WHAT'S NEW IN

Biological Control of Weeds?

Issue 67 Feb 14

Weeds on weeds (peltate morning glory and grand balloon vine smothering African tulip tree in Rarotonga).

What's Inside?

Landcare Research
Manaaki Whenua

Darwin's Barberry Focus Shifts to Disease

Darwin's barberry (*Berberis darwinii*) has the potential to become a serious woody weed like gorse (*Ulex europaeus*) and broom (*Cytisus scoparius*) in New Zealand. Biocontrol efforts have until recently focused on finding insect agents for this weed. Our Chilean collaborator, Hernan Norambuena, has been helping out with the project for several years. He completed the host-range testing of a seed-feeding weevil (*Berberidicola exaratus*) and a flowerbud weevil (*Anthonomus kuscheli*) which the Environmental Protection Agency (EPA) subsequently approved for release in New Zealand. More recently he has been helping with a rearing programme to enable releases of the weevils to begin. All insect shipments arriving from overseas must be reared through a generation in a containment facility to check their identity and ensure there are no unwanted hitchhikers. Only then can we apply to the Ministry of Primary Industries for permission to remove the insects from containment and liberate them in the field. With Hernan's help we have now imported several shipments of the weevils, but it has proved more difficult than expected to successfully rear them in containment.

Our first attempt at rearing the weevils in spring 2012 ran into some timing issues. Because these insects require specific plant parts it is critical to have plenty of flowers and fruits available to coincide with egg-laying. However, the Darwin's barberry plants did not like being grown in pots and failed to produce many reproductive structures. The timing of the shipments also proved to be suboptimal, with too few weevils produced too late in the season for releases to begin. With the benefit of that experience we had another go in spring 2013. "Flowerbud weevils were collected earlier in the season in Chile to try to synchronise better with the early flowerbuds on potted plants at Lincoln," explained Hernan. However, despite successful egg-laying no new adults emerged from the much damaged flower buds.

Chantal surveying Darwin's barberry in Chile.

A further shipment of weevils (of both species) was hand-delivered by Hernan in October 2013. Although the weevils appeared healthy, routine testing indicated that both weevil species contained microsporidia (internal fungal parasites) and were therefore unusable. Line-rearing to try and remove the microsporidian was not feasible because of the difficulties in producing a steady out-of-season supply of flowers and fruits (which need to remain attached to whole plants to develop) that individual weevils could be caged on, and to ensure adequate hygiene – much more difficult than line rearing the three tradescantia beetles, which we were able to do with sprigs of vegetation in Petri dishes but which nearly did not succeed. Since clean weevils had been collected previously, the next step was to try and identify the best sites to attempt to collect them from next spring.

Fortunately a few weeks after we discovered the imported weevils were diseased, Chantal Probst was due to travel to Chile for phase two of the barberry project to look for plant diseases that could complement the weevils. This meant that Chantal was able to include weevil collections in her November survey. Assisted by Hernan, Chantal was able to bring back 8 populations of the flower bud weevil and 14 populations of the seed feeder. The weevils are currently being checked for disease. "We are hoping to identify at least one site where the weevils appear to be free from infection," said Lindsay Smith.

Meanwhile, the main reason for Chantal's survey was successful. She found many signs of disease, including a rust that had previously been identified as worthy of further study when funds permitted. Plant tissues that either had leaf spots or showed dieback were able to be brought back into the new Tamaki plant pathogen containment facility for further study. "I have isolated different fungi from those tissues and they are currently growing on agar plates. The next job is to gene-sequence the different cultures to identify them," explained Chantal. An application will be submitted to the EPA soon requesting permission to import in containment the kinds of fungi, like rusts, that our current permits don't allow. Once we have that permission the rust will be imported for further study. In the meantime Hernan has ready some infected plants in safe-keeping.

This project is funded by the National Biocontrol Collective. Dr Hernán Norambuena has been able to travel to New Zealand twice thanks to a fellowship provided by the Agricultural and Marketing Research and Development Trust (AGMARDT).

Giant Buttercup in the Spotlight

Landcare Research recently joined forces with AgResearch to start looking at classical biocontrol options for giant buttercup (*Ranunculus acris*), a weed estimated to cost the dairy industry around $156 million annually. Giant buttercup is primarily a pest of improved pasture. It is prevalent on dairy farms in South Auckland, Hawke's Bay, Southland, Taranaki, Wairarapa, West Coast and the Tasman District. Sheep don't seem to mind the acrid-tasting toxin that the flowering plant produces (a glycoside), but it is not palatable to cattle. While currently only these seven of the 17 dairy regions are known to have significant populations of giant buttercup, modelling by AgResearch indicates that all regions are climatically suitable for the weed and therefore vulnerable.

Giant buttercup first established in New Zealand around 1910 and originates from Europe and Asia. It reproduces through seed and vegetatively by rhizomes and through nodal rooting (layering) of collapsed flower stems. The seed is easily spread via stock, agricultural equipment, flood waters and hay. Rhizome fragments are also spread by stock, machinery and flood waters. The longevity of the seed in the soil appears to vary depending on soil moisture and other climatic conditions. Rhizome fragments readily survive drought.

Graeme Bourdôt from AgResearch has been working on giant buttercup since the 1990s after it started to show resistance to phenoxy herbicides. Graeme said, "The historical reliance by dairy farmers on MCPA and MCPB during the 1950s caused the resistance to develop." Newer herbicides also have limitations. "Thifensulfuron methyl damages clovers, which further promotes the growth of giant buttercup, and the plant can evolve resistance to flumetsulam, leaving many dairy farmers with no options for selective removal of the weed from their pastures," added Graeme. Biocontrol may therefore offer the only long-term option for managing giant buttercup.

Past research has focused on developing a mycoherbicide formulated from a naturally-occurring fungus, *Sclerotinia sclerotiorum*. Not only is the fungus able to kill giant buttercup plants with negligible risk to neighbouring crops, it is also harmless to pasture grasses and clovers. "Unfortunately there has been little interest in developing a commercial product by the bigger agrochemical companies despite recent modelling showing it would be economically viable to do so," said Graeme. However, renewed interest by smaller companies in developing specialist environmentally sensitive products for weed management may still hold the key to its commercial development. Field trials conducted by AgResearch indicated that the mycoherbicide gave good (and environmentally safe) control of giant buttercup, and scientists have speculated that its use could be complemented with classical biocontrol agents such as insects.

Simon Fowler and overseas intern, Auste Cerniauskaite, sampling giant buttercup.

Late last year, a team from AgResearch and Landcare Research visited Golden Bay, Taranaki and Southland to talk to farmers about the giant buttercup problem and collect samples of the plant and its associated endophytes, pathogens and insect fauna. "Endophytes occur naturally in all plants and are of interest because they can interfere with the effectiveness of biocontrol agents, especially pathogens," explained Simon Fowler. As well as looking for insects damaging the plant, the team also looked for any that might disrupt biocontrol agents if they were introduced. Plants were also collected for DNA analysis. "We will be assessing the genetic variability of giant buttercup around New Zealand as well as trying to pinpoint which region of Europe the plants originated from. That way we can source potential agents from the best place," said Dagmar Goeke. "Widespread weed species like giant buttercup are often very variable genetically over their native range, so it is critical that we identify the origin of the plants that are invasive in New Zealand.

Giant buttercup doesn't occur exclusively on dairy farms, it also grows on roadsides, river flats, wetlands and anywhere else damp and warm. The weed is likely to have spread considerably over the past decade as the dairy industry has intensified and there are now localised populations in parts of the West Coast, Canterbury and Southland, but these are mainly on non-agricultural land. Now is definitely the time to thoroughly explore all biocontrol options for giant buttercup.

This project is funded through AgResearch's core-funded pasture weeds programme.

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Cooks Islands Project Becomes a Reality

New Zealand's Ministry of Foreign Affairs and Trade (MFAT) has agreed to fund a 5-year project to develop weed biocontol for the Cook Islands, and the project is now underway. The Cook Islands comprise 15 islands, the largest being the well-known holiday destination Rarotonga. A large number of plants introduced for their ornamental value, edible fruit, or timber have become seriously invasive, and are now threatening native biodiversity, traditional cultural practices, and the sustainable development of the island group. The programme of work for the Cook Islands was agreed in consultation with regional experts involved in agriculture, biodiversity conservation and biosecurity. After careful consideration the eight most appropriate targets were selected.

"Biocontrol agents developed elsewhere will be released against five species: mile-a-minute (*Mikania micrantha*), Noogoora burr (*Xanthium pungens*), grand balloon vine (*Cardiospermum grandiflorum*), strawberry guava (*Psidium cattleianum*), and giant reed (*Arundo donax*)," confirmed Quentin Paynter, who is leading the project. One of the first projects out of the blocks will be to gain permission to release a rust fungus (*Puccinia spegazzini*), which has already been released against mile-a-minute in Papua New Guinea, Fiji and Vanuatu, and requires no additional testing. It is hoped releases of the rust can get underway in the Cooks Islands this calendar year. Some testing of another rust fungus (*Xanthium pungens*), used successfully in Australia against Noogoora burr, will be undertaken this year to check it is safe to release in the Cook Islands and populations there are susceptible. No additional testing is needed for a third rust fungus (*Puccinia arechavaletae*) and a weevil (*Cissoanthonomus tuberculipennis*), identified as good potential agents for grand balloon vine in South Africa, where this weed is also problematic. "We plan to import these species into containment and obtain clearance for their release in 2016/17," said Quent. Most of the species to be worked on are not weeds in New Zealand. However, strawberry guava is naturalised here and may become a problem in the future. A scale insect (*Tectococcus ovatus*), recently released in Hawai'i, appears to be sufficiently specific for the Cook Islands and we will import it into containment for final clearance for release there in 2016. Giant reed is definitely a weed in New Zealand. Next year we plan to import two insects developed as biocontrol agents for this target in the USA, a gall wasp (*Tetramesa romana*) and a scale insect (*Rhizaspidiotus donacis*). "We could also seek permission to release them in New Zealand if there is sufficient interest in doing so," commented Quent.

Grand balloon vine.

Novel research will be undertaken for the remaining three species: red passionfruit (*Passiflora rubra*), African tulip tree (*Spathodea campanulata*), and peltate morning glory (*Merremia peltata*). New agents will be developed for red passionfruit. We will import two attractive *Heliconius* butterflies into containment for host testing next year. Agents will also be developed for African tulip tree, a major invasive weed throughout the Pacific Region. Potential agents were identified in preliminary surveys for biocontrol agents conducted in Ghana in 2009, funded by the Secretariat of the Pacific Community. Our plant pathologist, Sarah Dodd, will assist collaborators from Rhodes University in South Africa to complete additional surveys in Ghana next month. "Once all the potential candidates are known the best ones will be selected for host-testing," explained Sarah. A molecular study of peltate morning glory will begin shortly to determine, if possible, how and when this plant colonised the Pacific region. There are conflicting views about whether this invasive vine is native or introduced to various islands, which needs to be resolved before any further steps could be taken to develop biocontrol for this target.

Throughout the project we will be working closely with Maja Poeschko of the Ministry for Agriculture in Rarotonga, and Gerald McCormack, who directs the Cook Islands Natural Heritage Project. We hope that this project, through the development of new agents and capacity, will in time also benefit the wider Pacific.

Many thanks to MFAT for providing the funds for this project through its International Development Fund.

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Autumn Activities

There are a few things you might want to fit in before the wind-down towards winter. We would be very interested to hear about what you find.

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

- Check release sites for feeding shelters made by caterpillars webbing together leaves at the tips of stems. Also look for "windows" in the leaves and sprinkles of black frass. Small caterpillars are olive-green in colour and become darker, with two parallel rows of white spots, as they mature.
- Any harvesting of caterpillars should be left until spring.

Broom gall mites (*Aceria genistae*)

- Check release sites for galls, which look like deformed lumps and range in size from 5 to 30 mm across. Occasionally galls can be found on broom that are not made by the gall mite, but these are much less dense. We are happy to help confirm the identity of any galls you find.
- Harvesting of galls is best left until spring when predatory mites are less abundant.

Gall-forming agents

- Early autumn is the best time to check release sites for many gall-forming agents. If you find large numbers of galls caused by the mist flower gall fly (*Procecidochares alani*) and hieracium gall wasp (*Aulacidea subterminalis*) you could harvest mature specimens and release them at new sites.
- Do not collect galls caused by the hieracium gall midge (*Macrolabis pilosellae*) as this agent is best redistributed by moving whole plants in the spring.
- At nodding and Scotch thistle gall fly (*Urophora solstitialis* and *U. stylata*) release sites look for fluffy or odd-looking flowerheads that feel lumpy and hard when squeezed. Collect infested flowerheads and put them in an onion or wire mesh bag. At new release sites hang bags on fences and over winter the galls will rot down allowing adult flies to emerge in the spring.
- At Californian thistle gall fly (*Urophora cardui*) release sites look for swollen deformities on the plants. Once these galls have browned off they can be harvested and moved to new sites (where grazing animals will not be an issue) using the same technique as above.

Tradescantia leaf beetle (*Neolema ogloblini*)

- Check release sites, especially the older ones. Look for notches in the edges of leaves caused by adult feeding or leaves that have been skeletonised by larvae grazing off the green tissue. You may see the dark metallic bronze adults but they tend to drop or fly away when disturbed. It may be easier to spot the larvae, which have a distinctive protective covering over their backs. The white, star-shaped pupal cocoons may be visible on damaged foliage.
- We would not expect you to find enough beetles to be able to begin harvesting and redistribution just yet.

Tradescantia leaf beetle pupal case.

Tradescantia stem beetle (*Lema basicostata*)

- Most release sites are still fairly new but there is no harm in looking. The black knobbly adults also tend to drop when disturbed, but look for their feeding damage, which consists of elongated windows in the upper surfaces of leaves or sometimes whole leaves consumed. The larvae inside the stems will also be difficult to spot. Look for stems showing signs of necrosis or collapse and brown frass.
- We would not expect you to find enough beetles to be able to begin harvesting and redistribution just yet.

Tradescantia tip beetle (*Neolema abbreviata*)

- Releases only began a year ago, but again there is no harm in looking. The adults are mostly black with yellow markings on their wing cases, but like the other tradescantia beetles tend to drop when disturbed. Larvae will also be difficult to see when they are feeding inside the tips, but brown frass may be visible. When tips are in short supply the slug-like larvae feed externally on the leaves.
- We would not expect you to find enough beetles to be able to begin harvesting and redistribution just yet.

Woolly nightshade lace bug (*Gargaphia decoris*)

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

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Kauri Dieback: Kia Toitu he Kauri

As well as finding plant diseases to use as methods of mass weed destruction, our plant pathologists get called on to help out when all is not well with native plants. Unfortunately the increased movement of people and goods around the world is allowing plant pathogens to infect new hosts, often with devastating results. In New Zealand the discovery of diseased kauri (*Agathis australis*) in Northland in 2003 was a huge blow. Not only is this iconic, ancient species of high cultural importance to Maori, it is the dominant canopy tree species providing the framework for one of our primary forest ecosystems.

When kauri trees in the Waipoua Forest started showing symptoms of disease a decade ago *Phytophthora* was the prime suspect. Species of *Phytophthora* (which literally means "plant destroyer") have been responsible for many serious plant diseases, including the Irish famine when potatoes became infected in the 1840s, but also more recently affecting a range of trees worldwide including oak, chestnut, alder and jarrah. *Phytophthora* is a soil-borne microbe (or water mould). In kauri it initially affects the roots and subsequently disrupts the function of the secondary cambium and phloem resin cells, causing lesions on the lower trunk, leaf chlorosis, canopy dieback and ultimately the death of the tree. All age and size classes, from trees that are only 3 years old to huge trees that are over 800 years old, can be affected, posing a serious threat to the last remaining natural remnants of kauri in Northland, Auckland, and the Waikato.

Diseased kauri trees had been known from Great Barrier Island for several decades. The causative agent was identified as *Phytophthora heveae* in 1974, but after the discovery of diseased plants on the mainland, further investigations showed this to be incorrect and the pathogen was given the provisional name of *Phytophthora* 'taxon Agathis' or PTA. It is not known how the plants on Great Barrier Island or on the mainland became infected, but the disease is likely to have been accidentally introduced. The genus *Agathis* (Araucariaceae) includes at least 13 species that can be found in temperate areas in the southwest Pacific including, Papua New Guinea, New Caledonia, Australia, and New Zealand.

Once the threat to kauri became apparent, a multi-agency Kauri Dieback Joint Agency Response (KDJAR) group was established including four regional councils (Auckland, Bay of Plenty, Northland and Waikato), the Department of Conservation (DOC) and the Ministry for Primary Industries. Māori (tangata whenua), Crown research and university scientists contribute to a technical advisory group supporting the long-term management response. Well-attended public symposia resulted in government support for research efforts to "Keep Kauri Standing". Research funds have been used to identify the species of *Phytophthora*, develop diagnostic tools, determine the extent of the disease, understand key pathways for spread, determine if other plants are at risk and develop control tools and strategies. A report on this research has recently been completed by Landcare Research.

Identifying which species of *Phytophthora* is responsible for kauri dieback was a critical step towards understanding and managing the disease. Ross Beever initially led the work, with the project suffering a large set-back when he died in June 2010. Ross and his team used a combination of DNA based diagnostics and morphological analysis to conclude that there are five different *Phytophthora* species present in kauri forest soils; *P. cinnamomi, P. cryptogea, P. kernoviae, P. nicotianae* and PTA. Further molecular studies confirmed that PTA was a new species to science, most closely related to another new species of *Phytophthora*, previously considered to be *P. castaneae.* PTA will soon be formally named *Phytopthora agathadicida* (kauri killer), although its geographic origins remain uncertain.

Pathogenicity studies conducted by Ross Beever suggested that only kauri is killed by *P. agathadicida*. Kauri seedlings inoculated with the disease showed signs of stress after 3 weeks and were dead after 7 weeks.

Diagnostic methods to test for the presence of *P. agathadicida* have been investigated. Overseas stream-based sampling is often used to detect *Phytophthora*. Simon Randall, Masters student at the University of Auckland, trialled this technique

Infected kauri tree.

in the Waitakere Ranges to test its effectiveness as a passive monitoring method. Simon placed leaves from five different tree species in streams running through the kauri forest for 3 weeks and then retrieved them to see if they had been inoculated with *Phytophthora*. The results showed that the method was useful for detecting *Phytophthora* spp. (e.g. *P. gonapodyidies, Phytophthora* 'taxon Pg chlamydo', *P. kernoviae,* and *P. multivora*) and sensitive enough to pick up differences between sub-catchments. The technique demonstrated that it could detect soilborne *Phytophthora* species (e.g. *P. multivora*) but *P. agathadicida* was not detected, despite being present in the area. *Phytophthora* species can only sporulate in free water, and it was determined that *P. agathadicida* could be detected by flooding soil samples and then catching the motile zoospores on leaf baits. However, both stream- and soil-based detection take a significant amount of time (10–20 days) to complete and require specialist training to recognise *Phytophthora* from other pathogens. Modern nucleic acid detection techniques (e.g. TaqMan real-time PCR chemistry) are now being developed that will in time allow the presence/absence of *P. agathadicida* to be rapidly and decisively determined.

Between 2011 and 2013, two rounds of soil-based surveillance were funded by the KDJAR. Landcare Research managed this work and utilised *Phytophthora* expertise at Scion (Drs Nari Williams, Peter Scott, Rebecca MacDougall) and Plant & Food Research (Dr Ian Horner, Ellena Hough). *Phytophthora agathadicida* has now been confirmed from a number of forests in the Northland region (Trounson Kauri Park, Omahuta, Glenbervie, Mangawhai, Kaiwaka, Raetea, as well as Waipoua) and forest remnants in the Auckland Region (Waitakere Ranges, Awhitu Peninsula south of Manukau Harbour, North Shore/Albany, Waimauku/Muriwai) as well as Great Barrier Island. Stands further south (i.e. Coromandel Peninsula) currently appear to be free of the disease.

Working out how to prevent the disease from spreading further has been another important area of research. "The primary vector for kauri dieback appears to be movement of soil between forests on footwear, bikes and equipment," said Stan Bellgard, who took over the project following Ross's death. Soil collected from boot-wash stations contained three *Phytophthora* species, demonstrating the need for phytosanitary measures to contain the disease. "We were surprised to find that the *Phytophthora* remained viable within the soil for at least a year. Chemicals such as Trigene Advance II are effective against the mycelium of *Phytophthora,* so we are encouraging the public to clean their boots and bikes with a 2% solution," added Stan. To try to prevent further spread of the disease, an extensive public awareness campaign has been launched in the Auckland and Northland regions. Signage and foot-wash stations have been established at the start and finish of popular walking trails. DOC has invested

Left kauri tree showing dieback and healthy tree on right.

significant resources into building boardwalks around some of the most famous and best loved kauri trees, such as Tane Mahuta, which attract a continuous stream of tourists. Community-led efforts to inform hunters, mountain bikers and trampers about the importance of cleaning footwear to prevent soil transfer between forests have been initiated but the gravity of the situation does seem to be lost on some forest visitors. A recent survey of people using the kauri forests for recreation conducted by Auckland Council found that despite numerous public meetings and media messages, engagement with the public was poor and that compliance rates were below 40%. Better public support is needed to prevent further spread of the disease.

There still remains a lot to do. Lines of kauri will be screened by Scion in Rotorua from throughout its natural range to look for any natural resistance to the disease. If resistant lines can be found they will be bred up as replacement plants for devastated areas. Plant & Food scientists are also looking at whether resistance can be boosted by injecting kauri with phosphite. "This technique gave excellent control of *P. agathadicida* in glasshouse trials with potted kauri plants," said Ian Horner. "Early results from trials with infected trees in Auckland and Northland forests are also looking very encouraging," he said. Further research is also needed to better understand the risk kauri dieback poses to other native New Zealand plants. Some infection has been achieved under laboratory conditions that may not occur in the field. With the initial research results now available it is hoped that further funding can be secured to allow this important research to continue and kauri to remain giants of the New Zealand forest.

Funding for this research was provided by the Ministry for Primary Industries and the KDJAR. For more information see: http://www.kauridieback.co.nz/

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Privet Project Making Progress

In Issue 61 we shared some information with you about possible options for biocontrol of privet (*Ligustrum* spp.), which is an invasive weed causing problems in the North Island and in the warmer parts of the South Island. We can now update you on the two insects that have been identified as potential biocontrol agents.

Chinese privet (*Ligustrum sinense*) belongs to the family Oleaceae (which includes olives) and is also a major weed in the USA. A biocontrol programme has been underway there for some time now under the guidance of scientist Dr Jim Hanula from the USDA Forest Service. Jim is collaborating with scientists Yan-Zhuo Zhang and Jiang-Hua Sun from the Chinese Academy of Science in Beijing to determine the best candidate agents for privet control in the USA. The two most promising agents found so far are a sap-sucking lace bug (*Leptoypha hospita*) and a leaf-mining flea beetle (*Argopistes tsekooni*). Both the nymphs and adult lace bugs feed by piercing and sucking on the leaves, giving them a bleached appearance and causing dieback in the branch tips. The larvae of the leaf-mining flea beetle burrow between the upper and lower surfaces of the privet leaves. The adults tend to scrape the epidermal layer of the leaves often causing a small feeding hole. The combination of damage from the larvae and adult leaf-mining flea beetles usually leads to premature leaf fall.

We have been able to benefit from the US/Chinese work done to develop biocontrol for privet to date. "In 2013 we were able to obtain a shipment of the lace bug from the USA, and a shipment of the flea-beetle directly from China," explained Quentin Paynter, who is overseeing the privet project in New Zealand. "Extensive host-range testing has already been conducted in the USA, so we know that many important species that belong to the Oleaceae are not at risk. However, *Nestegis,* which is the only native New Zealand genus in the Oleaceae, was not included in the USA research and needed to be tested before we could consider releasing the bug in New Zealand," added Quentin.

Chris Winks has now conducted host-range testing of the lace bug inside the Tamaki containment facility and he has some good news to report. "The bug didn't attack any of the four native *Nestegis* species, which is a positive step forward. Host-range testing is now focusing on the risk of non-target attack on ornamental lilac (*Syringa* spp.) varieties grown in New Zealand, the most closely related genus to privet present here, and should be completed soon. It appears that although the bug can rear through to adult on some *Syringa* species under laboratory conditions, survival is so poor that the risk of serious non-target attack in the field is likely to be very low," said Chris.

The leaf-mining flea beetle is also currently in the Tamaki containment facility and is being reared to build up sufficient numbers to allow host-rang testing to begin. Based on host-range testing done with this species in the USA, it is expected to have a similar host-range to the lace bug, but may be more likely to damage lilac. However, this still needs to be thoroughly tested. As a bonus both agents are likely to also damage tree privet (*Ligustrum lucidum*). Once all the host testing is complete a decision will be made about whether to prepare an application to the Environmental Protection Authority to release one or both insects.

This project is funded by the National Biocontrol Collective.

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Privet lace bugs.

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