WHY DON'T MORE BIRDS EAT MORE FUNGI?

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Only one species of bird in Australia, the southern cassowary *Casuarius casuarius*, is known to have fungi as a regular and significant part of the diet (Barker & Vestjens 1989a, b). Admittedly one has concerns about the reliablity of the mycological data in these books as 'mushrooms' and 'bracket fungi' are listed as ALGAE in Appendix 1 (Barker & Vestjens 1989a). Cassowaries eat fruit of many species of plants digesting only the pericarps and excreting the seeds whole. However, it is known they also eat bracket fungi, as these were found in the droppings throughout the year (Crome 1976). The fungi were not identified. It is likely cassowaries also eat species of Agaricales and Pezizales though they were not observed in droppings. Soft fleshy fungi would disintegrate in the gizzard and not be identifiable without examination of the spores in the faeces.

Contrast that situation with the behaviour of the native vertebrates of Australia. Many small mammals (rodents and marsupials) and some larger ones, including grey kangaroos and swamp wallabies (Simpson unpublished), have macrofungi as a component of the diet. The significance of fungi in the diet varies with species but in some of the smaller mammals they are a major component. More than 100 different species of macrofungi, predominantly with hypogeous fruiting bodies, have been identified from faecal pellets from small mammals in Australia (Claridge & May 1994) and the number increases each year as new discoveries are reported.

So why don't birds eat fungi? For many birds they would not be difficult to find or browse upon. One might expect species of emus (Dromidae) that feed on leaves, seeds and fruits of diverse plants to also feed on fungi such as agarics and puffballs. Adult *Dromaius novaehollandiae* swallowed immature basidiomata of species of *Lycoperdon* and *Bovista* presented to them near Canberra. Brush turkeys *Alectura lathami* swallowed basidiomata of *Mycena* sp. presented to them near Atherton. This suggests that species of Megapodiidae might opportunistically feed on macrofungi. Zwart (1973) working in Sherbrooke Forest near Melbourne, observed pilotbirds *Pycnoptilus floccosus*, to 'feed rarely on small mushrooms'. These ground feeding warblers live on the 'moist leaf-strewn floor of dense forest' (Slater 1983) using their bills to find food under the litter (Zwart 1973). Again the fungi were not identified and the observation seems not to have been followed up. Superb lyrebirds *Menura superba*, scratch up large areas of forest floor in their search for invertebrates for food Slater 1983). Basidiomata of hypogeous fungi are often to be found in the scratchings of lyrebirds examined in late autumn and winter near Sydney and Goulburn. Their presence is perhaps an indication that the birds do not eat fungi. However, the scratchings of small mammals also often include basidiomata that are inadvertently buried or pushed to one side in the urge to gorge on an abundant fruiting.

One possible explanation for the absence of mycophagy amongst birds may be the kinds of sugars fungi accummulate. Most fruits are rich in short chain sugars such as glucose and fructose. Fungi tend to store trehalose or sugar alcohols. Are these compounds unpalatable or toxic to birds?

The data of Barker & Vestjens (1989a, b) were obtained by examining the stomach contents of a large number of birds collected and studied over a period of almost three decades. It is surprising that only one species of bird was recorded as having ?mould in the stomach (*i.e.* oesophagus, crop or gizzard) namely the white plumed honeyeater *Lichenostomus penicillatus*. Foliage infested with sap sucking insects commonly supports also a large population of sooty moulds. It was surprising that sooty mould was not recorded from the stomachs of bell miners *Manorina melanophrys*. These communal birds appear to help maintain large populations of Psylloidea on living leaves in quite extensive patches of eucalypts. Commonly the insect colonies develop sooty mould colonies about them. Do birds avoid insects with sooty mould? Does sooty mould afford protection from predatory birds?

Many insects are mycophagous (Kukor & Martin 1987, Lawrence & Milner 1996). Decomposing fungi of all kinds, putrescent and perennial, commonly contain large populations of larvae and adult invertebrates. Yet this large resource seems not to be directly exploited by birds. Rather than breaking basidiomata or ascomata apart to obtain the invertebrates birds seem to prefer to wait until they emerge and disperse. Is this an accurate observation? If not then why do birds ignore this source of readily available food? Further studies may indicate that Australian birds are not as mycophobic as the literature currently suggests.

References

Barker, R.D. & Vestjens, W.J.M. (1989a). *The Food of Australian Birds 1. Non-Passerines.* CSIRO Melbourne, Australia.

Barker, R.D. & Vestjens, W.J.M. (1989b). *The Food of Australian Birds 2. Passerines.* CSIRO Melbourne, Australia.

Claridge, A.W. & May, T.W. (1994). A review of mycophagy in Australian mammals. *Australian Journal of Ecology* **19**: 251–275.

Crome, F.H.J. (1976). Some observations on the biology of the cassowary in northern Queensland. *Emu* **76**: 8–14.

Kukor, J.J. & Martin, M.M. (1987). Nutritional ecology of fungus-feeding arthropods. pp. 791–814. **In** Slansky, F. & Rodriguez, J.G. (eds). *Nutritional Ecology of Insects, Mites, Spiders, and related Invertebrates.* John Wiley & Sons, New York.

Lawrence, J.F. & Milner, R.J. (1996). Associations between Arthropods and Fungi. *Fungi of Australia* **1B**: 137–202.

Slater, P. (1983). *A field guide to Australian Birds. Volume 2 Passerines.* Rigby Publishers, Adelaide.

Zwart, M.H. (1973). Breeding and behaviour of pilotbirds. *Emu* **73**: 124–128.

A FUNGUS AS THE CAUSE OF FROG DECLINES

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In recent decades it has been observed that populations of frogs and other amphibians have declined dramatically in parts of Australia, North America and Europe. Numerous causes for this phenomenon have been suggested including increased solar radiation resulting from destruction of the ozone layer and invasion of rainforests in Australia by camphor laurel trees. None of those claims has been substantiated.

Recently a new species of Chytridiales has been found on sick and dying amphibians in Queensland, Panama and the United States of America (Berger *et al.* 1998, Pessier *et al.* 1999). Under experimental conditions the fungus has been observed to be a virulent pathogen able to infect and cause thickening of the keratised epidermis of living adult anurans (Berger *et al.* 1998). This can impair cutaneous respiration and osmoregulation; the disease is often fatal (Berger *et al.* 1998). The fungus can infect tadpoles but does not cause mortality because tadpoles have only localised areas of keratised epidermis. This is apparently the first report of parasitism of a vertebrate by a species of Chytridiomycota.

In early conference reports it was suggested the amphibian parasite was a species of *Perkinsus* (Protoctista) but ultrastructural and DNA sequence data have shown this to be not the case (Berger *et al.* 1998). The frog chytrid, which in some respects resembles a species of *Rhizophydium*, is to be described as a new species and genus (Longcore 1998).

The geographic origin of the frog chytrid and the mode of international dispersal are not yet known. Berger *et al.* (1998) suggested it could be an introduced pathogen spreading through naive populations or it could be a widespread organism that has become more virulent because of unidentified amphibian stress factors. If the frog chytrid is an exotic to Australia it will be interesting to see if it was introduced on imported amphibians for the aquarium trade or if it came in on the collecting gear of students of amphibians. This has the attributes to be a challenging case for those interested in quarantine risk analysis.

References

Berger, L., Speare, R., Daszak, P., Green, D.E., Cunningham, A.A., Goggin, C.L., Slocombe, R., Ragan, M.A., Hyatt, A.D., McDonald, K.R., Hines, H.B., Lips, K.R., Marantelli, G & Parkes, H. (1998). Chytridiomycosis causes amphibian mortality associated with population declines in the rain forests of Australia and Central America. *Proceedings of the National Academy of Science U.S.A* **95**: 9031–9036.

Longcore, J.E. (1998). Chytrids: a teaching note. *Inoculum* **49** (5): 5.

Pessier, A.P., Nichols, D.K., Longcore, J.E. & Fuller, M.S. (1999). Cutaneous chytridiomycosis in poison dart frogs (*Dendrobates* sp.) and White's tree frogs (*Litoria caerulea*). *Journal of Veterinary Diagnostic Investigation*. (in press)