# THE QUEENSLAND MYCOLOGIST

**Bulletin of**
**The Queensland Mycological Society Inc.**
**Vol 6 Issue 1, Autumn 2011**

The *Queensland Mycologist* is issued quarterly. Members are invited to submit short articles or photos to the editor for publication. The deadline for contributions for the next issue is May 15, 2011, but earlier submissions are appreciated. Where possible, please send full-sized original photos separately.



**CONTENTS**



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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 commonwealth 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.

**Members are reminded that 2011 subscriptions ($20 pp) are now overdue.** Payment can be made by cheque mailed to the Treasurer, Queensland Mycological Society Inc., PO Box 295, Indooroopilly Qld 4068 or directly to the Treasurer at the next meeting. A Membership Renewal Form is included on page 15.

Please ensure that the Secretary (secretary[at]qms.asn.au) always has your current email address.

The Secretary, Queensland Mycological Society Inc, PO Box 295, Indooroopilly Qld 4068

**QMS WEBSITE:** www.qms.asn.au

**Cover photo:** Jutta Godwin took this photo of the lichen *Cladonia floerkeana.* (see page 10).

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## QMS CALENDAR 2011

Meetings are held in the Bailey Room at the Herbarium, Mt Coot-tha, commencing at 7pm on the second Tuesday of alternate months from February, unless otherwise scheduled. Check the website for any changes.

To assist those are unable to attend meetings, notes on the talks are included in the Queensland Mycologist wherever 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. So remember, where possible it is better to attend the meetings, get the information first hand and participate in the invaluable information sharing opportunity.

## QMS Meeting Programme 2011

| **Date** | **Speaker** | **Topic** |
|---|---|---|
| 12 Apr 2011 | QMS AGM<br>Katrina Syme, Mycologist and Botanical Artist | A Fascination with Fungi |
| 14 Jun 2011 | Foray reports: | Cunningham's Gap, Springbrook Plateau, Girraween National Park, Chermside Hills |
| 9 Aug 2011 | Fungimap Report<br>Foray reports | |
| 11 Oct 2011 | Nigel Fechner<br>Foray reports | Fraser Fungi |
| 6 Dec 2011 | David Fisher<br>Foray reports | Early mycologists, Elias Freis etc. |

# Meeting Supper Roster 2011

Two volunteers are required for each meeting – one to bring something savoury and one something sweet. TBA=Help! Any volunteers?

| Date | Savoury | Sweet |
|---|---|---|
| 12 Apr 2011 | QMS AGM - all to bring a small plate | |
| 3 Jun 2011 | Marie | Jutta |
| Aug 2011 | TBA | TBA |
| Oct 2011 | TBA | TBA |
| Dec 2011 | Christmas Party all to bring a small plate | |

# QMS 2011 Field Trip Programme

Field trip details may change as a result of drought or other unforeseen circumstances. Check the website for changes.

| Date | Location | Leader (contact details) |
|---|---|---|
| 15-17 Apr 2011 | Girraween National Park | John Dearnaley & Patrick Leonard (Patrick Leonard patbrenda.leonard [at] bigpond.com) |
| 30 Apr 2011 | Cunningham's Gap, Main Range National Park | Susan Nelles |
| 28 May 2011 | Chermside Hills, Brisbane | John Wrench (win_john [at] bigpond.net.au) & James Hansen |
| 2 July 2011 | Queen Mary Falls | Nigel Fechner (nigel.fechner [at] derm.qld.gov.au) |
| TBA | Mushroom Farm | Jon Atkinson (buildingbistro [at] hotmail.com) |
| TBA | Workshops & Forays for June, July, August, September, October & November. | |

# 2011 Workshop Programme

The 2011 workshop programme is yet to be finalised. Look out for details in future newsletters, and keep an eye on the QMS website. Workshops are given on a cost recovery basis so there will so will be a charge between $10 and $30.

# Don't Spread myrtle rust!

By now you will all be aware of myrtle rust which is such a threat to our forests and gardens. It is too late to stop it, but we can slow its spread and that of other pathogens and weed fungi such as *Favolaschia calocera* by practicing good hygiene.

Members should use clean equipment and clothes including hats, changing between sites and before and after gardening. For all future QMS forays please bring/wear clean equipment, hats, shoes and clothes. Disinfect shoes, clothes, and equipment as far as is practicable.

A very effective and inexpensive disinfectant for fungi is 70% alcohol (ethanol). Ordinary meths is almost pure alcohol (with a few nasties added so at cannot be drunk). Simply dilute it with water: e.g. put 350mL in a 500mL trigger spray and top it up from the tap. For groups on field trips a 1

litre sprayer bought from a garden centre would be a more robust option. For skin you can get disinfectant hand-washes in pump bottles from chemists- these contain ingredients to prevent drying of skin. There are also disinfectant wipes available.

**Biosecurity Queensland** have advice for people visiting and working in bushland at http://www.dpi.qld.gov.au/4790_19788.htm. The following is taken from their web site, but you should visit the site for more information, including identification:

## Arrive clean, leave clean

### Vehicles.

Ensure your vehicle is clean before entering a bushland area. Myrtle rust spores are tiny, so cleaning you car will reduce the likelihood that your car will carry the spores into bushland.

Where possible, leave vehicles in a designated car park and don't allow bushland plants to come in direct contact with the vehicle. If possible, limit the number of vehicles entering the bushland area.

Preferably, vehicles that have been in contact with myrtaceous plants should be washed thoroughly before going to a new bushland site.

### People.

If possible, limit the number of sites you visit to one site per day.

Minimise the number of personal items you carry, as all items that come into contact with myrtaceous plants could spread myrtle rust.

Change into clean clothes, including hats, gloves and footwear, before moving to another bushland site.

### Clothing and personal effects.

After visiting bushland, wash clothes, hats and gloves before wearing them in another bushland site or garden. Wipe down any other personal effects with water and detergent or wet wipes.

### Footwear.

Clean footwear between visits to bushland sites. To clean footwear, remove soil, leaves and mud, and then wash using water and detergent.

Cleaning should occur when you leave each site or as soon as you arrive home.

## Pack light

Minimise the number of items you bring to the site to reduce the opportunity to spread myrtle rust.

If possible, clean camping and hiking equipment when moving between sites or when you arrive home. To clean, remove soil, leaves and mud, and clean with water and detergent. For ease of cleaning, you should preferably use equipment that is in good condition and does not have wooden or cracked handles.

## Be aware

People who visit bushland must be aware of what myrtle rust looks like and the plants that it can affect.

Avoid parking or camping close to plants that might be a host for myrtle rust. If you suspect myrtle rust, report it on the contact numbers below.

## Keep to tracks

*(As this is not an option for our field trips, we need to be especially vigilant).* When driving through bushland areas, try to stick to allocated roadways and tracks to minimise contact between vehicles and myrtaceous plants.

When hiking or bushwalking, stay on pathways wherever they are available.

## Don't move plants

The movement of infected plant material can spread myrtle rust over long distances. A plant may be infected with myrtle rust before is shows visible signs of the disease. Don't move plants or plant cuttings into or out of bushland areas.

## Reporting suspected myrtle rust

Report any bushland plants suspected of being infected with myrtle rust to Biosecurity Queensland on 13 25 23 or the Exotic Plant Pest Hotline on 1800 084 881.

# President's Report

Sapphire McMullan-Fisher

To start with I would like to say that I hope that our members who were affected by the horrible weather over the summer are recovering well. Our best wishes now go across the Tasman to those affected by the Canterbury earthquakes.

Over the summer the QMS executive committee commented on the draft Queensland Biodiversity Strategy and accompanying "Protected Areas for the Future" see http://www.derm.qld.gov.au/wildlife-ecosystems/biodiversity/biodiversity-strategy.html. Details of our critique are on our website under the title '**Aiming for a comprehensive Queensland Biodiversity Strategy'.** We also shared our comments with a number of conservation groups.

The first meeting of the year was held on 8 February 2011, at the Queensland Herbarium. Members and visitors were fascinated by a talk from Dr Ross McKenzie on '**Mycotoxicosis Oz: A Survey of Poisonous Fungi in Australia'.** Ross is a retired Veterinary Pathologist & Toxicologist. A summary from this presentation are included in this Newsletter.

Also at the February Meeting Ailsa Holland alerted members to the fact that **Myrtle Rust *(Uredo rangelii)*** had been found in both Queensland and New South Wales. Here are some website links for more information about Myrtle rust (*Uredo rangelii*):
http://www.daff.gov.au/aqis/quarantine/pests-diseases/myrtle-rust
http://www.dpi.nsw.gov.au/biosecurity/plant/myrtle-rust
http://www.dpi.qld.gov.au/4790_19788.htm
http://www.dpi.qld.gov.au/4790_17185.htm

As Myrtle rust is a notifiable plant disease so please contact **Biosecurity Australia** and appropriate state authorities if found.

James Hansen is organising a QMS stall at the Hillbrook Anglican School Sustainability Day event planned for Saturday 4 June 2011 from 10am to 4pm at Hillbrook Anglican School, 45 Hurdcotte Street, Enoggera. James will need help with the QMS stall and all members are encouraged to attend.

A number of people are interested in fungi which glow in the dark. There is a local website which contains information about local bioluminescent fungi:
http://www.springbrook.info/research/bioluminescence.htm

I've also sent David a yummy mushroom recipe that members may want to try. We cooked this up as our main dish on Christmas day – we called it "Mushroom Wellington" rather than Rose Elliot's fancy name. We also added a mix of nuts including Brazil, macadamia and cashews. We also had cranberry jelly and chilli chutney as accompaniments – it was good served both hot and cold, it also freezes well.

Many weird and wonderful fungi images get sent to me. One such image was from Mary Monteith, who is a member of the Noosa Parks Association Botany group. Mary's image below shows a moth parasitised by a fungus, which is likely to be an *Akanthomyces* according to David Holdom our wonderful newsletter editor and local entomopathogenic fungi expert. These are parasitic on invertebrates. These fungi are a bit like the better known entomopathogenic fungi like Cordyceps, often called vegetable caterpillars and are used in Chinese medicine. Similarly research into *Akanthomyces* has found novel antibiotics like Akanthomycin, a new antibiotic pyridone. To see more mummified moths and other invertebrates simply do an image search on "*Akanthomyces*".

The white area's on the fungal branches are likely to be the conidiospores (asexual spores) which help the fungus spread around the environment. There is research into entomopathogenic fungi to see if they can be used as biological control of pests. It seems to me that the natural world is endlessly complex and inventive. It is great that we have observant people who can bring such amazing things to our attention.

Mummified moth parasitized by a probable *Akanthomyces* fungus found on Gheerull Falls track, Blackall Range (© Mary Monteith).

Finally I'm looking forward to our AGM on **Tuesday 12 April 2011, 7 pm.** Our guest speaker is Katrina Syme who is an superb Mycologist and Botanical Artist. The title of Katie's presentation will be 'A Fascination with Fungi' which I am sure will be interesting and entertaining. While we are on the subject of the AGM, I would like to thank the hard work and enthusiasm of our committee, foray leaders and recorders, our librarian Susan, website maintainer Andrew, Megan for getting our permit report in and last but not least our wonderful photographers. QMS has an amazingly generous group of people who give their time to give us great fungal events.

# QMS foray to Cooloola - 29 January 2011

Sapphire McMullan-Fisher

The weather was kind for the first foray of the year and gave us a lovely overcast day, which is always best for a fungal foray, although perhaps it was a little windy. There had been recent rains and the site was drying out with the puddles gone but the soil still damp. Ten members came out, about half from Brisbane, which is dedicated for half a days foray. We also were joined by two Sunshine Coast wallum enthusiasts Stephanie and Diane.

Wallum woodland at Cooloola National Park including *Banksia robur.* © SJM McMullan-Fisher.

Thanks to Marie Fisher for being the foray recorder for the day. The wallum woodland was looking handsome with several flowers including *Banksia robur, Grevillia leiophyllum* and little blue bladderworts (*Utricularia uliginosa).*

Despite the high rainfall from the La Nina weather there were not many macrofungi about. There were several unnamed polypores and a large amount of old, bleached out *Pycnoporus* but enough fresh material that the forayer's new to fungi got to see the bright orange regular. There was also a pretty orange *Gymnopilus* sp. but this was not collected as there was a single fruiting body and identification often requires veil characteristics of the immature specimens.


Single *Gymnopilus* sp. fruit body on log. © M Prance.

One interesting specimen found by Megan which looked like a typical brown polypore turned out to be *Gloeophyllum abietinum.* This species is tough and woody like many polypores but it has irregular plates which look like gills. I checked this specimen under the microscope and it had brown

*Gloeophyllum abietinum* looks like a woody polypore from above but has gill-like hymenium underneath. © SJM McMullan-Fisher.

*Boletellus emodensis* on woody gall, note bluing reaction on pores. © SJM McMullan-Fisher.

coloured, thick-walled cystidia, some of which had occasional encrustations. Based on these characters the species name *abietinum* was determined. This specimen will be lodged at the Queensland Herbarium.

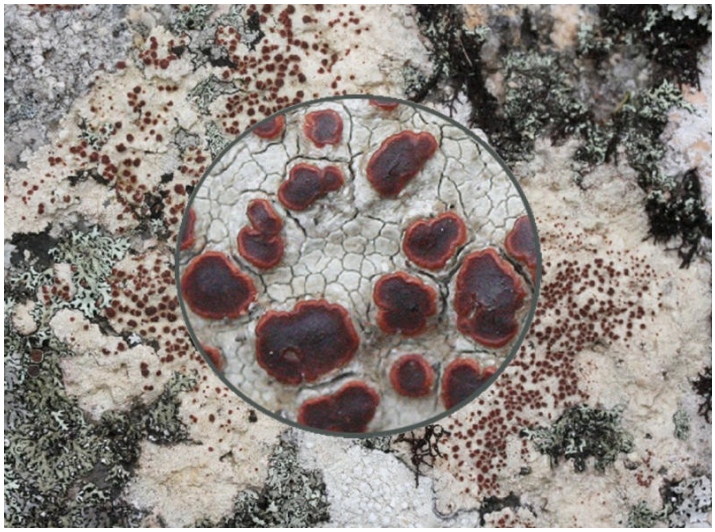
A new named taxon to the site, but a regular species seen on other QMS forays was *Boletellus emodensis.* This lovely bolete regularly scrambles up wood to produce fruiting bodies, in this case it was fruiting on a massive dead gall, which was part of a log on the ground. I took the mature fruiting body back home and checked the spores to be certain of the specimens identity but did not make a collection for the herbarium as there were only two fruit bodies and we wanted to leave the young specimen behind to spread it's spores.

Two named species and one new genus were added to our ongoing site list. Given there were so few new species there will be no species list in this report but if members are interested they can find a copy on the QMS field trip website.

# For the Love of Lichens

Jutta Godwin

Don't forget your magnifying glasses when you go bush. It's the little things that can make a walk very exciting. Once you discover the beauty of lichens along the way, you'll be hooked.



*Ramboldia sanguinolenta* – Stanthorpe on rock © Jutta Godwin

Australia's still growing list of lichens currently consists of 3610 species (including Island territories), with 35% considered to be endemic. Half of the named species are known from Queensland, and more species are expected to be discovered.
Lichens are a fascinating symbiosis between a fungus and one or more photosynthesising algae or, to a lesser extent, cyanobacteria. The partnership works well. The photobionts contribute to this partnership by providing carbohydrates while the fungus gives the lichen its body and ensures protection against i.e. moisture loss and UV exposure. Lichens are named after the fungal partner. Given time, moisture and some light, lichens grow on almost any substrate. including man-made structures. In a natural environment they grow on soil, rocks, bark of trees, dead wood, and even leaves of rainforest vegetation.

Lichens are categorized according to their growth forms. They are aptly named **fruticose** when they have a shrubby appearance and can be hanging or grow upright. They can truly look like

From left: fruticose lichens on bark *Usnea scabrida* subsp. *elegans*, Stanthorpe; *Teloschistes sieberianus, ,* Toowoomba; and *Ramalina celastri*, Indooroopilly © Jutta Godwin

Foliose lichen *Flavoparmelia rutidota,* Stanthorpe © Jutta Godwin

miniature shrubs with branches, attached to their substrate at one point only. These branches can resemble pendulous straps or have a cylindrical shape or even be hollow like the perforated pseudopodetia of *Cladia retipora.*

They are called **foliose** when the thallus has a leaf-like and mostly flat appearance, grows in lobes, has a distinctive upper as well as lower surface (unlike its crustose counterpart), and is only loosely attached to the surface it grows on. The thallus of

**crustose** lichens is very thin and attached to the surface like a crust. Any removal of the lichen means taking parts of the substrate as well.

© Jutta Godwin

**Squamulose** lichens like *Cladonia rigida* (above, on wood, Indooroopilly) have primary and secondary thalli. The primary thallus consists of minute scales from which fruticose podetia arise. Fruiting bodies can be found at the tip of fertile podetia.

Lichens generally reproduce vegetatively via soredia or isidia, two structures on the thallus surface consisting of fungal hyphae and algal cells. Both easily break off and disperse to new locations where they may start a new lichen. **Isidia** are tiny often cylindrical or pimplelike protuberances on the thallus surface. **Soredia** mostly have a powdery appearance or develop in clusters called soralia.

From left: Isidia on *Leptogium* sp, Indooroopilly; soralia on an unidentified lichen from Mt Nebo.
© Jutta Godwin

Only the fungal partner of a lichen can reproduce sexually. Most lichens are ascomycetous. Fungal fruiting bodies called **apothecia** come in a variety of shapes. They are often disc-like when emerging from the lichen thallus, but may also have an elongated form or may be positioned on the tips of podetias like different Cladia and Cladonia species. In some lichens spores are produced in **perithecia**, flask-like fruiting bodies imbedded in the thallus and containing the ascospores.

From left: *Glyphis cicatricosa* (on bark, Indooroopilly), ground lichens *Cladonia floerkeana* with bright red apothecia (Chapel Hill) and *Cladia retipora* with fungal fruiting bodies at tip of pseudopodetia (Stanthorpe) © Jutta Godwin

Lichen identification starts with the description of thallus structure, surface texture, and by distinguishing the reproductive methods. Thallus colour can be important but is unreliable as it varies with moisture content. Spot test are an important method. Very small amounts of chemicals are applied to the thallus. Any potential colour change in the affected area may give clues to the lichen‘s identify. This traditional method based on chemistry is relatively easy to apply but also limited. It has its improved continuation in the use of the more sophisticated thin layer chromatography where extracts of the lichen thallus are spotted onto a glass or aluminium plate and undergo a series of solvent and other treatments identifying their chemical components.

Fungimap target species *Heterodea muelleri*, a common ground lichen in open eucalypt forests of SE Qld © Jutta Godwin

Lichens dry out easily (see *H. muelleri* above left) but are equally fast in re-absorbing water after rainfall or from the atmosphere. Photosynthesis is resumed without delay once the thallus re-hydrates. Lichens are pioneers. Their acids break down rocks and help the formation of soils. They are able to colonise areas bare of any vegetation by contributing to the creation of protective soil crusts. Growth in lichens is slow compared to that of our trees, shrubs and flowering plants. It depends on the type of habitat, on climate, and, of course, on the type of lichen. Among the slowest growing lichens is *Rhizocarpon geographicum* developing in maritime Antarctica at a rate of 16mm per century. It is obvious that lichens are hardy survivors. They are found in all habitats from hot deserts to Antarctica where they form *the* by far dominant terrestrial vegetation.

How our native animals use lichens needs to be further explored. We know of a range of invertebrates feeding on lichens, among them mites, moth larvae, snails and slugs. Others use them to disguise themselves by covering their body with fragments of lichens or have evolved

The juvenile Spiny Leaf Insect (*Extatosoma tiaratum*) has the appearance of a foliose lichen. © Jutta Godwin

to resemble lichens like the insect depicted on the left. Birds build nests with lichen fragments, and some of our small mammals are known to feed on lichens. Lichens are an important food source for the endangered Mahogany glider in Northern Queensland.

Lichens are ideal biological indicators. In the northern hemisphere lichens are used to measure climate change, and research suggests that movement of lichen species already occurs. Because of the easy way they can absorb and store water, minerals and ie sulphur dioxide and nitrogen compounds they are used in many European countries to assess man-made atmospheric pollution. Tolerance levels differ among lichens with fruticose lichens being the most sensitive ones.

*Cladonia sulcata*, Mt Coot-tha. © Jutta Godwin

A lot of community education is needed to avoid the potentially damaging effects on slow growing lichens through hiking, mountain biking and other leisure activities. Fires, whether controlled or wild, destroy many lichens in natural settings. Some of them may never recover and locally be lost for good. Having said that, a few months ago a search for remaining ground lichens after backburning in Mt Coot-tha's foothills revealed the lower parts of a gully untouched by the fire. A group of Cladonia species among them *Cladonia sulcata* was found. This is particularly exciting as Queensland records for *C. sulcata* are only known from northern parts of the State.

## Further reading for beginners:


D. Eldridge and M. Tozer *A Practical Guide to Soil Lichens and Bryophytes of Australia's Dry Country,* (1997) 'Dept of Land and Water Conservation, Sydney, 1997

W. Purvis *Lichens*, The Natural History Museum, London, 2000

G.Kantvilas and S.J. Jarman, photographs by B.A.Fuhrer *Lichens of rainforest in Tasmania and south-eastern Australia.* Flora of Australia Supplementary Series Number 9, Australian Biological Resources Study, 1999, Canberra

www.anbg.gov.au/lichen (highly recommended new website!)

www.anbg.gov.au/abrs/lichenlist/introduction.html

http://members.westnet.com.au/roderickrogers/ (focus on subtropical Qld lichens)

# Mycotoxicosis Oz: A Brief Survey of Poisonous Fungi in Australia

Dr. Ross McKenzie PSM DVSc, Veterinary Pathologist & Toxicologist (retired)
yapunyah.house [at] bigpond.com

*This is a brief summary of a talk to the Queensland Mycological Society, 8 February 2011, based on a larger document (itself a summary, but too long for the newsletter) that members can view on the QMS website, www.qms.asn.au. That version too should not be taken to be comprehensive in any way.*

## 1. Overview

**1.1 Why are fungi poisonous?** Toxins are often natural chemical survival tools, protecting against animals such as molluscs and insects that eat them (macrofungi), or defense against other microbes in the same nutrient source (e.g. mould and ergot fungi). Toxins of *endophytic fungi* may help the host plant resist insect attack. Poisoning of humans and domestic animals is "unintended collateral damage" in the "war for survival".

1.2 Poisonous fungi: The Australian context**..** About 250,000 fungal species occur here, but known or suspected poisonous species account for very few of these (< 1%). The main risk to humans is from yeasts producing ethanol. Minor risks come from moulds producing aflatoxins and ochratoxins, and some macrofungi (e.g. *Amanita* spp.)

The main risks to domestic animals are from moulds producing aflatoxins, phomopsins and fumonisins, ergots producing ergot alkaloids and paspalitrems, and endophytes producing lolitrems and ergot alkaloids.

2. Poisonous Macrofungi (Basidiomycetes & Ascomycetes)

**2.1 Macrofungal peptides: Amatoxin or phalloides syndrome** results in liver destruction and death has been recorded in humans and dogs. Fungal taxa in Australia containing these toxins are *Amanita phalloides* (death cap- deaths of humans and dogs have been recorded in Australia), *Galerina unicolor, G. marginata, G. autumnalis* (deadly galerina), *Hypholoma fasciculare* (sulphur tuft), *Lepiota citrophylla* and *L. helveola.*

**2.2 Orellanine:** orellanus syndrome is characterised by vomiting and diarrhoea, then a gap of 4-15 days delay before kidney failure signs appear, followed by kidney destruction and death. Death have been recorded in humans (Europe, North America, Tasmania) and sheep (Scandinavia only). Fungal taxa in Australia containing these toxins include *Cortinarius eartoxicus* (with deaths of humans recorded).

**2.3 Gyromitrin syndrome** involves destruction of red blood cells (haemolysis) and has been recorded as killing humans and dogs. Fungal taxa in Australia containing these toxins include *Gyromitra esculenta* (false morel).

**2.4 Muscarine syndrome** results in vomiting and diarrhoea, sweating, mental confusion, pin-point pupils, slow heart, low blood pressure and can cause death (humans, dogs ). Fungal taxa in Australia containing these toxins include *Rubinoboletus* sp. (undescribed - humans) *Amanita preissii, Inocybe fastigiata* (straw-coloured fibre-head), *I. geophylla* (white fibre-head), *Mycaena pura and Tricholoma virgatum.*

**2.5 Isoxazoles: pantherina (ibotenic acid – muscimol)** syndrome shows as dizziness, hallucinations, sweating, excessive salivation, increased body temperature, convulsions and tremors. Deaths have been recorded in humans and dogs. Fungal taxa in Australia

containing these toxins include *Amanita muscaria* (fly agaric) with deaths recorded for dogs in Australia

**2.6 Coprine: alcohol-related syndrome** symptoms include warm face, tingling arms & legs, headache, vertigo, confusion, nausea, vomiting, racing heart, low blood pressure and collapse. It only occurs in humans when the fungi are consumed with alcohol. Fungal taxa in Australia containing these toxins include *Coprinus atramentarius* (common ink cap).

**2.7 Psilocybin: hallucinogenic syndrome** results in delirium, uncontrollable laughter, hallucinations, mental confusion, nausea and dilated pupils in humans. Domestic animals are susceptible. Fungal taxa in Australia containing these toxins include *Psilocybe cubensis* (gold top), *P. subaeruginosa, P. semilanceata, Panaeolina foenisecii, Gymnopilus junonius* (spectacular rustgill) and *Stropharia aurantiaca.*

**2.8 Gastrointestinal syndrome (unidentified toxins)** symptoms include nausea, vomiting, abdominal pain, diarrhoea. Humans and possibly dogs affected. Major fungal taxa in Australia containing these toxins include *Chlorophyllum molybdites* (green-spored parasol) (deaths in- humans) and *Agaricus* sp. (yellow-staining mushrooms) Other causes of Gastrointestinal syndrome in Australia include *Amanita xanthocephala, Armillaria mellea, Collybia dryophila, Dermocybe sanguinea, Entoloma* spp., *Hebeloma* spp., *Hygrocybe conica, Lepiota* spp., *Lepista nuda, Macrolepiota* spp., *Omphalotus nidiformis, Panellus* spp. *Paxillus involutus, Pholiota* spp., *Stropharia coronilla, Tricholoma* spp., *Boletus* spp., *Sullius* spp., *Lactarius* spp., *Russula* spp., *Morganella* spp., *Ramaria* spp., *Polyporus* spp. and *Scleroderma* spp.

**2.9 Haemolytic syndromes** result in blood destruction (haemolysis) leading to anaemia and kidney failure. In humans, causes include raw mushrooms eaten *to excess* (cooking destroys some toxins) and allergy in some individuals (Paxillus syndrome). Fungal taxa in Australia containing these toxins include *Pleurotus ostreatus* (edible oyster mushroom) and *Paxillus involutus* (brown roll-rim)

**2.10 Phallales (stinkhorn fungi) - unidentified toxins.** These cause effects including vomiting, diarrhoea, incoordination, collapse, liver damage, and death notably in dogs. Fungal taxa in Australia reported as producing poisonings include *Aseroe rubra* (starfish fungus), *Phallus rubicundus* (red stinkhorn) (dogs killed) and *Phallus multicolor* (crinoline fungus).

3. Mycotoxins from Moulds (Ascomycetes)

Mycotoxins are low molecular weight, non-antigenic chemicals produced by fungi that can poison animals. Sources include mould fungi (agents of plant decay), endophytic fungi (cryptic and symbiotic inhabitants of many plants) and ergot fungi (parasites of grass seeds). Significant impacts on humans and domestic animals usually come from standing crops (e.g. lupins, maize), particular pasture species (e.g. ryegrass, tall fescue) and stored feeds (e.g. maize, sorghum, peanuts, oilseeds, bread, feed pellets, dry dog food) with the latter being least important in Australia.

**Mycotoxin production in stored feeds.** Common predisposing causes include high moisture content at harvest, weather damage or wetting of stored feed and physical damage to feed grains during harvest and drying processes. Damaged kernels are more susceptible to fungal infection. Insects are the commonest cause of this damage

**General effects of mycotoxins on domestic animals.** Subclinical effects have the most economic impact, leading to reduced growth efficiency, lowered feed conversion rates, lowered reproductive rates, impaired resistance to infectious disease, reduced efficiency of vaccinations, and pathological damage to organs (liver, kidney, *etc.*) Clinical effects are “the tip of the iceberg”.

**3.1 Aflatoxins** cause liver damage. Small doses cause anaemia, bleeding, jaundice, chronic ill-health, and possibly neoplasia, while large doses cause death. Species affected (in descending order of susceptibility) are poultry, dogs, pigs, cattle and humans The main fungal source is *Aspergillus flavus* growing on carbohydrate-rich substrates. Sources in Australia include peanut kernels from drought-affected peanut crops causing aflatoxicosis in pigs and cattle, and *A. flavus*-infected mouldy bread affecting dogs.

**3.2 Phomopsins** are produced by *Diaporthe toxica*, a saprophyte in dead residues of *Lupinus* spp. crops grown for their seeds . The toxins cause liver damage [lupinosis] and muscle damage, mostly in sheep, but also in cattle and horses. In Australia, hosts include *L. albus* (white lupin), *L. angustifolius* (New Zealand blue lupin), *L. cosentinii* (Western Australian blue or sandplain lupin) and *L. luteus* (yellow lupin). Lupin crop stubble, in SW Western Australia and Victoria affects sheep and cattle.

**3.3 Zearalenone**. These toxins have oestrogenic effects, resulting in early sexual development in young animals and infertility in adults, with pigs and turkeys mostly affected, rarely sheep and cattle. Sources include *Fusarium graminearum* [*Gibberella zeae*] in feed grains (maize, sorghum). Some pastures in New Zealand have caused problems in sheep and cattle..

**3.4 Fumonisins** come from *Fusarium verticillioides* [syn. *F. moniliforme*] ear rot on maize, and are associated with heavy rains in late maize growing seasons. In horses, brain & liver damage lead to equine leucoencephalomalacia (blind staggers), while pigs suffer heart failure (pulmonary oedema). N.B. Maize does not have to be visibly mouldy to be toxic to horses.

**3.5 *Aspergillus clavatus* neurotoxin** is produced by *A. clavatus* on barley sprouts grown as cattle feed in droughts and affects cattle and sheep. The toxin, which is associated with hydroponic systems where the climate control fails, has not been identified. It causes tremors, stiff gait, collapse linked to brain and spinal cord grey matter damage leading to death in cattle and sheep.

**3.6 Sporidesmin** is found in *Pithomyces chartarum* spores on ryegrass pasture litter. In warm humid weather there can be > 70,000 spores per gram of pasture litter. It causes liver (bile duct) damage leading to hepatogenous photosensitisation (facial eczema) in alpacas, sheep, cattle and goats in descending order of susceptibility. It is common in New Zealand but rare in Australia.

## 4. Poisonous Endophytes (Ascomycetes)

**4.1 Lolitrems** are produced by *Neotyphodium lolii* [syn. *Acremonium lolii*] in *Lolium perenne* (perennial ryegrass) seeds and leafsheaths in well-cropped pasture under dry conditions. They cause tremors and staggers which are reversible and cause few deaths. Alpacas, sheep, horses, deer and cattle are affected in descending order of susceptibility.

## Poisonous Ergots (Ascomycetes)

**5.1 Ergot alkaloids.** Sources include *Claviceps* spp. (ergots of grain crops & grasses) and *Neotyphodium coenophialum* endophyte in *Festuca arundinacea (*tall fescue) pasture. The toxins cause damage to blood vessels and that can lead to gangrene (fescue foot, St.Anthony's fire), hyperthermia (excessive body temperature), agalactia (failure of milk production) in sows, cows and mares, dystocia (difficulty giving birth) in mares, and rarely abortion in pigs, cattle, horses, & humans.

Sources in Australia include *C. purpurea* sclerotia (ergot of rye) in *Lolium rigidum* (annual ryegrass) seeds (cattle affected) and *C. africana* (sorghum ergot) (pigs and cattle affected).

**5.2 Paspalitrems** are produced by *Claviceps paspali* (paspalum ergot) in seedheads of *Paspalum* spp. pasture grasses. Signs are tremors and staggers but are reversible with few deaths recorded. Cattle, sheep and horses are affected. Paspalum ergots do not produce ergot alkaloids.

## 6. Poisonous Gall-forming fungi (Ascomycetes)

**6.1 *Corallocytostroma ornicopreoides***, a gall-forming fungus, produces an unidentified toxin in galls ('corals') on *Astrebla* spp. (Mitchell grass) stems. The growth of galls is promoted by late wet season rains, about once in 20 years. The syndrome is known as 'black-soil blindness' and was identified in the Kimberley region, WA in 1994. The toxins cause blindness followed by rapid death, with 100% mortality. Internal effects are kidney, liver and stomach damage, with cattle affected.

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# Rose Elliot's Mushroom Pâté En Croute

(Serves 8)

A pâté or terrine of mushrooms and nuts wrapped in puff pastry has long been a favourite dish of mine. It's wonderful for a special meal.

**Ingredients**

2 large onions, chopped

2 tablespoons olive oil

2 garlic cloves, chopped

250 g / 9 oz chestnut mushrooms, sliced roughly

225 g / 8 oz cashews, powdered in a food processor or coffee grinder

225 g / 8 oz ground almonds

225 g / 8 oz whole meal breadcrumbs (stone-ground or very high fibre)

2 tablespoons soy sauce

2 tablespoons lemon juice

2 teaspoons dried tarragon

1 teaspoon yeast extract

500 g / 1 lb 2 oz puff pastryBeaten egg or soya milk, for brushing

**Method**

1. Preheat the oven to 200°C / 400°F / Gas Mark 6.

2. In a large saucepan, fry the onions in the olive oil for 7 minutes, until tender, then add the garlic and mushrooms and cook for a further 5 minutes, or until the mushrooms are tender.

3. Then tip the mixture into a food processor and blend to a purée.

4. Put the ground cashew nuts and almonds into a bowl with the breadcrumbs, the mushroom purée, soy sauce, lemon juice, tarragon and yeast extract and mix well. It will be quite stiff. Season well with salt and pepper.

5. Roll the puff pastry out on a lightly floured board to make a square about 38 cm (15 in) in size. Transfer the pastry to a baking sheet and heap the mushroom mixture in the centre, forming it into a loaf shape.

6. Make diagonal cuts in the pastry about 1 cm (1/2 in) apart on each side of the mushroom mixture, then fold these up over the mushroom pâté to make a kind of plait effect. Tuck in the ends neatly, trim off any extra bits and brush with beaten egg or soya milk.

7. Bake for 40 minutes or until the pastry is puffed and golden brown.

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