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What's New In Biological Control of Weeds?

What's Inside?

Manaaki Whenua
Landcare Research

Psyllids Turn Up the Heat

Last spring we asked a number of people to check their broom psyllid (*Arytainilla spartiophila*) sites and let us know how they were doing. We would like to thank all those people who managed to squeeze this task into their busy schedules. The information sent back to us has been extremely useful and we were delighted to receive a report from Southland of our first major outbreak (Table 1). One of the reasons we decided to import psyllids to New Zealand is that they are well known to undergo outbreaks in their native range from time to time. After huge numbers of these sap suckers have inhabited broom bushes for even a short time, the bushes are noticeably worse for wear. Since we made our first release back in 1993 we have been waiting with bated breath to see if this would happen here too. We were heartened by the fact that the psyllids seemed to be establishing fairly readily throughout all regions of New Zealand, but until now no spectacular-sized populations or obvious damage had been reported, and we were starting to wonder if they were ever going to make a show.

Broom psyllids and broom seed beetles (*Bruchidius villosus*) were released at the Mararoa River (near Te Anau) in the spring of 1995. The site was topped up with a second release of psyllids 2 years later. Both agents seemed to thrive at this site right from the word go. In the past some biological control agents have not done as well in Southland as other parts of the country, so it seems fitting that Southland is now getting its moment of glory. It will be very interesting to see what happens at Mararoa, and other psyllid sites, next spring!

Table 1. A summary of the information sent in

Region	Site Name	Released	Situation in 2001
Manawatu-Wanganui	Makakahi Rd	1999	None found, very wet spring
	Ongarue	1999	Easy to find in good numbers, damage seen
	Saddle Rd	1999	Fair numbers found
	Trickers Rd	1997	Fair numbers found
	Waikune	1999	None found, very wet spring
Wellington	Huangaroa	1997	Small number found
	Pakuratahi Forest	1997	Small number found
Canterbury	Aylesbury Rd	1999	Fair numbers found
	Conway Downs	1997	None found, may have been too early
	Glen Colwyn	1997	Fair numbers found
	McClelland Rd	1997	Fair numbers found
	Rakaia Gorge	1999	None found
	South Asburton River	1998	Fair numbers found
	Sugar Loaf Reserve	1997	Fair numbers found
Otago	Conical Quarry	1996	Easy to find in good numbers
	Finegand	1999	None found, site flooded soon after release
	Potts Rd	1999	Fair numbers found
	West Tapanui	1997	Easy to find in good numbers
Southland	Hamilton Burn	1995	Fair numbers found despite spraying
	Mararoa	1995, 1997	Present in huge numbers, damage seen

Note: Psyllids can be difficult to find in the first couple of years following release and may yet still turn up at some of the sites where none were seen this spring.

Cheers Pauline!

After 20 years in the biological control of weeds business Pauline Syrett has decided that it is time for her to devote herself to some new challenges. To mark Pauline's retirement we reflect back on some of the highlights of her biological control of weeds career.

The early days

After completing her Masters degree at Lincoln College (as it was in those days) Pauline joined the DSIR's Entomology Division in January 1981, as part of a group that was being formed to breathe some new life into biological control of weeds projects in New Zealand. Pauline's first tasks were to revive the ragwort programme, assess the success of the St John's wort programme, and begin a new project against broom. Renewing the ragwort programme proved to be an extremely worthwhile exercise. With Sue Scheele's assistance, Pauline managed to establish the cinnabar moth (*Tyria jacobaeae*) in areas where it had previously failed. But the real breakthrough in ragwort control came when Pauline and Sue introduced the ragwort flea beetle (*Longitarsus jacobaeae*). This little golden insect has proven to be a great success and many New Zealanders are supremely grateful for it.

Getting well connected

Since our weeds come from many corners of the globe, it has always been important to network with researchers in other countries. Also, because we are such a small country, many of the projects we have undertaken would never have gotten off the ground without international collaboration. "Forming and maintaining these international linkages was one of the most satisfying parts of the job", revealed Pauline. The broom project is a good example where a multinational approach has worked really well. "We were able to enhance the search for suitable control agents by pooling resources with both Australia and the USA, and to gain a much better understanding of how broom grows and replaces itself, by taking part in joint trials with Australia, the UK, and France."

Pauline spent a lot of time in Europe surveying broom and related plants to find potential natural enemies, for New Zealand, Australia, and the United States.

Pauline releasing some of the first ragwort flea beetles in a special field cage at Inchbonnie, West Coast, in 1983.

Leading the way

During much of her career Pauline was responsible for the team of people undertaking most of the biological control of weeds research in New Zealand. Initially this only involved about a half a dozen people, but it grew in recent years to supervising the activities of more than 30 people (when biological control researchers joined together with a group of predominantly weed ecologists to form an "Invasive Weeds Group"). Pauline feels proud of the team's achievements. "Many of our overseas colleagues are amazed by the amount we have achieved in New Zealand, given relatively modest resources, especially the speed with which we have successfully managed to establish control agents over wide areas, and the sheer number of projects that we have tackled."

Coaching the next generation

Not surprisingly, since she originally trained and worked as a

teacher, Pauline took a real interest in helping many students to gain postgraduate qualifications. Jenny Dymock (ragwort seed fly), Rory Gordon (nodding thistle), Nick Hancox, Bruce Fraser and Katrin Schöps (St John's wort beetle), Carol Stewart (alligator weed beetle), Helen Harman (broom twig miner), Kylie Galway (broom ecology), Melanie Haines (broom seed beetle), and Matthias Kloeppel (hieracium gall wasp) have all benefited enormously from Pauline's wisdom and guidance at this critical stage in their careers. "As Kylie and Mel are currently only halfway through their PhDs, I will be continuing to supervise them until they are finished", explained Pauline.

The big moment arrives when Pauline and Lindsay provide the Hieracium Control Trust with their first releases.

Gaining satisfaction

Looking back over the last 20 years Pauline concludes that she "got a real buzz, out of working closely with end-users to help them find solutions to some serious problems, for example, the Department of Conservation with the heather problem in Tongariro National Park and the Hieracium Control Trust with hawkweeds nationwide". As Pauline hangs up her sweep net, heather beetles (*Lochmaea suturalis*) are beginning to outbreak and show real promise, and five insect control agents have been approved for release against hawkweeds. The latter was no mean feat given the challenges associated with being one of the first to grapple with the rigorous new ERMA system for gaining permission to release new organisms. Now it's just up to the rest of us to do our part by getting the little blighters out there where they are needed!

The three broom PhDs who have all appreciated Pauline's assistance: Kylie, Helen, and Mel.

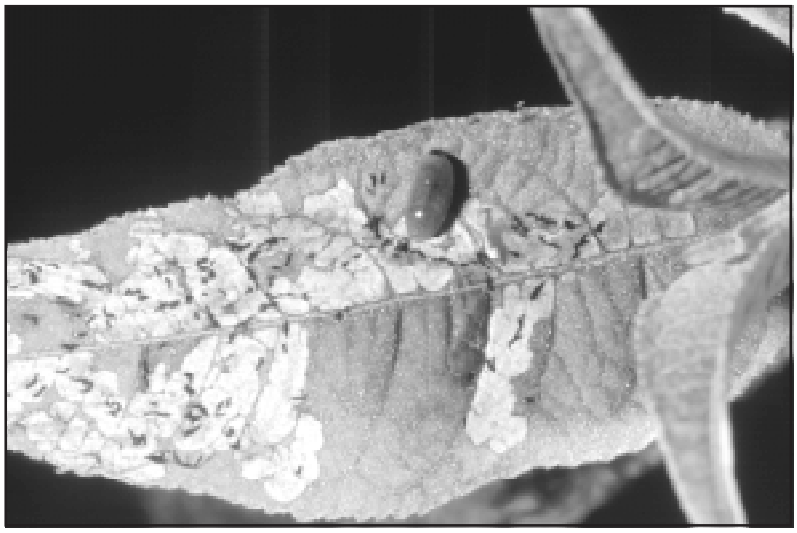
What next?

Pauline's partner, Rowan Emberson, is also retiring (from Lincoln University) and Pauline says that they have many plans, including more travel to far and away places, perhaps further study or research, and maybe even some volunteer work. There are also one or two manuscripts in the pipeline to round things off. We would like to wish them both all the best for the future. Thanks Pauline!

NB Simon Fowler (fowlers@landcare.cri.nz) has now taken over as leader of Landcare Research's Invasive Weeds Programme.

Hot Gossip

Forest Research is initiating an application to ERMA for the release of the foliage-feeding weevil, *Cleopus japonicus,* against buddleia. Richard Hill (Hill & Associates) is assisting with the application process. Host specificity testing showed that the weevil is restricted to buddleia species, which are all exotics in New Zealand. New Zealand does not have many native plants that are closely related to buddleia. One exception, *Geniostoma ligustrifolium* (Loganiceae), was not fed upon to any extent by adult or larva weevils in safety tests. Forest Research is hopeful that this weevil will turn out to be a successful agent. Meanwhile host specificity testing of a second agent, the stem-boring weevil (*Mecysolobus erro),* is under way in the Forest Research quarantine facility, with pairs of adult weevils being given no-choice tests on a range of buddleia species, native Loganiaceae, and native and exotic plants of the closely related Scrophulariaceae.



Cleopus japonicus *larva.* *Photo courtesy of Toni Withers, Forest Research*

This time last year we were delighted to announce our first ever heather beetle (*Lochmaea suturalis*) outbreak in Tongariro National Park. Just before Christmas Simon Fowler and Paul Peterson went back to the hot spot at Te Piripiri to see how it looks one year on. A patch of dense heather about 10 x 20 m has been knocked for a six and is on the way out. Not surprisingly the beetles have moved onto healthier neighbouring plants up to 80 m away and are now attacking those. There are no signs of any predators or parasites hampering the beetles at this stage, so it looks promising that they will continue to move onto bigger and better things each year. Further releases have been made this season on Department of Conservation and Army land in the Central North Island, and also further north on a heather infestation in the Bay of Plenty that has been getting steadily worse.

It was a great start when galls could be found on mist flower plants last autumn, only a couple of months after mist flower gall flies (*Procecidochares alani*) were first released. However, it never pays to count your chickens too early and, before we could get too carried away, we needed to see if the flies could survive their first New Zealand winter (which is often the make or break time for biological control agents) and cope with the intense defoliation that the mist flower fungus (*Entyloma ageratinae*) now causes here each spring. A number of release sites have recently been visited and the good news is that, so far, new season's galls have been found at two sites in Auckland and a site in Northland. The galls should be easier to find as the summer progresses so we are hoping that these first two positive sightings will prove to be just the tip of the iceberg.

Approximately every 4 years, biological control of weeds researchers worldwide come

together for a week to swap notes, forge new alliances, and get up to speed on the latest advances and thinking in this field of research. The last such gathering was held in Montana, USA, in 1999. The next gathering is now only just over a year away, and will be much easier for people in our part of the world to attend as it is going to be held in Canberra. So make a note in your diary that the XI International Symposium on Biological Control of Weeds is being held from 28 April – 2 May 2003, and start figuring out how you can convince your boss to let you go. This is a great opportunity to pick the brains of the world's best! For further information about this symposium refer to the website: www.ento.csiro.au/weeds2003.

Could We Create a Mass Exodus?

Wandering Jew (*Tradescantia fluminensis*) causes problems in damp, shady, frost-free areas of the North Island and northern South Island. It can form such a dense ground cover that nothing else gets a look in. Lowland forest remnants, gardens, riparian areas, banks, parks, and reserves are increasingly becoming infested with this South American invader. The plant has also naturalised in Australia, Spain, Russia, and the USA. The plant, thankfully, does not form seeds in New Zealand and regenerates only from stem fragments — it relies on water, people, and animals to spread it to new areas. Manual control methods are only successful if every last piece is removed (a tough job!) and are therefore only suitable for small infestations and people with lots of patience. Chemical control is currently the only tool available for dealing with large infestations. Recently the Department of Conservation (who have the weed in 11 out of 13 conservancies) commissioned a study to look at the feasibility of using biological control against this plant. Rachel Standish knows wandering Jew intimately, as it was the subject of her recent PhD thesis, and she undertook this study on our behalf.

On the plus side Rachel found that we don't have any close relatives of wandering Jew in New Zealand, native or naturalised, and parts of the plant's native range have a climate similar to northern New Zealand. On the minus side there isn't a lot known about the plant's natural insect enemies.

"A number of undescribed mirids have been recorded on *Tradescantia* and close relatives in the USA, and their feeding can deform shoots and reduce plant biomass", reports Rachel. However, the best prospects for biological control agents at this stage appear to be plant pathogens (Table 2), as there is more known about them, and the damp cool conditions the plant grows in seem to lend themselves to this approach.

If a decision is made in future to go ahead with this project, then as well as surveying the plant in its native range, we would also need to find out exactly what attacks the plant here. It may be possible that a pathogen already occurs here that could be developed into a mycoherbicide (several of the fungi listed in Table 2, e.g. *Alternaria*, *Cercospora*, *Colletotrichum*, *Fusarium*, and *Septoria,* are known to be particularly suitable for this purpose). "Of the potential agents we know at present, the rust (*Phakopsora tecta*) and leaf spot (*Septoria tradescantiae*) fungi appear to hold the most promise as classical biological control agents, and would be worth further study", concluded Rachel.

Overall because wandering Jew is widespread and the risk of damage to non-targets appears miniscule, the plant appears to be a good target for biological control. The Department of Conservation has recently indicated that it is extremely keen to run with this project in the near future. However, Rachel warns that to maximise the likelihood of success, an integrated approach will be necessary to prevent other problem weeds (e.g. wild ginger (*Hedychium* spp.) and selaginella (*Selaginella kraussiana*)) from simply replacing wandering Jew.

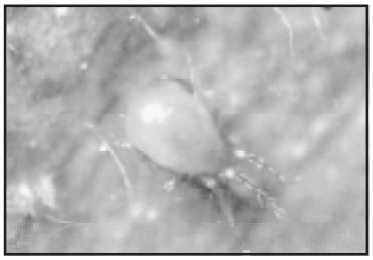
For a copy of this feasibility study email DOC Science Publications (science.publications@doc.govt.nz)

Table 2: Plant pathogens that warrant further investigation

Leaf spot fungus (*Alternaria* sp.)	Occurs on wandering Jew in Florida.
Gray mold leaf blight (*Botrytis cinerea*)	Occurs in many countries including New Zealand, found on wandering Jew in Alaska. Some strains have restricted host ranges – not known if suitable isolate occurs here.
Leaf spot fungus (*Cercospora* sp.)	Occurs on wandering Jew in Florida.
Anthracnose, crown rot and leaf spot fungus (*Colletotrichum* sp.)	Occurs on wandering Jew in Florida and Texas.
Root rot fungus (*Fusarium* sp.)	Occurs on *Tradescantia* sp. in Florida.
Rust fungus (*Phakopsora tecta*)	Specific to Commelinaceae and recorded on wandering Jew in Hawai'i, Puerto Rico, and South America. Should find conditions here to its liking.
Leaf spot fungus (*Septoria tradescantiae*)	Occurs in the USA, and known to be specific to *Tradescantia,* but not known if wandering Jew is susceptible (the distribution of these two are not known to overlap). Should find conditions here to its liking.
Rust fungus (*Uromyces commelinae*)	Occurs in many countries. May require a second host to complete its life cycle

A Mighty Disappointment

Well it's official. According to a study carried out by our colleagues Paul Pratt and Eric Coombs in North America, predators can definitely limit the impact of gorse spider mites (*Tetranychus lintearius*). Five years after we first released gorse spider mites here in New Zealand (1989) we sent starter colonies over to Oregon. Shortly after their release the gorse spider mites did spectacularly well in Oregon and we were amazed to see pictures of enormous outbreaks causing severe damage that far and away surpassed anything that we had seen here. Within 2 years of releasing gorse spider mites in New Zealand we found colonies being attacked by a mite (*Phytoseiulus persimilis*) that was introduced to New Zealand to control mites that are pests in orchards, and by a native ladybird (*Stethorus bifidus*). However, it didn't take long for the North American's bubble to burst as predators soon caught up with the mites in Oregon too.



Mite predator - Phytoseiulus persimillis

John Ireson, Tasmanian Institute of Agricultural Research, examines gorse spider mite colonies for predators as Raelene Kwong, Keith Turnbull Research Institute, looks on. John and Raelene visited us at Lincoln in October so we could compare notes on a variety of projects we have in common, particularly gorse.

Today similar levels of gorse spider attack occur in both countries when predators are present.

Our colleagues have carried out some experimental work to see what happened when they excluded one of their more damaging predatory mites from trials plots by using synthetic pyrethroids. Previous studies have shown that while predatory mites are highly susceptible to synthetic pyrethroids, the mites they prey on are often not affected at all. Trial plots were treated with either water or the insecticide. To ensure uniformity, colonies of about 500 gorse spider mites and 20 predatory mites (*P. persimilis*) were then introduced into the centre of each plot. Two months later a series of comparisons were made, and it was clear that the gorse spider mites did much better when the predators were excluded (more colonies, larger colonies, higher percentage of gorse infested, and more mites in total). In an associated laboratory study our colleagues found that the strain of *P. persimilis* they were collecting from gorse spider mites seemed to have become specialised at exploiting this new food source. For example, they had higher oviposition rates when fed gorse spider mites than other prey items, such as two-spotted spider mites (*Tetranychus urticae*).

We also supplied Australian colleagues with starter colonies of gorse spider mites in 1998. John Ireson, of the Tasmanian Institute of Agricultural Research, recently visited us at Lincoln and told us the same old story – that they are already routinely finding the same or similar predators there too. Apparently the colonies released at Volcano in Hawai'i don't appear to have succumbed to predators at this stage, probably because the gorse there is quite isolated from the areas where predators such as *P. persimilis* are known to exist, and because the gorse grows at a high altitude. Even so, the Hawai'ian mites haven't proven to be spectacular, probably because the climatic conditions at Volcano are quite challenging for them (e.g. regular periods of extremely heavy rainfall). So it appears that gorse spider mites are not going to find it easy to achieve their true potential as a biological control agent anywhere. However, it's not all doom and gloom because, despite the predators, the gorse spider mites still can and do damage gorse, and their impact in combination with other control agents and stresses on the plant may still be sufficient to topple the plant in years to come.

Autumn Activities

Autumn is a good time to look for evidence that gall-forming agents, like the hieracium gall wasp *(Aulacidea subterminalis)*, mist flower gall fly *(Procecidochares alani)* and Californian thistle gall fly *(Urophora cardui)*, have established. The plant deformities (galls) caused by these agents develop over the warmer months and are usually most obvious in early autumn. March to May is also a good time for harvesting and redistributing these agents as well as ragwort flea beetles *(Longitarsus jacobaeae)*, nodding thistle crown weevils *(Trichosirocalus horridus)*, nodding and Scotch thistle gall flies *(U. solstitialis & U. stylata)*, and gorse pod moths *(Cydia succedana)*. Refer to the appropriate pages in "The Biological Control of Weeds Book" for detailed instructions on how to go about this, or contact us for advice. Remember to avoid sealing up ragwort flea beetles with large quantities of ragwort in non-breathable containers in hot weather. Also be careful to sort through any material that you collect with your garden-leaf vacuum so that you don't shift any pests, like the clover root weevil *(Sitona lepidus)*, at the same time.

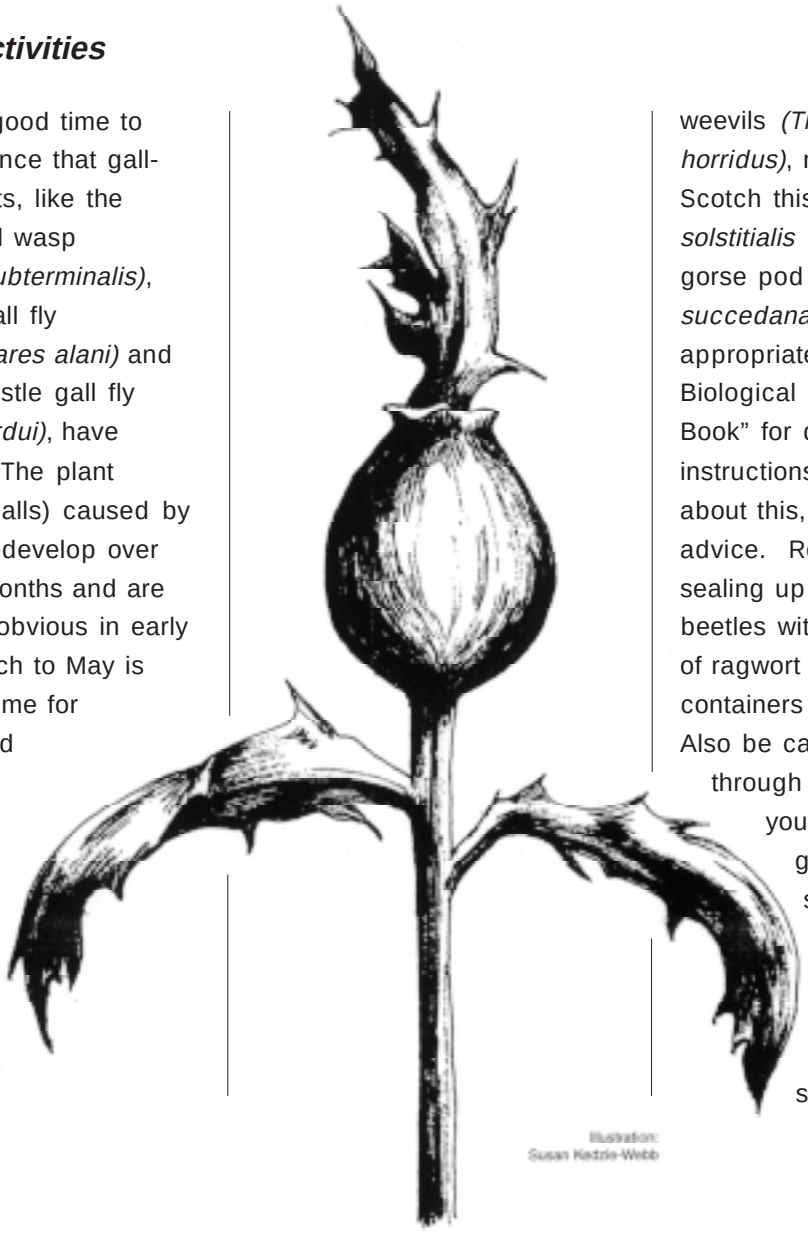


Illustration: Susan Keddie-Webb

Tell Me More…

Question: What is the ragwort flea beetle-like creature that you commonly see damaging lots of different plants in the spring?

A common native beetle (*Eucolapsis brunneus*) is sometimes mistaken for the ragwort flea beetle (*Longitarsus jacobaeae*). Bronze beetles are larger (about 6 mm long) than ragwort flea beetles (about 2.5–3.8 mm long) and darker in colour, being bronze to black as opposed to golden-brown. When disturbed bronze beetles leap around like ragwort flea beetles do and they make similar "shot-holes" in foliage. However, unlike the ragwort flea beetle, which has a limited host-range, the bronze beetle has a wide host-range. Bronze beetles feed on the foliage of many native trees and shrubs and have also become well-known pests of orchards, gardens, and even pine trees. Although they are normally harmless, bronze beetles can sometimes completely defoliate plants and seriously damage fruit (especially apples, stone fruit, and berry fruit crops). You are most likely to see bronze beetles from October to January.

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