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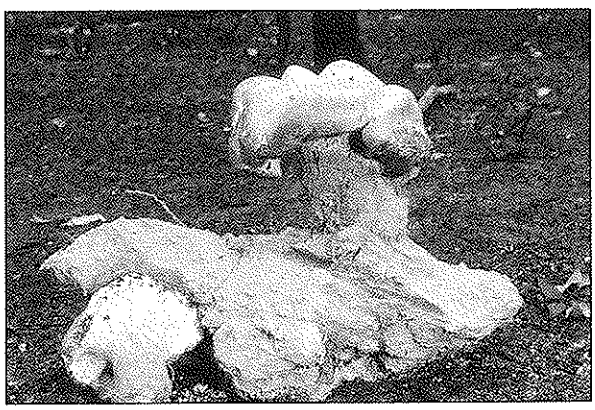
FUNGI RESPOND TO BUSHFIRES

Richard Robinson

Fungi are normally associated with wet forests where mushrooms appear in the autumn and winter, but only days after a bush fire the first signs of life may be large dinner plate-sized mushrooms. How do they survive the scorching heat of a wildfire and why do they fruit in this inhospitable environment?

Stone-maker fruit bodies 48 hours after fire in jarrah forest (they are golden-brown in colour).

Throughout the world there are many species of fungi that have taken advantage of the conditions provided by fire in order to compete and survive. In the eucalypt forests of southern Australia a number of fungi have evolved unique lifestyles which enable them to survive and reproduce following a bush fire.



The sclerotium of the stone-maker (grey in colour).

In karri and jarrah forest, several species of wood-rotting fungi are specifically adapted to survive fire. Under normal conditions these fungi exist in the form of microscopic thread-like filaments called mycelium which colonise dead logs of karri, jarrah and possibly marri. They are decomposers, rotting fallen logs and buried wood to return much needed nutrient back into the ecosystem. Generally wood decay fungi produce bracket-like fruit bodies on logs or wood that they colonise and if their log is destroyed in a fire, so are they.

How do those adapted to fire survive it? The answer is simple: they go underground. The fungal mycelium grows from the host log into the soil and produces a large underground mass called a sclerotium. Nutrients are supplied to the expanding sclerotium from the decomposing log and over time they can become very large. They are deep enough in the soil to survive the hottest fire and within days of a fire destroying their host log a mushroom-like fruit body emerges from the sclerotium. The growth rate of the mushrooms is extraordinary. They can appear at the surface of the burnt ground within 24 hours and after 48 hours they can be as large as a dinner plate. The mushrooms mature quickly and release spores from a pore layer on the underside of the caps. When conditions are more favourable, the spores germinate and colonise new logs to begin the cycle again.

The stone-maker fungus (*Laccocephalum tumulosus*) colonises and rots fallen jarrah and possibly marri logs.

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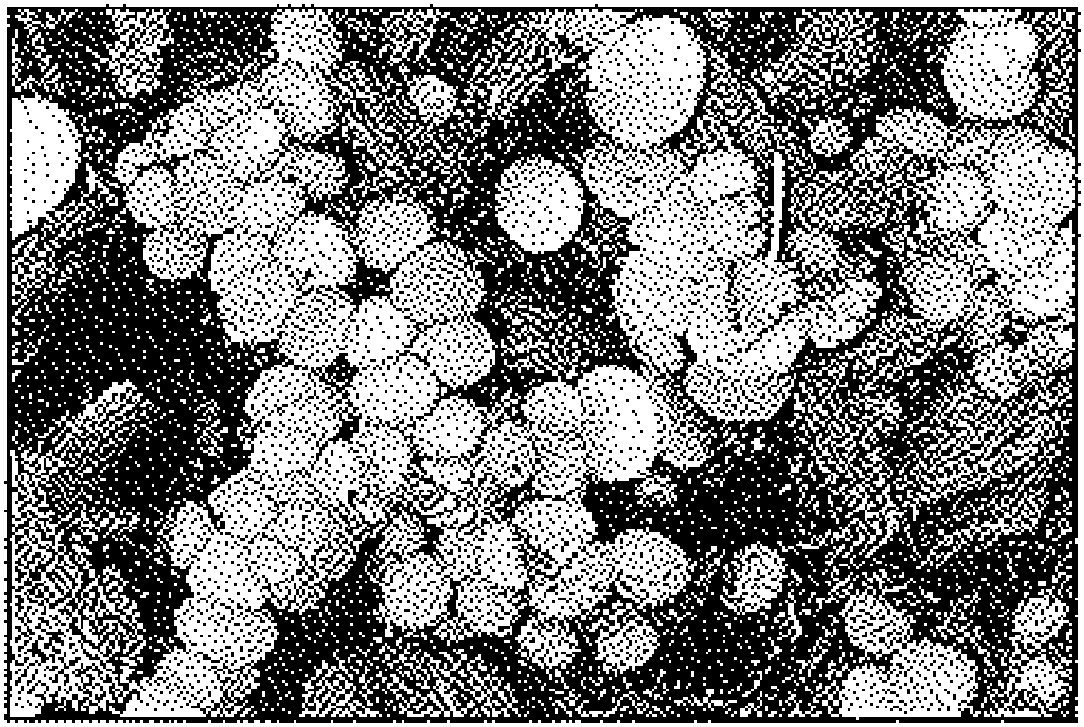

Above: Anthrocobia muelleri
Below: Morchella elata

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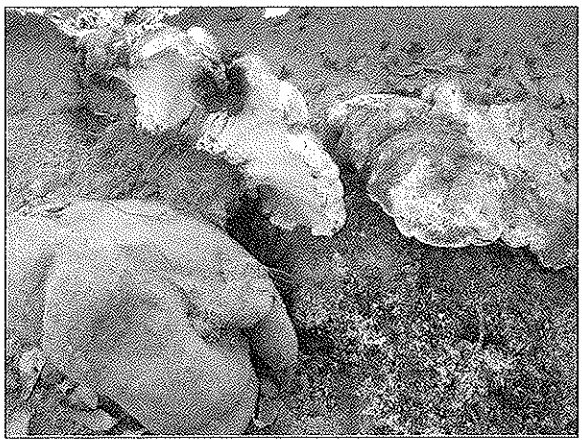
Fungi and bushfires

FUNGI



Mushroom (cream) and sclerotium (beige) of native bread.

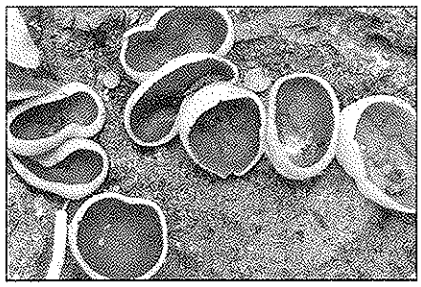
Underground the mycelium binds soil particles together to produce a hard stone-like mass. Native bread is the common name for the sclerotium produced by *Laccocephlum mylittae*. It is usually found under or alongside karri logs and is composed of pure fungal material encased in a thin, brittle skin. Early European settlers reported Aboriginal people collecting native bread as food. Sclerotia of the stone-maker can weigh over 30 kilograms and native bread can weigh as much as 25 kilograms. The sclerotia of these fungi appear to be a nutrient source specifically developed to fuel mushroom and therefore spore production for the species' survival. In the case of native bread, by the time the mushroom is fully developed the sclerotium is spent, and it then withers and decays to leave little sign of its presence in the soil.

Neolentinus dactyloides *mushroom and root-like sclerotium.*

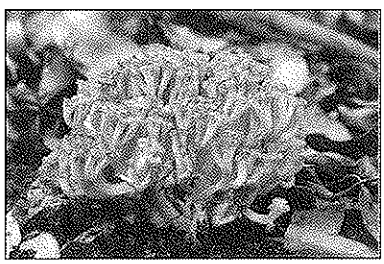
Neolentinus dactyloides develops a single or a multi-branched root-like structure projecting up to 40 centimetres into the soil. Fruit bodies emerge from the upper section of the sclerotium and resemble a typical mushroom, with gills on the underside of the cap. This fungus produces mushrooms profusely after fires and western grey kangaroos have been seen grazing on the fresh caps.

It is not known what specifically triggers these fungi to produce mushrooms or what competitive advantage their behaviour offers. It is assumed that the aftermath of a bushfire favours spore dispersal and increases the likelihood of their spores encountering and colonising fallen trees resulting from the fire. The mushrooms barely rise above the soil. If they were to develop under normal conditions they would be buried beneath the forest litter. Spore dispersal would be limited to the immediate vicinity with little or no likelihood of them encountering a new host. But when fire removes the surrounding scrub and litter, it is a prime time for spore dispersal to take place unhindered over a large area, and in the absence of their competitors which generally develop fruit bodies and spores in the autumn. Their spores are hardy and can survive until the first rains stimulate them to germinate.

Many other species of fungi take advantage of the conditions produced by fire and most fruit in autumn. A number of cup or disc fungi fruit prolifically in ash-beds and on burnt ground. Small orange and yellow species of *Anthrocobia* and purple, brown and black species of *Peziza* are common and prefer the alkaline soil conditions that result following fire. Several other brown mushroom-like species are also common. The coral fungus, *Ramaria capitata*, can also be found pushing up through burnt soil. In the spring masses of morels, *Morchella elata*, with their distinct ribbed and pitted conical fruit bodies, may be found.



Peziza tenacella *(cream with brown centre).*



Ramaria capitata *(orange).*

Many fungi found fruiting after fire are cosmopolitan, or are closely related to species found on burnt sites elsewhere in the world. In the karri forest alone, over 65 species of fungi are known to be associated with fire and are not found in long unburnt forest. A number of distinct phases of succession occur within fungal communities following fire. Fire therefore plays an important role in the ecology of many species of fungi and also promotes diversity within fungal communities.

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