Specialty Wood Products Research Partnership

NZDFI Biosecurity Risk Management Plan

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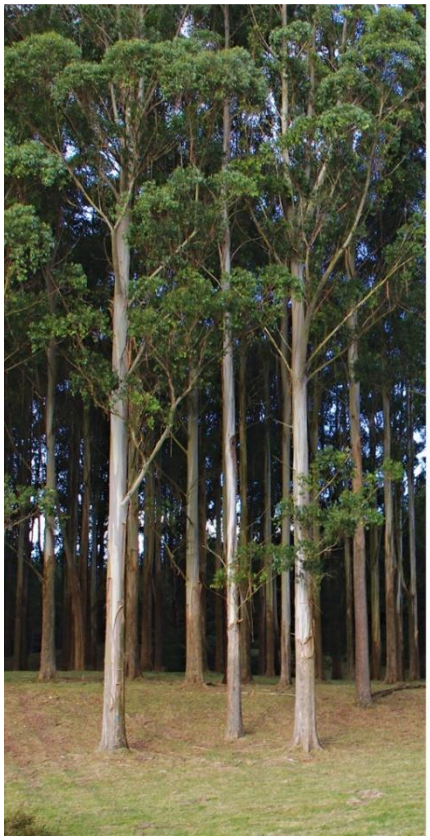

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FOREST GROWERS RESEARCH

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FOREST GROWERS RESEARCH

EXECUTIVE SUMMARY

A number of new biological threats to eucalypts have recently become established in New Zealand.

NZDFI are particularly concerned about the risk of spreading myrtle rust and EVB from the north to south Islands.

Movement of foliage has been assessed as carrying the highest biosecurity risk for both myrtle rust and EVB. Movement of wood samples carries a small risk of transferring EVB adults and a moderate risk of transferring eggs and larvae of *T. sloanei* in particular. Movement of people between sites also carries a small risk, particularly if myrtle rust becomes established at a site.

NZDFI researchers and students should undertake a series of measures to reduce this risk.

1) Conduct surveillance to assess risk level prior to commencing fieldwork or sampling
2) Carry out inspections to prevent contamination during sample collection and packing
3) If necessary, treat samples as recommended herein
4) Inspect samples in a contained area when unpacking to prevent escape of any live pests / pathogens that may still be contaminating consignments
5) Dispose of waste material as recommended herein

Treatments recommended include;

Foliage from Woodville to Christchurch

- Risk assessment prior to sample collection
- No collection if myrtle rust is detected
- Inspection for rust and insect eggs/larvae/adults during collection and packing
- Spray with flori-gas immediately prior to sealing containers for transport to South Island
- Visual inspection of container exterior before transport
- Storage of samples in cool room prior to unpacking
- Visual inspection of foliage during unpacking in sealed room (lab building away from main glasshouses) at Proseed
- Bag and burn or freeze waste material
- Ongoing pest and pathogen surveillance in propagation facility

Wood samples from Woodville to Christchurch

- Conduct risk assessment prior to sample collection
- Inspection during packing
- Overnight flooding
- Spray with flori-gas immediately prior to sealing containers for transport to the south island
- Visual inspection of container exterior before transport
- Storage of sample in cool room prior to unpacking
- Visual inspection of samples during unpacking in sealed room (wood-tech lab) at UC
- Treatment of waste water with bleach

INTRODUCTION

All individuals involved in the NZDFI have an obligation to the forestry and nursery industries to minimise the risk of spreading pests and disease during the handling and movement of plant material between sites. This includes between individual demonstration or breeding trials, and between field trials and laboratory or nursery facilities. This is particularly important when moving people and material between the North and South Islands given the recent incursions of the eucalypt variegated beetle and myrtle rust. It should be noted, however, that there are a number of other eucalypt pests present in the North Island that are not present in the South. There is also one psyllid present in Amberley that is not known to be present in any field trials in either the North or South Islands.

There is also a legal obligation to inform MPI if new pests or disease are detected in New Zealand, or in a region where they have not previously been found. This document is designed to inform the NZDFI science team (including UC staff, students, propagation specialists, and consultants) about key biological risks associated with field trials, nursery propagation and laboratory research and provide details on how to manage these biosecurity risks. Recommendations are provided on measures that can be taken to minimise the risk of spread pests and disease.

Current Biosecurity Concerns

Myrtle Rust (*Austropuccinnia psidii*)
Austropuccinia psidii (G. Winter) Beenken is part of a fungal complex native to Central and South America and the Caribbean. Since 1977, various forms of the rust (also called guava or eucalypt rust) have spread to many countries, including to Australia in 2010 (Fig. 1). In May 2017 myrtle rust was detected for the first time on the New Zealand mainland, most likely having arrived on wind currents from Australia.

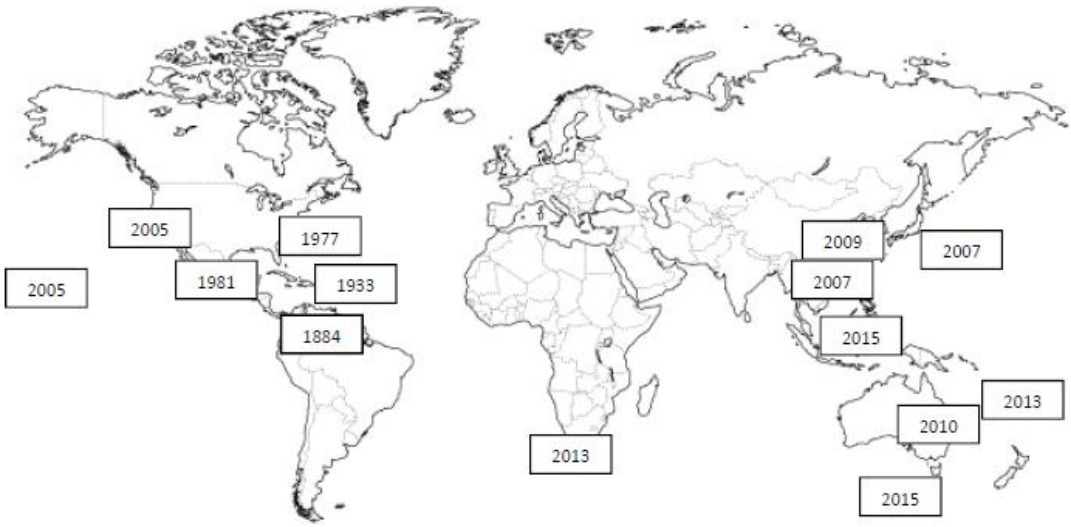

Figure 1: Global distribution of *Puccinia psidii* sensu lato complex showing year of first record (reproduced from Hood, 2016).

The fungus is an obligate parasite, preferentially infecting fast growing tissues including foliage, fruit, flowers and new shoots. It is unusual in having an exceptionally wide host range. It is specific to plants in the family myrtaceae, which, in addition to *Eucalyptus*, includes many native as well as exotic species (e.g. Acacia, Manuka, Pōhutukawa, etc.), Myrtle rust can reportedly infect 445 species in 73 genera (Hood, 2010). Impacts vary from minimal to severe, including plant death. In Australia ~350 species in 58 genera have been found to be susceptible, but to date minimal damage has been

observed in the forestry industry, and most eucalypt damage in the field is restricted to seedlings (Pegg et al., 2014). Significant impacts have occurred in the nursery and lemon myrtle industries. Screening of the 30 eucalypt species native to Tasmanian indicates those in the subgenus *Symphyomyrtus* may be more susceptible than those in the subgenus *Eucalyptus* (Potts et al., 2016). Severe damage has been observed in exotic eucalypt plantations (*E. grandis*, 1973) in Brazil (Tommerup et al., 2003), but susceptibility is highly variable between trees and the disease is controlled using fungicide applications to nursery stock and planting of resistant clones in heavily affected regions.

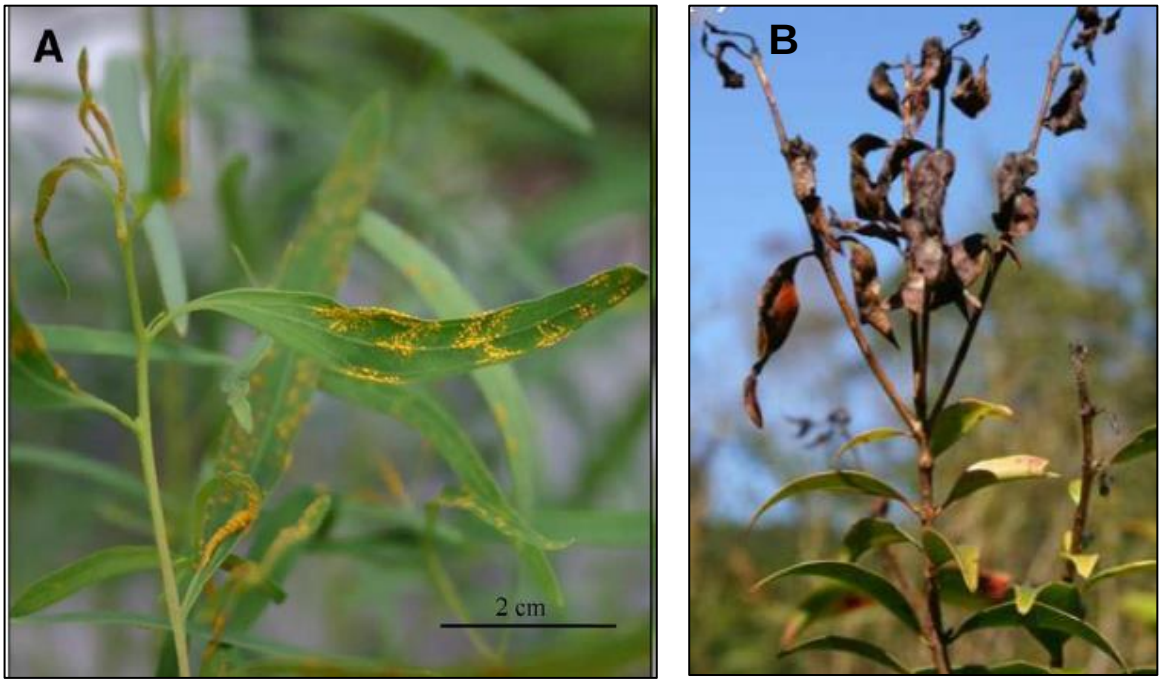

Figure 2: (a) *E. argophloia* showing severe infection following lab inoculation (from Lee et al., 2015); (b) Severe damage (host species not named) observed during field surveys in Queensland (from Pegg et al., 2014).

New Zealand Detection

Since the detection of myrtle rust on the New Zealand mainland, there have been ~48 confirmed finds up to September 2017 (Taranaki 39, Northland 4, Waikato (Te Kuiti, Otorohanga) 4, Bay of Plenty (Te Puke) 1). A Legal Controlled Area Notice has been issued by MPI extending 10km around all infected properties in the Taranaki area, prohibiting movement of any mytaceae plant material (with the exception of feijoa which appear unaffected). The disease has been detected on 5 genera to date (*Lophomyrtus*, *Metrosideros*, *Syzygium*, *Leptospermum* and *Eucalyptus*), including pōhutukawa (*Metrosideros excels* and *Metrosideros* sp.), ramarama (*Lophomyrtus bullata*); myrtle (*Lophomyrtus* sp.), mānuka (*Leptospermum scoparium*) and monkey apple (*Syzygium smithii*) (Myrtle rust stakeholder update, 13 June 2017). The greatest number of finds appear to be on ramarama and pōhutukawa (Fig. 3). Only one case has been confirmed on *Eucalyptus* and the species was not determined. Based on experience in Australia, known eucalypt hosts grown in New Zealand include *E saligna, E. botryoides, E. pilularis, E. regnans and E. nitens* (Colley, 2005). Heritable resistance to the Australian biotype of myrtle rust has been observed in inoculation studies with *E. argophloia* in Queensland (Lee et al., 2015).

Depending on factors such as temperature and humidity, myrtle rust may be present and unseen for long periods. Under optimal conditions (15-20^{o}C, or possibly lower, 90% R.H., > 6hrs leaf wetness, low light) first symptoms may be visible in 3-5 days, and the more easily identifiable yellow eruptions in 12 days. However, during winter, symptoms can be difficult to identify and when conditions are unsuitable for fungal growth resting spores may be produced that can survive as long as 150 days.

Figure 3: Myrtle rust symptoms; (left to right) Ramarama (*Lophomyrtus*), lilly pilly (*Syzygium*), pōhutukawa (Images from MPI website http://www.mpi.govt.nz/protection-and-response/responding/alerts/myrtle-rust/).

Kriticos and Leriche (2008) modelled the potential range of myrtle rust in New Zealand. Given the dryland focus of the NZDFI, established South Island trails are generally not represented in regions considered optimal to disease spread. Woodville and other east-coast North Island sites and potentially some Marlborough and North Canterbury sties could possibly be suitable (Fig. 4). The climatic conditions at Amberley where Proseed nursery is located are probably marginal for myrtle rust, however conditions within the nursery glasshouses themselves would be suitable if contaminated plant material was brought in.

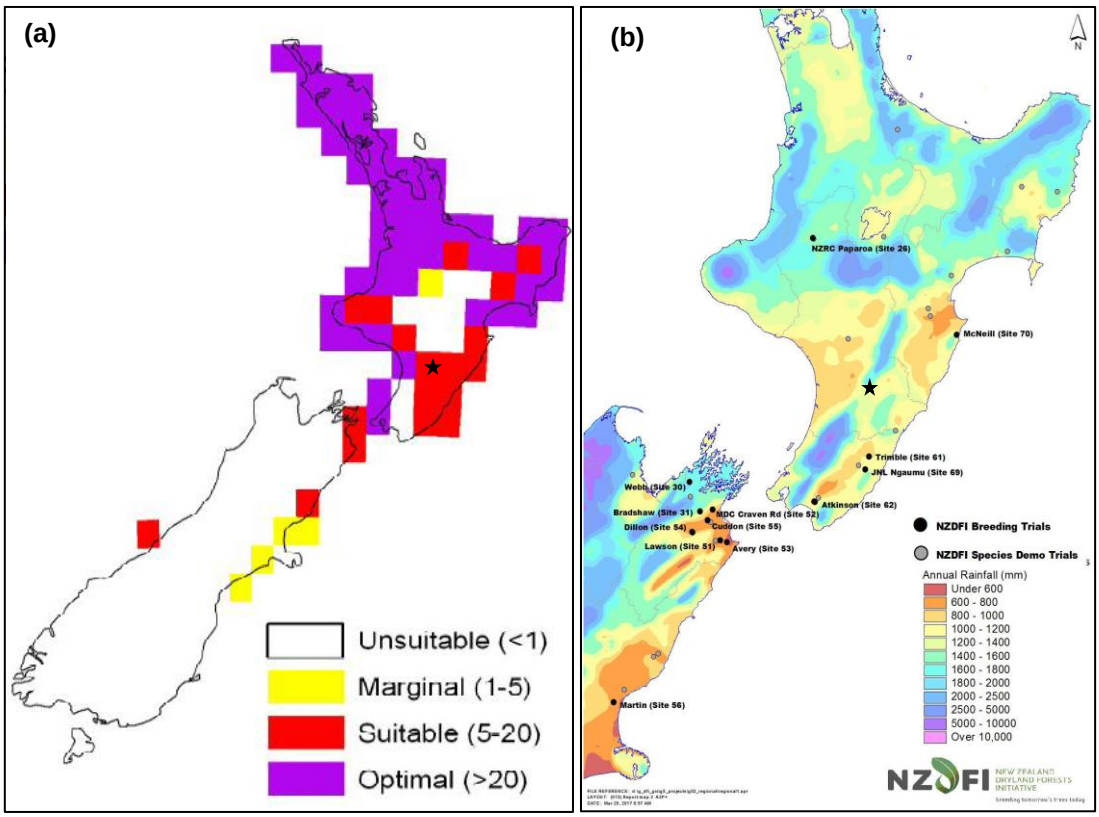

Figure 4: (a) Predicted range of myrtle rust in New Zealand (from Kriticos and Leriche, 2008), (b) location of NZDFI sties. The star on both maps shows the approximate location of Woodville.

Myrtle rust has been declared an Unwanted Organism and a Notifiable Organism under the Biosecurity act 1993. As such, if detected in any NZDFI trials (or any other place where MPI is not already aware of it) it must be reported to MPI immediately using the pest and disease hotline (0800 80 99 66). Suspected myrtle rust should not be touched – take a photo and send it to MPI.

To date myrtle rust has not been detected at Woodville (SPS inspection, June 2017) but it is expected to arrive eventually given the spread observed in other countries (e.g. Australia, Hawaii). Once detected at Woodville or any NZDFI trial, movement restrictions would most likely be put in place in the short term, meaning no plant material or equipment (whether associated with infect plants or not) will be able to be moved off-site and fungicide treatments (Appendix 1) would be implemented.

It may be possible to spread myrtle rust before it has been detected in Woodville. A number of precautions can be taken to prevent this happening. Herein we recommend undertaking measures based on those disseminated by NZPPI (New Zealand Plant Producers Incorporated).

Eucalyptus Variegated Beetle (*Paropsisterna variicollis*)

Paropsisterna variicollis (Fig. 5), or eucalyptus variegated beetle (EVB) is an Australian chrysomelid beetle closely related to the well-establish pest *Paropsis charybdis*. The beetle was detected in March 2016, in Esk forest near Te Pohue, Hawke's Bay. An MPI Incursion Response including a delimitation survey was initiated shortly after the detection, but was closed in autumn 2017 after surveillance confirmed the beetle had become established across the Hawke's Bay.

EVB is of major concern to the eucalypt forest industry given many related paropsine beetles are well-known pests in New Zealand (*Paropsis charybdis*), Australia (at least 12/~450 described species including *Pst. bimaculata*, *Pst. agricola* and *Pst. atomaria*), South Africa (*Trachymela tincticollis*), California (*T. sloanei* & *Pst. m-fuscum*) and Ireland (*Pst. selmani*) (Murray and Lin, 2017). Anecdotal evidence to date suggests EVB has the potential to be at least as problematic as *P. charybdis* given it appears to be active in the environment over a longer period (i.e. over-wintering later and emerging earlier in spring).

In January 2017, an assessment of >1600 trees at three NZDFI trial sites (HBRC, Alexander, McNiell) between15 and 60 km from the initial detection site showed EVB was well established and more abundant than *P. charybdis* (Lin et al., 2017). Defoliation was observed on all 11 eucalypts species present (*E. argophloia, E. bosistoana*, *E. camaldulensis*, *E. cladocalyx, E. eugenoides, E. globoidea*, *E. longifolia, E. macrorhyncha, E. notabilis, E. tricarpa* and *E. quadrangulata*), with most species suffering moderate chewing damage at that time. Generally, *E. macrorhyncha* had the least chewing damage, followed by *E. cladocalyx* and *E. globoidea*. *Eucalyptus bosistoana*, *E. quadrangulata* and *E. camaldulensis* were the most heavily defoliated, followed by *E. argophloia* and *E. tricarpa*. Eggs were most prevalent on *E. bosistoana* and least prevalent on *E. macrorhyncha* at that point in time, although a full assessment in spring will be required to accurately determine any preferences between species.

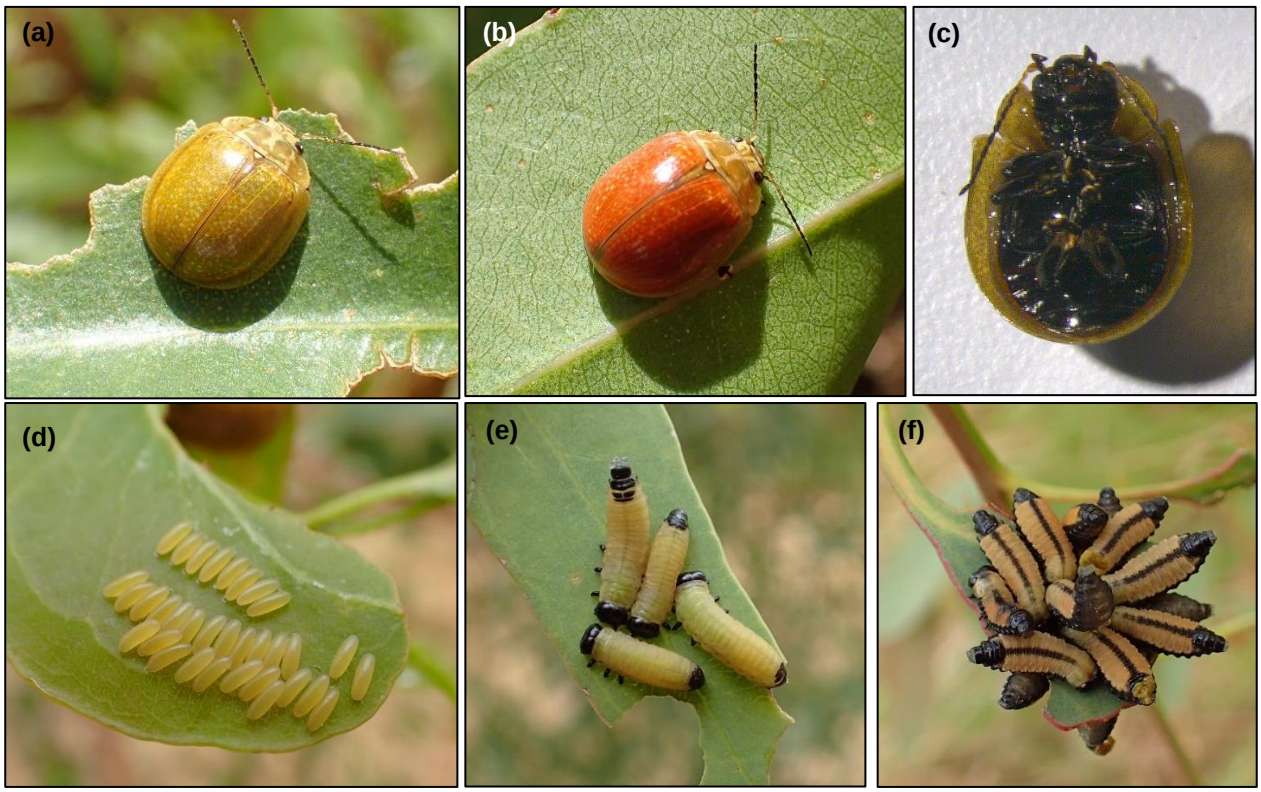

Figure 5: EVB life stages: (a, b) variable colour of adults, (c) distinctive black underside, antennae and legs, (d) loosely aggregated eggs (not glued together like *P. charybdis*) (e) early and (f) late instar gregarious larvae (late instar *P. charybdis* larvae are solitary).

Assuming the phenology of EVB is similar to that of *P. charybdis* it can be expected that there will be 1-2 generations per year. Adults will lay eggs on foliage from early spring in response to the presence of expanding flush (new growth). Defoliation will likely peak in December and again in late summer and adults will be active until early autumn. Pupae and second generation adults will enter a quiescent phase over winter when temperatures are low, however adults may emerge to feed occasionally during warm periods. Egg laying will not commence again until temperatures increase and flush foliage is present the following spring. There is no indication climate will pose a major barrier to the establishment of EVB wherever eucalypts occur throughout New Zealand.

It is anticipated some degree of biological control will occur as a result of the presence of two primary egg parasitoids already established in New Zealand; *Enoggera nassaui* (intentionally introduced to control *P. charybdis*) and *Neopolycystus insectifurax* (self-introduced). Shortly after the detection of EVB in New Zealand photos of eggs showed signs of probing by parasitoid wasps, while eggs assessed *in situ* at the NZDFI trial sties in January clearly showed parasitism was occurring (Fig. 6).

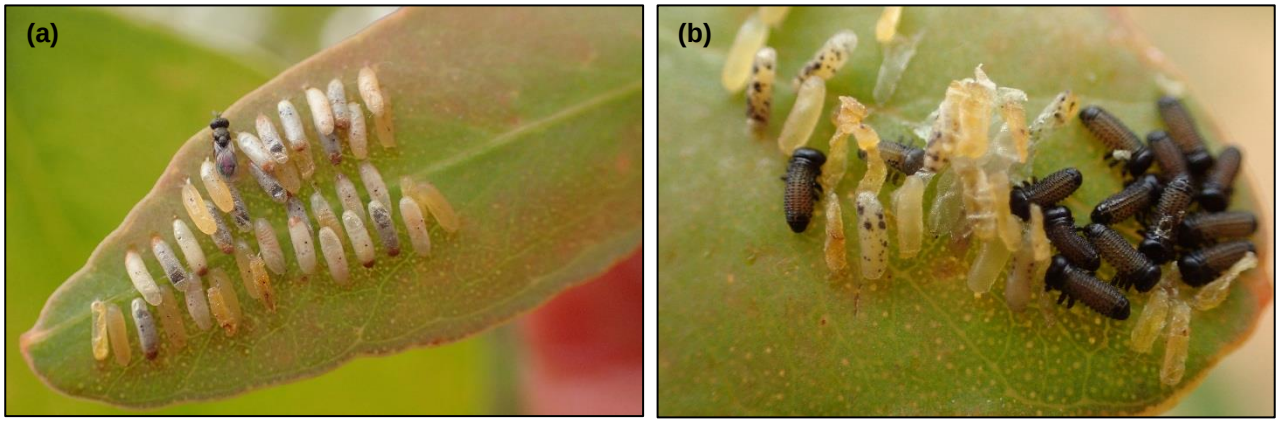

Figure 6: (a) Adult *Neopolycystus insectifurax* and EVB eggs that appear to be parasitised by *N. insectifurax* (eggs appear striped rather than uniform in colour). (b) EVB eggs that appear to be parasitised by *Enoggera nassaui* (eggs appear spotted rather than uniform in colour) amongst hatching EVB larvae.

Other insect pests of concern

There are ~34 eucalypt-specific insect herbivores established in New Zealand. Many of these occur throughout the country but several important pests are still restricted to the North Island. Although these species are likely to establish in the South eventually, care should be taken to avoid facilitating their spread. Of the 5 established paropsine beetles only *P. charybdis* (Fig 7a) is in the South Island. *Trachymela sloanei* (Fig 7b) has the potential to be a pest in dryland regions but is currently restricted to the upper North Island, particularly the east coast around Gisborne. *Paropsisterna beata* (Fig. 7c) was successfully eradicated following detection in Whiteman's Valley, Upper Hutt, in 2012. However, in 2016 the beetle was apparently found in near-by Waikanae and MPI determined they would take no further action against it. Its distribution is unclear but it is not present in the South Island.

Other Australian eucalypt insects with pest potential that are not yet present in the South Island include *Uraba lugens* (gum leaf skeletoniser), a hairy, gregarious caterpillar, and *Thaumastocoris peregrinus* (Bronze Bug). Gum leaf skeletoniser (Fig. 8a) is present in NZDFI trials in the Hawke's Bay (observed in Alexander, 2017). Bronze bug (Fig 8b) is considered a pest in parts of its native Australia and suddenly spread to 14 countries in 3 continents (Africa, South America, Europe) in just 10 years. It has been recorded on many eucalypt species, including *E. agophloia*. In New Zealand it established in Auckland and has dispersed as far south as Hamilton. It is tiny, fast moving and an excellent hitch-hiker.

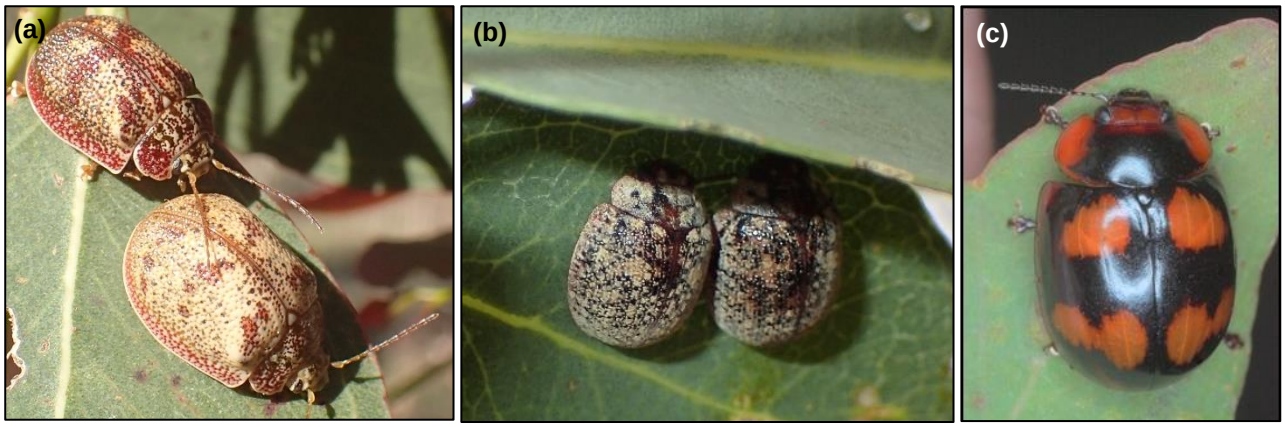

Figure 7: (a) *Paropsis charybdis* – present throughout New Zealand; (b) *Trachymela sloanei*, established in the North Island but not present in the South Island; (c) *Paropsisterna beata*, eradicated from Whitman's Valley but later detected in Waikanae, status unclear.

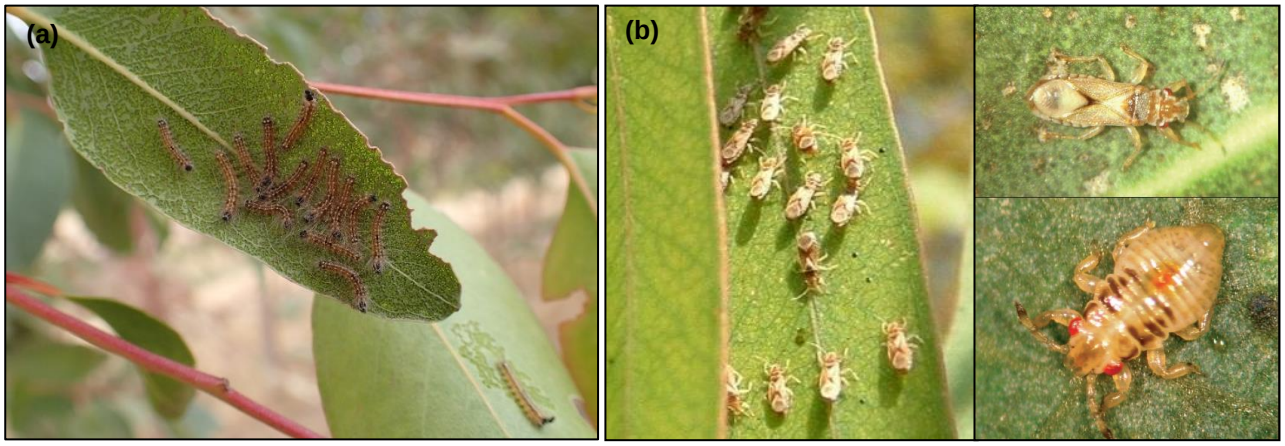

Figure 8: (a) *Uraba lugens*, established in parts of the North Island. Pest of eucalypts but also irritant to human skin. Note the cone shaped black head (bottom right) as a result of the insect retaining their head capsules after each moult (they stack them one on top of another on top of their actual head). (b) Bronze bug adults (left and top) and nymph (bottom right) are very difficult to see, clusters of tiny black eggs may also be present.

Nassella Tussock (*Stipa trichotoma*)

Nassella is an invasive grass from South America. It out-competes other plants and can become a significant pest of open country (Fig. 9), with the potential to dominate dry pastoral landscapes. It is unpalatable to stock and the serrated seed heads (Fig. 9b) can contaminate wool, damaging the fleece. Nassella can be difficult to identify but young plants are more erect than other tussocks and have blue/green leaves with blond tips. During spring-summer it can be identified by the masses of purple/pink flowers and distinctive serrated seed-heads.

The ecology and invasive biology of the weed is well suited to the dry hill country conditions characteristic of many NZDFI sites and it is well established in NZDFI areas in Marlborough, parts of the Hawke's Bay, and the Hurunui district of Canterbury. Nassella has been observed (2015) within and around the Avery's 2010 *E. bosistoana* breeding trial, and is likely to be present in, or adjacent to, other trials, particularly in the Marlborough region. Viable seeds are produced from late spring (November) with peak seed production in the December/January period. This correlates with periods of high activity in NZDFI trials. Seeds can be dispersed via the wind or by vectors such as livestock vehicles, clothing, shoes and felled logs.

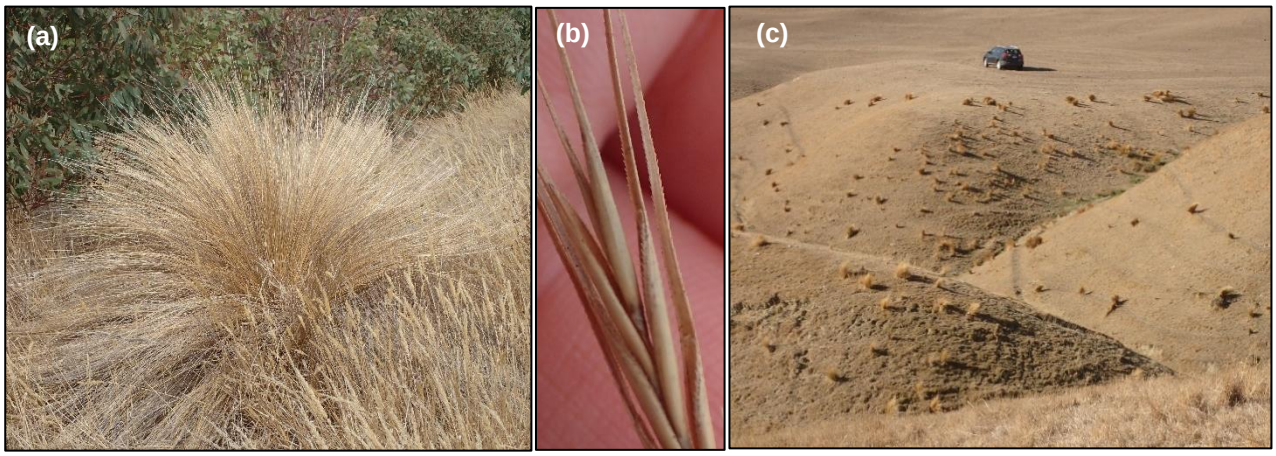

Figure 9: (a) Nassella tussock grass at 'Avery's 2010' *E. bosistoana* trail. (b) serrated seed-head. (c) Nassella scattered across paddocks on approach to Avery's trial (March 2015).

Nassella tussock is listed as an Unwanted Organism meaning it is an offence under sections 52 and 53 of the Biosecurity Act to sell, propagate or distribute the plant. It is included in nine Regional Pest Management Plans (RPMP) throughout New Zealand (Fig 10a). Most regional councils list it as an eradication/total control pest, with an objective to completely eliminate the plant from the environment. In Canterbury, eradication is not deemed feasible within the time frame of the RPMP, so the weed is treated as a progressive control pests (systematic progress towards eradiction). As part of the Environment Canterbury RPMP, land occupiers are required to eradicate plants by 30 September or 31 October each year, depending on location, to prevent seeding. For Martins and Proseed the 30 September date would apply if plants were present.

In Marlborough, Nassella is a widespread Containment Control pest. Landowners are obliged to prevent the spread and increased density of the weed before seeds are produced. This is usually achieved by grubbing and spraying prior to October.

In the Hawke's Bay, Nassella is a Total Control (service delivery) pest with the long term goal of complete eradication. It is considered cost effective for the council to undertake the control rather than leaving the responsibility with land-owners as intensive management has reduced infestation to just three sites. Two sites are in the Tangoio area which is near the NZDFI HBRC Tutira trial. The other is in the lower Tuki tuki, within 10-15 km of the McNeill trial.

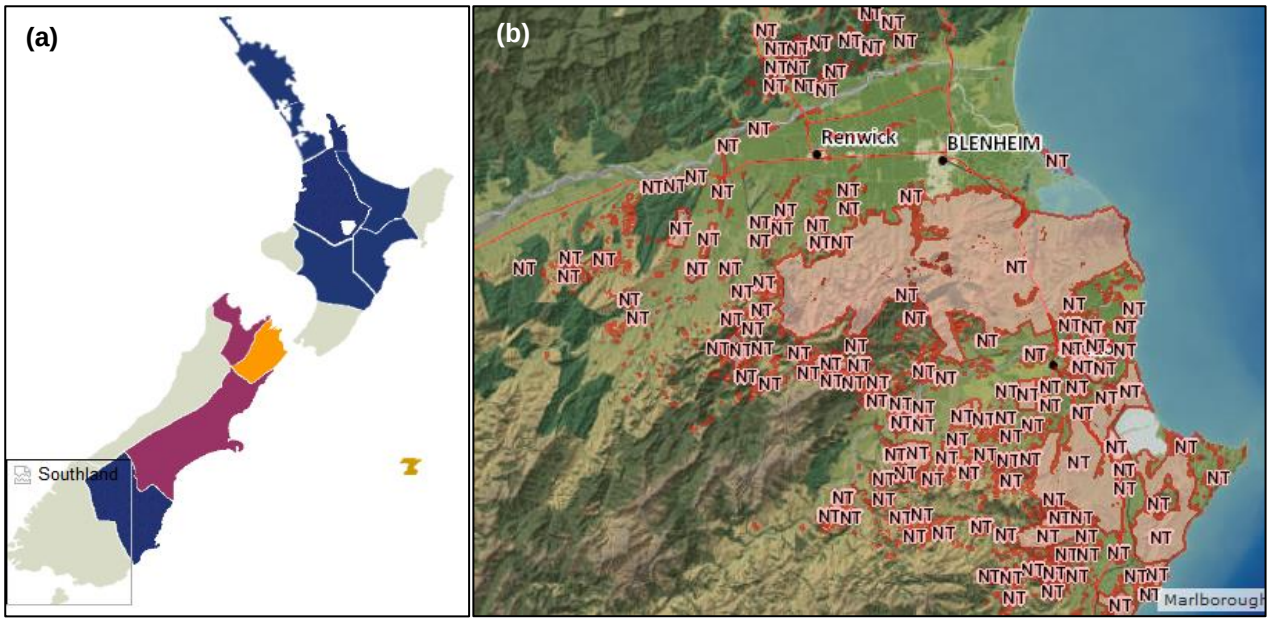

Figure 10: (a) Region Pest Management Plans listing Nassella as a pest. **Blue = total control/eradication** pest, **Yellow = containment** pest, **Pink = progressive control pest**. (b) Know locations of Nassella in Marlborough (Image: https://www.marlborough.govt.nz/environment/biosecurity/declared-pest-species/nassella-tussock)

Numerous common weeds will be present throughout NZDFI eucalypt trials and in most cases no specific action is necessary to prevent their spread as they are already established through much of New Zealand. Throughout spring and summer however, persons visiting and working in field sites should be vigilant for the presence of Nassella tussock grass. If present;

- Inform the land owner so control can be undertaken following RC guidelines
- Avoid placing clothing or equipment on the ground in areas that could harbour seeds
- Check clothing, gear (particularly boots and socks) and foot wells in vehicles are free of seeds before leaving the site
- Remove as much caked-on mud from boots as possible as this can also harbour seeds

Risks pathways

There are 3 main pathways by which pests and pathogens are most likely to be spread between field sites, or between field sites and research/propagation facilities. The major risks associated with each are detailed below.

1) Stem and wood samples

The movement of wood samples, including stems, cores or billets, presents a relatively low biosecurity risk but could potentially transfer myrtle rust spores if present. EVB and other insect pests are less likely to be moved on wood samples unless loose bark or cracks/crevices are present (Fig. 11). Adults of all paropsine beetle species will shelter under bark in cold weather. *Trachymela sloanei* lays its eggs in bark cracks and the nocturnal larvae will also shelter under bark and in cracks during the day. Larvae and eggs of EVB and other insects of concern are unlikely to be found on stems.

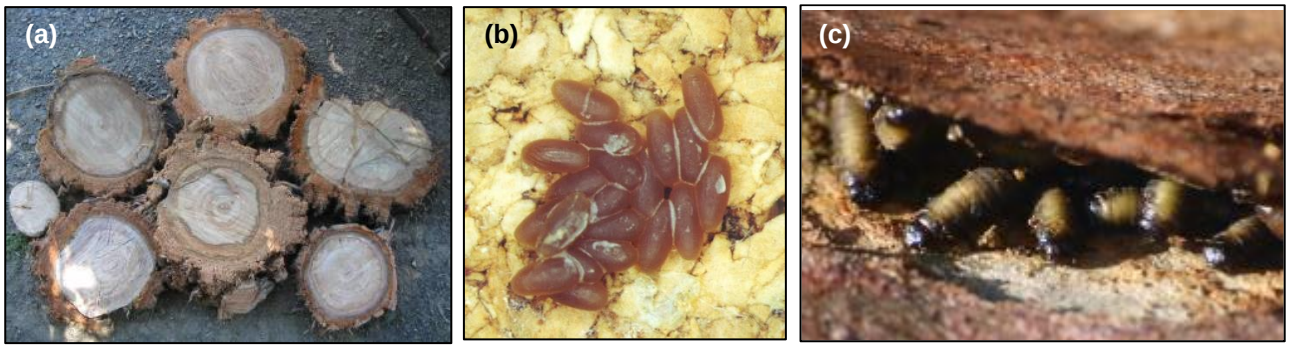

Figure 11: (a) *Eucaluptus globoidea* samples with rough bark exterior in which could shelter adult beetles or (b) *T. sloanei* eggs (*Photo credit Dean Satchell*) and (c) *T. sloanei* larvae.

2) Foliage samples

Movement of foliage presents the greatest biosecurity risk. Both pathogen spores and insect pests could easily contaminate foliage samples. With regard to EVB, foliage could bear eggs, larvae and adults. Eggs (Fig. 12) and larvae are most likely to be associated with flush foliage (collected for vegetative propagation at Proseed, Amberley) as this is required to stimulate egg production by the adult beetles and provides a soft food source essential for the early feeding by larvae. Mature foliage near flush may also harbour egg batches. Typically eggs are found near the leaf tip. Foliage could also harbour all life stages of other insects including hard-to-see sap sucking insects such as psyllids.

Figure12: (a) Preparing foliage for return to Proseed for propagation, (b) EVB eggs on new flush with typical scalloped adult feeding damage, (c) *Paropsis* eggs on tip of mature foliage from previous season.

3) People and equipment

Even when not transferring plant material, movement of people between sites carries some risk of facilitating pest spread. Pathogen spores can contaminate clothing and equipment. If Myrtle rust becomes established at any site people could easily vector it between sites if clothing and equipment is not decontaminated appropriately. Insects (particularly adult beetles) could take shelter in equipment and hitch-hike between sites. Weeds, particularly Nassella tussock, may become attached to shoes, clothing or equipment placed on the ground during field work.

RISK MITIGATION

General biosecurity measures should be undertaken during all site visits to minimise the risk of spreading unwanted pests and pathogens beyond their current range. The biosecurity risks should be **assessed** when visiting a site (i.e. what pests of concern are present) and then decisions can be taken as to how to manage those risks through **packing procedures** that **prevent their movement** with material being sent between locations and **unpacking procedures** that **assist in their detection and containment** when receiving material from another location.

Do not send any live plant material from Woodville to any other trial site, Proseed or UC unless the plant has been visually inspected for myrtle rust symptoms and insects pests and sprayed with fungicide or insecticide if there is a risk of contamination.

Risk Assessment

The following measures have been modified from the NZPPI recommendations with the collection of stems and foliage from Woodville bound for UC or Proseed in mind. Although less intensive inspections can be carried out when conducting field work or collecting material from sites where there is low risk of encountering myrtle rust or EBV some form of inspection should always be conducted before commencing work to identify what the risk level actually is.

Preparation:

- Become familiar with the symptoms of myrtle rust and insect pests
- Wear disposable overalls and gloves and washable footwear (if Myrtle rust is a risk)
- Carry mobile phone (to contact MPI if required) and camera
- Carry several large plastic bags and several specimen containers

Inspection:

- Spend an hour walking up and down rows of eucalypts prior to collecting any material
- Closely inspect 20 – 30 trees across the site
- Conduct an overall assessment of each tree from a distance before touching
- Inspect tops and bottoms of foliage throughout the crown as well as stems, buds or flowers for myrtle rust symptoms
- Look for signs of insect feeding damage, eggs, larvae and adult beetles, particularly in association with flush foliage

Depending on the outcome of risk surveillance one of four options can be taken;

1) Minimal risk - No action required, continue with work / sampling plan
2) Moderate risk - Implement inspection protocol during packing and unpacking
3) High risk - Implement inspection and treatment protocol when packing and unpacking
4) Myrtle rust detected – DO NOT TOUCH. Take a photo and contact MPI and follow their instructions. Discontinue sampling / fieldwork

Packing & unpacking protocols – Foliage

1) Wear disposable overalls while collecting material in Woodville and dispose before moving to any other site or returning to the South Island.
2) Be vigilant through-out sampling and remove any insects or eggs detected (laying cut foliage on a white sheet can help in the detection of insects)
3) Run fingers over foliage tips to detect paropsine eggs and remove
4) Apply fungicide (Appendix 1) and insecticide (e.g. floragas) spray to packed foliage in chiller boxes before closing and tape shut https://www.boc.co.nz/shop/en/nz/gases/more-gases/floragas
5) Upon return to Amberley open each box in the quarantine lab for visual inspection before plant material is taken to the glasshouse. Have a camera and phone on hand so MPI can be called if anything is detected (the inspector should not leave the room and no one else should come in so contamination can be minimised).
6) Do not wear any clothing (including boots) used in the North Island on return to the South island until they have been washed with trigene. Footwear can also be washed in trigene.
7) Any tools used in the North Island should be washed in Trigene. Ideally wash before leaving the North Island and again on return before use (e.g. if returning to Amberley unpack and wash tools in the 'bleach sink' lab before returning to glass houses or storage rooms.
8) Conduct regular myrtle rust inspections in the propagation facilities following the inspection protocol produced by NZPPI:
   a. http://nzppi.co.nz/documents/pests/MR-Nursery-Management-Protocol.pdf
   b. http://nzppi.co.nz/documents/pests/MR-Crop-Inspection-Protocol.pdf
9) After foliage propagation waste material should be disposed of in a way no insects or pathogens could survive (e.g. bagged and burned for pathogens, bagged and frozen for at least 48hrs for insects)

Packing & unpacking protocols – Stems

1) Consider pre-harvest insecticide treatment if large infestations of EVB or other insect pests are present (must be balanced between effectiveness and risk to workers given the amount of handling the samples will subsequently get in the lab – follow standard safety protocols)
2) Inspect all material during packing – bundling stems on a white sheet on the ground may help to prevent contamination with insects or foliage (containing insects) and help detect the presence of insect pests
3) Pack into plastic bins and flood over night or apply insecticide treatment (e.g. floragas) during shipping in containers
4) Inspect outside of containers immediately before leaving site (e.g. under rim. base etc). Spray with general insecticide if necessary.
5) Cool bins before unpacking if possible (reduces chance any insect might take flight if present).
6) Have collection containers and insecticide (e.g. flyspray) on hand.
7) Unpack inside room with closed door on a white sheet if practical.
8) Inspect inside of bin lid and surface of visible samples before commencing unpacking
9) Conduct a general inspection of each sample as it comes out of the container e.g. tap and turn. Any samples with loose bark should be inspected closely and bark removed if necessary.
10) Check work area regularly for escaped insects – e.g. windowsills.
11) Treat remaining water from bins with bleach before disposing.

Detection protocols

Equipment on hand: disposable gloves, fly-spray, fungicide spray, containers/specimen jars, camera, phone.

If **myrtle rust symptoms** are detected in the field or **during sample collection** follow the NZPPI protocol:

1) Do not move the plants from the site / vehicle / glasshouse
2) Take photos of the suspected myrtle rust and the whole plant.
3) Do not attempt to touch or collect samples as this may increase the spread of this disease.
4) If possible, isolate the plants with an igloo-hoop-like plastic cover.
5) **Call MPI's exotic pests and diseases hotline on 0800 80 99 66**

If **myrtle rust symptoms** are detected when handling material **at Proseed glasshouse / UC lab:**

1) Prevent anyone entering / leaving the room.
2) Photograph symptoms and **call MPI on 0800 80 99 66 and follow instructions.**
3) Cover the infected material if possible (e.g. replace lid on bins) and stop work on any other material to prevent spread.
4) Phone another staff member to ensure any material from the same consignment stored elsewhere (e.g. stored in warehouse / coolstore) is secured and pass on any other instructions from MPI.

If **insect pests** (eggs, larvae, adults) are detected **during collection** and packing of wood and foliage samples they should be removed and contained in a screw-top jar or similar.

- Common established insects – discard
- *Paropsis* / *T. sloanei* – kill by freezing and discard in general rubbish
- EVB / Uraba – kill by freezing, on first occasion photograph and inform Tara, subsequent finds can be discarded in general rubbish. (NB: use gloves if handling Uraba larvae as hairs can be irritating)
- Unknown / new insect – photograph, contact Tara, retain in freezer for identification

If **insect pests** (eggs, larvae, adults) are detected **during unpacking at another sites** (e.g. UC or Proseed Nursery) they should be caught and contained in a screw-top jar or similar and placed in a freezer for 48 hours. If unable to catch the insect use general fly-spray to kill it and then store in freezer.

- Common insects / *Paropsis* / *T. sloanei* – discard in general rubbish
- EVB / Uraba / unknown / new insect – photograph and retain specimen for Tara. Increase inspection effort for remaining consignment including the plant material itself and the containers in which they were sent. Ensure doors are closed and inspect room for other escapees (NB: adult beetles are often attracted to light from any windows – check windowsills)

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APPENDICES

Appendix 1: Fungicide treatment recommendations from NZPPI:

http://nzppi.co.nz/documents/pests/MR-Fungicide-Treatments.pdf

MPI Identified fungicides for myrtle rust control

Based on Australian, Hawaiian and Brazilian work, MPI shortlisted the following fungicides as being effective against myrtle rust infections. MPI did note that none of these have label registrations for myrtle rust on the host plant species. However, agricultural compounds & veterinary medicines (ACVM) regulations may allow off-label-use if there is no condition on the products that would restrict its use to the proposed label (eg. if the label specifies that off-label use is prohibited).

ACVM would expect that appropriate agrichemical application risk mitigation measures are in place when using the products off-label (including, but not limited to: personal protection equipment (PPE), adherence to re-entry periods before handling plants without PPE), and the fungicides are used in a controlled way to avoid off-target exposures.

It is recommended that these products are used at rates indicated on individual fungicide product labels for nursey and/or food crops. However, the off-label use (different plant species/use pattern combination) will not have been assessed by ACVM for plant safety and efficacy, hence any off-label use is at the user's risk – Test on a small batch first.

Fungicide (foliar treatments)

The following fungicides are shortlisted and recommended as protectants against myrtle rust. The chemical groups must be rotated to prevent resistance development in myrtle rust against a particular group of fungicides.

Fungicide active ingredient	Fungicide activity	Product available in NZ	Chemical group (Mode of Action)	Minimum re-treatment interval between consecutive applications
Triadimenol	Systemic, curative and protectant	Vandia 250 EC and Agpro Jupiter	3	10-14 days
Triforine	Systemic, slightly curative and protectant	Saprol®	3	7-10 days
Mancozeb	Non-systemic protectant	Several available	M3	7-10 days
Azoxystrobin	Systemic, slightly curative and protectant	Amistar® SC	11	14-21 days
Copper Oxychloride	Non-systemic protectant	Several available	M1	7-14 days
Propiconazole	Systemic, curative and protectant (Note: this has shown some phytotoxicity in Australian work)	Tilt® EC	3	7-10 days
Tebuconazole	Systemic, curative and protectant	Foilicur® WG	3/11	10-14 days
Trifloxystrobin	Systemic, curative and protectant	Flint® … and others	3/11	10-14 days
Oxycarboxin	Systemic, curative and protectant	No NZ product (Aust product Plantvax750 WP)	7	10-14 days

Copper oxide for ground treatment between crops

Spray ground and dead plant debris/litter with copper oxide (eg. Nordox 75 WG™, AgCopp 75) sprays at label rates for dilution. Among copper products, copper oxide is recommended as it is least soluble, has smallest particle size and more