Do mutualists matter? The significance of pollinators, seed dispersers and rhizobia on the differential success of *Acacia* species in New Zealand

Elizabeth M. Wandrag[1], Andy Sheppard[2], Richard P. Duncan[1] and Philip E. Hulme[1]
[1] Bio-Protection Research Centre, Lincoln University, 7647 Canterbury, New Zealand
[2] CSIRO Entomology, Black Mountain Laboratories, Clunies Ross Street, Black Mountain, ACT 2601, Australia
Corresponding author: Elizabeth.Wandrag@lincolnuni.ac.nz

Summary In order to establish successfully into a new area a plant species must be able to flower, set seed, germinate and survive; its ability to do so is mediated by positive and negative biotic and abiotic interactions. There is increasing evidence that release from natural enemies is not sufficient to explain why some plants are so successful in new environments while others fail. A key component to this outcome may be the role of mutualists rather than antagonists (Richardson *et al.* 2000). We aimed to examine the role of mutualisms in the invasion process by comparing between *Acacia* species exhibiting varying levels of success in their introduced range in New Zealand. Three species of Australian *Acacia* (*Acacia baileyana*, *A. dealbata*, and *A. pravissima*) were targeted.

We examined three key sets of mutualistic interactions covering three life history stages: pollination, seed dispersal, and germination and survival.

Acacia have generalist pollination syndromes but are largely self-incompatible (Grant *et al.* 1994). It is therefore possible that seed production is pollen rather than pollinator limited as a function of mate availability.

In their native range *Acacia* are dispersed by birds and ants (Davidson and Morton 1984). However, in New Zealand both the bird and ant fauna are relatively depauperate and it is expected that dispersal rates are low.

Rhizobia species with which *Acacia* are known to nodulate in Australia have been introduced to New Zealand (Weir *et al.* 2004), and species are expected to exhibit varying abilities to nodulate with these, as well as varying germination and survival responses.

Results of field observations and pod collection revealed variable performance within and between populations and species. The production of viable seed and the extent to which pre-dispersal seed predation is able to influence this appears highly species-specific. Exclusion experiments designed to reveal the organisms involved in seed dispersal and rates of seed removal indicate that invertebrate post-dispersal seed removal does occur and for some species at high rates. Results of laboratory experiments using soil collected from underneath conspecifics and congenerics reveal patterns in germination and seedling performance between species and in relation to soil origin.

These results suggest that *Acacia* species have formed mutualistic relationships in their introduced range to varying degrees and highlight important stages in the establishment process that future work should target.

Keywords *Acacia*, mutualisms, invasion ecology, plant establishment, pollination, seed dispersal, rhizobia.

REFERENCES

Davidson, D. and Morton, S. (1984). Dispersal adaptations of some Acacia species in the Australian arid zone. *Ecology* 65 (4), 1038-51.

Grant, J.E., Moran, G.F. and Moncur, M.W. (1994). Pollination studies and breeding system in *Acacia mearnsii*. Australian Tree Species Research in China: Proceedings of an International Workshop, pp. 165-70. (Australian Centre for International Agricultural Research, Canberra).

Richardson, D., Allsopp, N., D'Antonio, C.M., Milton, S.J. and Rejmánek, M. (2000). Plant invasions – the role of mutualisms. *Biological Reviews* 75 (01), 65-93.

Weir, B., Turner, S.J., Silvester, W.B., Park, D-C. and Young, J.M. (2004). Unexpectedly diverse *Mesorhizobium* strains and *Rhizobium leguminosarum* nodulate native legume genera of New Zealand, while introduced legume weeds are nodulated by *Bradyrhizobium* species. *Applied and Environmental Microbiology* 70 (10), 5980-7.