

Mistletoe and wildlife - a positive view of a parasite

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The unusual lifestyle of mistletoes

Mistletoes are partly parasitic flowering plants. There are twelve species (2 families, 6 genera) in Victoria all of which are native¹. Mistletoes have co-evolved with the Australian flora and fauna and some extraordinary relationships have developed between this plant and other species^{10,11}.

Mistletoe is only partially parasitic on its host plant. It can produce its own energy through photosynthesis but must obtain mineral nutrients and water from its host. A wide range of species may be infected by mistletoe including eucalyptus, acacia, casuarina, banksia, members of the Santalaceae and Myoporaceae and introduced street trees.

Camouflage

Most mistletoes mimic their host plant to some extent and some are virtually impossible to detect unless exposed by their flowers. Why do they 'hide'? The answer is unknown but it may be that the mistletoe benefits by appearing to be part of the host which may have chemical and other defences against herbivores that the mistletoe does not. For example, eucalypts contain high concentrations of toxins in their leaves that deter many animals from eating them.

Mistletoe and wildlife

Mistletoes are a vital part of the web-of-life in Victorian ecosystems.

Nectar & flowers

Forty-one species of birds, mainly honeyeaters, have been recorded feeding at mistletoe flowers¹⁰ and some species feed exclusively at mistletoe for periods of the year. In some areas, mistletoe flowers are a very important source of nectar for birds, particularly when nectar and manna production by other plants is at its lowest¹⁰. Mistletoe plants generally produce abundant flowers annually whilst many of their eucalypt hosts are irregular suppliers of nectar. A wide geographic distribution and long flowering period in many species makes mistletoe an attractive resource for wildlife. Mistletoe is highly attractive to butterflies and moths and other invertebrates no doubt also use mistletoe as a source of nectar. Brush-tailed Possums and Yellow-bellied Gliders have been recorded feeding on *Amyema* flowers¹⁰.

Fruits

The Mistletoebird *Dicaeum hirundinaceum* and Painted Honeyeater *Grantiella picta* are dependent on the fruits of mistletoe for their survival^{9,10}. Though quite common, Mistletoebirds are inconspicuous and rarely seen by untrained observers. They are effective dispersal agents for mistletoe because, although the fruits are eaten, the seed and its sticky coating pass through the bird undigested. Seeds pass out in the droppings and some are deposited on tree branches where their sticky coating helps them to attach and grow. Mistletoebirds are credited with perching sideways on branches thus facilitating placement of the seed. Painted Honeyeaters, classified rare in Victoria, feed largely on mistletoe berries and nest only where they are common. In their search for mistletoe berries, they migrate to the ironbark forests of northern Victoria in spring. Olive-backed Oriole, Little Lorikeet, Silveryeye, and various honeyeaters may be partially dependent on mistletoe berries⁴. In all, 33 bird species have been recorded feeding on mistletoe berries but the behaviour and digestive process of most does not aid

mistletoe dispersal¹⁰. Mistletoe fruits were also eaten by aborigines¹¹.

Foliage

The dense foliage of a mistletoe plant offers concealment and some bird species take advantage of this attribute as a secure nest or perching site (e.g. Regent Honeyeater). The haustorium provides a secure platform on which nests can be constructed. Ringtail Possums sometimes use mistletoe clumps for daytime shelter. Brushtail Possums eat the leaves.

Many butterflies have developed a unique association with mistletoe. Larvae of the Azure Butterflies (*Ogyris* spp) and Jezabels (*Delias* spp) rely on mistletoe as their food source. For example, Imperial White Butterfly *Delias harpalyce* caterpillars feed exclusively on mistletoe which they defoliate before pupating. Genoveva Azure *Ogyris genoveva* caterpillars feed at night on Box Mistletoe where they are attended by ants. The ants escort the caterpillars to their nest for daytime shelter and receive sugary secretions as reward from the caterpillars⁸.

Concerns about mistletoe

Mistletoe can be a conspicuous feature in trees, especially when the host plant foliage is of a different colour or if the host is deciduous. Where mistletoe is prolific, it is often highly visible. Tree death frequently coincides with heavy infestations of mistletoe, however, this observation may simply be a symptom of the problem rather than its cause.

Some landholders have expressed concern about the potential effects of mistletoe on its host plant and are apprehensive about the effects of mistletoe on trees retained or planted for various purposes around a property.

In 1904 mistletoe was declared a noxious weed in Victoria and up to the 1950s was manually removed from thousands of acres in some Victorian forests. This treatment proved ineffective because mistletoe rapidly re-invades and labour costs quickly outstrip any benefits.

Mistletoe as an indicator

Mistletoes obtain water, minerals and nutrients from their hosts but produce their own energy by photosynthesis.

Their long association with native plants, on which they are dependent, suggests that the relationship is not one in which the mistletoe has complete dominance under natural conditions. For example, it is not unusual to find a mistletoe plant dead on a living tree, although the reasons for this (e.g. old age, natural resistance of the host, less resistance to bushfire) are not always clear. Overseas, host resistance to mistletoe has been demonstrated⁴.

Healthy stands of native species could be expected to have defences against mistletoe. Some may even have a mutually beneficial relationship with it although there is no evidence of this in the literature. Alternative flowering times between host and parasite could advantageously attract insectivores, gleaners and other species that benefit the host.

Severe infestations of mistletoe are often associated with stressed or ageing plants or disrupted plant communities. Changes to the nutrient status of soils, soil compaction, salinity and cultivation, fertilizer use, partial clearing leading to forest trees being isolated in paddocks, changed water supply, fungal attack and insect predation may stress vegetation. Parasites, including mistletoe, and pathogens are likely to increase in these situations.



Heatwole and Lowman⁶ conclude that 'trees heavily infested with mistletoe may be killed directly by them; but probably more often they die as a result of a combination of stresses, one of which is mistletoe.'

Therefore, increasing infestations of mistletoe might actually be a useful indicator of unhealthy or unnatural conditions requiring remedial action.

Information relevant to control

Mistletoes affect their host plant through competition for water, nutrients and light.

They vary in their degree of host specificity; some only infest one or two species of host plant. The susceptibility of the host to infection also varies³, even within a species.

Mistletoes are more common in open forests with higher light penetration, such as the box and ironbark forests of northern Victoria. They tend to occur high in the canopy on northward-facing aspects or high exposed branches (dense trees), in intact forests. In disturbed situations, retention of lower limbs on host plants leads to a greater surface area with sufficient light for mistletoe growth.

In forests, mistletoe is rarely observed to be as prolific as it is on many isolated trees a short distance from the forest edge. Explanations for reports of increased mistletoe numbers have included the suggestions that additional light favours mistletoe growth and/or more frequent visits from Mistletoebirds, that reduced water stress favours mistletoe, that fire regimes (mistletoes may be killed by low intensity fires whilst eucalypts can survive) and lower numbers of Brushtail Possums (millions were taken for their skins in the 1930s) favour mistletoe.

In Victoria, germinating mistletoe seeds can only penetrate young branches with thin bark and so have no impact on the quality of timber production, although they may slow the rate of growth and reduce flowering, fruit and seed production of the host plant. The host branch usually dies beyond the point of mistletoe attachment thus enabling access to sunlight by the parasite.

Mistletoes have a limited life span (about 20-30 years⁷) that is much shorter than that of a eucalypt host (over 150 years).

Mistletoes can rapidly re-infest host plants after removal if the causes of infestation are unchanged³.

Natural predators of mistletoes include butterfly larvae (see above), at least one weevil, longicorn beetles, moths and wasps^{3,6}. Brushtail Possums (and probably Ringtails) eat the foliage. Little is known of potential pathogens but unexplained deaths of mistletoe do occur. All the above contribute to natural means of biological control of mistletoe in natural systems.

Whilst host eucalypts will control their water use in dry periods, mistletoes do not reduce their water loss significantly. Large infestations of mistletoe have been associated with locations near watercourses and dams.

Mistletoes apparently lack the dormant buds which allow their eucalypt hosts to resprout after fire⁴, have thin bark and so are probably fire sensitive¹².

Mistletoe distribution is limited by climate. For example, few mistletoes occur in open alpine environments.

Soil nutrient status may affect the distribution of mistletoe although this is unconfirmed.

Buloke Mistletoe *Amyema linophyllum*, Golden Mistletoe *Notothixos subaureus* and Jointed Mistletoe *Korthalsella rubra* are listed as rare or threatened plants in Victoria⁵.

Mistletoe control

Given the importance of mistletoe in the Victorian environment, the first issue to address is whether or not any control is desirable. In most cases, it will be best if mistletoe is left to perform its valuable functions.

Since the cause of problems associated with mistletoe appears to be related to an 'unhealthy' environment, a long-term solution is to try to create an environment on a

property, and in the surrounding landscape, which is more 'ecologically healthy' and hence where 'tree stress' is reduced. Some steps that can be taken are to fence off remnant native vegetation, restore areas by encouraging the growth of native understorey plants and native groundcovers. Regeneration of surrounding trees will eventually shade some of the mistletoes on isolated trees and may help their recovery. Leaving ground cover such as leaves, branches and logs will assist animals that make use of this habitat and may assist invertebrates that defoliate mistletoe. Fencing off reasonably large circular areas of native vegetation and taking care with agricultural practices (e.g. keeping fertilizers away from native vegetation) will assist. Connecting small remnants with larger ones using corridors of native vegetation can restore natural movement patterns including those of birds that eat mistletoe fruits but do not aid dispersal, thus potentially reducing recruitment.

If you are particularly concerned about the fate of an individual favourite tree then manual removal of mistletoe (usually the branch on which the mistletoe occurs) is an option, if combined with measures to address the cause of the infestation. Take care to remove all outgrowths of the mistletoe (particularly Creeping Mistletoe which has long outgrowths which attach to the host) or it may reshoot. Of course, this technique may be very difficult and dangerous depending on the location of the mistletoe. The cost of control must be evaluated against the benefits. Re-infestation is likely within a short time. Mistletoe is sensitive to heat and can be killed using a blowtorch (beware of fire risk)⁴.

Foliar application of chemicals can be used to kill mistletoe^{4,7}. The injection of a chemical into the trunk of a mistletoe-infested eucalypt has been suggested as a control option, however, this remedy does not target the cause of the infestation and involves the risk that the dosage will either fail to kill the mistletoe or will kill the host plant. The experience of the operator is one factor in determining whether such an operation is likely to succeed. There are also environmental and health risks associated with the chemicals used.

Revegetation, especially by natural regeneration, whilst not guaranteeing the survival of an individual tree, is a way of continuing to provide the significant benefits associated with native vegetation on a property (e.g. for shade of livestock) and is probably the most effective solution for landholders. Selection of a native species or variety that is resistant to mistletoe attack may be necessary when isolated trees are required.

This Note has attempted to evaluate the role of mistletoe in the Victorian environment so that a balanced approach to control can be achieved.

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