Spatial memory, search images and environmental cues: how do frugivores find ripe mistletoes fruits?

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I certify that the work in this thesis has not previously been submitted for a degree nor has it been submitted as part of requirements for a degree except as fully acknowledged within the text.

I also certify that the thesis has been written by me. Any help that I have received in my research work and the preparation of the thesis itself has been acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

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Abstract

Mistletoes in Australia are keystone resources that are patchily aggregated in space and with peak fruit production that varies in time. Understanding how seed dispersing birds find fruiting mistletoe and what visual or habitat-based characteristics may influence their searching decisions can shed light on potential bird-driven distributions of mistletoe. While mistletoe selection by foraging frugivores has been investigated in other mistletoe systems, none have explored their search strategies, specifically, the potential use of a search image and spatial memory. To determine the potential search strategies of frugivorous birds and the influences of those strategies when searching for mistletoe fruit, I designed a series of novel, manipulative experiments. These involved two approaches: 1) defoliation and 2) moving whole mistletoe plants to new locations. In Chapter 2 I compare bird visitation to defoliated and intact fruiting mistletoes to determine the visual effects of leaves on potential seed dispersing birds. Chapter 3 investigates the effects of mistletoe location in host *versus* non-host trees and the effects of visual characteristics of the host tree and manipulated mistletoe in a continuous forest. This was achieved by cutting mistletoe and either 1) replacing it (*In-situ*), 2) moving it to another tree of the same species or (*Same Species*) or 3) moving it to a tree species that does not host mistletoe (*Different species*). In Chapter 4, I repeat a modified version of the experiment conducted in Chapter 3, using only *In-situ* and *Same Species* treatments in a roadside habitat. The results of this experiment were then compared to the corresponding results from Chapter 3 to determine potential effects of habitat type on bird visitation of fruiting mistletoes. For each experiment I also explored potential differences in visitation patterns among birds grouped into three dietary guilds: mistletoe specialists, feeding primarily on mistletoe fruits and nectar; generalist frugivores, potential seed dispersers known to eat a variety of fruits and invertebrates; and opportunistic foragers that visit mistletoes but may be searching for invertebrates rather than fruits. Overall, birds showed a preference for intact, *In-situ* mistletoes in continuous forest habitat, preferences that were largely driven by the generalist frugivore guild. My research provides the first evidence of spatial memory in mistletoe-dispersing birds, linking foraging behaviour to aggregated seed dispersal patterns. As mistletoes are patchy fruiting resources with limited, specialised seed dispersers, the findings of this thesis may be transferrable and testable in other specialised fruit-frugivore systems.