What's New In Biological Control Of Weeds?

Issue 40 *May 2007*

What's Inside:

Proudly part of WEEDBUSTERS
Stopping the spread of weeds
www.weedbusters.org.nz

ISSN 1173-762X

A Bane for Boneseed

It was touch and go, but thanks to a break in the weather the first boneseed leafrollers (*Tortrix* s.l. sp."*chrysanthemoides*") were released in New Zealand on Waiheke Island, at the end of March. Chris Winks has been busy rearing the leafroller since they were released from quarantine in January. The release was smaller than hoped, however, as we are still working out the most effective mass-rearing techniques for the moth. "We expect the leafroller will have three generations a year, so despite it being a small release it has the potential to build up to significant numbers next summer," said Chris.

The release was made up of large caterpillars on cut shoots, which were then tucked into boneseed (*Chrysanthemoides monilifera monilifera*) bushes at the site. This is the first biocontrol agent we have released against boneseed so we are keen to see how the caterpillars settle in. This leafroller causes severe damage to boneseed in its native South Africa and we are hoping it will be able to do the same here. More caterpillars will be released next spring.

The boneseed project is funded by a national collective of regional councils and the

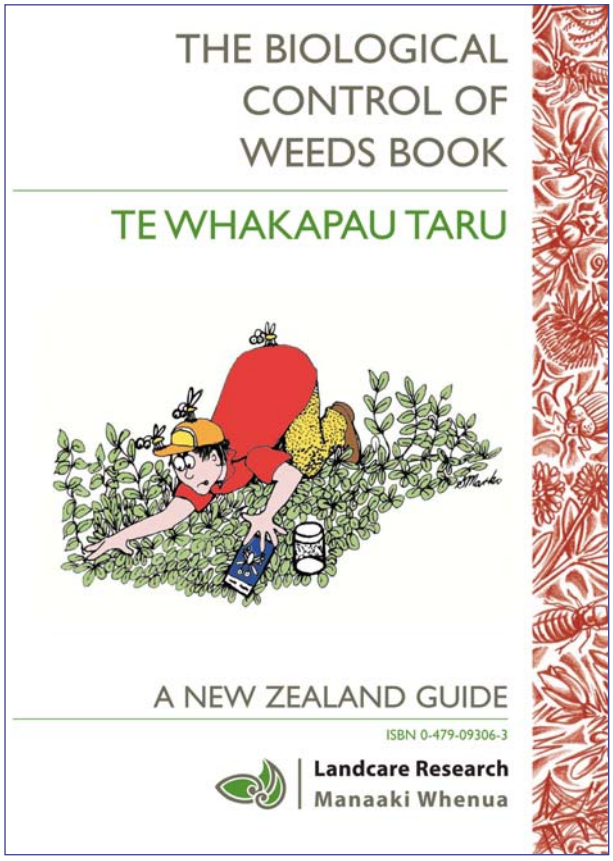
Damage caused by the boneseed leafroller caterpillar.

Landcare Research
Manaaki Whenua

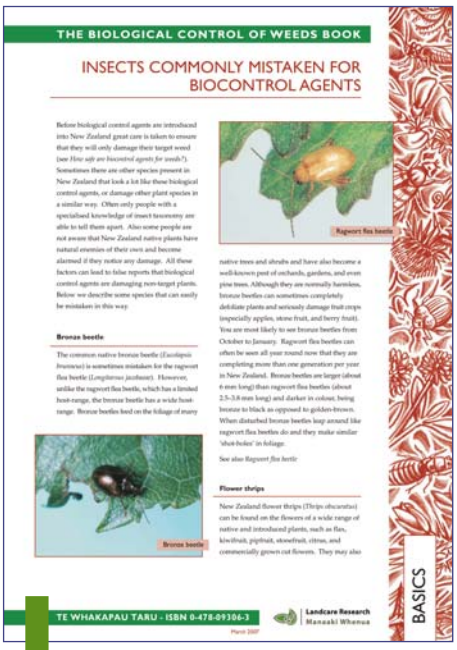
Biocontrol of Weeds Book Goes Online

Te Whakapau Taru – The Biological Control of Weeds Book was launched in 1996 as a way of providing comprehensive information about the philosophy and practice of biocontrol of weeds in New Zealand. Batches of pages have been produced and added to the book most years since, and now total more than 100. While the book has fulfilled its original aims it is now time to catch up with new technology and put the book online. The huge advantage of this system is that the information sheets can be updated quickly and easily and more people can access this information – they can also print off what they need thus minimising the cost of expensive colour printing and postage.

We have revised all the information sheets, which will soon be available as PDF files from: www.landcareresearch.co.nz/research/biocons/weeds/ . If you have got a copy of the book we suggest you tenderly put all the contents in the recycle bin and print off new copies of all the pages you are interested in. If you do not have a copy of the book, and want to start one, we suggest you get yourself a folder with a clear pocket on the front that you can slip the front cover page into, and also print off the pages you want. If you do not have access to a colour photocopier then we can still provide hard copies. Please contact Lynley Hayes if you require these (hayesl@landcareresearch.co.nz, Ph 03 321 9694).



Note that the release and monitoring forms have been made into Word files so you can now enter the information electronically and email them back to us.



An example of one of the pages.

In future if we update any of the information sheets we will include a notification in this newsletter so you can download them and keep your book as up to date as possible. If you have any suggestions for additional pages that may be useful then please let Lynley know.

Thanks to all the staff at Landcare Research who have helped with the task of getting the book online, which has been a major undertaking, especially Anouk Wanrooy and Stephen Burgham.

Upcoming Weeds Workshop

On 14 June we are holding a one-day workshop at Lincoln. The workshop will focus on new developments in biocontrol of weeds projects pertinent to Canterbury and the wider South Island, a warning about new weeds to watch out for, and some recent findings and highlights from weeds research being undertaken by other Crown Research Institutes and universities. As well as speakers from Landcare Research, we hope to have speakers from AgResearch, Ensis, and Canterbury and Lincoln universities. The workshop is free of charge and will be held in the Waikirikiri Room at Landcare Research. Numbers will be limited to 80. To register your interest in attending please contact Lynley Hayes (hayesl@landcareresearch.co.nz, Ph 03 321 9694). Hope to see you there!

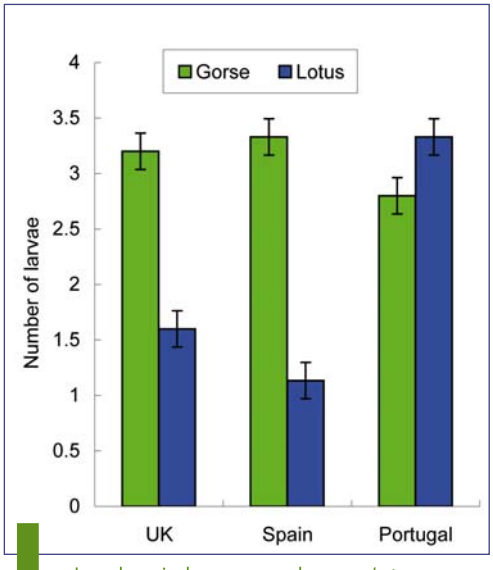
A Matter of Timing

We have cracked the case of the gorse pod moth's (*Cydia succedana*) unpredicted attack on exotic plants other than gorse (*Ulex europaeus*). The suggestion that gorse pod moths from England and Portugal, both of which were released here, are actually different but closely related species has been dismissed. Molecular work and examination of the genitalia of moths from England, Portugal and New Zealand show that only one species, *Cydia succedana*, was introduced here.

This left us wondering whether the different populations released in New Zealand might vary in their host specificity. The original host-range tests were conducted on moths collected from Yateley and Chobham Commons, England, from *Ulex e. europaeus*. However, moths collected at Viana do Castello, Portugal, where a different subspecies of gorse (*U. e. latebracteatus)* grows, were also released. Last year we re-collected moths from these three original collection sites. In quarantine, we tested adult egg-laying and larval feeding preferences for gorse, Scotch broom (*Cytisus scoparius*), Montpellier broom (*Teline monspessulana*), and lotus (*Lotus pendunculatus*). We also checked out the preferences of Spanish gorse pod moths. Although these moths are close geographically to the Portuguese moths, they are associated with *Ulex. e. europaeus*, like the English ones.

The testing showed that English pod moths are very specific to gorse, confirming the original host-range testing results. In no-choice tests, the Portuguese moths, by comparison, were equally likely to attack both gorse and lotus. The results for the Spanish pod moths were very similar to the English moths. This suggests that the differences in 'taste' between English and Portuguese pod moths may be due to the subspecies of gorse to which they are adapted. "The two original populations of gorse pod moths are quite different in their abilities to exploit different host plants. The Portuguese moths appear to be less fussy eaters!" said Quentin Paynter.

This is only part of the story, however, because when given a choice between gorse and lotus, the Portuguese moths strongly preferred to lay eggs on gorse. The key it seems is the timing between gorse flowering and pod moth activity. In England, *U. e. europeaus* flowers in the spring, coinciding with emerging gorse pod moths. Studies of non-target attack in New Zealand show that many gorse plants flower in autumn and winter, consequently pod moths are often active when gorse flowers and pods are not present. As the host-specificity tests show, moths from Portugal can cope with this asynchrony by finding alternative hosts, such as lotus. "I suspect that if we had only introduced gorse pod moths from England there is a chance that they may not have established," said Quentin.



Larval survival on gorse pods versus *Lotus corniculatus*, grouped by country of origin.

Work by researchers in France may explain the different flowering patterns of *U. e. europeaus* in England and New Zealand. They suggest that the damage caused by the gorse seed weevil (*Expion ulicis*) may pressure plants growing in warm localities, such as New Zealand, to flower in the autumn and winter, thus avoiding the weevil's active period. Plants growing in cold environments cannot do this because of the low temperatures and so can only flower in the spring when both seed feeders are active.

We are pleased that the solution to this mystery is not due to any flaws in the original procedure for host-testing gorse pod moth. This case is a good example of how we continually strive to improve our testing methods. When the first releases were made it was best practice to release as genetically diverse a population as possible, hence including moths from Portugal as well as England. "Our current best practice is to only release agents collected from the same location as the actual population tested, so this situation is unlikely to happen again," said Quentin.

This work was funded by the Foundation for Research, Science and Technology as part of the "Beating Weeds" Project.

Gorse Leads Succession Astray

Gorse (*Ulex europeaus*) is regarded by some as a "helpful" weed because it can facilitate native regeneration by providing shelter for seedlings. Native plants that grow taller can overshadow old gorse stands, and over time these stands may give way to native broadleaved forest. However, it has been questioned whether the resulting vegetation has the same biodiversity values as that which has grown through native scrub. A paper has just been published that compares secondary forest succession under kānuka (*Kunzea ericoides*) and under gorse, and claims that gorse leads native succession along a different pathway.

Gorse and kānuka scrub are composed of different assemblages of plant species and, when the equivalent stages of succession are compared, kānuka scrub also tends to contain a greater diversity of species. Many of the differences between the two are due to the presence or absence of native woody plants. Species such as *Coprosma rhamnoides* and kāmahi (*Weinmannia racemosa*) favour kānuka stands, and fewer small-leaved native shrubs (such as *Coprosma* species and mingimingi (*Cyathodes juniperina*)) are found under gorse than under kānuka. Of the more common forest herb and fern species, up to 20 were found under kānuka in comparison with only three found under gorse.

As time goes by the composition of plants in kānuka scrub and gorse scrub do not become more alike. This means then that the sequence of plant succession in the two vegetation types must also be different. "Different plants are successfully regenerating in the two vegetation types," said Peter Williams, who was involved in this study. Some differences can be directly attributable to gorse and kānuka themselves. Structural differences between gorse and kānuka scrub may influence succession. Old kānuka sites tend to have an open, evenly shaded understorey below a tall open canopy, unlike old gorse sites where the understorey shade remains dense. Gorse stands appear to be dominated to a greater extent by exotic bird species. These birds tend to favour fruit from exotic woody plants, such as barberry (*Berberis glaucocarpa*), thus spreading the seeds of these species. Gorse also has a thicker litter layer than kānuka, which may affect seedling establishment. Differences between kānuka and gorse also extend below the ground, as gorse fixes nitrogen into the soil.

Native plants growing up beneath old gorse scrub.

Environmental variables influence succession, particularly factors such as the distance to native and exotic seed sources. However, whether the site was a gorse or kānuka stand and the age of the stand had the greatest influence on plant species composition. This shows that the different patterns of succession were primarily due to what species the vegetation grew up through.

These findings show that while gorse may give way to native forest in the long term, it does not provide a direct substitute for native succession through kānuka. Many native plant species would be absent from the resulting gorse-fostered vegetation. Consequently, the report recommends that in areas where most native plant succession is through gorse, or other exotic shrubs such as broom, areas of kānuka scrub should be preserved or even purposefully planted to retain this process.

This work was funded by the Department of Conservation under science investigation number 3591.

Sullivan, J.J.; Williams, P.A.; Timmins, S.A. 2007: Secondary forest succession differs through naturalised gorse and native kānuka near Wellington and Nelson. *New Zealand Journal of Ecology* 31.

Students Help Uncover Secrets

We are pleased to introduce three new PhD students associated with our team, who are investigating aspects of the biological control of Californian thistle (*Cirsium arvense*), tradescantia (*Tradescantia fluminensis*) and ragwort (*Senecio jacobaea*). We also report on Imogen Bassett's latest findings in her PhD on the biocontrol of alligator weed (*Alternanthera philoxeroides*) which is due to be completed soon.

Michael Cripps has come to New Zealand from Canada to take a closer look at the relationship between Californian thistle (*Cirsium arvense*) and its biocontrol agents. Simon Fowler, Nick Waipara, Graeme Bourdôt (AgResearch) and Grant Edwards (Lincoln University) are supervising his work, which is funded by the National Centre for Advanced Bioprotection Technologies, and is part of a larger study on the importance of multi-trophic interactions in biological pest control systems. There are several aspects to Michael's project. Using Californian thistle as a model he is looking at how freeing a plant from its natural enemies contributes to its ability to invade new territory. Michael also plans to collect data on the genetic diversity of the thistle rust (*Puccinia punctiformis*) and Californian thistle from field surveys throughout New Zealand. By identifying whether there are different resistant varieties of the weed and different pathotypes of the rust he hopes to determine how the agent can be used more effectively. In addition to this, Michael will investigate the impact of the two potential new biocontrol agents, the stem-mining weevil (*Ceratapion onopordi*) and green thistle beetle (*Cassida rubiginosa*), individually and in combination on healthy and rust-infected Californian thistles.

Scot Waring sampling for corn flea beetles, North Carolina.

Sue Molloy is a Kiwi and she is working with us on the ecology of tradescantia. Simon Fowler, Dave Kelly (Canterbury University), Graeme Bourdôt and Shona Lamoureaux (both AgResearch) are supervising Sue's work, which is funded by AgResearch from their subcontract with Landcare Research under the Beating Weeds project (see *What Will It Take To Topple Tradescantia?*, Issue 39). Sue will measure tradescantia population characteristics and use these data to develop a model of the plant's growth, which is the key to its weediness. From this work Sue will predict how biocontrol and differing light intensity will affect tradescantia's spread. To determine the effectiveness of other control methods Sue will investigate the tolerance to drought and burial of both whole plants and pieces of stem. While the weed flowers in New Zealand, no seed has been found. Sue will also look into this unusual situation and determine whether tradescantia is likely to produce seed here. This work will help determine the best control methods for this pesky weed.

Mike Cripps in a Californian thistle patch, Papatotara, Southland.

Scot Waring is the newest of the three and has just started planning his PhD. Simon Fowler and Jon Sullivan (Lincoln University) are supervising his work looking at *Senecio* food web dynamics, which is funded by Landcare Research. Scot, who is American, will be examining the specific impacts on native plant communities of ragwort, and the insects that have been imported to control it. Over the next few years, he expects to investigate several possible phenomena including the apparent competition between ragwort and endemic *Senecio* species, interactions between some of the established ragwort biocontrol agents, and possible reasons for the lack of success of ragwort biological control in Westland. He also plans to resurvey ragwort's distribution in the South Island.

Imogen Bassett has found that alligator weed, in conjunction with one of its biocontrol agents, the alligator weed beetle (*Agasicles hygrophila*), has the potential to alter nutrient cycling in invaded waterways. From studying the decomposition of alligator weed in a Northland lake, she has found that alligator weed decomposes much faster than native sedge species. But in addition to this, herbivory by the beetle causes large mats of alligator weed to undergo mass dieback in early summer. This means that large amounts of rapidly decomposing plant material are released into the water over a very short period of time, potentially causing a sudden release in nutrients. In addition, this happens during summer, when the warm weather further speeds up decomposition and when other plants (including other weeds) are busily growing and ready to use the extra nutrients. When we think of non-target effects of biocontrol we usually think about non-target plants being eaten, but here we have an example of a biocontrol agent playing a role in affecting an ecosystem process.

Imogen has also made some interesting discoveries in relation to alligator weed's response to shading. While alligator weed growth is reduced by shading, the effect can be partly reduced by support from unshaded parts of the plant. In a shaded situation this support may allow alligator weed to compete more successfully against shade-sensitive plants. "The moral is, if you are trying to control alligator weed by using riparian vegetation to shade it out, make sure it is all shaded and there are some shade-tolerant plants to compete with it," said Imogen.

This PhD is jointly funded by Landcare Research and the Australian Co-operative Research Centre for Weed Management.

Alligator weed beetles.

Things To Do This Winter

This is a quiet time of year when most biocontrol agents become dormant or hide away. However, you can still:

- Check nodding thistle crown weevil (*Trichosirocalus horridus*) release sites. Although some weevils lay eggs all year around, most begin to lay in the autumn and the damage they cause to rosettes becomes more obvious as the winter progresses. Look for black frass in the crown and for leaves that have lost their prickliness. While nodding thistle (*Carduus nutans*) is the preferred host you may find that other species of thistles are also attacked. Crown weevil adults can often be successfully harvested and shifted around as late as June. To see the adults you will need to look carefully on the undersides of the leaves. **You may also be able to collect some for our study** (see *More Crown Weevil Samples Needed*, Issue 39).

Bridget Keenan

Infested thistle rosette showing white crown weevil larvae.

- Shift ragwort flea beetles (*Longitarsus jacobaeae*) around, provided you can find them in good numbers.

- Make sure all the paperwork relating to release sites is up to date. If you have been shifting agents around we would be interested to know about this (send information to Lynley Hayes at hayesl@landcareresearch.co.nz).

The Way We Were

Lynley Hayes moved office recently and uncovered a file of old newsletters, going back to the very first issue in August 1987. We thought it would be fun to share with you a few snippets from the past 20 years.

Gorse (Issue 1, August 1987)
The biocontrol of gorse programme is reactivated, amidst conflicting viewpoints. "The introduction of biocontrol agents for gorse is not nearly as straight forward as DSIR originally hoped. In fact gorse is becoming quite a political issue: to the beekeepers it is a source of early pollen; to some conservationists it provides a protective nursery for native trees and shrubs; … and yet to a great many others, gorse is an aggressive pest … Richard Hill is preparing an environmental impact assessment (EIA) on gorse and its biological control which will be available later for all interested parties to comment on."

Collection of *Arcola malloi* (alligator weed moth) from Australia (Issue 2, July 1987)
Something that has actually become a little less hazardous over the years. Chris Winks comments, "… I was able to take this chilli bin, now plastered with "live animal" stickers, with me as hand luggage in the passenger cabin. When the plane arrived in New Zealand, I was allowed to leave (with the precious bin and import permit) before the MAF went through spraying insecticide over all and sundry!"

Setback for gorse spider mites (Issue 8, January 1989)
Sometimes fixing one problem causes another. "… Everything was proceeding on schedule until the next generation became adults in late November–early December. Then it was found that every mite was a male (their potential for breeding was therefore very limited!). It is possible that the procedures which we used to cure the disease in the mite population also upset their reproduction. This has never been recorded anywhere in the world before and while very interesting academically, has put us back by several months."

Nodding thistle receptacle weevils prove remarkably hardy (Issue 11, October 1989)
If only they were all this tough! "… A fairly standard method for killing insects is to put them into a freezer … The weevils stayed in the freezer until September (about 6 months) when Jeremy [Sheat] decided he would mount them ready for the display boxes. However, when the weevils were thawed out, most of them got up and walked away. Undaunted by this display of hardiness, Jeremy put the weevils into a potassium cyanide chamber but to his surprise some weevils were still alive and kicking several days later!"

Hugh Gourlay releasing gorse spider mites, 1989.

***Clematis vitalba* report favours biological control attempt** (Issue 13, April 1990)
The biocontrol of old man's beard programme begins. "… The preliminary report to DSIR concludes that research into biological control of old man's beard is considered of national importance by the New Zealand public, and is well justified economically."

European hemlock moth found in New Zealand (Issue 16, January 1991)
The first discovery of this insect in New Zealand. "Green caterpillars of the hemlock moth, *Agonopterix alstromeriana*, have been devastating hemlock around Alexandra this summer. … We have no idea how this species got to New

Lynley Hayes in the brand new insect-rearing rooms, September 1991.

Zealand. … The hemlock moth caterpillar is from Europe where it lives exclusively on hemlock. This host specificity and its proven ability to damage hemlock mean it could be a useful, accidental arrival in New Zealand."

VII International Symposium on Biological Control of Weeds (Issue 21, April 1992)
This was only the second time this international meeting had been held in the Southern Hemisphere. "The symposium which was held at Lincoln University from Sunday 2nd to Friday 7th February, was extremely well supported, with more than 180 registrants from 21 different countries in attendance."

Welcome to Maanaki Whenua – Landcare Research (Issue 22, July 1992)
The DSIR is restructured. "On 1 July, 10 new Crown Research Institutes (CRIs) replaced several well known Government research organisations. Our Institute, Landcare Research, drew together 350 staff from several Divisions of DSIR, the Forest and Wildland Ecosystem of FRI, and the Rabbit and Land Management Group of MAFTech."

Collecting ragwort flea beetle (Issue 23, October 1992)
Sharing novel collecting methods. "Two enterprising noxious plants officers, Terry Regan and Des Pooley from the Bay of Plenty Regional Council, have discovered a better way of collecting beetles than on hands and knees with a pooter. Terry and Des purchased a Homelight HB 180 leaf blower, which can be adjusted to suck. By using this device like a vacuum cleaner, a release of flea beetles can be collected in as little as 10 minutes. The leaf blower needs to be adjusted so that the beetles are not sucked in too fast, or they get damaged."

Hieracium (Issue 24, January 1993)
The Hieracium Control Trust forms, kicking off the hieracium programme. "An action group has been formed to combat the growing problem of hieracium or hawkweed in the South Island."

Broom twigminer outbreak (Issue 25, April 1993)
If only this happened more regularly! "This summer extremely severe outbreaks of the broom twigminer (*Leucoptera spartifoliella*) have been noticed in Canterbury. Entire broom bushes rather than the more usual parts of bushes have been killed off."

Helen Harman checking cinnabar moth release sites, February 1991.

Noxious Plants Officer training workshops (Issue 30, August 1994)
Our technology transfer programme is expanded by the beginning of training workshops. "… [staff] of the Wellington Regional Council came to Lincoln for 2 days in June to participate in workshops. … We feel these workshops are of great value to both parties."

Contact Addresses

Lynley Hayes,
Julia Wilson-Davey
Landcare Research
PO Box 40
Lincoln 7640, New Zealand
Ph +64 3 321 9999
Fax +64 3 321 9988

Quentin Paynter,
Chris Winks
Landcare Research
PO Box 92170
Auckland, New Zealand
Ph +64 9 574 4100
Fax +64 9 574 4101

Peter Williams
Landcare Research
Private Bag 6
Nelson Mail Centre
Nelson 7042, New Zealand
Ph +64 3 545 7700
Fax +64 3 545 7701

Ambassador 9 Lives satin 150 gsm
This newsletter is printed on 50% recycled fibre including 15% post-consumer waste.

Editors: Julia Wilson-Davey, Lynley Hayes
Thanks to: Christine Bezar
Layout: Cissy Pan

Email: surname+initial@landcareresearch.co.nz
Web: www.landcareresearch.co.nz

Any enquiries to Julia Wilson-Davey.