Effective Ragwort Management: An Evidence-Based Approach

Phil D. Roberts and Andrew S. Pullin

Centre for Evidence-Based Conservation,

Biosciences, University of Birmingham, Edgbaston, B15 2TT

E-mail: pdr387@bham.ac.uk Web: www.cebc.bham.ac.uk

Introduction

Ragwort species are known to be toxic to grazing animals (Defra 2004). Both common (*Senecio jacobaea*) and marsh ragwort (*S. aquaticus*) are found as a component of many stands of natural and semi-natural habitats throughout Europe, N. America and Australasia.

Various control methods for these species have been used by farmers and conservation agencies to tackle ragwort infestations. However, little is known about their effectiveness.

Common ragwort (*S. jacobaea*)

Marsh ragwort (*S. aquaticus*)

Systematic review methodology

The "systematic review" is a scientifically rigorous tool which can be used to summarise, appraise, and communicate to practitioners and policy makers the results and implications of otherwise unmanageable quantities of research (CRD Report 4). It is of particular value in bringing together a number of separately conducted studies, sometimes with conflicting findings, and synthesising their results through meta-analysis. We present the findings of one of our first systematic reviews.

Meetings with practitioners from English Nature, National Trust and Local Authorities were undertaken to phrase the exact question: "The effectiveness of the different interventions used to control ragwort (*Senecio*) species".

14 search terms over nine scientific and agricultural databases, with additional searches of conservation organisations libraries and internet searches were used to identify all available citations. Through detailed filtering of the captured citations (Fig.1), all relevant sources of data were identified.

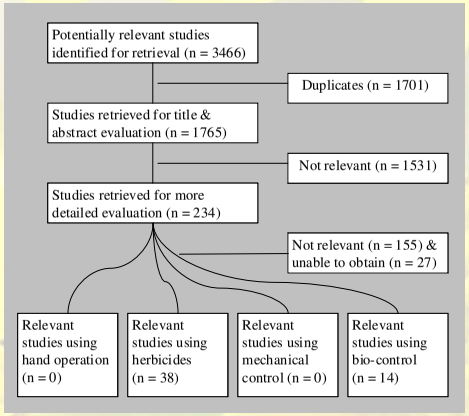

Fig. 1 Results of literature search and selection of studies relevant to the systematic review. Values (n) are the number of studies at each stage (QUOROM statement flow diagram).

Results – Herbicide Application

Data measuring the effectiveness of 16 herbicides was extracted from 38 relevant studies.

Each herbicide was analysed separately for its effectiveness against either *S.jacobaea, S.aquaticus* or both species. There was considerable difference in herbicide effectiveness between species (Table 1). Fig.2 shows an example of the output from the SMD meta-analysis.

Table 1: A summary table of the most commonly used herbicides and their effectiveness in ragwort control

	S. jacobaea	*S. aquaticus*
Effective (Significantly reduction in pop. density)	2,4-D MCPA	Asulam
Non-effective (Non-significant or no reduction present)	Asulam Clopyralid	2,4-D MCPA

Results – Biocontrol Application

Data measuring the effectiveness of either *Tyria jacobaeae, Longitarsus jacobaeae* or a combination of both natural enemies (Fig.3) were extracted from 14 relevant studies.

Initial results from the meta-analyses showed the potential of these agents to control ragwort infestations, although the number of datasets per analysis was limited ($n < 5$).

Time-series datasets (before and after results) were collated and analysed for each of the three interventions (Table 2). The use of both natural enemies in combination results in the greatest reduction in *S. jacobaea* densities.

Table 3: The three different biocontrol agents and the average density reduction of *S.* jacobaea achieved by each.

Agent	*Tyria jacobaeae*	*Longitarsus jacobaeae*	Combination of both
Density Reduction	**52.34%**	**96.50%**	**99.53%**

Fig. 3: An example of 2 possible biological control agents for ragwort: cinnabar moth *T. jacobaeae* caterpillar (left) and the adult (centre) and the larvae (right) of the ragwort flea beetle *L. jacobaeae*. Both the caterpillar and flea beetle adults attack the flowers and leaves of ragwort, while the flea beetle larvae burrow into the root crown.

Results – Other Management Techniques

No studies captured by the search strategy investigated the hand operation or mechanical removal (Fig.4) of ragwort species, therefore the effectiveness of these management techniques could not be established.

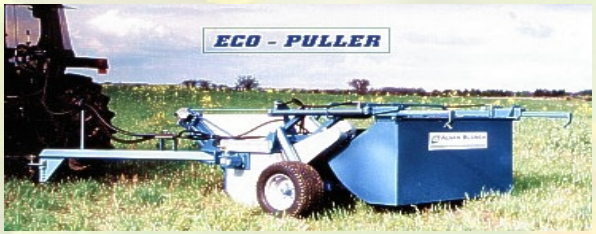

Fig 4: The Eco-Puller a mechanical weed pulling device that can be used on large infestations

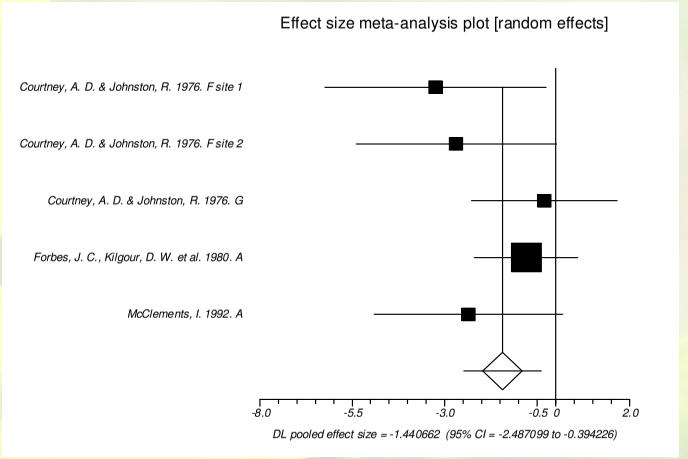

Fig. 2: A forrest plot showing the individual datasets point estimate and the overall pooled effect size for the effectiveness of 2,4-D at reducing the population density of *S. jacobaea*

Conclusions

Current evidence suggests that specific herbicides are required to control each of the ragwort species. Currently practitioners are using the same herbicide for both species.

The use of *L. jacobaeae* or a combination of *L. jacobaeae* and *T. jacobaeae* has the potential to provide effective biological control, however only in countries lacking a pool of predators and parasites of the two species.

We could not measure the effectiveness of all the desired management techniques for controlling ragwort species, due to lack of high quality evidence. More high quality experiments should be undertaken to test the effectiveness of those techniques either lacking any evidence or those, such as biocontrol agents, which have only a limited number of datasets available.

A dissemination programme is underway to provide these findings to key personnel so that current practice can be amended. This includes a number of publications and meetings.

The systematic review process allows for the critical appraisal of conservation interventions in an explicit, unbiased and repeatable way.

This systematic review is freely available to download online @:
www.cebc.bham.ac.uk

Acknowledgements
Gavin Stewart, Zoe Davies, Claire Tyler, Kevin Charman (EN), John Bacon (EN), Matthew Oates (NT) & Di Bennet (Wirral Rangers).

Support
This work was undertaken as part of a NERC PhD CASE award in partnership is English Nature.

References
CRD Report 4 (2001). Undertaking Systematic Reviews of Research of Effectiveness, NHS Centre for Research & Dissemination, Uni of York, U.K.

Defra (2004) Code of Practice to Prevent & Control the Spread of Ragwort. Dept. for Environment, Food & Rural Affairs. London, U.K.