (*c*) Submerged hyphae. (*d*) Oidia. (*e*) Basidium and basidiospores.

PLATE 4

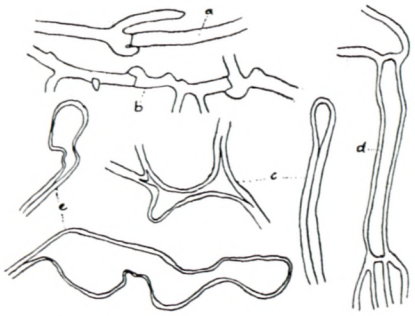

Fig.1

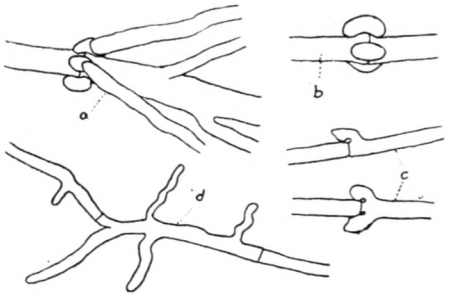

Fig.2

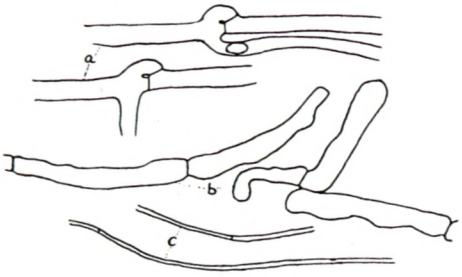

Fig. 3

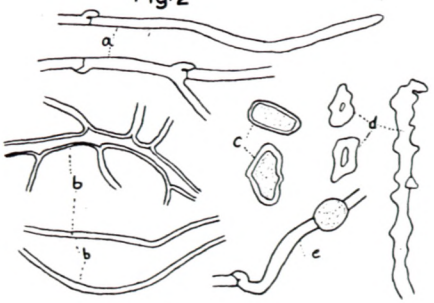

Fig. 4

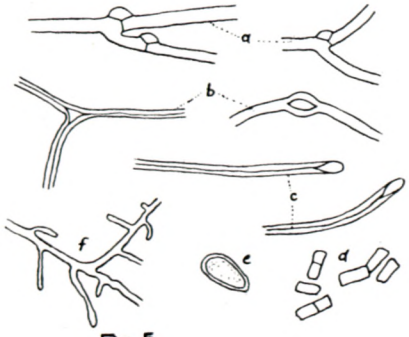

Fig. 5

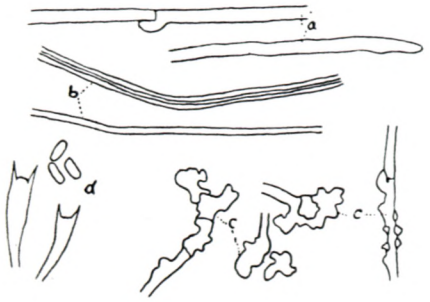

Fig. 6

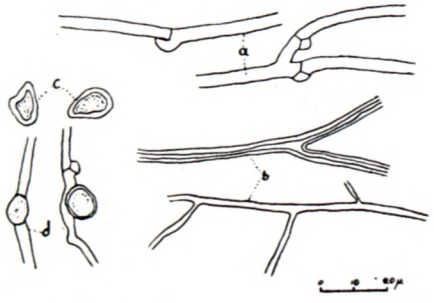

Fig. 7

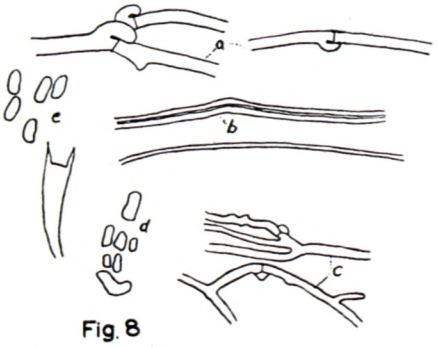

Fig. 8

PLATE 5.

FIG. 1.—*Poria vaillantii:* (*a*) Advancing hyphae. (*b*) Aerial hyphae. (*c*) Wide irregularly distended hyphae. (*d*) Fibre hypha. (*e*) Basidia and basidiospores.

FIG. 2.—*Schizophyllum commune:* (*a*) Advancing hypha. (*b*) Chlamydospores. (*c*) Hyphae with short, narrow side branches. (*d*) Submerged mycelium. (*e*) Basidia and basidiospores.

FIG. 3.—*Stereum hirsutum:* (*a*) Advancing and aerial hyphae with multiple clamps. (*b*) Fibre hyphae. (*c*) Helicoid hyphae.

FIG. 4.—*Stereum purpureum:* (*a*) Advancing hyphae. (*b*) Wide hypha from aerial mycelium. (*c*) Vesicular gloeocystidia. (*d*) Basidia and basidiospores.

FIG. 5.—*Stereum sanguinolentum:* (*a*) Advancing hyphae. (*b*) Wide hyphae with simple septa and paired clamps. (*c*) Helicoid hyphae.

FIG. 6.—*Trametes cingulata:* (*a*) Advancing and aerial hyphae. (*b*) Fibre hyphae. (*c*) Chlamydospores. (*d*) Submerged hypha. (*e*) Basidia and basidiospores.

FIG. 7.—*Trametes meyenii:* (*a*) Advancing and aerial hyphae. (*b*) Fibre hyphae. (*c*) Submerged hypha. (*d*) Oidia.

FIG. 8.—*Trametes proteus:* (*a*) Advancing hyphae. (*b*) Fibre hyphae. (*c*) Encrusted hypha. (*d*) Submerged mycelium. (*e*) Basidia and basidiospores.

PLATE 5

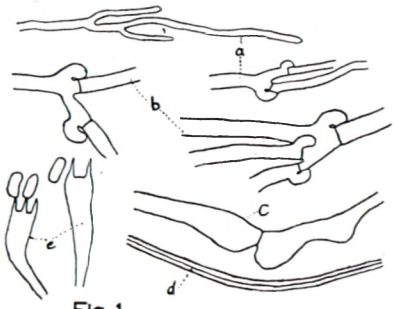

Fig. 1

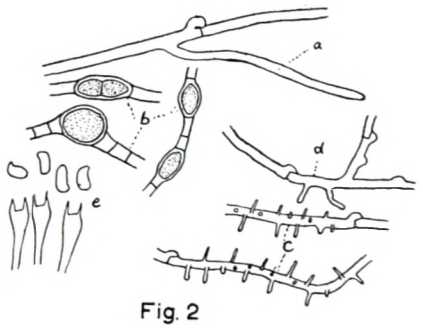

Fig. 2

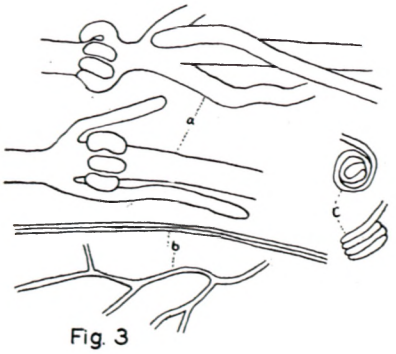

Fig. 3

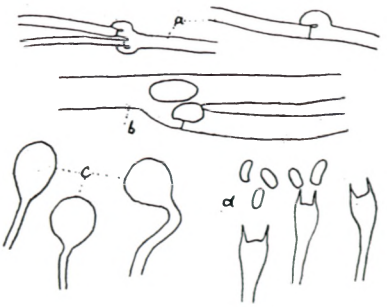

Fig. 4

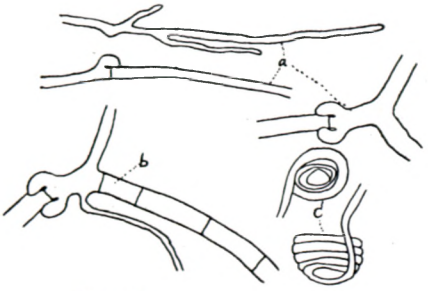

Fig. 5

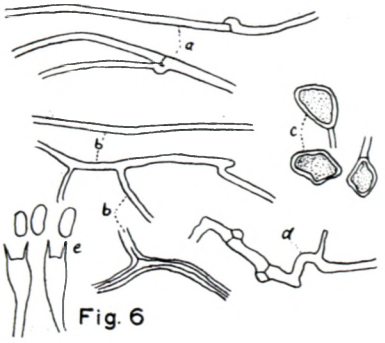

Fig. 6

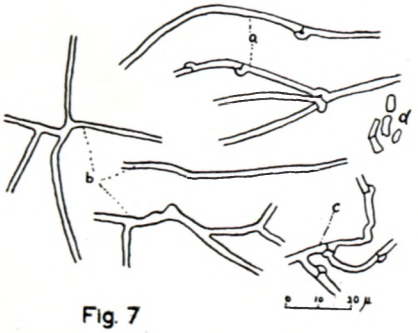

Fig. 7

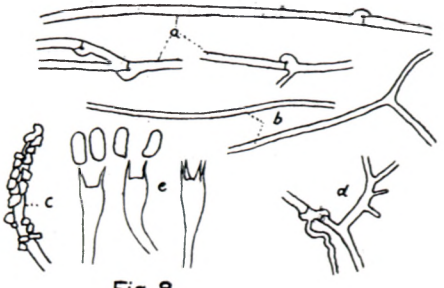

Fig. 8