

# **The beetles may be winning!**

**A summary report on the progress of the green thistle beetle (*Cassida rubiginosa*) in their attack on Californian thistles in Otago & Southland**



**This report follows Sustainable Farming Fund project L11-172 'Green thistle beetle monitoring to spread the bio-control attack on Californian thistles' (July 2011-June2013)**

This is not a scientific report but a summary of the project and its monitoring and observations, intended for farmers, the general public and to inform further research work on this promising bio-control agent against a significantly damaging New Zealand pastoral weed.

Malcolm Deverson  
Projects Manager  
on behalf of the Californian thistle Action Group  
and the Clutha Agricultural Development Board  
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## Executive summary

- ▶ The green thistle beetle appears to have established at 90% of Otago & Southland release sites and this at 2-5 years after release.
  - ▶ At 87% of the reviewed sites in Otago & Southland there were fewer thistles than at their respective releases; and we judged that at 63% of sites, the reduction could be described as significant or extensive. This is certainly interesting but we stress that we have no indication, and no science to show that the green thistle beetle has caused this situation.
  - ▶ Sightings of the windows' feeding evidence was more common (at 73% of site visits) than sightings of any of the beetles' adults, larvae or eggs (at 24% of site visits).
  - ▶ We observed evidence that these beetles movement across the countryside is inconsistent. We have evidence that they have travelled up to 5kms from one release site in three years, and that at another release site, they appear to have largely remained after five years.
  - ▶ 83% of sites where beetles were observed were on sites with trees (forest, plantation or shelterbelt) nearby – the likelihood that the beetles overwinter in these sites is noted in the literature (unknown to observers at the time).
  - ▶ Observations by farmers now in any area of Otago & Southland may be useful in helping to track the beetles' progress; they could help by looking out for the tell-tale windows' evidence of their presence.
  - ▶ We strongly believe that there is now a need for a scientific study of this agent and its impact on Californian thistle populations so that it may be managed to optimal effect throughout New Zealand, and in particular in hill country pastures where the terrain and costs preclude other approaches.
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### Thanks to:

**Ministry for Primary Industries**  
Manatū Ahu Matua



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Jesse Blythell & Peter Ayson for their determined bio-control work in Southland, and

Graeme & Denise Pringle for observations and photographs, and

Farmers on the 50+ properties around New Zealand who are looking after the green thistle beetle in these early stages for all New Zealand farmers who may benefit in the long term.

## The initial releases

The green thistle beetles (*Cassida Rubiginosa*)<sup>1</sup> were first released near Lawrence in November 2007. The first Southland release was a few days later in the Hokonui Hills near Browns.

There have been 31 releases in Otago (mostly South Otago, but 3 on the Otago peninsula, 2 near Oamaru, and one in the Mt Aspiring area); also 14 original releases in Southland, and one in the Horizons Regional Council area. These releases were all made under SFF project 05-010 between November 2007 and January 2011.

All these 46 releases were co-ordinated by the Californian thistle group, an associate group under the Clutha Agricultural Development Board, which has been active in bio-control programmes for Cali thistles since 1999.

Also over this time Landcare Research raised further beetles that were distributed largely to Regional Councils in other parts of the country, e.g. Wellington, Bay of Plenty, Manawatu, Rangitikei. These were not part of this project's monitoring programme.

## Aims of green thistle beetle monitoring project

For the current project L11-172 – 'Green thistle beetle monitoring to spread the bio-control attack on Californian thistles' (July 2011-June 2013), the aims were:

- To monitor the beetles' progress at the release sites over the two recent summers.
- To see how well they have established and where they have established best.
- To see, if there are large beetle populations developing at some sites, that these beetles are harvested and re-established on other farms 'to spread the attack' on thistles as per the project title.
- To establish a record of the release sites that can be used well into the future and as a basis for further work on Californian thistles which continue to be New Zealand's most damaging pastoral weed.

## The observation procedures

The project team was able to go back to 30 of the 31 Otago sites, and with the support of Environment Southland's bio-control contractors to 9 of the 14 Southland sites. Support from farmers throughout has been tremendous. Almost all are sticking to the initial informal agreement to avoid heavy grazing and spraying around the release sites. The beetles have to survive and adapt to current farming procedures in order to be widely successful and so we asked no more than this.

Two of the initial sites have been destroyed by re-development but even here, the beetles may have safely moved on. Finding these would have involved a larger scale search than the finances of the project allowed.

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<sup>1</sup> AgResearch in recent work are referring to this as a thistle-feeding tortoise beetle.

We worked to a very specific survey check sheet designed so that the status and success of each site could be compared. In Otago this was done mostly between late December and January in both of the two summers 2011-12 and 2012-13. In Southland checks were carried out in conjunction with Environment Southland's bio-control monitoring programme. It was not a scientific study but a practical and consistent survey by experienced observers so that sites could be compared.

- We checked for evidence of establishment – mostly by looking for the distinctive feeding 'windows' (not holes) that identify the beetles' presence.
- We also looked for beetle eggs/ larvae/ and adults.
- We searched outwards, generally involving firstly a close inspection of thistle plants in a 20m radius from the release site. We then had the general aim to look 50m and then 100m away from the release point. This idea had to be adapted, in light of the number and location of thistle plants within the wider area. An inspection of every plant was not feasible, so we thought it most sensible to look where we thought the beetles may have extended their range to. This may have been towards the next most promising patch of thistles, or downwind of the initial site, or towards the fence-lines in now well-grazed pasture or for some other site-specific reason. We believe that this enabled us to come to a reasonable conclusion as to how well the beetles had established at each location.
- As well as looking primarily at the Californian thistles, we did inspect Scotch and Nodding thistles also.
- We estimated the health of the current thistle population and made a very general comparison with the same population at release time. We took photos at all visits to enhance those comparisons.
- We noted the basic site management approach from the farmer/ land manager concerned, especially with respect to the level of grazing in and around the site and any spray use nearby.
- We established a comprehensive file record of the sites and all this information.

### **Fewer thistles noticed**

The indication that many of our 'nursery site' farmers have been impressed by, and that all farmers would be interested in, was that at 87% of the reviewed sites in Otago and Southland there were fewer thistles than at their respective releases. When the release sites were identified and set up, farmers took us to at least one of their most troublesome thistle patches. In almost **all** cases, in the summer of 2012-13 these patches were no longer as troublesome.

We judged that at 63% of sites the thistle mass reduction could be described as significant or extensive. At three of our 38 applicable sites (8%), the thistles have basically disappeared altogether – from one of a farmer's worst patches to none! At 25% of sites there was 'extensive' or complete reduction of the thistles compared to their state at release – as informally judged by observations and photos.

We hasten to add that there is no indication, and no science to show that the green thistle beetle has caused this situation. If it is a co-incidence, then it is surely still one worth investigating if we are to make the best use of this bio-control agent.

## **The beetles are shy creatures?**

We observed evidence of feeding (the distinctive 'windows') much more than we sighted the beetles themselves or their eggs and larvae. At perhaps four or five sites over the two summers we observed the beetles mating, and we have observed their mating on a scotch thistle plant on at least one site.

The evidence of feeding was much more widespread than sightings of the beetles. We saw this evidence at a fairly consistent 74% average of sites over the two summers. The evidence that we judged as significant or extensive was at 36% of sites in 2011-12 and 19% of sites in 2012-13. This decline in feeding percentage overall could be evidence that the populations are dropping off over the years. There is, however, no such trend when we looked at the windows evidence in relation to the year in which they were released. Taking beetle sightings and windows evidence together, at 41% of the sites, there was more observed in the second summer than the first, and this was the case at just as many of the earlier releases (2007-09) than the later releases (2010-11). All our numbers are made on very general observations – still they were done with consistency by experienced observers.

## **The beetles may be coming to a thistle patch near you**

An aspect of our observations that caused great interest was the question of how far they had spread from the respective release sites. We needed to be flexible in the field to try to find evidence if we could. We tended to attempt to 'follow a trail' at the sites where we did find good initial evidence around the release site.

We have an observant farmer near Lawrence to thank for our best find in terms of the beetle's distance travelled. On a casual look he found the windows evidence when topping near his house. This was later checked at 1.9kms from the initial release site and this was five years after release. They have also been seen at 1.6kms near the farmer's barn. A really close inspection of this property in December 2012 found windows and beetles at different points around a 120° arc from the release site. On a casual look on the roadside on the way out of the property, 750m from the release site, the observing team found beetles and larvae along the fence line and roadside grasses.

Another site, the 'first release' site in Southland in December 2007, has always been promising with beetles, larvae and eggs found at almost every visit. It was here again eating lunch in the car park some 0.8-1.0kms from the release site that we found three mating pairs on one scotch thistle plant. As well as good population numbers, the farmer here reports a 50% reduction in thistles in a three year period.

The most remarkable report of the distance travelled by the beetles is from the Wanaka area. The March 2010 release site is now devoid of thistles (95% gone) and the windows-feeding evidence has been seen 300m in one direction, and also 2.7kms and approx 5kms up the particular valley. The situation at this site, we believe, defies current explanation.

## **The 'best sites' for the beetles**

We considered a variety of factors that could have supported the best 'nursery' conditions for the beetles to progress well. It was clear that heavy grazing over winter did not have good outcomes, yet this was not tested on many sites. We did not establish any relationship between the sites' micro-

climatic conditions or altitude or prevailing wind directions and the windows or beetles' observations or the level of thistle reduction.

Because of the apparent spectacular success at the site near Wanaka, we did wonder if high country conditions suited the beetles really well, being similar to the conditions in the host range of *Cassida rubiginosa* in Southern Germany and Switzerland.

We did notice a strong relationship in Otago between sites that had trees (forest, plantation or shelterbelt) nearby (approx. 30m) and the 'loss of thistles' estimation. 83% of sites with the trees nearby had a thistle reduction estimated at 'significant' or 'extensive' compared to 76% overall for Otago. Perhaps more noticeably, on the 12 visits that beetles, larvae or eggs were seen, 10 of them were on sites with the trees nearby. That is, 83% of successful observations of beetles were on the 43% of the site visits to 'trees nearby' sites.

### **The questions without answers yet**

Why could we not see any evidence of the beetles, eggs or larvae themselves, especially where we saw significant feeding damage? What is the nature of the beetles' daily habits?

What is happening to the thistles in the field when minor feeding appears to be associated with a thistle population collapse? If the answer to this question could be found and replicated, there would be huge benefits for all farmers.

What is the explanation for the inconsistency about how far are the beetles travelling from the release sites? On 5 of the available 27 sites in Otago on the second summer's monitoring, beetle feeding evidence was observed at least 200m or more away from the release site. Then again, the 'best' site in Otago in the 2011-12 searches, with beetles, larvae and eggs too numerous to count, was actually under pine trees still at the release site. They mostly hadn't moved more than 30m in 5 years!

We suggest we also need to know more about the beetles reproductive actions and cycle. How easy is it for them to find a mate – especially where there has been wide dispersal?

How do the early summer and early autumn releases compare? Most of our releases were, in fact, late summer or early autumn ones. There probably isn't a large enough sample, but the three sites where we have seen the most significant numbers of beetles at all stages are from the early summer releases. Of the 9 sites which report extensive or virtually complete thistle reduction, three are from spring releases (that's 33% from 13% of the total releases).

What has caused the browning and deterioration of the younger and lower thistle leaves which we observed from early summer onwards? Is this age or have they been infected with a fungus or pathogen? Does this deterioration destroy signs of spring thistle leaf feeding?

Are the beetles acting as a conduit to fungal pathogens, perhaps the rust fungus *Puccinia punctiformis* or *Sclerotinia sclerotiorum*, and helping to weaken emerging plants? Is this a possible explanation for the general reduction of thistles at release sites? Much more science enquiry is required here.



## Finding the green thistle beetle – what to look out for?



Green thistle beetle eggs  
(often on underside of leaves)  
Photo: Jesse Blythell



Green thistle beetle larvae (near fingers)  
and extensive leaf damage



Green thistle beetle larvae & frass  
(black camouflage on back)  
Photo: Jesse Blythell



Green thistle beetle's mating  
(near Waitati January 2012)



The tell-tale 'windows' feeding of the Green thistle beetle only  
(near Lawrence December 2012)



Green thistle beetle - *Cassida rubiginosa* (6-7.5mm in length)

### Next steps? – more study of this promising agent

There is now a need to put some scientific endeavour behind making sure this promising start to the beetles' occupation of thistle populations results in the best possible outcomes for farmers. It would be careless for us to abandon this agent to the chances of nature just yet, just at the point that a little more support might confirm its success.

There is now a need for a quantitative ecological study of this agent and its impact on Californian thistle populations so that it may be managed for the best results throughout New Zealand, and in particular, in hill country pastures where the terrain and costs preclude other approaches.

Malcolm Deverson, Projects Manager  
19 August 2013

### Further reading about this project

The **Sustainable Farming Fund Final Report on L11/172** will be on the website soon: search at <http://www.mpi.govt.nz/environment-natural-resources/funding-programmes/sustainable-farming-fund/sustainable-farming-fund-search.aspx>

A PDF document with thistle beetle damage photos – before & after pictures – has been attached to the above report.

**“Report on observations during SFF project L11-172 ‘Green thistle beetle monitoring to spread the bio-control attack on Californian thistles’ (July 2011-June2013)”** - Malcolm Deverson, Projects Manager, Clutha Agricultural Development Board, August 2013

**FITT Final Report (11FT09)** – report on the project for co-funding partner Beef + Lamb New Zealand

This **“The beetles may be winning”** report has been assembled from the above three reports for a farming and general public audience.

Landcare Research's bulletin 'Green Thistle Beetle' from their Biological Control of Weeds booklet is at: [http://www.landcareresearch.co.nz/\\_data/assets/pdf\\_file/0014/20552/Green\\_Thistle\\_Beetle.pdf](http://www.landcareresearch.co.nz/_data/assets/pdf_file/0014/20552/Green_Thistle_Beetle.pdf)  
Although we suggest there will be few opportunities just yet for the capture and movement of thistle beetles as described in this bulletin.

**Also:** the Clutha Ag. Board has a considerable amount of further information and photos from each site. This is all available for further scientific enquiry on request.