FUNGI FORAGERS

No.27: November 2021

OUR PURPOSE: TO RAISE AWARENESS AND INTEREST IN FUNGI OF THE CAIRNS REGION

This newsletter is not associated with any club or organisation but is emailed free of charge to anyone who may be interested. Anyone who wishes to contribute to the newsletter with observations, anecdotes, corrections, comments or photographs is welcome to do so. Although this "newsletter" is science-based we try not to make it too "scientific". We recognise that there are school children, bush-walkers and others just interested in fungi, and we hope this leaflet will become a medium for furthering that interest. **The emphasis is on fungal biology and ecology** rather than identification.

Barry Muir, Editor Jenn Muir

Field meetings to find interesting species of fungi (not necessarily edible species) are known as 'forays', after the first such meeting organized by the Woolhope Naturalists' Field Club, Herefordshire, England, in 1868 and entitled "A foray among the funguses" [*sic*]. The Woolhope Club was an early member of the British Mycological Society founded in 1896. (Wikipedia)

SPECIAL EDITION PROMPTED BY THE APPROACHING WET SEASON:

A CHANCE FOR YOU TO CONTRIBUTE TO EVERYONE'S KNOWLEDGE OF FUNGI

Since February 2017 when this newsletter was first published, the readership has increased from a couple of dozen to nearly 500 readers. This is most gratifying, but it also provides a great opportunity. Much is written in popular literature about fungal taxonomy and edibility, but information on fungal ecology is almost totally restricted to scientific journals.

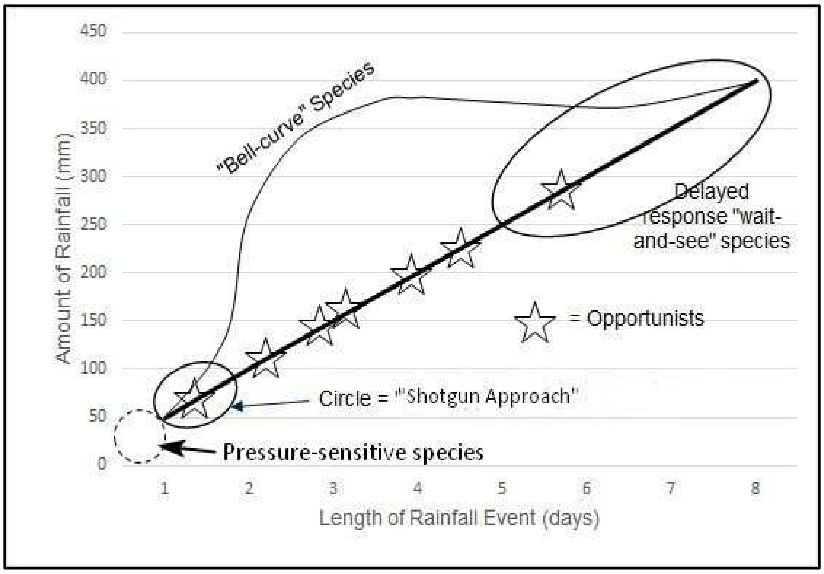
Many of our readers are in the tropics and the wet season is about to start. This is too good an opportunity to miss, so grab your umbrella and a comfy chair and go for it! Readers in southern Australia need not feel left out. Many observations made here could, and probably do, apply in cooler climes – we just don't know until observant people spend time with it, and record what they learn.

Study of fungal ecology raises a huge number of questions. Many of those questions will only be answered by detailed and complex studies of biochemistry and genetics, and remain in the domain of universities and other research organisations, but there are also many questions that can be tackled by citizen science.

Observation is the key. Most of us go fungus hunting for interest, photography, edibility, or just chance, as we bushwalk or garden, but in the process of doing so, we observe. Those observations, no matter how random and perhaps *seemingly* unimportant, can provide a great deal of information. When its all put together; patterns begin to emerge. Alse have a look at "You can do research on fungal ecology" in Cairns Fungi Foragers (CFF) No.12: December 2018. Just ask, if you'd like us to send it to you again.

Below I have raised a few questions. I believe readers have made observations that shed light on some of the answers. It doesn't require statistics or detailed study – just recording the information and sending it to me, so that I can search for patterns and pass the information on to other researchers. I can be contacted at unit57.may@gmail.com. In many cases, studies of this type provide an opportunity to take a folding chair into the garden or bush, and spend some quiet time just watching fungi going about their business! Take a notebook and camera, and record what you see. **DO NOT** rely on memory.

1. One of the most interesting observations is to look at fungal succession. I now have detailed information on several species, but much more is needed.



The diagram at left is based on real data and was originally presented in CFF No.18: February 2020. It shows five types of fungal fruiting:

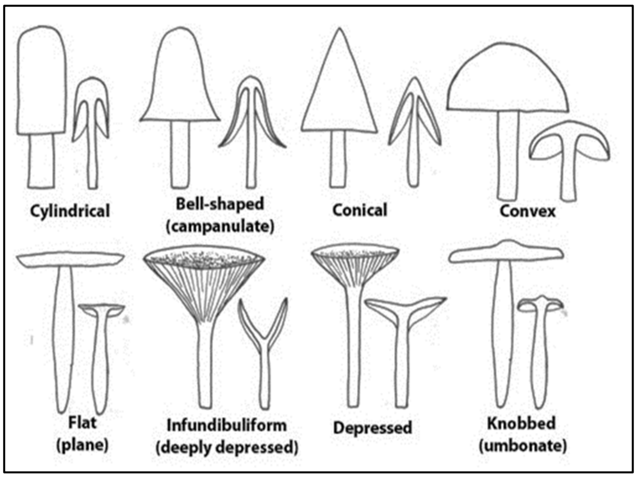
(A) a group of species that detect the reduced air pressure of an oncoming storm, and fruit just *before* it starts to rain;
(B) what I have termed "Shotgun" species. Immediately good rains occur, "Shotgun" species spring up and commence release of spores within a day or so, then disappear for the rest of the rainfall event or season;
(C) "Opportunists" that also appear immediately after rain but then disappear, only to reappear again each time there is a new rain event;
(D) "Bell-curve" species that appear shortly after rains commence, but only in small numbers. They then continue appearing throughout the rain event, gradually increasing in numbers then tailing off to only a few as food resources become depleted; and finally
(E) the "Wait and see" species. These do not appear until right at the end of the growing period, be it a single long rainfall event or the wet season in its entirety.

All that is required to record the information is to observe the species and relate them back to the time they occurred within the rainfall event or season. If you cannot identify the species, send me a heap of pictures of them – upperside and underside if they are mushrooms, and tell me where your nearest weather station is located.

2. Some work has been done on how airflow over fruit bodies can affect the way spores are dispersed from the gills or pores of typical mushroom-shapes such as cylindrical, convex and flat. However, nothing has been done on spore dispersal from other fruit-body shapes, such as campanulate, conical, infundibuliform, depressed, and umbonate (see diagram at right).

Presumably these shapes provide some advantage to spore dispersal *or longevity of the fruit body*: otherwise, why would fungi evolve with them? Is there an ecological advantage to the fungus in possessing one of these other shapes? Has anyone observed spore dispersal in these other shapes?

The easiest way to observe spore shedding is to have a light *behind* the fruiting body. The dropping of spores from between the gills, or out of the pores, can be seen against the light.



Source: http://urbanmushrooms.com/index.php?id=69

3. When you have observed variations in fruit-body colour, say a single species growing on a log, or on a patch of mulch, or in the garden, do these variations in colour correspond with the intensity, direction, or directness of the light in the environment in which the fungus is growing? For example, are the ones growing in direct light a different colour to those growing in shade at the hottest (brightest) time of day? In the garden, do they receive reflected light from a wall or window? Of course, all these factors can change in the course of a day or fruiting period. If they fruit for an extended time, such as several days, did light conditions change over that period? If so, is there any change in fruit body colour other than that caused by decay?

4. Following from the above, it has been suggested mucilaginous slimy coats on some fungal fruit bodies may play a role in ultraviolet (UV) light protection.

   Sometimes fungi, e.g., *Mycena austrororida*, will be found with vastly differing amounts of mucilage. Is there a correlation between mucilage volume and thickness, and the degree of exposure to damaging light rays? Why is there slime on the stems which, presumably, are less exposed to UV light than are the caps?

***Mycena austrororida* with great globs of slime**

5. If you observe a fungus species in several locations at the same time, such as *Phallus multicolor* that pops up regularly in garden beds, are the ones in one location slightly different in colour than those somewhere else? If so, is the soil different? Is one area fertilised and the other not? Is one area shaded and the other not? Does one area receive more water than the other?

Pink and orange varieties of *Phallus multicolor*

   Observe the fungi closely. If the colours are intended to attract insects that will disperse the spores of that fungus (we know the smelly gleba is the primary attractant for *Phallus multicolor*), do certain colours or colour intensities attract more insects?

6. Some of the coral fungi are white or pale, but many others are brightly coloured in pink, red, orange or yellow, and there are a couple of blue or purplish ones. Conventional wisdom is that these fungi use wind to disperse their spores. Making pigments of any colour, unless they are purely metabolic by-products, would be a drain on chemical and nutritional resources, so why do it? Make observations on soil or wood conditions (moisture, for example), host wood species if growing on wood, light conditions, timing in relation to rainfalls. What insects or other small critters, if any, are visiting the fruit bodies? Is one colour favoured over another? How much subtle variation is a result of habitat? As is so often the case, colour is noted but growing conditions ignored or brushed over. I believe there is a connection.

Pictures of *Clavulinopsis corallinorosacea* (red) and *Clavulinopsis amoena* (yellow) extracted from Grey and Grey (2017). A little book of corals. Field Naturalists Club of Victoria. Photographers acknowledged.

7. Those of you who have tried identifying fungi know there is a correlation between spore colour and genus (within a narrow range of variation), and have probably made spore prints (see CFF No.20: February 2018) to see what colour the spores are. Many species have white or very pale spores which, logically, saves energy in not having to make pigment. Mushrooms with brown or very dark brown/purple/black spores are common, and maybe these are species that need protection for their spores from UV light. Make some observations on this: when you find any species with black or very dark brown spores, make

a note of their degree of exposure to bright sunlight. Are they mostly in paddocks or open gardens where UV protection is important? If shaded, how much of the day is the shade likely to last?

8. The co-occurance of species is poorly recorded. Have you ever noticed that a cluster of fungus fruit bodies is often of a single species? Do the mycelia of a single species dominate that habitat, preventing mycelia of other species from becoming established?

   How territorial are fungi? Do fungi ‘tell’ other fungi ‘this is my patch’ so the other fungi do not fruit, even though they are present, and thereby do not compete for spore dispersal resources, to the detriment of the dominant species?

Pluteus petasatus **and *Gymnopus* sp growing in close association on mulch**

   If you observe two (or more) fungal species growing in very close proximity (on soil, wood or mulch), record the names of the species, or, if you don’t know them, take lots of photographs.

Attached to this newsletter is a supplement on how to take fungi photographs specifically for identification purposes.

9. Many fungi have distinct odours, to the point where some species can be identified by their odour alone. CFF No.17: December 2019, has an “odour wheel” that helps you characterise the smells. They can be fragrant or pleasantly perfumed, or smell very unpleasant. Fungal foragers often note both pleasant and unpleasant odours, but very few record the conditions in which those odorous fungi are growing. Make observations on soil or wood conditions (moisture for example), wood species if growing on wood, light conditions: are the fruiting bodies pre-sporulation, producing spores, or past their prime? If they are on soil, what type of soil (e.g. sandy or clayey, wet or dryish, fertilised or natural). Are the fungi attended by insects? Can you identify the type of insect, or can you get a photograph of them?

10. While on the subject of insects and other critters either eating fungi or spreading spores, flowers of plants that attract moths or bats for pollination produce large, often white, flowers that are conspicuous at night. Those pollinated by bees have white, blue, yellow, or UV reflective flowers while those pollinated by butterflies tend to have red or purple flowers.

    Likewise, there is every reason to suspect that fungi fruit-bodies may be both evolutionarily adapted, and perhaps physiologically responsive, to predation or exploitation in the same way as flowers. Maybe colour variations (and/or fruit-body shapes?) are associated with particular responses to predation, either to discourage it or to encourage it for spore-dispersal purposes. Perhaps white fungi are more heavily predated, or visited, at night because they are easier for spore-dispersal vectors or predators to see.

    Night observations of any kind on fungi are almost non-existent. If you are keen, try to identify or collect the critters in attendance.

Large numbers of beetles and collembola on a fruit body at night. None were observed during the daylight.

11. Bioluminescence has been reported in approximately 60 species of fungi, all of which are white-spored gilled mushrooms. Impressively, more than two-thirds of these bioluminescent species are *Mycena*.

Mycena is probably an ancient genus because it occurs all over the world. Does producing light convey some form of selective advantage to the species in which this phenomenon occurs? If so, why is it not more widespread throughout the fungi? Fungal luminescence has been hypothesized to attract animals like insects or snails that aid in spore dispersal.

Photo by Linda Reinhold

This may be the case with species with luminescent fruit bodies, but not for those in which only the mycelium glows, unless, of course, if mycelia consumed by animals survives and is dispersed through their droppings! Additional hypotheses include the attraction of predators that might eat animals that eat the mycelium, or even emitting light to discourage nocturnal animals that might otherwise consume the fungus. This would be similar to warning colorations observed in other organisms, but there is no evidence that bioluminescent fungi are especially toxic, or consumed. Lots of field observations on what animals visit luminous fungi are needed. For more information see CFF No.14: April 2019.

12. While you ae groping about in the dark looking for luminous fungi, what ecological advantage would be gained by a fungus that fluoresces, i.e., reflects ultraviolet light at night in a colour other than bluish? Maybe it is like fluorescent safety jackets – the jacket is very visible in daylight anyway, but the fluorescent component gives the colour 'an edge', making it just that little bit brighter and more conspicuous, even in full sunlight. Do fungi with this ability gain some advantage during daylight, perhaps by attracting species of animals that distribute the spores? If the fungi are toxic, does the heightened visibility alert potential predators just a little better than non-fluorescent fungi, thereby ensuring their survival?

Grommothele fulugo **natural color and under UV light**

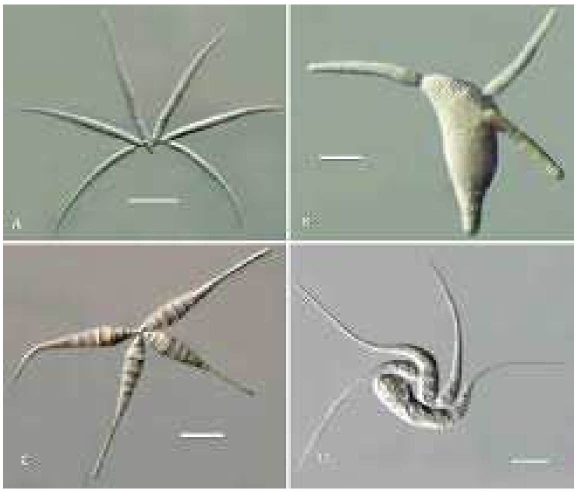
To the human eye, there is probably no difference, but to the insect, bird or native mammal eye the fluorescent species or individuals may be very prominent. Even more intriguing is the variation in fluorescence under UV light at night. Some fungi, or parts of fungi, fluoresce pink, orange, blue, green or white, even on a single specimen. Surely there must be some advantage and the colours serve differing purposes – or do they?

Many observations are needed before we can even begin to answer these questions. The next step is to encourage wider night searches to find more luminescent or fluorescent fungi, and to collect and identify them and get them into reference collections for future study. Flouresence and use of UV torches is discussed further in CFF No.15: June 2019.

Please send all observations and photographs to Barry Muir at unit57.may@gmail.com
Specimens require special preparation. Please either ask for advice on preparation, or take fresh specimens to a museum or a known mycologist.

INGOLDIAN SPORES

Aquatic fungi are important in the breakdown of organic matter in rivers and streams because their enzymes break down leaf tissue, making the nutrients available to aquatic insects and worms. There is a special group of aquatic fungi that have bizarrely shaped spores and are collectively called Ingoldian fungi after Cecil Ingold who first described them during the 1930s.



Ingoldian fungi grow on submerged decaying leaves and other organic matter, especially in clean running water with good aeration. Leaves fall from trees and shrubs into the stream, then aquatic fungal mycelia penetrate through the leaf surface and spread throughout the leaf tissue. The fungi then produce what are called conidia; special 'fruiting bodies' that are not produced by sexual processes like 'normal' fruiting bodies such as mushrooms. These conidia grow out of the leaves and project into the water where they develop strangely branched or four-armed spores.

Samples of Ingoldian fungal spores (picture from Raja, HA. & Shearer, CA. (undated) Univ. Illinois. Mitosporic Fungi Database).

The peculiarly shaped spores adhere to the surface film of water. and get collected into foam on the water surface and distributed downstream where they eventually settle on other stream debris. The spores, when settled, germinate and produce a special pad called an appressorium, securing the spore to the substrate and preventing it from washing away. The spores then produce hyphae that penetrate the debris.

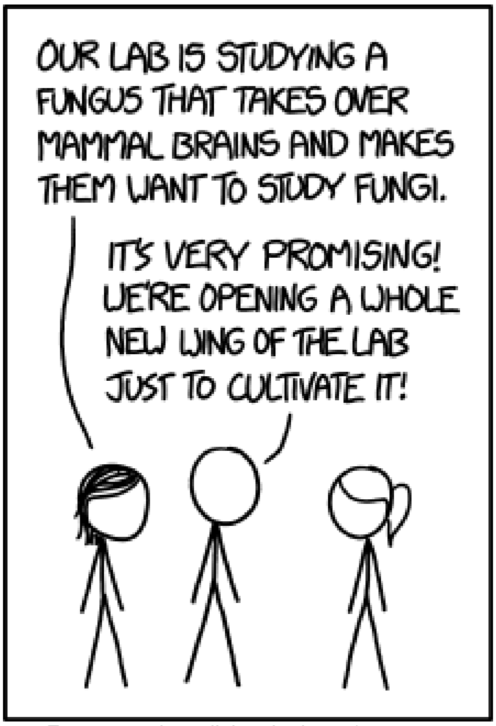
A NEW BOOK

Alison Pouliot and Tom May have recently produced a new edition: "Wild Mushrooming. A Guide for Foragers", published by CSIRO Publishing in Melbourne. The book has a wealth of information on the history of the pursuit of *edible* fungi in Australia and then goes on to discuss what fungi are, their role in conservation and the major groups of fungi. This is followed by a detailed discussion of the physical features of fungi, their identification and basic ecology. With regard edibility, there is a large chapter on poisonous fungi and how to identify edible fungi and their dangerous look-alikes. In the last chapter are many recipes which you can then try out ***after*** you have mastered the identification process. The book is valuable as an identification guide as well as a lead into foraging for food.

FUNGI THAT RUN ON ELECTRICITY!

Well – not really - but the Botanical Journal of Scotland (1995), Volume 47 Issue 2 had an article by N.A.R. Gow & B.M. Morris (dx.doi.org/10.1080/03746609508684833) which tells us that fungal cells generate DC and AC electrical currents during their growth. The DC electrical currents are due to clustering of ions (particles that are electrically charged either positive or negative) in certain regions of the cells and mycelium. These electrical currents seem to be concerned with control of nutrient uptake and perhaps in communication between mycelia and the growth of the hyphal tip.

Plant roots also produce weak electrical currents and these may be what attracts zoospores – the swimming spores of some pathogenic fungi, and may help them to find potential hosts.



From: mycology, link - xkcd.com/1664

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Attachment

CFF No.27: Supplement. Photographing fungi for identification purposes