Ecology of box mistletoe Amyema miquelii dispersal in pink gum Eucalyptus fasciculosa woodlands

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The proliferation of box mistletoe *Amyema miquelii* in eucalypt woodlands of south-eastern Australia may have resulted from the suppression of canopy fires, a reduction in herbivory by possums, and through environmental change, an improvement in conditions for mistletoe dispersal and establishment. In the Mount Lofty Ranges (MLR), South Australia, box mistletoe is often seen in high numbers in pink gum *Eucalyptus fasciculosa* woodlands. The following dissertation investigated box mistletoe dispersal and establishment by Mistletoebirds *Dicaeum hirundinaceum* in a pink gum woodland. The broad aims of the study were to advance our theoretical knowledge of mistletoe dispersal ecology, to understand why pink gum woodlands are more susceptible to mistletoe infection, and to increase the amount of ecological information available to land managers.

A survey of box mistletoe and its *Eucalyptus* hosts in reserves of the MLR region revealed that almost a third of all pink gums were infected with box mistletoe. Individual pink gums with less foliage cover surrounding their canopy were more likely to host box mistletoe, suggesting canopy access for Mistletoebirds may influence the susceptibility of pink gums to mistletoe infection. Woodland type was more influential than fragmentation and edge effects in determining mistletoe presence, indicating a variation in host specificity across *Eucalyptus* species. The results of this survey indicated that further examination was required on Mistletoebird behaviour and mistletoe establishment success.

Two aspects of Mistletoebird ecology were examined: the influence of their movement patterns on the spatial dynamics of mistletoe dispersal, and their foraging behaviour. Mistletoebirds had home ranges of around 20 ha, and used small core areas (1 ha) of high mistletoe infestation more frequently than areas with lower mistletoe abundance. Modelling of mistletoe seed shadows indicated that the majority of mistletoe seeds (approx. 70%) would be deposited within 100 m of a parent plant. Consistent with this, seed rain modelling showed that mistletoe seed rain was aggregated, with birds dispersing large amounts of seed (> 66 000 / ha) in areas with higher mistletoe infestation levels. This indicated that the movements of
mistletoe dispersers promote mistletoe aggregation not only at the scale of an individual tree, but also at a landscape scale. From a management perspective, the results indicated that the removal of mistletoes from single trees may have only short-term results, as reinfestation from neighbouring host trees is likely.

The attractiveness of pink gums to Mistletoebirds was a function of tree size, mistletoe crop size and tree access. Mistletoebirds preferred to forage in taller trees with a larger mistletoe crop size and which had greater canopy access, and Mistletoebirds most often alighted on dead pink gum when visiting a tree. The results support the notion that woodland dieback may improve conditions for mistletoe dispersal by allowing favourable habitat for Mistletoebirds, by increasing canopy access and by providing more perch sites. Dieback will also reduce mistletoe establishment, however, through a loss of suitable live host branches.

The high frequency of box mistletoe infection in pink gum woodlands could also be explained by differences in establishment of box mistletoe between eucalypt species. A mistletoe establishment experiment demonstrated that establishment was significantly higher on pink gums than on *E. porosa* and *E. camaldulensis*, and that mistletoes established on pink gums were larger and had a greater number of leaves. The differences probably lay in underlying differences in host physical and chemical defences, and subsequent relative success of mistletoes to establish a functional haustorium.

The dispersal syndrome of box mistletoe as described in this study is suitable and perhaps facilitated in the contemporary fragmented environment in a number of ways. These include an ability to concentrate their feeding and breeding activities in small areas of remnant vegetation, greater manoeuvrability between trees isolated by clearing, and easier access to the canopies and perch sites of individual trees in deteriorated woodlands. Priority research stemming from this study should include studies into the underlying causes of pink gum dieback, an experiment to test whether canopy dieback directly results in more frequent visitation by Mistletoebirds, an examination of Mistletoebird movements in areas with low mistletoe abundance, and continued monitoring of mistletoe abundance and tree condition as established in this dissertation.