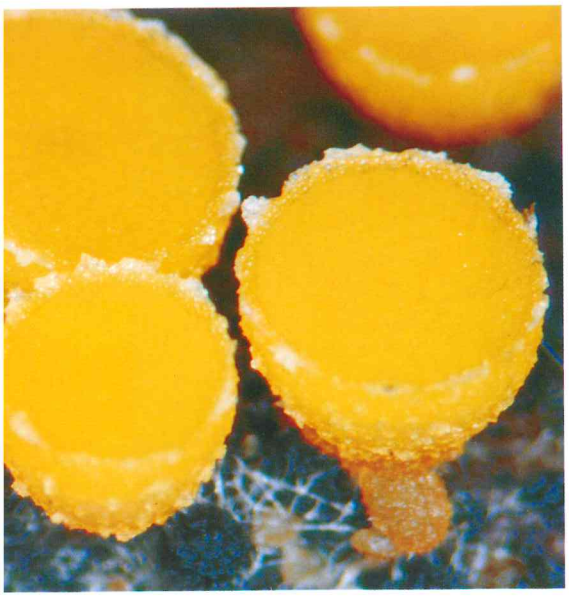
Perth's **fungi** forever

Story and photos by Neale Bougher

With eyes attuned to small bumps in the ground and an irresistible urge to scratch among the leaf litter, volunteers with the Perth Urban Bushland Fungi Project are revealing Perth's fungal treasures. With each new discovery, awareness is growing of why we need to understand and nurture the links between flora, fauna and fungi to help keep Perth's bushlands healthy forever.

Perth is blessed with numerous urban bushlands that harbour colourful displays of local flora, fauna and fungi. For many people, a stroll through one of Perth's bushlands may bring renewed appreciation of simple vistas—perhaps of trees, flowers and birds—and an unwavering expectation that the vistas will be unchanged on their next visit. Few people are aware that this expectation may partly hinge upon the capacity of bushland managers to understand and nurture a legion of concealed organisms linked to the more highly visible plants and animals. Most of the living things within Perth's bushlands are not easily seen, but have essential roles in sustaining bushland health. Fungi are foundation members of this support crew. Indeed, fungi are among the most ancient members of any bushland—fungi assisted the earliest plants to colonise the land. Without fungi, much of our bushland vegetation would struggle to thrive.

Many people may be familiar with at least a few fungi, aside from the ones in the supermarket, such as the luminescent ghost fungus that appears on trees around Perth every winter. In recent years, much more of the incredible diversity of fungi in Perth's bushlands has been coming to light—including those with strange names such as red fingers (*Colus pusillus*) and white punk (*Laetiporus portentosus*). But there is much more significance to fungi than their strange names, fascinating forms and mysterious nature.



Fabulous fungi

Western Australia has much more biodiversity than just flora and fauna—at least flora, fauna and fungi (and some that fit into other kingdoms). Fungi are not plants or animals, but are placed in a separate kingdom. After centuries of including fungi in botany at universities, fungi are now known to be more closely related to animals than to plants. There are probably at least 10 times more species of fungi than plants in the world. For WA that equates to about 140,000 fungi and 14,000 plant species. No-one really knows how many fungi we have, but it is estimated that only about 5 to 10 per cent of fungi species have been discovered and named so far.

Networks of cobweb-like threads called hyphae comprise the feeding and growing body of fungi. Fungal networks are ubiquitous in bushlands and are in a commanding position to influence bushland well-being. Fungi recycle precious nutrients in bushlands through the decomposition of organic material, including litter, dung and wood, and redistributing the nutrients throughout their extensive hyphal highways. Fungi also help to sustain healthy bushlands by interlinking directly with flora and fauna. Beneficial mycorrhizal fungi extract nutrients from the soil and supply them to plants such as eucalypts, wattles and orchids. Fungi also provide food and habitat for

Previous page
Main The spotted descolea (*Descolea maculata*) is a mycorrhizal fungus with a delicately grooved skirt-like ring on its stem. **Inset** Wax caps (*Hygrocybe*) are often very brightly coloured.

Top Birds nest fungi such as this *Cyathus olla* are shaped so that rain drops splash out their 'eggs' (spore packages) sending them whirling up into the air.

Above Many of Perth's fungi barely emerge from the soil, such as the rare pink-gilled amanita (*Amanita carneiphylla*).

Left The brightly coloured fruit bodies of the cup fungus (*Inermisia fusispora*) are tiny but occur in crowded groups.

Top left Fruit bodies of crust and skin fungi are flat, often on wood. Some have short spines or fingers such as the golden splash fungus (*Mycoacia subceracea*) pictured here in a battle for space with a smooth purple fungus (*Peniophora*).

Top The eyelash cup fungus (*Scutellinia scutellata*) is often the focus of camera-wielding people.

Above left The beefsteak fungus (*Fistulina hepatica*) is seen mostly on jarrah trees around the Perth region.
Photo – Joe Froudist

Above The shotgun fungus (*Pilobolus*) blasts its spores off the top of tiny semi-translucent stalks at high speed up to several metres away.

many animals, ranging from beetles and native flies to bandicoots and woylies.

Perth's larger fungi

Most fungi are entirely microscopic, but an estimated 5000 species or more in Australia produce fruit bodies that are visible to the naked eye. These are the larger fungi (macrofungi) such as mushrooms, toadstools, puffballs, coral fungi, brackets, earthstars and truffles.

About 500 species of larger fungi have been recorded in WA according to the only published State census. Most of them are known from few locations. Fungi of the Perth region exhibit a diverse array of forms, ranging from beautiful and colourful to bizarre and grotesque. Around May to July is the best time to see them. However, until recently, there have been no coordinated programs to document the diversity, abundance and distribution of fungi in the Perth region. Kings Park and Bold Park had attracted the most fungal attention. Mycology courses held at The University of Western Australia Botany Department by ERL Johnson and then Roger Hilton (until 1987) sent many undergraduates, including this author, scurrying about in Kings Park to complete their second-year fungi assignment. Many hundreds of fungi species probably occur in Kings Park, but most remain unrecorded. Surveys in Bold Park began in 1999 and have recorded about 280 species of fungi so far, with many previously unrecorded fungi discovered each year.

Mushrooming interest

The Perth Urban Bushland Fungi Project was initiated in 2004 to increase community skills in identifying fungi and surveying local bushlands, and thereby helping fill in some of the gaps in baseline knowledge about our fungi. The project also set out to encourage the consideration of fungi in managing Perth's bushlands, by raising awareness about the roles fungi have in helping to sustain healthy bushlands.

The distinctive forms and colours of Perth's fungi attracted enthusiastic support and participation from many volunteers in both the field and laboratory. From 2004 to 2006, about 2400 people took part in 86 Perth Urban Bushland Fungi Project workshops, forays, educational courses, survey contracts and seminars. A number of volunteers embraced roles as fungi leaders to teach others during surveys.

The project has so far surveyed 38 urban bushlands in the Perth

region—the first time fungi had been surveyed in most of these bushlands! Approximately 3000 fungi recorded as a result represented about 300 species. About 40 of the species were new records for WA, and several were new to science. More than 100 of the fungi discovered so far in Perth's bushlands are featured online in the ever-expanding *Perth Urban Bushland Fungi Field Book*. The book, and more about the project, can be seen at www.fungiperth.org.au.

Fungus forays

There is something addictive about hunting for fungi. The trick is to know how to find them in the first place. The Perth Urban Bushland Fungi Project's fungi leaders delight in showing people how to hunt for fungi in local bushlands, such as how to recognise small bumps in the ground and carefully lift off the soil to reveal the fungus below.

For many people, the array of fungi in their local bushland comes as quite a surprise, as they may not have seen many fungi there before. But once they have 'their eye in' many people find themselves on hands and knees, struck by an irresistible urge to scratch among leaf litter in search of fungal treasures or to contort themselves under logs to capture that perfect fungal photograph. With increasing incidence of such behaviour, Perth's fungi are beginning to reveal their hidden secrets, often raising yet more perplexing puzzles or challenges for management of our bushlands. Here are just a few examples.

Gondwanan relic

The volvate cortinar (*Cortinarius phalarus*) was discovered for the first

Top left Perth Urban Bushland Fungi Project volunteer John Weaver and Community Education Officer Roz Hart with a large bracket fungus on a tuart log at Bold Park.

Centre left A Gondwanan fungus recently discovered for the first time in the Perth region—the volvate cortinar (*Cortinarius phalarus*).

Left The pinwheel fungus (*Agaricus rotalis*) occurs in Perth, Hawaii and Estonia.

Right Pink clusters of *Mycena clarkeana* form on paperbark trees in swampy areas around Perth in winter.
Photo – Patricia Gurry

time in the Perth region during recent Perth Urban Bushland Fungi Project workshops at Forrestdale Lakes, Modong Nature Reserve and Whiteman Park. This fungus is known from only a few other scattered locations in southern parts of Australia.

The volvate cortinar is considered to be an ancient Gondwanan fungus, as it belongs to an unusual small group of *Cortinarius* species also found in South America. Members of this group are not typical of the genus *Cortinarius* as they have a cup (volva) at the base of their stem, whereas most other species do not. *Cortinarius* species are mycorrhizal fungi. So far, in Perth bushlands, our volvate cortinar has always been found near *Astartea* shrubs and *Melaleuca* paperbarks. The extent to which these plants and the fungus depend on each other is not known, but the discovery of this Gondwanan fungus emphasises the high conservation value of the bushlands where it was found.

Strange geography

A rather striking fungus called the pinwheel fungus (*Agaricus rotalis*) is another example of how little we know about our fungi. In 2005 it was discovered for the first time anywhere in Australia in various habitats and locations in the Perth region. It is a large fungus with black marshmallow-shaped buttons and a black and white radial pattern on its mature caps.

It is surprising that such a distinctive fungus could have been unrecorded anywhere in Australia before, and its known geographical distribution provides a further puzzle. Strangely, this fungus was initially discovered and named from the Hawaiian Islands in 2000, where it occurs in woodchips and also in litter under sheoaks. Until the Perth discovery, it had been unknown outside the Hawaiian Islands. Then it was reported from a zoo in Estonia. The known distribution now includes tropical Hawaii, temperate Perth and cool-temperate Estonia. Such a strange distribution may be due to recent introductions, but from where? Will it turn up in other parts of the world?

Fungi weeds

The invasion of weed plants into gardens and bushlands is a familiar sight in the Perth region. Less well recognised is that some fungi can also act like weeds. Just like plant weeds, these fungi arrive from somewhere else, quickly colonise disturbed areas, and may compete with or prevent native species from establishing.

One such species is a large member of the ink cap fungi, which self-digest into a black liquid as they mature. It is a variant of *Coprinus stanglianus*—a rare fungus previously known only from a few places in Europe. The first report of this fungus in Australia was from a public fungus foray in Kings Park about 10 years ago. Since then, abundant crops of its statuesque fruit bodies have been spotted in many Perth urban bushlands, mainly during June and July. It seems to be restricted to highly disturbed patches, such as alongside tracks among weeds, particularly in tuart/banksia woodlands. It seems unlikely that this distinctive large fungus had been overlooked before 10 years ago, and it may be spreading rapidly following its introduction into the Perth region. Many questions remain unanswered. Is this fungus native to Australia? If not, where did it come from, and how and when was it introduced? Does it affect bushland ecology or other fungi?

Above left A truffle (*Scleroderma*) exposed from under the ground cut to show the spores embedded in the front body. Truffles are mycorrhizal partners of plants and food for many animals, and need to be considered when restoring plants and translocating animals.

Above Ink cap fungi (*Coprinus truncorum*) occurs in large troops often around stumps.

Bottom left Red fingers (*Colus pusillus*) are coated with a slime that contains its spores. The foul-smelling slime is nauseating and attracts blowflies.

Perth's truffle orphans

Native truffles are mega-diverse in Australia. There are perhaps up to 2000 species, with only about 10 to 25 per cent named to date. Several dozen species of truffles have so far been found in Perth's bushlands.

Truffle fungi produce their tuber-like fruit bodies below ground and rely on animals to disperse their spores. Truffle odours attract animals such as bandicoots and woylies, which dig them up and eat them. The spores are unharmed when deposited in the animal's dung. Unfortunately, many of Perth's truffles may be sending out their special odours in vain. Fungus-eating mammals are now rare or absent in Perth's bushlands. How are these truffles dispersed in the absence of their mammal vectors that formerly coexisted with them in the bushlands? Are Perth's truffles doomed to a shrinking existence within the bounds of their bushland patch?

Fungi future

Flora, fauna and fungi—and the interdependencies between them—need to be understood and managed as a key part of nurturing Perth's bushlands. Growing awareness that fungi are a significant component of Perth's biodiversity has triggered increased demand for better information about our fungi. A scientific program dedicated to creating and distributing accurate and comprehensive information about fungi species of the Perth region now would be timely. This could provide the type of information we have at our fingertips about many of our plants, such as how to easily identify each species, where they occur, what conditions they prefer to live in, and how to grow and restore them. Improved information would help lift fungi out of the perceived 'too hard basket', and encourage the inclusion of fungi alongside flora and fauna in bushland management.

Through programs such as the Perth Urban Bushland Fungi Project, and with continuing community support, we are gradually becoming better placed than ever to nurture the biodiversity of our three 'F's'—flora, fauna and fungi. Along the way, many more surprises will be revealed about Perth's fungi and there will be many opportunities for community members and bushland managers to take part in unearthing exciting new discoveries.

Neale Bougher is a fungi specialist (mycologist) at the Department of Environment and Conservation's (DEC's) WA Herbarium. He has conducted many fungi expeditions and research projects throughout Australia and the world, and written several books and more than 200 scientific papers and educational articles on fungi ecology and taxonomy. He can be contacted by email (neale.bougher@dec.wa.gov.au).

The Perth Urban Bushland Fungi Project is a collaboration between the Urban Bushland Council, WA Naturalists' Club and DEC's WA Herbarium, with support from Lotterywest. Along with Neale Bougher, the core project team includes Roz Hart, Sarah de Bueger and the many volunteers who have contributed greatly to the project's success. A number of volunteers trained to become fungi leaders to teach on public forays. A georeferencing-based kit for fungi surveys was developed for the project by volunteer John Weaver, who has also been webmaster for the associated website and electronic designer of the *Perth Urban Bushland Fungi Field Book*.

The book, *Perth Urban Bushland Fungi Field Book*, and more information about the project, can be seen at www.fungiperth.org.au.

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