#93
AUG 2020

Manaaki Whenua
Landcare Research

Weed Biocontrol

WHAT'S NEW?

Contents

Key contacts

EDITOR: Angela Bownes
Any enquiries to Angela Bownes
bownesa@landcareresearch.co.nz

THANKS TO: Ray Prebble

LAYOUT: Cissy Pan

CONTRIBUTIONS:
Seona Casonato, Paul Peterson, Chantal Probst, Jenny Dymock, Mike Cripps, Lynley Hayes

COVER IMAGE:
Scotch thistle gall fly
(Mike Cripps , AgResearch)

www.weedbusters.org.nz

This information may be copied and distributed to others without limitations, provided Landcare Research New Zealand Ltd 2015 and the source of the information is acknowledged. Under no circumstances may a charge be made for this information without the express permission of Landcare Research New Zealand Ltd 2014

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

www.landcareresearch.co.nz

A Few Steps Closer With Nassella Tussock

Just less than a year ago we revived efforts to search for effective fungal biocontrol agents for nassella tussock (*Nassella trichotoma*), and we are pleased to report that we have already made significant headway. This collaborative project between Manaaki Whenua – Landcare Research, Lincoln University and AgResearch in New Zealand, in conjunction with colleagues in Australia and Argentina, is "progressing extremely well" according to Seona Casonato (Lincoln University), who is leading the project.

The research has two aims: to search for disease-causing micro-organisms (pathogens) that already occur on nassella tussock in New Zealand and could be used in an inundative or augmentative programme (e.g. through the development of a bioherbicide); and to revisit promising agents in Argentina and Australia that could potentially be used as part of a classical biocontrol programme. Irrespective of where a fungal biocontrol agent is sourced, it will hopefully provide a much-needed tool to help tackle nassella tussock infestations in New Zealand.

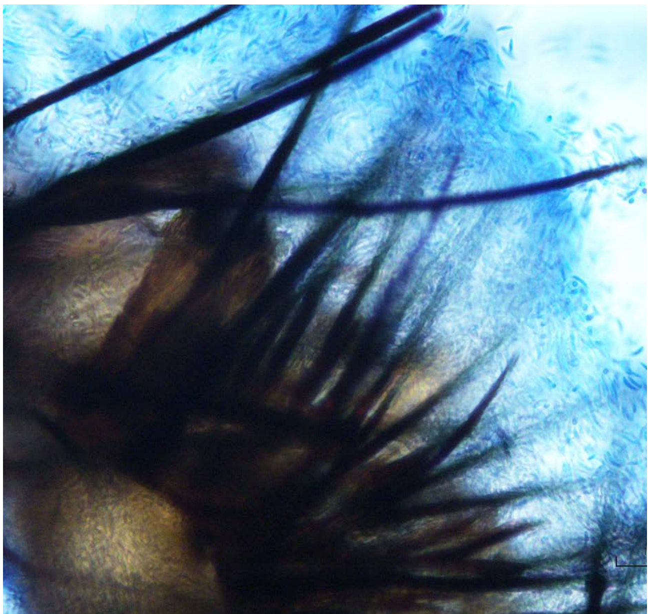
Nassella tussock is a perennial tussock grass infesting vast tracts of land in the North and South Islands of New Zealand, as well as in Australia. Over 600,000 hectares of land is already infected with this noxious weed in the South Island alone. Nassella tussock is unpalatable to stock and reduces the carrying capacity of pastures, with up to 90% loss in heavily infected pastures. Current management strategies predominantly involve manual removal (grubbing), which is costly and labour intensive, and chemical control, which can have non-target impacts on valued pasture plants. With the potential for climate change to exacerbate nassella tussock invasions in New Zealand, there has been an escalating demand for an alternative, effective method of control.

"It was with great optimism that we restarted the biocontrol project, even though we thought searching for fungal pathogens in New Zealand might be like looking for a needle in a haystack," said Seona. "So, much to our surprise, we have already found a

Seona (right) and Amber (left) searching for potential agents.

number of promising candidates." Amber Brooks, a technician on the project, with the assistance of Michael Kuchar (Lincoln University), have already surveyed over 40 nassella tussock sites in Marlborough, Canterbury, Hawke's Bay, Central Otago, Tasman and the Coromandel. During site visits the pair looked for tussocks that appeared to be unhealthy or were exhibiting symptoms, such as dying off, stunted growth, multiple flushes of seeds, ease of pulling from the ground, or areas where patches of tussock are no longer present. "At each site we spent most of our time examining nassella tussocks with a fine-tooth comb, searching for lesions, marks, discolouration, spots, or anything else indicative of fungal presence or reduced plant fitness," explained Amber.

Back at the laboratory the project was supported by technician Jenny Brookes (Lincoln University), who had the onerous task of culturing, identifying and preserving any fungi that were collected in the field. Despite very dry conditions during the surveying period, over 100 fungi were isolated and identified using both diagnostic and molecular techniques. "Although most of these have already been disregarded for use as biocontrol agents, we have found some that are worth testing further, and which target various aspects of the plant's life cycle," explained Seona. "We have even been fortunate to isolate a *Dinemasporium* species, which we found in Australia in the 1990s! This fungus was previously considered to have good biocontrol potential, and when it was found at the field site in New Zealand the plants looked sickly and were in decline," she added. Another promising fungus is associated with easy removal of plants from the ground. Although still awaiting confirmation of the identification, Seona believes it to be very similar to a fungus described from Australia and Argentina, as it has a characteristic thick, ropey, white mycelium growing at the base of the plants.



Spores (stained blue) and setae (black) of a *Dinemasporium* species.

Nassella tussock with characteristic white mycelium.

While the search for New Zealand fungi for potential use in an inundative or augmentative biological control programme is well underway, the search for potential classical biocontrol agents in Australia and Argentina is proving to be equally fruitful. Testing to determine pathogenicity of the fungi that have been selected for further investigation will commence very soon in all three countries. "We want real killers for our noxious nassella," said Seona. "We are specifically looking for agents that will reduce the numbers of seeds and seedlings, and inflorescence formation. We will also more than likely be looking at the progression of more than one fungal species to use in our arsenal to successfully control nasella tussock in New Zealand and Australia."

In addition to these promising developments, the project is further supported by the development of a nassella tussock population model by Shona Lamoureaux (AgResearch), which will help predict the impacts of fungal biocontrol agents on the weed in New Zealand. So stay tuned for further updates!

This project is funded by the Sustainable Farming Fund, administered by the Ministry for Primary Industries, with co-funding from Environment Canterbury, Marlborough District Council, the National Biocontrol Collective, and Manaaki Whenua – Landcare Research (Strategic Science Investment Funding), and from the Victoria Serrated Tussock Working Group and AgriBioscience in Australia.

CONTACT

Seona Casonato – seona.casonato@lincoln.ac.nz

Hieracium Biocontrol – 20 Years On

Hieracium (*Hieracium* and *Pilosella* species) or hawkweeds, are perennial herbs in the plant family Asteraceae that have dandelion-like yellow flowers. They are serious pasture weeds in New Zealand that form dense mats of tight, interconnected rosettes, with thick underground root systems. Hieracium can grow under harsh environmental conditions, and they are allelopathic, producing toxic chemicals that suppress the growth of other plant species.

Several biocontrol agents were introduced to control hieracium here, all of which were released between 1999 and 2002. These include a plume moth (*Oxyptilus pilosella*), a gall wasp (*Aulacidea subterminalis*), a gall midge (*Macrolabis pilosellae*), a root-feeding hoverfly (*Cheilosia urbana*) and a crown-feeding hoverfly (*Cheilosia psilophthalma*). Twenty years on, we conducted a thorough assessment of the establishment, spread and impacts of the agents, and are investigating the origins of the hieracium species in New Zealand using molecular techniques.

The project started with revisiting release sites at high-country farms in Canterbury and Otago in the South Island, and on the Central Plateau of the North Island, to check on progress. Paul Peterson, who is leading this project, together with recent retiree Lindsay Smith, who worked on the hieracium biocontrol project from its inception, developed the monitoring methods and conducted the first few site assessments. The remaining sites were assessed by Paul, with the help of Gavin Loxton, a high-country farmer from the Mackenzie Basin, Barry Wills (self-employed) in Otago, and Peter Espie (AgScience) in Canterbury. Altogether more than 60 sites were visited. "At each site a search for the biocontrol agents was performed along transects to look for evidence of establishment, and vegetation in quadrats was assessed to estimate the impacts of the agents that were present. Hieracium plants growing at various distances from the release sites were also checked to measure dispersal of the agents," explained Paul.

Hieracium with a wasp gall.

The research showed that the gall wasp and the gall midge have established in both the North and the South Islands, although their establishment rate and efficacy differ between the two. The plume moth and the two hoverfly species were not recovered at any of the sampling sites and are presumed to have failed to establish, which was not surprising given the small numbers released.

In the South Island, gall wasps were recovered from 92% of sites and had dispersed widely, whereas gall midges were recovered from 73% of sites and were only present near the original release sites. Despite the widespread distribution of the gall wasp, only 4.5% of hieracium plants were galled by the wasp, compared with 9.5% of plants that were galled by the midge. In the North Island, gall wasps were only recovered from 15% of release sites and evidence of their dispersal was limited. However, the gall midge has been more successful, establishing at 80% of release sites and dispersing over 10 square kilometres from the original release sites. A study in 2006 showed that up to 33% of hieracium plants were galled by the midge, reducing hieracium cover by 18% at sites in the North Island where galling was most intense.

Although site comparisons over time show that hieracium densities have been reduced by 10% in the South Island, this is predominantly attributed to changes in land management practices, rather than biocontrol. This conclusion is backed by the accounts of high-country farmers in Marlborough in a news article on hieracium trends in the Awatere Valley.

With the project nearing completion, we now know that biocontrol of hieracium is not very effective in the South Island. New biocontrol agents – or new genotypes of the biocontrol agents already released, or bigger releases of agents that failed to establish – may need to be considered. "This is where molecular studies to determine the origins of hieracium species and populations are crucial. The DNA technology to compare native and introduced range populations of weeds was not available 20 years ago, which meant we couldn't focus our search to source candidate agents that are well adapted to hieracium in New Zealand," explained Paul. "Once this aspect of the research is complete, we will assess the feasibility of starting up a fresh search for candidate biocontrol agents in the native range," he added.

This project is funded by Sustainable Food, Fibres and Futures (SFFF), administered by the Ministry for Primary Industries. The article on hieracium in the Awatere Valley is available at https://www.stuff.co.nz/business/farming/101800019/awatere-valley-farmers-make-a-dent-in- scourge-of-the-high-country.

CONTACT
Paul Peterson – petersonp@landcareresearch.co.nz

Three for the Price of One in Chile

Chantal Probst, our plant pathology technician, and Randall Milne (Environment Southland), travelled to Chile in November last year to collect starter cultures of the Darwin's barberry rust (*Puccinia berberidis-darwinii*) and pampas floral smut (*Ustilago quitensis*). As is often the case, to maximise returns on investment they took advantage of the opportunity to survey for candidate biocontrol agents for another troublesome weed in New Zealand, Chilean flame creeper (*Tropaeolum speciosum*).

Chilean flame creeper is a vigorous perennial vine with attractive, bright-red flowers and blue berries. It has been naturalised in New Zealand since the 1950s and is highly invasive in Southland, where it colonises forest margins and disturbed sites, smothering native vegetation. Although not as abundant in the north, its range extends up to Waikato, and there has been one report of the weed in Northland. Chilean flame creeper seeds are readily dispersed by birds, and the rootstock and stems easily re-sprout, making it difficult to control.

Research on Chilean flame creeper prior to the trip suggested that the plant is very rare in its native range, which could partly be attributed to the unusual geography and diverse climate of Chile, ranging from dry and arid in the north to cold and wet in the south. Chilean flame creeper has been recorded in the south of Chile, where it grows in humid areas along the coast up to 1,000 m above sea level. Chantal and Randall, along with our Chilean collaborator, Dr Hernán Norambuena (entomology consultant), searched for the creeper in the Bío Bío, Araucania and Los Rios regions of Chile, where Hernán had already located two sites.

"When we first got out into the field, we soon realised that our surveys would be challenging, not only because of the rarity of the plant, but also because they were not in flower at the time," explained Chantal. "This was further complicated by the fact that most of the herbarium records were old and outdated, so many of the sites had been replaced by *Pinus* and *Eucalyptus* plantations, or farmland, or they were no longer accessible to the public," she added. Since the herbarium records indicated that Chilean flame creeper was often found in close association with native bamboo (*Chusquea* spp.), the group focused their search on bamboo stands growing in close proximity to waterways. "We spent hours staring at foliage surrounding bamboo in the hope that we would spot a new plant which would provide us with another survey site," said Chantal. "Not even the locals seemed to have encountered this climber with its bright red flowers!"

Fortunately their efforts were not in vain, and they managed to find another two sites to add to the list. Of the four sites that were surveyed, three were along roadsides and one was in a hazelnut orchard. At all three roadside sites black insect larvae were found actively feeding on the leaves of Chilean flame creeper and were very damaging. A subsequent DNA analysis revealed that the larvae belong to the leaf beetle family, Chrysomelidae, and they were later confirmed to be *Blaptea elguetai*. Not a lot is known about this beetle, but it is thought likely to be highly host specific "Interestingly, but not surprisingly, the orchard site did not show any signs of insect feeding damage, probably due to regular pesticide use in the orchard, and the plants were growing there vigorously as they do in Southland," said Chantal.

Chrysomelid larva feeding on Chilean flame creeper.

Although there is much groundwork to be done before the beetles will be considered for importation into New Zealand, this was a very promising find. High numbers of Chrysomelid beetles have been successfully used as biocontrol agents worldwide, and they have an excellent track record for being highly host specific and very damaging to their hosts. Hernán, with the help of his wife Angelica and collaborator Sergio Escobar, have since located 24 additional Chilean flame creeper sites where they regularly found the chrysomelid larvae, as well as adult chrysomelid beetles of two different colours. Future work on Chilean flame creeper will be geared towards investigating their host range when funds permit.

As for the pathogens, Darwin's barberry fruits infected with the rust and a pampas floral stem infected with the smut were successfully imported into our containment facility at Tamaki, Auckland, for host range testing and mating experiments, respectively. Not a bad haul for one trip to Chile!

This project was funded by the Department of Conservation, Waikato Regional Council, Horizons Regional Council, Greater Wellington, Environment Canterbury, Otago Regional Council and Environment Southland.

CONTACT
Chantal Probst – probstc@landcareresearch.co.nz

Buddleia Be Gone!

Jenny Dymock

Mark Tutty

A heavily defoliated buddleia bush in Northland
Inset: Buddleia weevil larvae and damage.

Buddleia (*Buddleja davidii*) is native to China and is a serious weed in plantation forests, natural habitats and riparian areas in New Zealand, especially in the central North Island. Also commonly known as summer lilac or butterfly bush because of its showy, dense clusters of purple or white flowers, buddleia is a deciduous, multi-stemmed Scrophulariaceae shrub that can grow up to 3 m tall, forming dense, self-replacing thickets. Buddleia has a wide ecological tolerance and establishes and grows very quickly, competing with seedling trees in plantations, displacing pioneer species in native bush, and invading loose gravel riverbeds and stream-sides, causing a build-up of silt after flooding.

Because buddleia was a serious pest for the forestry industry, Scion initiated a biocontrol programme and imported the buddleia leaf weevil (*Cleopus japonicus*) from Hunan, China, into their containment facility in Rotorua in 1993. Both adult and larval feeding causes characteristic leaf scarring through removing the upper surface of a leaf, leaving the lower silvery epidermis intact. Leaves with extensive damage become silvery-brown, curl and drop to the ground. Adult feeding can also form ragged holes in the leaves, and heavily damaged plants become completely defoliated.

Host range testing of the buddleia leaf weevil was undertaken by Dr Malcolm Kay and Dr Toni Withers (Scion), and approval for its release was granted by the Environmental Risk Management Authority (predecessor of the Environmental Protection Authority) in 2006. The first release was made in Rotorua in September 2006, and thereafter multiple releases totalling 15,000 weevils were conducted until 2011 in both the North and South Islands, on private and publicly owned land, as well as in conservation areas.

Although buddleia was not considered a significant weed in Northland, the weevils were pre-emptively released by Ken Massey (Northland Regional Council) in April 2008 at a roadside infestation of about 20 plants, 10 km south of Kaikohe. The site was revisited 2 years later, and Ken reportedly found severely defoliated buddleia bushes – indicative of establishment of the weevil. In the following 3 years entomologist Dr Jenny Dymock (Northland Regional Council) monitored the site. “I was delighted to find heavily defoliated buddleia bushes every autumn, although this was followed by regrowth of the foliage by June the same year,” said Jenny. “After a break of a few years, I finally returned to monitor the site earlier this year, only to find one very straggly buddleia bush remaining alive.”

According to Toni, who has spent many years working with the weevil, this kind of persistent and extensive defoliation year after year, which eventually kills even large buddleia plants, has been replicated in other parts of New Zealand. “The damage observed in Northland is very similar to our findings in Rotorua, where buddleia has become a rarity, bar a few isolated specimens,” said Toni. “The only areas where damage by the leaf weevil is not consistent is at the very edges of its climatic range, around Queenstown and Mt Cook, where we suspect the weevil population is knocked back each winter and recovers too slowly in spring to reach damaging densities,” she explained.

Overall, the buddleia biocontrol programme has been highly successful. “It’s always exciting to witness effective biocontrol in action,” enthused Jenny. “Now I can only hope we see similar results with other woody weeds in Northland. I’ve got my eye on lantana, for example, which loses 50 to 60% of its leaves every winter due to infection by the lantana leaf rust (*Prospodium tuberculatum*),” she added.

This project was funded by the Foundation for Research, Science and Technology (now the Ministry for Business, Innovation and Employment).

CONTACT
Jenny Dymock – jennydymock@editento.com

Tale of the Scotch Thistle Gall Fly

Scotch thistle (*Cirsium vulgare*) is one of the most common thistle weeds in New Zealand, being present in all regions of the country in a diversity of habitats. The weed is a prolific seed producer, with an average of 200 seeds per seedhead, and individual plants can produce over 50,000 seeds. Scotch thistle is most problematic in grazed pastures, where it reduces pasture productivity by competing with desirable forage plants. An added problem is the loss of the pasture legumes if phenoxy herbicides are used to control this weed.

The Scotch thistle gall fly (*Urophora stylata*) is native to Europe and is a classical biocontrol agent for Scotch thistle that was released in New Zealand in 1998. The adult flies are active in spring, and females lay eggs on the green flower buds. Multiple larvae feed inside the seedheads during summer and autumn, destroying the seeds. Larval feeding stimulates the plant to form gall tissue, which results in the formation of a hardened woody gall, the size of which depends on the number of larvae present.

The gall flies were released at a limited number of sites up until the early 2000s and are known to be established and widespread. It is also known from studies on the same insect–weed system in Canada that the gall fly has great potential to reduce seed production (up to 60% of Scotch thistle seeds are destroyed in Canada). However, until recently the gall fly's impact on seed production in New Zealand had not been quantified, although a noticeable reduction in Scotch thistles had been observed at several release sites.

In the summer of 2018, 20 years after the first release of the gall fly, a survey was carried out to assess its impact on Scotch thistle. The surveys were conducted by Jovesa Navukula and Mike Cripps (AgResearch). Jovesa was a New Zealand Aid Scholar from Fiji, who was co-supervised by Mike and Seona Casonato (Lincoln University). "For the surveys, we randomly selected 10 sheep and beef pastures in the North Island and 10 in the South Island, and then located the nearest Scotch thistle population to the selected points," explained Mike. "The assistance of extension managers from Beef+Lamb NZ was essential for contacting farmers who could help to find suitable paddocks with Scotch thistle," he added.

After a busy field trip covering all regions of New Zealand, Jovesa took on the task of dissecting over 1,500 seedheads, taking meticulous measurements of galls and counting thousands of seeds. The fly was detected at 14 of the 20 Scotch thistle sites surveyed. Overall, the gall fly reduced the number of seeds per seedhead by 47%, individual seed weight by 21%, and seed germination rates by 30%. Estimated seed reduction for populations ranged from 11 to 61%.

"These findings were very encouraging, because seed reductions of 60% by the nodding thistle gall fly (*Urophora solstitialis*) are enough to provide an acceptable level of control of nodding thistle (*Carduus nutans*) in New Zealand," explained Mike. "This requires further evaluation, but it does suggest that the Scotch thistle gall fly has the potential to be as effective as its close relative on nodding thistle." Another important finding was that feeding damage by the gall fly larvae not only reduces seed production, but also reduces the viability of the remaining seeds within the galled seedhead.

Lastly, the study showed a strong latitudinal trend, indicating that the effectiveness of the gall fly increased from south to north, being most effective in northern New Zealand, where Scotch thistle seedheads are intensely attacked. "Next, we need to assess the impact of the gall fly on the population dynamics of Scotch thistle to determine if additional control measures are required, particularly in the South Island, where the gall fly appears to be limited by climate," concluded Mike.

This project was funded by AgResearch Strategic Science Investment Fund for Pasture Weed Ecology and Management.

CONTACT
Mike Cripps – Mike.cripps@agresearch.co.nz

Gall fly larvae inside damaged seedhead.

Mike Cripps

Spring Activities

Most biocontrol agents become active during spring, making it a busy time of year to check release sites and move agents around.

Broom leaf beetles *(Gonioctena olivacea)*

- We think this beetle has established quite widely, but it is not abundant and we are keen to know more. Look for beetles by beating plants over a tray. The adults 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, which may also be seen feeding on leaves and shoot tips.
- The beetles can be harvested if you find them in good numbers. Aim to shift at least 100–200 beetles to sites that are not yet infested with broom gall mites.

Broom shoot moth *(Agonopterix assimilella)*

- We are unsure if this moth has managed to successfully establish in New Zealand, so we will be interested to hear if anyone can find any sign of them. Late spring is the best time to check release sites, so look for the caterpillars' feeding shelters, made by webbing twigs together. Small caterpillars are dark reddish-brown and turn dark green as they get older.

Darwin's barberry weevil *(Berberidicola exaratus)*

- Since these weevils are difficult to mass rear we are attempting to establish them at a couple of field sites from which they can later be harvested and redistributed to all areas where they are needed. We are therefore very interested to know if establishment can be confirmed.
- Beat plants at release sites later in the spring to see if any of the small (3–4 mm long), blackish adults can be found. Also examine the fruits for signs of puncturing. Please let us know what you find.

Giant reed gall wasp *(Tetramesa romana)*

- We don't know if the gall wasp is successfully establishing in New Zealand, so we will be interested to hear about updates from release sites. Look for swellings on the stems caused by the gall wasps. These look like small corn cobs on large, vigorous stems, or like broadened, deformed shoot tips when side shoots are attacked. The galls often have small, circular exit holes made by emerging wasps.
- It will probably be too soon to consider harvesting and redistribution if you do see evidence of the gall wasp establishing.

Honshu white admiral *(Limenitis glorifica)*

- Look for the adult butterflies at release sites from late spring. Look also for 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. You will need to aim to shift at least 1,000 caterpillars to start new sites. The butterflies are strong fliers and are likely to disperse quite rapidly without any assistance.

Lantana blister rust *(Puccinia lantanae)*

- We don't yet have any evidence that the blister rust has established and are keen to hear if symptoms can be found in the field. Check sites where lantana plants infected with blister rust have been planted out, especially after a period of warm, wet weather. Signs of infection include leaf and stem chlorosis (yellowing), accompanied by large, dark pustules on the undersides of leaves and on the stems. Stunting, defoliation and die-back may also be apparent.
- Once established, this rust is likely to be readily dispersed by the wind. If redistribution is needed, this will require placing small, potted lantana plants beneath infected ones and then planting these out at new sites once they have become infected. However, to propagate and distribute lantana in this manner, an exemption from the Ministry for Primary Industries (MPI) is required.

Lantana leaf rust *(Prospodium tuberculatum)*

- Check sites where the leaf rust has been released, especially after a period of warm, wet weather. Look for yellowing on the leaves, with corresponding brown pustules and spores, rather like small coffee granules. A hand lens may be needed to see the symptoms during early stages of infection. If the rust is well established, then extensive defoliation may be obvious.
- Once established, this rust is likely to be readily dispersed by the wind. If redistribution efforts are needed, the best method is to harvest infected leaves, wash them in water to make a spore solution, and then apply this to the plants.

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.

Ragwort plume moth *(Platyptilia isodactyla)*

- October is the best time to check release sites for caterpillars, so look for plants with wilted, blackened or blemished shoots with holes, and an accumulation of debris, frass or silken webbing. Pull back the leaves at the crown of damaged plants to look for large, hairy, green larvae and pupae. Also check where the leaves join bolting stems for holes and frass. Don't get confused by larvae of the blue stem borer *(Patagoniodes farinaria)*, which look similar to plume moth larvae until they develop their distinctive bluish colouration.

- If the moth is present in good numbers, the best time to shift it around is in late spring. Dig up damaged plants, roots and all. Pupae may be in the surrounding soil so retain as much as possible. Shift at least 50–100 plants, but the more the better. Place one or two infested plants beside a healthy ragwort plant so that any caterpillars can crawl across.

Tradescantia leaf, stem and tip beetles *(Neolema ogloblini, Lema basicostata, N. abbreviata)*

- Look for the distinctive feeding damage and adults. For the leaf and tip beetles, look for the external-feeding larvae, which have a distinctive faecal shield on their backs.
- If you find them in good numbers, aim to collect and shift at least 100–200 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 brasiliensis)*

- Although the fungus has only been released for a short time at many release sites, promising signs of likely establishment can often be seen after only a few months, so it is worth taking a look this spring. Look for the distinctive yellow spots on the upper surface 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, again you will need 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 beetle *(Chrysolina abchasica)*

- It is early days for most tutsan beetle release sites, but the best time to look for this agent is spring through to mid-summer. Look for leaves with notched edges or whole leaves that have been eaten away. The iridescent purple adults are around 10–15 mm in size, but they spend most of the day hiding away so the damage may be easier to spot. Look also for the creamy-coloured larvae, which are often on the undersides of the leaves. They turn bright green just before they pupate.

Yellow leaf spot fungus on tradescantia.

Tutsan moth *(Lathronympha strigana)*

- We do not yet know if the tutsan moth has established so are keen to hear if anyone can find them. 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.

Other agents

You might also need to check or distribute the following this spring:

- boneseed leafroller *(Tortrix* s.l. sp. *chrysanthemoides)*
- broom gall mites *(Aceria genistae)*
- gorse soft shoot moth *(Agonopterix ulicetella)*
- gorse thrips *(Sericothrips staphylinus)*
- gorse colonial hard shoot moth *(Pempelia genistella)*
- green thistle beetle *(Cassida rubiginosa)*.

National Assessment Protocol

For those taking part in the National Assessment Protocol, spring is the appropriate time to check for establishment and/or to 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	Oct–Nov Oct–Nov Sept–Oct Aug–Sept	Leaf beetle (*Gonioctena olivacea*) Psyllid (*Arytainilla spartiophila*) Shootmoth (*Agonopterix assimilella*) Twig miner (*Leucoptera spartifoliella*)
Lantana	Oct–Nov (or March–May)	Blister rust (*Puccinia lantanae*) Leaf rust (*Prospodium tuberculatum*)
Tradescantia	Nov–April Anytime	Leaf beetle (*Neolema ogloblini*) Stem beetle (*Lema basicostata*) Tip beetle (*Neolema abbreviata*) Yellow leaf spot fungus (*Kordyana brasiliensis*)

CONTACT

Angela Bownes – bownesa@landcareresearch.co.nz

Who's Who in Biological Control of Weeds?

Alligator weed beetle (*Agasicles hygrophila*)	Foliage feeder, common, often provides excellent control on static water bodies.
Alligator weed beetle (*Disonycha argentinensis*)	Foliage feeder, released widely in the early 1980s, failed to establish.
Alligator weed moth (*Macrorrhinia endonephele*)	Stem borer, common in some areas, can provide excellent control on static water bodies.
Blackberry rust (*Phragmidium violaceum*)	Leaf rust fungus, self-introduced, common in areas where susceptible plants occur, can be damaging but many plants are resistant.
Boneseed leaf roller (*Tortrix* s.l. sp. "*chrysanthemoides*")	Foliage feeder, established and quite common at some North Island (NI) sites but no significant damage yet, limited by predation and parasitism.
Bridal creeper rust (*Puccinia myrsiphylli*)	Rust fungus, self-introduced, first noticed in 2005, widespread and providing good control.
Broom gall mite (*Aceria genistae*)	Gall former, becoming widespread in some regions, showing considerable promise by beginning to cause extensive damage to broom at many sites.
Broom leaf beetle (*Gonioctena olivacea*)	Foliage feeder, establishment confirmed at sites in both islands but not yet common, impact unknown.
Broom psyllid (*Arytainilla spartiophila*)	Sap sucker, becoming common, some damaging outbreaks seen, but may be limited by predation, impact unknown.
Broom seed beetle (*Bruchidius villosus*)	Seed feeder, common in many areas, now destroying up to 84% of seeds at older release sites.
Broom shoot moth (*Agonopterix assimilella*)	Foliage feeder, recently released at limited sites as difficult to rear, appears to be established in low numbers at perhaps 3 sites.
Broom twig miner (*Leucoptera spartifoliella*)	Stem miner, self-introduced, common, often causes obvious damage.
Californian thistle flea beetle (*Altica carduorum*)	Foliage feeder, released widely during the early 1990s, failed to establish.
Californian thistle gall fly (*Urophora cardui*)	Gall former, extremely rare as galls tend to be eaten by sheep, impact unknown.
Californian thistle leaf beetle (*Lema cyanella*)	Foliage feeder, only established at one site near Auckland, where it causes obvious damage and from which it is dispersing, also recently reported in the Hawke's Bay.
Californian thistle rust (*Puccinia punctiformis*)	Systemic rust fungus, self-introduced, common, damage usually not widespread.
Californian thistle stem miner (*Ceratapion onopordi*)	Stem miner, attacks a range of thistles, released at limited sites as difficult to rear, establishment success unknown.
Green thistle beetle (*Cassida rubiginosa*)	Foliage feeder, attacks a range of thistles, released widely and some damaging outbreaks beginning to occur.
Chilean needle grass rust (*Uromyces pencanus*)	Rust fungus, approved for release in 2011 but not released yet as waiting for export permit to be granted, only South Island (SI) populations likely to be susceptible.
Darwin's barberry flower bud weevil (*Anthonomus kuscheli*)	Flower bud feeder, approved for release in 2012, releases will be made after the seed weevil is established if still needed.
Darwin's barberry seed weevil (*Berberidicola exaratus*)	Seed feeder, releases began in 2015, difficult to rear so widespread releases will begin once harvesting from field is possible, establishment looking likely at a Southland site.
Field horsetail weevil (*Grypus equiseti*)	Foliage and rhizome feeder, field releases began in 2017, establishment success unknown, further releases planned.
Giant reed gall wasp (*Tetramesa romana*)	Stem galler, field releases began in late 2017, establishment success unknown, further releases planned.
Giant reed scale (*Rhizaspidiotus donacis*)	Sap sucker, approved for release in 2017, first field release planned for spring 2020.
Gorse colonial hard shoot moth (*Pempelia genistella*)	Foliage feeder, from limited releases widely established only in Canterbury, impact unknown, but obvious damage seen at several sites.
Gorse hard shoot moth (*Scythris grandipennis*)	Foliage feeder, failed to establish from a small number released at one site, no further releases planned due to rearing difficulties.
Gorse pod moth (*Cydia succedana*)	Seed feeder, common in many areas, can destroy many seeds in spring but not as effective in autumn, not well synchronised with gorse flowering in some areas.
Gorse seed weevil (*Exapion ulicis*)	Seed feeder, common, destroys many seeds in spring.
Gorse soft shoot moth (*Agonopterix umbellana*)	Foliage feeder, common in parts of the SI with some impressive outbreaks seen, and well established and spreading at a site in Northland, impact unknown.
Gorse spider mite (*Tetranychus lintearius*)	Sap sucker, common, often causes obvious damage, but ability to persist is limited by predation.
Gorse stem miner (*Anisoplaca pytoptera*)	Stem miner, native, common in the SI, often causes obvious damage, lemon tree borer has similar impact in the NI.
Gorse thrips (*Sericothrips staphylinus*)	Sap sucker, common in many areas, impact unknown.
Heather beetle (*Lochmaea suturalis*)	Foliage feeder, has damaged/killed 10,000+ ha heather at Tongariro National Park and Rotorua since 1996, spreading rapidly, uncertain if new strains more suited to high altitude released recently have established.
Hemlock moth (*Agonopterix alstromeriana*)	Foliage feeder, self-introduced, common, often causes severe damage.
Hieracium crown hover fly (*Cheilosia psilophthalma*)	Crown feeder, released at limited sites as difficult to rear, thought unlikely to have established.
Hieracium gall midge (*Macrolabis pilosellae*)	Gall former, established but spreading slowly in the SI, common near Waiouru, where it has reduced host by 18% over 6 years, very damaging in laboratory trials.
Hieracium gall wasp (*Aulacidea subterminalis*)	Gall former, established and spreading well in the SI but more slowly in the NI, appears to be having minimal impact although it reduced stolon length in laboratory trials.
Hieracium plume moth (*Oxyptilus pilosellae*)	Foliage feeder, only released at one site due to rearing difficulties, did not establish.

Hieracium root hover fly [*Cheilosia urbana*] **Hieracium rust** [*Puccinia hieracii* var. *piloselloidarum*]	Root feeder, released at limited sites as difficult to rear, thought unlikely to have established. Leaf rust fungus, self-introduced?, common, causes slight damage to some mouse-ear hawkweed, plants vary in susceptibility.
Horehound clearwing moth [*Chamaesphecia mysinformis*] **Horehound plume moth** [*Wheerleria spilodactylus*]	Root feeder, released at limited sites in late 2018, some promising early signs of establishment seen. Foliage feeder, released at limited sites in late 2018, some promising early signs of establishment seen.
Honshu white admiral [*Limenitis glorifica*] **Japanese honeysuckle stem beetle** [*Oberea shirahatai*]	Foliage feeder, field releases began in 2014, already well established and dispersing from site in the Waikato, widespread releases now underway. Stem miner, field releases began in 2017, difficult to rear so widespread releases will begin once harvesting from field is possible, some likely damage seen at one site.
Lantana blister rust [*Puccinia lantanae*] **Lantana leaf rust** [*Prospodium tuberculatum*] **Lantana plume moth** [*Lantanophaga pusillidactyla*]	Leaf and stem rust fungus, releases began autumn 2015, establishment success unknown. Leaf rust fungus, releases began autumn 2015, established well and causing severe defoliation already at several sites in Northland. Flower feeder, self-introduced, host range, distribution and impact unknown.
Mexican devil weed gall fly [*Procecidochares utilis*] **Mexican devil weed leaf fungus** [*Passalora ageratinae*]	Gall former, common, initially high impact but now reduced considerably by Australian parasitic wasp. Leaf fungus, probably accidentally introduced with gall fly in 1958, common and almost certainly having an impact.
Mist flower fungus [*Entyloma ageratinae*] **Mist flower gall fly** [*Procecidochares alani*]	Leaf smut, common and often causes severe damage. Gall former, common now at many sites, in conjunction with the leaf smut provides excellent control of mist flower.
Moth plant beetle [*Freudeita cupripennis*] **Moth plant rust** [*Puccinia araujiae*]	Root and foliage feeder, field releases began in late 2019 and will be ongoing, establishment success unknown. Rust fungus, approved for release in 2015 but not released yet as waiting for export permit to be granted.
Nodding thistle crown weevil [*Trichosirocalus horridus*] **Nodding thistle gall fly** [*Urophora solstitialis*] **Nodding thistle receptacle weevil** [*Rhinocyllus conicus*]	Root and crown feeder, becoming common on several thistles, often provides excellent control in conjunction with other thistle agents. Seed feeder, becoming common, can help to provide control in conjunction with other thistle agents. Seed feeder, common on several thistles, can help to provide control of nodding thistle in conjunction with other thistle agents.
Old man's beard bud-galling mite [*Aceria vitalbae*] **Old man's beard leaf fungus** [*Phoma clematidina*] **Old man's beard leaf miner** [*Phytomyza vitalbae*] **Old man's beard sawfly** [*Monophadnus spinolae*]	Gall former which stunts the new growth, approved for release in 2019, it is hoped the first field release can be made in late 2020. Leaf fungus, initially caused noticeable damage but has become rare or died out. Leaf miner, common, damaging outbreaks occasionally seen, but appears to be limited by parasitism. Foliage feeder, limited releases as difficult to rear and only established in low numbers at a site in Nelson, more released in North Canterbury and some promising signs of likely establishment seen.
Privet lace bug [*Leptoypha hospita*]	Sap sucker, releases began spring 2015, establishment confirmed in Auckland and Waikato, some promising early damage seen already.
Cinnabar moth [*Tyria jacobaeae*] **Ragwort crown-boring moth** [*Cochylis atricapitana*] **Ragwort flea beetle** [*Longitarsus jacobaeae*] **Ragwort plume moth** [*Platyptilia isodactyla*] **Ragwort seed fly** [*Botanophila jacobaeae*]	Foliage feeder, common in some areas, often causes obvious damage. Stem miner and crown borer, released widely, but probably failed to establish. Root and crown feeder, common, provides excellent control in many areas. Stem, crown and root borer, recently released widely, well established and quickly reducing ragwort noticeably at many sites. Seed feeder, established in the central NI, no significant impact.
Greater St John's wort beetle [*Chrysolina quadrigemina*] **Lesser St John's wort beetle** [*Chrysolina hyperici*] **St John's wort gall midge** [*Zeuxidiplosis giardi*]	Foliage feeder, common in some areas, not believed to be as significant as the lesser St John's wort beetle. Foliage feeder, common, nearly always provides excellent control. Gall former, established in the northern SI, often causes severe stunting.
Scotch thistle gall fly [*Urophora stylata*]	Seed feeder, released at limited sites but becoming common, fewer thistles observed at some sites, recent study suggests it can have a significant impact on seed production.
Tradescantia leaf beetle [*Neolema ogloblini*] **Tradescantia stem beetle** [*Lema basicostata*] **Tradescantia tip beetle** [*Neolema abbreviata*] **Tradescantia yellow leaf spot** [*Kordyana brasiliensis*]	Foliage feeder, released widely since 2011, establishing well and beginning to cause noticeable or major damage at many sites already. Stem borer, releases began in 2012, establishing well with major damage seen at several sites already. Tip feeder, releases began in 2013, appears to be establishing readily, no significant impact observed yet. Leaf fungus, field releases began in 2018 and are continuing, establishment confirmed at several sites and promising damage seen already at one site in the Waikato.
Tutsan beetle [*Chrysolina abchasica*] **Tutsan moth** [*Lathronympha strigana*]	Foliage feeder, difficult to mass rear in captivity so limited field releases made since 2017, establishment success unknown. Foliage and seed pod feeder, field releases began in 2017 with good numbers released widely, establishment success unknown.
Woolly nightshade lace bug [*Gargaphia decoris*]	Sap sucker, recently released widely, establishing readily at many sites and becoming common, beginning to cause significant damage at many shaded sites.

Further reading

Clarkson B, Paynter Q, Winks C, Bartlam S, Watts C, Thornburrow D 2019. **Best-practice guidelines for managing Tradescantia threats to native biodiversity. A research collaboration between BioHeritage National Science Challenge, Manaaki Whenua – Landcare Research and Living Water, Wairua River Catchment**. MWLR Contract Report LC3570 for the Department of Conservation. 7p

Ehler GAC, Caradus JR, Fowler SV 2020. **The regulatory process and costs to seek approval for the development and release of new biocontrol agents in New Zealand**. BioControl 65: 1-12. https://doi.org/10.1007/s10526-019-09975-9

Falla C, Najar-Rodriguez A, Minor M, Harrington K, Paynter Q, Wang Q 2019. **Effects of temperature, photoperiod and humidity on the life history of *Gargaphia decoris***. BioControl 64: 633-643. https://doi.org/10.1007/s10526-019-09969-7

Groenteman R, Heenan P, Barton J 2020. **Feasibility for biological control of water celery (*Helosciadium nodiflorum*)**. MWLR Contract Report LC3783 for Nelson City Council. 47p

Paynter Q, Paterson ID, Kwong RM 2020**. Predicting non-target impacts**. Current Opinion in Insect Science 38: 79-83. https://doi.org/10.1016/j.cois.2020.02.002

Paynter Q, Poeschko M, Winks C 2020. **Leaf heteroblasty explains unexpected spillover non-target attack on *Passiflora edulis* by *Heliconius erato cyrbia*, a biological control agent for *Passiflora rubra*, in Rarotonga**. Biological Control 141: 104132. https://doi.org/10.1016/j.biocontrol.2019.104132

Peterson P 2020. **Broom control in the Upper Awatere Valley – a successful programme**. Envirolink Grant 2032-MLDC154. MWLR contract report LC3753 for Marlborough District Council

Peterson PG, Merrett MF, Fowler SV, Barrett DP, Paynter Q 2020. **Comparing biocontrol and herbicide for managing an invasive non-native plant species: Efficacy, non-target effects and secondary invasion**. Journal of Applied Ecology https://doi.org/10.1111/1365-2664.13691

Smith A et al. (49 co-authors, including R. Groenteman) 2020. **Global gene flow releases plants from environmental constraints on genetic diversity**. PNAS 117: 4218-4227. https://doi.org/10.1073/pnas.1915848117

Tannières M, Fowler SV, Manaargadoo-Catin L, Lange C, Shaw, R 2020. **First report of '*Candidatus* Liberibacter europaeus' in the United Kingdom**. New Disease Reports 41: 3. http://dx.doi.org/10.5197/j.2044-0588.2020.041.003

Previous issues of this newsletter are available from: www.landcareresearch.co.nz/publications/newsletters/biological-control-of-weeds

Gavin Loxton (left) and Lindsay Smith (right) at a Canterbury hieracium biocontrol site.

Biocontrol Agents Released in 2019/20

Species	Releases made
Honshu white admiral (*Limenitis glorifica*)	19
Moth plant beetle (*Freudeita cupripennis*)	4
Tradescantia stem beetle (*Lema basicostata*)	4
Tradescantia tip beetle (*Neolema abbreviata*)	1
Tradescantia yellow leaf spot (*Kordyana brasiliensis*)	6
Tutsan beetle (*Chrysolina abchasica*)	3
Total	**37***

*A number of planned released were delayed by the Covid-19 lockdown.