

Acacia victoriae and its Association with Sugary- Exudate Producing Herbivorous Insects and Trailing Dominant Ants in Semi-arid Australia

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Cover image: Small black *Iridomyrmex* sp. attends *Sextius* sp. nymphs on *Acacia victoriae*, 2010. Photo N. Weichel.

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Declaration

I, Nyree Weichel, certify that this work contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text.

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Thesis Abstract

Associations between ants, sap-sucking herbivores, and plants are often mutualistic, but abiotic and biotic conditions can change the magnitude of costs and benefits to partners. This is sometimes sufficient to tip the outcome for at least one partner to neutral or negative. Little is understood about this conditionality of outcomes. Other arthropods on the plants are likely to affect outcomes for partners, but little is known about broader effects of these associations on the arthropod community. Consistent differences in environmental conditions might bring about differences in function of these associations, so there may be a tendency for outcomes for partners to depend on biome, for which there is some evidence. Associations where plants provide sugary exudate (SE) to ants either directly or through supporting populations of herbivorous insects are widespread and common in Australia on the two most common genera *Acacia* and *Eucalyptus*, yet very few studies of this have been done. Due to the unique suite of environmental conditions on the Austral continent such as the prevalence of aridity, these types of associations may be particularly adaptive for woody plants. *Acacia victoriae* is the second most widespread acacia in Australia. A membracid of a genus which is widely distributed across Australia, *Sextius* sp., frequently colonizes it in semi-arid southern Australia, as do various Margarodidae and lycaenid larvae. Very aggressive dominant small black ants of the genus *Iridomyrmex* (SBIs) trail among the shrubs to attend these sugary-exudate producing herbivores (SEPHs) on them. Spatial distribution of association partners can provide clues not only to likely effects partners have on each other but to how the associations might affect other sectors of the natural community. On gridded sites, *A. victoriae* shrubs, SEPHs on them, and nests of SBIs were mapped and their spatial distribution analysed. A field experiment and field survey examined effects of different densities of SEPHs/*Sextius* sp. on *A. victoriae* growth and

reproductive success and associated arthropod assemblages and investigated factors determining densities of SEPHs on the shrubs. The field survey also examined effects of slope-aspect, as an aridity gradient, on soil parameters, shrub growth and reproductive success, SEPHs attended by *Iridomyrmex*, and other arthropods on shrubs. The study found that *A. victoriae* clustering on sites decreased with size of shrub, and SEPH populations were positively associated with SBI populations both on individual shrubs and at the scale of 15 m x 15 m. SEPH/*Sextius* presence on *A. victoriae* depended on SBI presence, and SBI numbers on stems depended on SEPH numbers more than on stem size. *Sextius* density was linked to nutrient levels of soil near shrubs and shrub leaves and to shrub growth rate. *A. victoriae* growth rate was in turn reduced by exclusion of *Sextius* on stems, and on shrubs with naturally high SEPH/*Sextius* densities, growth and seed production was higher, folivory was lower, and assemblages of small arthropods were different. Parasitoid wasp densities were strongly affected by SEPH/*Sextius* densities and there was some evidence that wasp densities regulated SEPH/*Sextius* densities in turn. Indeed, parasitoid wasps and SEPH/*Sextius* may strongly regulate densities of each other and through that regulate densities of other small arthropods on the shrubs. Dynamics of both potentially influential insect groups may be affected by rainfall and insolation. Slope-aspect affected most parameters considered. Results were consistent with the possibility of favourability of semi-arid conditions for the shrub-SEPH-SBI interaction. This study is the first to investigate the association between these taxa and warrants further research into the dynamics of the association, favourability for the association of arid conditions, and how the association affects the broader community.