Fruits of Fire

It is a hot day in January and a wildfire has raged through the karri forest barely a week before. The blackened landscape and the beating sun produce a stiflingly hot atmosphere. The only signs of life are large dinner plate-sized mushrooms in the ash of several burnt logs. Fungi are normally associated with wet forests, where mushrooms appear in the autumn and winter, so how are they surviving in this inhospitable environment?

by Richard Robinson

Fungi that are specifically adapted to fire are known as pyrophilous fungi. 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, several fungi have evolved unique lifestyles that enable them to survive and reproduce following a bushfire.

In Western Australia's karri and jarrah forests, several species of wood-rotting fungi are specifically adapted to survive fire. Under normal conditions, these fungi are found in the form of microscopic thread-like filaments called mycelium, which colonise dead logs of karri, jarrah and possibly marri. They are decomposers, rotting the fallen logs and returning much needed nutrients to the ecosystem. Unlike normal wood-rotting fungi, they do not fruit on the logs that they colonise and if their log is destroyed in a fire, so are they.

How do they survive? 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. It is deep enough in the soil to survive the hottest fire. Soon after the fire a mushroom-like fruitbody emerges from the sclerotium. The mushrooms release spores that later germinate to begin the cycle again.

STONEMAKER

The stonemaker fungus (*Polyporus tumulosus*) colonises and rots fallen jarrah and possibly karri logs. At some stage in its life cycle, the fungus grows from the log into the soil where the mycelium binds with the soil to produce a hard stone-like mass. This structure gives the fungus its common name.

Nutrients are supplied from the decomposing log and, over time, the 'stone' may expand to the extent that it can eventually weigh as much as 30 kilograms. The cycle is completed when a fire destroys the log and the fungus fruits from the underground sclerotium. The growth rate of these mushrooms is extraordinary. They can appear at the surface of the burnt ground within 24 hours and within another 24 hours they can be as large as a dinner plate. They quickly mature and release spores from a layer of pores on the underside of the fruit.

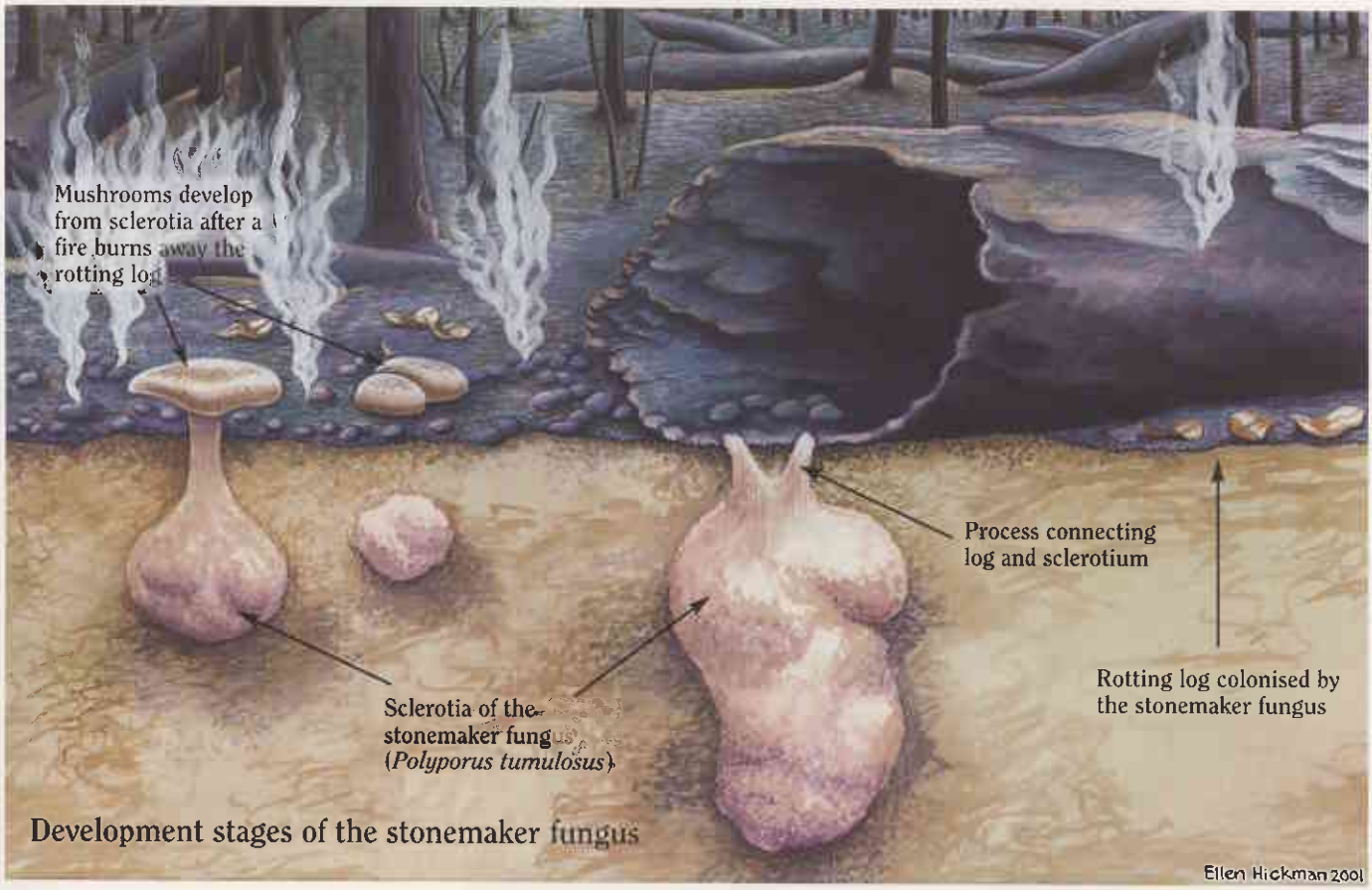
NATIVE BREAD

Native bread is the common name for the sclerotium produced by *Polyporus mylittae*. It is usually found under or alongside karri logs and is composed of pure fungal material encased in a thin, brittle, hard skin. Native bread is edible and early European settlers in the south-west reported that it was collected by Aboriginal people. When fresh, the flesh of native bread is firm but has a very bland taste. The sclerotia are generally oval-shaped and can grow to 60

Previous page
Main: Distinct cone-shaped morel mushrooms. These are a prized delicacy for those who like to eat wild mushrooms.
Inset: Fire in a jarrah forest.

Above left: Large mushrooms produced by the stonemaker fungus can emerge and grow to the size of a dinner plate within 24 hours of a bushfire sweeping through the forest.

Left: Native bread, cut to show the fleshy interior of the sclerotium. It can weigh as much as 18 kilograms.
Photos – Richard Robinson/CALM



centimetres in diameter and weigh as much as 18 kilograms.

After a fire, a large mushroom emerges from the sclerotium. Producing a mushroom completely exhausts the reserves in the native bread, which then shrivels and dries up soon after the mushroom matures and releases its spores. In general, the larger the native bread, the larger the mushroom, or alternatively several mushrooms may be produced. Sometimes several sclerotia are associated with one log, and mushrooms can be found beside burnt logs or in the ash remains of logs just a day or two after a bushfire. The mushrooms look similar to those of the stonemaker fungus, and spores are released from a pore layer on the underside.

MARBLEMAKER FUNGUS

In contrast to the large sclerotia and mushrooms produced by the stonemaker fungus and native bread, the marblemaker fungus (*Polyporus sclerotinius*) produces small mushrooms from small, hard, marble-sized sclerotia found two to five centimetres beneath the soil surface. It does not fruit immediately after a fire, but in the autumn produces a small flat mushroom between two and three centimetres in diameter. It is characterised by a brown, velvety, often concentrically-zoned surface and a white pore layer underneath.

UNUSUAL SHAPES

The hand or finger fungus (*Neolentinus dactyloides*) occurs in karri forests. The Latin term *dactyloides* describes its sclerotium and translates to mean finger-like. The underground mass may be a single finger-like or a multi-branched hand-like structure projecting up to 40 centimetres into the soil. It is firm and granular-like, encased in a brown sand-encrusted skin and can weigh up to three kilograms. Mushrooms emerge from the upper section of the sclerotium and resemble a typical mushroom, with gills on the underside

Right: Mushrooms produced by native bread.
Photo – Richard Robinson/CALM

Above: Small, velvet, brown mushrooms produced by the sclerotium of the marblemaker fungus.
Photo – Richard Robinson/CALM

Left: Sclerotia are hidden beneath the forest floor, undetectable until they surge into life to produce mushrooms after a bushfire.
Photo – Chris Garnett/CALM

Centre: Burning jarrah logs. Mushrooms may emerge through the ash remains within 24 hours.

Bottom: Gilled mushrooms of the finger fungus (*Neolentinus dactyloides*) emerging through the ash.
Photos – Richard Robinson/CALM

of the cap. This fungus produces mushrooms profusely after fires, and western grey kangaroos (*Macropus fuliginosus*) have been seen grazing on the fresh caps.

MORELS

Morels (*Morchella elata*) are found in the wetter karri and jarrah forest regions and fruit early in the next spring following a summer bushfire. They have a very distinct mushroom and an unusual life cycle. The morel has a cone-shaped head with a ridged honeycomb-like surface that is usually light to dark brown but sometimes grey. The fungus does not rot logs or wood, but persists in the soil, alternating between a mycelial and sclerotial state. The sclerotium is a tough resting body and allows the fungus to survive adverse conditions. When activated in spring, a sclerotium will either germinate to form new mycelium or, if stimulated by fire, produce a mushroom.

For those who like to eat wild mushrooms the morel is a prized delicacy. Morels may fruit in abundance on a burnt site, but their fruiting behaviour is unpredictable. To learn more about these and other edible

CALMScience senior technical officer Bob Smith holds the mushrooms and the hand-shaped sclerotium of the finger fungus (*Neolentinus dactyloides*).
Photo – Richard Robinson/CALM

When the end of this jarrah log was burnt away, the stonemaker mushroom emerged from a sclerotium that was developing below the log.
Photo – Richard Robinson/CALM

mushrooms read 'From Field and Forest: Edible Fungi in WA' (*LANDSCOPE*, Autumn 1988).

TRIGGERS

The underground structures of these fungi appear to be a nutrient source specifically developed to fuel mushroom, and therefore spore, production to ensure 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.

It is not known what specifically triggers these fungal structures 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 spores encountering a suitable host log on which to germinate and then grow.

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 and the likelihood of them encountering a new log to colonise would be virtually nil. But when fire removes the surrounding scrub, litter and trash, it is a prime time for these fungi to disperse spores over a large area and to successfully encounter a new log on which to germinate, grow and colonise. The spores are hardy and can survive until the first rains stimulate them to germinate.

Next time you see the aftermath of a bushfire, remember that some organisms rely on fire for survival. It may take months for the herbs, shrubs and trees to show signs of recovery, but fungi respond within hours to take advantage of the opportunity to ensure their own long-term survival.

COLLECTING FUNGI

If you enjoy collecting and eating wild fungi, remember that it is illegal to pick any flora in national parks. Native fungi are legally protected along with other native Western Australian flora. Fungi can be collected from private property with the permission of the owner. However, if you want to collect wild fungi from national parks or other Crown lands you must first contact CALM's Wildlife Branch and ask about a collecting licence. Although many species of fungi are edible, there are also poisonous varieties. If you are not sure what species you have collected, get a positive identification from an expert before you consume it.

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LANDSCOPE

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Western Australian botanists are taking part in a global plan to store seed from 10 per cent of the world's flora by 2010. See page 23.

Mushrooms the size of a dinner plate can appear within 48 hours of a fire in the karri forest. Read about forest fungi on page 48.

The Pilbara's numerous islands are rich in history, wildflowers and wildlife, with prolific marine life in the surrounding waters. See page 34.

Discover the rich bird life and tranquillity of the Canning River Regional Park on page 17.

Many of WA's threatened marsupials can be seen in the south-west for the first time in decades. Read about their return to Dryandra Forest on page 10.

FEATURES

REGULARS

COVER

Paradoxically, the stinging tentacles of sea anemones—a group of carnivorous invertebrates that sometimes resemble colourful flowers—can also provide a safe haven for many underwater creatures. Anemonefish gain immunity to the stinging cells and live primarily in sea anemone tentacles. Other animals, such as crabs, carry a protective anemone on their backs. Turn to page 28.

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