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Weed Biocontrol

WHAT'S NEW?

Contents

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COVER IMAGE:
Darwin's barberry rust fungus.

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A New Biocontrol Target for the Pacific?

Cordia alliodora, known as cordia or kotia in Tonga and Samoa, is increasingly recognised as an invasive weed of concern. Late last year the BSI weed biocontrol group began assessing whether this tree could be a suitable target for control. A feasibility study was prepared for the Secretariat of the Pacific Regional Environment Programme (SPREP) in response to rising concern in Tonga, but the scope covered all Pacific Island countries and territories.

Cordia is a large tree, native to Central and South America, introduced to the Pacific in the mid to late 20th century for forestry and agroforestry trials. Its tall, straight, self-pruning trunk makes it a valuable timber and attractive as shade tree in agriculture. However, harvesting in the Pacific has not kept up with the natural spread of the tree from the initial trial plots, and cordia is showing early signs of becoming a major problem.

The cordia invasion is a prime example of how climate change is going to affect weeds in the Pacific. In 2012 a Category 4 severe tropical cyclone, named Evan, tore through the Pacific destroying landscapes in Samoa, Wallis and Futuna, Fiji, and, to a lesser extent, Tonga. In its wake cordia flourished, filling the gaps created in the forest at a rapid pace that the native forest trees could not compete with. Thirteen years later cordia is dominating parts of Tonga's Toloa Rainforest Reserve and 'Eua National Park, and Samoa's Faleata Recreation Reserve.

Cordia's rapid growth, high propagule pressure, and ability to rapidly colonise and dominate open, full-sun spaces make it highly competitive, enabling it to capitalise on the destruction caused by severe weather and spread fast to create monocultures that block out other species. These traits are shared by several other problematic weeds in the Pacific, including African tulip tree (*Spathodea campanulata*) and falcataria (*Falcataria falcata*), which are currently being worked on by the BSI's weed biocontrol group. In Rarotonga, in the Cook Islands, African tulip tree's brilliant orange flowers are now a regular sight, signalling the extent to which the trees are filling the slopes of the inner mountains and valleys in dense groupings, while falcataria's umbrella-like canopy prominently juts out above the rest of the mountainside canopy.

As of 2024 African tulip tree and falcataria cover an estimated 1.6 % and 5.1% of the land area on Rarotonga, respectively. This might not sound like much, but, for example, despite its notoriety as one of New Zealand's worst invasive weeds, gorse covers only approximately 3.6% of New Zealand's land area, where it has been present for almost 200 years. African tulip tree was imported into Rarotonga approximately 100 years ago, and falcataria seeds were imported into Rarotonga in 1937. If these species are allowed to spread unchecked for another hundred years it could spell ecological disaster for Rarotonga.

With climate change it is expected that the intensity of cyclones will increase significantly. Severe cyclones can defoliate large areas of forest and cause landslides on mountain slopes, enabling more colonisation by weedy trees. Consequently, we can expect climate change to facilitate cordia becoming a dominant part of the landscapes in Tonga, Samoa, Vanuatu, and the Solomon Islands. Such large invasive trees can also become safety concerns. In 2014 tropical storm Iselle brought down thousands of trees onto homes, roads and powerlines in Hawaii, with falcataria accounting for 90% of fallen trees. This highlights the urgent need to find solutions for improved management of these weedy trees, including cordia.

Flowering cordia tree in Vanuatu.

At present cordia is being controlled manually in the Pacific through felling and chemical applications to kill the stumps. However, removing trees using these methods often creates large open areas in the canopy that are quickly reinvaded from seeds in the seed bank unless native species are actively replanted, increasing the labour and financial costs of effective control. Weed biocontrol is an attractive alternative: natural enemies could reduce the tree's competitive ability, slowing its rapid establishment and growth. It is a low-risk, cost-effective, and sustainable alternative to herbicides and does not pose health risks to handlers.

The feasibility study reviewed the international literature for host records of organisms that are reported to be natural enemies of cordia, and resulted in an initial checklist of 171 arthropods, 32 fungal genera, one bacterium, and two mistletoes. "Not all of these species are likely to be specialists," noted Dr Quentin Paynter, principal scientist in weed biocontrol based at the BSI Tamaki lab. "But the list is undoubtedly a fraction of the true number of natural enemies," he added, pointing out that published arthropod and plant pathogen host records are often incomplete.

From the list two promising natural enemies were identified, for which host records indicate they may be highly host specific: a tortoise beetle (*Coptocycla leprosa*) that feeds on the leaves, and a fungal pathogen (*Puccinia cordiae*) that causes a variety of symptoms, including leaf pustules, witch's broom, and canker. A moth (*Stauropides persimilis*) and a seed-feeding beetle (*Amblycerus atkinsoni*) may also be suitable candidates.

"*Cordia alliodora* is potentially a tricky target for biocontrol due to the presence of three *Cordia* species that are native to the Pacific region," said Quentin. However, the literature clearly indicates that *Puccinia cordiae* has been reported to only attack a handful of closely related species that belong to the *Gerascanthus* section of the *Sebestena* clade, which does not include the Pacific natives (*Cordia dichotoma*, *C. aspera*, and *C. subcordata*). Moreover, the tortoise beetle has been reported to only attack (and sometimes totally defoliate) cordia.

"We know that rust fungi and tortoise beetles can often be highly host specific," Quentin noted, adding that "this gives me confidence that we can find an agent that is both damaging and sufficiently host-specific, and who knows what else is out there waiting to be discovered by conducting surveys in the native range of cordia."

FURTHER READING

https://www.landcareresearch.co.nz/assets/Publications/Weed-biocontrol/Reports/Feasibility-of-using-natural-enemies-to-control-Cordia-SUMMARY.pdf?vid=6

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The Secretariat of the Pacific Regional Environment Programme (SPREP) administers the Pacific Regional Invasive Species Management Support Service (PRISMSS), and BSI is the PRISMSS partner that assists with the development of natural enemies for key widespread weeds. The feasibility study was an output of the GEF-6 Regional Invasives Project, funded by the Global Environment Facility, implemented by the United Nations Environment Programme and executed by SPREP. The project worked primarily in the Marshall Islands, Niue, Tonga, and Tuvalu, and has a regional component. Implementation of the GEF 6 RIP was supported by PRISMSS.

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Cordia seedlings in Tonga

A Rust for Darwin's Barberry

Gall with rust spores on Darwin's barberry.

In July 2025 the Environmental Protection Authority (EPA) approved the release of the Darwin's barberry rust fungus (*Puccinia berberidis-darwinii*) and the Darwin's barberry flower weevil (*Anthonomus kuscheli*) as biocontrol agents for the invasive shrub Darwin's barberry (*Berberis darwinii*). Approval for the flower weevil was first granted in 2012 but later lapsed. We had taken a wait-and-see approach, first monitoring the performance of the fruit-feeding weevil (*Berberidicola exaratus*) released in 2015, before deciding whether to introduce the flower weevil as well. Project funding for re-collection and release of the flower weevil has not yet been prioritised.

Darwin's barberry is a woody, evergreen shrub native to southern Chile and Argentina. Originally introduced to New Zealand as an ornamental because of its striking bright orange flowers, it has since become a serious invasive weed. The plant produces abundant berries that are readily eaten and spread by birds, forming new infestations. Once established, Darwin's barberry develops dense, spiny thickets that suppress native vegetation, restrict access, and can dominate large areas of forest margins and conservation land.

The development of the Darwin's barberry rust as a biocontrol agent has been a long and technically challenging process. In its native range the rust produces visible yellow to orange spores (aeciospores) only for a short period, typically from October to December, infecting both leaves and fruits. The rust was first imported into the Beever Plant Pathogen Containment Facility in Auckland in 2014 as dried specimens collected from multiple sites across southern Chile. These samples were used for molecular studies to confirm that only a single rust species is associated with Darwin's barberry, that rusts found on neighbouring barberry species are distinct, and that the rust is not related to known crop pathogens, including cereal rusts.

In June 2015 we received our first shipment of live rust into our Tamaki containment facility, supplied on detached leaves and on plants. Unfortunately, inoculations of plants in the facility did not result in infections, marking the beginning of a series of attempts to successfully infect Darwin's barberry with the rust to establish a laboratory culture.

A breakthrough finally came in 2017 when Lindsay Smith returned from Chile with rust-infected fruits. We realised that the number of spores contained in fruits was extremely high compared to leaves and more likely to result in infection. A small number of pustules developed, just enough to maintain the culture, although progress was slow as the rust can take around 90 days to produce new spores.

To enable host-range testing, further imports of infected fruit were required. Shipping plant material proved unreliable, with delays, loss of viability, and mould contamination. "Hand-carrying fruit from Chile turned out to be the most dependable method," said Chantal Probst, a researcher in plant pathology. In 2019 around 1,000 infected fruits were collected near Valdivia and used to begin host-range testing. This work was interrupted by Covid-19 travel restrictions and resumed only in 2022, once international travel became possible again.

An EPA application was submitted in February 2025, followed by a hearing in June. Approval to release the rust and the flower weevil was granted in July 2025. By this stage, extensive host-range testing had reduced the amount of rust available in containment. This shortage was exacerbated when ventilation fans in the containment facility failed during the summer of 2025, further slowing rust production.

"We didn't lose the culture, but rebuilding sufficient quantities in containment alone would have taken much longer than ideal," said Chantal. To ensure the rust would be ready for field release, senior technician Zane McGrath travelled to Chile in December 2025 to collect fresh infected material. This will allow sufficient rust to be available for the first planned releases in September 2026.

While collecting infected fruits in Chile, Zane and our collaborator, Dr Hernan Norambuena, observed leaf galls on Darwin's barberry that had not been recorded previously. These galls were formed by psyllids and, interestingly, were also infected by the rust fungus. The psyllids are likely to be host-specific and may represent a potential additional biocontrol agent. Further investigation would be needed, but this discovery highlights how ongoing exploration in a weed's native range can continue to uncover new opportunities for biological control.

This project is funded by the National Biocontrol Collective.

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Finding the Weevil in the Horsetail-Stack

Arnaud searching field horsetail for weevils.

The weed biocontrol team recently visited several release sites to check whether the field horsetail weevil (*Grypus equiseti*) has established. Signs of plant damage were detected back in 2023, but until now the agent itself had never been found at the field sites. This spring the team's efforts finally paid off: adults and eggs were found at all four monitored sites, confirming establishment.

Field horsetail (*Equisetum arvense*), which is native to Eurasia, has a limited distribution in New Zealand but can form major infestations in damp environments such as river margins, stream edges, poorly drained fields, and sandy and gravelly areas, including roadsides and rail tracks, where it can form pure stands outcompeting and excluding other vegetation. The plant grows an extensive root system made up of deep rhizomes and tubers, often reaching more than two metres underground. Common herbicides cannot penetrate deep enough to kill the entire root system, making it challenging and costly to control.

The plant spreads naturally via spores produced in early spring, which can travel long distances. Floodwaters and gravel movement have also contributed to its accidental spread, with the potential for much wider distribution. In the South Island, infestations of field horsetail can be found in Marlborough, Tasman, the West Coast, northern Canterbury, and Dunedin. In the North Island, isolated infestations have been recorded in Hawke's Bay, Gisborne, Taranaki, and Greater Wellington, and it has become well established and widespread in the Manawatū-Whanganui Region, particularly on the floodplains of the lower Rangitīkei River.

The field horsetail biocontrol journey started more than 18 years ago when Horizons Regional Council funded the BSI weed biocontrol group to investigate the feasibility of targeting field horsetail for biocontrol. Among the numerous natural enemies found in the native range of field horsetail, a stem-mining weevil stood out as the most promising. After gaining EPA approval for release, the weevil was introduced in Manawatū-Whanganui in 2017. Adult weevils feed on and lay their eggs in the stems of field horsetail by making distinctive oviposition holes. The larvae then tunnel down through the stem, killing all above-ground material before mining into the root system, reducing the plant's ability to regenerate the following season.

Mass-rearing the weevil was at first constrained by the physical stature of field horsetail stock plants. However, with significant improvements to the mass-rearing protocol more than 6,500 weevils have been released across multiple sites since 2017. Numbers ranged from a few hundred to more than 1,000 per site, but confirming establishment proved difficult. The weevil is small, the host plant is dense, and disturbance of horsetail plants causes adult weevils to drop instantly to the ground and enter thanatosis – a defensive immobility that can last several minutes. "Searching for them sometimes felt like trying to find a needle in a haystack," said Arnaud Cartier, senior technician, who has overseen the mass-rearing since 2020. "And when they drop and play dead, you often don't see them again, even in the rearing colony, so locating adults in the field proved particularly challenging."

In summer 2022/23, senior technician Paul Peterson visited all release sites, and although some damage looked consistent with weevil activity, there were no sightings of any life stage of the agent.

Fast forward to November 2025, when Arnaud, accompanied by biosecurity officer Robbie Sicely (Horizons Regional Council) and Paul, revisited several sites together, this time with conditions looking far more promising. "We were hoping the timing was finally right to catch the weevils red-handed," Arnaud explained. Before long the team noticed dead field horsetail stems and, sure enough, by gently dissecting them the search party found eggs in almost every single dead stem at all sites. Further, to their delight adult weevils were observed feeding, eliminating any remaining doubt: the weevil had indeed successfully established!

Although it is still too early to know the full impact the weevil will have on field horsetail, the team are optimistic. "If populations continue to build, we expect to see significant damage over time," Arnaud said. "This could really help reduce the size and vigour of infestations."

This project was funded by the National Biocontrol Collective and the Ministry for Primary Industries' Sustainable Farming Fund, administered by the Lower Rangitikei Horsetail Control Group. Mass rearing and releases are funded by Horizons Regional Council and Environment Canterbury.

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Surveying for Biocontrol Agents in a Weed's Native Range

The very first premeditated classical weed biocontrol programme was remarkably unsophisticated: 14 insect species collected by Albert Koebele in Mexico were released on lantana (*Lantana camara*) in Hawaii in 1902. Agent selection was based on Koebele's judgement and didn't even include host specificity testing. Most species Koebele released failed to establish or had only slight impacts, and four species that did establish attacked non-target plants. The discipline has advanced substantially since then!

Nowadays candidate agents must undergo host specificity testing to ensure environmental safety, and current best practice protocols have proven their predictive power over decades of safe introductions. But for a weed biocontrol programme to succeed agents must also be sufficiently damaging. Consequently, work to identify a weed's natural enemies and prioritise promising candidate agents for further study is arguably the most important stage of a biocontrol programme.

In 1970 Tony Wapshere, a researcher based at CSIRO in Australia, championed using meticulous ecological studies to assist the selection of effective agents. Wapshere described work on rush skeleton weed (*Chondrilla juncea*), for which data on weed density and natural enemy infestation levels in relation to climate and soil conditions were collected in both the native and invaded range of the weed. Many ensuing programmes followed this approach. For example, in the 1990s a large-scale study compared aspects of Scotch broom (*Cytisus scoparius*) ecology in its native (England, France) and introduced (Australia, New Zealand) ranges. Principal researcher Quentin Paynter, who took part in that study, noted that "It was very enlightening – we showed that successful seedling recruitment through existing broom stands was common in the introduced range, where plants produce bigger seeds, resulting in more competitive, shade-tolerant seedlings. Consequently, invasive broom populations were much more likely to persist for generations, unlike populations in the native range. Broom seed beetles preferentially attack large seeds – so a selection pressure for small seeds has now been reimposed with the establishment of the seed beetle throughout New Zealand."

Simon Fowler, another BSI principal researcher who worked on the broom project, noted that research funding only stretches to conducting native range ecological studies on a few focal species, such as broom and tradescantia. This might not be as bad for biocontrol as it sounds, because native range ecological studies are not a panacea. For example, in 1973 Peter Harris, a researcher based in Canada, noted that the multiplicity of species attacking a weed in its native range makes it difficult to distinguish the effects of each. "This was true for Scotch broom," said Simon, adding that "a classic long-term insecticide exclusion trial revealed natural enemies have a chronic but major long-term deleterious impact on the fecundity and longevity of broom plants in the UK, but the authors of the study could only speculate regarding which natural enemies were likely to be responsible."

Harris also noted that impacts in the introduced range are hard to predict because biocontrol agents will be introduced without the natural enemies that attack them in their native range.

However, although agents are introduced without parasitoids, some gain them in the introduced range. The likelihood that an agent will be attacked by specialist native parasitoids can now be reliably predicted according to the presence of 'native ecological analogues' (defined as a native species that belongs to the same superfamily as the agent and occupies a similar niche on the target weed). Agents that are attacked by parasitoids shared with native analogues have all failed to control target weeds in New Zealand. "Surveying target weeds in New Zealand to identify potential native analogues of candidate agents increases the odds of picking winners by winnowing out candidates that are likely to fail," said Quentin. "Moreover, guilds with concealed larvae are more likely to be regulated by specialist parasitoids and potentially benefit most from being released from parasitism in the introduced range."

A recent review of completed weed biocontrol programmes in New Zealand found that agents that were observed to be highly damaging (i.e. completely defoliating or killing plants, or reducing populations in the field) in the native range were almost invariably highly damaging in the introduced range. The review included a prototype scoring system to help prioritise candidate agents, as seen in the table below.

Although a simple tool to help select effective agents sounds compelling, the detective skills of a biocontrol researcher cannot be understated: some guilds (e.g. root-feeders) cause cryptic damage, and although agents that only damage reproductive structures rarely control a plant on their own, they should not be discounted entirely because they can enhance overall control in combination with other agents, and reduce weed invasion into new areas or reinvasion after conventional control.

Damaging agents may be overlooked if survey work is inadequate, but the efficiency of native range survey efforts is rarely scrutinised. CSIRO researchers working on a tropical wetland weed *Mimosa pigra*, noted that

Scoring system for prioritizing novel candidate agents. Predicted impact score = Potential specificity score (Score A) × (Potential damage score (Score B) + Guild score (Score C) + Analogue score (Score D)). Scores B-D are based on mean binomial impact scores for agents with those traits (agents that have "heavy", "medium", or "variable" impacts on host plants in NZ were scored 1, and agents that cause "slight" or "no impact" were scored 0). Score A is an additional weighting, promoting agents that are likely to be adequately host specific and penalising agents that are not.

Is the candidate agent likely to be host-specific?	Score A	Is the agent potentially damaging?	Score B	Guild	Score C	Is there an ecological analogue present?	Score D
Likely to be adequately host-specific, based on multiple host records, or results of extensive native range surveys	0.90	Yes, published information or native range surveys indicate it can be very damaging	0.92	Only attacks reproductive structures	0.00	No	0.42
Potentially host specific based on taxonomic considerations or a single host record	0.67	Unknown/insufficient information	0.33	All other guilds (defoliators, borers, piercing/sucking)	0.45	Yes, but agent is damaging in the native range, despite enemies	0.30
Unknown/insufficient information & or taxonomic uncertainty	0.50	Does not appear to be particularly damaging in native range	0.08			Yes, and the agent is not damaging in the native range	0.05
Unlikely to be host-specific based on taxonomic considerations or host records	0.05					Unknown	0.20
Host records or field surveys confirm it is not adequately specific	0.00						

746 collections were made at 277 localities throughout Mexico, the Caribbean, Central and South America. Despite this huge effort, most (11 of 12) insect agents that were eventually released in Australia were found in only 23 collections made at three sites in Mexico. They concluded that if researchers had conducted an early analysis of the results of the collections, then a decision to terminate the survey work could have been made earlier, freeing resources for other research, such as improved agent selection. "I think this study makes a valid point, that promising candidate agents are likely to be widespread and found quite quickly during native range surveys," said Quentin. Moreover, had this programme been conducted more recently, advances in genetic matching might have resulted in more targeted surveys. For weed species with large native ranges, genetic matching of native and invasive populations can ensure the target weed is surveyed in an appropriate region, maximising the chance that agents will be compatible with the invasive biotype, thereby cutting survey costs and greatly improving the chance of success.

Finally, the proliferation of easily accessible online data means that promising candidate agents can sometimes be identified without leaving the office, so feasibility studies conducted at the very start of a programme should include a thorough review of published literature on the natural enemies of the target weed.

Although ecological studies are no longer *de rigueur*, tools that have been developed should ensure candidate agents have a much higher chance of being effective than resorting to the much-derided 'lottery approach' of 'find them, screen them, release them', assuming that at least one ought to work!

Table of rankings for candidate arthropod agents for moth plant, prioritised according to the system (excluding species already rejected on the basis of confirmed host records indicating lack of specificity).

Rank	Potential candidate agent	Score A	Score B	Score C	Score D	Total Score
1	*Freudeita cupripennis*	0.90	0.92	0.45	0.42	1.61
2	*Araptus araujiae*	0.90	0.92	0.00	0.42	1.21
2=	*Anastrepha nigrotaenia*	0.90	0.92	0.00	0.42	1.21
4	*Pseudosphex noverca*	0.90	0.08	0.45	0.42	0.86
5=	*Naupactus* sp.	0.50	0.33	0.45	0.42	0.60
5=	*Eubule glyphica*	0.50	0.33	0.45	0.42	0.60
6	*Rhyssomatus diversicollis*	0.67	0.08	0.00	0.42	0.34
7	*Oncopeltus* spp.	0.05	0.92	0.45	0.42	0.09

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Autumn Activities

Gall-forming agents

Early autumn is the best time to check for many gall-forming agents.

- Check broom gall mite *(Aceria genistae)* sites for signs of galling. Very heavy galling, leading to the death of bushes, has been observed at many sites. Harvesting of galls is best undertaken from late spring to early summer, when predatory mites are less abundant.
- Check hieracium sites, and if you find large numbers of stolons galled by the hieracium gall wasp (*Aulacidea subterminalis*), you could harvest mature galls and release them at new sites. Look, also, for the range of deformities caused by the hieracium gall midge (*Macrolabis pilosellae*), but note that this agent is best redistributed by moving whole plants in the spring.
- Check nodding and Scotch thistle sites for gall flies (*Urophora solstitialis* and *U. stylata*). Look for fluffy or odd-looking flowerheads that feel lumpy and hard when squeezed. Collect infested flowerheads and put them in an onion or wire-mesh bag. At new release sites hang the bags on fences, and over winter the galls will rot down, allowing adult flies to emerge in the spring.
- Check Californian thistle gall fly (*Urophora cardui*) release sites for swollen deformities on the plants. Once these galls have browned off, they can be harvested and moved to new sites (where grazing animals will not be an issue), using the same technique as above.
- Look for swellings on giant reed (*Arundo donax*) stems caused by the giant reed gall wasps (*Tetramesa romana*). These look like small corn cobs on large, vigorous stems, or like broadened, deformed shoot tips when side shoots are attacked. Please let us know if you find any, since establishment is not yet confirmed.

Honshu white admiral (*Limenitis glorifica*)

- Look for the adult butterflies at release sites, for pale yellow eggs laid singly on the upper and lower surfaces of the leaves, and for the caterpillars. When small, the caterpillars are brown and found at the tips of leaves, where they construct pier-like extensions to the mid-rib. As they grow the caterpillars turn green, with spiky, brown, horn-like protrusions.
- Unless you find lots of caterpillars, don't consider harvesting and redistribution. You will need to aim to shift at least 1,000 caterpillars to start new sites. The butterflies are strong fliers and are likely to disperse quite rapidly without any assistance.

Privet lace bug *(Leptoypha hospita)*

- Examine the undersides of leaves for the adults and nymphs, especially leaves showing signs of bleaching.
- If large numbers are found, cut infested leaf material and put it in chilly bin or large paper rubbish bag, and tie or wedge this material into Chinese privet at new sites. Aim to shift at least 1,000 individuals to each new site.

Tradescantia leaf, stem and tip beetles *(Neolema ogloblini, Lema basicostata, N. abbreviata)*

- Look for the distinctive feeding damage and adults. For the leaf and tip beetles, look for the external-feeding larvae, which have a distinctive faecal shield on their backs.
- If you find them in good numbers, aim to collect and shift at least 100–200 beetles using a suction device or a small net. For stem beetles it might be easier to harvest infested material and wedge this into tradescantia at new sites (but make sure you have an exemption from MPI that allows you to do this).

Tradescantia yellow leaf spot fungus *(Kordyana brasiliensis)*

- Look for the distinctive yellow spots on the upper surface of the leaves, with corresponding white spots underneath, especially after wet, humid weather.
- The fungus is likely to disperse readily via spores on air currents. If human-assisted distribution is needed in the future, again you will need permission from MPI to propagate and transport tradescantia plants. These plants can then be put out at sites where the fungus is present until they show signs of infection, and then planted out at new sites.

Tutsan moth *(Lathronympha strigana)*

- Look for the small orange adults flying about flowering tutsan plants. They have a similar look and corkscrew flight pattern to the gorse pod moth (*Cydia succedana*). Look, also, for fruits infested with the larvae. Please let us know if you find any, as establishment is not yet confirmed.
- It will be too soon to consider harvesting and redistribution if you do find the moths.

Woolly nightshade lace bug *(Gargaphia decoris)*

- Check release sites by examining the undersides of leaves for the adults and nymphs, especially leaves showing signs of bleaching or black spotting around the margins.
- It is probably best to leave any harvesting until spring.

National Assessment Protocol

For those taking part in the National Assessment Protocol, summer is the appropriate time to check for establishment and/or assess population damage levels for the species listed in the table below. You can find out more information about the protocol and instructions for each agent at: www.landcareresearch.co.nz/weed-biocontrol

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Target	When	Agents
Broom	Dec–April	Broom gall mite (*Aceria genistae*)
Lantana	March–May	Leaf rust (*Prospodium tuberculatum*) Blister rust (*Puccinia lantanae*)
Privet	Feb–April	Lace bug (*Leptoypha hospita*)
Tradescantia	Nov–April Anytime	Leaf beetle (*Neolema ogloblini*) Stem beetle (*Lema basicostata*) Tip beetle (*Neolema abbreviata*) Yellow leaf spot fungus (*Kordyana brasiliensis*)
Woolly nightshade	Feb–April	Lace bug (*Gargaphia decoris*)