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Manaaki Whenua
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Weed Biocontrol

WHAT'S NEW?

Contents

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COVER IMAGE:
African tulip tree infestation (reddish-orange in the background) in the Cook Islands

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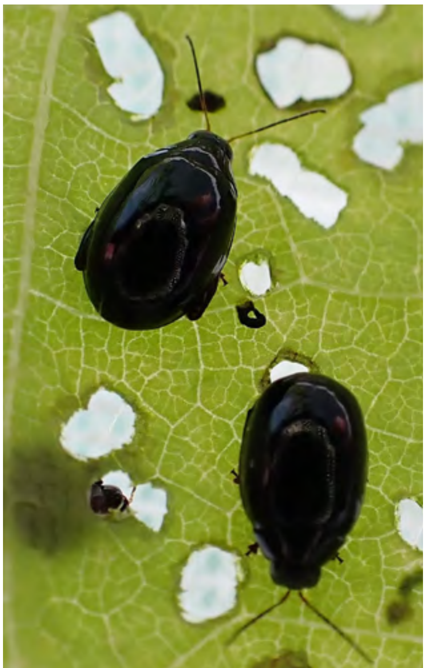
A Travel Bubble Spells Freedom for a Long-Awaited Beetle for the Cook Islands

The opening of New Zealand's travel bubble with the Cook Islands was welcome news for many. For one thing, it meant the long-awaited first release of the African tulip tree flea beetle (*Paradibolia coerulea*) could finally take place. After an extended stay in containment both in South Africa and at Tamaki in Auckland, the beetle finally found freedom in Rarotonga in June this year.

MWLR researchers and collaborators at the Centre for Biological Control at Rhodes University in South Africa have been researching biocontrol options for African tulip tree for many years. The African tulip tree (*Spathodea campanulata*) is an evergreen tree native to tropical Africa, which has been widely distributed throughout the world as an ornamental for its showy, bright reddish-orange, tulip-shaped flowers. As a result of its prolific flowering and fruiting, the production of masses of wind-dispersed seeds and its suckering growth, this tree has become highly invasive in the pantropics, including several Pacific islands. It is considered one of the 100 worst alien invasive species in the world and one of the top 30 terrestrial invasive plants.

The African tulip tree flea beetle was prioritised as a candidate agent early on for its narrow host range. Adult flea beetles are defoliators, and the larvae mine the leaves of the African tulip tree, causing extensive damage through feeding. Once host specificity testing of the beetle in South Africa was complete and approval for its release in the Cook Islands was granted, it was impossible to find a reliable way to get the beetles from South Africa to New Zealand under worldwide Covid travel restrictions. A fortuitous turn of events finally came a year later when our new plant pathologist, Alana Den Breeyen, agreed to make space for the beetles in her suitcase on her journey over from South Africa.

However, another Covid snag, and Auckland's snap lockdown in late February shortly after the beetle's arrival led to an unexpected stay in Tamaki. This meant the ageing



Flea beetle adults and damage

Adult flea beetle damage 2 days (top right) and a month (bottom right) after release

Stephanie packaging the beetles for release

adult beetles would need to breed to ensure a healthy population for release once travel to the Cook Islands was permitted. "Fortunately, we already had African tulip tree plants growing in our containment facility, so we were able to keep a culture going," said research leader, Quentin Paynter. "It took some careful rationing of the plants to rear enough beetles for a field release and to ensure they didn't eat us out of house and home. We needed to maintain a laboratory culture in case the first release failed."

The commencement of the New Zealand and Cook Islands travel bubble in mid-May finally put the wheels in motion and preparations were made to proceed with the release. Once the beetles arrived safely in Rarotonga, they were released by Quentin and research technician, Stephanie Morton. The release site for the beetles was carefully selected by Dr Maja Poeschko (Cook Islands Ministry of Agriculture) to ensure it would be free from routine insecticide spraying to manage mosquito populations to combat dengue fever.

"We initially released 40 beetles in four nylon rearing sleeves, to keep them contained and to ensure they didn't rapidly disperse," Quentin explained. "But we then decided to set 26 free, so that they could disperse, just in case we hadn't chosen an ideal release site. When we returned to the site 2 days later, we easily found several adult beetles, indicating Maja had chosen a spot where the beetles were happy," he added. Quentin also managed to make use of the travel bubble for some rest and relaxation a few weeks later in July and found extensive adult feeding damage as well as larval leaf mines. Maja confirmed she had seen adults just a few days before – encouraging early signs of establishment.

The flea beetle is the second agent to be released against the African tulip tree in the Cook Islands. A gall mite (*Colomerus spathodeae*), which forms leaf and stem galls that stunt new growth was released in 2017 and is now well established in Rarotonga. Although the damage by the mite doesn't appear to be having a significant impact yet, it is hoped that the combined impact of the mite and the flea beetle will reduce the invasiveness of African tulip tree. Indeed, Stephanie noted that when rearing the mites and beetles in containment, a combination of the two agents together was highly damaging. Maja is regularly checking on the flea beetle so we will know by the end of this year if it has definitely established. The plan then is to monitor the combined impact of the two agents at least annually. Even if heavy damage is observed within 1-2 years, the impact of this on such a long-lived tree may take 5-10 years to become clear. There are also plans to release the mite in Tonga and Vanuatu before the end of year, and the beetles will continue to be mass-reared in New Zealand for additional releases in Rarotonga.

This biocontrol project is one of several for the Pacific region aimed at reducing the impacts of invasive species on the livelihoods of Pacific people. "Now more than ever, it is vital to get control of key alien plant invaders in this region," said Lynley Hayes who is programme manager for MWLR's Pacific projects. "Recent reports suggest that children in the Pacific are suffering more from poor nutrition as a result of Covid and climate change. Weeds contribute to this problem by making it more difficult to produce food," she added. Other serious impacts of invasive alien plants include loss of biodiversity and a greater susceptibility to the threats associated with climate change. The release of African tulip flea beetle and the mite will hopefully take us one step closer to our goal of reducing the negative impacts of invasive species on the livelihoods of Pacific people.

This project is funded by the Ministry of Foreign Affairs and Trade as part of the Managing Invasive Species for Climate Change Adaptation in the Pacific (MISCCAP) project.

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Quent and Maja releasing the flea beetle in Rarotonga

All Systems Are Go for Multi-weed Biocontrol

We are excited to report that a multi-weed biocontrol programme has been funded by the Ministry for Primary Industries' (MPI) Sustainable Food and Fibre Futures (SFF Futures), with co-funding from the National Biocontrol Collective (NBC). MPI's SFF Futures (previously the Sustainable Farming Fund, SFF) funds initiatives from small grassroots community projects to large-scale industry development under four funding schemes, depending on the length and complexity of the projects. SFF Futures is a co-investment fund, requiring cash co-investment from alternative sources, although in-kind co-investments are also taken into account. MPI's proportional contribution is dependent on the extent of the benefits that will be made available to New Zealand (i.e. the public good).

The NBC is the sole co-funder of this new multi-weed biocontrol programme. Formed in 2002, it is currently made up of 15 regional councils and unitary authorities, and the New Zealand Department of Conservation (DOC). Funds are contributed annually and are pooled to fund weed biocontrol programmes for prioritised target weeds that affect all of New Zealand. The NBC has invested over $9.5 million in weed biocontrol research since 2002, facilitating the release of 29 new agents for 17 target weeds. The leveraging of research funds for weed biocontrol from state investment programmes such as the old SFF, and now SFF Futures would not have been possible without co-investment from the NBC.

According to Programme Leader, Ronny Groenteman, the process from project inception to contracting was exceptionally long, nearing 18 months. "Patience and many hours dedicated to developing the project plans and budgets finally paid off," said Ronny. "We now have just over $2 million of MPI SFF Futures funding, along with $840 000 from the NBC for biocontrol research on weeds that impact the productive sector," she added.

The project will run for 3 years and will focus on three work streams: i) progressing biocontrol programmes for six weed targets; ii) monitoring the outcomes of mature biocontrol

Chilean flame creeper flower

FA López Nuñez

Flower-bud-galling wasp for Sydney golden wattle

programmes (10-20 years since the agents were first released); and iii) developing an enduring partnership between the NBC and the Food & Fibre sector for the continuity of weed biocontrol programmes. In addition, the programme will have an extension component focused on bringing the benefits of biocontrol to the hearts and minds of farmers and growers in New Zealand.

"There are so many positives in this new model of work, especially when compared to the preceding Sustainable Farming Fund (SFF) model," explained Ronny. "For a start, we are able to work on multiple weeds simultaneously and transfer resources between the different projects, as needed. It is common in weed biocontrol research that some projects progress slower and others faster than anticipated. We did not have the flexibility to transfer resources under MPI's preceding funding model, even though the SFF was often funding research on several weed targets."

The scope of weeds we can work on has grown too. No longer are we limited to weeds that have an impact on farm productivity. We can now include weeds that affect the ability of farmers to comply with environmental regulations, as well weeds that affect the well-being of farmers. The six weed targets that fall under the first work stream were prioritised by the NBC and approved by MPI. They are Chilean flame creeper (*Tropaeolum speciosum*), Chilean needle grass (*Nassella neesiana*), old man's beard (*Clematis vitalba*), Sydney golden wattle (*Acacia longifolia*), woolly nightshade (*Solanum mauritianum*), and yellow flag iris (*Iris pseudacorus*).

Another major benefit of MPI's new funding model is the availability of funds to support evaluating the outcomes of mature weed biocontrol programmes. We're now in a position to revisit several weed biocontrol programmes 10 to 20 years on, when we expect the full impacts of biocontrol to start becoming evident. We will be evaluating some of the earliest

SFF programmes such as Scotch broom (*Cystisus scoparius*) and gorse (*Ulex europaeus*) and will continue monitoring nodding thistle (*Carduus nutans*), previously funded by the NBC programme.

In this programme we are also looking to develop training and extension for farmers and rural professionals, who we haven't connected with before. This will be a steep learning curve for us and so we have partnered with an external facilitator to guide us through developing an effective extension plan.

Finally, we will be working to build a partnership with the Food & Fibre sector towards developing a more stable funding model for weed biocontrol for the productive sector. This is an opportunity to expand the NBC, and is one that will come with many advantages and challenges. "To help us build a partnership with the sector, we have been fortunate to bring two talented representatives on board. Phil McKenzie from Deer Industry NZ will act as chair of the project's governance group, and Nicole Lang from Lang Sustainability will sit on the steering group. Between them, they cover the North and South Islands and the breadth of the sector," said Ronny. "They will ensure the sector perspective is present at the table, and will be instrumental in shaping the next phase, which we hope will allow us to expand and tackle more weeds, and to implement an active and successful extension programme, enabling New Zealand farmers to benefit from biocontrol," she concluded.

This project is funded by Sustainable Food and Fibre Futures, administered by the Ministry for Primary Industries, and the National Biocontrol Collective.

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Old man's beard smothering vegetation

Target weeds

Chilean flame creeper *(Tropaeolum speciosum)* is a vigorous perennial vine with attractive bright red flowers and blue berries. This weed is particularly problematic in Southland and Otago where it invades forest margins and disturbed sites. This is a new weed biocontrol target in New Zealand and the world. This programme is supporting preliminary research on candidate biocontrol agents.

Chilean needle grass *(Nassella neessiana)* is a tufted perennial tussock that can outcompete productive pasture grasses, particularly in dry areas such as Marlborough. This is an old weed biocontrol project for New Zealand, previously supported by the NBC. However, it was put on hold due to delays with obtaining a rust fungus (*Uromyces pencanus*) from Argentina. This programme will support completion of host range testing of the rust and next steps.

Old man's beard *(Clematis vitalba)* is a deciduous climbing, layering vine that forms dense masses that quickly dominate almost any kind of vegetation, but other agents are needed to reduce its invasiveness. This is an ongoing project now supported by this programme, which will include exploratory surveys in the native range in search of promising pathogens and to study them further.

Sydney golden wattle *(Acacia longifolia)* is a shrub or small tree that grows rapidly, forming dense thickets in disturbed and bare sites. This is a new weed biocontrol project for New Zealand, however Sydney golden wattle has also been targeted for biocontrol in South Africa and Portugal. This programme is funding an application to release a flower-bud-galling wasp (*Trichilogaster acaciaelongifoliae*) which has been highly successful in reducing seed production by Sydney golden wattle in South Africa.

Woolly nightshade *(Solanum mauritianum)* is a shrub or small tree which grows and matures rapidly, forming dense stands in a variety of habitats. One insect biocontrol agent has already been released against woolly nightshade in New Zealand but it is only damaging to plants growing in shaded areas. This programme will support host range testing of a flower-bud-feeding weevil (*Anthonomous morticinus*), and exploratory surveys for two stem-boring weevils in the native range.

Yellow flag iris *(Iris pseudacorus)* is a robust, perennial, semi-aquatic iris species that invades wetlands and river catchments and is toxic to livestock. This is a new weed biocontrol project in New Zealand, but candidate agents have already been identified and studied in the native range and in South Africa. This programme is supporting host range testing of the iris flea beetle (*Aphthona nonstriata*) to assess its suitability for release here.

Beetling ahead with Chilean flame creeper

Despite being a spanner in the works for many of our weed biocontrol projects, Covid hasn't halted progress on exploring biocontrol options for Chilean flame creeper (*Tropaeolum speciosum*). After a promising leaf-feeding chrysomelid beetle (*Blaptea elguetai*) was found on this new target weed in Chile in December 2019, our collaborator there, Dr Hernán Norambuena (entomology consultant), was contracted to initiate the project.

Hernán was tasked with collecting a starter colony of the beetles to study their biology and requirements for rearing, and to survey Chilean flame creeper populations in the search for other promising natural enemies. Although travel restrictions were implemented in Chile during a second wave of increasing Covid cases, Hernán has made significant progress towards these project objectives.

Eleven sites have been surveyed so far and the leaf beetle was by far the most common natural enemy of Chilean flame creeper in the region that was surveyed. The beetle appears to be confined to low altitudes and can cause extensive damage to the leaves of their host plant. Adults of the leaf beetle were collected at Quintrilpe, in Araucanía in southern Chile, and taken to the laboratory for further study. "These adults laid copious amounts of eggs which all hatched successfully and the beetle larvae consumed impressive quantities of Chilean flame creeper foliage in the lab," reported Hernán. "The larvae completed development to adults, with the egg to adult life cycle taking about 7 weeks in total."

Interestingly, Hernán could not find where the adults lay their eggs under natural conditions, so this aspect of the beetle's life history remains to be discovered when he gets a chance to visit new Chilean flame creeper sites in search of other agents and new populations of the beetle. Hernán is hopeful that site visits at different times of the year will reveal when and where the adult beetles deposit their eggs. Early instar larvae of the beetle were always found on the lower leaves of the vines, near the base of the plants, so it's possible that eggs are laid in

Leaf beetle eggs in the laboratory

Leaf beetle larvae and damage

the soil or in the leaf litter. In the lab, the beetles laid eggs on cut foliage and pieces of filter paper.

Another important aspect of the beetle's biology that Hernán continues to investigate is its overwintering requirements. Preliminary investigations suggest that egg laying is conditional on overwintering. "It will be critical to be able to mimic these conditions for the beetle when we can finally bring them into containment in New Zealand for host range testing," explained Ronny Groenteman, who is leading the project. "Successful rearing in the laboratory can be crucial to a successful biocontrol project," she added.

In addition to the leaf-feeding beetle, eggs and caterpillars of a moth were found on Chilean flame creeper during the surveys. The caterpillars were reared to adulthood in the laboratory and were identified as belonging to the microlepidopteran family Plutellidae, commonly known as the diamondback moths. Hernán will need to investigate this moth further before we know whether it is worth pursuing as a candidate biocontrol agent.

Chilean flame creeper is a rare plant in its native range, confined to the coastal areas of southern Chile up to 1,000 m above sea level. The plant's rarity and limited distribution in Chile make it fairly challenging for Hernán to find sites to survey. However, the extensive damage caused by the first agent prioritised for biocontrol of Chilean flame creeper gives us great confidence that this could be an effective tool to tame infestations in New Zealand.

This project is jointly funded by the National Biocontrol Collective and the Ministry for Primary Industries' Sustainable Food and Fibre Futures Fund (Grant #20095) on multi-weed biocontrol.

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Identity crisis for a weed of the Pacific

Taro vine (*Epipremnum pinnatum* cv. *Aureum*), also known as Devil's ivy, is a perennial epiphyte (a plant that uses another plant as a substrate) of tropical and subtropical regions that has become invasive in many countries and territories in the Pacific, including the Cook Islands, Hawai'i, Marshall Islands, Micronesia, Palau, Samoa, Tonga, and most notably Niue. It invades natural and anthropogenic environments, growing across the ground up to the tops of tall trees. Its smothering growth displaces native flora and prevents seedling establishment, as well as killing host trees. Taro vine has the ability to reproduce vegetatively, growing readily from tiny fragments, making large infestations very hard to control by conventional methods. The severe disruption taro vine causes to Pacific Island ecosystems made it a high priority for investigating the feasibility of developing a biocontrol programme for this weed.

"It is fair to say that taro vine has a convoluted taxonomic history – one that has yet to be fully resolved," said lead author of the feasibility study, Chris McGrannachan. "Taro vine has gone through several name changes since it was first described in 1880 and even presently, there is no firm consensus as to the correct taxonomic nomenclature of this species," he added. Online databases, as well as scientific and grey literature, interchangeably list taro vine as *Epipremnum pinnatum E. aureum*, or *E. pinnatum* cv. *Aureum*, making it difficult to reliably ascribe some information to the species of concern or to rely upon the accuracy of information. The confusion surrounding the true identity of taro vine has also led to different native origins being recognised, including Asia, Australia, French Polynesia, and the Solomon Islands.

"What we do know is that taro vine can have major detrimental impacts on native ecosystems if left unchecked," explained Chris. "Control methods such as herbicide applications or physical removal are time and labour intensive, with repeated treatments required. And, these conventional management methods are near impossible to employ due to the ecology of the weed," he added. Herbicides also kill the host trees, since the herbicide is translocated to tree trunks via the penetrating roots of taro vine. Physical or mechanical removal often results in fragments remaining high in the unreachable canopy, which quickly regrow. A scorched earth approach is often the only possible control method, but this is at the expense of killing native vegetation, as well as the host trees. The lack of effective management methods makes biocontrol a highly desirable control option for managing taro vine. A feasibility study was the first step towards determining if taro vine is a viable biocontrol target.

Biocontrol has never been initiated against taro vine, and little research has been conducted on its natural enemies. Through literature and database searches and consultation with international experts, five arthropods, 47 fungal pathogens and five algal or bacterial pathogens were identified as being associated with taro vine. Unfortunately, none of these species are suitable as biocontrol agents because they all have broad host ranges, are unlikely to cause significant damage, and/or are invasive themselves.

"To conclude, the feasibility study makes two recommendations before the viability of a biocontrol programme targeting taro vine can be fully evaluated," said Chris. "Firstly, it will be essential to conduct molecular studies on taro vine populations from the entire Pacific region as well as other regions such as Asia to confirm the true identity of the species and its native range. Secondly, it will be important to conduct surveys in the Pacific Islands where taro vine is invasive to identify any natural enemies already present, and in the native range, to identify natural enemies that have potential as classical biocontrol agents," he added.

Efforts are currently underway to enlist the aid of collaborators in the Pacific region to provide leaf samples of taro vine for molecular analysis. Surveys throughout the Pacific region are scheduled from mid-2022, Covid permitting. Once this research has been completed, a decision can be made regarding the next steps.

"Unfortunately, climate change is likely to exacerbate the spread and impact of taro vine" said Chris. "Many countries in the early stages of invasion appear to be unaware of the threat taro vine poses. As such, our report also strongly recommends that greater efforts be made to raise awareness on taro vine, to eradicate where feasible and to take steps to prevent new infestations," he concluded.

This feasibility study was undertaken as part of the Managing Invasive Species for Climate Change Adaptation in the Pacific (MISCCAP) programme, funded by the New Zealand Ministry of Foreign Affairs and Trade. Please contact us if you are able to provide leaf samples for the molecular study.

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Taro vine infestation in Niue

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 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)*

- Because 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 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 plants.

Moth plant beetle *(Freudeita cupripennis)*

- We think this beetle has established in the Bay of Plenty and the Waikato but it may still be at low densities due to a limited number of releases so far. Look for adult beetles on the foliage and stems of moth plant. The adults are about 10mm long with metallic orangey-red elytra (wings) and a black head, thorax and legs. The larvae feed on the roots of moth plant so you won't find them easily.
- The beetles can be harvested if you find them in good numbers. Aim to shift at least 100 beetles to sites that are not yet infested with the beetle.

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 coloration.
- 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 of the adult beetles and larvae on the stems and leaves of tradescantia. 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's 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 in the future, 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 underside of the leaves. They turn bright green just before they pupate.

Tutsan moth *(Lathronympha strigana)*

- We don't 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.


Tutsan beetle

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*)
- broom leaf beetle (*Gonioctena olivacea*)
- 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*)

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Who's Who in Biological Control of Weeds?

Alligator weed beetle [*Agasicles hygrophila*] **Alligator weed beetle** [*Disonycha argentinensis*] **Alligator weed moth** [*Macrorrhinia endonephele*]	Foliage feeder, common, often provides excellent control on static water bodies. Foliage feeder, released widely in the early 1980s, failed to establish. 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*] **Broom leaf beetle** [*Gonioctena olivacea*] **Broom psyllid** [*Arytainilla spartiophila*] **Broom seed beetle** [*Bruchidius villosus*] **Broom shoot moth** [*Agonopterix assimilella*] **Broom twig miner** [*Leucoptera spartifoliella*]	Gall former, becoming widespread in some regions, beginning to cause extensive damage to broom at many sites, especially in the South Island (SI). Foliage feeder, establishment confirmed at sites in both islands but not yet common, impact unknown. Sap sucker, becoming common, some damaging outbreaks seen, but may be limited by predation, impact unknown. Seed feeder, common in many areas, now destroying up to 84% of seeds at older release sites. Foliage feeder, recently released at limited sites as difficult to rear, appears to be established in low numbers at perhaps 3 sites. Stem miner, self-introduced, common, often causes obvious damage.
Californian thistle flea beetle [*Altica carduorum*] **Californian thistle gall fly** [*Urophora cardui*] **Californian thistle leaf beetle** [*Lema cyanella*] **Californian thistle rust** [*Puccinia punctiformis*] **Californian thistle stem miner** [*Ceratapion onopordi*] **Green thistle beetle** [*Cassida rubiginosa*]	Foliage feeder, released widely during the early 1990s, failed to establish. Gall former, extremely rare as galls tend to be eaten by sheep, impact unknown. 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. Systemic rust fungus, self-introduced, common, damage usually not widespread. Stem miner, attacks a range of thistles, released at limited sites as difficult to rear, establishment success unknown. 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 SI populations likely to be susceptible.
Darwin's barberry flower bud weevil [*Anthonomus kuscheli*] **Darwin's barberry seed weevil** [*Berberidicola exaratus*]	Flower bud feeder, approved for release in 2012, releases will be made after the seed weevil is established if still needed. 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 is looking likely, further releases planned.
Giant reed gall wasp [*Tetramesa romana*] **Giant reed scale** [*Rhizaspidiotus donacis*]	Stem galler, field releases began in late 2017, establishment success unknown, further releases planned. Sap sucker, approved for release in 2017, first field releases made early in 2021, establishment success unknown, further releases planned.
Gorse colonial hard shoot moth [*Pempelia genistella*] **Gorse hard shoot moth** [*Scythris grandipennis*] **Gorse pod moth** [*Cydia succedana*] **Gorse seed weevil** [*Exapion ulicis*] **Gorse soft shoot moth** [*Agonopterix umbellana*] **Gorse spider mite** [*Tetranychus lintearius*] **Gorse stem miner** [*Anisoplaca pytoptera*] **Gorse thrips** [*Sericothrips staphylinus*]	Foliage feeder, from limited releases widely established only in Canterbury, impact unknown, but obvious damage seen at several sites. Foliage feeder, failed to establish from a small number released at one site, no further releases planned due to rearing difficulties. 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. Seed feeder, common, destroys many seeds in spring. 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. Sap sucker, common, often causes obvious damage, but ability to persist is limited by predation. Stem miner, native, common in the SI, often causes obvious damage, lemon tree borer has similar impact in the NI. Sap sucker, common in many areas, impact unknown.
Heather beetle [*Lochmaea suturalis*]	Foliage feeder, has damaged/killed 40,000+ 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*] **Hieracium gall midge** [*Macrolabis pilosellae*] **Hieracium gall wasp** [*Aulacidea subterminalis*] **Hieracium plume moth** [*Oxyptilus pilosellae*]	Crown feeder, released at limited sites as difficult to rear, thought unlikely to have established. 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. 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. 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, established and spreading slowly at sites in the Mackenzie District and North Canterbury, impact unknown, further releases planned. Foliage feeder, released at limited sites in late 2018, established at sites in North Canterbury and Marlborough, causing obvious damage already, further releases planned.
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, does not appear to have established to date, and a further attempt will be made in 2021. 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 on-going, some promising early signs that establishment is likely. 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, the first field release is planned for 2021. 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 in shaded sites.
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 but some promising signs seen. 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

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

Woolly nightshade

Biocontrol Agents Released in 2020/21

Species	Releases made
Honshu white admiral *(Limenitis glorifica)*	14
Moth plant beetle *(Freudeita cupripennis)*	10
Tutsan beetle *(Chrysolina abchasica)*	7
Giant reed scale *(Rhizaspidiotus donacis)*	2
Giant reed gall wasp *(Tetramesa romana)*	1
Privet lace bug *(Leptophya hospita)*	3
Field horsetail weevil *(Grypus equiseti)*	7
Tradescantia yellow leaf spot *(Kordyana brasiliensis)*	15
Tradescantia tip beetle *(Neolema abbreviata)*	2
Tradescantia leaf beetle *(Neolema ogloblini)*	2
Total	**63**