

FUNGI SUCH AS THIS HONEY FUNGUS (ARMILLARIA) ARE THE GREAT RECYCLERS IN GARDENS.



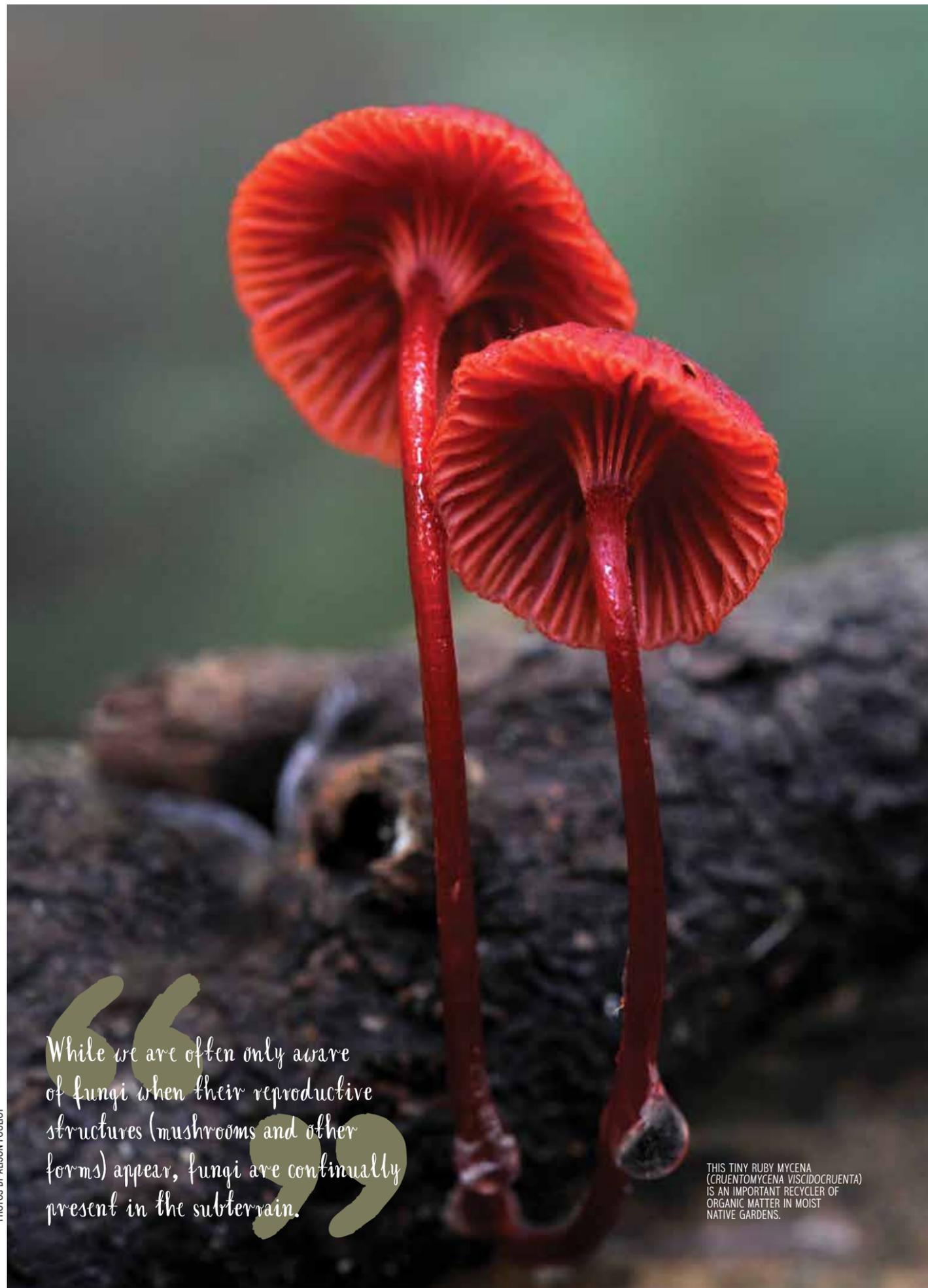
the secret world of
GARDEN FUNGI

FUNGUS EXPERT AND PHOTOGRAPHER ALISON POULIOT EXPLORES THE CURIOUS LIVES OF THESE OVERLOOKED BUT VITAL COMPONENTS OF OUR GARDENS.

Few gardens are free of fungi. This is a good thing as without fungi, the health and resilience of a garden is seriously compromised. While plants – especially vascular plants – are the focus of most gardeners' attention, fungi and their kin, such as mosses and liverworts, play essential roles in their flourishing.

Through their myriad forms and colours, unexpected appearance and strange habits, fungi have captured the imagination of people around the globe across the centuries.

Although long considered to be plants and relegated to the nether regions of the plant kingdom, fungi are very different organisms. Today they occupy their own kingdom – the Kingdom Fungi. They differ from plants in several ways. First, they contain a tough compound called chitin (rather than cellulose, as in plants) that gives them rigidity and structural support. This same compound is also found in the exoskeletons of insects and crustaceans. Unlike plants, fungi do not have chlorophyll. Rather, they gain nutrition



PHOTOS BY ALISON POULIOT

“While we are often only aware of fungi when their reproductive structures (mushrooms and other forms) appear, fungi are continually present in the subterranean.”

THIS TINY RUBY MYCENA (CRUENTOMYCENA VISCIDOCRUENTA) IS AN IMPORTANT RECYCLER OF ORGANIC MATTER IN MOIST NATIVE GARDENS.

by sitting directly in their food source, and through the secretion of enzymes, break down complex compounds into simple sugars. A third difference is that fungi reproduce by spores rather than seeds.

Fungi in the garden

While we are often only aware of fungi when their reproductive structures (mushrooms and other forms) appear, fungi are continually present in the subterranean. Here they work away, unseen, holding gardens together. Fungi dismantle large organic molecules into simpler forms, building soils through the process known as pedogenesis. Consequently, fungi cycle and govern nutrient and energy flows, regulating resources for subterranean and aboveground organisms.

While fungi can degrade almost any organic material containing carbon, among the two most significant substances are cellulose and lignin. These recalcitrant



RIGHT: ECOLOGIST AND ENVIRONMENTAL PHOTOGRAPHER, DR ALISON POULIOT.
CENTRE: INK CAPS, OR LAWYERS' WIGS AS THEY ARE COMMONLY KNOWN (*COPRINUS COMATUS*) ARE EARLY COLONISERS AND ARE COMMONLY FOUND IN DISTURBED AREAS IN LAWNS AND GARDENS.
FAR RIGHT: THIS *CLITOCYBE SEMIOCCULTA* RECYCLES OLD WOOD IN GARDENS IN SOUTHERN AUSTRALIA.

FORAGING AND GROWING YOUR OWN

People have foraged for wild foods including fungi since the beginning of time. More recently, a growing band of foragers is discovering the delights of wild edible mushrooms. Two of the more commonly foraged species in Australia are the saffron milk cap (*Lactarius deliciosus*) and the slippery jack (*Suillus luteus* and *S. granulatus*). However, unlike many European and Asian cultures that have long traditions of eating wild mushrooms, less is known about the edibility of Australian fungi. Hence, those out foraging need to be able to differentiate the desirable from the deadly. Unfortunately the various folkloric sayings about edible fungi always have their poisonous exceptions. Deadly fungi accompany the many edible fungi that can be found in local environments. For example, the appropriately named death cap (*Amanita phalloides*) and the poisonous (but non-lethal) yellow stainer (*Agaricus xanthodermus*) are becoming more widespread. Every forager should be able to recognise these species.

Fungal poisoning can occur from eating raw but also cooked fungi. Most fungi that cause human poisoning cannot be made nontoxic by cooking, canning, freezing, or any other means of processing. Hence, the only way to avoid poisoning is to avoid

RIGHT: OYSTER MUSHROOMS (*PLEUROTUS OSTREATUS*) CAN BE SAFELY AND EASILY GROWN AT HOME.
TOP FAR RIGHT: THE SLIPPERY JACK (*SUILLUS LUTEUS*) AND SAFFRON MILK CAP (*LACTARIUS DELICIOSUS*) ARE TWO OF THE MOST COMMONLY FORAGED MUSHROOMS.
BOTTOM FAR RIGHT: THE DEATH CAP (*AMANITA PHALLOIDES*) IS RESPONSIBLE FOR MOST MUSHROOM POISONING DEATHS WORLDWIDE.



PHOTOS: ALISON POULIOT
PHOTO OF ALISON: VALERIE CHETELAT

consuming toxic species. One great way to do this is to grow your own!

A great range of commercial mushroom growing kits is available with some of the more popular species being various types of oyster mushrooms (*Pleurotus*), button mushrooms (*Agaricus bisporus*) and shiitake (*Lentinus edodes*). The great advantage of a kit is that the work preparing a suitable substrate (often loose sawdust or a sawdust block or log that has been inoculated) and growing the mycelium, has already been done. You just need to follow the step-by-step instructions and supply suitable growing conditions – sufficient ventilation, water, shade, suitable temperature – and a good dose of patience!

Other than the obvious advantage of minimising the risks involved with mis-identifications in wild foraging, growing mushrooms is great fun and educational. Both children and adults alike can learn about the fungus life cycles and directly witness the developmental stages as the mushrooms mature. Growing mushrooms is also a step toward the satisfaction of self-sufficiency, with the added advantage of knowing where your food is coming from. Make sure the kit you buy is certified organic. In addition to providing new taste experiences and culinary discoveries, growing mushrooms also offers the sheer delight of experiencing these curious organisms in all their beauty, forms and colours as they manifest before your eyes. Watching things grow and thrive is inherently pleasing and often fosters a greater appreciation of wild fungi and their greater ecological significance in the natural environment.



ABOVE: MYCELIA EXIST AS INTERCONNECTED FUNGAL MATRIXES THAT UNITE SOILS, PLANTS AND OTHER FUNGI, AND PROVIDE THE ARCHITECTURE OF SOILS.

BEING NICE TO FUNGI

Instead of blasting fungal diseases in our gardens, we need to find techniques and sprays that do little or no damage to soil fungi. We should stop using copper on fruit trees and other plants, as copper accumulates in the soil, killing soil fungi on an ongoing basis. Use cultural tactics or less damaging sprays such as milk (diluted 1:9 with water) or potassium carbonate mixes on any early stage fungal problems. As a last resort use lime sulphur or wettable sulphur. These don't accumulate in the soil. A week or so after spraying, spread a layer of compost over the soil to help replace any fungi you have killed through spray drip.

compounds form the major structural and strengthening components of wood. Although bacteria and invertebrates also contribute to the decomposition processes, only fungi degrade lignin. Every leaf and stick that accumulates in gardens is likely to be recycled by fungi known as saprobes or saprophytes. Different saprobes degrade different compounds. Some are generalists, deconstructing a variety of compounds, while others are specialists. Some set to work on individual leaves, while others tackle entire fallen trees. White-rot fungi metabolise both cellulose and lignin, brown-rot fungi break down cellulose and hemicellulose, while soft-rot fungi are generalists.

Other fungi form relationships known as symbioses with plants. Sometimes this is a mutually beneficial symbiosis, in what is known as mycorrhizal associations. Other times it is a one-way relationship, such as with parasitism. Mycorrhizal associations are the most common form of fungal symbioses. In these clandestine trysts mycorrhizas form between fungi and the roots of plants with both benefiting from the union. By greatly extending plant root systems, mycorrhizal fungi facilitate water and selective nutrient uptake. These relationships are especially important in old and weathered, phosphorus-poor soils, such as those found throughout most of Australia.

Mycorrhizal fungi also improve the resilience and health of plants by increasing their resistance to soil-borne disease and other stresses associated with extremes of soil temperature and chemistry. Some mycorrhizal fungi protect tree roots from soil pathogens and nematodes, as well as increasing their drought tolerance. These 'acts of benevolence' are returned by the trees in the form of sustaining sugars.

The great connectors

What's more, mycorrhizal networks stretch beyond just individual trees. Fungi extend relationships through the soil to other plants, facilitating nutrient transfer between them, uniting plant communities across species.

Mycorrhizal networks are now considered to be the orchestrators of plant interactions mediating their growth and survival. The phenomenon of mycorrhizas explains why particular fungus species are always associated with particular plant species. This is significant in helping us identify fungi, as we can associate the different fungi with different plant species, or with the different substrates in which they grow.

Parasitic fungi parasitise plants, animals and other fungi, with some causing significant damage to their hosts. Most parasitic fungi are microscopic such as ringworm and tinea that affect humans. Although the word 'parasite' has received much bad press, parasitic fungi are essential to the functioning of most ecosystems including gardens. Most parasitic fungi are only 'weakly parasitic' and do not kill their hosts. These are known as biotrophic parasites and are typically host-specific. Examples include powdery mildew fungi and rust fungi. Necrotrophic parasites on the other hand, kill host tissues or the whole host in the process of obtaining nutrition. They tend to have a wider range of hosts. Some necrotrophic parasites such as various honey

fungus (*Armillaria* genus) are highly adaptive and can switch between parasitic and saprobic lifestyles.

Shaking off fungal phobias

Many Australians have historically had an uneasy relationship with fungi. Unlike many continental Europeans, most Australians do not have the extended histories of cultural association with fungi. Horticultural and agricultural teaching about fungi has focused mainly on those species of 'economic importance', i.e. those that are deemed likely to cause disease to plants and animals. Although the health and resilience of a garden's plants reflect the unseen workings of subterranean relationships with fungi, they have often been wrongly conceived only as being problematic. For example, the fungi mentioned in gardening columns of newspapers tend to be pathogenic fungi – fungal spots on roses, for example, or rusts and smuts on grain crops. Often the focus of these articles is to provide advice on their eradication. A foray through newspaper gardening columns reveals fungi to be condemned as 'noxious assailants', 'eyesores' and 'troublesome growths'. Less often are they described as vital connective networks that provide the supportive architecture of a garden's soils and plants, aerating soils, recycling organic matter and allowing water to gently filter to deeper horizons.

As well as maintaining the health of gardens, fungi delight the imagination, with their astonishing colours and forms. Artists and writers have long recognised their potency in inspiring mythology. Fungi also stir the ecological imagination, allowing us to reconsider them as beneficial organisms in gardens and beyond. 

TOP: THE TOXIC YELLOW STAINER (*AGARICUS XANTHO- DERMUS*) CAN CAUSE GASTROINTESTINAL UPSET AND IS OFTEN CONFUSED WITH THE EDIBLE FIELD MUSHROOM (*AGARICUS CAMPESTRIS*).

CENTRE: THE DELIGHTFUL GREEN SKINHEAD (*CORTINARIUS AUSTROVENETUS*) IS FOUND IN SOUTH EASTERN AUSTRALIAN GARDENS THAT HAVE EUCALYPTS AND ACCUMULATED LEAF LITTER.

RIGHT: THIS HONEY FUNGUS (*ARMILLARIA HINNULEA*) IS A PARASITE BUT VITAL TO HEALTHY ECOSYSTEMS.

More information

- Alison Pouliot's book on fungi will be published later this year by CSIRO Publishing. For photos and information on mushrooming visit: alisonpouliot.com
- *Fungi Down Under*, by Pat and Ed Grey.
- Young, Anthony M. *A Field Guide to the Fungi of Australia*. Sydney: UNSW Press, 2005.
- Australian Fungi: Australian fungus mapping scheme: fungimap.org.au
- Downloadable Australian fungus field guide: fncv.org.au/fungi-in-australial

PHOTOS: ALISON POULIOT

