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Weed Biocontrol

WHATS NEW?

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Ragwort Biocontrol Pays Off

Ragwort (*Jacobaea vulgaris*) spread to reach its full potential range in New Zealand back in the 1920s, infesting vast areas of pastoral land. Especially toxic to horses and cattle, this poisonous weed was a particular problem for dairy farms around New Zealand, and was one of the first biocontrol projects in New Zealand.

During the 1920s, government agencies took the advice of a Professor of Botany in the UK and chose the cinnabar moth (*Tyria jacobaeae*) and a seedfly (*Botanophila jacobaeae*) as biocontrol agents to try. The ragwort flea beetle (*Longitarsus jacobaeae*) was shortlisted in the 1930s, but then dismissed as a potential agent because it was thought to have little impact on ragwort, based on observations that the adults only cause minor damage to leaves, and overlooking the fact that the larvae can severely damage the roots. By 1939, both the cinnabar moth and the seedfly were well established, but failed to make any noticeable progress on the ragwort problem. It wasn't until 1980s that the idea of using the ragwort flea beetle was revisited based on encouraging reports from the USA and Australia where the beetle had been introduced to control ragwort. The ragwort flea beetle was released in New Zealand in 1983 and by the early 1990s was beginning to make inroads into the ragwort problem, which is now a rare sight in many previously infested parts of the country. "Although the beetle had a big impact on the ragwort, unfortunately, little quantitative data was collected or published so until now, we have only been able to speculate on the financial benefits to New Zealand farmers," explained Simon Fowler.

In 2005, two additional insect biocontrol agents, the ragwort plume moth (*Platyptilia isodactyla*) and the ragwort stem borer (*Cochylis atricapitana*), were released in New Zealand to complement the ragwort flea beetle at wetter sites where it is less effective. Both of these moths have been used successfully in Tasmania to improve the levels of control achieved by the flea beetle, although in New Zealand only the plume moth has established. As part of the application to release these two agents, a survey was conducted on 32 randomly selected West Coast dairy farms (where the ragwort flea beetle had not provided sufficient control) to determine the cost of ragwort control.

In the past few months, Simon has used this data to complete a national benefit-cost analysis that predicts what the cost of ragwort control would be across New Zealand in the absence of biocontrol by the flea beetle. "The ragwort flea beetle failing to suppress ragwort on the West Coast has given us a chance to extrapolate what the cost might be nationally if there wasn't successful biocontrol of ragwort in place elsewhere," explained Simon. This is only the second time that a post-release economic analysis of a New Zealand weed biocontrol programme has been done, the first being the analysis of St John's wort (*Hypericum perforatum*) (see Issue 61).

The costs of developing the biocontrol programme were calculated from excellent historical reports on the research carried out, and then inflation-adjusted back to the year they were incurred. Ragwort control costs (chemical and manual), were extrapolated from the 2005 survey of dairy farms on the West Coast, taking into account the proportion of farms nationally that had benefitted from the flea beetle (based on a aggregation of all the quantitative data we could compile). Further adjustments were made for inflation and the national size of the dairy herd from 1926 to the present day.

The economic analysis was undertaken on the assumption that the ragwort control costs, reported by the farmers in the 2005 survey, were accurate and indicative of costs that would have been incurred elsewhere in New Zealand in the absence of the flea beetle.

"We also assumed that the decline in ragwort elsewhere in New Zealand could be attributed to the presence of the ragwort flea beetle, and that where ragwort was suppressed it would be replaced with pasture and not some other invasive weed," said Simon.

The results of the analysis took everyone by surprise. The savings in ragwort control costs on dairy farms in New Zealand as a result of biocontrol by the flea beetle was predicted to be $44 million for 2015 alone. These annual savings are ongoing and sustainable, with no further investment needed. A net present value analysis of the annual benefits and costs from 1926 onwards gave a benefit-cost ratio of 14:1, i.e. for every dollar invested in ragwort biocontrol New Zealand has gained $14 in reduced ragwort control costs. Who wouldn't invest $1 to make $14! "Nevertheless, dairy farms nationally are still incurring costs of around $20 m each year, mostly in the wetter regions, to keep ragwort in check, but the establishment of the ragwort plume moth should help reduce this considerably," Simon added.

"Despite some ongoing costs in high rainfall areas, the biocontrol of ragwort has had very large benefits to New Zealand dairy farms in terms of reduced control costs. Especially considering that these costs don't include figures for loss of production or the costs to farmers when stock are poisoned," Simon said. "Had we included the benefits from ragwort biocontrol to other sectors of the farming community, such as deer or sheep and beef farming, the savings would be even greater," he added. Unfortunately, the decision to overlook the ragwort flea beetle as a biocontrol agent in the 1930s was very costly. Had it been introduced early in the programme, New Zealand would have saved a staggering $8.6 billion in today's terms (calculated as net present value).

The economic analysis has underlined the importance of selecting appropriate agents at the start of biocontrol programmes rather than relying on anecdotal, non-quantified evidence from researchers and professors! "Refining agent selection is a key area of our research," said Simon. "We want to avoid spending valuable stakeholder resources on agents that have a low chance of success and we have made considerable progress on understanding why around three of every four agents released and established in the past failed to have any significant impacts on the target weeds," concluded Simon.

This project is funded by the Ministry of Business, Innovation and Employment as part of Landcare Research's Beating Weeds programme. The project by the West Coast Ragwort Control Trust to bring in additional ragwort agents was supported mainly by the MAF Sustainable Farming Fund with contributions from a range of other organisations.

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An increasingly unfamiliar sight in New Zealand, ragwort in 1981 before the release of the flea beetle.

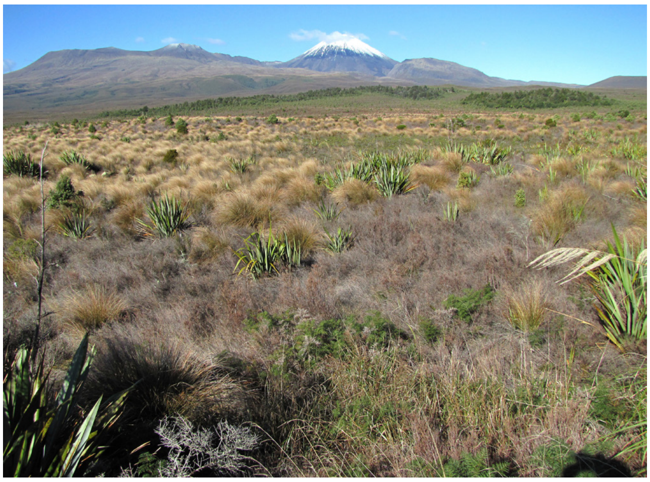
Heather Beetle set for Even Greater Things

In 2014, Paul Peterson (Landcare Research) and Paul Barrett (Massey University) went to Scotland to collect some larger, more 'rugged' heather beetles (*Lochmaea suturalis)* to supplement the existing population, which has struggled to cope with the conditions in some parts of Tongariro National Park. Heather was introduced to the park to create habitat for grouse back in 1912 and since then it has expanded its range to cover more than 50 000 ha of mainly conservation land, where it forms a dense monoculture displacing native plant communities.

"Although this biocontrol programme has been underway for some time, and we estimate that nearly 3000 ha of heather have now been killed by the beetles, establishment of the heather beetle in some parts of the park has been frustratingly slow," said Simon Fowler, who has been involved since the outset. Detailed investigations to explain the mixed performance of heather beetles since their release in 1996 have resulted in three hypotheses: poor climate matching, genetic bottle-necking and low foliar nitrogen in heather. "We suffered setbacks when line-rearing the original importation of beetles as some of them were infected with a microsporidian gut parasite," said Lindsay Smith, who reared heather beetles in containment prior to the first field release.

Subsequent work has shown New Zealand beetles to be genetically compromised and physically smaller, so more beetles were collected from Scotland and mated with New Zealand beetles. "One of the main goals was to increase heather beetle body size so that they had sufficient fat reserves to survive the long winter and variable spring conditions faced in Tongariro National Park," said Paul Peterson. "We had evidence to show that beetles from Scotland were larger and less likely to be carrying microsporidia, although we did screen all the new ones just to make sure" he added.

Last November more than 300 of the new line of beetles were released at a low altitude site (~400 m a.s.l.) near Turangi into a field cage, to prevent them from dispersing too quickly and hopefully improve their chances of establishing. "We also added fertiliser to the area because our research has suggested that the beetles survive better on heather that has higher nitrogen levels in the foliage," said Paul. "If we can get the new population to establish, comparisons between the original and new populations can then be made to see if performance has been improved. It is hoped that larger heather beetles will perform better at higher altitudes where heather has become increasingly prevalent and is altering the composition of alpine plant communities, according to DOC technical adviser Harry Keys. Lab rearing of remaining stock is ongoing and more releases will be made this year to improve the chances of establishing the beetles.



Heather killed by the heather beetle (greyish plants in the foreground).

Previously we compared the effects of using herbicide versus biocontrol. In the plots where heather was controlled using herbicide, a lot of native plants (mainly dicots) were also killed from contact with the herbicide and failed to recover afterwards, whereas in the plots controlled using biocontrol, the native plants had a new lease of life. Many native and exotic grasses also benefited from the removal of heather in both plots.

"We are closely monitoring the total area of heather being damaged by the existing population and most damage is occurring at four key sites within the park," said Paul. At each site, the damage is roughly doubling each year, which is slow compared with how quickly populations grow in the native range. "If we can't improve current performance, we predict it will take 18 years for the beetles to damage heather over the 50 000+ ha area currently infested," said Paul.

As well as monitoring the progress of new 'genetically rescued' heather beetle populations, future research is likely to include continuing to assess the recovery of native vegetation following heather biocontrol and monitoring native insect diversity and impacts on native and exotic vertebrates such as skinks, mice and birds.

This project is funded by the Ministry of Business, Innovation and Employment as part of Landcare Research's Beating Weeds programme.

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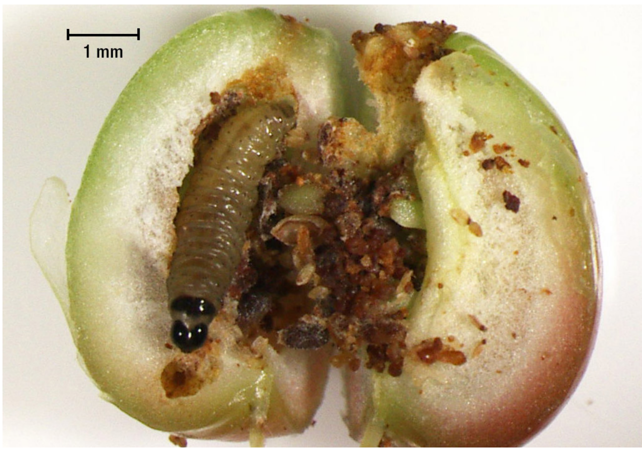
Tutsan Agents Imminent

South Islanders might not be familiar with tutsan (*Hypericum androsaemum*), but it is now a highly visible and well-known weed in the central North Island. Tutsan grows to about 1.5 m in height and has bright yellow flowers that appear from November until February. Round black berries are produced that are attractive to birds (and probably possums), who distribute the seed around the landscape. Like many other weeds, tutsan was originally introduced to New Zealand as a garden ornamental but soon naturalised into the wider environment, repeating the invasion patterns seen in a number of other countries including Australia. It was noted as a 'weed of significance' back in 1955 and since then has become a major issue in the hill country of the North Island, particularly around Ruapehu. In the last 50 years tutsan has not only affected productive landscapes but also conservation land.

As mentioned in Issue 66, there appears to be two different genetic origins of this weed in New Zealand. Tutsan growing in the North Island is more genetically similar to tutsan from Wales and Ireland, whereas the plants growing the South Island are more genetically similar to tutsan from England and France. Both genetic groups have a specialist rust disease (*Melampsora hypericorum*) associated with them, which may be holding South Island populations in check but, unfortunately, not North Island populations, which are continuing to expand.

"Since 2013, we have been investigating some new biocontrol agents on behalf of the Tutsan Action Group, a farmer-led group supported by Horizons Regional Council," explained Hugh Gourlay, who has led this project. "One of the challenges with finding suitable candidates for this plant has been the level of host specificity required. There are 19 *Hypericum* species in New Zealand including another invasive weed, St John's wort (*H. perforatum*). Four of these species are native to New Zealand and we need to be sure that any insects that we introduce will not harm them," said Hugh.

Two specialist insect species were imported from Europe, a leaf-tying moth (*Lathronympha strigana*), which attacks the stems, shoot tips and seed pods of the plant, and a small leaf beetle (*Chrysolina abchasica*), which attacks the foliage. Both have been in containment at Lincoln since 2014, and appear to be highly damaging. Host testing has recently been completed. The leaf-tying moth laid eggs only on *Hypericum* plants, with a preference for tutsan (*H. androsaemum*). The resulting larvae survived only on tutsan and St John's wort, leading us to conclude that there is no significant risk of non-target attack on other *Hypericum* species, including the native species.



Leaf-tying moth larva attacking a tutsan seed pod.

The leaf beetle testing results were not quite so clear-cut. Testing showed that two of the native *Hypericum* species (*H. pusillum* and *H. rubicundulum*) can be considered fundamental hosts i.e., the beetle was able to complete its lifecycle on them in the laboratory in an unnatural environment where there is no choice of host plant. However, most of the adults that were produced on these two plant species died soon after emergence. Not all plants that are fundamental hosts prove to be actual hosts in the field, and testing in cages can overestimate the risks. "In reality the risk of the leaf beetles attacking the two native *Hypericum* species in the field is low. These new beetles are likely to be less of a threat than the existing St John's wort beetles (*Chrysolina* spp.), which were released to control St John's wort over 50 years ago," said Simon Fowler. "To reach this conclusion, we used recent research in the Beating Weeds programme (see Issue 68), which shows that the relative performance of agents in laboratory trials on a test plant versus the target weed is a good predictor of whether a fundamental host will actually be attacked in the field," added Simon. In this case, the relative performance scores suggest the tutsan leaf beetle is a safer bet than the St John's wort beetles. Notably, the St John's wort beetles have proven to be well-behaved in the field and do not do any significant damage to indigenous *Hypericum* species.

An application to release the leaf-tying moth and the leaf beetle is currently being prepared and will be submitted to the Environmental Protection Authority before Christmas.

This project is funded mainly by the Ministry for Primary Industries' Sustainable Farming Fund (401451), with co-funding provided by a range of other organisations.

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Meet the National Biocontrol Collective

One of the advantages of being a small country is that it can be easier to achieve a co-ordinated and cohesive approach to issues of national importance. A great example of this is the National Biocontrol Collective (NBC), which since 2002 has been jointly tackling serious weeds through biocontrol methods. In this piece we reflect on what the NBC has achieved, some of the key reasons for its success, and current and future challenges.

The NBC pools its resources, and undertakes collaborative decision-making about how best to use them, for the benefit of the whole country. This has allowed work to be undertaken on some serious weeds that are currently low incidence, e.g. lantana (*Lantana camara*), that would otherwise be difficult to support. The NBC has also, by providing co-funding, enabled other significant funds to be leveraged by community groups for biocontrol of productive sector weeds via the Ministry for Primary Industries' Sustainable Farming Fund such as those currently operating for field horsetail (*Equisetum arvense*) and tutsan (*Hypericum androsaemum*). "Support from the NBC for local projects like this is a huge boost to local communities attempting to find solutions to serious weed problems," said Craig Davey of Horizons Regional Council.

Each spring the NBC (comprised of 10 regional councils, three unitary authorities and the Department of Conservation) gets together to reflect on progress and agree on priorities for funding the following year. "Differences in weed priorities regionally have always meant robust debates but the NBC has always been able to agree on an acceptable programme of work," confirmed Lynley Hayes. It is essential that all members can identify at least one project of benefit to them. Projects are ranked through a voting process and then the list is scrutinized, and if necessary tweaked slightly, to gain this agreement. "The NBC operates with a high degree of trust and goodwill, and this has been critical to its success and longevity," said Lynley.

The National Biocontrol Collective and Landcare Research staff at their annual meeting in October 2015.

Until recently the projects funded by the NBC have been mostly influenced by factors such as investment to date, the ability to leverage other funds and how widespread a weed is (which tends to gain it more votes). With far more weeds to manage in New Zealand than there will ever be funding to develop biocontrol for, it has been recognized that more emphasis needs to be given to tackling those with the worst potential impacts (e.g. ecosystem transformers), even if they are not widespread, and the NBC is now beginning to take this more into account.

Over the past 13 years the NBC has invested $7.3m in weed biocontrol, which has contributed substantially to allowing 18 new agents to be approved for 10 targets. Hard data on what has been achieved for this investment to date have been lacking, since it can be decades before biocontrol projects come to fruition and it has simply been too soon to assess the benefits. However, a number of projects appear set to be highly successful. Recent large outbreaks of the broom gall mite (*Aceria genistae*), woolly nightshade lace bug (*Gargaphia decoris*) and green thistle beetles (*Cassida rubiginosa)* have severely damaged their target weeds and, although only released recently, tradescantia beetles (*Neolema* spp., *Lema basicostata*) are already causing some impressive damage at some sites.

It has traditionally been difficult to gain support for the monitoring and assessment components of biocontrol projects, through any funding source. However, the NBC is supporting two projects currently to assess some agents released before the collective came into being. Ragwort flea beetle (*Longitarsus jacobaeae*), nodding thistle crown weevil (*Trichosirocalus horridus*) and nodding thistle gall fly (*Urophora solstitalis*) release sites are being revisited and reassessed nationwide 15–25 years after these agents were released. The NBC also recently adopted a nationwide monitoring protocol (see Issue 71) to ensure all the agents they develop are followed up appropriately. "Funding from the NBC supports a database that keeps track of the fate of released agents, the production of this newsletter and the development of other information resources to support the work, as well as annual workshops to upskill their staff in the philosophy and practice of biocontrol," explained Lynley.

Until more local data is available the case for biocontrol is often made by taking a global view. Overseas reviews have shown that around a third of biocontrol programmes are so successful that no other control is subsequently required, half are partially successful (e.g. effective in some habitats, but not in others) and only a sixth are failures (no impact). Often the reason for a

Currently the NBC is funding the development of biocontrol for:

- Banana Passionfruit (*Passiflora* spp.)
- Chinese Privet (*Ligustrum sinense*)
- Darwin's Barberry (*Berberis darwinii*)
- Japanese honeysuckle (*Lonicera japonica*)
- Lagarosiphon (*Lagarosiphon major*)
- Moth Plant (*Araujia hortorum*)
- Old Man's Beard (*Clematis vitalba*)
- Pampas (*Cortaderia* spp.)
- Wild Ginger (*Hedychium* spp.)
- Woolly Nightshade (*Solanum mauritianum*)

lack of success is insufficient funding to complete the necessary research, rather than the lack of suitable agents. Overseas studies have also shown that the benefit-cost ratio that can be expected from the investment in weed biocontrol projects is between 10:1 and 4000:1. Biocontrol projects typically cost between $500K and $2M all up, depending on whether they are a repeat of a project developed elsewhere or aimed at a never before attempted target. The benefits of successful projects are typically so large that they totally eclipse the costs of developing less successful projects (see Ragwort Pays Off, page 2). "All evidence suggests that substantial benefits can be expected from NBC-funded work, even if not all projects are successful," said Craig.

A recent analysis published, by Quentin Paynter as lead author, suggests that agents are being developed by the NBC in a highly cost-effective manner. This paper found that the average cost of developing an agent for New Zealand was NZ$355,686 (with the average cost per novel agent being NZ$475,334, more than double the average of NZ$202,803 for repeat agents). By comparison, in 1997 the cost on average to produce a weed biocontrol agent overseas (based on the number of scientist-years to test an agent reported by practitioners in Canada, Europe and the USA) through to introduction was estimated to be US$460,000. This equated to approximately NZ$1m in 2014 (taking into account the exchange rate of the day and CPI adjustment).

The NBC invests a modest amount of resources across a range of projects annually (typically around $50-$100K) so progress can be slower, but made on multiple fronts, to satisfy the wider needs of members. An important lesson has been that when a number of novel projects are begun in quick succession there can be lean periods where no new agents become available and progress is questioned. "These can be followed by boom periods when many agents come to fruition in quick succession, which can put stress on resources such as containment facilities and the regulatory body, the Environmental Protection Authority," explained Lynley. The NBC is now beginning to consider more fully the implications of the overall portfolio of projects agreed each year.

Objectives agreed with the NBC annually have often not been tightly prescriptive to allow minimal administration and maximum flexibility, so the work plan can quickly be refocused if necessary as opportunities arise and subside. However, this approach can mean that some NBC members feel they have insufficient control over what happens, and more prescriptive or milestone contracting may be required in the future, which is likely to increase the cost of the administration.

New Zealand manages to punch far above its weight on the international weed biocontrol scene, especially considering the modest resources it has for the work compared to others. New Zealand is probably developing weed biocontrol agents more quickly and cheaply than any other country in the world. Legislation that enables weed biocontrol agents to be approved in a timely and efficient manner in New Zealand is a contributing success factor. However, no other country appears to have a similar arrangement where end-users collaboratively undertake decision-making about priorities, advocate for and provide long-term support for projects, and assist with release and redistribution of agents and follow-up assessment. There is also no other model internationally where operational research sits so hand in glove with underpinning research programmes, where both are able to immediately benefit the other. "Landcare Research's government-funded Beating Weeds programme has enhanced the safety and efficacy of biocontrol and been able to support projects where more than routine operational research is required (e.g. when the tradescantia beetles needed to be freed of internal parasites)," explained Simon Fowler, who manages the Beating Weeds programme. The NBC programme also benefits the Beating Weeds programme by allowing it to demonstrate both immediate relevance and uptake.

Boom and bust funding, sadly a common scenario for science, has seen the major loss of weed biocontrol capability in countries like Australia, which were previously world leaders. Once capacity is lost it is extremely difficult, if not impossible, to replace it. Government and NBC funding have provided some stability to date, allowing national capacity in New Zealand (largely housed in Landcare Research) to remain mostly intact. Neither source, though, is keeping pace with inflation currently or is guaranteed to continue in the longer term, so the risk of loss of national capability remains. "However, other organisations are showing interest in joining the NBC, and this represents an opportunity to build on and enhance achievements to date, provided the key aspects that have contributed to success are not eroded," said Lynley. National Science Challenges, currently being set up in New Zealand, may also provide further opportunities for enhanced collaborations to minimise the impacts of serious weeds.

We thank the National Biocontrol Collective for their wonderful support over many years!

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Summer Activities

Summer is a busy time in the world of biocontrol. Some activities you may need to schedule are listed below.

Boneseed leafroller (*Tortrix* s.l. sp. *"chrysanthemoides"*)

- Check release sites for feeding shelters made by caterpillars webbing together leaves at the tips of stems. Also look for "windows" in the leaves and sprinkles of black frass. Small caterpillars are olive green in colour and become darker, with two parallel rows of white spots as they mature.
- Caterpillars can be harvested if you find them in good numbers. Cut off infested boneseed tips and wedge them into plants at new sites. Aim to shift at least 500 caterpillars to sites where scale insects and invasive ants are not known to be present.

Broom gall mites (*Aceria genistae*)

- Check release sites for galls, which look like deformed lumps and range in size from 5 to 30 mm across. Heavily galled plants may be dead or dying.
- If galls are present in good numbers, late spring – early summer is the best time to undertake harvesting and redistribution. Because the mites are showing much promise but are expected to disperse quite slowly, it will be important for all regions with a major broom problem to plan a comprehensive redistribution programme. Aim to shift at least 50 galls to each site and tie them onto plants so the tiny mites can shift across.

Broom leaf beetles (*Gonioctena olivacea*)

- Check release sites by beating plants over a tray. Look for the adults, which are 2–5 mm long and goldish-brown (females) through to orangey-red (males) with stripes on their backs. Look also for greyish-brown larvae that may also be seen feeding on leaves and shoot tips.
- It is probably still a bit soon to begin harvesting and redistribution.

Green thistle beetles (*Cassida rubiginosa*)

- Check release sites for adult beetles, which are 6–7.5 mm long and green and quite well camouflaged against the leaf. The larvae also make windows in the leaves. They have a protective covering of old moulted skins and excrement. You may also see brownish clusters of eggs on the underside of leaves.
- It should be possible to harvest beetles at many of the older sites. Use a garden-leaf vacuum machine and aim to shift at least 50 adults from spring throughout summer and into autumn. Be careful to separate the beetles from other material collected, which may include pasture pests. Please let us know if you discover an outbreak.

National Assessment Protocol

For those taking part in the National Assessment Protocol, summer is the appropriate time to check for establishment and/or assess population damage levels for the species listed in the table below. You can find out more information about the protocol and instructions for each agent at: www.landcareresearch.co.nz/publications/books/biocontrol-of-weeds-book

Target	When	Agents
Tradescantia	Nov-April	Leaf beetle (*Neolema ogloblini*) Stem beetle (*Lema basicostata*) Tip beetle (*Neolema abbreviata*)
Woolly nightshade	Feb-April	Lace bug (*Gargaphia decoris*)

Tradescantia leaf beetle (*Neolema ogloblini*)

- Check release sites, especially the older ones. Look for notches in the edges of leaves caused by adult feeding or leaves that have been skeletonised by larvae grazing off the green tissue. You may see the dark metallic bronze adults sitting on the foliage or the larvae, which have a distinctive protective covering over their backs. The white, star-shaped pupal cocoons may also be visible on damaged foliage.
- Redistribution has begun at some of the older sites. If you can see plenty of beetles sitting about then harvesting can begin. Aim to collect and shift 50–100 beetles. Collect the beetles either using a beating tray or a small net.

Tradescantia stem beetle (*Lema basicostata*)

- Check release sites, especially the older ones. The black knobbly adults tend to drop when disturbed, and can be difficult to see. Look for their feeding damage, which consists of elongated windows in the upper surfaces of leaves or sometimes whole leaves consumed. The larvae inside the stems will also be difficult to spot. Look for stems showing signs of necrosis or collapse and brown frass.
- If you can find widespread damage at the site then you may be able to begin harvesting and redistribution. We still need to identify the best possible method to do this. We suggest trying to remove a quantity of the damaged material and putting in a wool pack or on a tarpaulin and wedging this into tradescantia at new sites. However, to distribute tradescantia in this manner an exemption from the Ministry for Primary Industries will be required.

Tradescantia tip beetle (*Neolema abbreviata*)

- Check release sites, especially the older ones. The adults are mostly black with yellow wing cases, and you may see them sitting about on the foliage. Look also for their feeding damage, which looks like elongated windows in the leaves, similar to the stem beetle. Larvae will also be difficult to see when they are feeding inside the tips, but brown frass may be visible. When tips are in short supply, the slug-like larvae feed externally on the leaves.
- We expect it is probably still a bit soon to begin harvesting and redistribution just yet.

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