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What's New In Biological Control of Weeds?

What's Inside?

Manaaki Whenua
Landcare Research

Outbreak — Heather Beetle Arises from the Ashes

The heather project did not get off to a great start but things are starting to look up! In the early days (1994), routine testing revealed that many of the heather beetles (*Lochmaea suturalis*) we imported from the UK did not come with a clean bill of health. With painstaking care, persistence, and scrupulous hygiene Lindsay Smith reared pairs of beetles separately in an attempt to shake the disease. The first two releases were made in Tongariro National Park in January 1996, but it was not long before disaster threatened the project again. Mt Ruapehu underwent a series of eruptions and covered some of the release sites in a thick layer of ash. After 3 years of fruitless searches at these sites we were almost prepared to write the beetles off. However, it always pays to have patience in this game because in the fourth year we managed to find some adults

Simon Fowler collecting heather beetles at Te Piripiri

and larvae at the Te Piripiri site – not a lot but enough to provide a small glimmer of hope.

That was only last year and this year we have an outbreak! Simon Fowler and Paul Peterson visited Te Piripiri again in November and could hardly contain their excitement at the sight of a patch of dead and dying heather infested with thousands of beetles. "It looks as if heather beetle is starting to live up to the reputation it has developed in Europe of being a real pest of heather," said Simon. "It seems that our ability to detect adults before an outbreak is fairly poor — they drop to the ground very readily when disturbed and are notoriously difficult to find unless present in large numbers, " explained Paul.

The heather damage showing up at this site is old, probably caused by larvae and adults feeding last summer. The explosion in beetle numbers this year means that a lot more feeding damage should be evident later this summer. The main focus now is on redistributing the beetles to as many other areas as possible. A few large and lots of small releases of the Te Piripiri beetles have already been made this summer. The transfer seems to be going well so far, with beetle larvae seen at some of these new sites.

Hot Gossip

The **mist flower gall fly** (*Procecidochares alani*) has now been released in the field in New Zealand. The flies were imported in December from Hawai'i, into the capable hands of Chris Winks who has, amongst other things, nursed an endangered wētā species back from the brink of extinction. The fly population was kept in the quarantine facility at Mt Albert until it had completed one generation (approximately 6 weeks). The first field release took place in January in the Waitakere Ranges, close to the **mist flower fungus** (*Entyloma ageratinae*) release site. The mist flower fungus has spread so well that it is almost impossible to find an uninfested patch to release the flies on! Some flies have been held back for mass-rearing to enable further releases to be made.

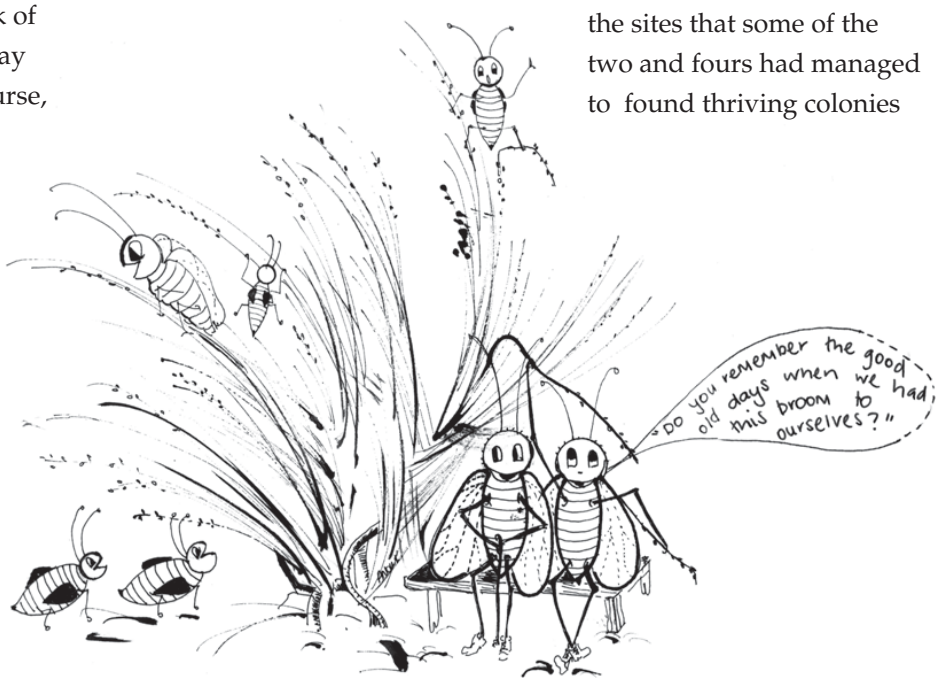
Chris Winks rearing mist flower gall fly

A **biological control of weeds training workshop** was organised in December at Lincoln by Lynley Hayes for nine biosecurity staff from four regional councils, and a contractor from Carter Holt Harvey. A grand total of 121 people have now

Workshop participants identifying insects beaten from broom

attended this course, which aims to give participants an opportunity to totally immerse themselves in biological control of weeds for a couple of days and get a good appreciation of what it is all about. This time round participants were invited to make a week of it and stay on for a 2-day plant identification course, run by Peter Heenan and other herbarium staff. "Many of those attending had not spent much time looking at things under a microscope before, so it was a fascinating whole new world for them, and it was quite difficult to drag them away for lunch!" chuckled Lynley. These courses will be repeated in future. If you would like to attend one, please contact Lynley (details on back page).

Broom psyllids (*Arytainilla spartiophila*) have impressed us with their powers of recovery. In 1994 with British researcher, Jane Memmott,we released these tiny aphid-like creatures at 55 sites in Otago. Just before Christmas Helen Harman revisited 13 of the sites that we thought had failed early on and which had not been checked since. She found that the psyllids had come back from the dead at two sites. Particularly impressive was the thriving population where the broom had been bulldozed within a year of the release of just four adults. This discovery reinforces what we have already learnt from this trial: psyllids can establish from tiny numbers of individuals. The number of psyllids released varied from just two (one of each sex) to 270. We were excited to discover during subsequent visits to the sites that some of the two and fours had managed to found thriving colonies



successfully. However, we do not recommend that people go around releasing twos and fours, as the establishment success rate is better with higher numbers of psyllids.

Hugh Gourlay has recently returned from a 2-week visit to Australia. Hugh advised John Ireson (Tasmanian Institute of Agricultural Research) and Raelene Kwong (Keith Turnbull Research Institute, Melbourne) on the ins and outs of rearing and releasing the **gorse thrips** (*Sericothrips staphylinus*) he had sent across earlier. A mass-rearing and release programme is planned for the thrips this summer in both Tasmania and Victoria. Hugh also got to see how the **gorse spider mites** (*Tetranychus lintearius*) that were descended from New Zealand stock he provided 2 years ago were doing in Tasmania. Unfortunately they have the same predators attacking them there too. Inland sites had both the major predators, the ladybird (*Stethorus* sp.) and mite (*Phytoseiulus persimilis*), present and were not very impressive. However, coastal sites appear to have only the ladybird and were managing to do quite well, with good numbers of mites present and dispersing. Hugh was able to get a sneak preview of the **bone-seed leaf roller moth** ('*Tortrix*' sp.) that we are hoping to introduce at some stage (in which case Hugh might have to mass rear it!). He visited a recent release site in Victoria where eggs and larvae were easily visible and establishment looks promising (see also "Out of Africa", page 5). The final stop for Hugh was Canberra to discuss progress with safety testing a new agent for broom, the **gall mite** (*Aceria genistae*) with CSIRO staff. International co-operation and collaboration is alive and well in the field of biological control of weeds and we all benefit enormously from this synergistic approach.

Raelene Kwong (KTRI, Melbourne) searching for recently released bone-seed leaf roller moths

Out of Africa

Pauline Syrett inspecting bone-seed damaged by the bone-seed leaf roller moth

Recently we have been exploring the possibility of developing biological control for a number of new target weeds. All indications suggested that we should pursue several new programmes, including ones against bone-seed and woolly nightshade. Late last year Pauline Syrett visited colleagues in South Africa and Australia to benefit from their wisdom and gain a clearer understanding of how we might best proceed.

Bone-seed

Bone-seed (*Chrysanthemoides monilifera* ssp. *monilifera*) is native to South Africa and has become a weed in Australia as well as New Zealand. The Australians have already grasped the nettle and begun a biological control programme for this weed. Australian researchers have been on the spot in South Africa for a number of years now. Petra Muller (CSIRO), who is based in Cape Town, showed Pauline first-hand the insects that naturally occur on bone-seed in its homeland. Bone-seed is a coastal resident in South Africa, inhabited by a myriad of natural enemies. "It is not uncommon to see ailing and dead plants," explained Pauline. "The bone-seed leaf roller moth ('*Tortrix*' sp.) with its characteristic webbing was clearly the most damaging insect, often killing whole plants." This moth has recently been released in Australia, and is number one on the list of potential candidates for New Zealand. Pauline discussed with Petra, and also Penny Edwards (CSIRO, Brisbane), the difficulties we are likely to encounter in working with this moth. She discovered that it is not the easiest biological control agent in the world to test and get meaningful results. "Trials have to be very well constructed to demonstrate host specificity for this species. Australian and South African researchers found that in the lab the moths lose their ability to discriminate, and lay eggs on just about anything including the cage itself." This means that testing has to be done outdoors under more natural and realistic conditions. Pauline also encountered some of the

other top candidates for bone-seed control. These included a damaging rust fungus (*Endophyllum osteospermii*), and a seed-feeding fly (*Mesoclanis* sp.). Far fewer seeds are produced on bone-seed bushes in South Africa, due partly to the activity of these seed feeders.

Lace bug nymphs guarded by adult, on a woolly nightshade leaf

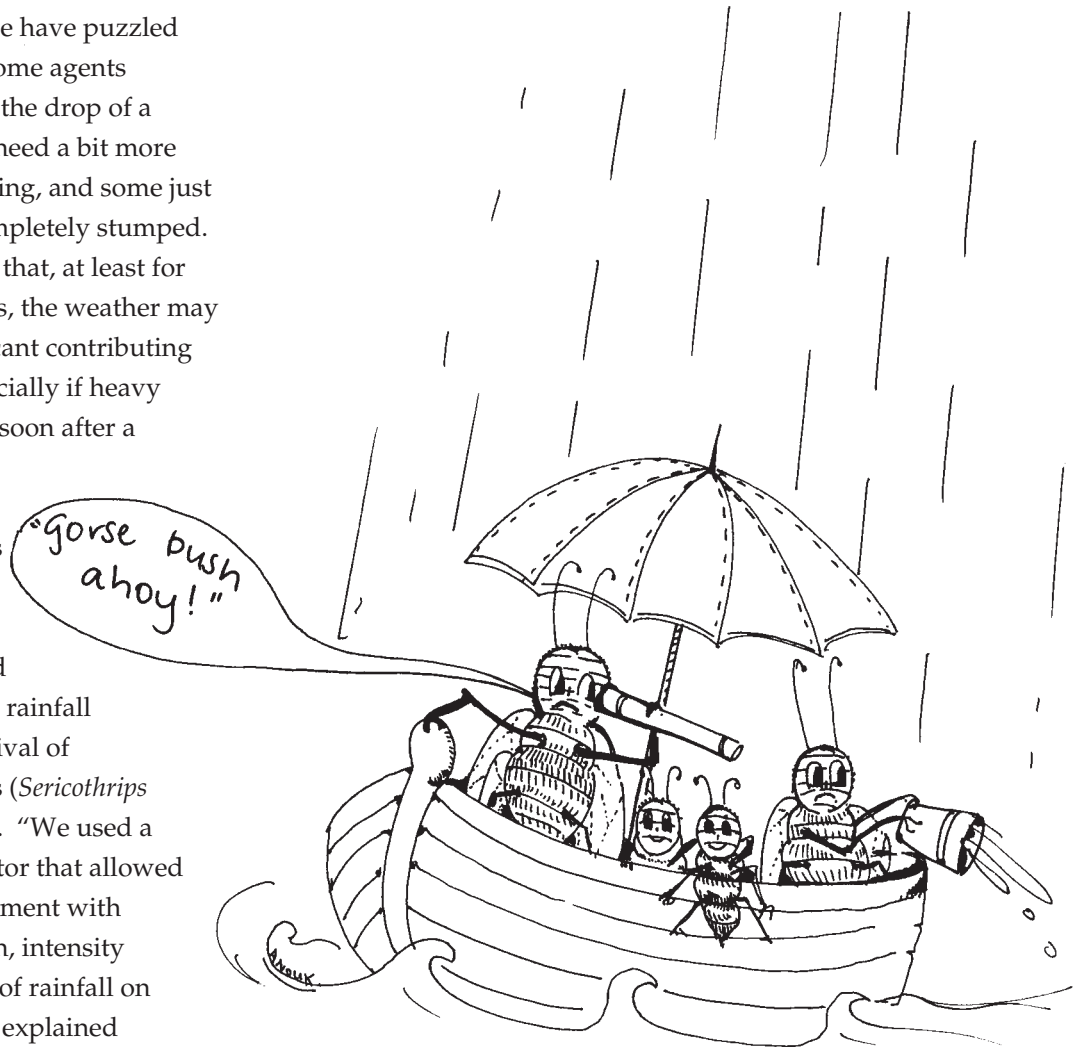
Woolly nightshade

Woolly nightshade (*Solanum mauritianum*), a native of South America, is a problem we have in common with South Africa. Researchers there have been tackling this weed for several years now. Terry Olckers, at the Plant Protection Research Institute (PPRI) in Pietermaritzburg, shared insights with Pauline about how the programme is progressing, and they discussed the possibility of expanding the safety testing programmes to include New Zealand native and cultivated species of *Solanum*. Terry showed Pauline a field site where their first agent, a sap-sucking lace bug (*Gargarphia decoris*), has been released and has successfully established. Pauline discovered that the lace bugs have some interesting behaviours. "The young lace bug nymphs huddle together in groups on the undersides of leaves with a parent nearby to protect them from predators," revealed Pauline. The lace bugs feeding causes damage (mottling) to the leaves and because they can produce several generations per year they have great potential to quickly build up damaging numbers on the plant. Several other insects from Argentina and Brazil are currently being put through their paces. One of these, a weevil (*Anthonomus* sp.), prevents fruiting, an important consideration given the role birds play in dispersing woolly nightshade seeds.

Throughout her trip to South Africa, Pauline met many people working on a variety of projects. At PPRI, Pretoria, she saw several successful biological control projects including water hyacinth, *Azolla*, *Sesbania*, *Opuntia*, and *Acacia*. "I was particularly impressed by the success the South Africans have had with controlling tree species such as *Sesbania* and *Acacia*, given that trees have a reputation as difficult targets for biological control," said Pauline.

Raindrops Keep Falling on My Head

For years we have puzzled over why some agents establish at the drop of a hat, others need a bit more mollycoddling, and some just have us completely stumped. We suspect that, at least for some agents, the weather may be a significant contributing factor, especially if heavy rain occurs soon after a release.



Researchers in the UK have investigated the effect of rainfall on the survival of gorse thrips (*Sericothrips staphylinus*). "We used a rain simulator that allowed us to experiment with the duration, intensity and timing of rainfall on the thrips," explained Becky Saunders. "We found that rainfall intensity, but not rainfall duration, was an important factor affecting their post-release survival."

Rainfall duration was not important as gorse thrips are mobile and can seek shelter to avoid the worst of the rain. On the other hand, the thrips were affected by rainfall intensity. If rain is gentle and light, the thrips can usually make it safely to shelter. However, if it suddenly starts to rain cats and dogs, the thrips may be drowned or washed from the plant before they have time to hide. "Newly-released insects may be particularly vulnerable if they haven't recovered from the shock of being uprooted and placed into a new environment," said Jane Memmott.

A release strategy that reduces the chances of the thrips encountering heavy rainfall soon after release may have a higher probability of success. If we take heed of weather forecasts and plan to make multiple small releases of thrips, at different times and over a wide area, then we can reduce the risk that our efforts will be a complete washout.

Do Not Disturb!

Broom infestation in pine plantation, New Zealand

Weed invasions are often associated with disturbance events, such as fire, flooding, and grazing, which provide the plants with a golden opportunity to go forth and multiply. However, land managers do not always take into account the full ramifications of disturbance when designing control strategies, probably because the impacts are not always fully understood. A Canberra-based PhD student, Paul Downey, has been looking at the role of disturbance in relation to broom (*Cytisus scoparius*, known as Scotch broom in Australia), with support from the Co-operative Research Centre for Weed Management Systems.

Paul's Australian study suggests that disturbance-based management techniques for the control of broom can do more harm than good if the timing is wrong and follow-up treatments are not used. Disturbance can be harmful as the seeds are moved, both within the soil and away from the area. As seedlings are present all year round, broom can easily respond to soil disturbances or disturbances that remove the adult plants (canopy). These seedlings do not establish while the adult plants (5–14 years old) are present. Once the canopy is removed, however, they quickly fill the gaps.

"Disturbance-based management techniques are most useful when broom stands are young (<5 years old)," explains Paul. At this time the seed bank may be limited and the plants are not producing large amounts of dormant seeds. Managing the seed input/seed bank is one of the keys to controlling broom, as the seeds have a long life. "Disturbance-based management techniques may also have some benefit when dealing with older senescing stands (>14 years old)." As some plants begin to die naturally, gaps are created allowing new seedlings to grow in their place. Disturbances that kill these seedlings may slow down the replacement process. However, without follow-up treatments, replacement will happen.

A large-scale disturbance, such as fire, can have a major impact on a broom stand. Not only are all plants removed in one fell swoop, but the seed bank is severely reduced (90%) by the triggered germination and heat-induced mortality. Regeneration is massive and, if left to its own devices, a burnt broom stand will quickly become a sea of broom seedlings, as thick as the hairs on a dog's back.

A large-scale disturbance usually kills all other vegetation too, giving broom seedlings a better start. However, seedling mortality is extremely high in the first 12 months. The disturbance event provides a window of opportunity that land managers can exploit. If the crop of newly germinated plants is killed before they are old enough to produce seeds (2–3 years), then it is not quite so easy for the stand to re-establish, especially as the seed bank has been depleted by fire. Follow-up treatments will be required every two years, however, until the seed bank is further reduced and other vegetation that might suppress broom seed germination recovers. Fire is the main way to reduce seed banks.

In conclusion, Paul's study suggests that disturbance management is a tool that may assist with broom control in some situations. It must be timed well, however, and is best used in conjunction with other control techniques such as herbicides and biological control.

The information in this story was taken from Paul's PhD Thesis "Disturbance and Invasion Ecology of Scotch Broom in Australia".

Autumn Activities

Autumn is a good time to look for evidence that gall-forming agents, like the hieracium gall wasp (*Aulacidea subterminalis*) and Californian thistle gall fly (*Urophora cardui*), have established. The plant deformities (galls) caused by these agents develop over the summer and are usually most obvious in early autumn. March to May is also a good time for harvesting and redistributing these gall-forming agents as well as ragwort flea beetles (*Longitarsus jacobaeae*), nodding thistle crown weevils (*Trichosirocalus horridus*), nodding and Scotch thistle gall flies (*U. solstitialis* and *U. stylata)*, gorse pod moths (*Cydia succedana*), and old man's beard fungus (*Phoma clematidina*). 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 enclosing 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 do not shift any pests, like the clover root weevil (*Sitona lepidus)*, at the same time.

Keeping Current

Every year we produce new pages for "The Biological Control of Weeds Book" and distribute them widely so people can update their books. However, we know that sometimes even the best laid plans can go awry and we have a sneaking suspicion that there are quite a few books out there that are not current. Therefore, we have included with this newsletter a copy of the index for people to check their books against. If you find that you are missing some pages, then first check that they are not buried in a dark corner of the office. If you have no luck, then mark which sheets you are missing on the index page and send this to Lynley Hayes (address on page 10). She will make sure that you receive them as soon as possible. Note that we are producing another batch this year, which you should expect to reach your desk around August/September.

Tell Me More...

Question: Help, it's raining and I've just received a shipment of insects! Should I put them out now or wait for a bit?

Generally, it is better to wait for fine weather before releasing a consignment of insects (see "Raindrops Keep Falling on My Head", page 7). Some insects, particularly large hard-bodied ones like beetles, will have few problems coping with the rain. Other soft-bodied or small insects such as moths, psyllids or thrips run the risk of being damaged or even drowned if they get caught in the rain, especially if the insects are suffering from relocation shock or if it is cold and they have become sluggish. The consignments that we send out can usually last a few days without major loss of life if they are kept in a cool place. If you need to hold your insects back until the weather improves, then it is a good idea to regularly replace any ice packs that have thawed inside the release container. Some deaths are likely to occur if you do not release the insects immediately, but you are still likely to be better off than if you risk losing the whole lot. For further advice about whether or not you should add extra food or moisture, read the instructions on the information sheets provided and, if in doubt, do not hesitate to give us a call.

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