Chemical profile differences in endemic parasitic weeds: a study of host-parasite chemical profiles in select mistletoe and eucalypt species

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Summary Chemical interactions between Australian mistletoe species and their hosts are poorly understood. In this study, the chemical composition of essential oil extracted from two species of mistletoe, from multiple *Eucalypt* hosts, were examined. Differences in chemical profiles were found between mistletoe species. Variation in host selection incurred minimal deviation in mistletoe chemical composition. Terpenes were the major class of compounds found in each mistletoe species. Further studies into the bioactivity of these compounds are needed to elucidate their role.

INTRODUCTION

Mistletoe is a group of parasitic plants from the order *Santalales*. The parasite deploys a haustorium that penetrates host plant tissue and allows the parasite to siphon nutrients and moisture from this new host. At low densities, this has negligible effect on the overall health of the host plant, although high parasite loads have the potential to damage, weaken and kill hosts (Watson 2001). Mistletoe can pose significant risk to commercial operations by damaging host plants and thus reducing crop yield. Once infestation is complete, hosts have limited defences. Eucalypts can limit the water allocated to infected limbs thereby facilitating the death and loss of the limb. However, some plants have a resistance or immunity to certain mistletoe species (Yan and Reid 1995). Research on dwarf mistletoes in North America indicates that plant chemistry plays an important role in determining interactions between host and parasite, particularly secondary metabolites (Snyder 1996). This study represents the first investigation into the chemical ecology of Australian mistletoe. This research was completed by examining the secondary metabolites present in the mistletoe tissue.

MATERIALS AND METHODS

Three mistletoe species, *Amyema miquelii*, *Amyema pendula* and *Amyema quandang* were selected for this analysis. The selection of species was based upon their pervasiveness, their apparent differences in preferred host selection and to allow for the analysis of inter-species variation. Plant material was collected from each of the *Amyema* spp. on multiple hosts. Each sample was dehydrated and submitted to hydro-distillation for extraction of essential oil. The collected essential oil was analysed via gas chromatography-mass spectroscopy and the chemical components identified from retention times and mass spectral libraries.

RESULTS AND DISCUSSION

No essential oil was recovered from *A. quandang*. It is unclear whether this lack of essential oil is due to its preferential selection of *Acacias* over *Eucalypts* as hosts, or simply due to interspecies variation. The oil profiles of the two remaining *Amyema* spp. were similar, comprising terpenes, primarily sesquiterpenes (Table 1). Almost a third of the components identified are shared between the two species, but the remaining components were different in each species. These differences may be related to observed variation in the respective host-parasite relationships.

Table 1. Summary of total and shared chemical components found in *Amyema* spp. on multiple hosts.

Species	Total components	Shared components
A. pendula	31	14
A. quandang	No oil	No oil
A. miquelii	28	13

The chemical profiles of the *Amyema* spp. analysed were independent of the host, with little difference in the major components. Some chemical variation was detected in the minor chemical components, especially with those detected at <0.1% of total composition. This disparity is expected as interspecies essential oil profiles often exhibit variation in components and percent composition (Sefidkon *et al*. 2009). In this study, host selection had a minor effect on the concentration or composition of the essential oil of the parasite. Future studies could examine the chemical profile of mistletoes of other species and genera. This would facilitate the quantitation of the effect of chemical composition upon host compatibility. Furthermore, determining the bioactivity of the secondary metabolites present could give further leads into the dynamics of the host-parasite relationship.

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