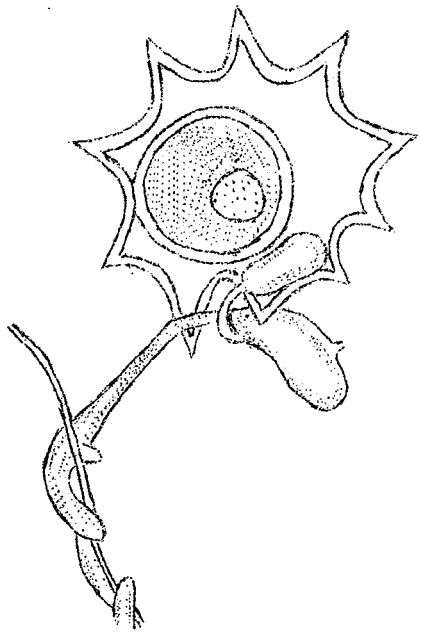

FOREST MYCOLOGY IN W.A.

by A.R. Kelly

Fungal attack with the resultant breakdown, or decay, of wood structure is conspicuous in all our hardwood forest and causes a considerable amount of damage in the bole of the living tree, and in converted timber.

The correct identification of the various rots, and a general understanding of the processes of decay, are necessary before accurate observations can be made and applied.

The main wood destroying fungi with the exception of Stemphylium belong to a large family called Basidiomycetes (Basidium means a little pedestal) which includes such familiar plants as mushrooms and toadstools. These structures which appear above ground are the fruit bodies containing the reproductive parts and correspond to the flowers and fruits of the higher plants.

It is known from extensive testing that some fungi attacking the living tree are sensitive to changed conditions and cause no further decay in converted timber; others are definitely capable of continued development providing moisture and other conditions are adequate, and a third class exists in which development of decay and also the rate of attack depend entirely on the conditions of service.

The results of investigations from 1935 onwards has enabled us to revise and modify our grading rules to allow for the acceptance of limited amounts of rot in most timbers and we refer to these as "minor pockets of primary rot".

Primary rots are those which attack the living tree and in general are not able to infect timber once it is converted.

Secondary rots are those which attack converted timber, stumps and old logs and which seldom cause decay in the living tree.

FUNGI (fungus is singular)

Fungi comprise a very large section of the vegetable kingdom.

A fungus is a vegetable growth, or plant, which draws its substance from other plants or waste materials containing cellulose, and cannot manufacture chlorophyll.

Being destitute of chlorophyll they are unable to utilise the carbon present in the atmosphere as carbon dioxide and are thus compelled to live a saprophytic or parasitic existence, deriving their supplies of carbon and other necessary substances from organic material which has been formed directly or indirectly from chlorophyll containing plants.

In order to understand the way in which fungi attack and destroy wood it is necessary to consider briefly the nature of the wood material.

The porous structure of wood is due to its being composed of minute tubular or fibrous elements. These are called cells and are tightly cemented together and it is their relative size and arrangement which give the characteristic grain and texture to different kinds of wood.

The wood substance, which forms the walls of the cells and the solid framework, is composed chiefly of cellulose and a complex substance called lignin; it is hygroscopic and becomes moister or drier according to the condition of the surrounding atmosphere.

In the standing tree and in freshly felled, or green, timber most of the cavities, or cells, in the wood contain free water and timber in this condition may have a moisture content of 100% or more of its oven dry weight.

The point at which all the free water has disappeared (the cell walls being still fully saturated) is known as the "fibre saturation point", and approximately 25% to 30% moisture content.

As the wood becomes drier the cell walls themselves begin to dry out.

Fungi which decay wood obtain their food supply by breaking down and digesting this cell wall substance, but they cannot do this if the moisture content of the wood is much below fibre saturation point.

Exceptions to this are fungi such as the Merulius and the Coniofera which introduce moisture through their hyphae, or produce moisture by chemically splitting the carbohydrates in the wood. Coniofera olivacea has been identified in this State, but no definite identification of Merulius.

Generally, the range of fungal activity is between 20% moisture content and a soaking wet condition in which all air is excluded.

If the wood is too dry for it to grow and spread, decay, will not occur.

If the wood is thoroughly saturated the fungus is "drowned out".

Conditions influencing the growth of fungi are :-

a) Suitable food material containing cellulose, obviously wood, but most can feed and live for a considerable period on materials having similar chemical composition such as paper, straw etc., and soil rich in humus.

b) A moisture content in the food, above 20% and below complete saturation - the optimum moisture content lies around 40%.

c) Sufficient air, as it requires oxygen for growth and respiration.

d) Suitable temperatures as few grow above 100° F. and growth stops entirely at, or a little above, freezing point. At 70° F it grows at least twice as fast as at 50° F. Ideal conditions are between 70° and 90° F.

e) And of course the presence of some infection in the form of spores or mycelium from which the fungus can develop.

Growth of fungi and the development of rot can only take place if each of the conditions mentioned above is satisfied.

Decay:- is really a chemical decomposition which is brought about by the ferments and acids (enzymes) secreted by fungi.

Hyphae:- is the vegetative part of a fungus and consists of a fine tube or hollow thread which grow in length by elongation of the tips, and combine to form mycelium.

Mycelium:- is formed from strands or cords of fungal hyphae, arranged loosely to form long strings or closely interwoven to form dense skins or sheets.

Sclerotium:- is a resting body or mass of fungal hyphae from which fruiting bodies may develop.

Sporophore:- is a fungal fruiting body (the under surface of which may be gilled or pored) containing the reproductive parts (spores).

Spore:- is the minute organism of a non-flowing plant which acts in place of a seed, and every one (or in some cases a pair) of these spores can give rise to a complete new fungus plant.

These spores are as fine as dust and approximate 2,000,000 to the square inch, and it is estimated that a 3" diameter mushroom would liberate 1,800 million.

These dust-like spores are widely dispersed by wind currents and if lodged in a suitable site continue their cycle.

To indicate the wide dispersal, spores of Fomes Annosus have been trapped 30 miles from land over the Irish Sea.

The most important fungi affecting our forests and products are:-

1. Polyporous Portentosus - Synonymous P. eucalyptorum.

The commonest and most important in our main jarrah forest where it does a tremendous amount of damage in the bole of the living tree.

The large conspicuous white fruiting bodies have been observed on jarrah, marri, blackbutt, tuart, wandoo, flooded gum and sheoak and will no doubt be found on other species.

This "column" or "heart rot" will attack the bole and limbs of a tree and may sometimes be found in the larger roots.

The rot occurs chiefly as a trunk and top rot, extending down the bole from the point of original infection which is usually a dead or broken limb.

The position of the fruiting body, which generally appear in early winter, approximately defines the lower limit of the rot column.

In the typical stage of decay in jarrah the rotted wood is brown in colour, soft, brittle and easily crumbled and has a slight tendency to crack cubically. The shrinkage cracks are filled with sheets of tough white mycelium which may reach a thickness of $\frac{3}{4}$" and are characteristic of this rot.

It is usually found that there is some discolouration of the wood outside the area of conspicuous rot.

This extension is due to the action of the hyphae and is the first stage of cell destruction.

Further deterioration generally ceases when the timber is cut, excepting in rare cases, where favourable moisture conditions may cause further development of complete decay.

The fruiting bodies often reach large size, 12" or more laterally, 9" wide and 6" deep at attachment. The upper surface is covered with a thin brownish or biscuit coloured cuticle and the underneath pored surface, when fresh, is canary yellow colour. The flesh is pure white, soft and tough becoming punky when dry.

2. Polyporus Pelles

This fungus causes the pocket rot which is common in jarrah. It occurs throughout the entire jarrah forest and is particularly common towards the drier northern and eastern fringes.

In the typical stage of decay the rotted wood is dark brown in colour and when dried out is brittle and easily powdered and is transversed by longitudinal and horizontal shrinkage cracks giving it a more or less cubical appearance.

The amount of mycelium is variable. It may be completely absent or present as a sparse downy white growth in the shrinkage cracks.

The rot does not take the form of a definite column but typically occurs as pockets, streaks, or irregularly shaped areas anywhere in the mature wood of the

tree in apparent isolation from other pockets.

The fungus does not penetrate far in advance of the areas of visible decay and incipient decay generally shows as an area of bleached wood around the pocket.

It produces a bracket sporophore usually 3" to 4" across and 1" or more in thickness, and is pored on the underside. They have also been found on dead logs.

"Pelles" means the skin of a beast and the fungus is so named because the top of a fresh sporophore resembles a furry skin.

3. Polyporous australiensis

The commonest and most important rot in our karri forest and is also known to attack marri, tuart and yellow tingle and will no doubt be found on other species.

It produces a light brown cubical rot with a white mycelium.

The sporophores are usually 5" to 15" across and 5" to 6" thick, bright orange coloured on the underside, with similar coloured pigment inside and they have a strong musty smell.

They can be found during many months of the year, sometimes on the bole of a tree but more often on old logs and stumps.

This fungus is both "primary" and "secondary", attacking mature wood in the living tree as well as dead wood.

4. Trametes lilacino - gilva

This fungus (secondary) occurs over a good deal of Australia and attacks dead wood of many species.

It is severe on karri, and marri and has caused destruction in untreated sleepers of these species in under 7 years.

Causes a light brown cubical rot associated with whitish mycelium.

The sporophore is a thin leathery bracket 1" to 4" across and $\frac{1}{4}$" or so thick, is pale brownish on top and lilac coloured and pored underneath.

5. Stemphylium species (fungi imperfecti)

Decay and brittleness in jarrah associated with most distinctive microscopic features have been found in living trunks, old logs and timber in service.

It is extremely common in old timber in contact with the ground and occurs in many species of timber.

The fungus is an imperfect form allied to Stemphylium and hence does not form a fruiting body (sporophore) but bears its spores directly on the mycelium.

Fungi of this type generally have a short life cycle and can reproduce rapidly.

There appears little doubt that the surface layer of soil in the forest, or where decaying wood and chips are plentiful, must be thoroughly infected by spores of this fungus.

Fortunately the decay produced is slow but in the case of jarrah fence posts it is probably the principal factor limiting their service life, decay working from the outside towards the centre at groundline.

A condition very commonly seen in almost any old jarrah timber in contact with the ground is a general surface softening which may penetrate several inches. The wood is soft and brittle and has a somewhat bleached and lifeless look and is extremely brittle when dry and forms thin cubes.