Non-Target Impact of *Rhinocyllus conicus* (Coleoptera: Curculionidae) on Rare Native California *Cirsium* spp. Thistles

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Although it is well known that the introduced weed control agent *Rhinocyllus conicus* (Coleoptera: Curculionidae) will attack non-target native California thistles in the genus *Cirsium*, the weevil's complete host range and the degree of damage it causes to endangered plants has not been determined. In this study, natural populations of five out of the six rare native *Cirsium* species surveyed were attacked by *R. conicus*. Field surveys and laboratory studies were used to document differences in the ecological and biological host range of *R. conicus* with respect to *Cirsium occidentale* var. *compactum*, a rare native species which was not attacked in the field. Field studies conducted for three years on *C. hydrophilum* var. *vaseyi* (Mt. Tamalpais thistle) indicate that seed production by flowers infested with *R. conicus* is significantly reduced when compared with uninfested flowers. However, because the thistle's flowering phenology is not well synchronized with the oviposition pattern of *R. conicus*, the overall seed destruction rate approximates only 21% of total seeds produced per year. Results of seed bank surveys and a seed addition experiment indicate that observed levels of seed predation are not expected to limit Mt. Tamalpais thistle seedling recruitment.

Strategies for the Biological Control of *Solanum mauritianum* in South Africa

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The South American tree *Solanum mauritianum*, a major environmental weed in the high-rainfall regions of South Africa, has been targeted for biological control since 1984. However, progress was constrained by insect agents feeding on cultivated and native species of *Solanum* during host-specificity tests in quarantine. In this paper, I discuss strategies that can influence the success of the biocontrol programme against *S. mauritianum* in South Africa. These include: (i) establishing a complex of agents that will reduce both the considerable reproductive capacity and rapid growth rate of the weed, (ii) minimising delays in clearing these agents for release, given the problem of expanded host ranges and the revised legislation pertaining to the release of biocontrol agents in South

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Africa, and (iii) implementing appropriate integrated control strategies to both conserve and maximise the agents' impact. The most promising agents are the flowerbud-feeding weevil (*Anthonomus santacruzi*), leaf-sucking lace bug (*Gargaphia decoris*), leaf-mining flea beetle (*Acallepitrix* n. sp.) and stem-boring weevil (*Conotrachelus squalidus*), all of which display expanded host ranges in captivity. Appropriate interpretation of these results, with particular emphasis on quantified risk assessments, is crucial and has already facilitated the release of one agent. After a delay of some 18 months with the regulatory authorities, *G. decoris* was released in 1999, marking the first agent to be released on this weed anywhere in the world. Future referral of such problematic agents to an international review panel can accelerate decisions on their suitability and alleviate local concerns pertaining to South Africa's revised legislation. Large-scale mechanical and herbicidal removal of *S. mauritianum* from invaded catchments and riverine areas, by South Africa's 'Working for Water' Programme, necessitates a focus on integrated control strategies which conserve established agents (e.g. demarcating natural enemy refuges) and promote their implementation.

Predictability, Acceptability and Potential for Non-Target Damage by Agents Released for Biological Control of Weeds

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Screening procedures for host-specificity of biological control agents rigorously attempt to limit the possibility that agents will affect non-target species, especially those having some economic benefit. There remains concern, however, about potential adverse environmental effects from agents released for biological control, particularly in those cases where agents attack non-target native species under quarantine conditions. Biological control of weeds in Australia appears to have a good record in this regard, although the post-release impact of agents on non-target natives has been rarely documented. The lack of documentation becomes of particular concern when one or several target weeds are related to rare or endangered native plant species, as can apply in Australia. We collated data from past programs for biological weed control to identify those cases in which agents were released despite prior knowledge from host-specificity testing that non-target native species could be affected. By ranking such cases in terms of the risk posed to the non-target native species, we highlighted the cases requiring follow-up field studies to determine more thoroughly the impacts, if any, of the agent(s). We suggest that glasshouse-based predictions of the likely impacts of agents on non-target species are accurate, thereby confirming the rigour of current screening procedures for host-specificity. More post-release empirical studies are required, however, to unequivocally demonstrate their accuracy. As far as we could ascertain using this methodology, Australia has an impeccable record of releases for weed biological control in terms of impacts on non-target native species and hence in terms of native plant biodiversity.