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The Queensland Mycological Society

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Society Objectives

The objectives of the Queensland Mycological Society are to:

1. Provide a forum and a network for amateur and professional mycologists to share their common interest in macro-fungi;
2. Stimulate and support the study and research of Queensland macro-fungi through the collection, storage, analysis and dissemination of information about fungi through workshops and fungal forays;
3. Promote, at both the state and federal levels, the identification of Queensland's macrofungal biodiversity through documentation and publication of its macro-fungi;
4. Promote an understanding and appreciation of the roles macro-fungal biodiversity plays in the health of Queensland ecosystems; and
5. Promote the conservation of indigenous macro-fungi and their relevant ecosystems.

Membership

Membership of QMS is \$25 per annum, due at the beginning of each calendar year, and is open to anyone with an interest in Queensland fungi. Membership is **not** restricted to people living in Queensland. Membership forms are available on the website, <http://qldfungi.org.au/>.

Could members please notify the membership secretary (memsec@qldfungi.org.au) of changes to their contact details, especially e-mail addresses.

The Queensland Mycologist

The Queensland Mycologist is issued quarterly. Members are invited to submit short articles or photos to the editor for publication. It is important to note that it is a newsletter and not a peer-reviewed journal. However we do aspire to high standards of accuracy.

Material can be in any word processor format, **but not PDF**. The deadline for contributions for the next issue is **15 June 2018**, but if you have something ready, please send it **NOW!** Late submissions may be held over to the next edition, depending on space, the amount of editing required, and how much time the editor has. The standard font used for text is Gothic 720BT, 9pt, with other sans serif fonts used for headings and captions. Font sizes may vary if required to make articles fit the available space, and text may be edited for the same purpose.

Photos should be submitted separately at full-size to allow flexibility in resizing and cropping to fit the space available while minimising loss of quality. Authors who have specific preferences regarding placement of photos should indicate in the text where they want them, bearing in mind that space and formatting limitations may mean that it is not always possible to comply. Material from published sources (including the internet sites such as Wikipedia) may be included **if that complies with copyright laws and the author and source are properly acknowledged**. However extensive verbatim copying is not acceptable.

Cover Illustration

Lichens on an Alexandra palm. Lichens feature in the second of Vanessa Ryan's "Introduction to Fungi" articles. The first one, on fungi in general, was in the previous issue. See page 8. Photo © V. Ryan.

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QMS Activities

Meetings

Meetings are held in the F.M. Bailey Room at the Queensland Herbarium, Mt Coot-tha Botanic Gardens, Mt Coot-tha Road, Toowong, commencing at 7pm on the second Tuesday of the month from February (no January meeting), unless otherwise scheduled. Check the website for details and any changes. There will be 3-4 guest speakers invited during the year and other meetings will be informal. Suggestions from members for topics or names of potential speakers or talks will be welcome at any time. Please contact a member of the Committee.

To assist those unable to attend meetings, notes on the talks are included in the Queensland Mycologist and on the website if possible. However, the notes never do justice to the topic as they do not reflect the enthusiasm of the speaker or cover the discussion that follows, and not all talks are written up for the newsletter. So remember, where possible it is better to attend the meetings, get the information first hand and participate in the invaluable information sharing opportunity.

Suppers are provided by volunteers. Please bring a plate if you can.

Forays

QMS hold regular forays during the first half of the year. The dates are nominally the 4th Saturday of the month, but actual dates may vary and additional forays may also be held. Field trip details may change as a result of drought or other unforeseen circumstances. Check the website for changes.

Members are invited to suggest venues for additional forays. If you have any suggestions (and especially if you are willing to lead a foray), please contact Susie Webster or another member of the Committee.

Workshops

What do you, our members, want to learn more about that could be presented in a workshop? QMS is always on the lookout for workshop ideas. Members are encouraged to suggest topics, whether new or reruns of past workshops.

Send your ideas to Judith Hewett or Wayne Boatwright (info@qldfungi.org.au).

Details of workshops will be included in newsletters and on the QMS website as they become available.

QMS Calendar – 2018

MONTH	MEETINGS	FORAYS/WORKSHOPS
November	13th: Dr John Dearnaley – Serendipita – Mycorrhiza with a Commercial Future	
December	11 th Dr Diana Leemon – The Santa Claus story, witchcraft, economic boom and bust, Irish diaspora: how fungi have shaped human history. Christmas Party	Christmas Break

Editor's Comments

We have one foray report this month. Pat Leonard has written up the Chermerside Hills foray and the report is accompanied by some wonderful photos from Solveig Gillis.

Fran has written about a fungus sometimes referred to by Ryvarden as a living fossil, *Phaeotrametes decipiens*, found during the Great Sandy National Park foray earlier this year.

We also have the second part of Vanessa Ryan's introduction to fungi, this time on lichens.

Vanessa has also provided more recipes from Joe and Kathy Brandt in the USA. I would add the caveat that what we think are the same species here may not be.

At the risk of sounding like a broken record, I will repeat my previous request for more foray reports. Powerpoint files are all very well but don't carry all the nuances and side stories about the fungi found, unless the author has included extensive speaking notes. Past experience has taught me that it is very hard to turn a PowerPoint file into a decent newsletter article without such notes. The actual text does not have to be long. Pat's brief article is an excellent example of what is needed.

Some aspects of the newsletter format.

The newsletter is prepared using the open source software suite LibreOffice. Composite photos are created in the suite's Draw package. I edit photos mostly using Photo Commander which, while limited, is easy to use.

Fonts and page layout. One of our members is dyslexic and asked that we use sans serif fonts, so at the moment I am using Gothic 720 BT for text and sub-headings, and Trebuchet MS for article titles, ariel for captions. Main headings are 15 pt, text 10 pt (but that may vary slightly to improve fit). Page margins are 2 cm all round. Paragraphs are separated by 2 mm below, nothing above. Please do not insert blank lines between paragraphs, as I

have to go through and remove them!

Names and capitalisation. I get confused about this, so I can sympathise with the authors! The problem is that there are differences between US and British usage, and in Australia we seem to use both. What is more there is variation in usage within those realms. As someone said in the context of IT, "The great thing about standards is that there are so many to choose from". I am trying to stick to British usage where there is a difference. But in general I quite like the style guide I just discovered on Wikipedia:

https://en.wikipedia.org/wiki/Wikipedia:Manual_of_Style

Genus names are always capitalised, while species (and subspecies) names are not, and scientific names are always in italics, including genus name when used alone.

Common names. Common names are not capitalised unless they include proper names, e.g. Queensland golden myrtle. When you turn a genus name into a common name, it is neither capitalised nor italicised, e.g. *Russula*, russulas. The words genus, family, phylum etc are not capitalised (but the generic, family or phylum names are, e.g. the genus *Russula*, the family Russulaceae).

Numbers. Spell out numbers up to ten, but use numbers above ten, e.g. six russulas, 15 amanitas, four boletes. Use numbers and a space for measurements, e.g. 6 mm. The units we use are mostly lower case, except litres, so mm, cm, L, mL.

However, my preference (and I am not alone in this) is to avoid pluralising generic names, so you might try something like "six species of *Russula*", or 15 *Amanita* species (or spp.).

There is room for more discussion on this topic, so feel free to comment. I am also thinking about changing the fonts I use, so if you have any preferences for a particular sans serif font, please let me know. In the end, of course, it has to be available in my software.

Chermside Hills Foray - March 2018

Patrick Leonard

The annual Chermside Hills foray took place on the 23rd of March in 2018. It was well attended and the party split in to two groups to accommodate the large numbers. The early date for the foray probably accounted for the fact that finds were dominated by amanitas, boletes and russulas. There were 42 records made, 26 of which were identified to species level. A further six collections had been previously recorded on QMS forays and written up in Fungi of Queensland so we were able to match the data even though they have not been formally named.

The most exciting find was a very brightly coloured apricot brown to chestnut puffball. Up to 70 mm across, 50 mm tall and pear shaped, with folds along its sides (crenulate). When mature, the outer skin flakes off leaving a golden brown patch below. When you cut the fruiting body in half vertically there is a single chamber containing the spores, no diaphragm and sterile area below. The spores are globose, with a thick wall and echinulate, you can just see a small stump of a pedicel. It is the least common of the calvatias: *Calvatia rugosa*. There are very few records of this fungus but one was found by F.M. Bailey in the Brisbane Botanic Garden at the start of the 20th century.



Calvatia rugosa. © Solveig Gillis.

Ten of our finds were in the genus *Amanita*, and although there is a substantial literature on Australian amanitas covering about 100 species, we always find some that do not fit the existing keys and descriptions and this was the case on this foray. *Amanita farinacea* is a relatively easy one to identify, it is white and covered in floury white flakes which cover the cap, hang off the edges and cover the stipe. The cap has irregularly shaped and flattened pyramid like warts. But the best way of recognising this species in the field is to touch the

stem and the white flakes attach themselves to your hand, hence its name, '*farinacea*' means floury.



Amanita farinacea. © Solveig Gillis.

Amanita pyramidiferinus is much less common, there being only four previous records and none in Queensland. It has distinctive pyramid-like warts on the cap, a large pendulous ring and a bulbous base to the stipe. The cap surface is off white to buff and the fungus is less robust than the common and closely related *A. pyramidifera*, which we also found on this foray.



Amanita pyramidiferinus. © Solveig Gillis.

The small *Amanita* with a yellow (or red) cap and no ring is *Amanita xanthocephala* which was found on three separate occasions.



Amanita xanthocephala. © Solveig Gillis.

February and March seem to be the best months for finding boletes and a third of all the records made were for bolete species. Five genera were represented and it was a good opportunity to see how diverse boletes can be. The first find was *Gyroporus* aff. *castaneus*. The main features that distinguish *Gyroporus* from other boletes are the hollow or chambered stipe and the fact that the hyphae that make up the stipe do not orient vertically from top to bottom, they go round and round, layered horizontally, and a *Gyroporus* stem can be snapped in two with a very satisfying snapping sound! Chestnut brown caps and white pores also characterise this genus. There are several species in Australia – this one is like the European one, hence the name 'aff. *castaneus*' where the aff. means 'like'.



Austroboletus mutabilis. © Solveig Gillis.

A. mutabilis is red brown with a viscid cap that changes colour as it matures and is known from the Sunshine Coast, the Atherton Tablelands and a single record in the Northern Territory.

A. austrovirens is known from less than ten collections mostly on the Atherton Tablelands and the Chermshire collection appears to be a southern outlier. It is recognised by its olive green colour and the dry olivaceous reticulate network on its stipe.



Austroboletus austrovirens. © Solveig Gillis.



Gyroporus aff. *castaneus*. © Solveig Gillis.

The most spectacular bolete seen was a large brown capped species with bright yellow pores which were irregular and a bit maze like, and a bright yellow stipe. It is currently recorded as *Boletus alliciens*, but that is very unlikely to be its correct name as it is based on a European bolete with similar colouration. In the past, the genus *Boletus* was used as a dumping ground for all fleshy pored species with a stem that could not be placed in some more specific genus. The current view seems to be that the name *Boletus* should be reserved for the *Boletus edulis* group of species and that other species, including this one, should be assigned to newly created genera.

Our next bolete was *Boletellus reminiscens*, a species recently named by Nigel Fechner and Roy Halling. This is a robust bolete with a reddish cap and it often fruits above the ground on tree trunks. It looks like a *Boletellus emodensis* (which was also found on this foray) that has lost the scales on its cap.



Boletellus reminiscens. © Solveig Gillis.

Two species of *Austroboletus* also recently named by Nigel Fechner and Roy Halling were seen on this foray: *A. mutabilis* and *A. austrovirens*. A feature of this genus is that the stipe of most species is reticulate; that is it has raised and criss-crossed ridges like the once fashionable fishnet tights.



Boletus alliciens. © Solveig Gillis.

Just to confuse everyone, one bolete genus we found does not have pores, but golden gills instead. This is the genus *Phylloporus* and there are probably a dozen or so species in Queensland. The names and characters have not yet been properly sorted out by taxonomists and several different specimens have been found in the Chermshire Hills

over the years. This year's find was of a large brown capped species with decurrent golden gills and a pale to almost white stipe which is likely to be *P. australiensis*.



Phylloporus australiensis. © Solveig Gillis.

New members had lots of questions about the edibility of the fungi we saw and as ever we had to admit that we really don't know whether most of the species we found were edible or not, with one exception. At this foray we saw an *Agaricus*,

present in quite large numbers. It has a strong unpleasant phenolic smell, like carbolic or Sunlight Soap. It also stains yellow when you scratch the stipe. This is one of the species in the 'yellow stainer' group which is toxic to most people and can land you in hospital if you consume enough of it. It is the most common fungus implicated in calls to the poisons line! The particular one that we saw is probably *Agaricus moelleri*.



Agaricus moelleri. © Solveig Gillis.

Nailing *Phaeotrametes decipiens* Frances Guard

Phaeotrametes decipiens (lavender pored bracket) is a species that has eluded me for years – both collecting and correctly identifying it. I must confess that I've mislabelled other polypores with this name. This year we found it in the wallum habitat of Great Sandy National Park, on small dead wood of *Allocasuarina littoralis*.



Frances Guard.

When looking at this small to medium bracket from the upper side it could be mistaken for a *Cyclomyces*, or even a *Hymenochaete*, with its rich brown, zoned velutinous surface. However, the underside is different from those taxa.

Hymenochaete has a macroscopically smooth brown underside. *Cyclomyces* has large (1-2 per mm), brown, angular, lacerate pores containing many setae (bristles), visible with a hand lens, and

has a white spore print. *Phaeotrametes decipiens* has brown pores, but often with a bluish-white to lavender bloom – hence the common name.

Its pores are also large (1-2 per mm), angular to elongate with smooth walls; the flesh is pinkish-brown, and the spore print variously described as lavender, yellowish-white or yellowish-brown. In truth, I think spore prints are seldom obtained. The spores themselves are distinctive: large, ellipsoid, with 2 to 3-layered thick walls, a prominent, slightly lateral apiculus, and a thin-walled section with an observable slit at the opposite pole which some taxonomists have suggested is a germ pore. Wright (1966) gives the spore size range in Australia as $14-20 \times 6.5-9 \mu\text{m}^1$. According to Fuhrer (2005), this species is said to occur most commonly on she-oaks in semi-arid to arid habitats². Hood comments that it grows in open woodland vegetation, including Casuarinaceae and Proteaceae³. It has been recorded in all states from coastal woodlands to inland habitats⁴, although it appears to be more common in temperate regions of Australia.

I tried to get an idea of its distribution in Queensland by checking the Herbarium collections. There were twelve under the name of *Phaeotrametes decipiens*. It was clear that several different genera were represented in those collections. Only three fulfilled the macroscopic criteria outlined above, and they were from Brisbane, Sydney and Cooloola. So, it appears to be relatively uncommon in the subtropics.

Another interesting feature of *Phaeotrametes decipiens* is that its asexual form sometimes occurs as cup-shaped structures, either attached to the sexual fruitbody pileus or nearby¹. Some interpret this as being a primitive character.

Only one species has been recognised in the genus, which in itself is not closely related to other polypore genera. Worldwide, it occurs in an austral distribution, including Brazil, Uruguay, Madagascar and Zimbabwe, according to Heino Lepp, as well as southern (mostly temperate) Australia. Leif Ryvardeen, a worldwide polypore expert, thinks of it as a 'living fossil'.⁵

References

1. Wright, J.E. 1966. The genus *Phaeotrametes*. *Mycologia* 58(4): 529-540.

2. Fuhrer, B. 2005. *A Field Guide to Australian Fungi*. Melbourne. Bloomings Books. p.267

3. Hood, I.A. 2003. *An Introduction to Fungi on Wood in Queensland*.

4. Atlas of Living Australia, Records for *Phaeotrametes decipiens*. Accessed August 2018. <https://bie.ala.org.au/search?q=Phaeotrametes+decipiens>

5. Lepp, H. 2012. *Australia's Gondwanan and Asian connections; Species found in Australasia-Africa-South America* Australian National Botanic Gardens and Australian National Herbarium, Canberra. Website. All Rights Reserved. <http://www.anbg.gov.au/fungi/mycogeography-distant.html>



Lichens - An Introduction

Vanessa Ryan

For many hundreds of years lichens were thought to be simple or lower plants like the mosses and liverworts. This conclusion is quite understandable if you look at the lichen in the picture below. It's green and appears to have leaves and stems and maybe even tiny red flowers.



It wasn't until the early 1700s when scientists started using microscopes to examine cellular structures and processes that they realised plants and lichens are quite different from each other.

What are lichens?

Lichens are complicated things. They are made up of fungi and either green algae or cyanobacteria (or sometimes both) living together as one composite organism.

Green algae are tiny plants and cyanobacteria are, as their name suggests, a kind of bacteria – which is another story. All we need to know for now is

that cyanobacteria can, like plants, photosynthesise – that is, use light to make their own food in the form of sugars.

The algal and cyanobacterial components of a lichen are called the photobionts. Photo – meaning relating to light and biont, meaning an organism. The fungus part of a lichen is called the mycobiont. Myco means “relating to fungi”. About 90% of lichens have a green alga as their photobiont.

Only quite recently another lichen component organism has been discovered. Many, if not most lichens also contain single-celled yeasts (another kind of fungus). The function of these yeasts is not yet known, but there appear to be hundreds, if not thousands, of yeast species associated with lichens.

Lichens have been described as being more than the sum of their parts. They possess structures and produce chemicals that none of the partners would produce if they were living by themselves.

The fungi, algae and cyanobacteria have been all been given their own scientific names, but the lichen as a whole is given the same name as its fungus component.

Why do these organisms live together?

The algae and cyanobacteria components of lichens can, and do, live independently in nature. However, it has been shown in experiments that lichenised fungal species can only survive on their own for about a year. They have evolved to become dependent upon their partners.

Like us, fungi need carbohydrates (sugars) to survive and, like us, fungi can't make their own. That's why we and fungi need to eat.

Think of lichens as tiny farms where a fungus is growing “crops” to produce the sugars it needs to survive. The fungus’s mycelium is the infrastructure holding together and protecting the algae and cyanobacteria within its network of hyphae. The fungus continually “harvests” the sugars the photobionts make. In fact it can take up to 80% of the sugar produced.

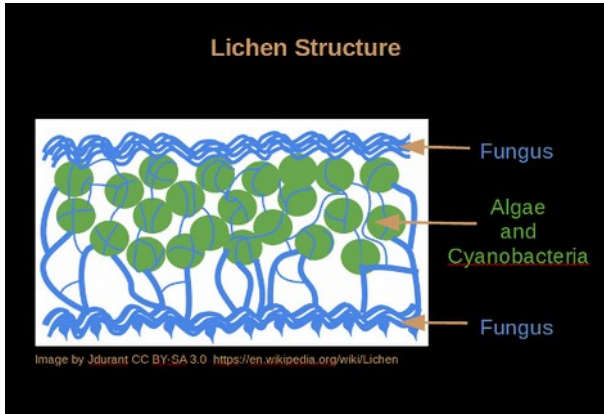


Image: Jdurant CC BY-SA 3.0
<https://en.wikipedia.org/wiki/Lichen>

With its relatively much larger surface area the fungus not only protects its photobionts from possibly harsh environments, it also provides them with water and nutrients that it gathers from the air – much more than they would get if they were living alone.

Depending on the lichen species this relationship may be mutualistic (where all the partners benefit); commensalistic, where the fungus benefits from the photobionts and the photobionts aren't affected, or even parasitic, where the fungus benefits and the photobionts are harmed – sometimes even to the point of death.

Some lichens contain more than one kind of alga or cyanobacterium. This can be very useful if changing conditions favour one photobiont over the other.

Also, some cyanobacteria can “fix” or gather nitrogen from the atmosphere. The algae components benefit from this, and in turn, so does the fungus.

How many species of lichen are there?

About 3,000 species of lichen have been described and named from Australia and world wide that number is about 20,000. Considering that it has been estimated that there are perhaps 1.5 million species (or more) of fungi and so far only about 100,000 of those (including the lichenised species) have been described and named, there must be a lot more lichens out there waiting to be discovered.

All those thousands of lichenised fungi species are associated with only 300-400 different photobiont

species. Of all the photobiont species, only two species, from two separate but closely related genera, account for about 35% of lichen relationships.

Where do they live?

Lichens need light to survive so most lichens grow on the surfaces of things – their substrate. Almost anything can be a substrate – soil, rocks, leaves, wood, bark, metal, glass, plastic and even bone and leather. Lichens don't feed on their substrate, they only use it as a place to live. This is unlike other fungi where most of the organism is hidden away within the substance it is feeding on, which, by the way, is also called the substrate.

Some desert lichens live inside rocks for shelter, growing between the constituent grains. Similarly, some lichens live in the very upper layer of soil. Lichen crusts in deserts do a lot to stabilise the soil and retain water. The most exposed lichens are those that don't live on anything and blow freely around in the air.

Lichens have been found on every continent – from dry deserts to wet jungles, and from both polar regions to the equator. It has been estimated that 6-8% of Earth's land surface is covered by lichens. Experiments have shown that lichens can even survive a few weeks' exposure to the vacuum and intense radiation of space.

Where we don't find them is important too.

Lichens pretty much get all their nutrients from the air and rain, so atmospheric pollution is a big problem for them. Some lichens can tolerate pollutants better than others, but those that can't won't grow in polluted areas. The interaction between lichens and air pollution has been used as a means of monitoring air quality since as far back as 1859.

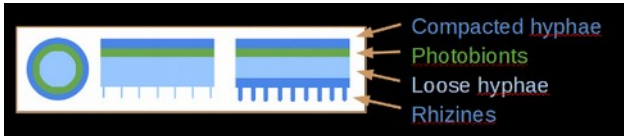
Lichens also respond to environmental changes in forests, including changes in forest structure. So if a forest becomes more open after a fire, the lichen population will change to those species better suited to the changed environment.

Lichens are well known to be the first colonisers of bare surfaces. They can live on rocks in full sun and in the harshest of environments. This is because they can survive for quite long periods without water. They dry out and enter a state of metabolic suspension which allows them to tolerate wider extremes of temperature and higher radiation levels than active organisms. This allows them to live in places where most fungi, plants and animals wouldn't survive. A lichen that might look dead can be quite quickly revived with a splash of water.

What do lichens do?

Even though they are composite organisms, just like all other living things lichens grow, reproduce, react to their environment, sometimes get sick and eventually die.

The body of a lichen is called the thallus. How the lichen grows is affected by the way the different components of the lichen are organised within the thallus. The resulting shape is controlled by the species of fungus involved.



Redrawn from material at <https://www.anbg.gov.au/lichen/form-structure.html>

Some lichen thalli are flat and attached very firmly to their substrates, forming thin crusts. These are, not surprisingly, called crustose lichens. Crustose lichens have a layer of tiny structures on their underside called rhizines which penetrate the substrate, making it impossible to see the lower surface of the lichen. Rhizines might look like roots, but unlike plant roots they don't absorb nutrients or moisture; they only act as anchors.



A crustose lichen.

Other lichen thalli are flat, leaf-like lobes which may lift up from the surface of the substrate. They grow in layers with distinct upper and lower surfaces and usually these surfaces are different colours. These lichens are called foliose lichens. Foliose lichens may also have rhizines on their undersides, but not as many as crustose lichens.

Some thalli are tendrils that are round in cross-section with no distinguishable upper and lower surfaces. As a result, they are hair-like or shrub-like in shape. These lichens are often found dangling from, or sitting upright on, tree branches. Lichens of this shape are called fruticose lichens.

There are other shapes as well, but these are the main ones. A few fungal species actually make a

different shaped or coloured lichen with different photobiont partners.



A foliose lichen.



A fruticose lichen.

A lichen's colour is determined by the photobiont's photosynthetic component, which is usually some shade of green or blue-green. Some lichens, such as the orange-coloured specimen pictured below, have special pigments in them which give them other colours. Usnic acid makes lichens a yellow to red or brown colour.



Usnic acid gives this lichen its orange colour.

Other chemicals in a lichen's thallus can make some species glow spectacularly under UV light,

and the colour of the glow can be quite different to the lichen's colour in daylight.

Lichens grow very slowly. Some species grow less than a millimetre per year. By measuring rates of growth, lichenologists (people who study lichens) have been able to estimate the ages of some lichens living high in the European Alps to be over 10,000 years old. Considering the fact that these lichens might not grow at all some years due to the harsh conditions, they might be quite a lot older. Some estimates have been as much as 50,000 years.

As lichens grow – particularly crustose lichens – they put pressure on rock surfaces, slowly pulling them apart. Some of the chemicals lichens produce also gradually eat away at the rock, dissolving it into fine particles. When lichens die they contribute organic matter and nitrogen to the soil they have helped to create.

Fossils from southern China show that lichens might have been around for 500-600 million years. It's thought that lichens may have provided a key stepping stone for life on land by helping other natural weathering processes create the first soils.

In my previous article about fungi, I mentioned a genus of fossil fungi named *Prototaxites*. These fungal species lived around 400 million years ago and they were giants, standing over six metres tall and about one metre wide at the base. There has been some debate as to whether or not *Prototaxites* were fungi or if they were actually enormous lichens. It's now looking more and more like they were indeed lichens.

Lichen Reproduction

Only the fungal part of the lichen organism is able to reproduce sexually. The photobionts can reproduce sexually when living independently, but when they are within a lichen this ability is suppressed.

The fungus reproduces sexually much like other fungi, but instead of producing a mushroom to release its spores, most lichenised fungi produce other structures.

The most easily recognisable of these structures are the little cups and discs often seen growing on top of the thallus. Sometimes the cup-shape is bulged outwards to form buttons or blobs. These structures are called apothecia.

Apothecia can be embedded in the thallus of the lichen (top photo), or raised above the thallus on tall stalks (second photo). The fungus's spores are released from the apothecia and dispersed into the air.



Should the spore land and germinate near a free-living photobiont, the baby fungus's mycelium will capture it within its network of hyphae and start a new lichen.

If it doesn't find a partner, the fungus will eventually die.

Many lichens reproduce asexually from fragments that break away from their thallus. Each piece contains both the fungus and photobiont and can grow into a new lichen, a process called vegetative reproduction. Some lichens even grow special structures that break off very easily just for this purpose. These fragile structures are called isidia.



The rough projections are isidia.

The mycobiont of the lichen pictured below is a basidiomycete. This is rather uncommon as most lichenised fungi are ascomycetes. The green fuzzy stuff at the base of the mushroom is the lichen's thallus and the gilled mushroom is its fruiting body.



To recap, in the above photo, it can be observed that the leafy parts near the rock are the lichen's thallus. The green colour is produced by the lichen's photobionts, busily making sugars to share with their fungus partner. The tall stalks with the tiny red bulges on top – its apothecia - are the fungus component's fruiting bodies.

Diseases, Dangers and Death

Lichens, just like fungi, plants and animals, are susceptible to a large range of diseases.

Not surprisingly, mycoviruses (which I discussed in my previous article about fungi) have been found in lichens.

It has also been discovered that some lichen-associated bacteria may actually be opportunistic freeloaders, rather than symbiotic partners.

Similarly, there are also fungal freeloaders. These fungi are referred to as lichenicolous fungi and they include a wide range of pathogens, saprotrophs and commensals. More than 1,800 species of

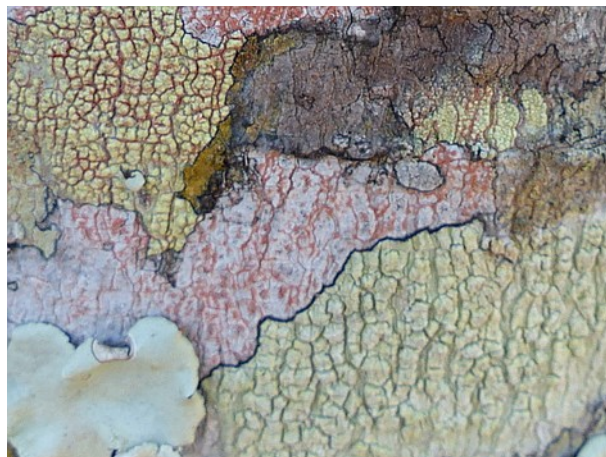
lichenicolous fungi have been described and it has been estimated that there may be as many as 3,000.

And there are even lichens which parasitise other lichens.

Finally, I've already mentioned that lichens are very susceptible to pollution. An unhealthy environment can cause diseases and even death.

Like all organisms, lichens compete with each other for food. Some lichens fight for their territory by producing chemicals that poison foreign invaders.

In the image below, the black lines between the different crustose lichen species are the "no go" areas where chemical combat is raging fiercely.



Plants are also considered a threat as they can provide significant competition for light. Some lichens produce chemicals which inhibit the growth of mosses and prevent the seeds of larger plants from germinating.

Another big threat comes from animals. Even though lichens are poor in nutrients and proteins, some large mammals such as reindeer are well known for relying on them during the harsh northern hemisphere winters. An individual reindeer can eat up to 5 kg of lichen in a single day.

Other mammals that are known to eat lichens are gazelles, goats, camels, llamas, lemmings and squirrels. One of the more unusual animals that has been observed eating lichens is the Christmas Island red crab.

Lots of much smaller animals also feed on lichens. These include invertebrates such as slugs and snails, termites, grasshoppers and the caterpillars of many butterflies and moths.

Many invertebrates are coloured so that they are camouflaged against the lichen thalli. Some cover themselves with fragments of lichen (e.g. case moths) and others have been living amongst lichens for so long that they have evolved to look

like them. Pictured below is a spectacularly adapted spiny leaf insect, *Extatasoma titarum*, that is found in Queensland.



Rebel's Photography
<https://open.abc.net.au/explore/35160>

Some of our local birds, such as *Eopsaltria australis*, the eastern yellow robin (pictured), also use pieces of lichen to camouflage their nests.



Andrew Rock. All rights reserved. Used with Permission.
<https://www.flickr.com/photos/strictfunctor/31225161320/>

Why do we need lichens?

We need them because plants and animals need them.

Plants need lichens because:

- Lichens break down rocks to make soil.
- Lichens fix nitrogen from the atmosphere and release it into the soil when they die.
- Lichens fix nitrogen from the atmosphere and when eaten, the nitrogen is released into the soil via the animal's dung.
- Lichen crusts help to stabilise soil and retain its moisture content.

Animals need lichens because:

- They may eat lichens.
- The plants they eat may need lichens.
- The animal's prey may eat lichens.

- They may use lichens as camouflage for protection.
- They may use lichens for their homes.

We humans have needed lichens for many of the same reasons as other animals need them.

In some cultures around the world some lichens are considered a staple food, in others a delicacy, while others considered them a food of last resort. Lichens can be ground into a flour and baked in bread or used as a flavouring. Alcoholic and non-alcoholic beverages can also be made from lichens. During WW2, the Russians used lichens to make sugar.

Some lichen species are poisonous and a few of those have also been put to use by some cultures. The Norwegians used a lichen, *Letharia vulpina* (photo below), to poison wolves.



https://en.wikipedia.org/wiki/Letharia_vulpina
 Photographer - Jason Hollinger - [Mushroom Observer](#)
 CC BY-SA 3.0

Lichens have been made into a huge variety of medicines for a very long time. A great many lichens, perhaps 50% of species, have antibiotic properties. Usnic acid is one of the strongest antibiotics lichens produce. These days it is used commercially in mouthwashes, toothpastes, deodorants, shampoos and even sunscreens.

For many thousands of years, lichens have provided us with scents for perfumes and cosmetics. This industry is still going strong in some parts of Europe. The two major lichens used are commonly known as treemoss and oakmoss.

The Ancient Egyptians used to stuff the body cavities of mummies with, amongst other things, treemoss. It's thought they did this because the lichen's aroma and antibiotic property might have helped to reduce the odour and decomposition of the body. Treemoss lichen doesn't appear to be native to Egypt and it may have been imported from Greece.

Since ancient times lichens have also provided us with colourful dyes for wool, silk and other fabrics. Perhaps the most well known are the lichens collectively known as the orchil or cudbear lichens. These were the sources of a “cheap” purple dye to the ancient Greeks and Romans. (The most expensive and better quality purple dye came from sea snails.) More recently (from the 1800s) other lichens have been used to make the dyes of pH sensitive litmus papers. Even though we now have synthetic dyes, lichens are still a source of natural dyes used for making such special things as traditional Scottish tartans.

Lichens also have other uses.

Some lichens are helping archaeologists and geologists date ancient stone surfaces. As mentioned earlier, if the rate of a lichen’s growth is known the age of the lichen can be calculated. By working out the age of the largest (therefore oldest) lichen growing on a rock surface, you can work out the age of the surface.

As previously mentioned, pollution sensitive lichens are being used as biological sensors to give us information about the environment.

As more research goes into lichens, we are finding more things we can do with them. Every day new species are being found with potentials as yet undreamed of.

How can we look after them?

If you think about it, it’s just common sense. Like us, lichens need clean air and water and a safe place to live. We need to ensure that they continue to have those precious things.

To help them survive, we also need to learn more about them – not only about all those undiscovered species, but the ordinary common species as well. So much of what they are and what they do is so poorly understood.

So what can you do?

The next time you come across a lichen, stop a moment to look at it. Think about what I’ve said. If you are with someone, point it out to them and talk about it.

Spread the word. Raise awareness.

Lichens truly are amazing.

Images: Copyright © V. Ryan unless otherwise noted.

Wonderful Winecaps

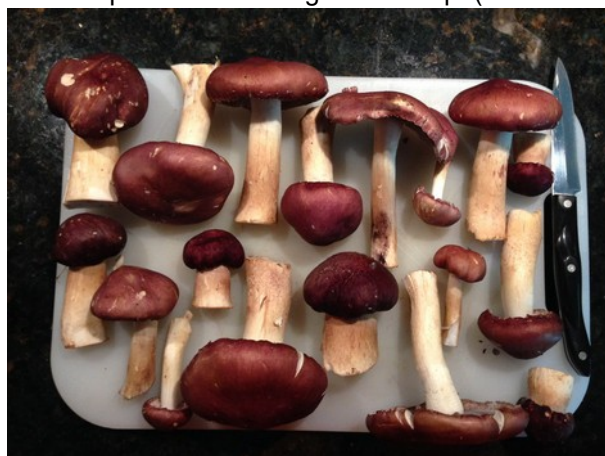
Joe and Kathy Brandt

Here in the Northeast US, Winecap stropharia (*Stropharia rugosoannulata*) are a prized edible, appearing in both spring and fall (sometimes in summer, too), often in large quantities. Although wood chips are not an exclusive growing medium, our experience has been that almost every time you see them come up, wood chips are exactly where you’ll find them.



These fabulous mushrooms have a distinctive flavour, are versatile and easy to prepare. Either pre-cooked (they freeze beautifully after cooking) or

used in a recipe when cooked fresh, wine-caps are hard to beat. Because of their favourite growing medium, winecaps are frequently easier to clean than many of their agaric counterparts. Bear in mind, however, that as with many of the “choice” edible mushrooms, insects love them just as much as we do. Even specimens that appear to be pristine must be carefully examined after an initial cut is made in order to determine whether the bugs have beaten you to it. What we will usually do in the field is make one cut crosswise through the bottom of the stem, and look closely for small holes. If there’s nothing there, you’re “good to go”, but even if there’s evidence of insects, all is not necessarily lost, because there’s always the chance that the insects have not penetrated through to the cap. (The stem



can just be discarded, and these often remove easily.) If you're not sure, a single lengthwise cut across the centre of the cap will give you the full story.

Our observation has been that, generally, the smaller the mushroom, the better chances are that they will be insect-free, although this is not always the case. The size of wine caps varies widely, from a closed cap the size of half a dollar all the way to an open cap as big as a dinner plate. Although the chances of insect involvement increase with the size of the mushroom, the good news is that it is not uncommon to find pristine specimens that are quite large, and winecaps are sometimes found in astonishingly great quantities. Big or small, there is little taste differential between any given winecap found in a particular place. We've heard people say that the really large ones aren't any good, and that's just not true. As long as the caps are not dried out, the chances are that they're still viable regardless of the size. Although smaller ones with closed (or partially-closed) caps have the most eye-appeal when sliced and cooked in dish, even the largest ones are terrific, and yes, the entire mushroom—stem included—is edible.

A deep brownish-red cap colour (thus the term "wine-caps") is characteristic, but in strong direct sunlight, bleaching may occur, giving a light-brown (or even taupe) appearance, and this in no way affects the flavor, unless the cap has become dried out as a result. For the most part, caps (regardless of their size) will have an incurved margin, although with age, the margin may be completely flat, or even upturned. If you're lucky enough to have found nice young specimens (regardless of size), there is no problem keeping these refrigerated in a paper bag for a day or two until you have the chance to cook them— but as with all wild edibles, once you've taken them out of their natural environment, "the clock is ticking", so we would advise against leaving them in your refrigerator for more than a few days.

Preparation for these is often a snap as far as wild mushroom go— sometimes, you can get away with just a wipe of a damp cloth. As with any mushrooms, the less they are exposed to water, the better. Winecaps have a comparatively high moisture content and will release quite a bit of liquid into the pan during cooking. We should point out that these are not a "flash in the pan", and a quick sauté will not do the trick here. A bare minimum of 15 minutes will be required, and a full pan can easily go double that length of time.

As with many other types of edible mushrooms, the basics are olive oil, garlic, onion, salt & pepper, but there's one spice that happens to go extremely well with winecaps, and although we're sure that this may not be to everyone's taste, fennel is a beautiful match to the flavor, in much the way that cumin agrees with oyster mushrooms. Fennel in any form

may be used— whole seeds, toasted ground seeds, or sliced bulbs. With mushrooms as versatile as these, you are limited only by your imagination. Another great feature of this mushroom is that very little in the way of flavour is lost in freezing, and winecaps will keep quite well— so if you're fortunate enough to have a major find, and you have extra space in your freezer, you can be assured of wonderful meals to come for a year or more.

If freezing is not an option, winecaps may be dehydrated, but we have found that this method of preservation is "second best" by a wide margin. These are enjoyed and prized in many parts of the globe, and the Japanese have a great name for them: "Sakétsubataké". Regardless of what you call them, the distinctive flavour is one that is easily remembered.

Wine Cap Sauce

2 Tbsp. olive oil
1 cup sliced wild ramp greens* & bulb, or, scallions
2 Tbsp. minced garlic
2 Tbsp. lightly toasted fennel seed
8 cups cleaned, sliced winecaps
2 Tbsp. butter, butter substitute, olive oil, or half butter, half oil
2 Tbsp. flour
½ tsp. salt
¼ cup water

Heat oil in large frying pan. Add leeks or onions. Sauté 3 minutes. Add garlic, sauté 1 minute. Add fennel seed, winecaps and salt, mix thoroughly. Cook, stirring occasionally, 8 to 10 minutes. Drain off released cooking juices and reserve.

Push mushrooms to the side of the pan and add the additional fat. Mix in flour, creating a roux. Add reserved liquid back into the pan, stirring constantly. Add water** or vegetable broth* as needed to attain desired consistency.

Cook 5 minutes more, season with salt and pepper to taste. Serve on pasta, rice, or with pita bread.

*Ramps are *Allium tricoccum*, an onion native to the USA.

**For an interesting variation, try adding ½ cup of sour cream and a few Tbsp. of your favourite tomato sauce (puree to Australians), which will result in a creamy pink sauce.

Winecaps with Fennel and Ramps

2 Tbsp. extra-virgin olive oil
2 cloves garlic, minced
1½ cups thin-sliced fennel bulb (approx. ½ bulb)
8 cups sliced winecaps
1-2 Tbsp. water
¼ tsp. ground toasted fennel seeds
3 Tbsp. cooked chopped ramps (or ½ cup sliced shallots*)

1 cup (cooked) protein— chicken, cubed tofu, whatever you have on hand

1 tsp. salt

1 Tbsp. fennel greens, chopped (for garnish)

Heat oil in large skillet, add garlic*, stir for 30 seconds, add winecaps and stir, add water as needed to prevent sticking until the winecaps release their liquid. Cook 5 minutes, add fennel, cook (stirring) 5 minutes, add ramps, ground fennel and salt. Cook 5 minutes more.

Garnish with greens. (Especially attractive served on broad noodles.)

* If using shallots instead of cooked ramp, add the shallots with the garlic and cook for 2 minutes (stirring) before adding the winecaps.

Savoury Wine Caps*

¼ cup corn oil

4 cups wine-cap stropharia mushrooms, chopped

1 carrot, thin sliced

¼ cup parsley, chopped

¼ cup onion, chopped

1 tsp. salt

1 tsp. fennel seeds, ground

1 tsp. cumin, ground

1 tsp. nutmeg, ground

2 cups fresh young spinach or wild curly dock leaves, chopped

1 Tbsp. lemon juice

Sauté the mushrooms in the corn oil with all remaining ingredients except the spinach (or curly dock) and lemon juice, for 15 to 20 minutes, or until the carrots are tender. Stir in the spinach (or curly dock) and lemon juice, reduce the heat, cover, and simmer another 10 minutes. Balance spices as needed.

* Recipe courtesy of "Wildman" Steve Brill (<http://www.wildmanstevebrill.com>), used with permission.

Pickled Winecaps

1 pound (more or less) fresh, small winecaps, unopened, halved or quartered*.

¼ cup olive oil**

2 tsp. Salt

1½ tsp. Peppercorns***

2-3 cloves garlic (depending on size), peeled & quartered

1 tsp. ground mace

3-4 sprigs fresh oregano, or 1 tsp. Dried White vinegar****

(Have several very clean glass jars ready before starting.) In a large pan, heat mushrooms (covered with half vinegar, half water) to boiling, reduce heat, and simmer 5 minutes. Drain. Place a layer of drained mushrooms into a jar. Sprinkle in a little salt. Drop in a few peppercorns. Drop in a piece or two of garlic. Sprinkle in a little mace. Add a sprig of oregano, or sprinkle in a little dried oregano if using. Drizzle in a little olive oil. Repeat in layers until the jar is almost completely full. Prepare a mixture of vinegar & water (approximately 1/3 vinegar to 2/3 water), and pour in over the mushrooms & spices to cover everything completely. Cap tightly, and store in the refrigerator for at least 3 days. These must be kept refrigerated, and will last for up to 6 months.

* Larger mushrooms (bigger than golf-ball size) may need to be cut smaller.

** You can experiment with different flavoured oils, but we generally stick with extra-virgin olive oil.

*** Try multicolour peppercorns for more of a "kick".

**** Try different vinegars such as balsamic, or combining vinegars to taste.

Pickled mushrooms may be used as an addition to salads, as a topping for croustades, or simply eaten with pita bread— and by the way, this recipe works great for other types of wild mushrooms as well, including hens, oysters, and very young, firm, shaggymanes.

Puffball Paradise

Joe and Kathy Brandt

In New England during late summer and early fall, the most obvious members of the macrofungi community are often puffballs, the "giant" variety (*Calvatia gigantea*) in particular, although there are at least a dozen different types that may be found in the U.S., running the gamut in edibility from choice to outright poisonous. All puffballs share a common characteristic when evaluating them for the table, and that is the inner picture when cut in half, which should always be solid white, and devoid of any chambering or evidence of gills, regardless of their



outward appearance. As with all other mushrooms, they must be checked carefully for insect infestation. They can be small and exquisitely delicate, like the pear-shaped puffball (*Lycoperidon pyriforme*) or almost absurdly huge, like the well-known and aforementioned giant puffball, or almost any size in between that you can think of.

After a year's absence, giant puffballs will sometimes appear suddenly almost everywhere you look, and it takes everything you can do to restrain yourself from picking past the point of sanity. One or two of them can easily become more than can be processed and cooked within a reasonable amount of time, and there is very little "shelf life", as many pot hunters have found out the hard way. (This is also the reason why there is no commercial market for the things.) In some years, they seem to line up on the edges of roadways looking like discarded volleyballs, begging you to slow down so that they may jump into your car. Once you arrive home, you realise only a marathon-length session in the kitchen will even make a dent in what would appear to be enough to feed a small army, let alone you and your family. You are then faced with several choices: Call a few friends, and see if anyone wants to take some puffball(s) off your hands, or, break them up and spread them around outside, in the hope that the spores may someday produce offspring. Of course, you can always stay in the kitchen for that marathon cooking session.

Can you preserve puffballs? Well, yes and no. They can certainly be cooked and frozen without difficulty, but considering the sheer volume that puffballs will often yield, this can be a tremendous amount of work. Dehydrating? We'll be honest, and say that it can be done, but the uses are then quite limited. Dried ground puffball may be used as a seasoning in a variety of soups and recipes, but it's strong flavor demands that it be used in moderation. We recommend cooking and freezing them, being sure to wrap the cooked pieces carefully. (We prefer plastic wrap covered with tinfoil.)

The basic method for cooking and preserving slices of giant puffballs is:

- 1) Peel off the outer "skin",
- 2) Slice them (no thicker than about 1/2 inch (12 mm)).
- 3) Coat them with a mixture of beaten egg and milk, or egg substitute.
- 4) Bread the slices with seasoned bread crumbs, panko, or corn flake crumbs.
- 5) Fry them (until golden brown on each side) in several tablespoons of olive oil.
- 6) Finish with a touch of salt and a squeeze of fresh lemon juice.

We suspect that there has been many a myco-chef who has eaten his-or-herself silly just wolfing down hot pan-fried slices at this point, although once cooked, the choices as to what could be done with them are limited only to your imagination. For example, here in the Northeast, the good graces of the universe have seen fit to have puffball season correspond to the time when tomatoes are at peak in late summer, and there are few things that can beat a fried puffball and fresh tomato sandwich, made with any trimmings you deem suitable, fresh basil leaves and mayonnaise included.

A recent discovery for us involves deep-frying puffball cubes (½ inch to ¾ inch (12-18 mm) thick) with the "basic" breading method described above (corn flake crumbs work really well for this particular application), using corn oil or corn and peanut oil, heated to 190°C. Fry cubes until golden brown on all sides (approximately 3-4 minutes), and serve with tomato sauce as a "dip". (The puffball will become semi-solid, and the outer breading will become crunchy— a terrific combination!)

Another fun use for very large slices of pan-fried giant puffball is to use them as wraps— but be careful when handling these, as they're much more fragile than most other materials commonly used for this purpose. Normally, to achieve the feat of cooking a single slice of this size, one standard-size frying pan will handle just one slice at a time— unless like us, you happen to have a big electric griddle, which we had purchased specifically for the purpose of frying large amounts of puffballs.

Puffball Parmesan is surely a favourite, and super simple. Start with the basic fried puffball recipe. Spread a thin layer of your favourite tomato puree in the bottom of a baking pan, and cover with a layer of fried puffball. Top with a layer of shredded mozzarella cheese (Preferably low-moisture, part-skim), fresh ground pepper, and a little shredded Parmesan cheese. If desired, you can repeat with a second layer of everything. Cover tightly with foil, and bake for about 30 minutes in a 175°C oven, or until cheese is all melted, and the dish is heated completely through. (Please note: this can be prepared for cooking well in advance, although the cooking time will be increased if it's stone cold to begin with.)

One of the other great uses for pan-fried giant puffball is in lasagna. For this, you simply substitute the fried puffball in place of the lasagna noodles in any lasagna recipe, or for a more traditional lasagna, just substitute fried puffball for the centre noodle layer. (Please note that this works well if the puffball has been fried and frozen, but it should be thawed before using.)