

# What's New In Biological Control Of Weeds?

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**Landcare Research**  
**Manaaki Whenua**

## Introducing Ronny and Stan

### Ronny Groenteman

Originally from Israel, Ronny Groenteman started with us as a PhD student in 2005. She recently completed her thesis on thistles, looking at the effectiveness of the three nodding thistle biocontrol agents and how they interact. For her findings on nodding thistle crown weevil (*Trichosirocalus horridus*) taxonomy see *Crown Weevil Identity Crisis*, page 3. On completing her PhD, Ronny's first priority was catching up on sleep! Having done that, she enjoyed a holiday spent tramping and reading. Now she is keen to get back to unravelling biocontrol mysteries, and we are pleased that she will stay with us as a postdoctoral researcher for another two years, based at Lincoln.

In her new role Ronny will be looking at biocontrol of St John's wort (*Hypericum perforatum*). The St John's wort biocontrol

programme is considered a success story in New Zealand, as the plant is no longer the problem it once was. The first agent, the lesser St John's wort beetle (*Chrysolina hyperici*), was introduced in 1943, and while some host-specificity testing was done in Australia beforehand, none was conducted here. Also no native *Hypericum* species from Australia or New Zealand were tested. Ronny's work will involve retesting the host-specificity of this agent to see if the results meet present-day criteria and whether we would still introduce it now. "Our native *Hypericum* species are quite uncommon, but whether this is because of non-target attack by biocontrol agents, competition with other plants (including St John's wort), or other factors, such as mammalian browsing and habitat changes, remains in question," said Ronny. She will start her work by checking herbarium records for the locations of native species and visiting them to see if she can find plants and/or beetles.

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Ronny measuring thistles during her PhD project.

Ronny is currently on the look out for field sites to collect St John's wort beetles (*Chrysolina* spp.) and would appreciate your help. If you have seen the beetles on St. John's wort this autumn, or in previous recent years, please contact Ronny at groentemanr@landcareresearch.co.nz or Ph 03 321 9904.

### Stanley Bellgard

With the departure of Nick Waipara we have recently appointed an Australian, Stanley Bellgard, to join our team. Stan is based at our Auckland office and will work alongside Sarah Dodd to provide plant pathology expertise. In particular Stan will take responsibility for pathogen work related to alligator weed (*Alternanthera philoxeroides*), Darwin's barberry (*Berberis darwinii*), lantana (*Lantana camara*), moth plant (*Araujia sericifera*), pampas (*Cortaderia* spp.), and wild ginger (*Hedychium* spp.). Sarah will look after any pathogen work related to boneseed (*Chrysanthemoides monilifera monilifera*), climbing asparagus (*Asparagus scandens*), Japanese honeysuckle (*Lonicera japonica*), old man's beard (*Clematis vitalba*), and tradescantia (*Tradescantia fluminensis*).

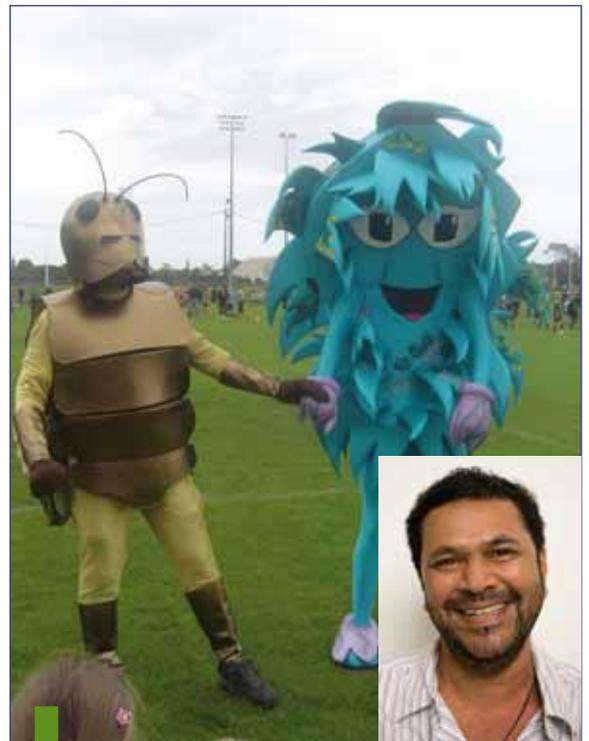
Stan comes to us with a wide range of pathology experience. Most recently he was working as an environmental consultant for RioTinto Alcan, a mining company in Australia. He was the principal ecologist there and specialised in environmental compliance which involved developing hygiene practices for their operations to limit the spread of soil

and plant pests and diseases. He also collected baseline data on the vegetation at the mining sites and identified threatened plants in the area. Stan has been involved in the environmental impact assessment and project management of major gas, infrastructure and mining developments in several Australian states.

Prior to this Stan worked for four years as a senior plant pathologist for the Northern Territory Government. In this role he provided diagnostic crop plant pathology services for growers of everything from asparagus to zucchini, and worked a lot with cotton.

He was also involved in assessing weed biocontrol programmes targeting environmental weeds such as broom weed (*Sida* spp.), and he undertook surveys of diseases affecting native *Hibiscus*, and their mycorrhizas.

Arbuscular mycorrhizal fungi are a particular interest of Stan's; these are fungi which live in the soil in symbiotic relationships with plant roots. For his PhD at the University of Wollongong he studied the impacts of soil disturbance on these fungi and their role in post-mining revegetation, and later looked at their density and diversity in wheat as an OECD-post-doctoral fellow at the University of Wyoming, in the USA.



Stan dressed up as a weta for Bioblitz.

Stan has also worked on *Phytophthora*-mediated dieback: "I was very interested to hear that a new, undescribed, *Phytophthora* species has been found causing collar rot in kauri in New Zealand."

Part of what attracted Stan to New Zealand is the fishing and he has visited several times for this and work reasons. Another outdoor activity he enjoys is surfing and he is a good cook, particularly of Indian food. Stan also plays the guitar and was part of a duo called "Core" who released an original album and have toured the Sunshine Coast of south-eastern Queensland. Stan is also a keen bird-watcher and looks forward to visiting offshore islands to see some "real" kiwis.

## Upcoming Weeds Workshop

On 12 June we are holding a one-day weeds workshop at Tamaki, Auckland, focusing especially on new developments in biocontrol projects of interest to northern New Zealand. The workshop is free of charge. If you would like to attend please contact Lynley Hayes (hayesl@landcareresearch.co.nz, Ph 03 321 9694). Hope to see you there.

## Crown Weevil Identity Crisis

Back in May 2006 we asked for your help because there was some uncertainty about what species of crown weevil we have attacking thistles in New Zealand. The weevil imported into New Zealand in the 1980s to attack mainly nodding thistle (*Carduus nutans*) was believed to be *Trichosirocalus horridus*, and in the 1990s, we sent some of our weevils to Australia. However, while the weevils attack Scotch thistle (*Cirsium vulgare*) and cotton thistle (*Onopordum acanthium*) quite happily here, the progeny of the weevils we sent to Australia do not. Also, crown weevils imported to Australia from Spain appeared to have a different host preference altogether. Our Australian colleagues sent samples to weevil experts in Spain who decided that "*T. horridus*" was in fact a species complex that should be split into three species: *T. horridus* (a *Cirsium* specialist), *T. mortadelo* (a *Carduus* specialist), and *T. briesei* (an *Onopordum* specialist). The weevil Australia had gotten from us was decreed to be *T. mortadelo*. The weevil's performance has been variable in New Zealand, and there was now a possibility that we had released a *Cirsium* specialist on *Carduus*. So it was time to take another look at what species we have established

on various thistle species here. We thank all of you who responded to our call and collected crown weevils and sent them in to us (we received weevils from 51 sites in eight regions). Now we can tell you what we found out.

Ronny Groenteman undertook the painstaking task, as part of her PhD, of dissecting 774 tiny weevils and examining their genitalia under a microscope. "All of the weevils keyed out to *T. horridus*," explained Ronny. As expected from pre-revision knowledge, our weevils were happily attacking *Carduus*, *Cirsium* and *Onopordum* thistles, with *Carduus* the most favoured of the three. This is quite contradictory to the species revision, which stated that *T. horridus* would prefer *Cirsium* and not attack *Onopordum*. Ronny also ruled out the possibility that more than one species was released in New Zealand and had since died out. She examined specimens collected for a Lincoln University Masters thesis in 1990. These were from the original release site near Ashburton, which was the source of all subsequent releases supplied by the DSIR and later Landcare Research, and they too were all *T. horridus*.

An Australian weevil expert has since looked at New Zealand and Australian crown weevil specimens and has concluded that they are the same species. They were more similar to the description given for *T. horridus* than for *T. mortadelo*. At this point, without a lot more further study of weevils from Australia and their native range, it is impossible to know if the species revision is in fact correct or leading us astray. Some species naturally exhibit considerable variation, which can confuse even the experts. It is possible for distinct populations within a species to have slightly different host preferences, such as English and Portuguese populations of the gorse pod moth (*Cydia succedana*). "So for the time being we should stick with the name *T. horridus* for our weevils," recommended Ronny. We also cannot explain the reason for the difference in behaviour of the weevils in New Zealand and Australia, but it could be due to subtle differences in the thistles themselves. Again considerable study would be needed to get to the bottom of this.

*This project was funded by the Foundation for Research, Science and Technology under the Outsmarting Weeds Project.*



Nodding thistle crown weevil adult negotiating a Scotch thistle.



## Declaring Mycological Warfare on Californian Thistle

In addition to work done by Landcare Research to develop a classical biological control programme for Californian thistle (*Cirsium arvense*), AgResearch scientists Bob Skipp and Graeme Bourdôt are exploring another way to beat this persistent prickly pest. Their complementary approach focuses on identifying fungal pathogens that occur naturally in New Zealand and attempting to develop them into mycoherbicides.

The pathogen that they identified back in the early 1990s as a potential mycoherbicide candidate, *Sclerotinia sclerotiorum*, has not yet made it through to becoming a commercially available product. While this fungus is highly damaging to the thistle, finding a cost-effective formulation remains a stumbling block and the project is currently "sitting on the back burner".

A country-wide survey to identify other potential candidates began in 2005/06, funded by Meat and Wool NZ. This survey of about 150 farms was prompted by the difficulties with *Sclerotinia* and the hopes that a more easily manipulated pathogen, and possibly even one that attacks the

thistle's roots, may exist. The survey did uncover some pathogens of interest.

"One of the fungi we found may be responsible for the anecdotal evidence that mowing Californian thistle in the rain leads to its demise," revealed Graeme. The AgResearch team has revisited some of the surveyed farms this autumn to seek the help of the farmers with a field trial. We have asked these farmers to mow an area of the thistle in the rain and another area when it is dry, while leaving a third patch unmown. Estimates of the ground cover of the thistle and samples of stems and roots taken before and after the mowing will confirm whether mowing in the rain does bring about the demise of the thistles, and also determine the role that the pathogen plays in this.

Back in the lab the AgResearch team are also investigating the biocontrol potential of over 30 other fungi and bacteria found in leaf, stem or root tissues collected during the survey. One of these fungi is of particular interest because it is easily cultured,

and its spores infect the thistle without the need for added nutrients. These two characteristics are highly desirable for mycoherbicide development, and AgResearch scientists are now studying this promising fungus in detail.

Contact: Graeme Bourdôt (graeme.bourdôt@agresearch.co.nz).



A thistle that yielded the fungus believed to be responsible for the thistle's demise when mown in the rain.

## Canada Leads the Way

Recently we hosted a visit from Karen Bailey of Agri-Food and Agriculture Canada's Saskatoon Research Centre. Karen is part of a team of eight scientists involved in developing bioherbicides for weeds. Other large teams are working just as hard to produce bioinsecticides and biofungicides.

Research to develop alternatives to synthetic pest control products is very strong in Canada for a variety of reasons. As well as the problem that satisfactory

herbicide solutions are not available for all weeds, and some weeds are increasingly developing resistance, there has also been a shift in public attitudes towards the use of synthetic pest control products. People are increasingly uncomfortable with the use of such products and more of them want to be able to produce or purchase organic food. As a result legislation is now in place that has restricted the use of herbicides – for example, they may not be used in urban areas and products are being

re-evaluated and often subsequently banned from use.

The Saskatoon team is highly experienced at overcoming the typical problems that scientists face when attempting to develop bioherbicides, such as developing a suitable formulation, and we are hoping we can collaborate with them more in the future so that the dream of having a commercially available bioherbicide for a weed in New Zealand can finally become a reality.

## Blackberry To Come under Additional Strain

Have you ever been left battered and bloodied after an encounter with a clump of blackberry (*Rubus fruticosus* agg.) and wanted to get your own back? Hundreds of land managers in Australia are now being given the opportunity to do just that. Eight additional strains of the blackberry rust (*Phragmidium violaceum*) have recently been imported from Europe into Australia and are being released in an attempt to improve biological control of this beastly bramble.

Just to refresh your memory, blackberry rust first appeared in New Zealand in 1990, 6 years after illegal releases of unknown strains were made in Australia and one year before the officially sanctioned (F15) strain was released there. The rust has provided useful control of blackberry in some areas of Australia, but work by pathologist Kathy Evans (University of Tasmania) and colleagues has revealed that its effectiveness has been limited due to the resistance of some blackberry taxa. After identifying which blackberry taxa and rust strains were present in Australia they set about finding new strains that would specifically attack the resistant blackberries. They used a clever method where they planted resistant Australian blackberry plants in a "trap garden" at the CSIRO European Laboratory in Montpellier, France. Eight strains of blackberry rust subsequently attacked these "trap" plants and were imported into Australia for host range testing. Approval to release them was obtained in 2004.

In order to ensure the new rust strains can be released quickly in all areas where they are needed the community is being roped in to help. More than 460 "expression of interest" forms were distributed to land managers across Australia in order to find suitable sites to release the new strains.

Experimental plots have been set up at some release sites to allow monitoring of establishment, persistence and impact. "Impact will be measured using fungicide to exclude the rust from half the plots," explained Louise Morin of CSIRO.

In spring 2006 the first release kits were sent out to land managers so that they could make their own releases. Kits include guidelines for collecting blackberry "voucher" specimens when the weed is flowering. These are to be sent back to CSIRO so that the inoculated blackberry plants can be identified and a national map showing the distribution of the various blackberry taxa can be generated. Over 150 releases have been made to date and these are scheduled to continue until autumn 2009.

Microsatellite DNA markers have been developed so that the establishment and persistence of each of the additional rust strains can be tracked. These markers should also make it possible to determine

which, if any, of the new strains make it across the Tasman to New Zealand. The arrival of new strains would likely be welcomed by land managers here, as many of the blackberry taxa here (we have 22 naturalised species and hybrids) are similarly resistant to the strain that self-introduced here, and the plant continues to be a difficult and expensive weed to control.

There is just one possible downside to this gift horse. Several New Zealand native *Rubus* species were tested against a pool of 15 isolates of the rust before the first official strain was introduced to Australia, and were found to be possibly at risk of attack. Such testing done under optimal conditions often overestimates what really happens in the field, and subsequent non-target surveys here only found one instance of very minor attack on bush lawyer (*Rubus cissoides*) (see *No surprise that Aussie Rust Misbehaves*, Issue 32). "It is possible that the increased genetic diversity provided



Don Gomez (CSIRO) releasing new blackberry rust strains in Tumut in November 2006.

by additional blackberry rust strains could slightly increase the risk to our native *Rubus* species," cautioned Jane Barton. However, when all things are considered the benefits of improved control of blackberry would appear to outweigh this minor risk. Commercially cultivated species appear to be totally in the clear.

We would be very interested to hear from you if you find native *Rubus* plants that appear to be attacked by blackberry rust or notice blackberry suddenly being attacked in areas where you have not seen the rust before (please email Jane at [jane.barton@ihug.co.nz](mailto:jane.barton@ihug.co.nz)). Autumn is an ideal time to look. Other rusts attack

native and exotic *Rubus* so check the box below for tips on how to recognise them.

*Thanks to Louise Morin for providing information for this story. For further information see: [www.ento.csiro.au/weeds/blackberry/project.html](http://www.ento.csiro.au/weeds/blackberry/project.html). Jane Barton is a contractor to Landcare Research.*

### Rusts on Exotic and Native *Rubus* species

Blackberry cane and leaf rust (*Kuehneola uredinis*) has small, closely spaced, lemony-yellow-coloured spore pustules. Blackberry rust (*Phragmidium violaceum*) pustules are usually larger, further apart, and yellowy-orange in colour. Blackberry rust also produces distinctive pustules of black spores on the underside of the leaves towards the end of the growing season, and blackberry cane and leaf rust does not. Blackberry rust causes distinctive purplish-brown spots on the upper surface of the leaves that correspond with pustules on the underside. Blackberry cane and leaf rust does not do this although areas of discolouration may occasionally be present. Septoria leaf spot (*Septoria rubi*) also causes similar purplish-brown spots on the leaves, but they never have corresponding pustules underneath. Another rust (*Hamasporea australis*), which is common on native *Rubus* species here, causes reddish-purple spots on the upper surface of leaves, but is easy to identify because it often produces characteristic "horns" of spores that stick out from the spots on the undersides of leaves.

## Things To Do This Winter

As most biocontrol agents hide away or become dormant during the next few months, winter is a quiet time of year. However, you can still:

- Check nodding thistle crown weevil (*Trichosirocalus horridus*) release sites. While some weevils lay eggs all year around, most begin to lay in the autumn and the damage they cause becomes most apparent later in the winter. Look for black frass in the crown and for leaves

that have lost their prickliness. Although nodding thistle (*Carduus nutans*) is the preferred host you may find that the beetles attack other species of thistles too, especially Scotch (*Cirsium vulgare*) and cotton (*Onopordum acanthium*) thistles. Crown weevil adults can often be successfully harvested and shifted around as late as June; to find them look carefully on the undersides of leaves.

- Shift ragwort flea beetles (*Longitarsus jacobaeae*) around, provided they are present 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: [hayesl@landcareresearch.co.nz](mailto:hayesl@landcareresearch.co.nz)).

## 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/research/biocons/weeds/](http://www.landcareresearch.co.nz/research/biocons/weeds/) and print out the following:

- Index
- Contact Information
- Nodding Thistle Divider
- Nodding Thistle Crown Weevil
- Nodding Thistle Gall Fly
- Nodding Thistle Receptacle Weevil
- Old Man's Beard Divider
- Old Man's Beard Fungus



## The Way We Were Part 2: Weeds in the 1920s

Last Christmas Lynley Hayes was given a book entitled *Weeds of New Zealand*, written in 1926 by a lecturer at Lincoln Agricultural College, Dr Frederick W. Hilgendorf (Lincoln University has a building named in his honour). The book offers a fascinating insight into the weeds causing trouble at that time and how people were advised to manage them. So much has changed and yet so much has stayed the same! The book focuses on agricultural and pastoral weeds, with environmental weeds barely rating a mention, and below are some excerpts we thought you might enjoy.

### Enforcement

"The Noxious Weeds Act of New Zealand declares that blackberry, sweetbriar, ragwort, and Californian thistle are 'noxious' everywhere in New Zealand (except where the local body in control decided to the contrary), and that owners of land must take reasonable steps to keep these weeds in check. The inspectors of the Agricultural Department are usually satisfied if the plants are kept from seeding so that spread from this cause is controlled, but in places where blackberry is at all bad even this amount of enforcement of the Act is impossible. The land worst infected is often waste land or on native reserves or in river-beds,

so that it is useless to attempt to enforce the law."

"...Besides these three weeds, a local body may declare practically any weed to be 'noxious' within the district under its control. Some counties have a list of 40 or 50 noxious weeds, any one of which may render its grower liable to prosecution, while a great number have no list at all. The chief weakness of this plan is that it allows A on one side of the road to grow thistles in profusion, and let their seeds scatter on every breeze, while B on the other side of the road will be prosecuted for growing a single thistle from A's seeds. The inspectors have been very reasonable in their administration of the Act, but it is now largely in abeyance."

### Blackberry (*Rubus fruticosus*)

"Occasionally called bramble, is commonest in the middle and south of the North Island, and on the west coast of Nelson. Of course it occurs nearly everywhere but in the districts mentioned it has in certain localities taken possession...Poisoning by spraying with arsenical preparations attracted a good deal of attention in about 1917, and produced some satisfactory results. Fungoid and insect parasites have at times promised cheap means of control,

but the inefficacy of all previously tried plans is evidenced by the fact that in May, 1925, the Government offered a reward of 10,000 pounds for an economic method of destroying blackberry."

### Broom (*Sarothamnus scoparius*)

"It was introduced as a hedge plant, and has become a weed under much the same circumstances as gorse. It is harder to eradicate than gorse, because it is tougher to cut with a grubber, and because it will not carry fire. On flat land it is a good plan to roll the broom with a heavy concrete roller behind a traction engine. This kills the plant, and then a fire can be run through it as a preparation for the swamp plough."

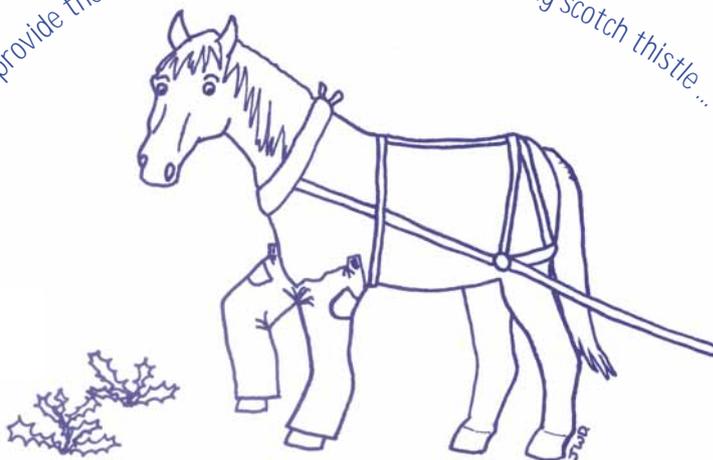
### Californian thistle (*Cirsium arvense*)

"Californian thistle is one of the most dreaded weeds in Zealand...On arable land there is only one reasonable method of treating the thistle, and that is to exterminate and eradicate it in one act. All other treatments are costly and ineffective. Perhaps the only way to secure the total death of the thistle is to prevent any green leaf reaching the surface for a whole growing season. If the leaves are allowed to appear they send nutriment down to the underground stems, which are therefore enabled to produce more leaves, and so on *ad infinitum*."

### Gorse (*Ulex europaeus*)

"This exceedingly common hedge plant has become a weed over much of the agricultural land of the South Island...If the land is worth it, gorse should be burnt and ploughed with a swamp plough, and the succeeding crops of seedlings ploughed in: or where ploughing is impossible the gorse must be grubbed by hand. Much gorse-covered county will, however, not pay for clearing and in

"... provide the near horse with trousers when mowing scotch thistle ..."



such places pines or other suitable fast growing trees should be planted. Thus a useless or actually injurious piece of land will be turned into a prospective source of revenue. Steep gullies, stony hill sides, river beds and so on, now wasted with gorse and broom, should all be planted, and the State Forest Service at Wellington is sure to recommend the most suitable trees and the best method of planting them. The complete success of this plan of destroying gorse has been demonstrated in scores of localities during the past few years.

Probably no more gorse is being sown in New Zealand nowadays, and on progressive farms many such fences are being done away with... 'Seedless' gorse was introduced to New Zealand some thirty years ago, but has never proved a success, though it persists as a weed in the Wairarapa."

#### **Horsetail (*Equisetum arvense*)**

"It has been recorded from Wanganui only, but its spread should be very jealously watched; it has underground stems of a twitchy nature, and judging from its great commonness in cultivated fields in pastures in England, it must be very difficult to control."

#### **Lantana (*Lantana camara*)**

"...is a shrub up to 10 ft in height that has proved very aggressive in Ceylon, the Pacific Islands, and Queensland, and so has occasioned some concern here. It does not seem to spread in New Zealand, however, but has remained confined to the neighbourhood of Hokianga Harbour."

#### **Nodding thistle (*Carduus nutans*)**

"Also called bastard Scotch thistle, is found in Auckland, South Canterbury and Otago."

#### **Pennyroyal (*Metha pulegium*)**

"Is one of the worst weeds in the North Island. The control of pennyroyal was investigated by Deem of Taranaki...He concludes that small patches should be sprayed during dry weather, when the plant is just coming into flower, with arsenic and soda, at the rate of 360 gallons per acre. He takes one pound of washing soda and one pound of white arsenic, and boils for 20 minutes, making this quantity up to 20 gallons when wanted for application."

#### **Ragwort (*Senecio jacobaea*)**

"Is found in many places in both island, but is most abundant in Southland and

Taranaki...The weed is very aggressive in some places, and in Southland is said to be reducing the carrying capacity of the land by 25 to 75%. The only method of combating it without cultivation is to stock hard with sheep before the flowering stalks shoot up in spring. Its matured parts, such as the dead stems and the seeds contain a substance that causes deterioration of the liver in horses and cattle, the so-called 'Winton disease'..."

#### **Scotch thistle (*Cirsium lanceolatum*)**

"There are many instances of weeds being much more troublesome here than in their native country. Some sixty years ago Scotch thistle was in this position, and the settlers of those days feared that the country would be completely overrun by it. But the virulence of the attack passed, and Scotch thistle is now no more troublesome here than it is at Home...On agricultural land it is usually grubbed out by hand in its first season, or sometimes mowed (the near horse being provided with trousers) just before it flowers."

#### **St John's Wort (*Hypericum perforatum*)**

"Not uncommon in waste places throughout both islands, and in Canterbury at least invading pastures and becoming a serious weed."

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