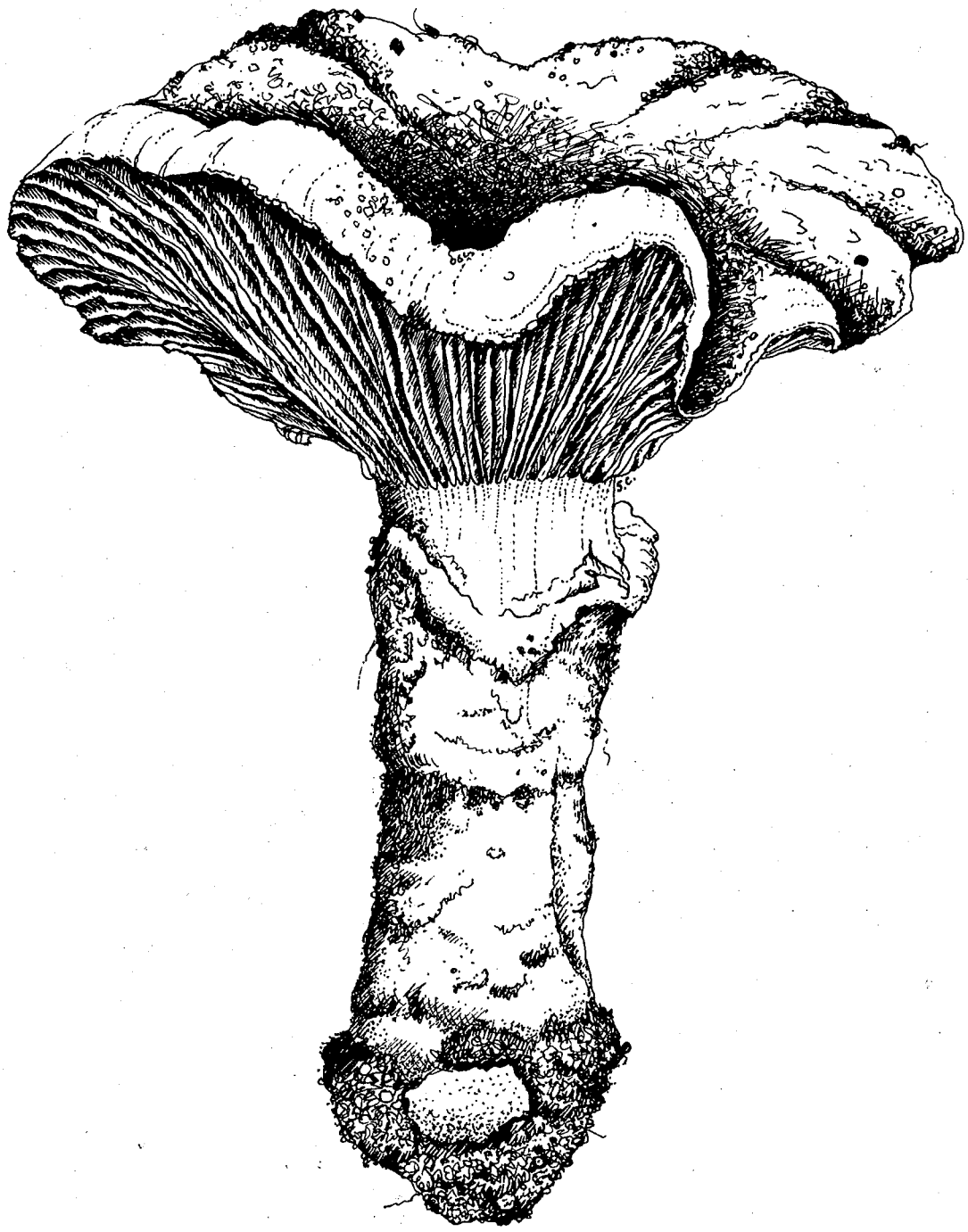

LARGER FUNGI of the Jarrah Forest

with an Appendix on books suitable for identifying the species

by R.N. Hilton Illustrated by Shirley Clancy

COLIN CRANE

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Introduction

To the casual visitor in summer there must be few forests in the world that appear so hostile to the growth of larger fungi. There is no litter layer of the type familiar in temperate or tropical forest, much of the other organic matter (duff) is destroyed by frequent fires, the jarrah itself has a hard decay-resistant wood and its leaves are rich in tannins and eucalyptus oil, many of the associated plants are sclerophyllous, and the summer drought ensures deep drying out and heating of the soil. Yet in Autumn, once the temperature has dropped and a few centimetres of rain have fallen, the forest displays a remarkable mycoflora in which most of the genera reported from the Northern Hemisphere have been recorded. The season begins with larger forms like boletes and amanitas, which are associated with tree roots, and builds up to troupes of smaller forms once the rain has soaked through the soil surface and debris thereon. Throughout, the mainstay of the mycoflora is the number of mycorrhizal species. Because of the phenomenon of host specificity these are the species most likely to be diagnostic of the Jarrah, as distinct from other, forest. it has become more and more evident that the mycorrhizal/non-mycorrhizal habit is correlated with taxonomic position (Miller, 1983), so that it is possible to suggest the status of a given species without having established it experimentally.

Taking the 17 families of Agaricales as recognized by Miller (1983, p. 911), all are represented in the Jarrah Forest with the exception of the Gomphidiaceae. The mycorrhizal prediction cannot be made for the polyphyletic Tricholomataceae or Cortinariaceae, and applies there at generic level only. Of the Tricholomataceae, *Clitocybe, Collybia, Flammulina, Hohenbuehelia, Lyophyllum, Marasmius, Melanoleuca, Resupinatus* are all represented and appear to be non-mycorrhizal. *Laccaria, Omphalina, Oudemansiella,* and several *Tricholoma* would be mycorrhizal candidates. Of the Cortinariaceae the non-mycorrhizal candidates would be *Crepidotus, Galerina, Gymnopilus* and the mycorrhizal candidates *Cortinarius, Hebeloma, Inocybe*, and *Rozites*.

Whether mycorrhizal or not, the larger fungi are profoundly affected by rainfall and by fire. There is little one can do about rainfall, and there is a subjective impression that the reduced rainfall of recent years has seen a dimunition of fungi fruiting within the Jarrah forests. Fire can be controlled to some degree and forest managers should consider its effect on the fungi as well as on plants and animals. Progressive destruction of organic matter must reduce the food base of fungi, and this applies even to the underground mycorrhiza for they depend upon organic matter for extensive growth and fruiting. The solubles released by burning must also have a profound effect on fungi that survive the burn itself. It must not be forgotten that the mycorrhizal association is a two way process, so that disappearance of the fungi means that the trees themselves lose an important agency in

facilitating their nutrition and in protecting them against disease. Contrary to what one might think at first, a forest rich in fungi is a healthy forest.

I am often asked how many species of larger fungi there are in Western Australia. Defining "larger" as being any fungus that one might have hope of recognising solely with the naked eye i.e. upwards of 5mm across, some 500 have been formally recorded at species level (Hilton, 1982; Hilton, 1988a). A specialist working on material already collected could double this to 1000. When one considers how few the collectors, how short the season, and how vast the state, I would be surprised if the number of species eventually recorded proved less than that of flowering plants - say about 6000. Fungi are more widely distributed than flowering plants, so one can guess that perhaps 2000 of these would be represented within the Jarrah forest, albeit rarely in many cases.

In the pages that follow only a handful of the most common are mentioned, put into the ecological categories that help to recognise them and focus attention on their importance in the life of the forest.

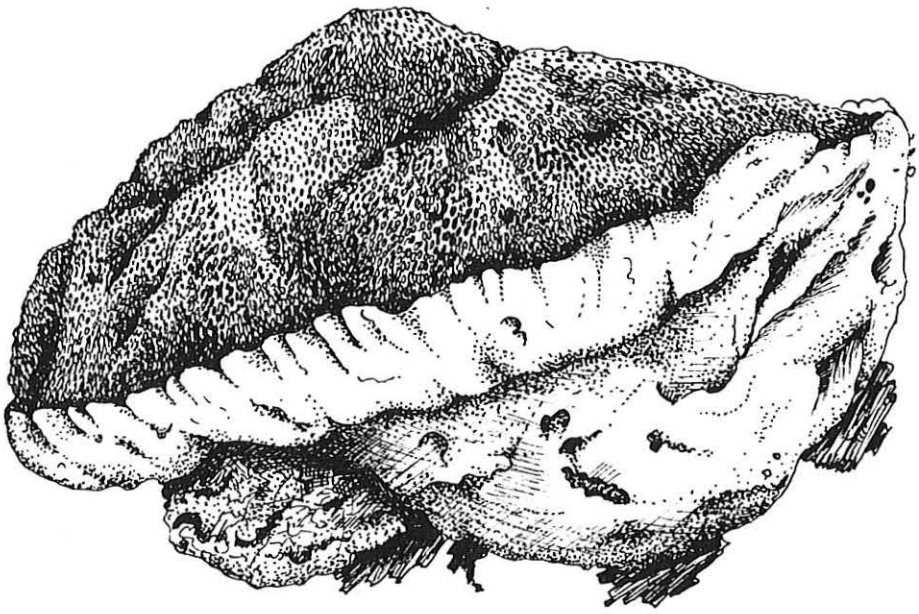
Fungi attacking standing trees

The most typical of all Jarrah Forest fungi would be those found on living Jarrah itself, and on no other species. This would be as a result of specificity in overcoming the resistance mechanisms of the tree, especially one with timber so hard as Jarrah. Evidence so far is that no species can invade an intact Jarrah. Yet Jarrah is devoid of natural preservative substances according to Ernest (1936).

The most prominent wound parasite of standing Jarrah is the Beefsteak Fungus *Fistulina hepatica* Fr. It is often found growing from the wounds inflicted when numbers are carved into map reference trees. Meagher (1974 p. 60) cites descriptions of a "boletus" growing from Jarrah trunks called "numar" by the aborigines and eaten by them. "*Numar*" must be *Fistulina*, which is a well-known edible in the Northern Hemisphere. It causes a pencilling of the timber but not a rot (Tamblyn 1937). Most records to date are on Jarrah itself.

A superficially similar fungus to the Beefsteak is *Polyporus pelliculosus* Berk. with a similar soft context, but paler colour and hairy surface. in Victoria it has been called Furry Punk and occurs on a number of host species; in Western Australia it is known from Marri and Bullich amongst trees of the Jarrah Forest. In Jarrah itself it produces a brown cubical pocket rot (Tamblyn 1937).

Another prominent bracket fungus on Jarrah, on Marri, and on Flooded Gum is the Punk Fungus, *Piptoporus portentosus* (Berk.) G. Cunn. It causes a brown cubical rot, and the sheer size of its fruit body, as much as 40cm across and 20cm deep, mobilises a mass of mycelium which can destroy the crown of a tree.



Piptoporus portentosus. This is a small specimen of a bracket fungus that can reach 40 cm across. The upper surface is buff and the under, pored, surface is lemon yellow. The texture is soft and pithy. The spore powder is white.

The related Curry Punk, *Piptoporus australiensis* (Wakef.) G. Cunn., has not been recorded on Jarrah and is a characteristic fungus of the Tuart Forest.

A resupinate polypore is *Poria mutans* (Peck) Peck, originally described from Jarrah as *Poria healeyi* N.E.M. Walters (Walters 1958), and responsible for Yellow Straw Rot of the timber. Lowe (1963) has demonstrated that this is the same fungus as one previously known only from Chestnut in the Eastern part of the United States.

Although not so commonly attacking the Jarrah itself, the Honey Fungus, *Armillaria luteobubalina* Watling & Kile, is found throughout the forest on a number of woody species. Its fruit bodies occur in masses round the base of parasitised trees. Specific records are given by Kile *et al* (1983).

Fungi characteristically occurring as causes of rots of standing timber in the forest other than Jarrah, are the "Ghost Fungus" *Pleurotus nidiformis* (Berk.) Sacc. most commonly on Peppermint, *Phellinus rimosus* (Berk.) Pilat on Wandoo, *Schizophyllum commune* Fr. on acacias, *Stereum hirsutum* (Willd.) Pers. on Marri, and *Pleurotus australis* (Cooke & Massee) Sacc. on Macrozamia. *Phellinus gilvus* (Schwein.) Pat. is a less common bracket fungus, but has been implicated by Tamblyn (1937) as a cause of a white pocket rot in Jarrah,

Marri, Sheoak, and other trees. *Phellinus rimosus* is a species first described from Western Australia (Hilton, 1983 p. 338) and subsequently found to be common in the Northern Hemisphere. It may explain records, all needing confirmation, of the Northern Hemisphere species *P. robustus* and *P. igniarius* in Western Australia. Two other bracket fungi are not now common but may have been more so in the past because they were amongst the first fungi ever collected from Western Australia: *Hexagonia vesparius* (Berk.) Ryvarden and *Phaeotrametes decipiens* (Berk.) Lloyd. The latter appears to be confined to Casuarina.

All these fungi must play a part in creating the hollows that are an important part of the animal ecosystem (Saunders 1979). Some can continue this work after a tree has fallen, when they will be joined by other wood attackers.

Fungi on fallen timber

On fallen timber some of the aforementioned fungi are no longer active and a succession of larger fungi appears, starting with those penetrating dying timber, and finishing with those growing on timber so decomposed that it is no longer a selective substrate.

Polyporus tumulosus Cooke & Massee is a vigorous invader of fallen Jarrah timber (Tamblyn, 1937). Cleland suggested that there is a variety, *westraliensis*, differing from Eastern States varieties, but did not confirm this by publishing a description. It is the cause of the "xylostroma heart rot" - a brown, cubical rot.

Well-decomposed hardwood supports growth of the brilliant scarlet *Pycnoporus coccineus* (Fr.) Bond. & Singer, but this is most common on Paperbark and introduced Pine.

Ganoderma applanatum (Gray) Pat. is recorded, but less common than would be expected from its abundance in the Northern Hemisphere and the South East Asian equatorial regions. *Trametes lilacino-gilvus* complex is not uncommon on fallen timber and may attain large size, say 60cm long, towards the coast.

When logs are sufficiently rotted to fall, a growth of the soft, brown-spored, gilled bracket *Crepidotus uber* (Berk. & Curtis) Sacc. may appear on Jarrah, Marri, or subsidiary species. A less-common, white-spored, gilled bracket is *Hohenbuehelia atrocaerulea* (Fr.) Singer.

Common resupinate fungi at this stage are the smooth surfaced *Stereum hirsutum* (Wild.) Pers. ex Gray and *Xylobolus illudens* (Berk.) Boidin together with the pored *Poria* species.

The two characteristic stipitate wood-attacking agarics of the forest are sufficiently close to the Northern Hemisphere *Gymnopilus penetrans* (Fr.) Murrill and *Pholiota highlandensis* (Peck) A.H. Smith

Gymnopilus penetrans. A bright yellow fungus with a rich rust-like spore powder which in the specimens shown has deposited on the traces of a stem ring making it prominent.

& Hesler respectively, for them to have been recorded under those names. The former grows on dead fallen wood of any species, the latter in similar situations where there has been recent fire. The recently described *Pholiota multicingulata* Horak is a fungus similar to *Pholiota highlandensis* and may account for many records of the latter. A fungus similar to a miniature *Gymnopilus* is *Phaeomarasmius horizontalis* (Bull.) Kühner, which occurs on burnt fallen logs . At the other extreme of size is the large *Gymnopilus pampeanus* (Speg.) Singer, a rarity. Intermediate in size is *Gymnopilus purpuratus* (Cooke & Massee) Singer, an occasional parasite of trees in the wetter areas of the forest.

Panus fasciatus (Berk.) Pegler is an uncommon but characteristic saprophyte of well-rotted Jarrah and Marri wood. Of the characteristic wood-attacking genus *Pluteus*, the large species

P. cervinus (Fr.) Kummer, and *P. atromarginatus* (Kondrad) Kühner, are encountered in the vicinity of sawmills, and are arguably introduced species. Smaller species like *P. lutescens* (Fr.) Bres. may be encountered on well-rotted wood anywhere in the forest. Species of *Mycena* occur in similar situations, and in clefts in less well-rotted stumps.

A fungus of rotted stumps of fallen trees is the local form of the European Sulphur Tuft, *Naematoloma fasciculare* (Fr.) Kummer.

Mycena subgalericulata. A brown fungus with bell-shaped cap and hairy stems that grow from deep down in clefts in tree stumps and fallen logs. The spore powder is white.

The brilliant yellow Jelly Fungi *Tremella mesenterica* Fr., *Calocera guepinioides* Berk, and *Heterotextus peziziformis* (Berk.) Lloyd, are prominent on wet well-rotted fallen branches throughout the forest.

Pholiota multicingulata. "Multicingulate" means "many ringed", and one can see the rings of scales ascending the stem. Similar scales are on the cap, which is slimy when wet. The colour is a dull yellow and the spore powder is cocoa brown.

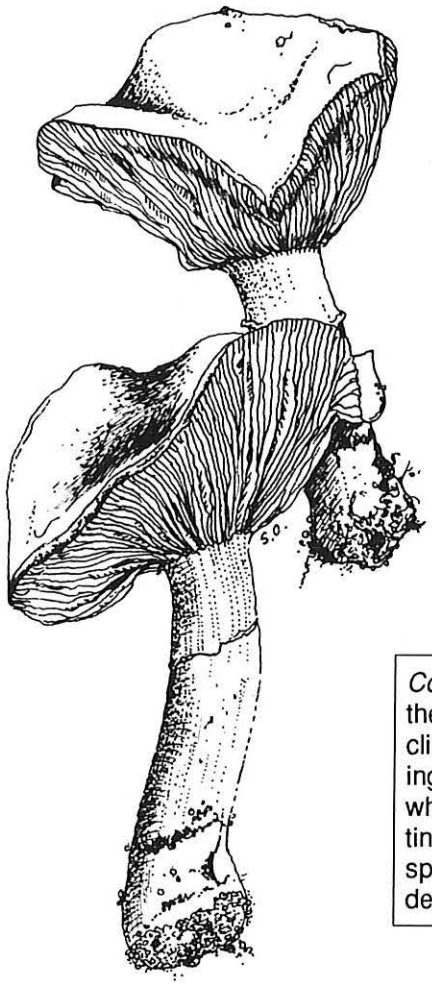
Dung fungi

Of all the fungi of the forest, those on dung can be expected to be least specific. Nevertheless they have become part of the mycoflora although in many cases they cannot even be considered native, let alone indigenous, to the State. Records from dung of non-native animals within the forest are excluded here. The identity of seven members of the Coprinaceae and their possible indigenous status has been investigated by Bougher (1983). He confirmed the presence on kangaroo dung of *Coprinus curtus* Kalchbrenner, *C. radians* (Desm.) Fr., *C. stercoreus* Fr., and *C. vermiculifer* Josserand : Dennis.

Poronia punctata Fr. is an uncommon fungus in Europe, but its button-like growths are common on kangaroo dung. *Stropharia semiglobata* (Fr.) Sacc. is common as a solitary slender stipe growing from beneath pieces of kangaroo dung, rising 6-8cm vertically and capped by a 1-2cm hemispherical pileus. Well-weathered dung may support the Bird's Nest Fungus *Cyathus stercoreus* (Schw.) de Toni.

Radicating fungi

This is a category recognized by A.H.R. Buller (1934) for fungi arising from a long process, the pseudorhiza, making it appear as though they have a 'tap root'. One, *Cortinarius radicatus*, is recorded (p. 21) in the accepted mycorrhizal category and one other (p. 6) as a wood rotter, *Polyporus tumulosus*. As observed by R.T. Wills (1983), *P. tumulosus* does send down a process into the soil that initiates growth of mycelium into soil particles to form a giant pseudosclerotium. Under the stimulus of an autumn burn the pseudosclerotium sends up processes that develop into the white, tough, pored fruit body (Reid *et al.* 1979). This fungus should not be confused with *P. mylittae* Cooke & Massee, the Blackfellows' Bread, which produces a true sclerotium and also is not a Jarrah Forest fungus. *Oudemansiella radicata* (Relham ex Fr.) Singer grows individually in the forest, with a long process down to tree roots as described by A.H.R. Buller (1934). As variety "*superbiens*" it was one of the early fungi to be described, by Berkeley, from Drummond's collection. Occasionally, and always associated with fire, it may occur in large numbers but of small size. The varietal name appears to be of ecological rather than taxonomic significance, describing as it does a common growth form.



Cortinarius radicatus. Note how the base is broken and has soil clinging to it, the remains of a rooting (i.e. "radicate") stem. The white colour is unusual for a cortinarius and contrasts with the rust spore powder where this gets deposited on the stem.

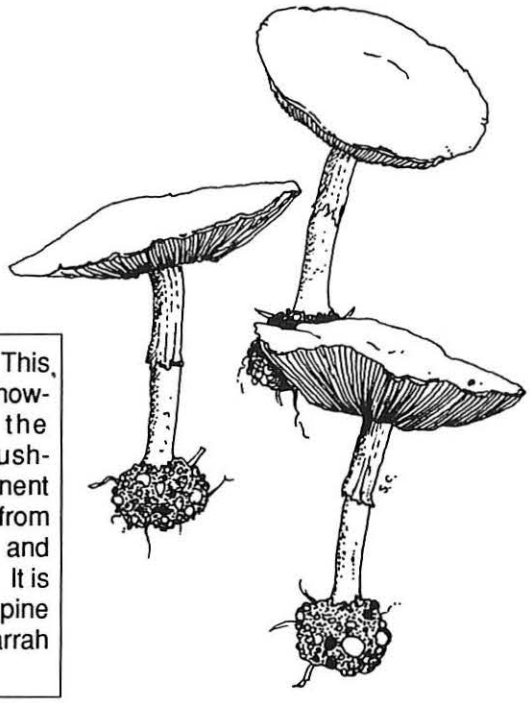
Cortinarius australiensis Horak is the largest of forest agarics, and is white and fleshy. Despite its persistent ring, which led Cleland and Cheel to classify it as a *Rozites*, it is a *Cortinarius* so that it and *Cortinarius radicatus* Cleland form a pair of common white cortinarii. Both are very commonly eaten by native mammals.

Cortinarius australiensis. This is an unusual cortinarius in its large size, white colour, and prominent ring. The ring is often thick with a rich rust deposit of spore powder.

Litter fungi

The deep litter that supports so many species in temperate forests is not to be found in the Jarrah forest. Nevertheless there are hollows in which leaves and twigs accumulate and such litter supports a restricted non-mycorrhizal mycoflora.

This would represent the restricted habitat from which native species of Common Mushroom, *Agaricus*, have spread to occupy the extensive clearings for pasture within the forest area. *Agaricus silvaticus* is typical of this situation, as well as species of *Lepiota*. *Lepiota konradii* Huijsman : P.D. Orton (=*L. gracilenta* (Krombh.) Quél.

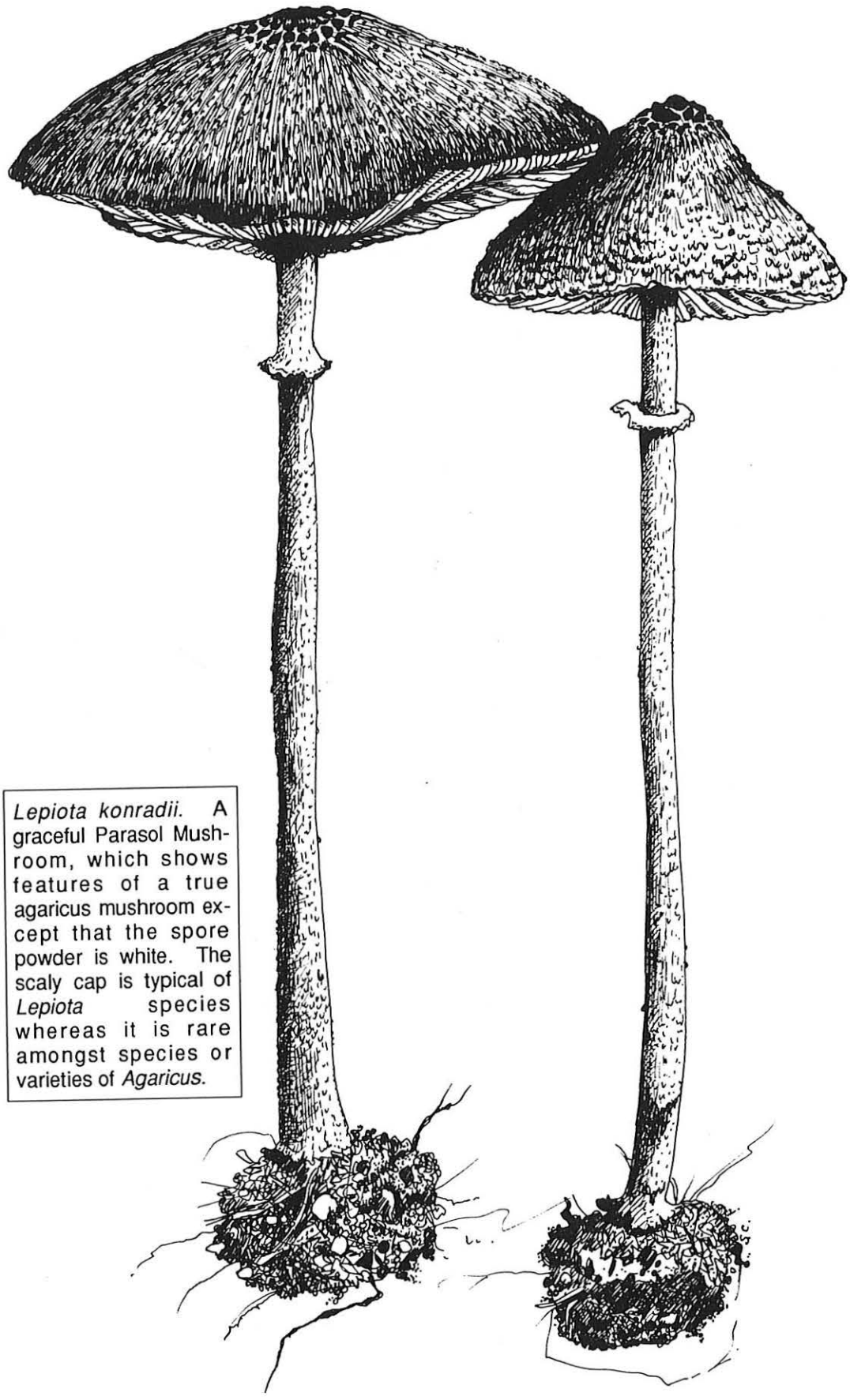


Agaricus semotus aff.. This species is a miniature, showing to perfection all the features of the true mushroom : free gills, prominent ring, stem arising direct from soil without frills or cup, and dark brown spore powder. It is found in the introduced pine plantations, not in the jarrah forest as such.

and other species yet to be described. *Collybia dryophila* (Fr.) Kummer can be abundant in accumulated loose litter within the forest, and also *Collybia butyracea* Fr.

Because of their association with buried organic matter two species of *Coprinus* fall into this category, rather than into the dung group that represents the typical habitat of *Coprinus*. Namely *C. comatus* (Fr.) Gray and *C. disseminatus* (Fr.) Gray. Another litter fungus is the rare, and possibly introduced, *Tricholomopsis rutilans* (Fr.) Singer.

Where there is a combination of litter and dampness, as at the edge of streams, the Pagoda Fungus *Podoserpula pusio* (Berk.) Reid may be found occasionally; further South, in the Karri forest, it is more common and more likely to be found away from streams. An agaric with similar ecological pattern is the garnet red *Tubaria rufo-fulva*



Lepiota konradii. A graceful Parasol Mushroom, which shows features of a true agaricus mushroom except that the spore powder is white. The scaly cap is typical of *Lepiota* species whereas it is rare amongst species or varieties of *Agaricus.*

(Cleland) Reid & Horak. Also *Anthracophyllum archeri* (Berk.) Pegler, and *Marasmius crinisequi* Mueller : Kalchbr.

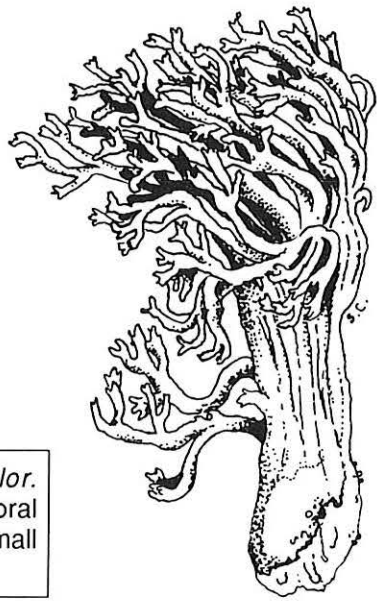
A number of non-mycorrhizal Gasteromycetes favour the litter habitat, growing on dead stems and leaves: *Sphaerobolus stellatus* Tode : Pers., *Crucibulum laeve* (Huds. : Relh.) Kambly, species of *Nidula, Nidularia*, and *Cyathus*.

Others occur where litter is buried: *Calostoma luridum* (Berk.) Massee, and the Stinkhorns *Ileodictyon gracile* Berk. and *Clathrus pusillus* Berk. This is also the favoured site for the several species of *Calvatia, Lycoperdon* and *Geastrum*.

Fungi of the forest floor

A remarkable feature of the Jarrah forest is the appearance of numerous species of larger fungi on a surface practically devoid of organic matter. Fruit bodies of genera that in the Northern Hemisphere are associated with deep litter appear growing from bare earth. On digging for the source of the mycelium one encounters it associated with fragments of buried charcoal and with roots that penetrate the charcoal. Rarely are large masses of organic matter or sclerotia found. By association, and knowledge of family affiliations, one can conclude that all fungi in this ecological category are mycorrhizal.

Amongst Aphyllophorales, the most prominent are several species of *Ramaria*. The fruit bodies of the bright orange-yellow *Ramaria ochraceo-salmonicolor* (Cleland) Corner would be the most abundant of all larger fungi of the forest of whatever classification. The more slender, and purer yellow, *Ramaria sinapicolor* (Cleland) Corner is as widespread but in less quantity than *R. ochraceo-salmonicolor*. These Clavariaceae are recognized mycorrhizal candidates;



Ramaria ochraceo-salmonicolor. This is a portion of a growth of coral fungus that was the size of a small cauliflower.

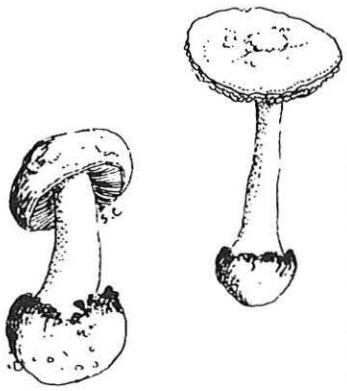
members of the Hydnaceae are less obviously so under Jarrah forest conditions as they require the shelter of litter to fruit satisfactorily. Nevertheless, they grow from the ground, not from the litter. *Hydnum repandum* Fr. is locally abundant, often associated with the reddish

Ramaria sinapicolor. This is the mustard yellow, more sparsely branched of the jarrah forest coral fungi.

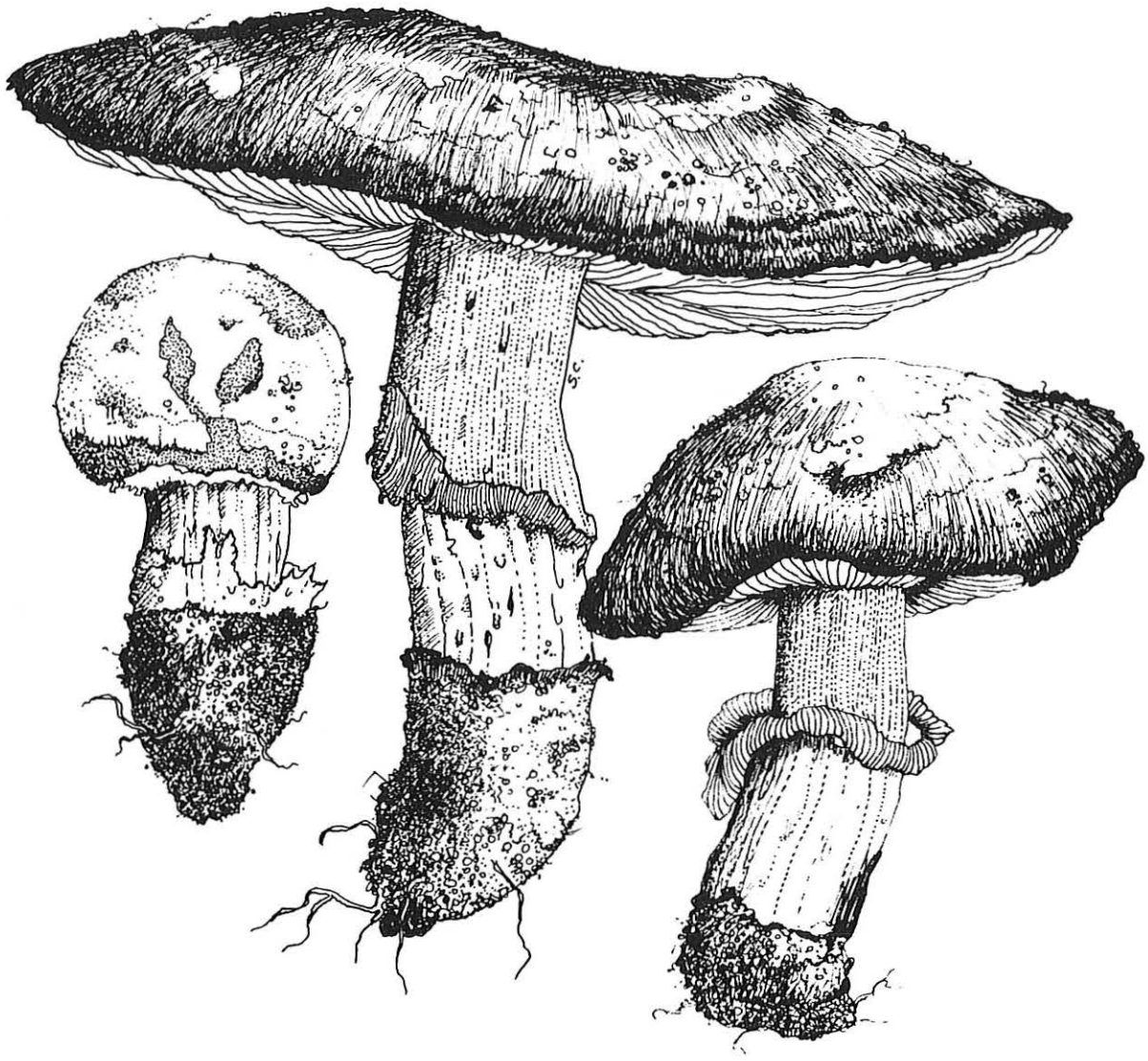
form sometimes named as a separate species, *H. rufescens* Fr.. Both are confirmed and easily recognised edibles. *Phellodon melaleucus* (Fr.) Karst. is a less common but still widespread member of the Hydnaceae.

Amongst the Agaricales the most striking are the several species of large white amanitas of the section Lepidella of Bas (1969). The

Amanita persicina ined.. A delicate peach-coloured amanita set in a cup but with a ring that quickly rubs away.



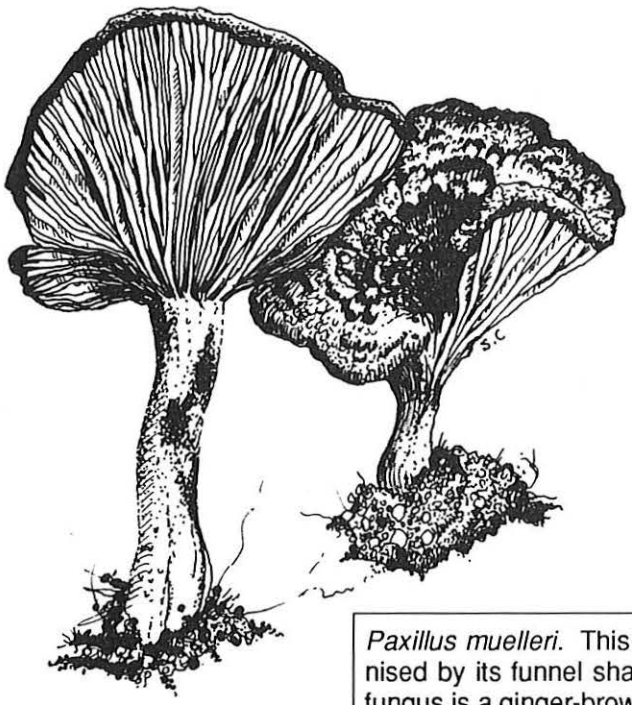
Amanita xanthocephala. "Xanthocephala" means "yellow headed", but the cap may range from pale yellow to deep orange. The white spots on the cap have led people to assume that it is a miniature Fly Agaric, but the absence of a ring and the presence of a cup at the base show that it is in a completely different section of *Amanita*.



Amanita umbrinella. The large fruit-bodies, which may reach 30 cm in height, are unmistakable with the white-spotted brown caps, prominent rings, and smoky-coloured stems. The spore powder is white, as in all amanitas.

most common is the large *Amanita preissii* (Fr.) Sacc., which bears a strong resemblance to the Eastern States *A. farinacea* (Sacc.) Cleland. & Cheel. Similar species are *A. hiltonii* Reid and *A. subalbida* Cleland. *A. conicobulbosa* Cleland and *A. clelandii* Gilbert are species not yet confirmed for Western Australia but probably here within the *preissii* complex. Fruiting of the largest Jarrah forest amanitas, *A. umbrinella* Gilbert & Cleland, is common in disturbed soil along power lines and fire breaks. This species is in the section Amanita of Bas, along with the small but common and easily-recognised species *Amanita xanthocephala* (Berk.) Reid & Hilton. *Amanita murina* Sacc. represents the Death Cap section, Phalloideae, and is occasional throughout the forest.

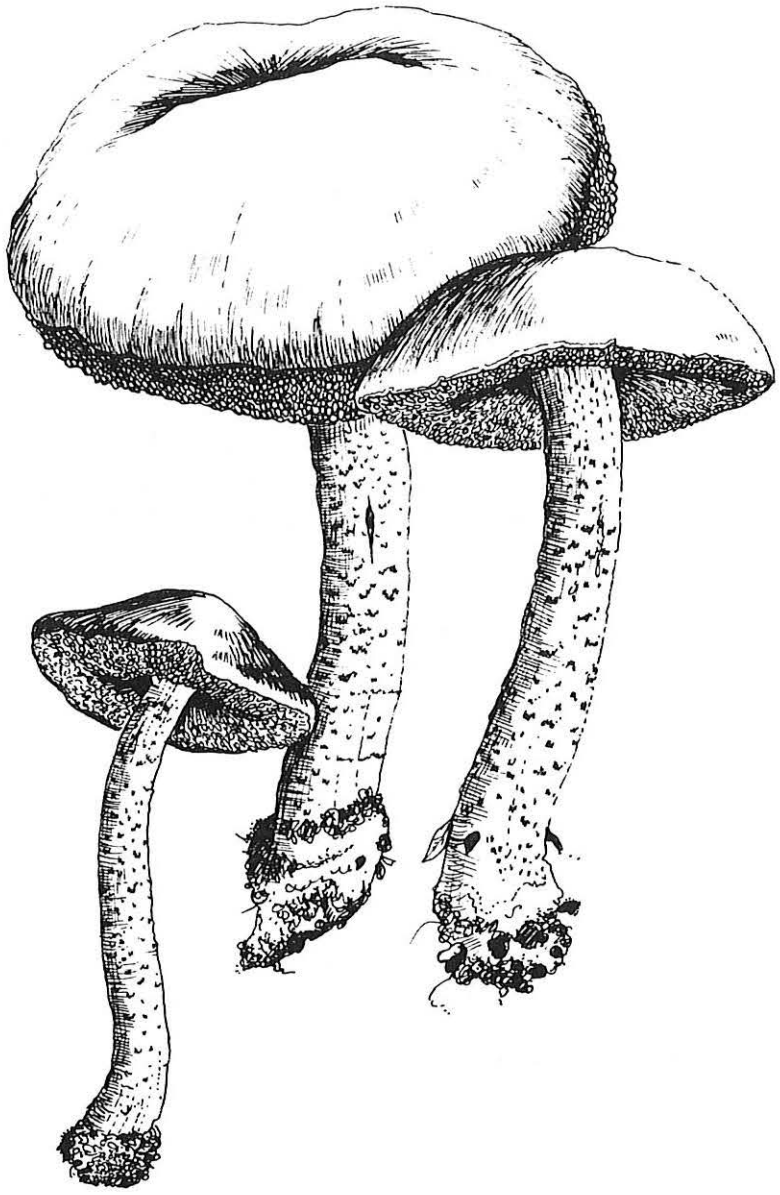
Paxillus is represented by the abundant *Paxillus muelleri* (Berk.) Sacc. The other gilled genus related to the boletes is *Phylloporus hyperion* (Cooke & Massee) Singer, but which is rare and small-sized in the forest but much larger associated with certain introduced plants.



Paxillus muelleri. This is easily recognised by its funnel shape. The whole fungus is a ginger-brown, with a brown spore powder that colours parts of the stem.

The boletes are pre-eminently agarics of open ground and known mycorrhizal habit. Of those with ornamented spores, *Boletellus obscurecoccineus* (Höhn.) Singer is the most common, easily recognisable from its rich red pileus and yellow pores. *Boletellus ananas* (Curtis) Murrill is much more rare, but striking because of its resemblance to the Northern Hemisphere "Old Man of the Woods", *Strobilomyces*. *Austroboletus occidentalis* Watling is a striking fungus, with its cinnamon-brown suede-like cap and strongly lacunose reticulate stem. It is now recognised as distinct from the Queensland

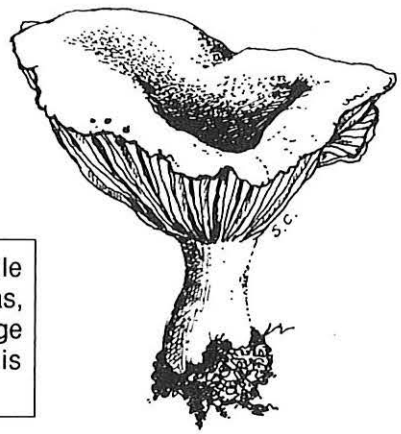
A. cookei (Sacc. & Sydow) Wolfe, (Watling & Gregory, 1986). The boletes with smooth spores are much less distinct, apart from those that fall outside the genus *Boletus*: *Gyroporus cyanescens* (Fr.) Quél. and the giant *Phaeogyroporus portentosus* (Berk. and Broome) McNabb. There are awaiting determination a number of smooth-spored species of *Boletus* with distinctive colours and colour reactions. *B. sinape-cruentus* Cleland is common. The scarlet, blueing, *Boletus caesareus* Fr. was one of the first fungi to be described from the State (Hilton, 1988b). No species of *Suillus* has



Boletellus obscurecoccineus. The sponge-like cap of the boletes makes them a distinctive group of fungi. In this species the red and yellow colouring is diagnostic, especially combined with the scurfy rhubarb-like stem.

been found away from introduced pines, and the genus *Lecclnum* appears to be absent from the State.

A well-defined family accepted as fully mycorrhizal is the Russulaceae, with the two genera: *Russula* and *Lactarius*. In the



Russula flocktonae. The "brittle wax" texture typical of the russulas, combined with a deep yellow orange cap and white gills, make this species easy to recognise.

Jarrah Forest there are at least twenty species of Russula, few of which have been named, and only one or two of *Lactarius*. This contrasts with the 100 or so species of *Russula* and 60 of *Lactarius* in the European deciduous forests (Moser, 1978). Two russulas are notable for their association and simultaneous fruiting in the forest: the pan-Australian species *R. flocktonae* Cleland & Cheel and the cosmopolitan *R. delica* Fr. Their fruiting marks the peak of the fungus

Lactarius eucalypti. The *Lactarius* genus combines the brittle wax texture of the russulas with the possession of a milky juice, which oozes out when the flesh is broken. This species is by far the most likely one to be encountered in the jarrah forest.

season and it is worth noting that in the dry autumn of 1981 they failed to appear at all. Red russulas are close to *R. emetica*, specifically: *R. mariae* Peck, *R. purvureo-flava* Cleland, and *R. clelandii* Miller & Hilton. *Lactarius eucalypti* Miller & Hilton, was the first lactarius to be specifically identified for Western Australia, in 1973, and is widespread but never abundant. A lactarius close to *L. piperatus* has been seen but not collected for the herbarium.

Among the mycorrhizal genera of Cortinariaceae, *Inocybe* is represented by a few small species, notably *I. australiensis* Cleland & Cheel, and *I. fibrillosibrunnea* Miller & Hilton. *Hebeloma* by *H. aminophilum* Miller & Hilton, a species dependent upon recently decomposed animal matter in the soil in order to fruit (Hilton, 1978).

The mycorrhizal Entolomataceae and Hygrophoraceae are represented by a number of species, mostly small in size and scattered in occurrence.

The genus *Cortinarius* (including *Dermocybe*) would be the largest single genus represented in the Jarrah forest and circumstantial evidence points to all its members being mycorrhizal. Of the few that have been named to date, the large white *Cortinarius (Phlegmacium) radicatus* Cleland and *Cortinarius (Phlegmacium) australiensis* (Cleland & Cheel) Horak are the most common and conspicuous. Classifying by the artificial category of colour:

Red	*C. (Myxacium) erythraeus* Berk., *Dermocybe erythrocephala* (Dennis) Moser
Yellow	an as yet undescribed *Dermocybe*
Yellow/Brown	*Cortinarius (Myxacium) ochraceus* Cleland
Brown/Yellow	*Cortinarius (Sericeocybe) vinaceo-lamellatus* Cleland
Brown	*Dermocybe splendida* Horak, *Cortinarius (Telamonia) basirubescens* Cleland & Harris
Green	*Dermocybe austro-veneta* (Cleland) Moser & Horak
Green/Blue	*C. (Myxacium) rotundisporus* Cleland & Cheel
Violet	*C. (Myxacium) archeri* Berk., *C. (Myxacium) subarcherl* Cleland, *Cortinarius (Phlegmacium) lavendulensis* Cleland,

but the taxonomy, specific plant relationships, and status of all these is still only in the early stages of investigation.

One or more species of *Laccaria* are common in the forest, and are important for mycorrhizal associations with both native and introduced plants. At least some of the laccarias correspond with the notoriously variable Northern Hemisphere *Laccaria laccata* (Fr.) Berk. & Broome. A common species of *Tricholoma* is *T. eucalypticum* Pearson, a eucalypt fungus early recognised as being mycorrhizal

because of the abundance of its appearance in South Africa associated with introduced eucalypts. Another recently-discovered member of the Tricholomataceae in the forest is *Leucopaxillus lilacinus* Bougher, (Bougher, 1986).

Cortinarius subarcheri. Colour is really needed to do justice to a Cortinarius. This species is a brilliant mauve. The lines on the stem are where the rust-like spore powder has clung to fragments of the collapsed web-like veil.

Two cosmopolitan genera of Gasteromycetes are prominent in the forest, especially where disturbance appears to have encouraged fruiting. Both are Sclerodermataceae: *Pisolithus* and *Scleroderma*. *Scleroderma polyrhizon* Pers. has been associated with Casuarina within the forest (Miller, 1983, p. 914).

Underground fungi

The presence of underground fungi in the Western Australian forests and their connection with the feeding of animals was commented on by Von Mueller a hundred years ago (Hilton, 1980), but it was not until Christensen investigated the feeding habits of the woylie and the tammar wallaby (Christensen, 1980) that the importance of the habit emerged. The first collection of a true truffle from temperate Western Australia, *Labyrinthomyces varius* (Rodway) Trappe, was made during this work, as well as a number of other hypogeous fungi. These fungi have a mycorrhizal significance apart from their serving as food for small mammals.

References

Bas, C. (1969). Morphology and sub-division of Amanita and a monograph of its section Lepidella. Persoonia 5 : 285.

Bougher, N.L. (1983). Western Australian Coprinus as a part of a Cosmopolitan Flora. Trans. Br. mycol. Soc., 81 : 147.

Bougher, N.L. (1986). A new species of Leucopaxillus from Western Australia. Sydowia 39 : 17-21.

Broughton, H.C. and Hilton, R.N. (1972). The fungus *Panus fasciatus*. J. R. Soc. West. Aust. 55 : 31.

Buller, A.H.R. (1934). Pseudorhizae and gemmifers as organs of certain Hymenomycetes, in Researches on Fungi Vo1.6. Hafner reprint, New York, 1958.

Christensen, P.E.S. (1980). The Biology of *Bettongia penicillata*. and *Macropus eugenii* in Relation to Fire. Bull. Forests Department, West. Aust. 91.

Ernest, E.C.M. (1936). A test for the presence of natural preservative substances in wood. Forestry 10 : 1: 60.

Hilton, R.N. (1978). The ghoul fungus, *Hebeloma sp. ined.* Trans. mycol. Soc. Japan, 19 : 418.

Hilton, R.N. (1980). The potoroo truffle. West. Aust. Naturalist, 14 : 235.

Hilton, R.N. (1982). A census of the larger fungi of Western Australia. J. R. Soc. West. Aust. 65 : 1.

Hilton, R.N. (1983). The Drummond collection of Western Australian fungi at the Royal Botanic Gardens, Kew. Nuytsia, 4 : 333.

Hilton, R.N. (1988a). A census of the larger fungi of Western Australia Part 2. J. R. Soc West. Aust. 70 : 111.

Hilton, R.N. (1988b). The Preiss Collection of Western Australian Fungi. Nuytsia (in press).

Kile, G.A., Watling, R., Malajczuk, N. and Shearer, B.L. (1983). Occurrence of *Armillaria luteobublina* Watling & Kile in Western Australia. Australasian Plant Pathology, 12 : 18.

Lowe, J.L. (1963). The Polyporaceae of the World. Mycologia, 55 : 7.

Meagher, S.J. (1974). The food resources of the aborigines of the South West of Western Australia. Rec. West. Aust. Mus., 3 : 14-65.

Miller, O.K. (1983). Ectomycorrhizae in the Agaricales and Gasteromycetes. Can. J. Bot. 61 : 909-916.

Miller, O.K. and Hilton, R.N. (1986). New and interesting agarics from Western Australia. Sydowia 39 : 126-137.

Moser, M. (1978). Basidiomycetes II: Röhrlinge und Blätterpilze. Auflage 4. Teil II b2 der Kleinen Kryptogamenflora. G. Fisher Verlag, Stuttgart.

Reid, D.A. (1980). A monograph of the Australian species of Amanita. Aust. J. Bot., Suppl. Series No. 8.

Reid, D.A., Hilton, R., Reid D.G. and Brittan, N. (1979). A note on *Polyporus tumulosus* Cooke & Massee. West. Aust. Naturalist, 14 : 120.

Saunders, D.A. (1979). Conserving tree hollows and their occupants. Aust. Wildlife Res. 6 : 205-216.

Tamblyn, N. (1937). Decay in timber with special reference to Jarrah. Aust. Forestry, 2 : 6.

Walters, N.E.M. (1958). *Poria healeyi sp. nov.* The causal fungus of yellow straw rot in Jarrah. Trans. Br. mycol. Soc. 41 : 95.

Watling, R. and Gregory, N.M. (1986). Observations on the Boletes of the Cooloola sandmass, Queensland and Notes on their distribution in Australia. Proc. R. Soc. Qd. 97 : 97-128.

Wills, R.T. (1983). The ecology of the wood-rotting basidiomycete *Polyporus tumulosus* with special reference to the significance of fire. Honours dissertation, Botany Department, UWA.

Appendix

Books suitable for identifying the species of Larger Fungi of the Jarrah Forest.

The books listed here are chosen for having clear drawings, together with colour photographs and/or watercolours. The prices are those prevailing at the time of first publication.

A Western Australian Book :-

Griffiths, K. (1985). "A Field Guide to the Larger Fungi of the Darling Scarp & South West of Western Australia". Published by Kevn Griffiths. Hard or soft cover $16.50 or $11.00.

This book is valuable in being the work of an experienced field naturalist who is also a water colourist and who has been prepared to use his microscope to check his finds. The whole has been incorporated into the framework of a modern classification of fungi so that the user can have the satisfaction of at least getting to the family of the fungus. It does not claim to be a key to numbers of species. Fungi of particular interest (eg. *Hebeloma aminophila*) may be figured instead of some more common species.

Keys lead the user first to the family and then, in a number of cases, down to the genus.

The book has been designed to be supplemented by Roy Watling's "Identification of the Larger Fungi", Hulton, 1973. This is an inexpensive text illustrated by line drawings, not colour. It is available in libraries or on overseas order, although with sufficient demand local booksellers might be persuaded to stock it.

Helpful books from the Eastern States :-

Young, A.M. (1982). "Common Australian Fungi", New South Wales University Press, Hard Cover Price $9.50.

This book has been reviewed by J C Willis (himself author of the now out-dated "Victorian Toadstools and Mushrooms"), in the Victorian Naturalist Volume 100, January/February 1983 pp 40, 41. Willis points out that although 220 species are adequately described, 71 of them in colour, a number of very common widespread fungi are omitted. Also, when genera have been given up-to-date names these are given underneath the old name instead of being used as the main heading.

Tony Young has collected extensively in the Jarrah Forest and is an expert in the tradition of the European amateurs who have done so much to advance the knowledge of fungi in that continent. He rightly assumes that any serious student will acquire a microscope and will be ready to use it.

Aberdeen, J. (1979). "Introduction to the Mushrooms, Toadstools and Larger Fungi of Queensland". Set from typescript; soft cover Handbook No. 1, obtainable from the Queensland Naturalists' Club, G P O Box 1220, Brisbane 4001. $4.95 + $1 post and packing.

Recommended supplement: "Common Queensland Mushrooms", a set of 3 sheets of coloured illustrations by Aberdeen and Vock (1976) published by the Department of Primary Industries, Indooroopilly, Q. 4068 and obtainable from them free of charge.

A number of guides have appeared in recent years but none cover quite the ground attempted by Dr Aberdeen. His aim is to cover the larger fungi at least down to the generic level and to do so without resorting to the use of the microscope. There may be doubts as to whether this is possible, but if anyone can succeed it is Dr Aberdeen, and this is the book that makes the attempt. Western Australian readers can test the success of Dr Aberdeen's presentation, as most of the fungi he includes have been found in W.A. In doing so they will learn a lot of the basic terminology that is used for describing fungi, whether one supplements with microscopic features or not, and will enjoy Mrs Aberdeen's line drawings and a two page spread of coloured illustrations.

Northern Hemisphere books :-

Because of the widespread distribution of fungi over the world, books from the Northern Hemisphere can be of great use. However an important exception is at species level for the big mycorrhizal genera like Amanita, Russula, Lactarius and Boletus which have evolved a distinct suite of species in their own country, and occur in Australia only occasionally, always in association with introduced trees.

Lange & Hora (1965) "Collins Guide to Mushrooms and Toadstools" Collins 257pp B/W and colour reproductions of water colours. Hard cover. At times available from stock at the University Bookshop, Nedlands. Hardcover $18.

For long recommended as the best book to use locally, but out-dated by the quality of modern photographic reproduction. it is based on a selection of watercolours from Jacob Lange's Agaric Flora of Denmark with modern annotation including (in the index) information on microscopic features.

Phillips, R. (1981). "Mushrooms and other Fungi of Great Britain and Europe". PAN Books. Superb reproductions of studio colour photographs, 900 species. Hard or soft cover $24 or $16.

An 'A4' size book, rather large for field use but remarkable for the beauty of its pictures, the authority of those who checked their names, and the reasonable price.

Pegler, D.N. (1981). "Pocket Guide to Mushrooms and Toadstools" Mitchell Beazley. 168pp colour reproduction of watercolours. Hard cover $9.

This book adopts a classification based on habitats as found in Europe. This is of limited use locally except where introduced trees and 'universal' habitats like grass and dung are involved. The value lies in the eminence of the author and the beauty of the illustrations, which include pictures and measurements of spores.

Miller, 0.K. Jr. (1979) "Mushrooms of North America" E.P. Dutton. 368pp B/W and colour reproductions of *in situ* photographs. Soft cover $12.

Professor Miller's book is invaluable for the firm "family" approach it adopts. There are excellent family and generic keys and colour pictures of examples of these families. Forty or so of the 200 species of fungi illustrated might be expected to be found here, but nearly all of the genera.