Predicting the realised host-range of weed biocontrol agents using laboratory specificity testing: a review of New Zealand weed biocontrol programmes

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Host-range testing can reliably determine the fundamental host-range of a candidate weed biocontrol agent. Predicting which “fundamental hosts” will become “realised hosts” in the field can, however, be problematic. It is, nevertheless, often assumed that fundamental host plants on which candidate agents perform relatively poorly compared to the target plant are unlikely to be seriously damaged in the field. This assumption was tested quantitatively using host-range testing data from New Zealand weed biocontrol programmes. The relative performance of arthropod weed biocontrol agents on the target host plant and on other plants within the fundamental host-range that occur in New Zealand was related to the degree that these other potential hosts were attacked in the field (no attack; minor spill-over attack; full colonisation in the absence of the target weed). Relative performance in no-choice larval starvation tests was a comparatively poor predictor of realised host-range. Relative performance in oviposition tests was a better predictor. Combining the relative performance in no-choice larval starvation tests and oviposition tests to create a ‘risk index’ was a good predictor of non-target impacts in the field which could be used to help inform regulatory authorities regarding the risk of releasing biocontrol agents in the future.

How safe are weed biological control agents?
A worldwide review of non-target attack

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Non-target attack (NTA) by intentionally-released organisms has long been a concern in the field of biological weed control. Even though a few individual NTA cases have received much attention in recent years, larger-scale reviews on the topic are either missing, outdated or restricted to one or a few countries. One useful resource documenting NTA is Julien and Griffiths (1998), “A World Catalogue of Agents and Their Target Weeds”. The recent comprehensive revision of the catalogue provided an opportunity to analyse NTA by weed biological control agents worldwide. Information in the review includes the number of agents attacking non-targets, whether attack occurred temporarily or was sustained and whether attack was predicted pre- or post-release. Examples will be provided for each scenario. We examine whether there is a relationship between NTA and the time period during which the program was conducted. We also examine the extent to which NTA translates into impact on the respective non-target plant species as far as data are available. Finally we discuss how to incorporate NTA, realistically, into post-release monitoring programs and we make suggestions on how best to avoid cases of unpredicted NTA in the future.

Fifty years of open-field testing to evaluate the risks of non-target attack by candidate biological control agents

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Analysing risks to predict the likelihood of non-target effects by a potential biological control agent after its introduction into the invaded range is one of the fundamental challenges of pre-release studies. Open-field host-specificity testing of weed biological control candidates is usually considered to offer a more refined assessment of the likelihood of non-target attack than laboratory no-choice tests. I will provide an overview of the frequency, purpose and designs of open-field host-range tests conducted in weed biological control over the past 50 years and will discuss the challenges and opportunities of conducting pre-release, open-field, host-range tests. Particular emphasis will be placed on test designs that help elucidate the relationship between herbivore mobility and spatial distribution and, or, abundance of target and non-target species.