Impacts of environmental weed invasion on arthropod biodiversity and associated community structure and processes

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Abstract

Invasive exotic species frequently change natural patterns of biodiversity. This study investigated the effects of one of Australia's most serious environmental weeds, bridal creeper (*Asparagus asparagoides*), in remnant eucalypt woodland in South Australia. Research considered the impact of bridal creeper on different taxa and trophic groups (plants, arthropods and parasitic Hymenoptera), high-level (orders and families) and low-level (species) taxonomic assemblages, and ecological processes (parasitism and pollination). The impact of bridal creeper on the native plant community was overwhelmingly detrimental, undoubtedly due to direct interactions with the weed such as shading and root competition. It was predicted therefore, that the replacement of a species-rich and open ground-cover into a closed homogenous one would have flow-on effects to other biota in the habitat.

Despite the significantly adverse impact on the native plant community, a very abundant and diverse arthropod and wasp community occurred in bridal creeper invaded habitat. There was some evidence however, that the weed was not providing seasonally equivalent habitat to that of native vegetation for several herbivorous and nectar-feeding groups. Invaded areas were also being used for the reproduction and development of a diverse range of parasitic wasps and their hosts. However, the homogenous habitat produced by bridal creeper compared with native vegetation was reflected in the composition of the wasp assemblages occurring in invaded areas. Wasp functional group analysis based on host niche associations revealed the mobility and multi-habitat use of parasitic wasps and, presumably, their hosts. The collection from foliage of parasitoids of litter-associated arthropods and, in the absence of herbivores, the presence of parasitoids of plant-associated insects on bridal creeper, showed that many species used different habitat for juvenile development compared with that used by adults. The indirect effect of higher levels of leaf litter associated with bridal creeper invasion also resulted in greater numbers of litter-associated arthropods and their parasitoids and, in particular, the extreme abundance of one soil and litter parasitoid species which dominated the wasp assemblage that emerged from invaded habitat. Finally, the highly specific interaction between an orchid and its pollinator was not impacted upon by the presence of bridal creeper, and may have even been enhanced due the increase in the numbers of its soil/litter-associated pollinator in weed-invaded areas. Consequently, the ground-cover plant community that was so completely altered by bridal creeper was not as important as other components of the woodland habitat, such as the soil, leaf litter and canopy microhabitats, for the reproduction and development of the majority of arthropod taxa recorded.

The contrasting results for plant and arthropod diversity found in this study indicate that a plant community may always be negatively impacted by a successful weed due to direct interactions among plant species, such as competition that, in turn, reduce growth and fecundity. However, the impact of weed invasion on native fauna can be more complex. Direct (eg. provision of resources such as habitat) and indirect (eg. via increased leaf litter) interactions with the weed, species mobility, and multiple habitat use can influence the structure and composition of faunal communities. These findings are important not only for considering the effects of weed invasion on native biota, but also other disruptions where habitat structure and complexity, rather than simply plant diversity per se, are modified via changes in the plant community. This research has also highlighted the value of considering multi-species assemblages whose members comprise wide ranging taxonomic, trophic and ecological classifications to investigate the impacts of habitat change.

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