Te Uru Rākau New Zealand Forest Service

Native plant nursery pest and disease field guide

Te Kāwanatanga o Aotearoa
New Zealand Government

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About this guide

This field guide has been developed to help identify some of the insects and diseases that could be present when cultivating native plants. It includes examples of beneficial organisms and those not deemed to cause significant damage.

Information on plants that commonly host these organisms are intended as a guide and are not an exhaustive list of potential hosts. Space has been left in the guide to add your own notes and observations.

Scope of this guide

This guide provides a quick reference and is not a substitute for conducting additional research, independent advice or laboratory testing.

The guide does not provide commercial product recommendations for the treatment, control, or prevention of pests and diseases. It is recommended that you consult an agrichemical manual or check product labels for correct product selection and application rates.

Who this guide is for

This guide is for plant nurseries and mentions common nursery practices. However, this guide is also useful for anyone cultivating New Zealand native plants from seed, cuttings, division or other propagation methods.

Best practice recommendations

Regularly monitor crops for pests, diseases, and beneficial insects within your production operation. Keep records of what you observe and how you treat each of these.

If you discover a pest or disease, establish whether more investigation, testing, or treatment is needed. More information and templates for recording what you find are in the *Monitoring for pests and diseases* section of this guide.

Report unwanted organisms

If you suspect you have found an unwanted organism, please report it to the Ministry for Primary Industries (MPI) on **0800 80 99 66**. If possible, take photographs and collect samples.

Key

We've used icons to show whether an insect is a pest, beneficial, or neutral with little impact on native plants.

PEST **NEUTRAL** **BENEFICIAL**

Insects

This section is designed to help you identify potential insect pests and the damage they can cause. We have included examples of invasive species, beneficial insects, species that may look concerning, and those not deemed to cause significant damage.

Ant

Small brown bush ant

Southern ant

Description

In New Zealand, there are 39 species of ant. There are 11 native species, and the remainder are introduced. Most species in New Zealand are less than three millimetres long. The largest native species is about six millimetres long.

Ants live in colonies and behave as social insects. Usually, the colony is made up of one or more queens and many workers. The queens remain in the nest and lay eggs and workers take care of them. To effectively control ants, you need to kill the queens as they produce the eggs for the colony.

Ants prefer building their nests in warm, dry locations. Nests are usually found in the ground or inside buildings, decomposing logs, and underneath plant pots and pavers.

Worker ants are sent from the nest to search for and collect food. When food is located, they return to the nest and lay a pheromone scent trail to the food source. This allows other worker ants to follow the trail to the food source. Food is then gathered and returned to the nest and fed to the colony. This is why baiting programmes are effective in controlling ant nests.

Ants can be easily spread by human activity. In a nursery they can be spread in potting media, freight, vehicles, containerised plants, and production materials.

Symptoms and damage

Ants commonly form symbiotic relationships with sap-sucking insects such as aphids, scales, psyllids, mealybugs, whiteflies and leafhoppers. Ants "farm" these pests by protecting them from predators in exchange for the honeydew they secrete. They also feed on their eggs. Ants are known to move these pest insects from plant to plant, further spreading infestations.

Honeydew produced by sap-sucking insects can have a negative effect on plants by inhibiting photosynthesis, which can affect plant growth. It also provides a breeding ground for fungi including sooty mould.

Ants are known to carry away freshly planted seed to their nest.

Ant infestations can cause problems in homes and buildings. They can invade cupboards, sealed containers, electrical areas, wall cavities, clothing and bedding, and can contaminate food.

Prevention and control tips

- Baiting programmes are effective in controlling ant nests. Place bait near ant trails and regularly monitor and refresh bait. Application may be required for four to six weeks to ensure that new ants that hatch from eggs during that time can be treated.
- Investigate if ants are acting as predators or "farmers" of insect pests before deciding to use control measures.
- Control sap-sucking insects, for example, aphids and scales to eliminate the ants' food source.

Invasive ant species

Biosecurity New Zealand monitors for invasive ant species, such as fire ants.

Use your phone to scan the QR code to view a factsheet on the National Invasive Ants Programme.

Argentine ant

Photo: Elias Freyhof, some rights reserved (CC-BY)

Argentine ants

Description

An invasive species that established in Auckland in 1990. These ants are aggressive and territorial. Argentine ant nests cooperate with one another and are known for establishing super colonies. These super colonies can extend hundreds of metres and allow the ant population to grow to massive numbers.

Argentine ants pose a problem to native biodiversity. They compete with our native fauna for food resources such as nectar, pollen and seeds. They will kill other ants, insects and lizards, and may eat bird's eggs, newly hatched chicks and nesting birds. They may also raid beehives. They are known to bite humans but are not poisonous.

Argentine ants:

- are two to three millimetres long;
- are honey-brown in colour (most other ants seen in New Zealand are black);
- move quickly and with purpose on defined trails;
- have a greasy odour when crushed;
- are often observed climbing trees;
- are often seen moving in large, distinctive trails several ants wide on trees, paths, buildings and lawn edges;
- swarm from the ground in large numbers if disturbed.

Aphid

Tōtara aphid

Photo: Julia Palmer, some rights reserved (CC-BY)

Black fern aphid

Photo: Stephen Thorpe, some rights reserved (CC-BY)

Description

Aphids are a common insect pest with over 100 different species found in Aotearoa New Zealand. They are small, soft bodied, pear-shaped insects that usually grow two to four millimetres long. Aphids can be winged or wingless.

The colour of aphids can vary by species depending on time of year, and the plants they are feeding on. Common colour variations include yellow, green, black and white. They can also have a woolly appearance.

Many aphid species can reproduce without males, and most species give birth to live young. In warmer climates they can do this year-round. In cooler climates they overwinter by mating and laying eggs that hatch in spring.

Common native plant hosts

Scientific names	Māori/common names
Asplenium spp., *Blechnum* spp., *Cyathea* spp., *Dicksonia* spp.	Ferns, ponga, hen and chicken fern, whekīwhekī, whekīwhekī ponga, pikopiko, kiokio
Fuchsia spp.	Climbing, trailing or creeping fuchsia, tree fuchsia, kōtukutuku
Fuscospora spp.	Beech, nothofagus, tawhairauriki, tawhairaunui
Pittosporum spp.	Karo, tarata, lemonwood, kohukohu, black matipo, kōhūhū
Podocarpus tōtara	Tōtara
Veronica spp.	Hebe

Symptoms and damage

Aphids are sap-sucking insects that can spread diseases and viruses, and stress or weaken plants. They like to feed on the soft new shoots or growing tips of plants and will often cluster on new growth.

Aphid damage to plant foliage can include wilting and distortion of leaves and new shoots.

Aphids excrete honeydew, which ants and wasps feed on. Honeydew can have a negative effect on plants by inhibiting photosynthesis, which can affect plant growth. It also provides a breeding ground for fungi including sooty mould.

Prevention and control tips

- Biological control organisms.
- Chemical insecticides.
- Neem.
- Organic pyrethrum.
- Plant soap.
- Spray oil.

Natural predators

- Earwigs.
- Hoverflies.
- Lacewings.
- Ladybirds.
- Parasitic wasps.
- Spiders.
- Wasps.

Bronze beetle (flea beetle)

Bronze beetle

Photo: Lee Harris, MPI

Description

Small oval-shaped beetles that grow three to five millimetres long. Beetles are shiny brown or black in colour. Larvae live underground and feed on grass and clover roots.

If alarmed, the beetles can quickly jump off plants, which is why they are often referred to as "flea beetles".

Common native plant hosts

Broad range of potential native plant hosts including native broad leaf and coniferous trees.

Symptoms and damage

A minor pest for natives but in large numbers cause shot hole damage to leaves and eat new shoots and flower buds. Known to be a pest in orchards. Bronze beetle larvae (grass grub) are a significant pasture pest.

Adults feed at night leaving random shot holes in leaves and causing damage to leaf edges. Feeding can also cause damage to developing fruit.

Prevention and control tips

- Chemical insecticides.
- Soil treatments.

Brown marmorated stink bug

Brown marmorated stink bug

Description

The brown marmorated stink bug (BMSB) is designated an unwanted organism in Aotearoa New Zealand. The BMSB is an agricultural, horticultural and social pest. It is native to Asia and has spread throughout North America and Europe. It isn't established in Aotearoa New Zealand but has been caught at our border many times.

The BMSB feeds on more than 300 plant species. If established in Aotearoa New Zealand, it could decimate our fruit and vegetable industries.

During autumn and winter, thousands of bugs can enter houses to shelter from the cold. When they are disturbed, they release a foul-smelling liquid, which can make your house hard to live in.

Adult BMSBs are a brown "shield" shape and about the size of a 10-cent coin. The easiest way to identify them is from the white bands on their antennae and alternating black and white markings on their abdomens. BMSBs have an underside that is white or tan in colour. BMSB eggs are light green, shaped like barrels, and are usually in clusters of 20 to 30.

What to do if you find a stink bug

If you think you've found a BMSB:

- don't kill it;
- catch it;
- take a photo;
- call Biosecurity New Zealand immediately on **0800 80 99 66** or submit a report using the online form: **report.mpi.govt.nz/pest**

More information

Use your phone to scan the QR code to view the Biosecurity New Zealand factsheet about brown marmorated stink bugs.

Brown shield bug (Dictyotus caenosus). Approx 10mm long
Present in New Zealand

Pittosporum shield bug (Monteithiella humeralis). Approx 9.6mm long
Present in New Zealand

Brown soldier bug (Cermatulus nasalis). Approx 15mm long
Present in New Zealand

Brown form of Green Vegetable bug (Nezara viridula). Approx 17mm long
Present in New Zealand

Brown marmorated stink bug (Halyomorpha halys). Approx 17mm long
NOT Present in New Zealand

Yellow spotted stink bug (Erthesina fullo). Approx 23mm long
NOT Present in New Zealand

Photos: Ministry for Primary Industries

How can I identify BMSB?

There are currently other species of stink bugs found in New Zealand that could be confused with the Brown Marmorated Stink Bug (BMSB).

Key distinguishing features of the adult BMSB are:

- its size (14–17mm);
- white banding on the antennae;
- alternate black and white markings on the abdomen.

CATCH IT SNAP IT REPORT IT

0800 80 99 66

Brown soldier bug

Brown soldier bug

Brown soldier bug eggs and nymphs

Photos: Lee Harris, MPI

Description

Brown soldier bugs are a species of predatory shield bug that grow to about 12.5 millimetres long. They are orange, brown to dark brown in colour with black markings. Nymphs are black with a white or yellow patch. They hatch from black or dark coloured eggs.

Benefits

Brown soldier bugs feed on a variety of living prey and are often seen eating caterpillars.

Cabbage tree mealybug

Cabbage tree mealybug

Photos: Lee Harris, MPI

Description

Cabbage tree mealybugs are small flat-bodied insects that live at the base of cabbage tree leaves. The adult female is oval shaped and about four millimetres long and two millimetres wide. Males are smaller in size, about two millimetres long and have wings. The body of a mealybug is orange-pink, and covered with a powdery white wax, which the bug produces. Mealybugs also cover the areas they live in with the white wax, which assists with visual detection.

Common native plant hosts

Scientific names	Māori/common names
Cordyline spp.	Tī kōuka, cabbage tree, tī

Symptoms and damage

Cabbage tree mealybugs are sucking insects that excrete honeydew. High levels of infestation can cause severe damage and even death of young plants.

Prevention and control tips

- Biological control organisms.
- Chemical insecticides.
- Insect growth regulators.
- Plant soap.
- Spray oil.

Natural predators

- Lacewings.
- Ladybirds.
- Parasitoid wasps.

Cabbage tree moth

Cabbage tree moth

Caterpillar of the cabbage tree moth

Photos: Lee Harris, MPI

Description

Cabbage tree moths have a wingspan of about 40 millimetres. They are pale brown and camouflage themselves by carefully aligning with the veins on dead cabbage tree leaves. They can also be found hiding amongst dead foliage hanging from established cabbage trees. Adult moths play a role in pollinating cabbage tree flowers.

Caterpillars are green and are well concealed against live cabbage tree foliage. When they are fully grown, they are about 25 millimetres long. Young caterpillars feed on unopened cabbage tree leaves and their damage may not be visible until the leaf unfurls.

Small caterpillars chew grooves along the leaf surface causing leaf scarring while larger caterpillars chew holes and notches in leaves.

Common native plant hosts

Scientific names	Māori/common names
Cordyline spp.	Tī kōuka, cabbage tree, tī

Symptoms and damage

Cabbage tree moths are nocturnal. Feeding activity creates holes and notches in cabbage tree leaves. Caterpillars feed on young unopened leaves of cabbage trees but plants can tolerate significant leaf loss. Damage is mainly aesthetic.

Cabbage tree damage

Heavy infestation of caterpillars on cabbage tree

Photos: Lee Harris, MPI

Prevention and control tips

- Cabbage tree moths don't usually require control, but treatment may be needed in the case of heavy infestation in small young plants.
- Caterpillars live and feed between young leaves which makes them difficult to target using contact insecticides. Apply insecticides in the evening when caterpillars are more likely to leave protection to feed.
- *Bacillus thuringiensis*.

Natural predators

The following are known to feed on cabbage tree moth caterpillars:

- birds;
- brown soldier bugs;
- hoverflies;
- parasitoid flies;
- parasitoid wasps.

Cabbage tree scale

Photo: Royal New Zealand Institute of Horticulture

Cabbage tree scales

Description

Cabbage tree scales are small sap-sucking insects usually found on cabbage tree leaves in large numbers. They are white and have an elongated shape.

Common native plant hosts

Scientific names	Māori/common names
Cordyline spp.	Tī kōuka, cabbage tree, tī

Symptoms and damage

Feeding damage includes:

- stunted growth;
- leaf damage;
- leaf yellowing;
- sooty mould;
- plant stress.

Prevention and control tips

- Biological control organisms.
- Chemical insecticides.
- Insect growth regulators.
- Plant soap.
- Spray oil.

Natural predators

- Lacewings.
- Ladybirds.
- Parasitoid wasps.

Common bag moth

Variations of mobile silk bags

Photos: Lee Harris, MPI

Description

Common bag moth caterpillars are black or brown with a white speckled head or thorax and can grow up to 80mm long. Bag moth caterpillars live in mobile silk bags that hang from the trees and shrubs they eat. The bag is formed by the caterpillar, which spins a strong silk around itself incorporating twigs, bark, and vegetation from its plant host. This helps to camouflage the bag.

The caterpillar secures itself within the bag using hooks on its rear prolegs, allowing its head and thorax to emerge. The caterpillar uses its true legs to move and hold onto foliage while dragging the bag behind it as it forages for food. It can also lower itself down from branch to branch using silk threads.

The bag's design can be used to determine the sex of the larvae. Male caterpillars incorporate vegetation all along the length of the bag while females place vegetation at the narrow end.

Adult females are flightless and grublike, and they remain in the bag. They die soon after laying eggs. The adult male is a fully winged moth, dark brown to black in colour with a wingspan of about 30 millimetres.

Caterpillar emerging from bag

Photo: Lee Harris, MPI

Common bag moth (male)

Photo: Christopher Stephens, some rights reserved (CC-BY-SA)

Common native plant hosts

Scientific names	Māori/common names
Alectryon excelsus	Tītoki
Leptospermum scoparium	Mānuka
Sophora spp.	Kōwhai
Podocarpus tōtara	Tōtara
Pittosporum spp.	Karo, tarata, lemonwood, kohukohu, black matipo, kōhūhū

Symptoms and damage

Caterpillars eat plant foliage and can be damaging in large numbers.

Prevention and control tips

- *Bacillus thuringiensis*.
- Remove by hand.
- Organic caterpillar control products.
- Chemical insecticide if required.

Natural predators

- Tachinid flies.
- Whitespotted ichneumonid wasp.

Common grass moth

Photos: Lee Harris, MPI

Common grass moths

Description

Thin, brown moths with a wingspan of about 40 millimetres. Common grass moths camouflage well on grasses and will fly if disturbed. Moths are active during the day. Larvae hide underground in tubular-shaped webs during the day and feed on new grass shoots during the night.

Common native plant hosts

Scientific names	Māori/common names
Austroderia spp.	Toetoe, kākaho
Carex spp.	Sedge, cutty grass, bastard grass, hook grass, rautahi
Uncinia spp.	Hook grass, bastard grass

Symptoms and damage

- Common grass moths can cause damage to foliage when found in large numbers.
- Leaf blades may appear scarred or damaged.
- Leaf blades can turn brown and die off.

Prevention and control tips

- Chemical insecticides.
- Sticky traps.

Earwig

Photo: Lee Harris, MPI

Earwig

Description

A dark brown, long and skinny insect that grows between 12 and 24 millimetres in length. They have pointy pincers at the end of their abdomen which are used as defence against predators and for male competition.

Earwigs are omnivorous insects that eat plant material, decaying organic matter, and a range of other insects.

Benefits

They are predators for the eggs and active stages of a large range of insects including ants, moths, beetles, plant hoppers, spiders and caterpillars. Earwigs are a voracious predator of aphids and believed to be more efficient than lacewings or ladybirds.

Symptoms and damage

- Earwigs can cause plant damage but are not generally considered a major pest in a native nursery.
- Holes in leaves or tops of seedlings removed.
- Irregular holes in leaves or flowers.
- Jagged edges of leaves or flowers.
- Small, jagged chewed holes in fruit.

Eriophyid mite

Galls caused by eriophyid mites

Photos Lee Harris, MPI

Description

Eriophyid mites are tiny, soft-bodied insects ranging in size between 0.1 and 0.2 millimetres long. There are several different species that affect a range of native plants.

Common native plant hosts

Scientific names	Māori/common names
Aristotelia serrata	Wineberry, makomako
Clianthus	Kākābeak
Hoheria spp.	Lacebark, ribbonwood, houhere
Lophozonia menziesii	Silver beech
Muehlenbeckia spp.	Mingimingi, wiggywig, tororaro, pōhuehue, wire vine
Myoporum laetum	Ngaio
Plagianthus spp.	Ribbonwood, mānatu, lowland ribbonwood, marsh ribbonwood
Podocarpus tōtara	Tōtara
Vitex lucens	Pūriri

Symptoms and damage

Eriophyid mites are sap-sucking insects. When the mites feed, they cause plant abnormalities including:

- galls;
- blisters;
- distortion of new growth;
- discolouration of foliage;
- witches broom (deformed growth that resembles a broom);

- felty patches on leaves.

Damage can be found on leaves, stems, or flower buds depending on the species of mite and host species. The damage is mainly aesthetic.

Prevention and control tips

- Biological control organisms.
- Chemical insecticides.
- Miticides.

Flax looper moth (flax window maker)

Flax looper moth

Caterpillar of the flax looper moth

Photo: kiwialli, some rights reserved (CC-BY)

Photo: henry_id, some rights reserved (CC-BY)

Description

Flax looper moths have a wingspan between 35 and 38 millimetres. They are pale brown/white in colour. Caterpillars are initially green, changing to yellow with red stripes.

Larvae are nocturnal and hide at the base of the flax in dead, dry leaf material during the day. During the night, they feed on foliage, chewing strips on the undersides of the leaves. This causes the leaves to deteriorate.

Common native plant hosts

Scientific names	Māori/common names
Phormium tenax, Phormium cookianum	Flax, harakeke, whararikī, kōrari, swamp flax, mountain flax

Leaf damage

Photo: Lee Harris, MPI

Symptoms and damage

Feeding damage does not cause death of the plants but in large numbers can cause significant damage. Looper caterpillars feed nocturnally on the underside of young leaves. This makes the top of the leaf colourless, forming a window-type hole.

Prevention and control tips

- *Bacillus thuringiensis.*
- Insecticides for caterpillars with additional sticking agent.

Flax notcher moth

Flax notcher moth

Caterpillar of the flax notcher moth

Description

Flax notcher moths are brown in colour with a wingspan of about 40 millimetres. Caterpillars are brown-yellow and feed at night on young flax leaves.

Common native plant hosts

Scientific names	Māori/common names
Phormium tenax, Phormium cookianum	Flax, harakeke, whararikiki, kōrari, swamp flax, mountain flax

Symptoms and damage

Feeding damage appears in the form of notches along the leaf edge. Damage is more aesthetic and doesn't cause the death of plants.

Leaf damage

Prevention and control tips

- *Bacillus thuringiensis.*
- Insecticides for caterpillars with additional sticking agent.

Flocculent flax scale

Flocculent flax scale

Photo: Lee Harris, MPI

Description

Flocculent flax scales live on the underside of host plants often in colonies. Clusters of white flocculent (soft and looking like wool) wax makes visual identification easy. The female has a bright yellow body that is often coated with white flocculent wax.

Flocculent flax scales are often mistaken for mealybug, which are known to live in their old colonies. Sometimes both pests may be present.

Common native plant hosts

Scientific names	Māori/common names
Arthropodium spp.	Rengarenga lily, rock lily
Cordyline spp.	Tī kōuka, cabbage tree, tī
Libertia spp.	New Zealand iris, mīkoikoi
Phormium tenax, Phormium cookianum	Flax, harakeke, whararikī, kōrari, swamp flax, mountain flax

Symptoms and damage

Adult females and juvenile scales are sucking insects. Feeding damage causes leaves to turn yellow and patches can be seen from the upper side of leaves. Flocculent flax scale can cause significant damage to small flaxes and cause fungal infections in plants.

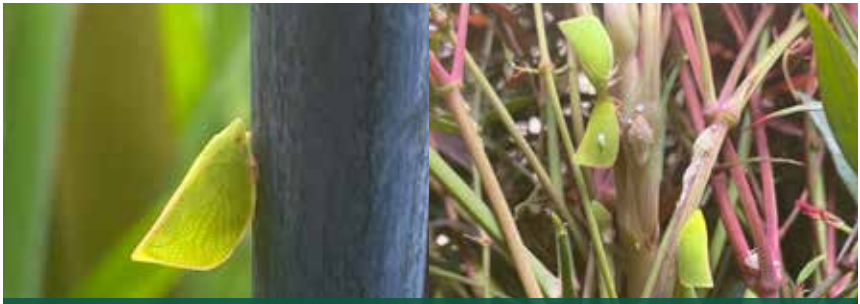
Prevention and control tips

- Chemical insecticides.
- Plant soap.
- Spray oil.

Natural predators

- Armoured scale ladybird.
- Flax scale eating caterpillar.
- Flocculent scale ladybird.
- Parasitoid wasps.
- Steelblue ladybird.

Green plant hopper (torpedo bug)



Green plant hopper adult | Adults and nymphs

Photos: Lee Harris, MPI

Description

Adult green plant hoppers are about 10 millimetres in size and are yellowish green or green. They have triangular-shaped wings that are usually folded. Nymphs are smaller in size and are white with tufts on their abdomen.

Common native plant hosts

Scientific names	Māori/common names
Asplenium spp., *Blechnum* spp., *Cyathea* spp., *Dicksonia* spp.	Ferns, ponga, hen and chicken fern, whekī, whekī ponga, pikopiko, kiokio
Beilschmiedia tarairi	Taraire
Brachyglottis repanda	Rangiora, bushman's friend, bushman's toilet paper
Coprosma spp.	Shiny karamū, twiggy coprosma, taupata, mikimiki, kanono, manono
Cordyline spp.	Tī kōuka, cabbage tree, tī
Corynocarpus laevigatus	Karaka, kōpī
Fuchsia spp.	Climbing, trailing or creeping fuchsia, tree fuchsia, kōtukutuku
Griselinia spp.	Puka, broadleaf, kāpuka
Myoporum laetum	Ngaio
Phormium tenax, Phormium cookianum	Flax, harakeke, whararikī, kōrari, swamp flax, mountain flax
Piper excelsum	Kawakawa, pepper tree
Pittosporum spp.	Karo, tarata, lemonwood, kohukohu, black matipo, kōhūhū

Scientific names	Māori/common names
Podocarpus tōtara	Tōtara
Pseudopanax spp.	Five-finger, lancewood, savage lancewood, whauwhaupaku, horoeka, houpara

Symptoms and damage

Green plant hoppers are sap-sucking insects. The young insects feed on plant leaves and the older insects feed on the stem. Feeding can cause leaf speckling damage and transmission of plant diseases.

Prevention and control tips

- Do not usually require control.
- Chemical insecticides.
- Neem.
- Organic pyrethrum.
- Spray oil.

Natural predators

Steelblue ladybirds which eat its eggs.

Green vegetable bug (stink bug, shield bug)

Green vegetable bug

Photo: Lee Harris, MPI

Description

Shield-shaped insects that grow up to 15 millimetres in length. They vary in colour from bright green to brown. Nymphs are wingless and about 10 millimetres long. They sometimes display orange, red or white markings during different instar stages.

Green vegetable bugs use a chemical defence mechanism. When attacked or disturbed, they can release an unpleasant smelling chemical that deters predators and can cause other vegetable bugs to drop to the ground.

Common native plant hosts

Scientific names	Māori/common names
Coprosma spp.	Shiny karamū, twiggy coprosma, taupata, mikimiki, kanono, manono
Clianthus	Kākābeak
Pseudopanax spp.	Five-finger, lancewood, savage lancewood, whauwhaupaku, horoeka, houpara

Symptoms and damage

- Heavily infested plants may become deformed, shrivel and wilt.
- Sap-sucking insect.

Prevention and control tips

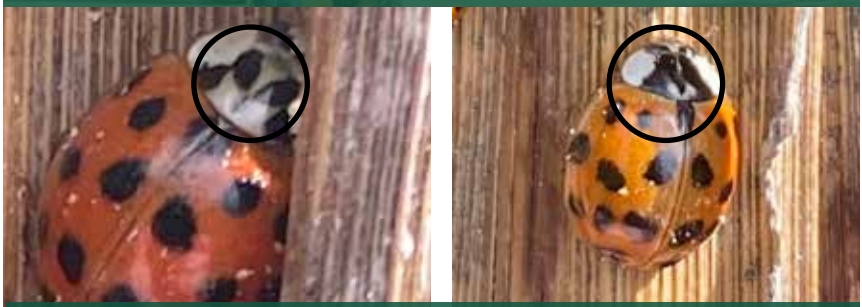
- Chemical insecticides.
- Neem.

Natural predators

Many beneficial insects eat their eggs.

Harlequin ladybird

Harlequin ladybird



Close up of M shape markings on pronotum

Photos: Lee Harris, MPI

Description

Harlequin ladybirds are a globally invasive species native to Central and Eastern Asia. They were first detected in Auckland in 2016 and quickly spread throughout the North Island and established themselves on the East Coast of the South Island. They vary in appearance from red, orange with zero to 21 black spots, or can be black or black with two or four orange or red spots. They grow between five and eight millimetres in size. A distinguishing feature of the harlequin ladybird is black spots on the pronotum (the first segment behind the head) which form an M shape.

Harlequin ladybirds can be found in large clusters in homes and tend to overwinter indoors. As a defence mechanism they produce an unpleasant odour when frightened or squashed. They are known to bite humans.

They feed on aphids and other small insects including native ladybirds and can harm native and beneficial insects. They have been documented in Aotearoa New Zealand feeding on giant willow aphids. They are also regarded as a pest on fruit trees and grape vines.

Hoverfly

Three lined hoverfly

Photo: bythepark, some rights reserved (CC-BY)

Small hoverfly

Photo: Steven Wallace, some rights reserved (CC-BY-NC)

Description

There are 37 species of native hoverfly in Aotearoa New Zealand. They are yellow and black striped, and are noisy when flying. Adult hoverflies feed on nectar and pollen from flowers.

Benefits

Larvae eat aphids, caterpillars, psyllids, mealybugs, and other small soft bodied insects.

Katydid

Photos: Lee Harris, MPI

Katydids

Description

Katydids are a type of bush cricket native to Aotearoa New Zealand and Australia. Their appearance resembles a green leaf. Adult katydids are 40 to 60 millimetres in length. Nymphs can be coloured pink through to green based on the type of plant they are consuming.

Katydids will usually stay near vegetation so they can camouflage themselves. They are nocturnal and usually move around at night as this is a safer time for them to forage. They are often heard making a soft chirping sound in the early evening or at night.

Common native plant hosts

Scientific names	Māori/common names
Leptospermum scoparium	Mānuka
Melicytus spp.	Māhoe, hinahina, whiteywood
Metrosideros excelsa	Pōhutukawa
Phormium tenax, Phormium cookianum	Flax, harakeke, whaririki, korari, swamp flax, mountain flax
Pittosporum spp.	Karo, tarata, lemonwood, kohukohu, black matipo, kōhūhū

Symptoms and damage

Katydids feed on soft buds, leaves, fruit, and flowers of native and introduced species but do not usually cause considerable damage.

Prevention and control tips

Katydids do not usually cause considerable damage and do not require control.

Kawakawa looper moth

Kawakawa looper moth

Kawakawa looper caterpillar

Photo: Christopher Stephens, some rights reserved (CC-BY-SA)

Photo: Lee Harris, MPI

Description

The kawakawa looper moth grows about 10 to 15 millimetres long and has a wingspan between 30 and 55 millimetres. Kawakawa looper moths vary in colour from a mottled yellow-brown to brown-black. They usually have a spot on each forewing.

Caterpillars can be 30 to 40 millimetres long and are mainly green or brown. A new caterpillar is green in colour and has dark or white stripes the length of its body. They position themselves on the leaf veins and lay as flat as possible to camouflage themselves. Caterpillars can drop from plants and hang by a silk thread.

Common native plant hosts

Scientific names	Māori/common names
Aristotelia serrata	Wineberry, makomako
Carpodetus serratus	Putaputawētā, marbleleaf, piripiriwhata
Dodonaea viscosa	Akeake
Lophomyrtus bullata	Ramarama
Piper excelsum	Kawakawa, pepper tree
Pseudopanax arboreus	Five-finger, whauwhaupaku
Pseudowintera spp.	Horopito, pepper tree
Sophora spp.	Kōwhai

Photo: Lee Harris, MPI

Leaf damage caused by kawakawa looper caterpillar

Symptoms and damage

Caterpillars feed on young leaves usually making holes in the edges and centre. The leaf damage is mainly aesthetic and people harvesting kawakawa for rongoā would use the leaves with holes.

Prevention and control tips

In the nursery you may consider treating with chemical insecticide or product for caterpillars to prevent leaf damage if plants became unsaleable. In most circumstances treatment would not be required.

Kōwhai moth

Photo: Christopher Stephens, some rights reserved (CC-BY-SA)

Kōwhai moth

Kōwhai moth caterpillar

Photo: Lee Harris, MPI

Description

Adult kōwhai moths range in colour from a red-brown to green. They are usually lightly patterned with a wingspan of about 27 millimetres. Caterpillars are bright green or yellow with black and white spots and will drop from the plants if they are disturbed.

Common native plant hosts

Scientific names	Māori/common names
Sophora spp.	Kōwhai

Symptoms and damage

Caterpillars feed on leaves and in large numbers can completely defoliate kōwhai seedlings and trees. They will also feed on tree lupin, broom and gorse. Healthy plants should recover quickly from their feeding, and permanent damage is unlikely.

High populations of snails can also defoliate kōwhai seedlings, and their feeding sign could be mistaken for kōwhai moth caterpillars.

Prevention and control tips

- Healthy kōwhai are tolerant of defoliation and will recover quickly when pest populations decrease.
- For smaller nursery plants an insecticide application may be required if damage renders plants unsaleable.

Ladybird

Two spotted ladybird

Eleven spotted ladybird

Fungus eating ladybird

Steelblue ladybird

Photos: Lee Harris, MPI

Description

Ladybirds are small beetles that grow between five and eight millimetres long. In Aotearoa New Zealand there are both native and introduced species. Not all species are widely distributed across the country, and several species have been introduced as biological control measures for specific pests.

Benefits

Many ladybirds are beneficial insects and feed on scales, aphids, mealybugs, mites, and powdery mildews.

Ladybirds found in Aotearoa New Zealand and their prey

Name	Prey
Antipodean ladybird	Native and introduced insects, psyllids, scales
Cardinal ladybird	Cottony cushion scales
Citrus whitefly ladybird	Whitefly, psyllids, soft scales
Diomus mealybug ladybird	Mealybugs
Dusky ladybird*	Aphids, whitefly, mealybugs, eggs of butterflies and moths
Eleven spotted ladybird	Variety of insects including aphids, caterpillars, butterfly eggs, psyllids
Forestier's ladybird	Scale insects
Fungus eating ladybird	Powdery mildew, pollen
Gumtree scale ladybird	Gum tree scales
Karo felted scale ladybird	Felted scale found on *Pittosporum crassifolium*
Koebele's ladybird	Cottony cushion scales
Large spotted ladybird	Aphids, psyllids, other small insects
Loew's ladybird	Mealybugs and other insects
Mealybug ladybird	Mealybugs and scale insects
Native mealybug ladybird	Mealybugs
Scale eating ladybird	Scale insects including flocculent flax scales
Steelblue ladybird	Psyllids, whitefly, scales, moth eggs, gall mites, thrips larvae, nectar and honeydew
Tasmanian (southern) ladybird	Eucalyptus tortoise beetle, aphids, psyllids
Two spotted ladybird	Aphids, psyllids, and other small insects
Variable ladybird	Aphids
Yellow haired ladybird	Psyllids, mealybugs, aphids, scales
Yellow shouldered ladybird	Aphids

*Can be purchased as a biological control agent.

Leaf miner

Photo: Lee Harris, MPI

Leaf miner

Description

Leaf miners are larvae of a variety of insects including flies, moths, beetles and sawflies. These insects either inject an egg into the leaf surface or lay an egg on the surface. Once the egg hatches the tiny larvae burrow into the leaf and start feeding. The larvae live and feed within the interior layer of a leaf, creating white tunnels or mines as they feed. Leaf miners are considered a minor pest for established native trees but may cause significant aesthetic damage in a nursery.

Common native plant hosts

Scientific names	Māori/common names
Agathis australis	Kauri
Astelia spp.	Astelia, kakaha, shore kōwharawhara
Clianthus	Kākābeak
Coprosma spp.	Shiny karamu, twiggy coprosma, taupata, mikimiki, kanono, manono
Lophozonia menziesii	Silver beech
Melicytus spp.	Māhoe, hinahina, whiteywood
Olearia spp.	Golden akeake, akiraho, tree daisy
Pseudopanax ferox, Pseudopanax crassifolius	Lancewood, horoeka, fierce lancewood, savage lancewood
Veronica spp.	Hebe

Symptoms and damage

- Damage is mainly aesthetic and unlikely to be serious – control may not be required.
- Linear mines in leaves or leaf mine blotch caused by larvae feeding.
- Leaf curling and mottling.

Prevention and control tips

- Biological control organisms.
- Chemical insecticides.
- Neem.

Natural predators

- Lacewings.
- Parasitic wasps.

Lemon tree borer

Photo: Tyler McBeth, no rights reserved (CC0)

Lemon tree borer

Lemon tree borer larvae

Photo: Mike Lusk, some rights reserved (CC-BY-NC)

Description

Lemon tree borer is a New Zealand native beetle with a slim body, which grows about 15 to 30 millimetres long. The beetles fly at night and eat pollen. The larvae can be between 10 and 30 millimetres long, and burrow into twigs and branches causing them to die back. Larvae can live inside a plant for between one and two years.

Common native plant hosts

Scientific names	Māori/common names
Aristotelia serrata	Wineberry, makomako
Brachyglottis repanda	Rangiora, bushman's friend, bushman's toilet paper
Leptospermum scoparium	Mānuka
Melicytus spp.	Māhoe, hinahina, whiteywood
Olearia spp.	Chatham Island akeake, hakapiri, golden akeake, akiraho, tree daisy

Symptoms and damage

- Wilting leaves.
- Dieback of individual branches.
- Holes in branches two to three millimetres round with piles of powdery dust indicate active burrows.

Prevention and control tips

- Cannot be controlled with pesticides.
- Larvae can be killed by inserting a thin piece of wire or guitar string into borer holes to spike the larvae.
- Prune off and burn infested branches.
- Treat pruning cuts or wounds on trees with pruning sealant.

Magpie moth and caterpillar

Magpie moth

Magpie moth caterpillar

Description

Adult magpie moths have black and white wing markings with a black and yellow-orange striped body. They have a wingspan between 35 and 45 millimetres and are active during the day. Caterpillars are black and orange-red and are covered in long black hairs. Caterpillars grow between 35 and 38 millimetres long.

Common native plant hosts

Scientific names	Māori/common names
Brachyglottis repanda	Rangiora, bushman's friend, bushman's toilet paper
Senecio spp.	Groundsel, fireweed

Symptoms and damage

- Caterpillars can cause leaf damage to rangiora, but damage is usually insignificant.
- Caterpillars are more likely to eat weed species in a nursery such as ragwort and groundsel.

Prevention and control tips

No control required as damage should be minimal.

Mānuka chafer beetle

Mānuka chafer beetle

Photo: Lee Harris, MPI

Mānuka chafer beetle grub

Photo: AgPest

Description

Mānuka chafer beetles are a native scarab beetle that grow up to 10 millimetres in length. Most commonly they are a bright iridescent green but can be bright pink, copper or blue. Beetles fly during the day and can form swarms in hot weather. Beetles are only present for a few weeks in late spring or early summer. During this time, they mate, and females lay their eggs in soil. Larvae are soil-dwelling. They are grey-white coloured grubs with tan heads. They are about 10 millimetres long and can be found in soil laying in a C-shape. They look like grass grub larvae but are usually smaller. Larvae feed on the roots of many pasture and weed species and can cause pasture damage. They also feed on the roots of mānuka.

Common native plant hosts

Scientific names	Māori/common names
Kunzea ericoides	Kānuka
Leptospermum scoparium	Mānuka

Symptoms and damage

- Adult beetles feed on the young foliage of mānuka, kānuka and other native species.
- Larvae will feed on roots of pasture, weeds and mānuka.
- Considered a minor pasture pest but can cause damage when populations are high. Populations are estimated by digging at least 10 spade squares (holes that are 200 by 200 millimetres wide and 100 millimetres deep) per paddock and examining the soil for grubs. Averages over 12 larvae per spade square (300 larvae per square metre) can cause pasture damage.

Prevention and control tips

Chemical control in pastures where the larvae are causing damage.

Mealybug

Photo: Lee Harris, MPI

Mealybug colony

Description

There are several species of mealybug that can be seen in a production nursery. Mealybugs are small, oval shaped, soft bodied insects that can crawl around. Female mealybugs grow to about four millimetres long. Their body is orange, yellow, pink or white, covered with powdery white wax and surrounded by long white filaments. The male mealybug is a small gnat-like flying insect.

Mealybugs often live in colonies and produce white wax which covers the areas they live in. This makes visually locating them easier. They will usually hide on sheltered or protected parts of a plant and will often be found hiding in leaf axils.

Common native plant hosts

Scientific names	Māori/common names
Asplenium spp., *Blechnum* spp., *Cyathea* spp., *Dicksonia* spp.	Ferns, ponga, hen and chicken fern, whekī, whekī ponga, pikopiko, kiokio
Astelia spp.	Bush flax, bush lily, kakaha, kowharawhara
Cordyline spp.	Tī kōuka, cabbage tree, tī
Dacrycarpus dacrydioides	Kahikatea, white pine
Myrsine australis	Red matipo, mapau
Phormium tenax, Phormium cookianum	Flax, harakeke, whaririki, korari, swamp flax, mountain flax

Symptoms and damage

- Mealybugs are sap-sucking insects that excrete honeydew which can attract ants and growth of sooty mould.
- Will infest most parts of a plant including leaves and stems.
- Root mealybugs are common in containerised plants and will display white fluffy patches on the roots.
- Stunted growth.
- Heavy infestation can severely damage or kill juvenile plants.

Prevention and control tips

- Mealybug can be difficult to kill due to their waxy coating and the protected areas they hide in.
- Biological control organisms.
- Weed management.
- Insect growth regulators.
- Plant soap.
- Spray oil.
- Systemic insecticides.

Natural predators

- Lacewings.
- Ladybirds.
- Parasitic wasps.

Mirid

Fern mirid

Ngaio mirid

Photo: Steven Wallace, some rights reserved (CC-BY-NC)

Photo: Dave Holland, some rights reserved (CC-BY-NC)

Description

Adult mirid are small brown coloured bugs about five millimetres in size. Nymphs are yellow to green in colour. Both the adult and juvenile are sap-sucking insects and feed on young leaves and stems.

Common native plant hosts

Scientific names	Māori/common names
Asplenium spp., *Blechnum* spp., *Cyathea* spp., *Dicksonia* spp.	Ferns, ponga, hen and chicken fern, whekī, whekī ponga, pikopiko, kiokio
Coprosma spp.	Shiny karamu, twiggy coprosma, taupata, mikimiki, kanono, manono
Myoporum laetum	Ngaio

Symptoms and damage

- Can cause serious damage to ngaio and coprosma.
- Leaf speckling.
- Leaf bronzing.
- Leaf distortion.

Prevention and control tips

- Chemical insecticides.
- Spray oil.
- Synthetic pyrethroids.

Mite

Two spotted spider mite

Description

Mites are tiny insects that are microscopic, growing to less than one millimetre in size. There are several species of pest mites in Aotearoa New Zealand that cause a range of damage and symptoms to plants. Mites have also been introduced to Aotearoa New Zealand as a biological control for pest plants such as gorse.

Spider mites cause the most damage to a broader range of plants. The two-spotted spider mite and European red mite are the most common spider mite pests. Mites are chewing insects; they chew through leaves resulting in leaf speckling and pale leaves. They often produce webbing to protect themselves against predators. Mites thrive in hot conditions and populations build rapidly.

Common native plant hosts

Scientific names	Māori/common names
Clianthus	Kākābeak
Cordyline spp.	Tī kōuka, cabbage tree, tī
Podocarpus tōtara	Tōtara

Symptoms and damage

- Can cause galls on some plants.
- During high infestations webbing may be visible on foliage.
- Leaf bronzing.
- Leaf distortion.
- Leaf speckling and chlorosis.
- Yellow speckles on leaves which turn silver or bronze.

Prevention and control tips

- Weed management.
- Biological control organisms.
- Miticides.
- Organic insecticides.
- Spray oil.
- Sulphur.

Natural predators

Ladybirds.

New Zealand praying mantis

New Zealand praying mantis

Egg capsule

Photos: Lee Harris, MPI

Description

Adult New Zealand praying mantis are green in colour and grow between 35 and 40 millimetres in length. The female is larger in size than the male. Nymphs are a pale, translucent green with a dark stripe running down the length of their body.

New Zealand praying mantis have a triangle shaped head and veined, leaf like wing covers which allow them to camouflage well in foliage. They have blue spots underneath their front legs. Their front legs are long with sharp spikes designed to capture prey.

The New Zealand praying mantis egg capsule has eggs arranged in two rows and are usually found on trees or fences and positioned to face north towards the sun.

New Zealand praying mantis hide well from predators but are susceptible to pesticides. They prefer shrubby, leafy vegetation which can be used as camouflage to ambush or stalk prey.

Unlike the South African praying mantis, the females rarely engage in cannibalism. The male New Zealand praying mantis is sexually attracted to the introduced South African praying mantis female and is likely to be eaten when approaching her.

Benefits

The New Zealand praying mantis predates on a wide range of insects including aphids, caterpillars, wasps, flies, cicadas, and mosquitos.

Parasitoid wasp

Photo: alingham, some rights reserved (CC-BY-NC)

Norton's giant ichneumonid wasp

Photo: commoncopper, some rights reserved (CC-BY-NC)

Orange ichneumonid wasp

Photo: Rhonda Billington some rights reserved (CC-BY-NC)

Lemon tree borer parasitoid wasp

Photo: Rhonda Billington, some rights reserved (CC-BY-NC)

Yellow banded leafroller parasite wasp

Description

In Aotearoa New Zealand there are about 2,500 species of native wasp and five species of introduced social wasps. Most of New Zealand's native wasps are parasitoid wasps which means they feed on a living host for part of their development. They have a wide range of hosts and are important for controlling insect pests.

Parasitoid wasps don't sting, the females use a long ovipositor to lay their eggs on, or inside, the bodies of other insects, their larvae, pupae or eggs. The wasp larvae hatch and consume their host which eventually dies. The ovipositor is often mistaken as a large stinger which makes the wasps look more sinister. The very long ovipositor of the Norton's giant ichneumonid wasp is designed to reach wood boring insect larvae. Most parasitoid wasps are small and grow between one millimetre and 30 millimetres long.

Several parasitoid wasps have been introduced to New Zealand as biological control agents for pests in agriculture, horticulture and forestry. There are several species that are commercially available as biological control organisms for horticultural pests.

Benefits

This group of wasps parasitise several hosts including caterpillars, flies, moths, beetles, aphids, and whitefly or their larvae, pupae and eggs.

Passionvine hopper

Passionvine hopper

Passionvine hopper nymph

Description

Passionvine hoppers are brown, oval shaped insects with partially transparent wings. Adults grow between five and 10 millimetres long. Nymphs are wingless and grow to about five millimetres long and are commonly known as fluffy bums. When disturbed, passionvine hoppers will hop off a plant with a snapping sound. They are sap-sucking insects which can be found on a broad range of plant species and will often be found in large numbers on stems and shoots of plants.

Common native plant hosts

Scientific names	Māori/common names
Asplenium spp., *Blechnum* spp., *Cyathea* spp., *Dicksonia* spp.	Ferns, ponga, hen and chicken fern, whekī, whekī ponga, pikopiko, kiokio
Clianthus	Kākābeak
Cordyline spp.	Tī kōuka, cabbage tree, tī
Phormium tenax, Phormium cookianum	Flax, harakeke, whararikī, korari, swamp flax, mountain flax
Pittosporum spp.	Karo, tarata, lemonwood, kohukohu, black matipo, kōhūhū
Pseudopanax ferox, Pseudopanax crassifolius	Lancewood, horoeka, fierce lancewood, savage lancewood
Sophora spp.	Kōwhai
Veronica spp.	Hebe

Symptoms and damage

- Damage to young leaves.
- Egg laying can cause damage to soft plant growth, particularly young stems and leaf veins.
- Sooty mould due to secretion of honeydew.
- Wilt to new shoots.
- Possibly a vector of cabbage tree sudden decline and bacterial phytoplasma disease in phormiums.

Prevention and control tips

Chemical insecticides.

Pittosporum shield bug

Photo: Lee Harris, MPI

Pittosporum shield bug

Photo: caseyjanenz, some rights reserved (CC-BY-NC)

Pittosporum shield bug nymphs

Description

Pittosporum shield bug adults grow to about nine millimetres long. They have brown shield shaped bodies, and pale green legs. They are herbivorous and feed on Pittosporum species.

Nymphs are smaller in size and circular in shape. First instar nymphs are black with white spots that change to black with orange spots in later developmental stages.

The bugs use a defence mechanism that releases an unpleasant-smelling chemical when they are attacked or disturbed, deterring predators.

Common native plant hosts

Scientific names	Māori/common names
Coprosma spp.	Shiny karamu, twiggy coprosma, taupata, mikimiki, kanono, manono
Pittosporum spp.	Karo, tarata, lemonwood, kohukohu, black matipo, kōhūhū

Symptoms and damage

Pittosporum shield bugs are sucking insects that feed on unripe pittosporum fruit and seeds. They may also feed on leaves and stems. They are deemed a minor pest on Pittosporum species.

Prevention and control tips

Chemical insecticides.

Natural predators

Two species of parasitic wasps, *Trissolcus basalisi* and *Trissolcus oenone* are known to parasitise their eggs.

Pōhutukawa leaf miner

Pōhutukawa leaf miner

Pōhutukawa leaf miner damage

Photos: Lee Harris, MPI

Description

Pōhutukawa leaf miner is a New Zealand native weevil that is considered a minor pest for established trees but may cause significant aesthetic damage in a nursery. Adults are brown in colour and about three millimetres long. They may fly if disturbed. Larvae are white grubs with no legs and a brown head.

Common native plant hosts

Scientific names	Māori/common names
Metrosideros spp.	Pōhutukawa, rāta

Symptoms and damage

Pōhutukawa leaf miner adults chew small round or oval shaped holes in leaves. If the leaves are mature the holes remain small, if the leaf is actively growing the holes become larger as the leaf continues to grow. The larvae tunnel into leaves forming mines. Feeding damage may cause leaves to die.

High populations of adult pōhutukawa leaf miner can cause damage to new growth on *Metrosideros* spp.

Prevention and control tips

Chemical insecticides.

Predatory mite

Hyper-mite™ and Mite E™

Photos: Bioforce Limited NZ

Description

There are several commercially grown predatory mites available in Aotearoa New Zealand to be used as a biological pest management agent.

Benefits

Predatory mites target a variety of horticultural and nursery pest species including psyllid, whitefly, sciarid fly, spider mites, and thrips. They can be used in greenhouse and outdoor crops.

Pseudocoremia fenerata

***Pseudocoremia fenerata* moth**

***Pseudocoremia fenerata* caterpillar**

Photos: Lee Harris, MPI

Description

A native looper moth that is pale yellow-brown or pale grey in colour, with dark coloured lines across the wings. Their wingspan is between 27 and 34 millimetres. The caterpillars have a light brown or green head and green body with a band along their sides.

Common native plant hosts

Scientific names	Māori/common names
Agathis australis	Kauri
Dacrydium cupressinum	Rimu, red pine
Halocarpus bidwillii	Bog pine
Halocarpus biformis	Pink pine, yellow pine
Phyllocladus alpinus	Mountain toatoa, mountain celery pine
Phyllocladus trichomanoides	Tānekaha, celery pine
Podocarpus tōtara	Tōtara
Prumnopitys ferruginea	Miro

Symptoms and damage

The caterpillars eat both native and exotic conifers. Damage can defoliate seedlings which may take time to recover. When the caterpillars are small, they can be difficult to locate and may align themselves with plant stems which assists in their camouflage.

Prevention and control tips

- *Bacillus thuringiensis*.
- Chemical insecticides.
- Products suitable for caterpillar control.

Caterpillar feeding damage on tōtara seedlings

Photo: Lee Harris, MPI

Psyllid

Psyllid nymph | Pittosporum psyllid

Description

Psyllids are tiny sap-sucking insects. Adults grow between one and three millimetres long and look like a tiny cicada. Their body is brown or green and has white or yellow markings. Nymphs are oval shaped, scale-like, and yellow, green or orange in colour. Adults will fly when disturbed and can spread rapidly. There are about 50 native species of psyllid in Aotearoa New Zealand.

Common native plant hosts

Scientific names	Māori/common names
Dodonaea viscosa	Akeake
Griselinia spp.	Puka, broadleaf, kāpuka
Metrosideros excelsa	Pōhutukawa
Olearia spp.	Chatham Island akeake, hakapiri, golden akeake, akiraho, tree daisy
Pittosporum spp.	Karo, tarata, lemonwood, kohukohu, black matipo, kōhūhū
Pseudopanax arboreus	Five-finger, whauwhaupaku
Sophora spp.	Kōwhai

Symptoms and damage

Psyllids excrete honeydew, which ants and wasps feed on. Honeydew can have a negative effect on plants by inhibiting photosynthesis, which can affect plant growth. It also provides a breeding ground for fungi including sooty mould. Psyllids are known to transmit diseases to plants.

Psyllid damage to foliage can include:

- stunted and deformed new growth;
- wart looking bumps on leaves;
- severe wilting;
- plant stress;
- yellowing leaf margins.
- upward curling of leaves.

Prevention and control tips

- Keep plants healthy.
- Monitor populations with sticky traps.
- Organic insecticides.
- Systemic insecticides.

Multiple generations of psyllid

Damage to foliage

Photos: Lee Harris, MPI

Root mealybug

Photo: New Zealand Winegrower

Root mealybug

Description

Root mealybugs appear as cotton-type masses on infested roots and feed on the plant's root system. Their bodies are not covered in wax like foliage feeding mealybugs.

Common native plant hosts

Broad range of native plant hosts.

Symptoms and damage

Root mealybugs can remain undetected for long periods of time. They feed off the plant's root system resulting in stunted growth. Heavy infestation can severely damage or kill juvenile plants.

Prevention and control tips

- Keep trays and equipment clean.
- Regular crop monitoring.
- Removing plants from containers.
- Neem.
- Chemical insecticides.

Scale

White tōtara scale

Photo: Grey Smith, some rights reserved (CC-BY)

Cottony cushion scale

Photo: Lee Harris, MPI

Ross' black scale

Photo: Christopher Stephens, some rights reserved (CC-BY-SA)

Chinese wax scale

Photo: Caiden B, some rights reserved (CC-BY-NC)

Description

Scales are sap-sucking insects with protective coverings. There are about 400 species of scales in New Zealand, and some are specific to their host plant.

Scales fit into two main groups, soft scales and hard (armoured) scales. They can vary in appearance between species. Some species are very small, growing between one and two millimetres in size, are immobile and live under protective wax covers. Other species are larger and grow between five and 10 millimetres in size, are mobile and can produce eggs in large ovisacs (egg containing capsules). Scales vary in colour but are normally black, brown, grey, white, or translucent.

Common native plant hosts

Broad range of native plant hosts.

Symptoms and damage

- Leaf yellowing and defoliation.
- May attract growth of fungi such as sooty mould.
- Plant stress.
- Wilting.
- Scales can transmit diseases to plants.
- Unsightly.

Prevention and control tips

- Chemical insecticides.
- Neem.
- Organic pyrethrum.
- Plant soap.
- Spray oil.

Sciarid fly (fungus gnat)

Sciarid flies

Photos: Uwe Schneehagen, some rights reserved (CC-BY-SA)

Description

There are over 50 species of sciarid fly in Aotearoa New Zealand. They are small, dark coloured, mosquito-like insects. Adults grow between two and three millimetres long and can be seen flying around plants during watering or crawling on the soil surface. Their larvae are tiny transparent maggots about three to five millimetres long with black heads. Larvae live in damp soil or growing media rich in organic matter. They are usually found within the top 50 millimetres of soil or growing media. Larvae can cause significant damage by chewing the roots of seedlings and containerised plants.

Common native plant hosts

Broad range of native plant hosts.

Symptoms and damage

- Larvae transmit soil borne fungal diseases which can cause damping off in seedlings.
- Larvae tunnel into the roots or stems of seedlings causing them to collapse.
- Leaf yellowing.
- Plants can collapse from soil level.
- Plants lack vigour.
- Presence of large numbers of small mosquito-like insects.
- Small brown scars on roots, root hairs eaten off.
- Weak or dead plants.

Prevention and control tips

- Avoid overwatering and waterlogging.
- Biological control organisms.
- Chemical insecticides.
- Commercially available predatory mites and nematodes.
- Use sterile growing media.
- Yellow sticky traps to monitor the adult population.

Slugs and snails

Photos: Lee Harris, MPI

Common garden snail

Leaf veined slug

Description

Slugs and snails are gastropod molluscs. They have a flat, slimy, muscular foot on which they move around and can travel along most surfaces including vertically and upside down.

Aotearoa New Zealand has about 1,400 native species of slugs and snails, many of which are endangered and unlikely to be encountered in a nursery or home garden. There are several introduced species of slugs and snails, many of which feed on plants. The common garden snail and grey field slug are more likely to be encountered. The common garden snail grows a shell up to 40 millimetres long.

Slugs and snails are nocturnal and are more active during damp or humid weather. During the day they hide in damp, dark places usually close to where they have been feeding. Slugs and snails eat fruit, flowers, soft stems, and foliage of plants.

Common native plant hosts

Scientific names	Māori/common names
Clianthus	Kākābeak
Phormium tenax, Phormium cookianum	Flax, harakeke, whahariki, korari, swamp flax, mountain flax
Pittosporum spp.	Karo, tarata, lemonwood, kohukohu, black matipo, kōhūhū
Sophora spp.	Kōwhai

Symptoms and damage

- Defoliation.
- Holes in leaves.
- Plant stress.
- Silver slime trails.
- Snails also eat seeds.

Prevention and control tips

- Beer traps.
- Coarse sand on seed trays.
- Manual removal and destruction.
- Molluscicides.

South African praying mantis (springbok)

South African praying mantis

Description

The South African praying mantis (springbok mantis) is native to Southern Africa and appeared in Aotearoa New Zealand in 1978.

Adults are between 32 and 60 millimetres long and are pale green or brown in colour. They may display pink or purple colours near the front wings. The rear wings are green or bright yellow, and there are dark spots in the inner of the front legs. Males are smaller in size and have longer antennae than the females. The abdomen of egg bearing females bulges beyond the wings.

Nymphs are green or brown with a strip down the length of their body. The tip of the abdomen is curved upwards. Nymphs are cannibalistic and will attack and eat each other even in the presence of prey.

The South African praying mantis displays sexual cannibalism; the females are likely to eat the male prior to or immediately after mating. The male New Zealand praying mantis are sexually attracted to the introduced South African praying mantis female and are likely to be eaten when approaching her.

Benefits

The South African praying mantis feeds on a wide range of insects including flies, mosquitos, caterpillars, wasps, cicadas and aphids.

Spider hunting wasp

Large black spider hunting wasp

Photo: Lee Harris, MPI

Golden hunting wasp

Photo: Richard Littauer, some rights reserved (CC-BY)

Description

There are several species of spider hunting wasps in Aotearoa New Zealand. They are solitary wasps that nest underground. The female wasps actively hunt for spiders and paralyze them with their stinger. Females can often be seen dragging spiders much bigger than themselves back to their nests to be used as food for their larvae. The female will drop the spider into a cell constructed of mud then lay an egg on top of it. When the egg hatches the larvae eat the spider. Adult wasps will feed on fruit and nectar from a variety of plants.

Spider

Photos: Lee Harris, MPI

Spiders

Description

Aotearoa New Zealand has about 1,100 named native spider species with hundreds still to be described and named. Spiders are abundant predators and catch prey in a variety of ways, including with webs, stealth, ambush, and speed.

Benefits

Spiders consume a large range of garden and nursery pests including aphids, beetles, flies and mosquitos.

Spittle bug

Adult spittle bug

Spittle bug nymph

Photo: Lee Harris, MPI

Photo: Helen Macky, some rights reserved (CC-BY-NC)

Description

Spittle bugs are small sap-sucking insects that form a frothy blob on plant foliage that looks like spit. The froth is created by the nymph which mixes plant sap with air to make frothy bubbles. The nymph hides in the bubbles protected from the sun and predators. The bubbles also provide insulation against low or high temperatures and the ability for the nymph to stay moist.

Adult spittle bugs fly or jump from plant to plant.

There are about 14 different species of spittle bug in Aotearoa New Zealand. They are not known to cause damage unless heavy infestation is present.

Common native plant hosts

Scientific names	Māori/common names
Coprosma spp.	Shiny karamu, twiggy coprosma, taupata, mikimiki, kanono, manono
Leptospermum scoparium	Mānuka
Melicytus spp.	Māhoe, hinahina, whiteywood
Metrosideros excelsa	Pōhutukawa
Metrosideros robusta	Rātā
Muehlenbeckia spp.	Mingimingi, wiggywig, tororaro, pōhuehue, wire vine
Pseudopanax arboreus	Five-finger, whauwhaupaku
Veronica spp.	Hebe

Symptoms and damage

- Frothy blob on plant foliage.
- May appear unsightly but very little damage.
- If heavily infested may cause leaves to lose shape.
- Potential vector for plant diseases.

Prevention and control tips

Spittle bugs cause little damage. If treatment is required, the froth can make it difficult to target with contact insecticides. Hose the plants first to remove the froth and spray when plants are dry or use a systemic insecticide.

Steelblue ladybird

Steelblue ladybird

Adults overwintering on cordyline

Photos: Lee Harris, MPI

Description

Steelblue ladybirds are about four millimetres long and are a shiny metallic blue colour. They were released into Aotearoa New Zealand in 1899 and are currently widespread in the North Island and present in the north of the South Island. During the colder months they can be found overwintering in clusters.

Benefits

Steelblue ladybirds feed on a variety of insects and mites including scales, whitefly, psyllids and gall mites.

Stick insect

Photos: Lee Harris, MPI

Stick insects

Description

There are about 20 species of stick insect in Aotearoa New Zealand. They can grow up to 20 centimetres long and are usually green, brown, or grey in colour and can have cryptic patterns, prickles or spikes. Stick insects are very well camouflaged on plants and behave like sticks or leaves.

During the day they remain hidden and keep movements to a minimum to avoid being eaten by predators (mainly birds). Stick insects mainly feed at night on vegetation and will be more active during this time.

Common native plant hosts

Scientific names	Māori/common names
Dacrydium cupressinum	Rimu, red pine
Kunzea ericoides	Kānuka
Leptospermum scoparium	Mānuka
Lophomyrtus bullata	Ramarama
Metrosideros excelsa	Pōhutukawa
Metrosideros robusta	Rātā
Muehlenbeckia spp.	Mingimingi, wiggywig, tororaro, pōhuehue, wire vine
Plagianthus spp.	Ribbonwood, mānatu, lowland ribbonwood, marsh ribbonwood
Podocarpus tōtara	Tōtara

Symptoms and damage

Foliage damage in the form of small holes. May cause aesthetic damage to nursery crops but not generally a problem on established plants.

Prevention and control tips

Not generally regarded as a serious pest. If they become a problem, gently pluck insects from plants and transport to somewhere else.

Tachinid fly

Photo: Lee Harris, MPI

Australian leafroller tachinid

Description

There are about 180 known native species of tachinid fly in Aotearoa New Zealand. Tachinid are parasitic flies that target the immature life cycles of insects. They are known to prey on plant hoppers, caterpillars, beetles, butterflies and moths, and mainly lay eggs on or inside their host. Some species are known to lay eggs on plant foliage which is then eaten by its host. When the eggs hatch, the fly larvae feed on the host, eventually killing it.

Adult tachinid feed on nectar or honeydew and can assist with pollination.

Benefits

The Australian leaf roller tachinid was initially introduced as a biological control agent for agricultural pests including the light brown apple moth and potato tuber moth. It is known to predate on at least ten agricultural and forestry pests.

Tasmanian lacewing

Tasmanian lacewing adult

Tasmanian lacewing larvae

Description

Adult Tasmanian lacewings are a small predatory insect that grow between seven and 10 millimetres long. Tasmanian lacewings can be commercially purchased for biological control.

Benefits

Both adults and larvae eat aphids and psyllids. They will eat other small insects such as citrus whitefly and caterpillars.

Tasmanian ladybird (southern)

Tasmanian ladybirds

Photos: Lee Harris, MPI

Description

The Tasmanian ladybird is bright yellow or orange with black zig zag markings and grows to about seven millimetres in size.

They were initially introduced to Aotearoa New Zealand as a biological control agent for eucalyptus tortoise beetle in 1977 and only survived in Marlborough. In 2006 and 2007 they were introduced again to other parts of Aotearoa New Zealand and established in Northland, Auckland, and Bay of Plenty.

Benefits

Tasmanian ladybirds feed on eucalyptus tortoise beetle eggs and larvae, aphids and psyllids.

Thrips

Thrips

Description

Thrips are sap-sucking insects that mainly feed on young leaves and flowers. There are over 100 species of thrips in Aotearoa New Zealand.

Adult thrips are small, thin insects that grow one to three millimetres long. They range in colour from pale yellow to dark brown. They have delicate fringed wings and can fly large distances. Larvae are wingless and smaller in size than the adults.

Thrips are likely to migrate from host weeds to nursery plants when the weather becomes hot and dry.

Common native plant hosts

Scientific names	Māori/common names
Asplenium spp., *Blechnum* spp., *Cyathea* spp., *Dicksonia* spp.	Ferns, ponga, hen and chicken fern, whekī, whekī ponga, pikopiko, kiokio
Metrosideros excelsa	Pōhutukawa
Metrosideros robusta	Rātā
Myoporum laetum	Ngaio

Photo: Christopher Stephens, some rights reserved (CC-BY-SA)

Thrips

Symptoms and damage

- Distortion of leaves and fruit.
- Leaf silvering on top side of leaf and brown sticky substance on underside.
- Spotting on flowers.
- Leaf speckling.
- Some species of thrips spread viral and fungal diseases.

Prevention and control tips

- Keep plants healthy, well fed and watered to avoid plant stress.
- Weed management.
- Commercially available predatory mites and nematodes.
- Plant soap.
- Spray oil.
- Organic insecticides.
- Chemical insecticides.

Natural predators

- Lacewings.
- Ladybirds.
- Parasitoid wasps.
- Predatory bugs.

Weevil

Garden weevil

Black vine weevil

Photo: Kyle Bland, some rights reserved (CC-BY-NC)

Photo: commoncopper, some rights reserved (CC-BY-NC)

Description

There are about 1,500 species of weevil in Aotearoa New Zealand. Different species feed on different plants, fungi, and leaf litter. Many plant feeding weevils feed exclusively on one or a few different plant species.

Adult weevils are small beetles with long snouts (rostrum). They are usually two to 10 millimetres long and grey, brown, or black in colour. Some have cryptic patterns which make them difficult to see. Larvae are creamy white in colour and don't have legs.

Pest species commonly found in nurseries, gardens, and horticultural crops include:

- Argentine stem weevil;
- black vine weevil;
- buddleia leaf weevil;
- Fuller's rose weevil;
- garden weevil;
- vegetable weevil;
- white fringed weevil.

The New Zealand giraffe weevil (on the next page) is not a pest species but may be seen in a native nursery. They can grow up to 90 millimetres in length. Males use their long snout to fight for females. The female giraffe weevil has a shorter rostrum with antennae halfway along. Adults are sap or nectar feeders and larvae eat fungi.

Common native plant hosts

Broad range of native plant hosts.

Photo: Lee Harris, MPI

New Zealand giraffe weevil male

Symptoms and damage

Adult weevils eat plant foliage causing notches and holes in leaves. Most larvae live in the soil and eat roots, corms, and tubers. Larvae feeding on roots causes plants to become weak.

As well as the above, weevil infestations can cause significant damage including:

- plant death;
- stem boring;
- wilting.

Prevention and control tips

- Weed control.
- Biological control organisms.
- Chemical insecticides.
- Larvae can be treated in soil with suitable insecticide granules.

Natural predators

Parasitoid wasps.

Whitefly

Close up of whitefly

Whitefly

Photos: Lee Harris, MPI

Description

Whitefly are small sap-sucking insects that resemble tiny white moths. They grow between one and three millimetres long. Adults and nymphs both suck sap from plants causing damage. Whitefly will fly around when disturbed and resettle back on the host plant.

Whitefly populations can increase quickly in warm conditions, especially in covered cropping systems.

Common native plant hosts

Scientific names	Māori/common names
Leptospermum scoparium	Mānuka

Symptoms and damage

- Leaf yellowing.
- Plant stress.
- Stunted growth.
- Secrete honeydew so can attract sooty mould.
- Can transmit viruses to plants.

Prevention and control tips

Whitefly can be difficult to control because the eggs and pupae are quite resistant to pesticides. It is likely that different life stages may be found on infected plants at the same time and multiple applications may be necessary for effective treatment.

- Monitor populations with sticky traps.
- Biological control organisms.
- Chemical insecticides.
- Neem.
- Organic pyrethrum.
- Plant soap.
- Spray oil.

Plant diseases

This section helps you identify potential plant diseases. Plant diseases are caused by different pathogens (bacterium, viruses or other microorganisms). They can be spread in lots of ways, including handling plants, water, infected soil and growing media, and insects.

Algal leaf spots

Photo: Lee Harris, MPI

Algal leaf spot on mahoe

Description

Leaf spots on New Zealand native plants can be caused by several different pathogens, including algae. Most don't cause significant damage and mainly affect aesthetics.

Common native plant hosts

Broad range of native plant hosts.

Symptoms and damage

- Circular leaf spots on the topsides of leaves.
- Brown spots on the underside of the leaf may coincide with the spots on the upper surface.

Prevention and control tips

- Avoid conditions where foliage remains wet for long periods.
- Fungicide application.

Bacterial leaf spots

Description

Bacterial leaf spots on New Zealand native plants can be caused by a variety of bacteria. Bacterial diseases in plants can spread fast, particularly during wet weather, and disease symptoms can appear quickly.

Common native plant hosts

Scientific names	Māori/common names
Didymocheton spectabilis	Kohekohe

Symptoms and damage

- Angled shapes contained by the leaf veins. These spots are often surrounded by a yellow halo of greasy or water-soaked plant leaf tissue.
- Greasy translucent lesions that drop out and cause shot holes in leaves.
- Leaf spots.
- Stem dieback.

Prevention and control tips

Avoid conditions where foliage remains wet for long periods.

Botrytis (grey mould)

Description

A fungal disease that affects a variety of plant species and is common in high humidity, warm, and damp conditions.

Common native plant hosts

Broad range of native plant hosts.

Symptoms and damage

Observed as fuzzy, grey to brown mould spores (mycelium) on affected plants. Botrytis can cause dieback and in serious cases death of new seedlings. It is often seen in freshly germinated stock, seedling trays, newly transplanted seedlings, overcrowded propagation trays or situations where foliage is wet for long periods of time.

Prevention and control tips

- Avoid over sowing propagation trays.
- Air circulation and ventilation.
- Increase spacing of stock to increase airflow.
- Improved watering practices that enable plants to dry after getting wet.
- Avoid conditions where foliage remains wet for long periods.
- Reduce humidity.
- Remove infected plant material.
- Systemic fungicides.

Cabbage tree sudden decline

Cabbage tree showing signs of infection

Photo: Lee Harris, MPI

Description

Caused by the pathogen *Candidatus* Phytoplasma *australiense* which is also responsible for coprosma lethal decline, phormium yellow leaf, and strawberry lethal yellows. The infection is spread by sap-sucking insects. It is believed a native flax plant hopper is responsible for transmitting the disease.

Common native plant hosts

Scientific names	Māori/common names
Coprosma spp.	Shiny karamu, twiggy coprosma, taupata, mikimiki, kanono, manono
Cordyline spp.	Tī kōuka, cabbage tree, tī
Phormium tenax, Phormium cookianum	Flax, harakeke, whararikī, korari, swamp flax, mountain flax

Symptoms and damage

Infection starts at a single point in the tree. One tuft of leaves turns yellow, wilts and defoliates leaving a bare stem. Plants infected with this disease wilt, and leaves fall off. There is no cure for the disease and mature trees can die within months after symptoms first appear.

Prevention and control tips

- Avoid placing trees under stress.
- Insecticides to treat plant hoppers and sucking insects.

Coprosma lethal decline

Description

Caused by the pathogen *Candidatus* Phytoplasma *australiense* which is also responsible for cordyline sudden decline, phormium yellow leaf and strawberry lethal yellows. The infection is spread by sap-sucking insects. It is believed a native flax plant hopper is responsible for transmitting the disease.

Common native plant hosts

Scientific names	Māori/common names
Coprosma spp.	Shiny karamu, twiggy coprosma, taupata, mikimiki, kanono, manono
Cordyline spp.	Tī kōuka, cabbage tree, tī
Phormium tenax, Phormium cookianum	Flax, harakeke, whararikī, korari, swamp flax, mountain flax

Symptoms and damage

- Abnormal leaf yellowing, reddening or bronzing.
- Dieback of shoots.
- Leaf loss.
- Stunted growth.

Prevention and control tips

Insecticides to treat plant hoppers and sucking insects.

Damping off

Description

Caused by several different soil pathogens including *Fusarium*, *Pythium*, *Phytophthora*, and *Rhizoctonia* which can be present in wet or dry soil conditions. In damper soils and growing media *Pythium* can infect seedlings, causing them to collapse and die. In drier soils and growing media *Rhizoctonia* fungi can cause damping off with similar symptoms.

Common native plant hosts

Broad range of native plant hosts.

Symptoms and damage

- Infected seedlings may fail to emerge (pre-emergence damping off).
- Seedlings collapse or rot at soil level, often covered with white fungal growth (post-emergence damping off).

Prevention and control tips

- Avoid over sowing propagation trays.
- Water carefully.
- Air circulation and ventilation.
- Keep trays and other equipment clean.
- Nursery hygiene practices.
- Improved drainage.
- Fungicide application if it appears.
- Soil fungicides.

Downy mildew

Description

A disease caused by fungus-like organisms called Oomycetes. Downy mildew is common during cool and humid conditions.

Common native plant hosts

Scientific names	Māori/common names
Veronica spp.	Hebe

Symptoms and damage

- Leaf and stem distortion.
- Grey or white downy patches on the underside of leaves. Corresponding upper leaves are mottled and yellow.
- In some species, infection may appear as black patches on the upper leaf surface and stems.
- In some cases, plants will die.

Prevention and control tips

- Air circulation and ventilation.
- Avoid conditions where foliage remains wet for long periods.
- Improved watering practices that enable plants to dry after getting wet.
- Fungicide application.

Flax yellow leaf

Infected flax

Photo: Dr Ross Beever, Landcare Research

Description

This disease was first reported in the early 1900s and had a major impact on the flax industry. Yellow leaf disease is the most serious disease of harakeke and is caused by the pathogen *Candidatus* Phytoplasma *australiense* which is also responsible for cordyline sudden decline, coprosma lethal decline, and strawberry lethal yellows. The pathogen is transmitted by the native flax plant hopper.

Common native plant hosts

Scientific names	Māori/common names
Coprosma spp.	Shiny karamu, twiggy coprosma, taupata, mikimiki, kanono, manono
Cordyline spp.	Tī kōuka, cabbage tree, tī
Phormium tenax, Phormium cookianum	Flax, harakeke, whaririki, korari, swamp flax, mountain flax

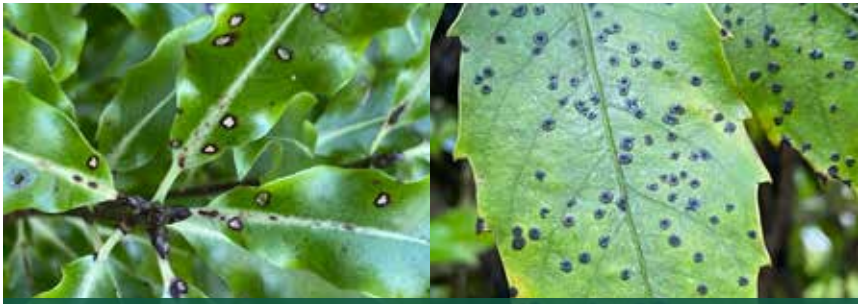
Symptoms and damage

- Abnormal yellowing of leaves, stunted growth, and premature flowering.
- Rhizome rots and leaves collapse.
- Plants will die over a period of months.

Prevention and control tips

- In pā harakeke, a bush that is suffering from yellow leaf should be dug up and burnt so that it can no longer act as a source of infection.
- Maintain good plant health.
- Regularly monitor for flax plant hoppers and other insect pests.
- Insecticides to treat plant hoppers and sucking insects.

Fungal leaf spots



Fungal spots on Pittosporum

Tar spot on *Pseudopanax arboreus*

Photos: Lee Harris, MPI

Description

Leaf spots can be caused by caused by several different pathogens including fungi. Most don't cause significant damage and mainly affect aesthetics. Fungal spores can be spread in raindrops and splashed water. Leafspot fungi are dormant in dry conditions but can return if conditions are suitable.

Common native plant hosts

Scientific names	Māori/common names
Aristotelia serrata	Wineberry, makomako
Arthropodium spp.	Rengarenga lily, rock lily
Coprosma spp.	Shiny karamu, twiggy coprosma, taupata, mikimiki, kanono, manono
Melicytus spp.	Māhoe, hinahina, whiteywood
Phormium tenax, Phormium cookianum	Flax, harakeke, whararikī, korari, swamp flax, mountain flax
Pittosporum spp.	Karo, tarata, lemonwood, kohukohu, black matipo, kōhūhū
Pseudopanax arboreus	Five-finger, whauwhaupaku, puahou
Veronica spp.	Hebe

Symptoms and damage

Spots on leaves that vary in size, colour and pattern.

Prevention and control tips

- Improved watering practices that enable plants to dry after getting wet.
- Air circulation and ventilation.
- Fungicide application.

Fusarium

Fusarium infection on tī kōuka

Photo: MPI Plant Health and Environment Laboratory

Description

Fusarium is a genus of soil fungal pathogens that can cause a range of diseases in plants such as stem canker, damping off and root rot. They are more likely to occur in warm, moist and poorly drained soils. The most common species found in nurseries are *Fusarium oxysporum* and *Fusarium solani*.

Common native plant hosts

Broad range of native plant hosts.

Symptoms and damage

- Plant death.
- Root rot.
- Seed rot.
- Stem canker.
- Stem rot.
- Wilting.
- Leaf yellowing.

Prevention and control tips

- Avoid overwatering and waterlogging.
- Moisture management.
- Reduce plant stress.
- Well-draining soils and growing media.
- Biological control agents, for example, *Trichoderma* spp.
- Fungicide application.

Mānuka blight

Mānuka blight scale insects

Mānuka blight soot fungus

Photos: Lee Harris, MPI

Description

Caused by a combination of a scale insect and a fungus.

The scale insect '*Eriococcus orariensis*' was discovered in Aotearoa New Zealand in 1937 after being accidently introduced from Australia. The scales are oval shaped about 0.8 to 1.25 millimetres in size. They are red to light brown in colour.

The scales feed on the plant and excrete honeydew onto stems and foliage. This provides a food source for black soot fungus.

Common native plant hosts

Scientific names	Māori/common names
Leptospermum scoparium	Mānuka

Symptoms and damage

The soot fungus establishes itself on stems and foliage. It blackens infested plants giving them a fire-blackened appearance. Mānuka blight is common but not often severe enough to cause plant death. The fungi alone has little effect on plant health, but a significant infestation of scales can cause a reduction of nutrients and cause plant damage and death over time.

Prevention and control tips

- Fungicide application.
- Parasitic fungus destroys the scale insect.
- Spray oil.
- Systemic insecticides.

Myrtle rust

Photo: Joseph Knight, some rights reserved (CC-BY-NC)

Photo: Dr. C.R. Schack, some rights reserved (CC-BY-NC)

Myrtle rust

Description

A serious fungal disease that affects plants in the myrtle family. It is an unwanted organism that was first identified in Aotearoa New Zealand in 2017 and spread rapidly. Myrtle rust spores are microscopic and travel large distances carried by wind. They can also be transported by insects, birds, animals, people, and machinery.

Common native plant hosts

Scientific names	Māori/common names
Leptospermum scoparium	Mānuka
Lophomyrtus bullata	Ramarama
Lophomyrtus obcordata	Rōhutu
Metrosideros excelsa	Pōhutukawa
Metrosideros robusta	Rātā
Syzygium maire	Swamp maire, maire tawake, waiwaka

Symptoms and damage

Infection only occurs on the young actively growing shoots. It appears as bright yellow to orange powdery pustules on young leaves, shoots, fruits and flowers. Leaves and stems brown off and die or appear buckled and twisted. The disease causes deformation and dieback of new leaves and shoots and prevents flowers and fruit developing.

Prevention and control tips

- Avoid conditions where foliage remains wet for long periods.
- Increase spacing of stock to increase airflow.
- Nursery hygiene practices.
- Regular crop monitoring.
- Preventative fungicide programmes.
- Report myrtle rust findings to: **inaturalist.org/projects/myrtle-rust-reporter**

Phytophthora agathidicida (PA) (kauri dieback disease)

Phytophthora agathidicida

Kauri bleeding gum

Description

Phytophthora agathidicida (PA) is a soil borne pathogen that infects kauri causing the fatal kauri dieback disease. It infects kauri trees through their roots and can be spread through the movement of contaminated soil, water, and plant material. In a nursery, PA can be rapidly spread through propagation, growing and distribution of infected seedlings and nursery stock.

The disease restricts the ability of the tree to transport water and nutrients, causing it to starve and die. PA can affect kauri of all ages and sizes including those established in forests.

In 2022, a National Pest Management Plan was put in place to help protect kauri from PA. This is the strongest protection available under the Biosecurity Act 1993. It was established to provide nationwide consistency for managing the disease and has introduced 10 rules to protect kauri. The National Pest Management Plan includes strict protocols for anyone growing kauri.

Common native plant hosts

Scientific names	Māori/common names
Agathis australis	Kauri

Symptoms and damage

- Bleeding gum.
- Dead branches.
- Plant death.
- Thinning canopy.
- Tree decline.
- Leaf yellowing.

Prevention and control tips

Comply with the rules of the National Pest Management Plan for managing the risk of *Phytophthora agathidicida* (PA).

More information

View the Tiakina Kauri – Kauri Protection website:
kauriprotection.co.nz

Tiakina Kauri – Kauri Protection has developed a nursery best practice guide to help nurseries develop their production plan and meet requirements of the National Pest Management Plan:
kauriprotection.co.nz/national-plan/growing-kauri

Scan the QR code to view the full National Pest Management Plan for managing the risk of *Phytophthora agathidicida* (PA) on the New Zealand Legislation website.

Phytophthora root rot

Description

A common root disease caused by soil borne fungus-like pathogens called Oomycetes. They infect trees and shrubs mainly in poorly drained or waterlogged soils and growing media.

Common native plant hosts

Broad range of native plant hosts.

Symptoms and damage

- Outer root tissues easily slide off.
- Plants turn yellow and die.
- Root tips are brown or dead.
- Stunted growth.
- Wilting.

Prevention and control tips

- Beneficial fungi – Trichoderma.
- Containerised plants not placed directly onto bare ground.
- Fungicide application.
- Improved drainage.
- Water permeable weed mats that allow drainage.

Powdery mildew

Photo: Mike Lusk, some rights reserved (CC-BY-NC)

Powdery mildew

Photo: Lee Harris, MPI

Powdery mildew on tītoki

Description

A fungal disease that affects a large variety of plants. Powdery mildew is common during warm and humid conditions.

Common native plant hosts

Native plants are not usually significantly affected by this disease, but it can be present on the plants below.

Scientific names	Māori/common names
Alectryon excelsus	Tītoki
Aristotelia serrata	Wineberry, makomako
Brachyglottis repanda	Rangiora, bushman's friend, bushman's toilet paper
Hoheria spp.	Lacebark, ribbonwood, houhere
Plagianthus spp.	Ribbonwood, mānatu, lowland ribbonwood, marsh ribbonwood
Sophora spp.	Kōwhai

Symptoms and damage

Infected leaves are discoloured and covered with grey or white fungal spores (mycelium). With most powdery mildews, the fungal spores are on the upper surfaces of leaves and stems, but some can be present on the undersides.

Prevention and control tips

- Air circulation and ventilation.
- Fungicide application.
- Remove and destroy infected plants.

Pythium

Description

Pythium is a genus of soilborne and waterborne fungus-like pathogens called Oomycetes that can cause root rot diseases in plants.

Common native plant hosts

Broad range of plant hosts.

Symptoms and damage

- Brown tissue on the outside of the root that can be easily pulled off.
- Damping off.
- Plant death.
- Root rot.
- Stunted growth.
- Wilting.
- Leaf yellowing.

Prevention and control tips

- Avoid overwatering and waterlogging.
- Moisture management.
- Reduce plant stress.
- Well-draining soils and growing media.
- Biological control agents, for example, *Trichoderma* spp.
- Fungicide application.

Rust

Rust on leaves

Photos: Christopher Stephens, some rights reserved (CC-BY-SA)

Description

A fungal infection that causes twisted and distorted leaves and shoots. Rust can cause defoliation.

Common native plant hosts

Scientific names	Māori/common names
Carex spp.	Sedge, cutty grass, bastard grass, hook grass, rautahi
Coprosma spp.	Shiny karamu, twiggy coprosma, taupata, mikimiki, kanono, manono
Fuchsia spp.	Climbing, trailing or creeping fuchsia, tree fuchsia, kōtukutuku
Hoheria spp.	Lacebark, ribbonwood, houhere
Olearia spp.	Chatham Island akeake, hakapiri, golden akeake, akiraho, tree daisy
Phyllocladus trichomanoides	Tānekaha, celery pine
Plagianthus spp.	Ribbonwood, mānatu, lowland ribbonwood, marsh ribbonwood
Sophora spp.	Kōwhai
Uncinia spp.	Hook grass, bastard grass

Symptoms and damage

- Defoliation.
- Distortion of stems, shoots and leaves.
- Visible clumps of yellow, orange, brown or black fungal spores (pustules) on leaves or stems of infected plants.
- Many rusts are not considered serious on native plants, however some can be significant.

Prevention and control tips

- Fungicide application.
- Prune infected shoots off woody plants.

Sooty mould

Sooty mould

Photo: Lee Harris, MPI

Description

A fungal infection caused by fungi feeding on honeydew secretions from sap-sucking insects like aphids, scale, mealybug and whitefly.

Common native plant hosts

Scientific names	Māori/common names
Beilschmiedia tawa	Tawa
Fuscospora spp.	Beech, nothofagus, tawhairauriki, tawhairaunui
Leptospermum scoparium	Mānuka

Symptoms and damage

- Foliage and stems are covered in a black sticky substance.
- Can reduce the plant's ability to photosynthesise and can affect growth in smaller plants.

Prevention and control tips

- Fungicide application.
- Chemical insecticides.
- Organic insecticides.

Tōtara blight

Tōtora blight close up

Tōtora blight

Photos: Scion

Description

Tōtara blight was first reported in 2011 and is caused by the pathogen *Phytophthora podocarpi*. It is commonly found in remnants of native bush and has been recorded across the North Island however it is unknown how widespread this disease is.

Common native plant hosts

Scientific names	Māori/common names
Podocarpus tōtara	Tōtara

Symptoms and damage

- Needles turn khaki, often becoming black before falling off.
- Shoots can be infected.
- Tips may die but retain dead browned needles and appear fire-scorched.

Prevention and control tips

Chemical fungicides.

Xylella fastidiosa

Photo: Diego Olmo, IRFAP, Spain

Foliar symptoms of infection on grape (Pierce's disease)

Description

Xylella fastidiosa is a bacterial plant disease that is spreading around the world. It poses a threat to Aotearoa New Zealand's environment and economy.

Xylella fastidiosa can infect a broad range of plant hosts and goes by many names depending on the host, such as bacterial leaf scorch, Pierce's disease, phony peach disease, olive quick decline syndrome, and citrus variegated chlorosis.

Xylella fastidiosa kills plants by blocking their water-carrying vessels, causing typical leaf scorching symptoms. There is no cure for the disease once the plant is infected.

Overseas, *Xylella fastidiosa* has caused devastating diseases in crops like grapes, olives, stone fruit, and citrus. This bacterium has had a devastating impact in Italy, where it killed 1,000-year-old olive trees and decimated olive production, costing billions of Euros on production losses and damages. In California, Pierce's disease significantly impacts grape production, costing around $104 million annually due to reduced yields and control measures.

Common native plant hosts

Xylella fastidiosa is known to infect more than 600 plant species, including Aotearoa New Zealand native, horticultural, and ornamental plants. **It's important we keep this plant disease out of Aotearoa New Zealand.**

Symptoms and damage

Xylella fastidiosa multiplies in the water transport system in plants, blocking and damaging it. This impairs water movement within the plant, causing leaf scorching and wilting.

Symptoms can vary between hosts and in some cases, plants may have no symptoms (asymptomatic). It is important to keep in mind that symptoms can be confused with water stress, nutrient deficiencies, frost and herbicide damage.

The main symptoms to look out for are:

- leaf scorch, where leaves may show marginal browning or scorching starting at the tips;
- leaf chlorosis, involving yellowing of the leaves particularly between the veins;
- stunted growth, wilting and dieback that may only involve one branch;
- premature leaf drop;
- the production of smaller, harder fruits that may shrivel or drop early;
- dieback and death of the plant.

Keep in mind that these symptoms can also be a sign of other plant diseases already present in Aotearoa New Zealand.

How it spreads

Xylella fastidiosa is spread by the movement of infected plant material and by sap-sucking insects such as spittlebugs and sharpshooters. It could travel internationally on infected nursery stock or illegally imported plant material.

The meadow spittlebug (*Philaenus spumarius*), which is a key disease vector in Europe, is present and widely distributed in Aotearoa New Zealand. In addition, there are many native local insects that could potentially spread *Xylella fastidiosa*.

Prevention and control tips

- Closely monitor plants for signs of infection.
- If you have found signs you think might be *Xylella fastidiosa* on host plants, photograph your plant and call MPI on **0800 80 99 66**.

Monitoring for pests and diseases

This section helps native plant nurseries and other growers to develop a structured approach for detecting and managing pests and diseases in their production system. Improving biosecurity and pest management practices enables nurseries to produce healthy plants for restoration, revegetation, and conservation projects.

Why monitoring matters

Native plant nurseries play a critical role in biodiversity and ecological restoration. However, they may be vulnerable to pests and diseases that:

- are potential biosecurity risks to New Zealand and its primary industries;
- are a risk to New Zealand's native flora and threaten its natural ecosystems;
- have the potential to establish or spread quickly through nursery practices;
- reduce plant quality and survival rates;
- cost time and money to effectively manage or control.

A regular and effective nursery monitoring programme assists with early detection of pests and diseases. It allows plant producers to make management decisions based on what is present in their nursery at any given time. Understanding the type of pests and diseases, their lifecycle, and potential damage they have on plants helps with decision making.

Nursery staff are additional eyes in the field – encourage staff to report pests and diseases if they are discovered.

Pest and disease monitoring objectives

Finding pests and diseases early reduces the potential damage they can cause, reduces risk of unwanted spread, and increases the options for management and control. Pests and diseases may be seasonal or appear on certain plant species.

An effective monitoring programme aims for:

- early detection of pests and diseases;
- accurate identification;
- timely response to prevent spread and damage;
- documentation for traceability and continuous improvement.

Create a monitoring plan

Monitoring should be completed regularly and consistently. Ensure that high-risk plant species or high-risk areas in the nursery such as propagation houses or tunnel houses are always included in the monitoring plan. Maintain good records of findings and actions using a crop monitoring record form like the example on page 112.

Crop monitoring plan template

Download a copy of the crop monitoring plan template by scanning the QR code with your phone.

A successful monitoring plan could include:

- weekly visual inspections during active growing seasons (spring to autumn);
- fortnightly or monthly checks during winter or dormancy;
- pre-dispatch inspections before plants leave the nursery.

Crop scouting

Scouting is an important role in the nursery and should be completed by trained or skilled staff who are familiar with pests, diseases, and their signs or symptoms.

It is time consuming and impractical to inspect every plant in the nursery, so establishing a routine procedure or pattern allows for inspecting the nursery in an efficient way. Work out the most effective scouting technique for your production system. Below is an example of a scouting technique that you could adapt to suit your nursery.

Example of how to scout

- Walk every second row of the nursery (alternate rows each time you scout).
- As you are walking, visually inspect the plants paying attention to what looks out of place and for signs of pest infestation or disease symptoms.
- Pay attention to any new growth as it is likely this will be more attractive to pests.
- Stop at regular intervals such as every 10 metres, irrigation upright, or tunnel house post, or when signs of pests or disease symptoms are detected.
- Inspect five plants or trays from the same batch more thoroughly, particularly the underside of leaves for signs or symptoms of pests or disease.
- If possible, remove the plants from containers and inspect root balls looking for soil borne pests or pathogens, check moisture content and root growth (this will depend on container type and age of stock).
- Assess the percentage of plants in the batch that have been affected and compare healthy with unhealthy plants.
- Record pests, diseases, beneficial insects or any other findings on a crop monitoring record.
- Mark or note any areas requiring treatment and advise the appropriate person (spray technician or nursery manager).
- Collect any unknown pest or diseases for further identification.

Tools and materials

- 30x hand lens or magnifier.
- Crop monitoring record sheets or another method to record findings.
- Camera or cell phone for photo documentation.

- Sample bags or containers to capture unknown pests for identification or lab submission.
- Pest ID guides.

What to look for

Below are quick guides of what to look for when scouting.

Sign of pests	Potential pest
Chewed leaves	Caterpillars, beetles, snails
Sticky residue or honeydew	Aphids, scales, mealybugs, psyllids, whitefly
Webbing	Mites, caterpillars
Leaf distortion	Thrips, aphids, mirid, mites
Leaf bronzing	Thrips, mirid
Leaf notches	Moths, caterpillars, weevils
White powdery wax	Mealybugs, flocculent flax scale
Linear mines in leaves	Leaf miner
Leaf yellowing	Scales, psyllids, whitefly
Plant abnormalities – galls, witches broom	Mites
Leaf curling	Caterpillars, leaf miner, psyllids

Symptoms of disease	Potential pathogen
Leafspots or blotches	Fungi, bacteria, phytoplasma
Wilting or dieback	Phytophthora, *Pythium*, phytoplasma
Powdery or downy growth	Powdery mildew, downy mildew
Abnormal growth	Virus, nutrient imbalance
Root rot	Phytophthora, *Pythium*

Response actions

If a pest or disease is found:

- Identify the pest or disease – if necessary, submit samples to a diagnostic lab or submit photos to the iNaturalist website for help with identification: **inaturalist.org**
- Apply appropriate treatment (biological, cultural, or chemical).
- Review hygiene protocols (for example, tool cleaning, footbaths).
- Update monitoring records and communicate with staff.

What to do if you think you have found an exotic pest or disease

If you think you have found an exotic pest or disease that hasn't been found here before contact the Ministry for Primary Industries (MPI) immediately. Any delay can make it harder for them to investigate.

MPI contact information

Freephone the MPI exotic pest and disease hotline on **0800 80 99 66.**

Or use the online report form:
report.mpi.govt.nz/pest

Photographing the pest or disease

Photos will help MPI interpret your finding. Photograph the pest if possible and catch it if it's safe to do so. Photography tips:

- place the finding against a white background;
- include a common object for scale (such as a 10-cent piece) or use a ruler;
- use the default settings on your phone's camera;
- don't zoom in or add filters;

Guide to photographing biosecurity suspects

Scan the QR code with your phone to watch the MPI guide to photographing biosecurity suspects:
youtu.be/0ehdLclfbL4

Crop monitoring record – example

Person monitoring: John Smith

Date: 29/10/2025

Area monitored (e.g. propagation house, shade house, growing bed)	Plant species and grade Batch number if known	Number of plants sampled	Physical signs or symptoms	Presence of pests, pathogen or disease (Y/N) List if known	Presence of beneficials (Y/N) List if known	Initial action taken	Follow up action	Date
Fenceline in the Pitto block	Pittosporum tenuifolium – T28 #2024 – 10	5 trays	Sticky leaves, ants present, aphids on new growth	Aphids – all life stages	Steelblue ladybirds, lacewings	30/10/2025 Moderate infestation, beneficials unlikely to manage. Treated with soft chemical and monitor.	Chemical treatment successful. Beneficials maintaining low population	05/11/2025
Propagation house	All propagation trays mixed natives	100 trays	Small black flies on soil surface. Small transparent larvae observed in media.	Sciarid fly (fungus gnats)	N	30/10/25 Reduce irrigation and manage moisture levels in trays. Bacillus thuringiensis drench on trays to control larvae. Release Stratiolaelaps scimitus to control eggs, larvae and pupae. Monitor adult population with yellow sticky traps.	Small number of adults observed on sticky traps. Replace sticky traps and continue monitoring. Beneficials present.	19/11/2025

Glossary

Bacillus thuringiensis	A naturally occurring bacterium that produces proteins toxic to certain insect larvae and caterpillars when eaten. Commercially produced as a biological insecticide
Beneficial insects	Species that provide a benefit such as pollination or pest control
Biological control	Using one organism to control another
Biological control organisms	Natural enemy like a parasite, predator, or disease that is introduced into an environment to control a pest
Colony	One species living close together or forming a connected structure like a hive or nest
Cryptic pattern	Colouration or markings that help camouflage an animal in its natural environment
Defoliation	Significant leaf loss
Distortion/distorted	Warped, twisted or deformed
Flocculent	Fluffy and looks like wool
Fungicide	Toxic substance used to kill or inhibit fungal growth
Galls	Abnormal growths on plants caused by parasitic organisms
Gastropod	Mollusc such as a snail or slug
Honeydew	Sugary substance excreted onto plants by sap-sucking insects
Infestation	Large number of organisms that are present where they are not wanted
Insect growth regulators	Substances that inhibit the development of insects. Used to break part of the life cycle of insects, stopping them reaching maturity and preventing them from reproducing
Insecticide	Toxic substance used to kill insects
Larvae	Immature form of an insect, for example, caterpillar and grub
Leaf axils	Area of the plant where a shoot grows out of the main stem
Miticide	Toxic substance used to kill mites
Mollusc	Invertebrate organism which includes snails and slug
Molluscicides	Toxic substance used to kill molluscs (snails and slugs)
Mottled/mottling	Marked with spots or blotches of two or more colours
Mycelium	Mass of filaments (hyphae) that form the body of a fungus
Neem	Organic pesticide derived from the tropical neem tree
Nocturnal	Active at night
Oomycetes	Unique group of microorganisms often called water moulds
Ovisac	Egg containing capsule
Pathogens	Bacterium, virus or other microorganism that can cause disease
Pesticides	A substance used to destroy insects or other organisms
Photosynthesis	The process by which green plants and some other organisms use sunlight to synthesise nutrients from carbon dioxide and water
Prolegs	Fleshy abdominal limb of a caterpillar or insect larva
Pronotum	Plate like structure that covers all or part of the thorax of an insect

Pyrethrin	A natural insecticide made from dried flowers of pyrethrum plants
Rongoā	Traditional Māori healing system which includes herbal remedies, physical therapies, and spiritual healing
Secrete	Produce and discharge
Sticking agent	Spray additive that enhances the retention and adherence of agricultural chemicals. Designed to improve the performance of the spray mix
Symbiotic	Mutually beneficial relationship between two different organisms
Systemic	Absorbed by plants and distributed through their tissues, which protects all parts of the plant after application
Translucent	Semi transparent
Transmission	Spread from one thing to another
Trichoderma	Genus of fungi that is used as a biocontrol agent to suppress plant diseases caused by other fungi
Vector	Living organism that carries and transmits infectious pathogens
Witches broom	Deformed growth that resembles a broom

More information

Scan the QR codes with your phone to open the related resource.

Crop monitoring record template

Download a copy of the crop monitoring record template.

Invasive ant species factsheet

View the Biosecurity New Zealand factsheet on the National Invasive Ants Programme.

Brown marmorated stink bug factsheet

View the Biosecurity New Zealand factsheet about brown marmorated stink bugs.

Tiakina Kauri website

Learn more about Tiakina Kauri, the national programme for kauri protection.

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Or use the online report form:
report.mpi.govt.nz/pest

Notes

Notes

Te Uru Rākau – New Zealand Forest Service
Ministry for Primary Industries
PO Box 2526, Wellington 6140, New Zealand
0800 00 83 33
mpi.govt.nz/forestry

Te Kāwanatanga o Aotearoa
New Zealand Government