FUNGI FORAGERS

No.31: August 2022

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)

FURTHER FINDINGS FROM FORAGING FABULOUS FUNGI

In Cairns Fungi Foragers (CFF) No. 29, April 2022 there were two articles that arose from observations I made in a small area (0.5 ha) of remnant woodland in the Cairns Botanic Gardens Precinct. One was entitled "What happened with fungi during "The Wet" and discussed fruiting "styles", i.e., pressure-sensitive species, opportunists, wait-and-see" species, etc. The other was "Number of fungal species each month – data from Cairns" and presented summarised data from the three years of study. It showed that the majority of fungi appeared in the "Wet Season", basically January to March, as one might expect.

But wait – there's more - during the tropical wet seasons of 2020, 2021 and 2022, I made daily observations of fungal species and numbers. Cairns receives about 2000 mm of rainfall per year, of which from 100 to 600 mm falls during the hot wet season which usually starts suddenly (known locally as "the break of rains") and may last from late December through to March. Total wet season rainfall is very erratic from year to year – in the last 20 years or so the lowest has been only 160 mm, while the highest was 620 mm.

Xylocoremium flabelliforme, one of the "Shotgun" species

Of the 48 species of fungi sporocarps (fruit bodies) found in the 0.5 ha area, about 28 % were mycorrhizal, 64 % were recyclers and 8 % were parasites. This demonstrated the proportion of species with these different lifestyles, recognised the diversity and importance of mycorrhizal species within the area, and the relatively low number of parasites suggested the vegetation is healthy and not under stress. Recycling of plant debris is well established, and the ecosystem is probably fairly stable, despite its small area.

During the study it was possible to observe a long and a short rainfall "event" each year when the falls continued unabated for several days and was separated from the next event by several days with no rain. I

obtained rainfall data from the Australian Bureau of Meteorology (BOM) Station "031011 Cairns Airport" which is located *ca* 3.7 km due north of the study area. Table 1 shows the results.

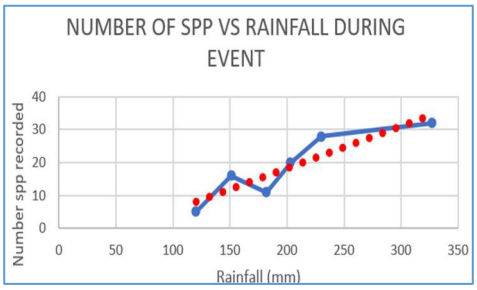
Table 1. Year of observations, rainfall during each event, number of species and number of sporocarps recorded.

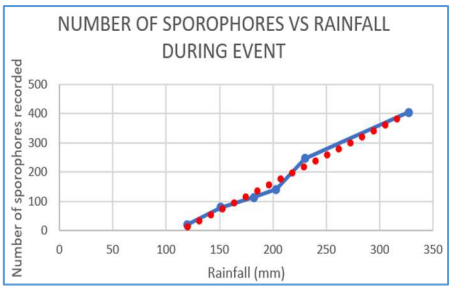
YEAR	Rainfall and study period	No. Spp	No. Sporocarps
2020	230 mm over 21 days	28	246
	182 mm over 7 days	11	113
2021	327 mm over 9 days	32	404
	120 mm over 4 days	5	20
2022	203 mm over 10 days	20	141
	151 mm over 4 days	16	80

***Auricularia cornea* was an opportunist**

If we plot numbers of species and sporocarps against rainfall, we find that there was a clear association between number of species and amount of rainfall and number of sporocarps and amount of rainfall during the six events studied. This may be intuitively obvious, but now we have data to back that assumption up. Just because there was a good correlation here doesn't mean there would be a good one at some other location. We need more simple studies like this to see if the macrofungi follow the same pattern in other environments. – and, if they do not, ask why?

Figures 1 and 2. Number of species and sporocarps plotted against rainfall in each event, and the trend line (red) showing the relationship between the data



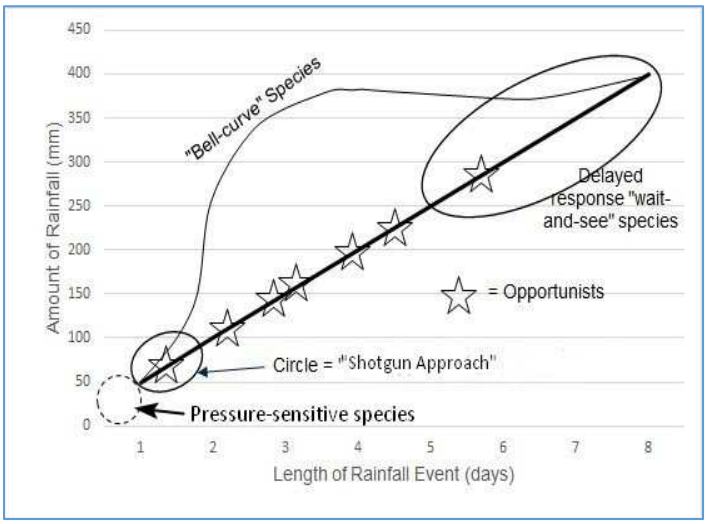


What about "triggering"? This is when we observe no or very few fungi, then they suddenly appear. I found that light rains at the start of the wet season produced no or very few fungi, and it became apparent that falls of 20 mm or more over a 24-hour period (i.e., overnight **plus** the previous day) were the minimum that would promote meaningful numbers of macrofungi, although a very small number sometimes popped up. The "shotgun" and opportunistic" species first appeared anytime over the first four days after good rains commenced, especially around Day 3.

In each wet season there was at least one extended period of rainfall where rain continued for nine days or more without stopping. It was these events that produced the greatest proliferation of sporocarps (see Table 1 and Figures 1 and 2). Appearance of both species and numbers of sporocarps of some followed the patterns presented in Muir (CFF 18, 2020) and reproduced here in Figure 3.

***Austroboletus lacunosus,* is a mycorrhizal species**

Figure 3 Fruiting patterns as presented in Muir 2020.



1. "Pressure-sensitive" species are those that are triggered to fruit by a sudden drop in air pressure *before* rains commence.
2. "Shotgun Species" - those that appear in the first 2- 3 days of the rainy period and then disappear for the rest of the event (or season);
3. "Opportunists" - dry out on low-rain days then reappear each time it rains heavily;
4. "Bell-curve" species produced sporocarps through most of the rain event, appearing in low numbers, increasing to many during the middle of the rain event, then tapering off, even if it continues to rain; and
5. "Wait and See" species seem to require a long period of near-continuous rainfall before they fruit.

Observations in the Botanic Gardens study provided the following information (Table 2).

Table 2. Fruiting patterns observed in the present study

Shotgun species	Opportunists	Bell-curve species	Wait and see species
Marasmius "alveolaris"[1]	*Auricularia cornea*	*Amanita* sp (5 species)	*Boletellus emodensis*
Xylaria ianthina-velutina	*Auricularia mesenterica*	*Austroboletus lacunosus*	
Xylocoremium sp	*Tremella globispora*	*Leucocoprinus fragillisimus*	
		Protoxerula flavo-olivacea	
		Russula sp (1 species)	

[1] *Sensu* Fuhrer (2016). *Marasmius* is presently under revision.

There were not enough data to suggest which other species may fall into one of these categories, but features of note from the available data are that:

***Protoxerula flavo-olivacea* is tall, elegant and green**

A. There were no "Pressure-sensitive" species recorded at this site.

B. All the opportunists were "jelly fungi" and these are well known for dehydrating then rehydrating when rains recommence;

C. Seven out of the nine Bell-curve fungi were known mycorrhizal species. It is also interesting to note that *Protoxerula flavo-olivacea* followed that same bell-curve pattern although it is reputed to <u>not</u> be mycorrhizal. It is worth noting that the specimens of *Protoxerula flavo-olivacea* found in the Study Area all *appeared* to be associated with the roots of Gondola Bush (*Tabernaemontana orientalis*), so is there a mycorrhizal connection?

Gondola Bush

D. On the other hand, *Boletellus emodensis* is a recognised mycorrhizal species, yet it appeared very late in the rain event. A possible explanation is that it always appeared on mounded litter and fallen paperbark at the base of *Melaleuca leucadendra* trees. It may have taken several days for rains to penetrate through the dense litter and bark to the underlying soil. It has been shown (Muir CFF 29, 2022) that up to 96% of rainfall can be intercepted by natural or artificial deep mulch layers.

E. What controlled the *Leucocoprinus fragillisimus* appearance I have no idea – room for more research! 31 out of the 32 *Leucocoprinus* sporophores I found were all within a 2 m^2 area. Is this just a cluster – like in a fairy ring, or is there something else going on?

With respect to variability between years, five species, *Panus fusipes, Parasola plicatilus, Psathyrella sp, Pycnoporus sanguineus,* and a *Russula* sp were found in 2022 but not 2020 or 2021. All these species have been recorded elsewhere in the Botanic Gardens, but not in the study area prior to 2022. The *Parasola* and *Psathyrella* are both short-lived ephemeral species and could have been easily missed during searches. *Pycnoporus sanguineus* is a wood-dwelling recycler that appeared on fallen branches of *Melaleuca leucadendra* that had been broken off a tree by strong winds during Tropical Cyclone Tiffany between 10th and 13th of January 2022. Presumably this fungus had been present in the wood while it was in the canopy before the wind damage occurred.

DID YOU KNOW?

Fungi are estimated to contribute to 25% of the total biomass on Earth. Approximately 250,000 fungi species (estimated between only about 5-10% of the potential existing species) have been catalogued in Australia, including microorganisms like mould, yeast, and mushrooms. Australia has also become the world's fourth-largest producer of the most-prized black gold truffle, and the small town of Manjimup, situated east of Margaret River in WA, is known as the *bona fide* truffle capital of Australia. The region is accountable for around 85 per cent of Australia's annual truffle crop. The richness of the soil, along with the cool climate, make it perfect for growing the beloved fine-dining staple. Reference: Bougher, NL. (2017). "Fungi of the Perth Region and Beyond." Western Australian Naturalists Club (Inc.). www.fungiperth.org.au.

PLANTS THAT ARE PARASITIC ON FUNGI

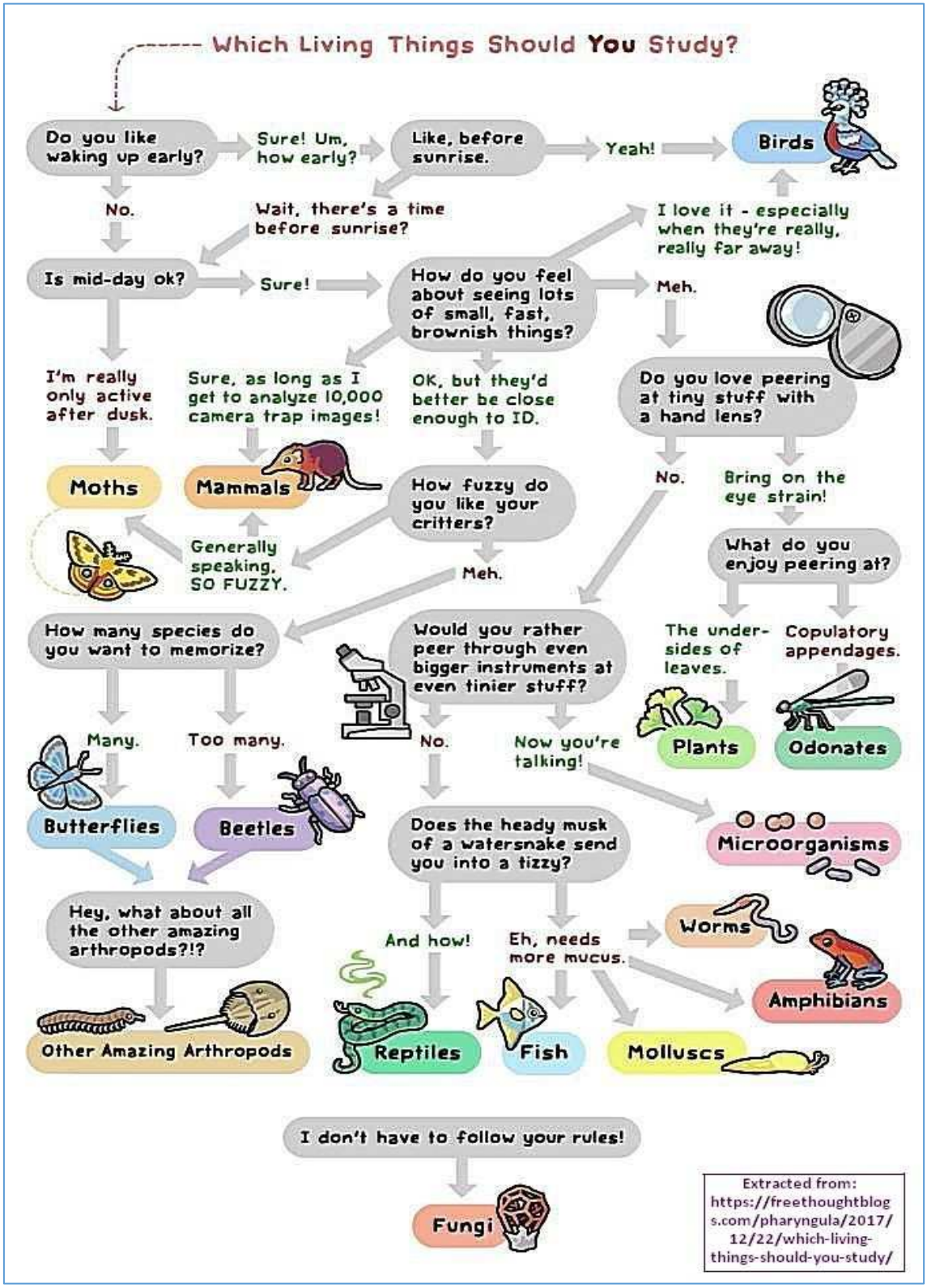
There is a special group of plants called myco-heterotrophs (myco = fungus, hetero = different, troph = nutrition) that are parasitic on fungi. It was assumed that these chlorophyll-free plants lived on decaying plant material but there is now compelling evidence that myco-heterotrophic plants have their roots entirely sheathed in ectomycorrhizal fungal mycelium and are nourished exclusively by carbon and nitrogen passing through a common mycorrhizal network linked to adjacent green trees.

There are about 400 known plants in 87 genera that don't have any chlorophyll at all, at any time, and another 30,000 or so species (comprising approximately 10% of the plant kingdom), that depend upon myco-heterotrophy for early establishment from seeds or spores. These latter plants apparently require fungal carbon during their critical early establishment stage but go on to produce green shoots after they emerge into sunlight from the soil. Which fungi do this are mostly unidentified.

The well-known *Balanophora fungosa* is almost certainly a myco-heterotroph

Source: Leake, JR. (2005). Plants parasitic on fungi: unearthing the fungi in myco-heterotrophs and debunking the 'saprophytic' plant myth. Mycologist 19(3): 113-122. doi: 10.1017/S0269915XO5003046 113

JUST FOR FUN



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