Orchard Biosecurity Manual

for the Apple and Pear Industry

Reducing the risk of new pests entering and becoming established in your orchard

Version 2.0

Plant Health AUSTRALIA

Apple & Pear Australia Ltd.

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

Apple & Pear Australia Ltd.

Apple and Pear Australia Limited (APAL) is the peak industry body representing the interests of commercial apple and pear growers in Australia in matters of national importance including regulation and legislation, marketing, research and development.
www.apal.org.au

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Six easy ways to protect your property

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You have an important role to play in protecting your property and the entire apple and pear industry from biosecurity threats.

Here are six easy ways you can reduce the threat of new pests impacting on your property. Each practice should be embedded in your orchard's everyday management as they make good business sense. Don't put your livelihood at risk by neglecting orchard biosecurity.

1. Be aware of biosecurity threats

Make sure you and your orchard workers are familiar with the most important exotic apple and pear pest threats. Conduct a biosecurity induction session to explain required hygiene practices for people, equipment and vehicles in your orchard.

2. Use high health status, pest-free propagation material from known sources

Ensure all propagation material and orchard inputs are fully tested, pest-free and preferably certified. Keep good records of your orchard 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 and equipment can spread pests, so make sure they are decontaminated before entering and leaving your property. Have a designated visitor's area and provide vehicle and personnel disinfecting facilities.

4. Check your orchard

Monitor your trees frequently. Knowing the usual appearance of your orchard and trees 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.

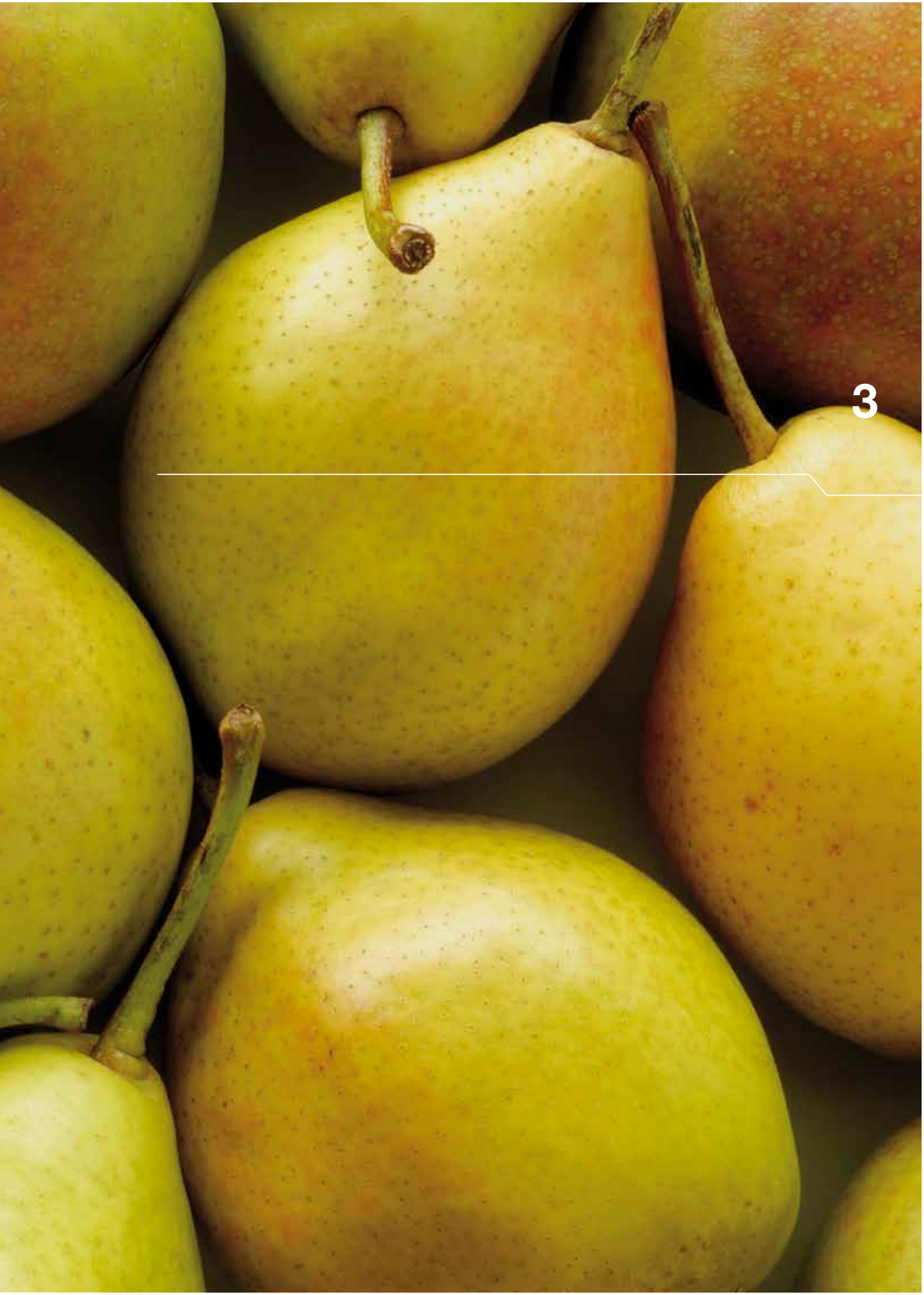
5. Abide by the law

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

6. Report anything unusual

If you suspect a new pest – **report it immediately to the Exotic Plant Pest Hotline**.

EXOTIC PLANT PEST HOTLINE
1800 084 881



3

Biosecurity overview

4

This manual is designed to assist you in protecting your property and the apple and pear 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 produce losses and unnecessary costs.

What is biosecurity?

Biosecurity is about the protection of livelihoods, lifestyles and the natural environment, which could be harmed by the introduction of new pests.

Biosecurity is a national priority, implemented off-shore, at the border and on-farm. Biosecurity is essential for your business.

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 and sustainability of Australia's plant industries. Biosecurity allows us to preserve existing trade opportunities and provide evidence to support new market negotiations.

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** (or **endemic**) pests are those present within Australia.

What is orchard biosecurity?

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

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

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

Regional biosecurity

To strengthen the biosecurity measures implemented on your property, consider initiating biosecurity meetings and activities to promote biosecurity at the regional level. Through this collaborative approach, biosecurity threats to all properties in your region can be minimised.

Potential sources of biosecurity threats may be neighbouring orchards (operating or abandoned), nurseries, other commercial plantings, native vegetation and/or peri-urban residential or amenity plantings.

Implementation of orchard 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's vulnerability, and the source and nature of threats, knowledge of the expertise base and resources available to the region, and a commitment from stakeholders to implement biosecurity measures, surveillance and reporting.

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

Pests

6 High priority exotic pest threats of the apple and pear industry

The following are some key high priority exotic pest threats for the Australian apple and pear industry as identified through the development of the Apple and Pear 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 apple and pear industry, refer to Apple and Pear IBP available from **www.phau.com.au/biosecurity/apple-and-pear**. Additional information on each of these pest threats is included in the fact sheets at the back of this manual.

Rosy apple aphid (*Dysaphis plantaginea*)

OVERALL RISK – HIGH

- Apple trees are the preferred hosts
- Aphids range from 0.5 mm to 2.5 mm in length and from dark green to rosy purple and black in colour as they develop
- Leaf symptoms include curling, discolouration and appearance of sooty mould on the surface
- Affected fruit clusters are severely distorted and growth is stunted
- Severe infestations can damage up to 50% of fruit in an orchard

Jack Kelly Clark, UC Statewide IPM Program

Fire blight (*Erwinia amylovora*)

OVERALL RISK – HIGH

- Infects a range of pome fruit species
- Damage occurs on leaves, branches, shoots, blossoms and fruit tissue
- Infection results in tissue death, together with bacterial ooze droplets on infected tissue
- Infected shoots often bend near the tip to form a 'shepherd's crook' shape
- Spread with infected plant material and through wind dispersal
- Establishment of Fire blight would impact market access

Clemson University - USDA Cooperative Extension Slide Series, Bugwood.org

Cedar apple rust (*Gymnosporangium juniperi-virginianae*)

OVERALL RISK – HIGH

- Only infects apples and cedar *(Juniperus virginiana)*, and requires both hosts to complete its life cycle
- Infected fruit and leaves develop yellow-orange lesions on the surface and in some varieties spore-producing tufts also develop
- Lesions are raised and can crack as the fruit enlarges
- Stems may develop a slight swelling
- Galls with finger-like projections are produced on cedar hosts
- Spread with infected plant material or by wind dispersal

University of Georgia Plant Pathology Archive, Bugwood.org

Asian gypsy moth (*Lymantria dispar*)

OVERALL RISK – HIGH

- Very wide host range, with over 650 known hosts
- Egg masses laid on any available solid surface and usually covered in yellow or light tan fuzz
- Caterpillar is 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 wingspan) in females
- Larval stage causes heavy defoliation of trees and shrubs, and may produce large amounts of webbing

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

Apple brown rot (*Monilinia fructigena*)

OVERALL RISK – HIGH

- Infects a range of fruit trees and berries
- Produces similar symptoms to Brown rot in stone fruit
- Fruit develop rapidly spreading, firm, brown spots that progress to/into rotting
- Rotting areas covered or surrounded by creamy-white pustules, often in concentric circles
- Infected fruit can become mummified on the tree
- Blighted twigs with cankers can also develop
- Spread by wind, rain and with infected plant material

University of Georgia Plant Pathology Archive, Bugwood.org

Apple maggot (*Rhagoletis pomonella*)

OVERALL RISK – HIGH

- Fruit fly that primarily attacks apples
- Cream coloured legless larvae (up to 10 mm long) leave brown trail through fruit flesh
- Small black fly (up to 5 mm long) with yellowish head and legs, a white spot on the back and four irregular or zigzag black bands on the wings
- Sunken dimple-like spots and discolourations develop on the surface of fruit following egg laying and larval feeding
- Damaged fruit drop prematurely

Whitney Cranshaw, Colorado State University, Bugwood.org

European canker (*Neonectria galligena*)

OVERALL RISK – MEDIUM-HIGH

- Economically damaging fungus worldwide that causes up to 60% yield loss
- Reddish brown lesions develop on small branches, usually around leaf scar, spur or pruning wounds
- Lesions develop into cankers that cause dieback of affected braches
- Cankers can girdle trunks of young trees causing tree death
- Rot may develop in trees or on fruit
- Long distance dispersal likely through movement of infected (though often symptomless) fruit

H.J. Larsen, Bugwood.org

8 Pest surveillance

Orchard monitoring and surveillance involves looking for and recording the presence, absence and population levels of pests. Conducting regular monitoring is a fundamental part of orchard management practices and gives the best chance of spotting a new pest soon after it arrives.

Pest surveillance is necessary for:

- **Market access**: Export destinations for apples and pears can require 'evidence of absence' data for exotic and some established pests that are of concern. The Australian apple and pear industry, in collaboration with governments, must prove through surveillance that exotic pests have been looked for and found to be absent.
- **Exotic pest eradication:** Early detection of exotic pests improves the chance of eradication or containment within a region. However, if eradication or containment is 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.
- **Improved pest management**: Management of established pests requires regular inspections to determine population levels to improve management decisions.
- **Pest status information**: Surveillance at the orchard 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 used by consultants is an effective recording mechanism. An example pest surveillance datasheet is included in this manual.

Report suspect pests

Early detection and reporting may prevent or minimise long-term damage to, or quarantine period of, your orchard and the apple and pear 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:

- Mark the location of the pest and limit access of both people and equipment to the area.
- Wash hands, clothes and boots that have been in contact with affected plant material or soil.
- 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 Apple and Pear 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, Apple and Pear Australia Ltd. (APAL) 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, APAL 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; ORCs) are included for direct costs incurred as a result of eradication of a pest incursion. For more information on ORCs refer to the PHA website **www.phau.com.au/epprd**.

Product management

10 Planting and propagating material

Use only high-health, 'clean' (i.e. tested with no pest detections) planting and propagation material. Obtain these only from nurseries that will provide you with reliable records of the material's source and testing history.

You cannot visually assess the health of your planting material. Viruses, viroids and phytoplasmas will not display symptoms under some circumstances, such as on dormant wood and bare roots. Even many bacterial, nematode and fungal pathogens may have no obvious symptoms on dormant trees.

To minimise the risk:

- Purchase plant material only from a nursery that takes biosecurity, hygiene, health testing and record keeping seriously.
- Check your nursery and planting material thoroughly.
- Maintain a register of your orchard's propagation material, including its source (with contact details), cultivar/rootstock combinations, specific planting locations, numbers of plants and date planted.
- Request information on the source of budwood, mother tree health testing regime and timetable, location of foundation material of new imports and the Quality Assurance scheme or certification status of the nursery itself and the planting material provided.

Chemical residues

Chemical residues on apple and pear produce can result in rejection from export and domestic markets, particularly as these residues can pose a risk to human health.

Appropriate training and advice on the safe use of pesticides should be obtained prior to chemical control of pests and always follow label regulations and withholding periods. Don't put your livelihood or the industry at risk through poor or illegal practice.

In most states and territories, growers and contractors who apply pesticides must complete an accredited chemical training course (for example ChemCert or SMARTtrain) to gain the appropriate knowledge base on the safe use of pesticides and the legal requirements.

Details about regulations for agricultural and veterinary chemicals can be obtained from the Australian Pesticides and Veterinary Medicines Authority (APVMA) **www.apvma.gov.au** or from relevant state agencies. Consult these sources frequently for information regarding chemical regulations as these may change.

Apple and pear (or other pome species) by-products

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

Collect all plant waste and dispose of it away from nursery and orchard areas and water sources. Appropriate disposal mechanisms for plant waste include deep burial (away from production areas), burning or hot composting.

Ensure that no soil, plant material or insects are left adhering to vehicles, bins, and other equipment (including hand tools) used for the harvesting of fruit.

Biosecurity and Quality Assurance

If your orchard or the nursery providing your trees is accredited (i.e. maintains a Quality Assured scheme such as ISO 9000, SQF 2000, NIASA, Freshcare or Woolworths Quality Assurance Scheme), it is likely that some fundamental techniques of biosecurity best practice are already being applied.

Ensure that your scheme and your records allow full traceability. That is, the ability to trace-back plant material on your orchard to its source (including the budwood sources, seed source, health testing specifics and authenticity records), to trace-forward plant material or produce that has left your property, and the provision of records of surveillance and pest management practices undertaken on your property.

Auditable Quality Assurance schemes and achievement of membership to them, is beneficial in terms of biosecurity, market access, meeting specifications and customer expectations, and food safety.

12 Hive Biosecurity

Good hive biosecurity practices minimise the risk of new pest introductions to the Australian honey bee industry. These measures provide benefits to beekeepers and protect the honey and pollination-dependant industries.

There are a number of bee and hive pests currently exotic to Australia that have the potential to severely impact on the honey bee and pollination-dependant industries if they were to become established. Many of these pests are prevalent in neighbouring countries.

The Australian Honey Bee Industry Council (AHBIC), as the peak industry body, has a focus on protecting beekeepers and their hives through sound biosecurity practices.

For more information visit **www.honeybee.org.au** or call 02 9221 0911.

If you see any unusual signs of pests in your bees call the Emergency Animal Disease Watch Hotline or the Exotic Plant Pest Hotline.

EXOTIC PLANT PEST HOTLINE
1800 084 881

EMERGENCY ANIMAL DISEASE WATCH HOTLINE
1800 675 888

Bee and hive threats

The Australian honey bee industry currently faces several key biosecurity threats. The highest threat is considered to be Varroa mite (*Varroa destructor* and *V. jacobsoni*), which is carried on Asian and European honey bees in countries to the immediate north (Papua New Guinea) and east (New Zealand) of Australia. The Asian honey bee is capable of not only carrying the Varroa mite but is also a very aggressive competitor.

Varroa mites feed on both adult and broodbees, weakening them and spreading bee pathogens within the colony. Infestation ultimately results in deformed bees, early death of individual bees and slow death of the honey bee colony unless control measures are applied.

Other threats include:

- **Tracheal mite**: Infestations result in sick bees that do not work as hard or live as long as healthy bees. The mite spreads from bee to bee, hive to hive and is difficult to detect.
- ***Tropilaelaps clarae* mite**: This parasite causes brood death or shortened life span for any bees that survive to adulthood.

The application of biosecurity measures also addresses pests already established in Australia, such as the Small hive beetle, American foulbrood and the European foulbrood of honey bees.

Increasing hive biosecurity

There are a number of things you can do to improve your orchard biosecurity and to help safeguard Australia's apple and pear, and honeybee industry

Beekeepers should:	Apple and pear producers and beekeepers should:
• Check the health of any bees purchased (get a vendor declaration to define the health status). • Consider hive placement and what pests might be at a new location. • Specifically check for Varroa mite, Tracheal mite and Asian honey bee. • Position hives to limit the transfer of pests from hive to hive. • Consider the stress placed on bees that are regularly moved. • Avoid placing hives in proximity of rubbish tips or where birds are fed honey. • Avoid the placement of hives near abandoned hives or abandoned orchards. • Avoid contact of livestock with the hives. • Regularly inspect bees for unusual behaviour. • Isolate captured swarms for six months to ensure their health and that they are free from pests.	• Ensure all orchard and hive equipment has been cleaned between uses. • Wash and disinfect hands when moving between hives. • Ensure boots and clothing are free from plant material, soil, insects and other pests before entering and leaving orchards or handling hives. • Minimise the number of people that visit the hives. • Prevent vehicles from driving in close proximity of the hives. • Secure honey stores and equipment so robbing bees cannot gain access. • Report anything unusual to the Emergency Animal Disease Watch Hotline or the Exotic Plant Pest Hotline. EXOTIC PLANT PEST HOTLINE 1800 084 881 EMERGENCY ANIMAL DISEASE WATCH HOTLINE 1800 675 888

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 orchard hygiene, safety and audit 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 orchard manager and formally register their presence, before entering any production areas. The sign should include important contact details, such as the home telephone number, mobile number and/or UHF channel.

Contact Plant Health Australia for further information on obtaining biosecurity signs for your property.

Managing people movement

People moving between orchards, nurseries and other horticultural regions can spread pests on vehicles, equipment, boots and clothing. Even hair and watchbands can carry fungal spores or bacteria. The most obvious risks are pests carried in soil and plant material.

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

- Maintain a visitor register (example on page 22), which will record visitor movements and help manage safety issues.
- Brief all workers, contractors, casual workers and visitors of your orchard biosecurity measures.
- Make sure employee and visitor footwear and clothing are free of soil and plant material before entering or leaving the orchard.
- Provide scrubbing brushes, footbaths, boot covers, rubber boots and protective clothing such as disposable overalls, for people entering or leaving your orchard, or moving from contaminated to clean areas of the property.
- Ensure budding crews clean their knives and footwear between cuts. At a minimum, knives should be cleaned between each bundle.
- Display biosecurity awareness material in staff rooms, trimming and packing sheds. Keep the messages simple and effective.

Casual workers and tourists

Casual workers (e.g. contract harvest crews, backpackers, retirees, etc.) are often employed to assist with orchard budding, pruning, harvesting/picking and packing. While their contribution is highly valued, they are a particular biosecurity threat because they move from orchard-to-orchard and region-to-region. They can potentially carry and spread pests from and to susceptible hosts on their clothing, footwear, gloves, and equipment.

Before entering production areas or packing sheds, make sure casual workers understand biosecurity measures at your property, have changed or washed their clothes and boots, and all tools and equipment are cleaned and disinfected.

Overseas travellers

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

Several specimens carrying pome fruit 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 orchard from overseas pests, ensure that all people who have recently returned from overseas have cleaned their boots and clothes before entering the orchard. Great care should be taken to prevent the introduction of plant pests into Australia.

Contractors and utility providers

The term ‘contractors’ includes utility providers, orchard contractors, earthmoving companies and research personnel who enter an orchard in their day-to-day operations. As with casual workers, contractors pose a significant risk because of their movement 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.

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 in your orchard.

Equipment and vehicles

16 Movement of vehicles and machinery

Vehicles and orchard equipment such as sprayers, tractors and hand tools can carry pests in adhering soil, sap 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 orchard 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 (compost, mulch, fertiliser, etc.) and earth moving equipment entering the property should be requested to clean their vehicles and equipment before entering your orchard. Orchards open to the public (e.g. U-pick businesses) 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.

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

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

- Cleaning vehicle floors and tyres of soil, plant material and pests, especially after visiting other properties.
- Where possible, use your own vehicle to carry visitors around your orchard.
- In production areas, keep vehicle movement to a minimum, especially on wet soil. Stick to regular pathways through the orchard.
- Hose off and disinfect machinery in a designated wash-down area (see page 17) before moving between properties.
- Ensure contractor equipment is washed down thoroughly to remove any plant material or soil before entering or leaving your orchard.
- Always make sure that borrowed and second-hand equipment and machinery is cleaned of all plant material and soil before moving them into your orchard.
- Regularly clean all tools and equipment, including pallets, pallecons, cherry pickers, boxes, bags, trimmers and any other equipment used in the orchard, preferably with a disinfectant or bleach solution.

Designated parking areas

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

Parking areas serve to contain the entry of new pests away from production sites. They also allow for the inspection of tyres, equipment, floor mats and boots for soil 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 threat of spreading pests between properties.

Do not allow the movement of orchard machinery through the parking area.

Wash-down facilities

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

A wash-down area should:

- Be readily accessible and located between the driveway and orchard 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 as far as practically possible to give access to internal spaces.
- Leave covers off after cleaning to allow inspection.

For additional protection, an added detergent-based degreaser or disinfectant (for example, Septone Truckwash®, Castrol Farmcleanse® or Virkon®) may be appropriate. For best results, seek advice from re-sellers on the best product, and remove as much soil 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.

Biosecurity best practice checklist

To ensure your property has the best protection against the introduction and spread of new pests, identify the strengths and weaknesses of your orchards biosecurity activities through the following self-assessment questions.

Once identified, a few simple, non-costly and practical procedures can be implemented to strengthen areas of greatest risk to your orchard. While changing everyday practices can take more effort in the short term, these will become second nature with time and are easier and cheaper than dealing with the introduction of a new pest.

Date of biosecurity check: _____

RECOMMENDED PRACTICES	YES	NO	COMMENTS
Pests			
Orchard staff know how and where to report pests			
Pest surveillance regularly conducted, with activities and results recorded even when nothing is found			
Orchard staff are familiar with common established pests and the high priority exotic pests of apple and pear			
Commercial trees and neighbouring vegetation regularly inspected for pests			
Pest threat posters displayed			
Product management			
Planting or propagation material is 'certified' or has a defined and documented health status			
Propagation material thoroughly checked upon receival			
Records of planting material and its source are maintained			
No soil, plant material or insects left on equipment or bins			
Fruit loaded and unloaded on paved or sealed pad away from production areas			
Fallen or waste fruit, packing shed waste and plant trimmings disposed of away from production areas and irrigation sources			
People movement			
Biosecurity signs with contact details located at main entrance			
Staff trained in biosecurity measures and threats			
All visitors sign a visitor register on arrival			
All visitor and staff clothing, footwear and tools are free of loose soil or plant matter before entering and leaving the nursery			
All people recently returned from overseas are checked to ensure they have clean footwear and clothing before entering nursery			
Footbaths and scrubbing brushes are provided			
Staff understand neighbouring enterprises and their activities			
Equipment and vehicles			
Designated parking area for visitors and contractors equipment available and clearly signed			
Cleaning and wash-down facilities, preferably on a concrete pad, provided for people, machinery and equipment and clearly signposted with instructions			
High pressure water or air available for use to remove plant material and soil from equipment and machinery			
Sump installed in wash-down facility to catch unwanted weeds and stop run-off			
Machinery entering the property inspected for pests, soil and plant material prior to entering production areas			
Borrowed and second-hand machinery and equipment is cleaned and disinfected before use			
Vehicle movement kept to a minimum in production areas			
Root trimming secateurs, budding and grafting knives are disinfected between trees			

Further information

More information on biosecurity, orchard hygiene, pests and the apple and pear industry can be found through the following sources.

		Contact details
ORGANISATION	**Apple and Pear Australia Limited**	**Phone**: 03 9329 3511 **Email**: applenpear@apal.org.au **Website**: www.apal.org.au
	Plant Health Australia	**Phone**: 02 6215 7700 **Email**: biosecurity@phau.com.au **Website**: www.planthealthaustralia.com.au
	Farm Biosecurity	**Phone**: 02 6215 7700 **Email**: info@farmbiosecurity.com.au **Website**: www.farmbiosecurity.com.au
GOVERNMENT	**Australian Government – Department of Agriculture, Fisheries and Forestry (DAFF)**	**Phone**: 02 6272 3933 **Website**: www.daff.gov.au
	Victoria – Department of Primary Industries	**Phone**: 13 61 86 or 03 5332 5000 **Website**: www.dpi.vic.gov.au
	New South Wales – Industry and Investment	**Phone**: 1800 808 095 or 02 6391 3100 **Website**: www.industry.nsw.gov.au
	Queensland – Department of Employment, Economic Development and Innovation	**Phone**: 13 25 23 or 07 3404 6999 **Website**: www.deedi.qld.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

Visitor register

Please enter your details to assist us with our orchard biosecurity records

Date	Time on property		Name	Reason for visit	Vehicle registration and mobile phone	Blocks visited	Location/date of last contact with commercial apples or pears or other Pome species
	Arrival	Departure					

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

EXOTIC PLANT PEST HOTLINE
1800 084 881

* An electronic version of this Visitor Register can be downloaded from the Plant Health Australia website at **www.phau.com.au/biosecurity/apple-and-pear**

Pest surveillance data sheet

Orchard: _____

Scout: _____

Date: _____

	Endemic pests					Exotic pests			
Block	No. sites	Pest 1	Pest 2	Pest 3	Pest 4	Pest 1	Pest 2	Other pests found	Comments

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

EXOTIC PLANT PEST HOTLINE
1800 084 881

Estimated established pest infestation level (e.g. zero/low/med/high or % crop affected) and exotic pest presence/absence should be scored. Pests targetted by surveillance must be named before surveillance initiated (for both established and exotic pests).

* An electronic version of this pest surveillance data sheet can be downloaded from the Plant Health Australia website at **www.phau.com.au/biosecurity/apple-and-pear**

Fact sheet

Plant Health AUSTRALIA

Rosy apple aphid

What is Rosy apple aphid?

The Rosy apple aphid (RAA, *Dysaphis plantaginea*) is considered the most destructive aphid species that attacks apples, with infestation resulting in major damage to leaves, roots and fruit.

What does it look like?

RAAs are small, soft-bodied insects with piercing-sucking mouthparts and two cornicles, which resemble tailpipes, projecting from the back of the abdomen. Adults grow up to 2.5 mm in length and can be winged or wingless. Winged adults are a brownish-green to black colour, while wingless adults are rosy brown or purple and covered in a greyish-white wax coating.

The RAA has five nymphal stages which range in size from 0.5 to 2 mm long. Colouring of the nymphs is age dependent, ranging from dark-green through to rosy-purple. The eggs are small (0.5 mm in length) and change from greenish-yellow when they are first laid, through to shiny black before hatching.

What can it be confused with?

RAA can be confused with Apple green aphids and Apple grain aphid. The eggs are indistinguishable, however RAA egg-laying females can be differentiated by a prominent central tubercle (outgrowth) on the front of their head.

Whitney Cranshaw, Colorado State University, Bugwood.org

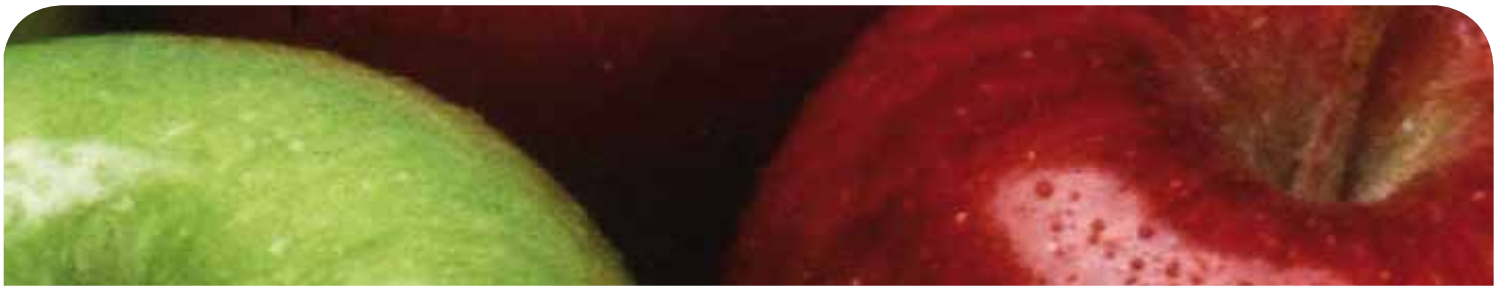
A colony of Rosy apple aphids on the underside of a leaf

Zapote

'Tailpipe' structures (cornicles) on the rear of the abdomen can be clearly seen on the Rosy apple aphid

Jack Kelly Clark, UC Statewide IPM Program

Leaf curling and distortion caused by aphid infestation



What should I look for?

RAAs can be detected through direct observation of the aphids themselves, particularly under high infestation levels. However, RAA presence would most likely be detected by the plant symptoms produced by aphid feeding. Leaf symptoms include curling, abnormal colouring and premature leaf drop. Twigs can become distorted and natural fruit drop is impeded, resulting in the fruit remaining attached in large numbers. Fruit may also be small in size and have a 'bumpy' surface.

Vast quantities of honeydew are also produced through aphid feeding and sooty moulds may develop on leaves or fruits.

How does it spread?

RAA can fly short distances, but the most common means of long distances movement is with infested seedlings. Eggs can also be spread on bark and adults/nymphs may travel on leaf material.

Where is it now?

RAA is widespread throughout the apple growing regions of North America.

How can I protect my orchard from Rosy apple aphid?

Source plant material only from clean, accredited suppliers, and preferably material that is certified. Check your orchard frequently for the presence of new pests and unusual symptoms. Make sure you are familiar with common pome fruit pests so you can tell if you see something different.

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

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1800 084 881

Jack Kelly Clark, UC Statewide IPM Program

Small, mature eggs of the Rosy apple aphid

Jack Kelly Clark, UC Statewide IPM Program

Adult winged form of the Rosy apple aphid (left) and a nymph (right)

Jack Kelly Clark, UC Statewide IPM Program

Both fruit and leaves can be distorted by aphid infestations

Fact sheet

Plant Health AUSTRALIA

Fire blight

What is Fire blight?

Fire blight (*Erwinia amylovora*) is a devastating bacterial disease that mainly infects apple and pear trees. Currently, there are no effective chemical controls available where this pest is present.

What does it look like?

Fire blight gets its name from the burnt appearance of affected plants. Symptoms of Fire blight infection can vary between cultivars, but infection generally affects all part of the tree including blossoms, leaves, shoots, branches, fruits and roots.

New shoots and leaves appear glassy and water soaked with an off-green colouring before turning brown or black. Reddish brown streaks can appear in the sap wood beneath the bark.

What can it be confused with?

Fire blight may be confused with a number of other bacterial or fungal disease symptoms, as well as damage resulting from insect attack or frosts. The presence of bacterial ooze seeping out of cankers is an identifying feature of Fire blight and will distinguish it from these other pests.

What should I look for?

Shoots and branches bent into a 'shepherd's crook' shape or the development of a bacterial ooze are key symptoms to be looked for.

Other symptoms that can be detected following Fire blight infection include water soaked and dark sunken cankers, dry twigs, dead branches that appear a burnt or deep rust colour, and dead leaves that remain on the tree. Blossoms and fruitlets may also develop a dark brown to black blight.

Jody Fetzer, New York Botanical Garden, Bugwood.org

Infected trees have a rusty, burnt appearance

William Jacobi, Colorado State University, Bugwood.org

Branches appear burned and then die

William Jacobi, Colorado State University, Bugwood.org

Dark sunken cankers appear on branches

How does it spread?

Within an orchard, heavy rain, birds, insects, animals and plants rubbing against each other can spread the pest. The bacteria can spread larger distances on infected plant material or on personnel and equipment that has been in contact with infected plant material.

Where is it now?

Fire blight is a major problem in Europe, Asia, Egypt, Bermuda, Canada, Mexico, USA and New Zealand.

How can I protect my orchard from Fire blight?

Source plant material only from clean, accredited suppliers, and preferably material that is certified. Check your orchard frequently for the presence of new pests and unusual symptoms. Make sure you are familiar with common pome fruit pests so you can tell if you see something different. Any bacterial ooze on pome trees or fruit should be checked out.

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

EXOTIC PLANT PEST HOTLINE
1800 084 881

A.L. Jones, Michigan State University

Typical 'shepherd's crook' bending of shoots

A.L. Jones, Michigan State University

Translucent liquid containing bacteria oozes from infected fruit

Mary Ann Hansen, Virginia Polytechnic Institute and State University, Bugwood.org

Young leaves appear glassy and water soaked before turning black

Fact sheet

Plant Health AUSTRALIA

Cedar apple rust

What is Cedar apple rust?

Cedar apple rust (*Gymnosporangium juniperi-virginianae*) is a fungal pathogen that causes lesion development in apples. Significant impacts on apple production only occur when apple trees are in close proximity to the alternate host, *Juniperus virginiana* (cedar). In addition to the development of lesions, Cedar apple rust can produce a number of spore producing structures on the apple surface and also causes severe canker development in cedars.

What does it look like?

Cedar apple rust requires both *Juniperus* and apple host trees to complete its lifecycle. The symptoms produced by this pathogen vary depending on the life cycle stage and host species.

On apples, small yellow-orange lesions appear on the upper surface of the leaves and petioles. In some susceptible apple varieties, small (up to 17 mm) yellow-brown tufts of spore-producing structures appear on the lower surface of the leaves and occasionally fruit, a few weeks later. Stems may show slight swelling and young fruit may abort. On fruit, the more common Cedar apple rust symptoms are slightly raised bright yellow-orange lesions, which may become brown and cracked as the fruit enlarges.

On *Juniperus* hosts, Cedar apple rust causes the development of galls on twigs and branches. These galls, known as 'cedar apples', produce a number of finger-like protrusions from the host tissue.

What can it be confused with?

When present on apples, Cedar apple rust can produce similar lesion symptoms to other bacterial and fungal diseases. However, the development of yellow-brown tufts of spore-producing structures or galls can distinguish Cedar apple rust.

University of Georgia Plant Pathology Archive, Bugwood.org

Initial symptoms include bright yellow-orange lesions on leaves

University of Georgia Plant Pathology Archive, Bugwood.org

Rust lesions develop on both leaves and fruit

Rebekah D. Wallace, Bugwood.org

Small yellow-brown tufts of spore-producing structures can be produced on the fruit surface

Paul Bachi, University of Kentucky Research & Education Center, Bugwood.org

The lesions may cover a large proportion of infected leaves

How does it spread?

The most likely means of spread is by the movement of infected plant material. While apple leaves and fruit can spread the pest, the most likely means of movement is as infected *Juniperus virginiana* material.

Where is it now?

Cedar apple rust is currently restricted to North America.

How can I protect my orchard from Cedar apple rust?

Source plant material only from clean, accredited suppliers, and preferably material that is certified. Check your orchard frequently for the presence of new pests and unusual symptoms. Make sure you are familiar with common pome fruit pests so you can tell if you see something different.

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

Spore-producing structures can also be produced from the leaf surface

Jerry A. Payne, USDA Agricultural Research Service, Bugwood.org

Cankers, or cedar apples, produced on *Juniperus virginiana*

Fact sheet

Plant Health AUSTRALIA

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 wide host range, feeding on the foliage of more than 650 species of plants.

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

Hairy larvae showing distinctive blue and red spots

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 four to 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 30-40mm, whereas the adult female moths are white with grey markings and larger with a wingspan of around 40-70 mm.

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

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

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 identification.

Milan Pernek, Forestry Research Institute, Bugwood.org

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

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'.

How does it spread?

Young larvae can spread up to several kilometres on the wind through a process known as ballooning (spinning silk that catches the wind). 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 orchard from Asian gypsy moth?

Source plant material only from clean, accredited suppliers, and preferably material that is certified. Check your orchard frequently for the presence of new pests and unusual symptoms. Make sure you are familiar with common pome fruit pests so you can tell if you see something different.

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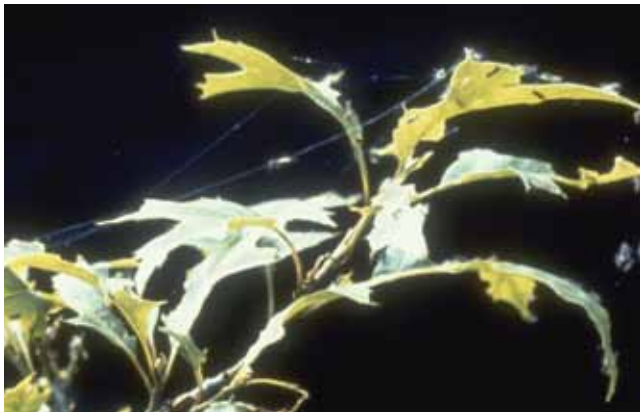


USDA Forest Service - Region 8 Archive, USDA Forest Service, Bugwood.org

Damage to oak trees and the larval webbing which is used for 'ballooning'

Manfred Mielke, USDA Forest Service, Bugwood.org

Tan egg masses on door, US Army ammunition bunker

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

Examples of Asian gypsy moth larval forms

Fact sheet

Plant Health AUSTRALIA

Apple brown rot

What is Apple brown rot?

Apple brown rot (*Monilinia fructigena*) is a fungal pathogen of apple and pear trees. This pest develops similar symptoms to Brown rot in stone fruits (*M. fructicola*), which causes serious economic problems in stone fruit in Australia, and Apple brown rot is predicted to have a similar impact on Australian pome fruit if it becomes established. Apple brown rot is primarily present throughout Europe, where it can cause losses of about 35% in apples, especially during the warm and humid summer months.

Clemson University - USDA Cooperative Extension Slide Series, Bugwood.org

Stem blight symptoms of infection, including blossom rot

What does it look like?

Infected fruit typically develop spreading, firm, brown spots that rapidly develop into rotting. These rotting areas will normally be surrounded by conidial pustules, often in concentric circles. These pustules resemble small, raised white-cream spots. Within five days of infection, the entire fruit can be rotted and covered with pustules. Infected fruits become mummified and tend to remain on the tree.

Pavel Sirkyrik

Concentric circles of conidial pustules on rotting fruit

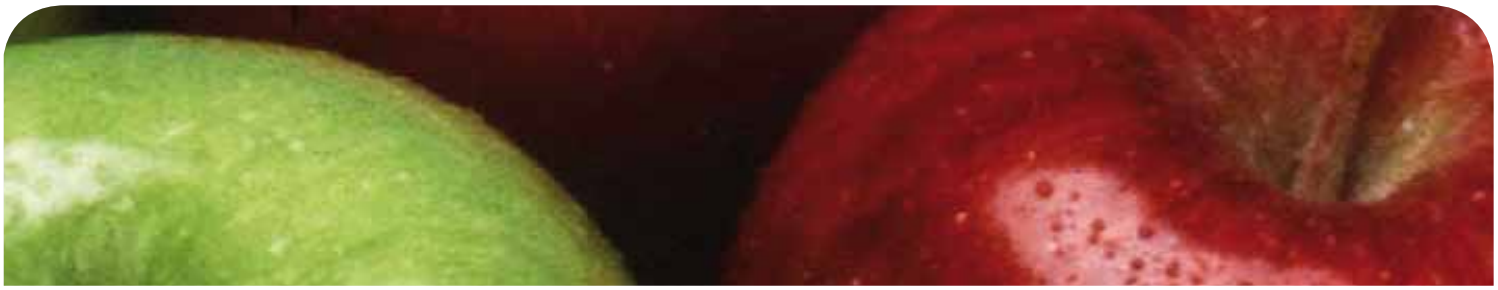
Symptoms can spread to the stems resulting in blighted twigs developing into cankers. Leaves may turn dark brown and remain attached instead of abscising. Cankers are generally restricted to the twigs and do not extend into the previous year's wood.

At harvest, apparently healthy fruit may be contaminated with spores and decay during storage and marketing.

Infected fruit can become mummified

What can it be confused with?

Apple brown rot produces similar symptoms to other Brown rot species that are present in Australia, however Apple brown rot produces more severe symptoms in apples and pears than other species. Pustule development in concentric circles on the fruit surface may suggest the presence of Apple brown rot.



What should I look for?

The development of brown rotting areas of apple or pear fruit, particularly when surrounded by pustules. Mummified fruit and brown leaves that remain on the tree are further signs of Apple brown rot infection.

How does it spread?

Fungal spores can be spread by wind and rain, and the pathogen can also be spread with infected plant material. Fruit-to-fruit contact will spread the pathogen within a single tree.

Where is it now?

Apple brown rot is found in most temperate regions of Europe, Asia, North Africa and some South American countries.

How can I protect my orchard from Apple brown rot?

Source plant material only from clean, accredited suppliers, and preferably material that is certified. Check your orchard frequently for the presence of new pests and unusual symptoms. Make sure you are familiar with common pome fruit pests so you can tell if you see something different.

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

EXOTIC PLANT PEST HOTLINE
1800 084 881

Michal Maňas

Apple brown rot can also infect stone fruit, such as this apricot

Radek Sotolář

Rotten fruit will occasionally fall to the ground and remain as a source of inoculum for further infections

Conidial pustule formation does not always occur in concentric circles

Fact sheet

Plant Health AUSTRALIA

Apple maggot

What is Apple maggot?

The Apple maggot (*Rhagoletis pomonella*) is one of the most serious fruit fly pests of North America, mainly damaging apples, but also attacking a range of stone fruit. Direct host fruit damage occurs through feeding activities of the larvae and secondary infections can occur through egg laying wounds.

What does it look like?

Adult flies are smaller than house flies (up to 5 mm in length with a wingspan of just over 10 mm) with black bodies, yellowish head and legs and greenish eyes. Wings are clear with characteristic black bands and a white spot can be seen on the thorax. The abdomen is black with three (males) or four (females) light coloured cross bands.

The larvae can grow up to 10 mm in length and are usually cream coloured. The larvae are normally contained within the fruit tissue of hosts. Pupae are yellow/brown, about 5 mm long and oval shaped.

What can it be confused with?

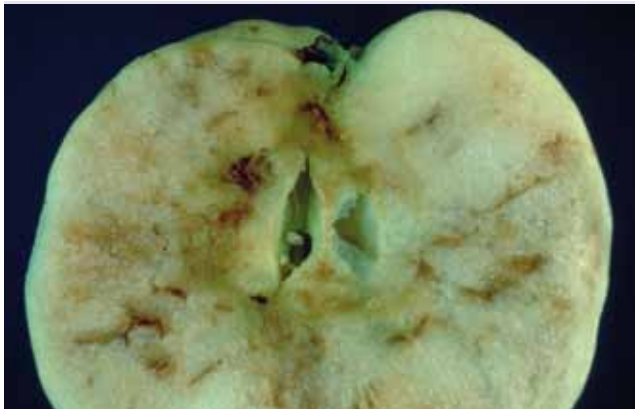
Apple maggot adults look similar to other small flies, but are recognisable by the four irregular or zigzag black bands on the wings and the pronounced white spot on their back. Fruit symptoms are similar to damage caused by Mediterranean and Queensland fruit flies.

What should I look for?

On the fruit surface, oviposition punctures and sunken dimples can been seen, together with occasional discolouration around the puncture marks. When fruit is cut open, characteristic brown trails left by larvae can be seen. The honeycombed flesh may eventually break down and apples may drop prematurely.

Joseph Berger, Bugwood.org

The Apple maggot can be distinguished by the zigzag pattern on the wings and the pronounced white spot on its back

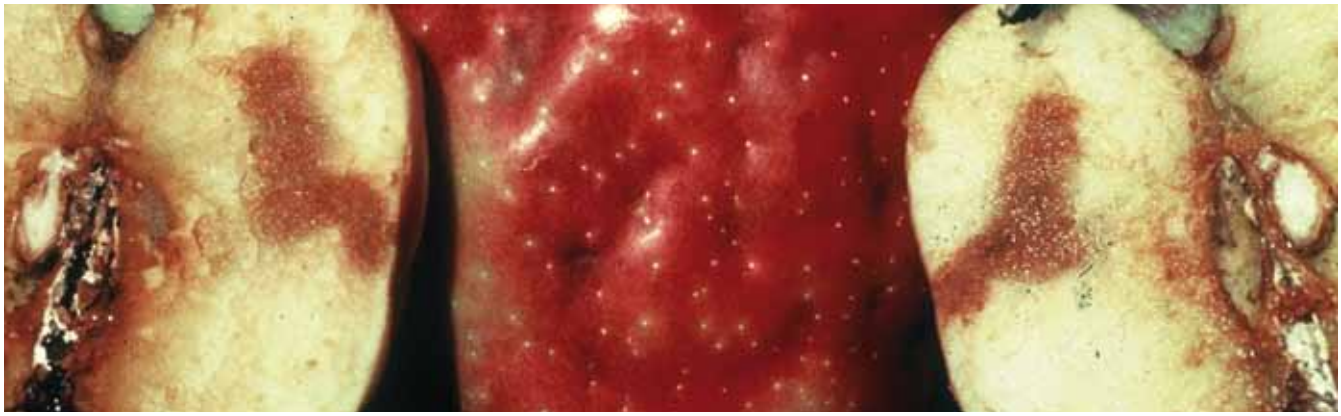


E.H. Glass, New York State Agricultural Experiment Station, Bugwood.org

Internal fruit symptoms of Apple maggot feeding

New York State Agricultural Experiment Station Archive, "Cornell University, Bugwood.org

Dimpling of the fruit surface resulting from infestation



Whitney Cranshaw, Colorado State University, Bugwood.org

Fruit surface dimpling and internal larval feeding tracks in infested apples

How does it spread?

Adult flies can spread small distances around the orchard, but longer distance dispersal occurs through movement of infested material. Pupae can be transferred in contaminated soil, whilst eggs and larvae spread widely in infested fruit.

Where is it now?

Apple maggot is widespread in the USA and also has a restricted distribution in Canada and Mexico.

How can I protect my orchard from Apple maggot?

Source plant material only from clean, accredited suppliers, and preferably material that is certified. Check your orchard frequently for the presence of new pests and unusual symptoms. Make sure you are familiar with common pome fruit pests so you can tell if you see something different.

If you see anything unusual, call the Exotic Plant Pest Hotline on 1800 084 881.

EXOTIC PLANT PEST HOTLINE
1800 084 881

Whitney Cranshaw, Colorado State University, Bugwood.org

Monitoring for Apple maggot can be completed using a yellow sticky trap

Joseph Berger, Bugwood.org

Adult flies are similar to other small fly species, with the exception of the zigzag pattern on the wings and white dot on back

Fact sheet

Plant Health AUSTRALIA

European canker

What is European canker?

European canker (*Neonectria galligena*), also known as crotch canker or eye rot, is an economically important fungal disease of apples and pears throughout the world causing fruit losses of up to 60%. The fungus has a wide host range, with the main hosts including apple, pear, maple and birch trees.

In 1954 it was introduced into Tasmania, but it was successfully eradicated from Australia by 1991.

What does it look like?

European canker symptoms are mostly present on branches and trunks of trees. Early signs of infection are reddish brown lesions which develop on small branches, generally around a leaf scar, spur or pruning wound. Symptoms usually present in late spring or early summer.

These lesions elongate into cankers with ring-shaped cracks. The cankers may cause shoot dieback and leaves may wilt or drop prematurely in spring in older trees. In young trees, cankers can girdle the trunks killing the whole tree. The fungus may also result in a rot of the trees and fruit.

What can it be confused with?

Shoot tip dieback caused by European canker closely resembles the effect of water stress or severe frost. Fruit rotting symptoms also look similar to other fruit rots such as that caused by *Gloeosporium perennans*. Look for cankers on branches and the trunk, which distinguishes European canker from the other disorders.

Abrahami

Lesions develop into cankers on branches

Abrahami

Reddish brown lesions on branches

William M. Brown Jr., Bugwood.org

Canker development may girdle the trunks of young seedlings

What should I look for?

Look for reddish brown lesions on branches of established trees that may develop into cankers with ring-shaped cracks. Unexplained death of young trees may also indicate the presence of European canker.

How does it spread?

Spores are spread by wind and rain splash and possibly by insects and birds. Long distance dispersal is more likely through the movement of infected (though often symptomless) fruit.

Where is it now?

With the exception of Australia, European canker is present in all regions of commercial apple and pear production throughout the world.

How can I protect my orchard from European canker?

Source plant material only from clean, accredited suppliers, and preferably material that is certified. Check your orchard frequently for the presence of new pests and unusual symptoms. Make sure you are familiar with common pome fruit pests so you can tell if you see something different.

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

EXOTIC PLANT PEST HOTLINE
1800 084 881

H.J. Larsen, Bugwood.org

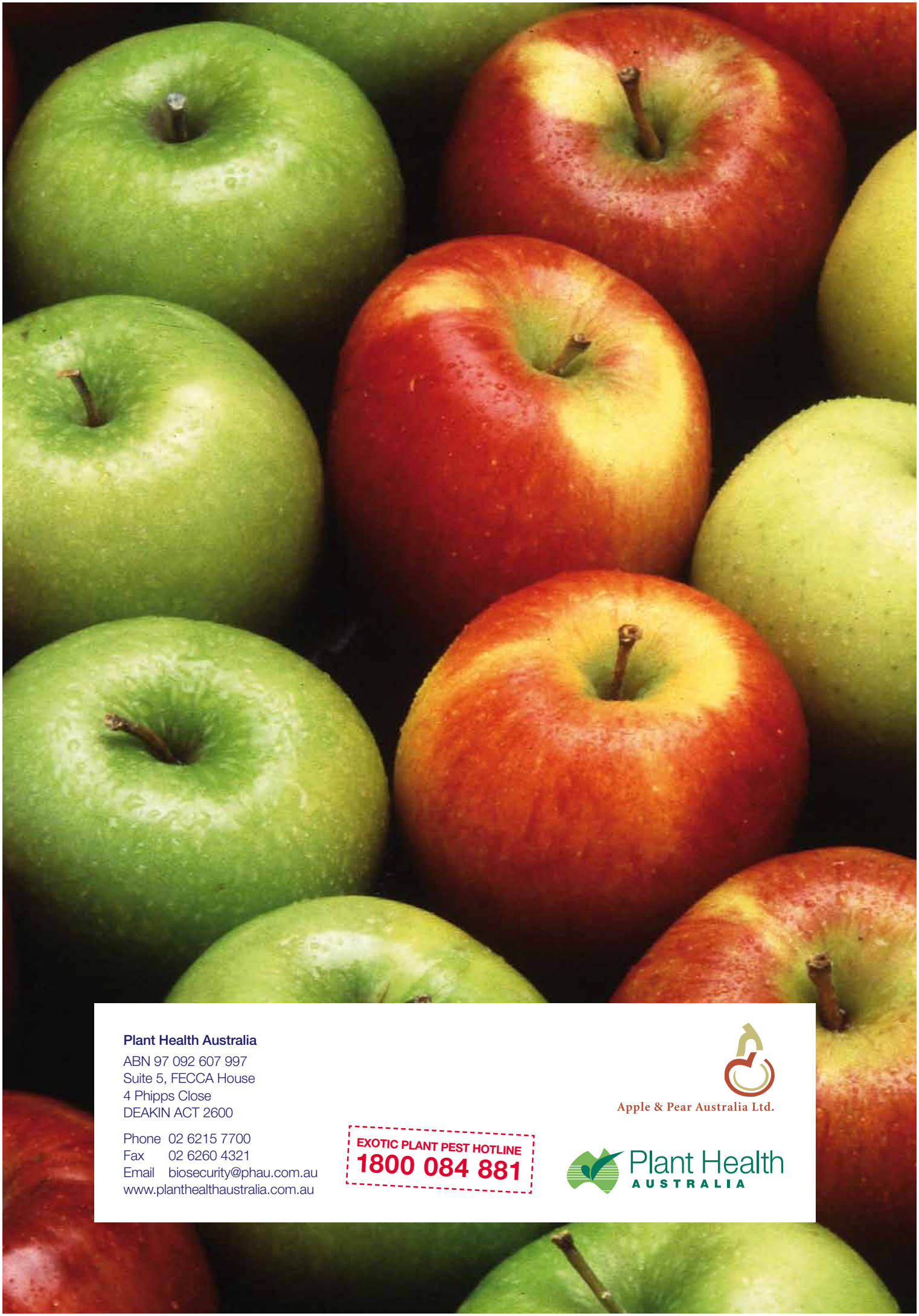
Severe cankers on branches lead to dieback of the branch

William M. Brown Jr., Bugwood.org

Reddish brown lesions on seedling are early symptoms

Herb Aldwinckle, Cornell University

Dieback of shoot tips



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EXOTIC PLANT PEST HOTLINE
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Apple & Pear Australia Ltd.

Plant Health AUSTRALIA