

Biosecurity Manual

for the Nursery Production Industry

Reducing the risk of pests entering and becoming established in your production nursery

Version 1.0





Plant Health Australia (PHA) is the lead national coordinating body for plant health in Australia. PHA works in partnership with industry, governments, researchers and others, providing national coordination to improve biosecurity policy and practice across Australia's plant industries and to build capacity to respond to plant pest emergencies.
www.planthealthaustralia.com.au



The Nursery and Garden Industry Australia (NGIA) is the peak industry body for the Australian nursery and garden industry and is responsible for overseeing the national development of this diverse industry. This includes liaising with government departments on industry issues, providing strategic direction and leadership and ensuring communication of relevant information. The industry is far broader than the perceived "ornamental" market, and supplies greenlife to a wide array of end users including the forestry sector, revegetation/landcare sector, landscapers, fruit orchardists, cut flower and vegetable growers.

NGIA's vision is for a unified Australian nursery and garden industry that is productive, profitable and sustainable.
www.ngia.com.au

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Six easy ways to protect your production nursery

2 You have an important role to play in protecting your production nursery and the entire industry from biosecurity threats.

Here are six simple, routine practices you can do to reduce the threat of new pests (invertebrates, pathogens and weeds) entering and establishing on your property. Each practice should be embedded in your nursery's everyday management as they make good business sense by reducing the risk of spreading pests. These also support on-farm programs (Nursery Industry Accreditation Scheme Australia (NIASA), EcoHort and BioSecure *HACCP*) developed by Nursery and Garden Industry Australia (NGIA) to ensure good farm hygiene at all times. Don't put your livelihood at risk by neglecting nursery biosecurity.



1. Be aware of biosecurity threats

Make sure you and your production nursery workers are familiar with the most important exotic production nursery pest threats. Conduct a biosecurity induction session to explain required hygiene practices for people, equipment and vehicles on your property.

2. Use only clean, pest-free and preferably certified, production nursery inputs

Ensure pests and other contaminants do not enter your property with production nursery inputs, such as growing media, fertiliser and propagation material. Purchase these only from reputable suppliers, preferably with NIASA accreditation or BioSecure *HACCP* certification. Keep records of all nursery inputs.

3. Keep it clean

Practicing good sanitation and hygiene will help prevent the entry and movement of pests onto your property. Workers, visitors, vehicles, raw material and equipment can spread pests, so make sure they are decontaminated, or have come from a clean source, before entering and leaving your property. Have a designated visitor's area and provide vehicle and personnel disinfecting facilities.

4. Check your production nursery

Monitor your crops and raw materials frequently. Knowing the usual appearance of the plants in your production nursery will help you recognise new or unusual events and pests. Keep written and photographic records of all unusual observations. Constant vigilance is vital for early detection of any exotic plant pest threat.

5. Abide by the law

Respect and be aware of laws and regulations established to protect the nursery production industry, Australian agriculture and your region.

6. Report anything unusual

If you suspect a new pest – **report it immediately.**

**If you see anything unusual,
call the Exotic Plant Pest Hotline**

**EXOTIC PLANT PEST HOTLINE
1800 084 881**



Biosecurity overview

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This manual is designed to assist you in protecting your property and the nursery production industry from new and invasive pests. By implementing the recommended measures in your day-to-day operations, you will improve your own biosecurity and that of your region, while minimising crop losses and unnecessary costs.

The definition of a **pest** used in this manual covers all insects, mites, snails, nematodes, pathogens (diseases) and weeds that may harm plants or plant products. **Exotic** pests are those not currently present in Australia. **Established** pests are those present within Australia.

What is biosecurity?

Biosecurity is a set of measures that can be put in place at the national, regional or production nursery level to protect against the introduction and spread of new pests, and to effectively deal with them should they arrive.

Australia's geographic isolation has meant that we have relatively few of the pests that affect plant industries overseas. Freedom from these exotic pests is a vital part of the future profitability, productivity and sustainability of Australia's plant industries. Biosecurity allows us to preserve existing trade opportunities and provide evidence to support new market negotiations.

What is production nursery biosecurity?

Production nursery biosecurity is a set of measures designed to protect a property from the entry and spread of pests. Production nursery biosecurity is your responsibility and that of every person visiting or working on your property.

Through the implementation of production nursery biosecurity measures, growers play a key role in protecting the Australian nursery production industry from exotic pests. If a new pest becomes established in your production nursery, it will affect your business through increased costs (for monitoring, cultural practices, additional chemical use and labour to apply them), reduced productivity (yield and/or quality reductions) and/or loss of markets.

The industry has developed BioSecure *HACCP* guidelines to assist production nurseries implement sound on-farm biosecurity measures. More information on BioSecure *HACCP* can be found at www.ngia.com.au

Early detection and immediate reporting of pests increase the chance of effective and efficient eradication.

Regional biosecurity

Biosecurity implementation at the regional level supports the measures implemented on your property. Consider establishing or contributing to biosecurity meetings to coordinate and promote regional biosecurity, which will reduce the biosecurity threats to all properties in your region.

At a regional level, potential biosecurity threats may originate from neighbouring nurseries or farms (operating or abandoned), other commercial plantings, native vegetation or amenity plantings. Movement of plants or plant products within the region also increases biosecurity risks.

Reduction and management of biosecurity risks at the regional level can be achieved through activities such as raising awareness of key threats to the area, identifying and documenting the locations of production, providing guidance on the appropriate protocols to follow when moving produce within the region and engaging the local council.

Within a region, every agricultural business will be financially affected in the event of an exotic pest incursion. The impact might be in lost production, restrictions on market access, compliance costs, quarantined produce or even crop destruction.

Implementation of production nursery biosecurity underpins regional biosecurity, which in turn underpins national biosecurity. Promotion of biosecurity at the regional level is enhanced through broad engagement of the community, understanding the region, the source and nature of threats, and having knowledge of the expertise and resources available to the region. This is supported by a commitment from everyone to implement biosecurity measures, carry out surveillance and report suspect pests.

If production nursery biosecurity measures are supported by community based measures, a regional framework for biosecurity can be coordinated and is achievable.



Industry Best Practice and biosecurity

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The Nursery Production Farm Management System (FMS) includes the Nursery Industry Accreditation Scheme Australia (NIASA), EcoHort and BioSecure *HACCP* Best Management Practice programs. Membership and involvement in the Nursery Production FMS is open to production nurseries and growing media suppliers and provides participating business with a good grounding in biosecurity measures and practices.

Implementing the Nursery Production FMS in your business encourages good hygiene, pest monitoring and traceability in your operations. Biosecurity traceability allows for the trace-back of plant material and production nursery inputs on your property to its source, the trace-forward of plant material that has left your property, and the provision of records of surveillance and pest management practices undertaken on your property.

In addition, information included in the Nursery Production FMS provides further details and recommendations for the implementation of many of the measures outlined in this manual.

For more information about the Nursery Production FMS, visit NGIA at www.ngia.com.au



BioSecure *HACCP* – an on-farm biosecurity program

BioSecure *HACCP* is the on-farm biosecurity program for production nurseries and growing media businesses in Australia, which validates many of the Best Management Practice strategies employed under NIASA. This program provides growers with decision making tools to support on-farm biosecurity, and guides the identification and mitigation of relevant risks.

The BioSecure *HACCP* risk management system encourages a businesses to maintain the strictest internal quarantine procedures possible and record the actions taken at critical control points. Through these actions a business is better protected in the event of a biosecurity threat. Importantly, BioSecure *HACCP* will support future market access both domestically and internationally.





Pests

8 High priority exotic pest threats of the nursery production industry

The following are some key high priority exotic pest threats for the Australian nursery production industry as identified through the development of the Nursery and Garden Industry Biosecurity Plan (IBP). Any of these pests would have serious consequences should they enter and become established in Australia. For a complete list of exotic pest threats for the nursery production industry, refer to Nursery and Garden IBP, available from www.phau.com.au/biosecurity/nursery-and-garden. Additional information on each of these pest threats is included in the fact sheets at the back of this manual.

Guava (Eucalyptus) rust (*Puccinia psidii*)

POTENTIAL ECONOMIC IMPACT – HIGH-EXTREME

- Over 100 known host plant species, mainly from the Myrtaceae family
- Brown to grey lesions usually surrounded by yellow spores
- Lesions develop on actively growing leaves, shoots and fruits
- Severe infections may kill shoot tips or cause leaf distortion
- Spread with infected plant material or through wind dispersal



PaDiL (J.A. Rocabado)

Glassy-winged sharpshooter (*Homalodisca vitripennis*)

POTENTIAL ECONOMIC IMPACT – HIGH

- Wide host range of over 200 species
- Adults (12-14 mm long) are dark brown with stippled spots on head and back, and transparent wings with reddish veins
- Produces watery excrement, appearing as white spots, which often collects during feeding
- Known vector of *Xylella fastidiosa* pathogen (Pierce's disease), which causes leaf scorch symptoms
- Can spread by flight or as a hitchhiker on plant material



Bevies Garcia III, USDA Agricultural Research Service, Bugwood.org

Serpentine leafminer (*Liriomyza huidobrensis*)

POTENTIAL ECONOMIC IMPACT – HIGH

- Wide host range of over 40 species
- Small (1-2.5 mm) black fly with yellow head and yellow spots on thorax
- Larvae mine under the surface of stem or leaf tissue
- Mines are white with dampened black and dried brown areas
- Mines are typically serpentine, of irregular shape and increase in width as the larvae mature
- Spread occurs with infested plant material



Merle Shepard, Gerald R. Carner and PAC Ooi, Bugwood.org

Asian gypsy moth (*Lymantria dispar*)

POTENTIAL ECONOMIC IMPACT – HIGH

- Very wide host range, with over 650 known hosts
- Egg masses laid on solid surfaces and covered in light tan fuzz
- Mature caterpillars are large (50-65 mm long) and hairy with two rows of spots (red and blue) along their back
- Moths have greyish-brown wings (30-40 mm wingspan) in males or white with grey markings (40-70 mm) in females
- Causes heavy defoliation and larvae may produce webbing
- Can spread large distances naturally or with infested plant material



John H. Gient, USDA Forest Service, Bugwood.org

Sudden oak death (*Phytophthora ramorum*)

POTENTIAL ECONOMIC IMPACT – HIGH

- Infects over 130 tree and shrub species
- Symptoms in shrubs: blackened shoots, diffuse dark brown spots or blotches with fuzzy margins, starting at the leaf tip
- Symptoms in trees: stem canker with red to black thick sap oozing on the bark surface. Stem necrosis leads to the death of whole crown
- Spread with infected plant material, or water, growing media and compost that has been in contact with infected plants



Joseph O'Brien, USDA Forest Service, Bugwood.org

Citrus longicorn beetle (*Anoplophora chinensis*)

POTENTIAL ECONOMIC IMPACT – MEDIUM

- Wide host range of over 100 species of woody trees
- Large black beetle (20-40 mm) with white spots on outer wing covers and antennae that are longer than the body
- Larvae (50-60 mm long) are creamy white with a black head
- Larvae and adults remain under bark or within woody tissue
- Frass (sawdust) accumulates at the base of infested trees
- Can spread in infested plant material. Adults can fly up to 1 km



Art Wagner, USDA APHIS PPQ, Bugwood.org

Poinsettia thrips (*Echinothrips americanus*)

POTENTIAL ECONOMIC IMPACT – MEDIUM

- Attacks over 100 species, particularly greenhouse crops
- Adults are brown (1.6 mm in length) with red between segments
- Feeding damage results in shallow puncture wounds on the leaves, reduced leaf size and lightening of colour
- Black spots (faecal droppings) left on leaf surfaces
- Potential to act as a vector of plant pathogens
- Can spread with infested plant material



Lance Osborne, University of Florida



10 Pest surveillance

Monitoring and surveillance across a production nursery involves looking for and recording the presence, absence and population levels of pests. Conducting regular monitoring is a fundamental part of nursery management practices and gives the best chance of spotting a new pest soon after it arrives. Pest surveillance is also a key component of NGIA's BioSecure HACCP on-farm biosecurity program.

Pest surveillance is necessary for:

- **Exotic pest eradication:** Early detection of exotic pests improves the chance of eradication or containment within a region. However, if eradication or containment are not feasible, early detection in conjunction with contingency planning and preparedness by government and industry bodies (e.g. preparing emergency chemical registrations, permits for importation of biocontrol agents, awareness material and training in pest diagnostics), assists with a more rapid and effective response.
- **Market access:** Export and interstate markets can require 'evidence of absence' data for exotic and some established pests that are of concern. The Australian nursery production industry, in collaboration with governments, must prove through surveillance that pests of concern have been looked for and found to be absent.

- **Improved pest management:** Management of established pests requires regular inspections to determine population levels to improve management decisions and provide clients with healthy nursery material.
- **Pest status information:** Surveillance at the nursery level contributes essential information to regional biosecurity efforts and ultimately to the national status (presence/absence) of a pest.

All pest (exotic and established) surveillance activities carried out on your property should be recorded. These records can be used in the response to a pest outbreak and provide support to industry surveillance activities.


The addition of exotic pests to current datasheets is an effective recording mechanism. Guidelines for effective nursery monitoring are included in the BioSecure HACCP manual and an example crop monitoring record sheet is included in this manual (see page 27).

Report suspect pests

Early detection and reporting may prevent or minimise long-term damage to, or quarantine period of, your production nursery, region or the entire industry.

Report any unusual or suspect plant pest immediately via the Exotic Plant Pest Hotline on 1800 084 881.

Calls to the Exotic Plant Pest Hotline will be forwarded to an experienced person in your state or territory government, who will ask some questions about what you have seen and may arrange to collect a sample.



Do not send samples without first speaking to someone from the state department, who can discuss the correct type of sample, its packaging, handling and transport to the laboratory assigned for diagnosis.

In some states, the Exotic Plant Pest Hotline operates only during business hours. Outside these hours, leave your full contact information and a brief description of the issue and your call will be followed up as soon as possible. Every report will be taken seriously, checked out and treated confidentially.

If you have found a suspected exotic plant pest, the following general precautions should be taken immediately to contain the pest and protect other parts of your production nursery:

- Mark the location of the pest detection and limit access to the area for both people and equipment.
- Wash hands, clothes and boots that have been in contact with affected plant material or growing media.
- Restrict operations in the area while waiting for the identification of the suspected exotic pest.

**If you see anything unusual,
call the Exotic Plant Pest Hotline**

**EXOTIC PLANT PEST HOTLINE
1800 084 881**

The Emergency Plant Pest Response Deed (EPPRD) and the Nursery Industry

The EPPRD is a formal, legally binding document between Plant Health Australia (PHA), Australian and state/territory governments, and plant industry signatories. As a signatory to the EPPRD, Nursery and Garden Industry Australia (NGIA) has a seat at the decision making table and also contributes to funding if an approved Response Plan is implemented to eradicate an Emergency Plant Pest (EPP).

Under the EPPRD, NGIA and its members have a responsibility to report suspect pests. The earlier a new pest is detected, the greater the chance an eradication response will be mounted and the more likely it will be successful.

Within an approved Response Plan, grower reimbursement payments (Owner Reimbursement Costs) are included for direct costs incurred as a result of eradication of a pest incursion. For more information on Owner Reimbursement Costs refer to the PHA website www.phau.com.au/epprd

Product management

12 Growing media, propagating material and other production inputs

Pests and contamination can be easily brought onto your property with production nursery inputs (including growing media, plant containers and fertiliser) and plant material.

Be aware that you cannot visually assess the true health of your propagation material, as viruses, viroids, phytoplasmas and other pests may not display symptoms. Ensure propagation material is 'clean' (i.e. tested with no pest detections) and where possible, use only certified production nursery inputs.

To minimise the risk:

- Purchase plant material only from trusted sources (i.e. NIASA accredited or BioSecure *HACCP* certified businesses) that will provide you with reliable records of the material's source, and the treatment and testing history.
- Check your propagation material and production nursery inputs thoroughly.
- Maintain a register of all production nursery inputs entering your property, including its source (with contact details), specific planting or storage locations, numbers of plants or other products, and the date of use (see page 25 for an example).
- Request information on the source of material and testing timetable.

- Maintain and monitor any motherstock plants to the same standards as production areas.
- Follow the procedures outlined in the BioSecure *HACCP* manual.

Potting and propagating facilities

Good hygiene practices undertaken during potting and propagation will minimise the chance of pest spread. The facilities and areas where these practices are undertaken should be separated from production areas.

Benches and tools used for propagation should be regularly washed and disinfected, preferably between each batch of media or plant material. Potting containers should be clean and disinfected before use.

All spilt material and plant waste should be collected and discarded regularly.





Water management

The management of water quality, including pest infestation levels, is important for the maintenance of healthy plants. If water sources become contaminated they can spread pests throughout production areas.

To minimise the risk:

- Regularly test water storages and monitor surrounding vegetation for the presence of pests.
- Keep areas around water storages free of plant waste and other potential sources of infestation.
- Production nursery area run-off should not enter irrigation sources without prior catchment and treatment.



Production nursery waste

Maintaining good production nursery hygiene can minimise cross-contamination and breeding environments for pests. This should be achieved in combination with an effective pest monitoring/management program. A 'spray diary' record should accompany each consignment of plant material.

NGIA has developed a Best Practice Manual CD for Pesticide Application in the Nursery and Garden Industry. This CD outlines measures for effective and safe application of pesticides as part of an Integrated Pest Management program for production nurseries and contains a pesticide management diary to record pesticide application events. For more information visit www.ngia.com.au

All plant waste and spilled growing media should be collected and removed from production areas. Waste should be disposed of away from production facilities/areas and water sources.

Appropriate disposal mechanisms for plant waste include hot composting or delivery to a dedicated waste management facility.

People and biosecurity

14 Biosecurity signs

Well designed signage informs visitors that biosecurity on your property is important and that they share responsibility for maintaining it. The signs serve to alert people to the potential impact of their visit.

Signs also demonstrate your commitment to production nursery hygiene, safety and auditable systems. Biosecurity signage should be placed at the main gate, external entrances, visitor parking areas and wash-down facilities.

Biosecurity signs at entrances or near storages should direct visitors to contact the owner or nursery manager and formally register their presence before entering any production areas. The sign should include important contact details, such as the office telephone number, mobile number and/or UHF channel.

Contact PHA for further information on obtaining biosecurity signs for your property.



Managing people movement

People moving between different production nurseries and horticultural regions can spread pests on vehicles, equipment, boots and clothing. The most obvious risks are pests carried in growing media and plant material.

Implementing the following measures will reduce the threat of human activity introducing new pests into your production nursery:

- Maintain a visitor register (see page 24), which will record visitor movements and help manage safety issues.
- Brief all workers, contractors and visitors on your biosecurity measures.
- Employee and visitor footwear and clothing should be free of soil and plant material before entering or leaving the production nursery.
- Provide scrubbing brushes, footbaths, boot covers, rubber boots and protective clothing, such as disposable overalls, for people entering or leaving your production nursery, or moving from contaminated to clean areas of the property.
- Sealed or compacted pathways with good drainage should be installed throughout propagation and production areas.
- Display biosecurity awareness material with simple and effective messages in staff rooms, storage sheds and other places where staff congregate.

Contractors and utility providers

The term 'contractors' includes utility providers, earthmoving companies, transport providers and research personnel, who enter a production nursery in their day-to-day operations. Contractors pose a significant risk because of the movements between properties.

Placing biosecurity signs on external property gates can play an important part in raising biosecurity awareness with contractors, especially providers of power, water, gas and communications.

Limit the risk of contractors introducing new pests onto your property, by requesting all contractors' vehicles and equipment be cleaned before starting work on your property. Provide a suitable wash-down bay to complete this task (see page 18).

To ensure your property does not become the source of pest infections for others, you have a responsibility to inform contractors of any declared or notifiable pests already present on your property.

Overseas travellers

People returning from overseas are a threat to our biosecurity, especially if they have visited production nurseries, farms or markets where plant material and produce was sold.

Several plant pests have been intercepted at the Australian border and overseas travellers have unknowingly brought in pests in the past. Air travel means exotic plant pests are only a few hours away.

To protect your production nursery, ensure that all people who have recently returned from overseas have cleaned their boots and clothes before entering. Great care should be taken to prevent the introduction of plant pests into Australia.



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Equipment and vehicles

Movement of vehicles and machinery

Vehicles and production nursery equipment, such as sprayers, tractors and hand tools can carry pests in adhering growing media and plant material. Pests can then be introduced to a previously clean property or crop.

It is impractical to stop all vehicle and equipment movement on and off the property, but using dedicated nursery vehicles, washing down machinery on concrete pads and denying access of dirty machinery can reduce the spread of pests.

Contractors, re-sellers, service providers, and drivers of delivery trucks (for growing media, compost, mulch, fertiliser, etc.) and earth moving equipment entering the property should be requested to clean their vehicles and equipment before entering production or storage areas. Alternatively, place these storage areas at a point on the property that allows access without traversing the production areas.

Businesses open to the public and those open to growers (e.g. for field days, equipment demonstrations, etc.) have a heightened risk and therefore designated parking areas away from production sites are important.

Measures to reduce the risk of pest entry on equipment and vehicles include:

- Inspect all vehicles entering the production nursery for the presence of pests and plant material and record the outcome in a register (see page 26).
- Hose off and disinfect machinery in a designated wash-down area (see page 18) before moving between properties.
- Cleaning vehicle floors and tyres of growing media, plant material and pests, especially after visiting other properties.
- Where possible, use your own vehicle to carry visitors around your property.
- In production areas, keep vehicle movement to a minimum, especially on wet soil, and stick to regular pathways.
- Always make sure that borrowed and second-hand equipment and machinery is cleaned before moving them into your production nursery.
- Regularly clean all tools and equipment used in the production nursery, preferably with a disinfectant or bleach solution (see Appendix 1 of BioSecure *HACCP*).

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Inspecting and cleaning machinery is more time and cost effective than managing a new pest introduced to your property.



18 Wash-down facilities

A wash-down facility allows employees, contractors and visitors to clean their vehicle and equipment (including hand tools) in an easily managed area where waste water is contained. This will ensure that plant material, pests and growing media are not moved into or out of your production nursery.

A wash-down area should:

- Be readily accessible and located between the driveway and property roads.
- Be isolated from production areas.
- Have access to power and high-pressure water.
- Have a sealed (concrete or bitumen) or packed gravel surface.
- Not drain into a waterway or production area.
- Have a sump or collection area for easy inspection and waste management.



Clean machinery from the top down to avoid contaminating areas already cleaned, and consider the following points:

- Dismantle machinery as far as practically possible to give access to internal spaces.
- Leave covers off after cleaning to allow inspection and record outcome in a register (see page 26).
- Get a second opinion – a fresh look will see contamination you may have missed.

For additional protection, an added detergent-based degreaser or disinfectant, for example Septone Truckwash®, Castrol Farmcleanse® or Virkon®, may be appropriate. Seek advice from re-sellers on the best product, and remove as much growing media and plant material as possible from the equipment before using the disinfectant.

The wash-down area may be the same as that used for chemical wash-down of vehicles and equipment. If so, all occupational health and safety issues associated with chemical wash-down areas must be taken into account.



Designated parking areas

A well sign-posted designated parking area should be provided for all visitors. Ideally, dedicated production nursery vehicles should be used for transport around your property, with other vehicle movement limited to direct entry to the designated visitor parking area only.

Parking areas serve to contain any new pests away from production sites. They also allow for the easy inspection of tyres, equipment, floor mats and boots for growing media and plant material which may carry new pests. This area should be regularly monitored for the presence of new pests.

A biosecurity sign in the parking area will remind visitors of the importance of biosecurity and production nursery hygiene on the property.

Do not allow movement of production nursery machinery through the parking area.





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Biosecurity summary

This is a summary of key risks and priority actions to consider in improving production nursery biosecurity.

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Key risks to biosecurity	Primary actions to help minimise these risks
Pests (page 8)	<ul style="list-style-type: none">• Surveillance should be carried out and recorded to reduce the risk of new pests establishing and maintain access to markets.• Be aware of key production nursery pest threats.• If you suspect a new pest or see unusual symptoms on crops:<ul style="list-style-type: none">– Report it immediately to the Exotic Plant Pest Hotline on 1800 084 881.– Restrict movement of people and equipment in the area.– Wash clothes and skin in contact with affected crops, produce or equipment.
Product management (page 12)	<ul style="list-style-type: none">• Ensure propagation material and production nursery inputs are clean, tested and from a reputable supplier.• Record the source, testing and treatments applied to all propagation material, including where it is planted on your property.• Collect all production nursery waste and dispose of in an appropriate manner away from production areas.• Implement the nursery industry's NIASA and BioSecure HACCP schemes.
People and biosecurity (page 14)	<ul style="list-style-type: none">• Biosecurity signs should be placed at production nursery entrances.• Use a visitor register to track people movement.• Provide cleaning equipment for all visitors and employees, and ensure they have cleaned their vehicles, clothing and equipment before entering the property.• Be aware of and manage the increased biosecurity risk posed by contractors, utility providers and overseas travellers.
Equipment and vehicles (page 17)	<ul style="list-style-type: none">• Provide a designated visitor parking area.• Do not allow entry to contractors, visitors or employees who do not clean their vehicles and equipment.• Provide a wash-down facility on the property or identify an available wash-down facility in your region.

If you see anything unusual, call the Exotic Plant Pest Hotline

EXOTIC PLANT PEST HOTLINE
1800 084 881

Further information

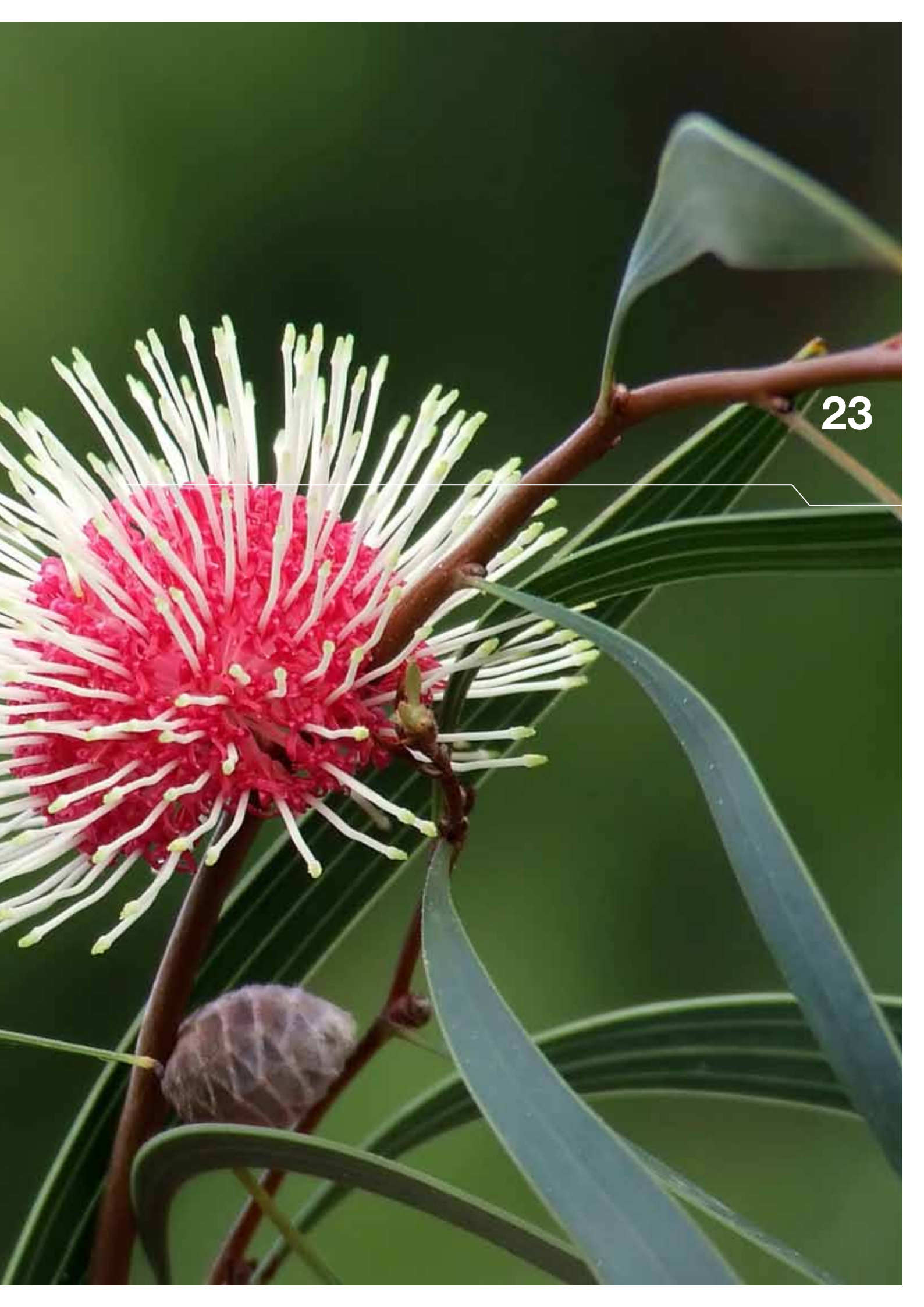
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More information on biosecurity, nursery hygiene, pests and the nursery production industry can be found through the following sources.

		Contact details
ORGANISATION	Nursery & Garden Industry Australia	Phone: 02 9876 5200 Website: www.ngia.com.au
	Plant Health Australia	Phone: 02 6215 7700 Website: www.phau.com.au
	Farm Biosecurity	Phone: 02 6215 7700 Website: www.farmbiosecurity.com.au
GOVERNMENT	Department of Agriculture, Fisheries and Forestry (DAFF)	Phone: 02 6272 3933 Website: www.daff.gov.au
	Queensland – Department of Employment, Economic Development and Innovation	Phone: 13 25 23 or 07 3404 6999 Website: www.deedi.qld.gov.au
	New South Wales – Industry and Investment	Phone: 1800 808 095 or 02 6391 3100 Website: www.industry.nsw.gov.au
	Victoria – Department of Primary Industries	Phone: 13 61 86 or 03 5332 5000 Website: www.dpi.vic.gov.au
	South Australia – Department of Primary Industries and Resources	Phone: 1300 666 010 or 08 8168 5200 Website: www.pir.sa.gov.au
	Western Australia – Department of Agriculture and Food	Phone: 08 9368 3333 Website: www.agric.wa.gov.au
	Tasmania – Department of Primary Industries, Parks, Water and Environment	Phone: 1300 368 550 Website: www.dpipwe.tas.gov.au
	Northern Territory – Department of Resources	Phone: 08 8999 5511 Website: www.nt.gov.au/d

If you see anything unusual, call the Exotic Plant Pest Hotline





Visitor record

Business name: _____
Business address: _____



Date	Visitor's name and organisation	Reason for visit/staff member visiting	Time arrived	Time departed

Materials import inspection record

Business name: _____

Business address: _____



Date received	Supplier's name	Material type & quantity (e.g. media, greenlife, timber, etc.)	Invoice, batch number or other identification	Vehicle inspection (contamination, pests, etc.)	Material inspection (pests and diseases)	Inspection results	Action (e.g. reject stock, treat stock)	Signature of authorised inspector

This materials import inspection record has been taken from the BioSecure HACCP manual

Vehicle inspection record

Business name: _____

Business address: _____



Date	Vehicle identifier (e.g. spray unit or rego number)	Organisation	Area visited	Vehicle inspected for foreign material/ organisms	Cleaned Y/N	Staff name

This vehicle inspection record has been taken from the BioSecure HACCP manual

Crop monitoring record

Business name: _____

Person monitoring: _____ Date: _____



Area monitored (e.g. green/shade house, bed)	Crop	Plant number sampled	Indicated presence or absence (Y/N)			Physiological problems present	Comments/actions
			Insect (list and include quarantine insects)	Disease (list and include quarantine diseases)	Weed (list and include declared weeds)		

This crop monitoring record has been taken from the BioSecure HACCP manual

Guava (Eucalyptus) rust

What is Guava rust?

Guava rust (*Puccinia psidii*) is a fungal pathogen of a wide range of host plant species, especially those in the Myrtaceae family. Like other rusts, Guava rust spreads quickly and would be extremely difficult to control.

A Guava rust incursion into Australia would impact the native biodiversity, commercial operations, forestry, wildflower production and urban streetscapes and gardens.

What does it look like?

Brown to grey lesions are produced on actively growing leaves, shoots, fruit and sepals on infected plants. These lesions may be surrounded by, or totally covered in, masses of bright yellow to orange spores. Older lesions can show a purpling of their margins.

Severe infections in young trees may kill shoot tips, causing a loss of leaders and a bushy growth habit. Prolific branching and galling, or persistent localised lesions, stem swellings or leaf distortions have been reported in many species.

What can it be confused with?

A number of other fungal pathogens are known to cause similar shoot dieback symptoms, particularly when associated with extreme environmental conditions. However, any rust symptoms in members of the Myrtaceae family in Australia should be reported.

What should I look for?

The development of lesions on leaves, stems, fruit or sepals or shoot dieback symptoms, particularly on plants in the Myrtaceae family.



Gradient of symptom severity on Eucalyptus seedlings

PaDIL (D. T. Junghans)



Spore covered lesions and shoot dieback in Eucalyptus seedling as a result of Guava rust infection

PaDIL (D. T. Junghans)



Melaleuca stem showing dieback symptoms

Forest & Kim Starr, U.S. Geological Survey, Bugwood.org



Division of Plant Industry Archive, Florida Department of Agriculture and Consumer Services, Bugwood.org

Dark lesions formed on a guava leaf due to Guava rust infection

How does it spread?

The spores are produced in vast numbers and are readily dispersed by wind or rain splash. Spores can also be spread on clothing, equipment and vehicles.

Where is it now?

Guava rust is native to South America, but has now become established throughout the Americas, as well as in India and Japan.

How can I protect my production nursery from Guava rust?

Check your production nursery frequently for the presence of new pests and unusual symptoms. Make sure you are familiar with common pests of the nursery production industry so you can tell if you see something different

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**EXOTIC PLANT PEST HOTLINE
1800 084 881**



Forest & Kim Starr, U.S. Geological Survey, Bugwood.org

Lesions on Malaysian apple leaves, which are covered with yellow spores



PaDIL (D. T. Junghans)

Rust induced lesions on Eucalyptus leaves

Glassy-winged sharpshooter

What is Glassy-winged sharpshooter?

The Glassy-winged sharpshooter (*Homalodisca vitripennis*) is a leafhopper that causes direct damage through its feeding activities and excrement 'showers'. However, the greatest threat associated with this pest is that it acts as a highly efficient vector of the bacterium *Xylella fastidiosa*, which causes Pierce's disease in *Vitis* species or Leaf scorch in *Prunus* species.

What does it look like?

Glassy-winged sharpshooters are 12-14 mm long and easily seen with the naked eye. They are dark-brown to black with yellow dots on their head and body (thorax). Their wings are translucent with distinct reddish veins visible.

'Clutches' of up to 27 eggs are laid on the underside of leaves in a side-by-side arrangement. Eggs are deposited just under the leaf surface giving it a blister-like appearance.

What can it be confused with?

There are a number of sharpshooters that are native to Australia that share features with the Glassy-winged sharpshooter. Head shape and size is one key distinguishing feature of the Glassy-winged sharpshooter, but an expert would be required to identify this pest to the species level.

What should I look for?

The large insects can be spotted easily with the naked eye following infestation, particularly as they commonly sit on leaf and stem surfaces. Watery excrement, appearing as white spots, often collects during feeding. Leaf scorch symptoms may also be evident if *X. fastidiosa* was also introduced into the country.



The dark-brown to black leafhopper is covered with numerous yellow dots on the head and thorax

Reyes Garcia II, USDA Agricultural Research Service, Bugwood.org



The underside of the Glassy-winged sharp shooter is a lighter colour

Russ Otters, University of Georgia, Bugwood.org



Adult Glassy-winged sharp shooter on a leaf surface

Johnny N. Dell, Bugwood.org





How does it spread?

Adult Glassy-winged sharpshooters are strong flyers and can move through crops rapidly. Nymphs are unable to fly, but readily spread between plants by walking and jumping. Most long distance movement occurs as viable egg masses on nursery stock or crop plants.

Where is it now?

The Glassy-winged sharpshooter is found in eastern and western USA and in Mexico. Recently this pest has been detected on a number of new locations, including the neighbouring countries of Tahiti and the Cook Islands.

How can I protect my production nursery from Glassy-winged sharpshooter?

Check your production nursery frequently for the presence of new pests and unusual symptoms. Make sure you are familiar with common pests of the nursery production industry so you can tell if you see something different.

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Egg masses deposited just under the leaf surface in a side-by-side manner

Reyes Garcia II



The lighter underside of the insect contrasts with the dark brown-black colour of the top side

Johnny N. Dell, Bugwood.org



Top view of adult insect, showing reddish veins present in the translucent wings

PaDIL (N. Hummel)

Serpentine leafminer

What is Serpentine leafminer?

Serpentine leafminer (*Liriomyza huidobrensis*) is a small fly whose larvae feed internally on plant tissue, particularly the leaf. Feeding of the larvae disrupts photosynthesis and reduces the quality and yield of plants. This pest has a wide host range, including many economically important vegetable, cut flower and grain crops.

What does it look like?

The black flies are just visible (1-2.5 mm in length) and have yellow spots on the head and thorax. Leaf mines caused by larval feeding are usually white with dampened black and dried brown areas. These are typically serpentine or irregular shape, and increase in size as the larvae mature.

Damage to the plant is caused in several ways:

- Leaf stippling resulting from females feeding or laying eggs.
- Internal mining of the leaf by the larvae.
- Secondary infection by pathogenic fungi that enter through the leaf mines or puncture wounds.
- Mechanical transmission of viruses.

What can it be confused with?

Australia has a large number of Agromyzidae flies that look similar to the Serpentine leafminer, however these rarely attack economically important species.

What should I look for?

A Serpentine leafminer infestation would most likely be detected through the presence of the mines in leaf tissue. Adult flies and larvae are not likely to be seen due to their size.



The small adult fly is predominately black with some yellow markings

Central Science Laboratory, Harpenden Archive, British Crown, Bugwood.org



Serpentine mines on an onion leaf caused by the feeding larvae

Merle Shepard, Gerald R. Camer, and P.A.C. Ooi, Bugwood.org



Pupae of the Serpentine leafminer

Merle Shepard, Gerald R. Camer, and P.A.C. Ooi, Bugwood.org



Plant Protection Service Archive, Bugwood.org

Typical symptoms of underleaf mining in a Chrysanthemum

How does it spread?

Adult flies can spread throughout a crop by flight, but most long distance transport occurs when plant material containing larvae is transported.

Where is it now?

The Serpentine leafminer is now widespread through Africa, America, Europe, Asia and parts of Oceania.

How can I protect my production nursery from Serpentine leafminer?

Check your production nursery frequently for the presence of new pests and unusual symptoms. Make sure you are familiar with common pests of the nursery production industry so you can tell if you see something different.

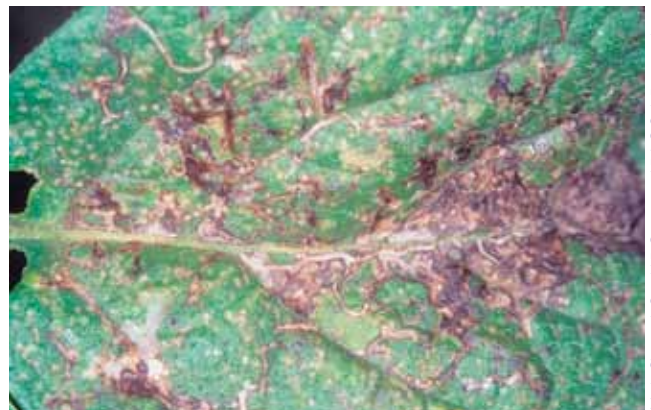
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Plant Protection Service Archive, Bugwood.org

Side view of a Serpentine leafminer showing lighter underside colouring



Merle Shepard, Gerald R. Carter, and P.A.C. Ooi, Bugwood.org

Damage to a potato leaf caused by larval feeding

Asian gypsy moth

What is Asian gypsy moth?

Asian gypsy moth (*Lymantria dispar*) is a destructive pest of forest, horticultural and urban trees and if it were introduced into Australia it could cause extensive environmental and economic damage to our native bush, forests, crops and gardens.

The larval (caterpillar) stage of this pest causes heavy defoliation of trees and shrubs, killing them or increasing their susceptibility to other pests. Asian gypsy moth has an extremely broad host range, feeding on the foliage of more than 650 species of plants.

What does it look like?

Asian gypsy moth produces large (2-3 cm by 1-2 cm) egg masses that are generally covered with yellowish or tan fuzz. These are deposited on solid objects, such as trees, rocks, outdoor furniture, machinery and structures.

The larvae are the most destructive stage and range in length from 3 to 65 mm. They are covered in long hairs and mature larvae have a very recognisable double row of spots along the back, usually five pairs of blue followed by six pairs of red.

Adult moths show a difference in appearance between the sexes. Adult male moths have greyish-brown wings and a wingspan of 30-40 mm, whereas the adult female moths are white with grey markings and larger with a wingspan of around 40-70 mm.

What can it be confused with?

There are a number of endemic and exotic moth species within the same family as Asian gypsy moth, many of which are economically important pests of trees and shrubs. However, any moth or caterpillar that matches the Asian gypsy moth description should be referred to an expert for formal identification.



Hairy larvae showing distinctive blue and red spots

Evgeny Akulov, Russian Research Institute of Plant Quarantine, Bugwood.org



Male (bottom) and female (top) Gypsy moth adults

USDA APHIS PPQ Archive, USDA APHIS PPQ, Bugwood.org



Large numbers of egg masses can be found on single trees or other solid objects

Milan Pemek, Forestry Research Institute, Bugwood.org



What should I look for?

Egg masses affixed to structures, equipment or plants are the most likely life stage to be directly detected. As infestation levels increase, feeding damage will become evident and webbing may be seen attached to plants following larval 'ballooning' (spinning silk that catches the wind).

How does it spread?

Young larvae can spread up to several kilometres on the wind through 'ballooning'. Adults are strong flyers and can travel up to 40 km before mating.

Eggs can also be transported when attached to nursery stock, plant parts, vehicles, machinery and equipment.

Where is it now?

The Asian gypsy moth originated in Asia, and is now found throughout eastern Russia, China, Korea and Japan. There have been several introductions of the pest into North America since the early 1990s which have been the subject of intensive control and eradication campaigns to prevent its establishment. The pest was also introduced into New Zealand in 2003 and subsequently eradicated.

How can I protect my production nursery from Asian gypsy moth?

Check your production nursery frequently for the presence of new pests and unusual symptoms. Make sure you are familiar with common pests of the nursery production industry so you can tell if you see something different.

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Examples of Asian gypsy moth larval forms

USDA APHIS PPQ Archive, USDA APHIS PPQ, Bugwood.org



Caterpillars feeding on oak foliage

Tim Tigner, Virginia Department of Forestry, Bugwood.org



Female moths depositing tan-coloured egg masses on trunk surface

John H. Ghent, USDA Forest Service, Bugwood.org

Sudden oak death

What is Sudden oak death?

Sudden oak death (*Phytophthora ramorum*) is a fungal pathogen of a wide range of tree, shrub and herbaceous species. Unlike other *Phytophthora* pathogens, *P. ramorum* is a foliar pathogen impacting on stems, trunks and leaves. It is known to devastate forests wherever it occurs and is commonly found in nurseries.

What does it look like?

Symptoms of Sudden oak death infection vary depending on the host. In shrubs, diffuse dark brown spots or blotches with fuzzy margins develop, usually at the leaf tip. These grow to cover the entire leaf over time. Shoots also become blackened.

In trees the first symptom is generally the development of a canker on the trunk, with burgundy-red to tar-black thick sap oozing from the bark surface. Young trees can show a distinct edge between healthy and necrotic tissue. Stem necrosis leads to death of the whole crown by restricting the movement of water.

What can it be confused with?

Bleeding stem cankers can be caused by a number of other fungal pathogens, but Sudden oak death differs from these pests because it only affects aerial parts of the plant. Foliar symptoms can also be confused with other pathogen infection or sunburn. In general, infection with Sudden oak death is characterised by irregular, necrotic lesions, instead of distinct leaf spots.

What should I look for?

The development of bleeding stem cankers, blackened shoots or diffuse lesions on leaf tips.



Leaf lesions in rhododendrons, demonstrating the typical diffuse margins

Joseph O'Brien, USDA Forest Service, Bugwood.org



Shoot dieback symptoms developing on Douglas-fir

Joseph O'Brien, USDA Forest Service, Bugwood.org



Bleeding trunk canker resulting from *P. ramorum* infection

Joseph O'Brien, USDA Forest Service, Bugwood.org



How does it spread?

Natural spread of the pathogen occurs through wind and waterborne movement of spores. Long distance transport overseas has previously occurred through the trade of infected ornamental plants and other nursery stock, as well as infected green waste.

Where is it now?

Sudden oak death is currently found only in North America and Europe.

How can I protect my production nursery from Sudden oak death?

Check your production nursery frequently for the presence of new pests and unusual symptoms. Make sure you are familiar with common pests of the nursery production industry so you can tell if you see something different.

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Shoot dieback in Tanoak

Joseph O'Brien, USDA Forest Service, Bugwood.org



Early stage of leaf lesion development

Joseph O'Brien, USDA Forest Service, Bugwood.org



Complete tree death as a result of Sudden oak death infection

Joseph O'Brien, USDA Forest Service, Bugwood.org

Citrus longicorn beetle

What is Citrus longicorn beetle?

Citrus longicorn beetle (*Anoplophora chinensis*) is a large wood boring beetle that attacks a wide range of plant species, particularly citrus and other fruit trees. It is considered a destructive pest due to the detrimental effects of the larval feeding activities, which reduces plant vigour and results in death of young or small plants.

What does it look like?

Adults are black and shiny with 10-12 irregular white spots on the outer wing cover. Males grow up to 21 mm in length and females up to 37 mm. The banded antennae are between 1.2 and 2 times the length of the body.

The creamy-white eggs are 2 mm wide and 6 mm long and change to a yellow-brown colour just before hatching. Larvae are creamy-white with a black head and grown up to 60 mm in length. They are cylindrical in shape and lack obvious legs.

What can it be confused with?

Australia currently has a number of large (>2 cm in length) endemic beetles that share characteristics with the Citrus longicorn beetle, but none are as destructive on commercial plants. The exotic pest can be distinguished by the body markings and by the antennae, which are longer than their body.

The Citrus longicorn beetle is also commonly confused with the Asian longicorn beetle. This pest is also exotic, so any large beetle with antennae longer than its body should be reported.



Plant Protection Service Archive, Bugwood.org

Outer wing covers are black with irregular white spots



Plant Protection Service Archive, Bugwood.org

Characteristic exit hole produced in the trunk



Art Wagner, USDA APHIS FPO, Bugwood.org

Citrus longicorn beetle larvae feed internally on woody tissue



What should I look for?

The larvae and adult beetle feed internally on plant tissue and are hard to see. However, their presence can be detected by round exit holes (6-11 mm) in the base of trunks, sap bleeding from egg laying sites, possible swellings in the trunk where pupal chambers occur or frass (sawdust) accumulating at the base of infested trees.

How does it spread?

This beetle can spread over 1 km by flight. However, long distance spread of this pest would most likely occur through the movement of eggs, larvae and pupae in woody planting material, such as nursery stock.

Where is it now?

This beetle is endemic throughout Asia, and some isolated populations have been detected in Europe and North America.

How can I protect my production nursery from Citrus longicorn beetle?

Check your production nursery frequently for the presence of new pests and unusual symptoms. Make sure you are familiar with common pests of the nursery production industry so you can tell if you see something different.

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Adult beetles have striped antennae that are longer than the body

Art Wagner, USDA APHIS PPO, Bugwood.org



Stem feeding damage caused by Citrus longicorn beetle

Art Wagner, Washington State Department of Agriculture, Bugwood.org



Internal trunk damage caused by larval feeding

Art Wagner, Washington State Department of Agriculture, Bugwood.org

Poinsettia thrips

What is Poinsettia thrips?

Poinsettia thrips (*Echinothrips americanus*) is an emerging pest of greenhouse and ornamental species in eastern USA and in some parts of Europe and Asia. This pest has the potential to vector viruses and can impact on integrated pest management programs.

What does it look like?

Adult Poinsettia thrips, which grow up to 1.6 mm in length, are distinguishable from other thrips by their general appearance. Their body is dark brown with red internal pigment, and the unusually slender forewings have transverse light and dark bands. Legs are bicoloured (brown and yellow), while their slender antennae are predominantly yellow.

Larvae are predominantly yellow and have bright red eyes. The segmented abdomen has a row of hairs present on each side.

What can it be confused with?

Common green house thrips (*Heliothrips haemorrhoidalis*) is the only thrip species in Australia that may be confused with Poinsettia thrips. Common greenhouse thrips have no red internal pigment or yellow legs, and the forewings are paler in the adult.

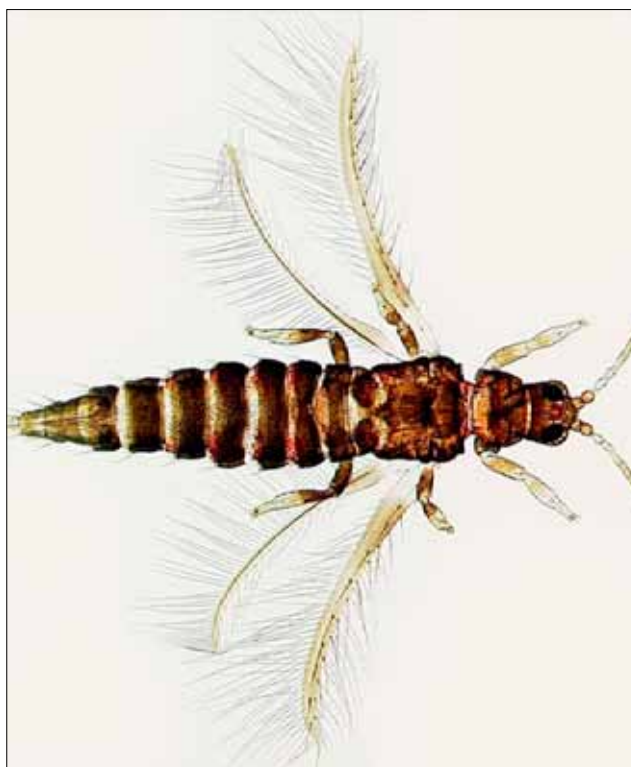
What should I look for?

Poinsettia thrips feed on leaf tissue and the damage of light spots on the leaf is very similar to typical mite or thrips damage. It will feed on both the upper and lower leaf surfaces but is usually more common on the lower surface. Their numerous but shallow punctures result in injured tissue with a shrunken appearance. Infested leaves will have numerous black specs on them that are faecal droppings of the thrips. They also will feed on parts of the flower.



Lance Osborne, University of Florida

Mature Poinsettia thrips are darker in colour, have wings and a thinner body shape



PaDiL (Laurence Mound)

Fixed specimen of adult Poinsettia thrips



How does it spread?

Adult Poinsettia thrips can fly and distribute through crops rapidly. Larvae are unable to fly, but readily distribute between plants by walking and through human and animal assistance. Most long distance movement is through transportation of infested nursery stock or other plant material.

Where is it now?

Poinsettia thrips is present throughout eastern USA, but is more predominant in the southern regions. This pest has also been reported in Europe, Japan, Taiwan and Thailand.

How can I protect my production nursery from Poinsettia thrips?

Check your production nursery frequently for the presence of new pests and unusual symptoms. Make sure you are familiar with common pests of the nursery production industry so you can tell if you see something different.

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Immature Poinsettia thrips are pale green in colour with distinctive red eyes

Lance Osborne, University of Florida

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