Number 11 February 1999

What's New In Biological Control of Weeds?

What's Inside?

Manaaki Whenua
Landcare Research

New Attack Launched on Californian Thistle

Californian thistle has languished in the too-hard basket for a long time. Although it is the most common thistle in New Zealand, it has not been easy to find money to tackle this perennial nuisance. Three agents have been released in New Zealand to date, two foliage-feeding beetles (*Lema cyanella, Altica carduorum*) and a gall fly (*Urophora cardui*), but they are not sufficiently damaging to make a difference to this persistent problem on their own. More agents are needed to strengthen this attack.

Recently we helped a group of farmers from some of the worst affected areas, Otago and Southland, to make a successful application to the Agricultural and Marketing Research and Development Trust (AGMARDT) for funds to push along this worthy cause. The AGMARDT money will be spent over the next 3 years in two main areas. Firstly, we are joining an international consortium (with the USA and Canada) to search for potential new agents in previously unexplored parts of the weed's native range in eastern Europe and western Asia. Recent evidence suggests that these areas, which have up until now been inaccessible, may actually be the centre of origin of Californian thistle, and could therefore yield many more rewards than the parts of Europe previously surveyed. Secondly, we plan to look at how we can maximise the impact of the three agents that have already been released here. For example, we hope to get farmers involved in breeding up large numbers of beetles and flies in specially designed cages. Both the Otago and Southland regional councils will be assisting with this project.

Hot Gossip

Scotch thistle gall fly

The **Scotch thistle gall fly** (*Urophora stylata*) was released for the first time on two farms in Auckland's Rodney District just before Christmas. This project was also made possible by a cash injection from AGMARDT and some funding from the Wool Board. We imported the flies from Australia as larvae inside infested flowerheads and the new adults emerged inside our quarantine facility at Lincoln.

Speaking of quarantine and gall flies, the **mist flower gall fly** is safely installed inside our quarantine facility at Mt Albert, Auckland, undergoing final testing. We also have good news about the first agent for mist flower, the **white smut fungus**, which was released at nine sites in the North Island late last year. Jane Fröhlich has been back to each of the sites and reports that the fungus appears to be taking hold. She observed symptoms of the disease at each site, close to where she had put out infected plants.

Old man's beard leaf miner (*Phytomyza vitalbae*) would have to get the prize for the fastest dispersal rate of any of our control agents. In only 2 years the leaf miner has dispersed from release sites at Nelson and Blenheim to colonise all old man's beard infestations in between (>100 km). Similar rapid dispersal patterns are being noticed in the North Island too. Even small, isolated clumps of old man's beard have not escaped attack. The number of mines per square metre of leaf material seems to be increasing rapidly too.

Keeping at the Cutting Edge of Weed Issues

Email is a wonderful forum, which removes physical barriers such as distance and allows discussions on a host of topics by an ever-increasing audience from diverse backgrounds. Weeds are now making a big splash on the email front and there are currently eight weed listservers operational in Australia that will be of interest to many New Zealanders. They include environmental, pasture, and cropping weeds, which means nearly all ecosystems are now covered!

If you are interested in keeping up with the play, then you can subscibe to any of the listservers. All you need to do is send a message to the relevant email address with a special command in the body of your message (see below). Do not put the command in the subject line, and if you have an automatic signature at the end of your message, then you need to turn it off. All listservers are free of charge and you can unsubscribe at any time. So subscribe away!

Topic	Purpose	Email Address	Command
Crop Weeds	to distribute and discuss information on the management of weeds in annual cropping systems	cropweed-request@ farrer.riv.dsu.edu.au	subscribe cropweed
Pasture Weeds	to distribute and discuss information on the management of weeds in pasture systems	majordomo@ metz.une.edu.au	subscribe pasture-weeds
Environmental Weeds	to distribute and discuss information on the management of environmental weeds in natural ecosystems in Australia	ENVIROWEEDS-request@ majordomo.nre.vic.gov.au	subscribe enviroweeds
Nursery Weeds	to look at how the spread of invasive plants from gardens can be reduced	NURSERY-WEEDS-request @majordomo.nre.vic.gov.au	subscribe nursery-weeds
Weeds Education	to assist those involved in education and other training on environmental weeds	EDUenviroWEEDS-request @majordomo.nre.vic.gov.au	subscribe eduenviroweeds
Weed Watch	to look at how identifying, reporting, and recording new or expanding weeds in Australia can be improved	WEEDWATCH-request@ majordomo@nre.vic.gov.au	subscribe weedwatch
Weed Buster Week	to provide progress on annual national Weedbuster Week preparations and activities	WEEDBUSTER-WEEK-request@majordomo.nre.vic.gov.au	subscribe weedbuster-week
Wild Radish	to facilitates the distribution of information and discussion on *Raphanus raphanistrum*	wild_radish@ farrer.riv.csu.edu.au	None required but please introduce yourself

To Feed Or Not to Feed?

The first question on many peoples' lips when they hear about biological control agents being released is "What are they going to eat next?" To some people biological control sounds frightening and dangerous. They fear massive ecological damage, and often our work is directly compared with the introduction of rabbits or ferrets. This comparison could not be further from the truth. Safety issues are also foremost in the minds of biological control of weeds researchers, and only specialist feeders are considered. These specialists have co-evolved with their host plants over a long period of time, and have developed adaptations that allow them to find and feed on that host plant, and sometimes close relatives of that plant. This specialisation makes it difficult for them to change host, and the chance of this happening has been calculated at between one in ten million, and one in one-hundred million (the risk of native species unexpectedly becoming a problem is the same). Biological control agents will also never run out of food because they are unable to eradicate their host plants — this is because they can never find or utilise every plant. If biological control is successful, plants become increasingly rare and the agent populations reduce accordingly, so a new equilibrium forms between the abundance of agents and their host plants.

Host specificity test set up used for the hieracium gall wasp

To make sure, researchers rigorously test all proposed agents to assess the risk of damage to non-target plants. It is not possible to test every plant species in New Zealand, but a set of internationally accepted procedures has been developed to help researchers choose the right sample. These procedures work, as more than 600 biological control introductions have been made worldwide without any unpredicted host change occurring. Recently claims have been made that attempt to tarnish this good record. For example, the media have reported that the agent we know here as the nodding thistle receptacle weevil (*Rhinocyllus conicus*) is unexpectedly damaging native thistles in the USA. Closer investigation of this story reveals that the risks had been identified beforehand. Even though testing showed that native thistles were at risk, a decision was made in the 1960s to go ahead and release the weevil — biodiversity wasn't quite so highly valued at that time! The ecological studies that prompted these media reports are extremely useful in that they enable us to improve our understanding of the full consequences of unleashing biological control agents on the environment, and they will allow researchers to make even better decisions in future.

The scientific community believes that safety tests represent extreme and unnatural conditions and usually overestimate rather than underestimate the real host range of control agents. Researchers need to carefully consider an agent's biology and behaviour when deciding on the most appropriate kinds of tests to use. For agents that disperse passively no-choice tests (where they are given the option of feeding on an alternative host or dying) are considered appropriate, because they are continually exposed to no-choice situations in real life. Agents like gorse spider mites and fungi that blow about on the wind may end up anywhere with little or no chance of being able to escape onto a preferred host. These no-choice tests can often give "false positives" when the agents

attack plants under artificial experimental conditions that they have never actually been known to attack in real life. This was the case with gorse spider mite (*Tetranychus lintearius*), which during testing laid eggs on dwarf beans (*Phaseolus vulgaris*), although it never colonises bean plants under field conditions.

For agents that actively disperse, choice tests (where they are given the option of feeding on their host and one or more alternative hosts) are considered more appropriate and realistic because the agents are able to choose in real life. However, carrying out these tests alone may still not give you the full picture if circumstances can force the agent into no-choice situations. For example, this summer we were surprised to discover broom seed beetles (*Bruchidius villosus*) on tree lucerne. The beetles do not attack tree lucerne seeds in their home range because the plant does not grow there. Since tree lucerne does grow in Australasia and it is closely related to broom, researchers on both sides of the Tasman included this plant in choice tests before the beetles were released down under — the beetles chose broom every time. We have discovered that in New Zealand because, the beetles become reproductively active much earlier in the spring than in their homeland, they do not always have a choice. They are able to begin egg-laying weeks before broom begins to flower when only tree lucerne pods are available to them. We plan to investigate this situation further and we will keep you posted as we find out more.

If we are to make the best possible decisions when evaluating risk, then we need to continue to develop more sophisticated tests that more accurately reflect real-life situations, and to improve our interpretation of the results we obtain. For this reason Pauline Syrett is undertaking a study to compare the predicted targets of introduced biological control agents with their actual targets in the field after release. You can help too by providing us with some really valuable information (see box below).

Can You Help?

Pauline Syrett would like to know if anyone has seen **ragwort flea beetles** *(Longitarsus jacobaeae*), **cinnabar moths** (*Tyria jacobaeae*) or **magpie moths** (*Nyctemera annulata*) feeding on any plants other than ragwort.

Ragwort flea beetle and cinnabar moth were purposely introduced as biological control agents, but the magpie moth is a native insect that uses ragwort as one of its host plants. The magpie moth is interesting to us as a model of a potential biological control agent that has a wider host range than a single plant species, but is probably restricted to a single plant family.

Records and laboratory tests tell us that we should expect to find magpie moths on a wide range of plants in the daisy (Asteraceae) family, and that cinnabar moths mainly feed on ragwort, but may also be found on other closely related plants. The ragwort flea beetle has a narrower host range, but Pauline would not be surprised to find it on groundsel (*Senecio vulgaris*) or marsh ragwort (*Senecio aquaticus*).

You can help us to improve our knowledge of host specificity testing by filling in the enclosed form. If you have any queries please contact Pauline by phone (03) 325-6701 ext 3724, fax (03) 325-2418, or email syrettp@landcare.cri.nz.

Thanking you in anticipation!

Hieracium — A Problem Shared

Mouse-ear hawkweed

Last year Pauline Syrett spent several months working in the United States and she was able to catch up with American colleagues working on similar biological control projects. One project that we have in common is hieracium. Pauline was shown extensive infestations of field hawkweed (*Hieracium caespitosum*) by two farmers who run the Hawkweed Action Group — a fund-raising group that is modelled on our own Hieracium Control Trust. Field hawkweed is not regarded as the worst of the four weedy hawkweeds we have in New Zealand. "At present it is only a serious problem in Marlborough, but that may be because it is a more recent arrival," warned Pauline. We need to keep a close eye on field hawkweed as the Americans are collecting impressive data that shows it has massive a growth rate and reproductive potential. While field hawkweed is not our primary target for control, three of the six agents (the two hover flies and the gall midge) that the Hieracium Control Trust hope to release in New Zealand will attack it (see below). American researchers plan to look for additional agents that will specialise on field hawkweed.

Field hawkweed

Agent	Species of hawkweed attacked	Method of attack	Status
Hieracium rust	Mouse-ear*	Attacks the leaves, slowing growth	Widely established
Plume moth	Mouse-ear	Caterpillars graze rosette crowns & leaves	Mass-rearing underway to enable widespread releases to begin
Gall wasp	Mouse-ear	Larvae gall the stolons	2 field releases made in February 1999. Mass-rearing underway
Gall midge	Mouse-ear, field* & king-devil*	Larvae gall the plant	Undergoing final testing
Root hover fly	Mouse-ear, field & king-devil	Larvae feed on roots	Undergoing final testing
Crown hover fly	Mouse-ear, field, king-devil & orange*	Larvae feed within leaf axils and rosettes crowns	Undergoing final testing

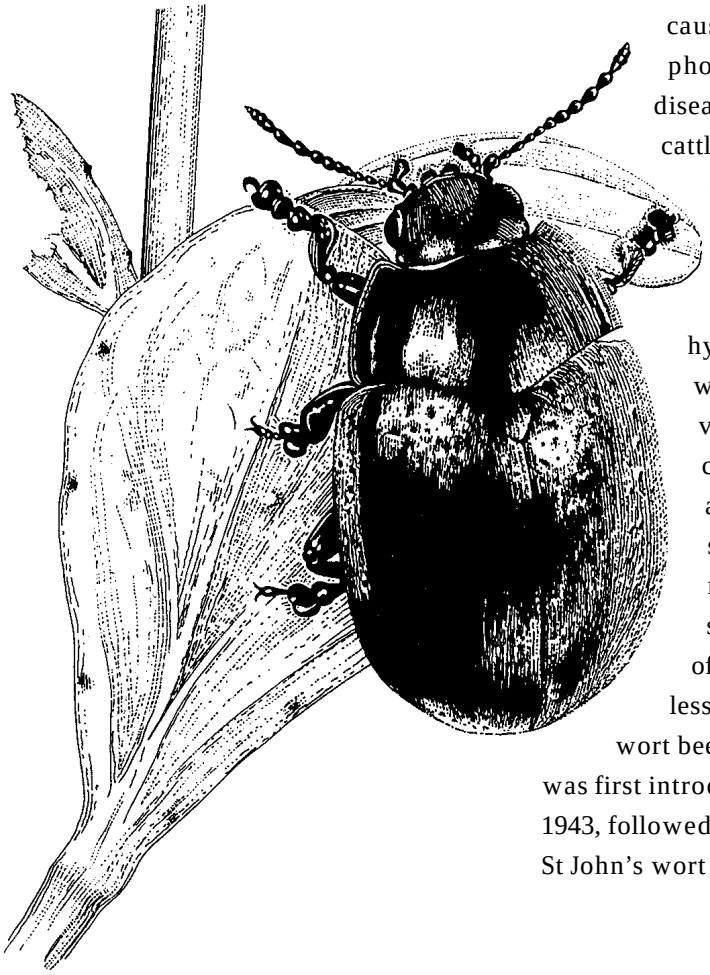
* Mouse-ear hawkweed = *H.pilosella*, field hawkweed = *H. caespitosum*, king-devil hawkweed = *H. praealtum*, orange hawkweed = *H. aurantiacum*

Lest We Forget

The town of Eureka in Humboldt County, Northern California, was so grateful to the greater St John's wort beetle (*Chrysolina quadrigemina*) that it erected a monument in its honour in the 1960s. St John's wort was once a huge problem in this area, but it is now under control, thanks to the beetle. Perhaps we should be doing the same sort of thing here?

Pauline Syrett with a memorial dedicated to the St John's wort beetle

The curse of St John's wort has been forgotten by most New Zealanders because they have never experienced it. Earlier this century it was one of the four worst weeds, up there with gorse, ragwort, and blackberry. The plant contains a nasty chemical called hypericin, which causes a photosensitisation disease in sheep and cattle that have eaten it. Affected stock also become hypersensitive to water resulting in violent convulsions and muscle spasms. In response to the serious impacts of this plant, the lesser St John's wort beetle (*C. hyperici*) was first introduced here in 1943, followed by the greater St John's wort beetle in 1965.



The impact of the defoliating beetles and improved land management techniques have caused St John's wort populations to shrink into obscurity. These days you are most likely to see the plant along roadsides where it is most obvious during flowering — look out for yellow, ragwort-like flowers, and you may also see the shiny metallic beetles feeding on them.

In the 1990s the tables have well and truly turned on St John's wort. The plant is back in favour as a herbal remedy for treating depression, sleeping disorders, seasonal affective disorder, and as an antioxidant and antiviral agent. Some councils have even granted exemptions that allow people to grow this former menace under controlled conditions.

Water, Wattles & Wasps

Collecting seed-feeding wasps from silver wattle using sleeve cages

Water is one of South Africa's most precious commodities. Invasive pines and Australian wattles (now called *Racosperma* in New Zealand, but previously known as *Acacia*) are seriously threatening that resource by sucking rivers dry, displacing native vegetation, increasing the risk of fire, and interfering with agriculture. The South African government has started a "Working for Water" programme, which aims to reduce the exotic tree cover in key areas. It is a huge, expensive undertaking. The plants are physically cleared but, with so much seed in the ground, this is only a temporary solution . A more permanent solution, incorporating biological control, is required and New Zealand is playing a small part in trying to help.

South African researchers have been investigating the natural enemies of wattles in Australia. Unfortunately some of these potential biological control agents are rare in their homeland, possibly because they, in turn, have their own natural enemies and competitors. Fortunately New Zealand has been able to come to the rescue. We have a small black wasp *(Bruchophagus acaciae)* that feeds inside wattle seeds. Since we don't have any native wattles here, the wasp must have originally come from Australia. It was first "discovered" at Lincoln in 1910, before it was known in Australia. The wasp is extremely common, and can destroy up to 90% of the annual seed crop of silver wattle (*Racosperma dealbatum*) around Lincoln. No wonder that the South African Plant Protection Research Institute (PPRI) are keen to get their hands on some!

Dr Richard Hill (Richard Hill & Associates) has been working for PPRI to assess whether this wasp is a suitable control agent, collecting seed from over 40 species of wattles to see which ones are attacked. Preliminary results suggest that the wasp only attacks a small number of closely related Australian wattles, and fortunately this is the group that causes most problems in South African riverbeds. Richard has also been looking at the biology of the wasp, its seasonal activity pattern, fecundity, distribution, and impact on seed production. He has already sent a shipment of the wasps to South Africa so that PPRI can do further testing in containment.

There are other natural enemies commonly seen attacking wattles in New Zealand. Look out for a weevil (*Storeus* sp.) that also feeds on the seeds, and a fungus (*Uromycladium* spp.) that forms galls on stems and pods. The galls are initially green and later turn brown when spores are formed. Without these natural enemies it is likely that we would have more problems with wattles here in New Zealand too. Autumn is a good time for

Autumn Activities

harvesting and redistributing ragwort flea beetles, nodding thistle crown weevils (*Trichosirocalus horridus*), nodding thistle gall flies (*Urophora solstitialis*), gorse pod moths (*Cydia succedana*), old man's beard leaf miner, and old man's beard fungus (*Phoma clematidina*).

For the first four agents listed refer to the appropriate pages in "The Biological Control of Weeds Book" for detailed instructions on how to go about this. See also "Tell Me More..." (later in this newsletter). Two words of caution when shifting agents around. Avoid sealing up ragwort flea beetles with large quantities of ragwort in non-breathable containers. It is possible that the plant releases toxic gases that can prove fatal to the insects under these conditions. Where possible collect on a cool day (or during the cooler parts of the day), put the insects in paper bags (not plastic bags), and provide only just enough plant material to tide the insects over while they are in transit. Also be careful to sort through any material that you collect with your garden-leaf vacuum so that you don't shift any pests, like the clover root weevil (*Sitona lepidus*), at the same time.

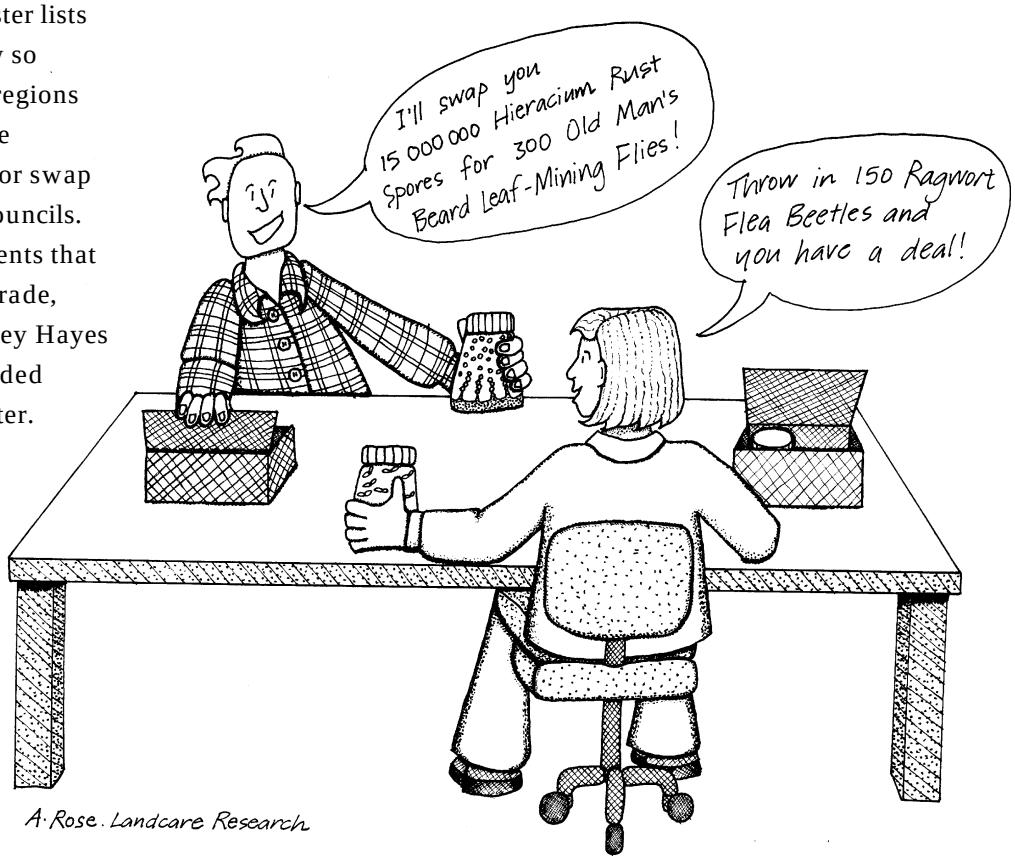
Old man's beard leaf miners are dispersing extremely quickly throughout the country, but if you do come across any uninfested patches before they do, then you can easily help to fill any gaps in their distribution. Simply collect as much mined leaf material as you can from a heavily infested site and leave this on the ground at the new site where it won't get blown away. You may notice small brown pupal cases stuck to the undersides of leaves. New adults will quickly emerge from these and colonise the new sites. Any larvae still mining the leaves will complete development on the cut material, and provide additional new adults for establishment.

Old man's beard leaf miner pupae

Likewise it is easy to shift old man's beard fungus to new sites. Collect blackened, infected leaves and wash the spores off by swilling them around in a bucket of water. Transfer the resulting liquid into a sprayer (it is better to keep one especially for this purpose to avoid contamination with herbicides etc.) and apply it to some old man's beard foliage. It is preferable to soak one area thoroughly than to apply the mixture too thinly. Because the fungus needs moisture to be effective, where possible choose shady, damp sites. If it rains heavily soon after application, then the spores may get washed off and you may need to repeat the procedure.

Trading Biological Control Agents

The following register lists agents that are now so abundant in some regions that the councils are prepared to share (or swap them) with other councils. If you also have agents that you would like to trade, please contact Lynley Hayes so you can be included in the next newsletter.



Agent	Available from
Alligator weed beetle	Peter Joynt, Northland Regional Council, Ph 09 439 6662
Cinnabar moth	Dave Galloway, Auckland Regional Council, Ph 09 426 7643 Lindsay Scott, Manawatu-Wanganui Regional Council, Ph 06 374 6700 Kevin Worsley, Wellington Regional Council, Ph 06 378 2484
Gorse pod moth	Rob McCaw, Canterbury Regional Council, Ph 03 365 3828
Gorse spider mite	Dave Galloway, Auckland Regional Council, Ph 09 426 7643 Bob Morgan, Manawatu-Wanganui Regional Council, Ph 06 376 7758 Ken Massey, Northland Regional Council, Ph 09 438 4639 Kevin Worsley, Wellington Regional Council, Ph 06 378 2484
Nodding thistle crown weevil	Phil Crotty, Canterbury Regional Council, Ph 03 688 9069
Nodding thistle gall fly	Phil Crotty, Canterbury Regional Council, Ph 03 688 9069
Ragwort flea beetle	Laurence Smith, Canterbury Regional Council, Ph 03 314 8014 Lindsay Scott, Manawatu-Wanganui Regional Council, Ph 06 374 6700

Tell Me More ...

This is a new section where we will deal with some of the questions that we are most commonly asked or topical issues that have arisen.
Please feel free to submit any questions you may have to Lynley Hayes (address below).

Question: *Leaf miners are now becoming established in a residential area where we require people to control old man's beard. What is the best advice that we can give these people so that the weed is controlled without wasting the leaf miners?*

Answer: Tell them to leave the cut vines on the ground for at least a fortnight. This way any flies that complete development and emerge will still survive and be able to seek out other old man's beard infestations nearby. Alternatively the cut vines could be taken straightaway to other sites where control is not mandatory or feasible.

Question: *What's the optimum time of year for collecting ragwort flea beetles for redistribution*?

Answer: Studies in the Manawatu suggest that egg laying occurs over a much longer period than was previously thought. Even as late as May there was no indication of a decline in the number of eggs obtained from field-collected samples. This means that even if beetles are collected late in autumn they are still likely to lay large numbers of eggs. However, we suggest that any time between mid-February and mid-March would be best.
If you collect too early, some of the beetles that you release may disperse or die before they begin to lay eggs. If you release the beetles too late they will have fewer eggs to lay before they succumb to adverse weather.

Question: *How far will ragwort flea beetles have dispersed after 3–4 years?*

Answer: Dispersal seem to be highly variable. We've had reports of ragwort flea beetles being recovered several kilometres away from a release site in the first season, but these might have been

Ragwort flea beetle

from an unrecorded, unofficial release nearby. More commonly we find that a release of 300 beetles in one corner of a large paddock will have covered the whole paddock (several hundred metres), but not much further, by the next year. Conversely, at one of our experimental sites that was heavily infested with ragwort, the beetles took 3–4 years to spread over the whole paddock. When a ragwort infestation is severe, beetles may spread slowly because they have no need to travel far to find good plants on which to lay eggs. The beetles are good at finding ragwort plants, so when ragwort infestations are sparse, with widely scattered plants, flea beetle populations may disperse rapidly. Some of our colleagues in Oregon put a potted ragwort plant on the roof of a tall building in the middle of a city, many kilometres from the nearest naturally growing ragwort plant, and ragwort flea beetles quickly discovered it.

Question: *Do ragwort flea beetles prefer rosettes over flowering plants*?

Answer: Yes. They lay more eggs per weight of ragwort foliage on rosettes than on flowering plants. This makes sense, as flowering plants usually die and larvae that cannot complete their development before the roots and crown senesce must either transfer to a nearby plant or perish.

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Care for the land. Care for the people.