Weed Biocontrol

WHAT'S NEW?

#87
FEB 2019

Manaaki Whenua
Landcare Research

Contents

Key contacts

EDITOR: Lynley Hayes
Any enquiries to Lynley Hayes
hayesl@landcareresearch.co.nz

THANKS TO: Ray Prebble
LAYOUT: Cissy Pan

CONTRIBUTIONS: Alison Evans

COVER IMAGE:

Tongariro National Park before (2008) and after (2018) biocontrol of heather.

www.weedbusters.org.nz

ISSN 2463-2961 (Print) ISSN 2463-297X (Online)

www.landcareresearch.co.nz

Horehound Agents Ready for Action

A grant from the Ministry for Primary Industries' Sustainable Farming Fund has enabled the importation of two agents to help bring horehound (*Marrubium vulgare*) under control. Horehound is predominantly found on hill country farms, where it affects the quality of wool, lowering profit margins. The meat can also be tainted if sheep are grazing in areas where it is abundant. Some farmers are having to retire areas of their land due to extremely high horehound infestations because it is no longer suitable for grazing. Horehound is also troublesome in lucerne crops, which are susceptible to the heavy-duty herbicides needed to control this weed. Current costs of horehound to dryland sheep farmers are estimated to be in excess of $6.85 million per annum.

Two biocontrol agents were recently sourced from Australia. The plume moth (*Wheeleria spilodactylus*) attacks the above-ground vegetation, while the clearwing moth (*Chamaesphecia mysiniformis*) attacks the roots.

Landowner and chair of the Horehound Biocontrol Group, Gavin Loxton, has been involved with the project from the start and has taken a personal interest in seeing the agents released. "Once we started to gather information about the extent of horehound, we realised that we had underestimated its true distribution," said Gavin.

Sourcing the agents has been relatively straightforward compared with other biocontrol programmes. "Satisfactory host-range testing had already been completed by our Australian colleagues before the moths were released there in 1994. An application to release the same biocontrol agents was made to the Environmental Protection Authority (EPA) in May 2018," said Ronny Groenteman, who is leading the scientific aspects of the project for the Horehound Biocontrol Group.

During the pre-application consultation process concerns were raised by the Herb Federation of New Zealand and the New Zealand Association of Medical Herbalists

Gavin Loxton and helpers releasing the clearwing moth in the Mackenzie Basin.

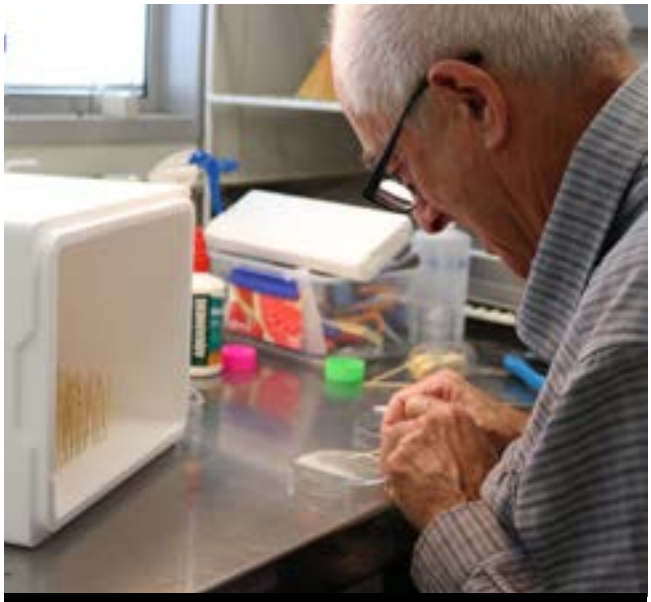
regarding the impacts of biocontrol agents on wild horehound, which is harvested for medicinal purposes. Ronny met with members of these groups to listen to their concerns and explain how they could participate in the decision-making process undertaken by the EPA. On balance, the EPA decided that the circumstances faced by farmers, including costs from having the plant on their land and the shortcomings of other management options, outweighed the concerns of the herbalists, which could be mitigated. Therefore, approval was granted by the EPA to release the moths. "We are continuing the dialogue with the herbalist industry to develop techniques to mechanically protect some horehound plants from the moths and we are hopeful that a win-win solution can be found," said Ronny.

Clearwing moths require specific conditions, such as high temperatures during the summer months, to mate and reproduce. The moths also require sheltered sites, as they rely on pheromones to attract mates and these are easily diluted in the wind. "Initially we were uncertain if we would be able to create the right conditions for the clearwing moths inside the containment facility. Fortunately, the moths responded well to the natural light available in the facility, and started reproducing prolifically," said Ronny. A novel technique for releasing the moths in the field developed by the Australians has been adopted here. "We learned that gluing the eggs to the top of a cocktail stick/toothpick and sticking that onto a cut stem of horehound allows the newly hatched larvae to crawl down on to the cut stems, eventually reaching the roots of the plant – a winning formula," said Ronny. Once the moth has successfully established there is no need to repeat the fiddly egg-gluing exercise, since infected root material can then be transferred to other farms.

Thankfully the plume moth is easier to rear in containment, and much more straightforward to release in the field too. Our Australian colleagues predict that the plume moth will easily establish anywhere horehound is present in New Zealand. In Australia establishment was successful wherever annual rainfall was above 450 mm, which describes most of New Zealand.

Shortly before Christmas, Manaaki Whenua – Landcare Research was granted permission to remove the horehound moths from containment, and in the 2 weeks that followed, releases were made in Marlborough, North Canterbury and the Mackenzie District. Altogether, five releases of the clearwing moth and eight of the plume moth were made, including one on a farm close to Lincoln, where we are aiming to create a 'nursery site' for future redistribution.

"Most landowners have been very receptive to the idea of biocontrol and we hope that the programme will be at least as successful as other biocontrol projects, such as the one for ragwort [*Jacobaea vulgaris*]," said Gavin. Gavin has been monitoring horehound on Sawdon Station in Tekapō for 3 years to gain a better understanding of the population dynamics. He found that cocksfoot [*Dactylis glomerata*] is one of the main competitors for horehound, and he expects that once the vigour of the horehound is reduced it will be quickly replaced. "Horehound plants can produce up to 20,000 seeds per year, and the seeds remain viable in the ground for 7 years or more," Gavin explained. Gavin is encouraging farmers to consider temporarily replacing horehound-infected lucerne crops with cocksfoot until such time as the horehound seed bank is exhausted. But the biocontrol agents will, hopefully, in time, offer good control and expand into areas that are not able to be managed using other methods.


Lindsay Smith gluing clearwing moth eggs onto toothpicks.

For now, though, it is a matter of waiting to confirm that the moths have established. The plume moth has two or three generations per year, so with a bit of luck it may be possible to find some sign of them next spring. The clearwing moth, which has only one generation per year, will take a bit longer. Even if moths can be seen flying about at release sites next summer, it will probably take a few years to determine whether conditions are consistently suitable for them to mate and produce offspring. Here's hoping!

A big thanks to John Weiss of Agriculture Victoria and Jean-Louis Sagliocco for their valuable assistance, including securing populations of the horehound moths in Australia and rearing and release advice.

CONTACT
Ronny Groenteman – groentemanr@landcareresearch.co.nz

Two Agents Ready to Trim Old Man's Beard

Approval to release a bud-galling mite (*Aceria vitalbae*) to attack old man's beard (*Clematis vitalba*) was given by the Environmental Protection Authority (EPA) in October 2018. It is hoped that this mite can provide a valuable tool in the long-running battle to reduce the vigour and harmful impacts of this rampant vine. Horizons Regional Council, which administers one of the regions worst affected by this weed, submitted the release application on behalf of the National Biocontrol Collective. With permission to release now granted, the next hurdle will be to establish a thriving mite colony that can provide material for field releases.

"Establishing a mite colony in containment has so far proved to be a tricky business," said Lindsay Smith, who is overseeing the project. The mites have either arrived from Europe in poor condition or there have been issues with insect pests like aphids and thrips out-competing the mites on potted plants. These pests are not a problem on old man's beard (OMB) grown outside, but in the warm, protected environment inside containment they can quickly become problematic. Sometimes it becomes impossible to control them without also harming the mites, or the plant quality becomes too poor to sustain the mites. Lacewings and ladybirds offer some level of control once in containment, but the best strategy is to prevent unwanted pests from initially colonising plants through insecticide treatment. But this can also be problematic, at the very least requiring a substantial withholding period before the mites can be put on treated plants, by which time they are once again vulnerable to attack from other insects.

A fresh attempt to establish a mite population in containment will be made in June. All possible measures will be taken to prevent unwanted pests from colonising potted OMB plants. Also, to avoid any shipping issues, mite expert Dr Biljana Vidovic from the University of Belgrade, Serbia, who completed the host specificity testing of the mite, will hand-deliver them. She will also help with the painstaking transfer of the tiny (much < 1 mm long) mites onto potted OMB plants in containment. The plan is to rear the mites in containment until leaf burst occurs on OMB in early spring, and then begin field releases. "Galls caused by mites stunt new plant growth and offer the mites protection from unfavourable weather conditions and predation," said Lindsay. It is uncertain how the mites will perform in NZ or how quickly they will reproduce. However, the OMB gall mite is closely related to the broom gall mite (*Aceria genistae*), which has performed exceptionally well since its release, so hopes are high that it will also do well.

Arnaud Cartier releasing sawflies at Waipara river in December.

Lindsay has also been involved in attempting to improve establishment of the OMB sawfly (*Monophadnus spinolae*). This agent was first released in the 1990s but is only present in low numbers at one of the 16 release sites. It seems likely that due to mass-rearing challenges the releases were sub-optimal: probably, with hindsight, they were too small, and possibly skewed towards males. Unmated females will only produce males, and even mated females will produce only male offspring if conditions are not optimal for them. So the plan this time is to put out a large number of sawflies, with a good sex ratio, at an ideal site (based on observed preferences in Serbia – sunny with sandy soil) to see if they do better. If we can establish a sawfly 'nursery' in this way it can later be used to supply other OMB-infested areas. A fresh sawfly shipment from Europe was imported into containment last May. This material had its identity and disease-free status confirmed and was then successfully reared through three generations. "We managed to crack the rearing procedure this time and produce good numbers of both male and female sawflies," said Lindsay.

The sawflies were released in stages in December near the Waipara River in North Canterbury as material became available. "The sawflies seemed very happy to be out of containment, with mated females ovipositing the moment they settled onto a leaf!" said Lindsay. Already there is feeding damage starting to appear, and three male flies were spotted flying around. This augurs well for another generation this season. Adult sawflies, especially females, can be difficult to spot as they often sit on the underside of leaves. The larvae are the damaging life stage and are much easier to see, being white and creating obvious semi-circular feeding notches along leaf edges.

In southern central Europe the OMB sawfly has two generations per year. The first generation of larvae, produced in spring, drop to the ground and pupate for a few weeks, emerging as adults by midsummer. However, second-generation pupae remain in the soil in their cocoons from late summer through

until the following spring. In the milder oceanic climate of New Zealand there may be sufficient time for the sawflies to complete a third generation. We will revisit the Waipara site next spring to search for signs that the attempt to set up a nursery site is succeeding.

This project is funded by the National Biocontrol of Weeds Collective.

CONTACT
Lindsay Smith – smithl@landcareresearch.co.nz

Tradescantia Terminators off to Boston

A team of seven students from Kerikeri High School have been making a big impression in their Northland community and have recently been awarded first place in the Senior Community Problem Solving Division at the 2018 Future Problem Solving New Zealand National finals. The students are now preparing to attend the Future Problem Solving Program International Conference at the University of Massachusetts Amherst, USA, in June 2019.

With the guidance of science teacher Sandra Leaming and entomologist Dr Jenny Dymock, the students, dubbed "The Tradescantia Terminators", have been working with the community on a project that includes elements of science communication and stream-side restoration or kaitiakitanga (guardianship). Their competition display was draped with blue silk that flowed across the table. Team member Emilia Finer explained that "the silk symbolised Te Wairere waterfall and the Wairoa stream, one of the arteries of Papatūānuku in which the water, her life blood, flows".

The students started their project in 2017 after walking down the newly opened Wairoa Stream Track. Once a popular attraction, access to the stream and spectacular Te Wairere waterfall had been lost to the community for over 60 years due to subdivision and the subsequent growth of weeds.
The project involved translocating the leaf beetle (*Neolema ogloblini*) and stem beetle (*Lema basicostata*), two biocontrol agents that have been released in the region to combat tradescantia (*Tradescantia fluminensis*), a weed that prevents regeneration of native vegetation. The agents, nicknamed Shiny and Knobbly, were released beside the Wairoa Stream 2 years ago and the students compared the level of plant cover before and after the beetles were released. Their results suggested that the tradescantia biomass had halved since the beetles had arrived and it was nowhere near as dense where the beetles had been busy.

The team engaged with a wide range of people, including the Ministry for Primary Industries, council staff and community groups, including Friends of the Wairoa Stream. They also ran community workshops and set up a Facebook page to share the message about biocontrol of tradescantia.

"What impressed me," said Jenny, "was the enthusiasm and dedication the students showed." She described them as self-motivated and having great initiative, and said "they even set up a mock Environmental Protection Authority hearing where they debated the pros and cons of introducing a new organism into the New Zealand environment." Another of the school's science fair entries focusing on statistics and the abundance of wētā in areas with and without tradescantia also scored highly. Since the promotion of the project by the students there have been numerous enquiries from people wanting to know how to collect and distribute the beetles to areas where tradescantia is a problem. "At the workshops they showed people how to make a pooter to collect the beetles and the best way to transport them to new sites," added Jenny. "Quite often once people know where and how to look for the beetles they phone me back to say that the beetles are already present. This tells me that the beetles are naturally dispersing and reaching new sites by themselves, which is really encouraging," Jenny said.

The success of the students follows that of Aimee Leaming, who won the Far North Science Fair in 2016 and then went on to win her category at the Taiwan International Science Fair. Aimee's project looked at whether you could reliably tell male and female tradescantia beetles apart and whether they had different feeding strategies depending on the level of light they were exposed to.

View the Tradescantia Terminators Facebook page at:
https://www.facebook.com/pg/tterminatorsKKHS/posts/?ref=page_internal

Sandra Leaming

The team at the National Finals: Charlotte Gamble, Emilia Finer, Jeany Kim, Charlie Potter and Faith Hohepa.

Heather Beetle Gives Natives a Fighting Chance

Scientists and land managers are hailing the success of a biocontrol agent that is finally winning the battle with a central North Island weed, heather (*Calluna vulgaris*). Recently retired Department of Conservation (DOC) scientist Harry Keys, who managed the project from the DOC side for 20 years, is thrilled to see the progress the beetle has now made against heather. Recent years have been very significant for the long-running project. "It has been a surprisingly long and winding road to get to this point, but we finally have good things happening on quite a large scale," said Simon Fowler, who has been overseeing the project.

Heather displaces native vegetation, outcompeting vulnerable threatened plant species, and disrupts military operations on army land. The problem was first recognised in the 1960s, and by the 1990s heather had become the most widespread weed in Tongariro National Park. Since then heather has continued to spread far beyond park boundaries and is now present in over 50,000 ha of the North Island's Central Plateau.

Until recently the overall impact of the heather beetles (*Lochmaea suturalis*), which were first released here in 1996, was less impressive than hoped, particularly at higher altitudes. The first beetle outbreak was detected at Te Piripiri in late 1999, leading to some optimism that it would not be long before we would see the sort of outbreaks that make this beetle a pest in its native range. But then the beetle populations struggled to repeat their early form until nearly 20 years after release, when large outbreaks started to form and gain momentum. The beetles have now damaged or killed heather over 5000 hectares (see map). "Every year the damaged area has been growing exponentially and the nett reduction of heather is now at landscape levels in some places," said Paul Peterson, who regularly visits the sites.

In the outbreak areas the majority of heather plants have completely died, with only a small number of plants showing signs of regrowth. "Some of the questions we wish to explore now relate to the level of heather regrowth that will occur in the outbreak areas and the extent to which native plants will replace the heather," said Simon. "We suspect that there will be changes in the soil nutrient loads as the heather dies and decomposes. This will initially favour exotic grasses, but as the nutrient 'flush' gradually declines, we would expect to find conditions more favourable to native plants," added Simon. Already there is evidence that native plants such as *Dracophyllum subulatum* remain healthy in areas once dominated by heather, and that the heather is being replaced by native tussocks within some of the permanent plots that are being used to assess changes over time.

Research to determine why the beetles were struggling initially showed that heather in Tongariro National Park is very low in nitrogen (a key component for insect growth) compared with heather in its native range in Europe. To try to kick-start beetle populations, fertiliser was used at some release sites with some success, but this was not feasible as a widespread approach. It also became clear that the heather beetle population had suffered a genetic bottleneck in containment, when line

Purple shading shows the area infested with heather and blue shading where the heather beetles are, or have been, causing significant damage.

rearing of individual females was necessary to remove a microsporidian disease. Studies showed that this had resulted in the New Zealand beetle population having a relatively small body size, which means fewer fat reserves and less ability to cope with cold weather. Post-release the beetles have especially struggled with the harsh climatic conditions at high altitude sites in the Park. Fresh stocks of larger-bodied beetles have been introduced from Scotland in an attempt to increase the average body size of the New Zealand beetles. It is too early to determine if this approach will be successful, but it also may no longer be needed. "The recent explosion of the original heather beetle population in the Central Plateau suggests that they have now managed to adapt to the conditions, including higher altitude areas," explained Simon.

It is now clear that the project is finally starting to make significant gains for conservation in Tongariro National Park and the surrounding wetlands. "We expect that, in time, heather will become a minor component in the landscape of Tongariro National Park World Heritage Area," said Paul. Other forms of control for widespread weeds such as heather, covering large remote areas, are not cost-effective, practical or sustainable. "We could not have achieved the results to date using control

Header beetle

methods such as herbicide treatment without significant damage to native species," Paul said.

This project is currently supported with funding from the Ministry of Business, Innovation and Employment as part of Manaaki Whenua – Landcare Research's Beating Weeds programme.

CONTACT
Paul Peterson – petersonp@landcareresearch.co.nz
Simon Fowler – fowlers@landcareresearch.co.nz

Autumn Activities

There are a few things you might want to fit in before winter sets in. We would be very interested to hear about what you find.

Gall-forming agents

Early autumn is the best time to check many gall-forming agents.

- Check broom gall mite (*Aceria genistae*) sites for signs of galling. Very heavy galling, leading to the death of bushes, has already been observed at some sites. Harvesting of galls is best undertaken from late spring to early summer, when predatory mites are less abundant.
- Check hieracium sites, and if you find large numbers of stolons galled by the hieracium gall wasp (*Aulacidea subterminalis*) you could harvest mature galls and release them at new sites. Look also for the range of deformities caused by the hieracium gall midge (*Macrolabis pilosellae*), but note that this agent is best redistributed by moving whole plants in the spring.
- Check nodding and Scotch thistle sites for gall flies (*Urophora solstitialis* and *U. stylata*). Look for fluffy or odd-looking flowerheads that feel lumpy and hard when squeezed. Collect infested flowerheads and put them in an onion- or wire-mesh bag. At new release sites hang the bags on fences, and over winter the galls will rot down, allowing adult flies to emerge in the spring.
- Check Californian thistle gall fly (*Urophora cardui*) release sites for swollen deformities on the plants. Once these galls have browned off they can be harvested and moved to new sites (where grazing animals will not be an issue), using the same technique as above.
- Although it is early days, it might be worth checking release sites this summer to look for swellings on the stems caused by the giant reed gall wasps (*Tetramesa romana*). These look like small corn cobs on large, vigorous stems, or like broadened deformed shoot tips when side shoots are attacked. It will be too soon to consider harvesting and redistribution if you do see evidence of the gall wasp establishing.

Japanese honeysuckle white admiral (*Limenitis glorifica*)

- Look for the adult butterflies, for the pale yellow eggs laid singly on the upper and lower surfaces of the leaves, and for the caterpillars. When small, the caterpillars are brown and found at the tips of leaves, where they construct pontoon-like extensions to the mid-rib. As they grow, the caterpillars turn green, with spiky, brown, horn-like protrusions.
- Unless you find lots of caterpillars, don't consider harvesting and redistribution activities: unless it is very early autumn this would be better left until the following spring.

Tradescantia showing symptoms of infection by the yellow leaf spot fungus at Waingaro.

Ben Wolf

Privet lace bug [*Leptoypha hospita*]

- Examine the undersides of leaves for the adults and nymphs, especially leaves showing signs of bleaching.
- If large numbers are found, cut infested leaf material and put it in chilly bin or large paper rubbish bag, and tie or wedge this material into Chinese privet at new sites. Aim to shift at least 1,000 individuals to each new site.

Tradescantia leaf, stem and tip beetles [*Neolema ogloblini, Lema basicostata, N. abbreviata*]

- Look for feeding damage and adults. For the leaf and tip beetles look for the external-feeding larvae which have a distinctive protective covering over their backs.
- If you find them in good numbers, aim to collect and shift 50–100 beetles using a suction device or a small net. For stem beetles it might be easier to harvest infested material and wedge this into tradescantia at new sites (but make sure you have an exemption from MPI that allows you to do this).

Tradescantia yellow leaf spot [*Kordyana brasiliense*]

- Although the fungus was only released last autumn, promising signs of likely establishment have been seen at some sites already, with typical symptoms visible only a few months after the release. Look for the distinctive yellow spots on the upper surfaces of the leaves, with corresponding white spots underneath, especially after wet, humid weather. Feel free to take a photo to send to us for confirmation if you are unsure, as occasionally other pathogens do damage tradescantia leaves.
- The fungus is likely to disperse readily via spores on air currents. If human-assisted distribution is needed in the future, you will need to have permission from MPI to propagate and transport tradescantia plants. These plants can then be put out at sites where the fungus is present until they show signs of infection, and then planted out at new sites.

Tutsan moth [*Lathronympha strigana*]

- Although the moths were only released last autumn, if you can't wait, look for the small orange adults flying about flowering tutsan plants. They have a similar look and corkscrew flight pattern to the gorse pod moth [*Cydia succedana*]. Look also for fruits infested with the larvae.
- It is too soon to consider harvesting and redistribution if you do find the moths.

Woolly nightshade lace bug (*Gargaphia decoris*)

- Check release sites by examining the undersides of leaves for the adults and nymphs, especially leaves showing signs of bleaching or black spotting around the margins.
- It is probably best to leave any harvesting until spring.

National Assessment Protocol

For those taking part in the National Assessment Protocol, autumn 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
Broom	Dec–April	Broom gall mite [*Aceria genistae*]
Lantana	March–May	Leaf rust [*Prospodium tuberculatum*] Blister rust [*Puccinia lantanae*]
Privet	Feb–April	Lace bug [*Leptoypha hospita*]
Tradescantia	Nov–April Anytime	Leaf beetle [*Neolema ogloblini*] Stem beetle [*Lema basicostata*] Tip beetle [*Neolema abbreviata*] Yellow leaf spot fungus [*Kordyana brasiliense*]
Woolly nightshade	Feb–April	Lace bug [*Gargaphia decoris*]

CONTACT
Lynley Hayes – hayesl@landcareresearch.co.nz