WHAT'S NEW IN

Biological Control of Weeds?

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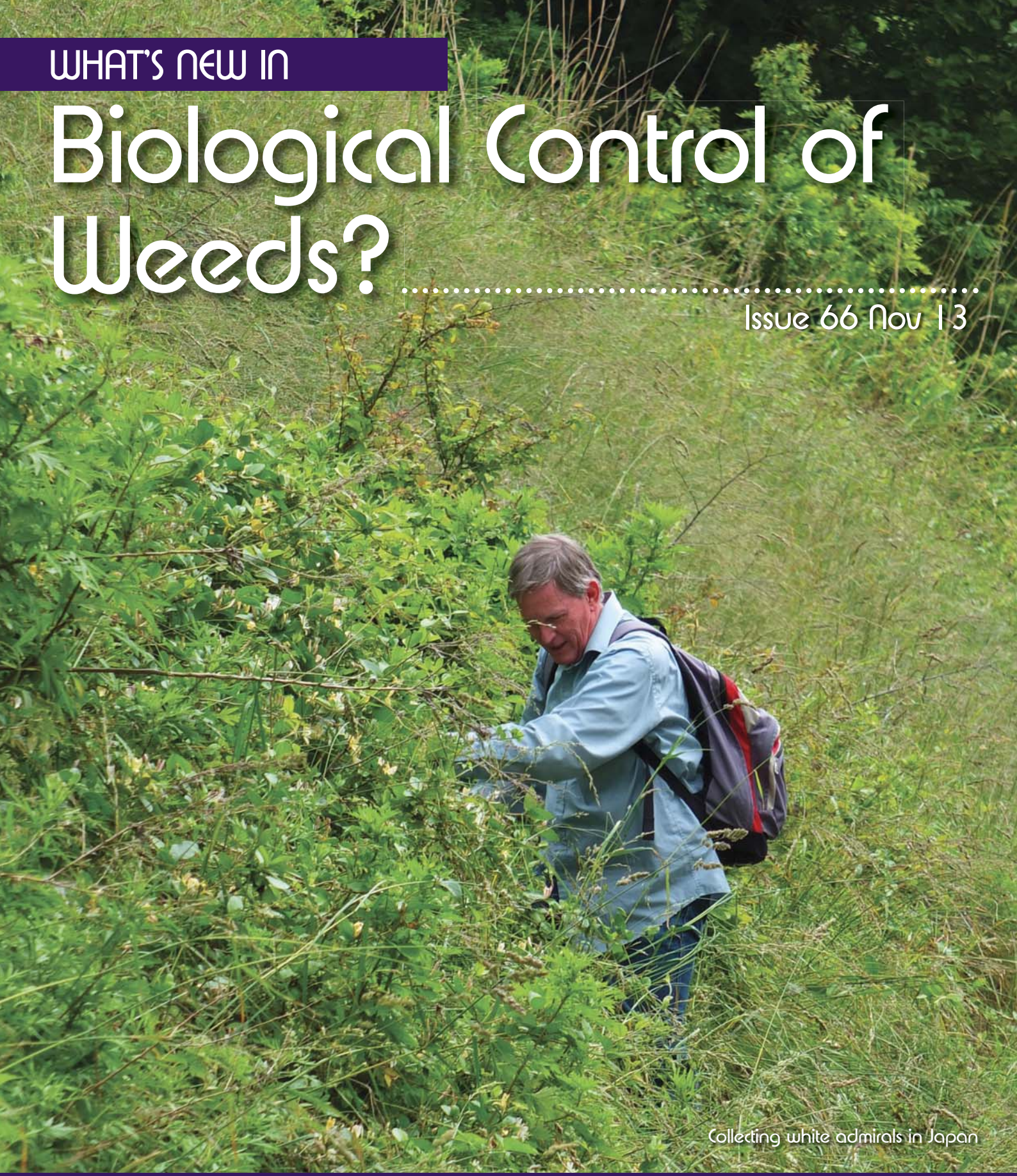

Collecting white admirals in Japan

What's Inside?

Landcare Research
Manaaki Whenua

West Coast Ragwort Control – A Successful Community Project

Ragwort (*Jacobaea vulgaris*) belongs to the daisy family, Asteraceae, and is widespread throughout New Zealand. Like many of our pastoral weeds, ragwort was brought here accidentally in contaminated seed during the 1870s. The climatic conditions here suited ragwort "down to the ground" so it quickly became a serious weed. Ragwort protects itself from grazing animals by chemical compounds that damage the liver cells of stock, particularly cattle, deer and horses, eventually causing death, although sheep can tolerate eating it to some extent. Controlling ragwort in New Zealand got off to a volatile start back in the 1930s when farmers used a chlorate chemical to spray the pasture. Farmer Buckley discovered that when the mixture came into contact with his woollen trousers the combination became explosive!

A number of options are available for controlling ragwort, including better herbicides than were available in the 1930s, but the timing has to be carefully managed and control can be very costly. Biological control of ragwort was first explored in the 1920s, and was one of the first biocontrol programmes to be implemented in New Zealand. Two seed-feeding flies (*Botanophila jacobaeae* and *B. seneciella*) were released between 1928 and 1939, but only *B. jacobaeae* established – in the central North Island. This fly has little impact on ragwort as it is unable to destroy enough seeds to make a difference. Cinnabar moth (*Tyria jacobaeae*) was first released between 1928 and 1932, but only established in the lower North Island. A mass-rearing programme in the late 1980s and early 1990s managed to increase the distribution of the moth and it now occurs patchily throughout the country. Although cinnabar moth appears to be limited by parasitism and predation, it still regularly manages some spectacular outbreaks in which large areas of ragwort can be defoliated. However, the major breakthrough in ragwort biocontrol was made with the widespread establishment of the ragwort flea beetle (*Longitarsus jacobaeae*) during the 1990s. Since then the ragwort flea beetle has significantly reduced ragwort populations throughout much of the country, and ragwort is under such effective control now in many places that often no other control measures are required. A study is currently underway to attempt to quantify how ragwort populations have changed in the last 20–25 years, by revisiting as many of the original ragwort flea beetle sites as possible.

However, as good as it is, the ragwort flea beetle has not been able to get on top of all ragwort populations, especially where people continue to use herbicides. While other parts of the country were reporting excellent results with the ragwort flea beetle, ragwort remained a stubborn problem on the West Coast of the South Island. About 15 years ago a group of farmers approached Hugh Gourlay about what could be done about this. With Hugh's encouragement the farmers formed a group in 2001 called the West Coast Ragwort Control Trust (WCRCT) and sought funding from the then newly established Ministry of Agriculture and Forestry Sustainable Farming Fund (MAFSFF). The group was successful in gaining funding and the first project to be tackled was to find out what was going on with the ragwort flea beetle on the West Coast. This study found that conditions there were ideal for ragwort but not for the flea beetle. "On the West Coast, there is only one generation of flea beetle per year and it doesn't seem to reach high enough densities to affect the ragwort populations. This is most likely related to the high soil moisture affecting immature stages of the beetle's life cycle," said Hugh. "Once rainfall gets to around 1700 mm per annum or higher, and if it results in waterlogging of soil at times when the larvae are developing, the ragwort flea beetle is not able to be an effective agent."

Once we had confirmed that the ragwort flea beetle was widely established on the West Coast, but unable to do the job there, we researched other potential agents. In Australia two moths released for biocontrol of ragwort, with good results, looked promising. In particular the ragwort plume moth (*Platyptilia isodactyla*), which also lives on a related species marsh ragwort (*Jacobaea aquatica*), which as its name suggests grows in wetter areas, looked like an excellent candidate. The plume moth is native to Europe and was released in Australia in the late 1990s. The plume moth has 2–3 generations per year and can lay up to 100 eggs at one time. The larvae tunnel down into the crown and roots of ragwort rosettes and into the stalks of flowering plants, completing their development as pupae inside curled leaves or in the soil surrounding the plant. Attack by as little as 2–3 larvae can kill ragwort plants. The crown-boring moth (*Cochylis atricapitana*), also from Europe, causes similar damage but is less effective at killing ragwort plants.

West Coast site, Makarora, where plume moths were released in January 2009 and showing a substantial reduction in ragwort 3 years later in January 2012.

The WCRCT decided to look at importing both moths and, with Landcare Research's help, succeeded in gaining approval from the Environmental Risk Management Authority in 2005 to release both species. But the Coasters didn't stop there. They wanted to make the moths widely available to West Coast farmers. Although, the MAFSFF project ended in 2005, the WCRCT made a further application to the fund for money to employ a local person to rear and release the moths over the next few years. This money was granted to the trust and they employed Caryl Coates to rear moths and release and monitor them at selected sites. Caryl has reared at least 9000 moths for release and has 47 active sites from Westport through to Haast, demonstrating both great dedication and tenacity. Unfortunately the crown-boring moth proved difficult to rear, both for Caryl and Landcare Research staff, and from the limited number of releases made appears to have failed to establish anywhere in New Zealand. However, the ragwort plume moth, as hoped, appears to love it on the Coast and has established at around 85% of sites where it has been released.

Caryl is still today rearing and releasing these moths on the West Coast for interested farmers, and occasionally provides some on request to other parts of New Zealand too. She is also continuing to monitor the establishment success and impact of the moth on ragwort populations there. "The plume moth is showing positive results on ragwort control throughout the Coast. Some release sites have been active for 7 years now and are showing a significant reduction in the ragwort population. Farmers in this situation are only having to spot spray these areas now, instead of using a boom spray or even a helicopter," said Caryl. During a recent survey Hugh also noticed that populations of the plume moth are becoming widespread on the Coast, and that ragwort is now far less common than during the pre-plume-moth surveys.

Good results with the plume moth are also being reported in other parts of New Zealand. Landcare Research is preparing an economic analysis to demonstrate how much money has been saved by the farming sector through using ragwort biocontrol agents instead of chemicals, and this is expected to run into many millions. "It is fantastic that we have been able to work with a community to solve a serious problem, and that the WCRCT is still active so many years later," said Hugh. "What started out as a community project has also provided a solution for many other regions where ragwort biocontrol also needed an extra boost. This project is a really good example of what a committed community can do and has provided exactly the kind of results that the Sustainable Farming Fund was set up to achieve."

Landcare Research is providing ongoing science support to the WCRCT. The West Coast Development Trust, West Coast Regional Council, West Coast farmers, Westland Milk Products, the Department of Conservation, Forest and Bird (West Coast branch) and the New Zealand Landcare Trust were all involved in the initial MAFSFF project.

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Japanese Butterfly To Be Released Soon

In the past year there has been great progress towards biocontrol for Japanese honeysuckle (*Lonicera japonica*). In August the Environmental Protection Authority gave approval to release the Honshu white admiral butterfly (*Limenitis glorifica*). Greater Wellington Regional Council was the applicant on behalf of the National Biocontrol Collective. "The host-testing was done in Japan due to difficulties mating the butterflies in captivity here in New Zealand. The butterflies have an elaborate courtship flight which they were unable to achieve in containment. For some reason they could also not be successfully hand-mated either, even by an expert who was flown over from USA to assist," explained Hugh Gourlay.

The host-testing was completed by Hugh and Quentin Paynter based at the National Institute of Agro Environmental Sciences at Tsukuba just north of Tokyo. "Maintaining a disease-free population of the butterflies was crucial to the project. This was achieved by collecting mated female butterflies in the field, keeping the eggs from each individual separate and line rearing those without disease symptoms," explained Quent. A few tricks were learnt along the way such as the importance of keeping the females under good lighting and well fed while they were producing eggs. Japanese collaborators surprised Quentin by feeding the females a high energy sports drink 'Pocari Sweat' to keep them going!

The resulting disease-free larvae were shipped to New Zealand and are currently being held in containment at cool temperatures to allow them to be re-phased to our seasons. We have also imported several additional shipments of eggs sent by our Japanese collaborators to boost numbers. These eggs have been allowed to develop into larvae and pupae, and when butterflies have emerged, and their identity has been confirmed, we have been sending them to a butterfly house in Auckland known as Butterfly Creek. The small number of butterflies released inside the butterfly house at the end of October appeared to happily take to their surroundings but laid infertile eggs. We did not confirm the sex of the butterflies before releasing them (to avoid handling and possibly damaging them) and it is possible the first batch were all females. We are still hoping for fertile eggs from later batches in which case we will collect and take them to our Auckland containment facility. This is to ensure that the larvae are not infected with any disease before releasing them in the field around December. Once establishment at field sites is achieved we will aim to harvest eggs and larvae to release in all areas where the white admiral is needed. "New Zealand's climate is less extreme than Japan's, and the butterfly is expected to do well throughout the country. The number of generations it might have in New Zealand is expected to vary from 2–3 in warmer parts of the country but perhaps only one generation in cooler parts of the country," said Quent.

Honshu white admiral.

Further progress has also been made with other potential agents. Testing of a long-horn beetle (*Oberea shirahatai*) in containment at the Lincoln facility is nearly complete. The beetle, whose larvae are able to kill whole stems, shows a clear preference for Japanese honeysuckle and another weed, Himalayan honeysuckle (*Leycesteria formosa*), with major ornamentals such as *Lonicera nitida* and *Lonicera xheckrottii* 'gold flame' at low risk of attack. We are planning to prepare an application to release the beetle soon and hope to submit it to the EPA around the middle of 2014.

Testing of a leaf-tying moth (*Allotolanta* sp.) has also been continuing in containment at Lincoln but has proven difficult. This moth will not lay eggs normally when caged, so we can't undertake realistic oviposition tests. Testing using small larvae placed on cut stems has ruled out the majority of test plant species as possible hosts, but larvae have not survived for long enough using this method for us to adequately understand the risk to some species. Additional testing on whole plants of these species and/or some field testing in Japan will therefore be needed to complete host-testing.

Finally, another shipment of the foliage-feeding sawfly (*Zarea lewisii*) has been imported into containment for further study. "Difficulties in rearing the sawfly to the adult stage have prevented any host-testing from being undertaken to date, but we are having one last go at trying some new approaches to trigger adult emergence," said Hugh.

This project was funded by the National Biocontrol Collective.

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Tutsan Project Moves Towards Phase Two

The Tutsan Action Group secured funding in 2011 for a biocontrol programme against tutsan (*Hypericum androsaemum*). New Zealand surveys subsequently found little in the way of insect damage on tutsan. Tutsan rust (*Melampsora hypericorum*) was common, but not providing sufficient control in the North Island. The reasons why were not well understood (e.g. is it due to environmental conditions, tutsan susceptibility, or pathogenicity of the rust?). However as phase one of the tutsan project draws to a close, information has been gathered that is helping to better understand the nature of the tutsan problem in New Zealand and what steps might need to be taken to improve control in phase two.

"Tutsan is not behaving in an invasive manner in the South Island but is becoming widespread in some regions in the North Island," confirmed Hugh Gourlay. We have found that plants from the South Island, and some from Wellington, are genetically similar to some of those from southern England, Scotland, Wales, Ireland, France and Spain. The other North Island populations share some genetic characters with those from Wales and Ireland. The main North and South Island types can sometimes be found growing together in the same location overseas. Some isolated plants in the Hawke's Bay and Auckland are genetically different to other North Island material and each other. These plants are most likely the result of a deliberate attempt to breed tutsan in New Zealand, since it was grown for ornamental purposes, rather than representing separate introductions from other parts of its native range.

Some interesting new information about tutsan rust has recently been collected. We have confirmed that there are two main strains of the rust present in New Zealand, with one type in the South Island and the other in the North Island. Stewart Island has both the North and South Island types. The South Island rust strain occurs widely across much of the UK, Ireland and France. The North Island rust strain is mainly found in Wales. Two other strains of the rust that are different to the strains present in New Zealand have been found in Spain and Georgia. "New Zealand tutsan will be assessed to see if it is susceptible to all of the rust types found in Europe and whether they offer any potential for improved tutsan control," said Hugh. Already some preliminary testing has shown differences in the susceptibility of tutsan populations from the West Coast of the South Island and from Otago indicating there may be more subtle differences in tutsan populations in New Zealand yet to be resolved.

In addition to the rust work, CABI Europe-Switzerland has been undertaking surveys to look for other potential biocontrol agents. The most promising organisms found so far are three foliage-feeding beetles (*Chrysolina* spp.), which are similar to the highly successful St John's wort beetles, two fruit/seed-feeding insects, a tortricid moth and a pentatomid bug, and a shoot tip-boring moth (*Lathromorpha strigana*). These survey results suggest that overall prospects for improving tutsan control in New Zealand are looking hopeful.

The Tutsan Action Group is currently preparing an application for funds for phase two of the tutsan project, which will be submitted in the next round of the Ministry for Primary Industries' Sustainable Farming Fund (October 2013). If successful, phase two will get underway in July 2014 allowing at least one new biocontrol agent to be host-tested, imported, cleared for release, and then mass-reared and field released.

This project is funded by an MPI Sustainable Farming Fund grant to the Tutsan Action Group, with contributions provided by other co-funders. The Tutsan Action Group is looking for co-funding to support phase two. If you are able to assist please contact the secretary, Ros Burton, at gtb@xtra.co.nz.

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CABI Europe-Switzerland

One of the beetles (*Chrysolina varians*) that will be further investigated.

Exciting Potential New Wasp Control Research

Wasps are now widespread throughout New Zealand and in some habitats they are one of the most common insects encountered. In New Zealand, there are two introduced *Vespula* wasp species, the German wasp *(V. germanica)* and the common wasp *(V. vulgaris).* Despite arriving first, the German wasp is now outnumbered by the common wasp, which is a stronger competitor.

The impacts of wasps on native biodiversity have been well studied in New Zealand, particularly in beech forest. Wasps not only take the nectar and honeydew resources that birds and other insects depend on, but are efficient predators as well. The arrival of wasps has also had social costs for New Zealanders, giving rise to human health issues and disrupting recreational activities such as gardening, walking or even having a simple picnic. The economic costs to primary industries such as apiculture, horticulture and viticulture have not been calculated but are considered to be significant.

Social insects such as wasps, bees, ants and termites are notoriously difficult to control. In a recent report, compiled for the Tasman District Council by Darren Ward, the options for improving wasp control were thoroughly investigated and summarised. The options ranged from manually destroying nests, using baits and attractants for chemical control, using pheromones to disrupt wasp behaviour, genetic manipulation (RNA interference) or using biocontrol agents to suppress the number of workers and reduce nest densities.

Biological control against wasps in New Zealand was attempted in the late 1980s using a parasitoid wasp *(Sphecophaga vesparum vesparum)* that lays its eggs on developing wasp larvae. Unfortunately they failed to build up large populations and provide adequate levels of control. Although there were other potential agents to explore, they were not considered to be sufficiently host-specific for release in New Zealand and the programme was discontinued. Landcare Research was therefore interested to hear recently about the serendipitous discovery of a seemingly devastating mite in wasp nests in New Zealand.

The mite was found a couple of years ago by Bob Brown, at the time a PhD student. Bob was working on the chemical ecology of wasps, as part of collaboration between Auckland University and Plant and Food Research at Lincoln. He was quite concerned when some wasp colonies he collected for his study started collapsing in the lab. When he examined the wasps under a microscope, he discovered they were heavily infested with mites. The mites turned out to be a species belonging to the genus *Pneumolaelaps*, which is normally associated with bumblebee nests rather than wasps. It is not known whether the mite is native to New Zealand or not, or how common or widespread it is.

Funding is now being sought to allow further investigations to be undertaken to determine the potential of this mite to be used as a biocontrol agent to control wasps. A newly formed community group, *V*-BAG (*Vespula* Biocontrol Action Group), will be applying to MPI's Sustainable Farming Fund this month. *V*-BAG is based at the top of the South Island, and currently includes mainly conservation and restoration volunteer groups, along with Nelson and Central Otago winegrowers. "Soon, we hope to have more industries (forestry, apiarists) and regions represented on the group," said Ronny Groenteman, who has been busy drumming up support for the project.

"It is far too early to know how much potential this mite offers as a wasp biocontrol agent. We may discover that the mite is only a hitchhiker, or that it is damaging to beneficial insects or native insects. We may also find that it doesn't transfer well between wasp nests in the field. These and other risks will be built into the funding application in the form of "stop–go" points, and if we discover the mites do not satisfy requirements, we will call the research off. We would then be keen to explore other potential agents in the wasps' native range," explained Ronny.

People interested in joining or supporting V-*BAG should contact Ronny Groenteman or the group's chairman, Bryce Buckland (bbuckland@xtra.co.nz). The report on the "Status of control of* Vespula *wasps in New Zealand" is available at:*
http://www.envirolink.govt.nz/PageFiles/1032/1226-TSDC88%20Status%20of%20control%20of%20Vespula%20wasps%20in%20New%20Zealand.pdf

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The newly discovered mite found on wasps in New Zealand.

Bob Brown

Summer Activities

Summer is a busy time for many of our biocontrol agents. Some activities you may need to schedule over the next few months are listed below.

Boneseed leafroller (Tortrix s.l. sp. “chrysanthemoides”)

- Check release sites for feeding shelters made by caterpillars webbing together leaves at the tips of stems. Caterpillars makes “windows” in the leaves where they have eaten the green tissue away, leaving behind sprinkles of black frass, and the leaves may be turning brown. Small caterpillars are olive-green in colour and become darker, with two parallel rows of white spots as they mature. We would be very interested to hear if you find any severe damage to boneseed foliage.
- Caterpillars can be harvested if you find them in good numbers. Cut off infested boneseed tips and wedge them into plants at new sites. Aim to shift at least 500 caterpillars to sites where scale insects and invasive ants are not known to be present.

Broom gall mite (*Aceria genistae*)

- Summer is a good time to check plants at release sites for galls, which look like deformed lumps and range in size from 5 to 30 mm across. They will probably be fairly close to the release point. 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.
- Because the mites are showing much promise, but are expected to disperse quite slowly, it will be important to plan a comprehensive redistribution programme once you have good numbers. Note that October–November is the best time for harvesting and redistribution, when mite numbers are building inside the galls. However, it may still be possible to successfully move the galls around in December if the weather is not too hot and dry. Aim to shift at least 50 galls, and tie them onto plants in bunches of 10 galls per plant at the new site so the tiny mites can shift across.

Broom leaf beetles (*Gonioctena olivacea*)

- Check sites where beetles have been released for three or more years for signs of establishment. The adults are 2–5 mm long and females tend to be goldish-brown while males have an orangey-red tinge, although colouration can be quite variable. These beetles can be quite hard to find so it is best to use a beating tray and don’t be surprised if you only find one or two. The adults lay eggs over a period of 3–4 months, starting in spring, so you may also be able to find the greyish-brown larvae feeding on the leaves or shoot tips.

Female broom leaf beetle and egg.

- It is probably still a bit soon to find enough beetles to be able to begin harvesting and redistribution just yet.

Broom seed beetle (*Bruchidius villosus*)

- Beetles can be harvested and redistributed while they are still inside mature brown pods but avoid green ones as the beetles will not be completely developed. Cut infested branches and wedge them into bushes at the new site. A period of hot weather can cause pods to ripen rapidly, so once the first ones have started to burst, don’t delay.

Gorse soft shoot moth (*Agonopterix ulicetella*)

- Check release sites now as, by late November – early December, the caterpillars will be quite large but not yet pupated. Look inside webbed or deformed growing tips for dark brown or greyish-green caterpillars. We would be very interested to hear of any outbreaks or caterpillars found in new locations – areas of particular interest are the North Island and lower South Island.
- Redistribute caterpillars by harvesting infested branches or even whole bushes.

Green thistle beetles *(Cassida rubiginosa)*

- Check release sites for windows eaten into the leaves made by the adults and larvae. Adults are well camouflaged, being green, so it may be easier to spot the larvae, which have a distinctive protective covering of old moulted skins and excrement, and prominent lateral and tail spines.
- If you find beetles in good numbers then make plans to harvest adults next spring.

Hieracium gall midge (*Macrolabis pilosellae*)

- Check release sites for plants with swollen and deformed leaves caused by larval feeding. Summer is not a good time to redistribute this agent as whole infected plants must be moved and it is crucial that they do not dry out.

Tradescantia leaf beetle (*Neolema ogloblini*)

- Check the older release sites for signs of the beetles, such as 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. Look on the underside of damaged leaves for signs of young larvae which are gregarious and may be seen in packs forming feeding fronts. Older larvae feed individually. The pupal cocoons are extremely unusual (white, star-shaped and resemble styro-foam) and may be visible on damaged foliage. We would be very interested to hear if you find any sign of the beetles.
- We would not expect you to find enough beetles to be able to begin harvesting and redistribution just yet.

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 earlier this year, but again there is no harm in looking. The adults are mostly black with yellow 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 on leaves showing signs of bleaching or black spotting around the margins.
- We expect the lace bugs might also be slow to disperse so if good numbers are present it would be worth collecting some to release in other areas. Always wear gloves when handling woolly nightshade foliage to avoid any health issues. Cut leaf material that is infested with adults and/or nymphs and wedge or tie this material firmly into new woolly nightshade plants so the lace bugs can move across. We recommend that you shift at least 1000 individuals to each new site at any time during the warmer months.

Other agents

You might also need to check or distribute the following this summer (for further details see http://www.landcareresearch.co.nz/publications/books/biocontrol-of-weeds-book):
- Gorse thrips (*Sericothrips staphylinus*)
- Gorse colonial hard shoot moth (*Pempelia genistella*)
- Ragwort crown-boring moth (*Cochylis atricapitana*)

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Changes to Pages

If you are making an effort to keep your copy of *The Biological Control of Weeds Book – Te Whakapau Taru* up to date you need to go online and download some new and revised pages. Go to www.landcareresearch.co.nz/publications/books/biocontrol-of-weeds-book and print out the following:
- Index
- Contact details
- Tradescantia stem beetle monitoring form
- Tradescantia tip beetle monitoring form
- Lantana (*Lantana camara*) summary
- Lantana blister rust
- Lantana leaf rust
- Tradescantia beetle comparison

Advanced Biocontrol Workshop

We will hold an advanced biocontrol workshop in Auckland in March–April 2014 if there is sufficient interest. If you would like to attend this workshop, and have not already sent through an expression of interest, please contact Lynley Hayes before 10 January 2014 (hayesl@landcareresearch.co.nz).

www.landcareresearch.co.nz

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