

Orchard Biosecurity Manual

for the Summerfruit Industry

Reducing the risk of new pests
impacting on your orchard

Version 1.0





Plant Health Australia (PHA) is the national coordinator of the government-industry partnership for plant biosecurity in Australia. As a not-for-profit company, PHA services the needs of Members and independently advocates on behalf of the national plant biosecurity system. PHA's efforts help minimise plant pest impacts, enhance Australia's plant health status, assist trade, safeguard the livelihood of producers, support the sustainability and profitability of plant industries and the communities that rely upon them, and preserve environmental health and amenity.

www.planthealthaustralia.com.au



Summerfruit Australia Ltd. is the national organisation that represents the interests of its member states and orchardists from around Australia.

www.summerfruit.com.au

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Six easy ways to protect your property

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

Here are six easy ways you can reduce the threat of new pests impacting on your livelihood. Each of these practices should be embedded in your orchard's everyday management as they make good business sense by reducing the risk of spreading pests. 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 summerfruit pest threats. Conduct a biosecurity induction session to explain required hygiene practices for people, equipment and vehicles in your orchard.

2. Use pest-free propagation material

Ensure all propagation material is from trusted sources 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 clean before entering and leaving your property. Have a designated visitor's area and provide vehicle and personnel wash-down 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 summerfruit 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



Biosecurity overview

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This manual is designed to assist you in protecting your property and the summerfruit 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 our plant industries. Biosecurity allows us to preserve existing trade opportunities and provide evidence to support new market negotiations.



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The definition of a **pest** used in this manual covers all insects, mites, snails, nematodes, pathogens (diseases) and weeds that are injurious to plants, plant products or bees. **Exotic** pests are those not currently present in Australia, while **established** (and **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 summerfruit 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

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To strengthen the biosecurity measures implemented on your property, consider including biosecurity issues and activities in community or regional meetings. 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.

Promotion of biosecurity at the regional level is enhanced through broad engagement of the community, understanding the region's vulnerability, the source and nature of threats, knowledge of the expertise base and resources available to the region, together with a commitment from stakeholders to implement biosecurity measures, surveillance and reporting.

Implementation of orchard biosecurity underpins regional biosecurity, which in turn underpins national biosecurity. If orchard measures are supported by community-based measures, a regional framework for biosecurity can be coordinated and is achievable.

Pests

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High priority exotic pest threats of the summerfruit industry

The following are some of the key exotic pest threats for the Australian summerfruit industry identified through the development of the Summerfruit 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 summerfruit industry, refer to Summerfruit IBP (available from www.phau.com.au/biosecurity/summerfruit).

The climate of Australian summerfruit production regions would allow each of these pests to survive, spread and establish should they be introduced. Additional information on each of these pest threats is included in the fact sheets at the back of this manual.

Plum pox virus (*Plum pox potyvirus*)

OVERALL RISK – EXTREME

- Also known as Sharka, the virus affects numerous *Prunus* spp.
- Symptoms are highly variable but may appear on trunks, leaves or fruit
- Leaves may show chlorotic spots, bands or rings and vein clearing
- Fruit or stones can look mottled or spotted
- Trunks can split and fruit may drop prematurely
- Spread locally by aphids
- Dispersed long distance through infected propagation material



European and Mediterranean Plant Protection Organization Archive, Bugwood.org

Brown rot (*Monilinia fructigena*)

OVERALL RISK – HIGH

- Infects a range of fruit trees and berries
- Fruit rapidly develop firm, brown spots that progress into rotting
- Rotting areas covered by creamy-white pustules, often in circles
- Infected fruit can mummify on the tree
- Blighted twigs with cankers can also develop
- Young fruit turn from green to violet, followed by fruit drop



Pavel Šinkyrik

False codling moth (*Cryptophlebia leucotreta*)

OVERALL RISK – HIGH

- Wide host range
- Moth is up to 20 mm and has a triangular mark on the outer part of the wing with a crescent shaped mark above it
- Larvae are up to 15 mm long with red-pink bodies and yellow-brown heads
- Larvae mine just beneath the fruit surface causing premature ripening
- Larvae spin cocoons which can be seen in soil or debris under trees
- Dispersed long distances in fruit infested with larvae



Terita Grové, Institute for Tropical and Subtropical Crops, Bugwood.org

Remain observant for anything unusual in your orchard and storage facilities.

If a pest is found that is not normally present, it may be new not only to your property, but to the region, state or even Australia.

Plum fruit moth (*Cydia funebrana*)

OVERALL RISK – HIGH

- Causes up to 50% yield loss in Europe
- Adult moths have dark grey-brown forewings with four short black dashes near wing tips.
- Larvae are 10-12 mm long with red-pink bodies and dark heads
- Larval entry holes in fruit exude sticky gum
- Young fruit turn from green to violet, typically followed by fruit drop
- Dispersed long distances in fruit infested with larvae



Magnus Gammelgaard.
www.plant-diseases.com

Spotted winged drosophila (*Drosophila suzukii*)

OVERALL RISK – HIGH

- Attacks a range of soft skinned fruit
- Egg deposition and larval feeding can occur in maturing, firm fruit
- Flies are 2-3 mm long with yellow-brown colouring, dark bands on the abdomens and red eyes
- Males have a dark spot on the tip of their forewings
- Larvae feed in fruit, are cream coloured and about 3 mm long
- Secondary infections can occur at egg laying sites, leading to fruit rot
- Flies spread by flight or longer distances in infested fruit



John Davis

Oriental fruit fly complex (*Bactrocera papayae*, *B. dorsalis*, *B. carambolae*)

OVERALL RISK – MEDIUM-HIGH

- Includes Oriental, Papaya and Carambola fruit flies
- Found in Asia, Papua New Guinea, the Pacific, South America
- Adults 6-8 mm long with a narrow brown band along edge of wings
- Flies are similar to a number of other endemic species
- Larval feeding can result in fruit rot and may cause fruit to drop, resulting in up to 100% fruit loss



Scott Bauer

Plum curculio (*Conotrachelus nenuphar*)

OVERALL RISK – MEDIUM

- Major pest of summerfruit in North America
- Weevils are 5 mm long, grey-brown with four pairs of ridges on the forewings
- Adult weevils lay eggs causing scarring and wounds on fruit
- Larval feeding causes internal fruit damage resulting in fruit drop
- Dispersed long distances in fruit infested with larvae



E. Levine, Ohio State
University, Bugwood.org



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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 because of:

- **Market access:** Export destinations for summerfruit can require 'evidence of absence' data for exotic and some established pests that are of concern. The Australian summerfruit industry, in collaboration with governments, must prove through surveillance that exotic pests have been looked for and determined 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:** Regular inspections of orchards to determine pest presence and population levels will inform management practices.

- **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 on your property should be recorded. These records can be used in the response to a pest incursion and provide support to industry surveillance activities. The addition of exotic pests to current data sheets used by consultants is an effective recording mechanism. An example pest surveillance data sheet is included in this manual (see page 25).

Report suspect pests

Early detection and reporting may prevent or minimise long-term damage to, or the quarantine period of, your orchard and the summerfruit industry.

Report any unusual or suspect plant pests 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 orchard:

- Mark the location of the pest or symptoms 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 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**





10 The Emergency Plant Pest Response Deed (EPPRD)

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, Summerfruit Australia 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, the summerfruit industry has 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.



PHA

Owner Reimbursement Costs

Under the EPPRD, grower reimbursement payments (Owner Reimbursement Costs; ORCs) may be included for direct costs incurred as a result of the implementation of an approved Response Plan. ORCs may cover direct grower costs or losses through such actions as the destruction of crops, enforced fallow periods, replacement of trees and additional chemical treatments.

Calculation of ORCs is prescribed in the EPPRD, including the different formulae used to accommodate the wide range of crops grown by Industry signatories. Summerfruit ORCs are calculated using the “Perennial Trees” formula. To ensure that these calculations are accurate, growers should keep records of key information (example record sheet provided on page 26).

It is important to remember that ORCs only apply to approved Response Plans aimed at eradication, which are more likely to be developed following early detection of a pest.

For more information on the EPPRD refer to www.phau.com.au/epprd.







Product management

12 Planting and propagating material

Use only clean planting and propagation material (i.e. tested with no pest detections). 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.

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 and the planting material.

Chemical residues

Chemical residues on summerfruit 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.

Waste fruit and plant material

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 summerfruit produce.

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.



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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, health testing and authenticity records), and to trace-forward plant material or produce that has left your property. Records of surveillance and pest management practices should also be 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.



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14 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



Bee and hive threats

The Australian honey bee industry currently faces several key biosecurity threats. The highest threat is 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 of Australia (New Zealand).

Varroa mites feed on both adult and broodbees, weakening them and allowing other bee pathogens to spread 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.

All of these pests can easily spread to feral bees, causing significant colony losses and therefore reducing pollination for summerfruit crops.

The application of biosecurity measures in managed hives 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 that you can do to improve your orchard biosecurity and to help safeguard Australia’s summerfruit and honey bee industries.

Beekeepers should:	Summerfruit producers and beekeepers should:
<ul style="list-style-type: none">• 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.	<ul style="list-style-type: none">• Ensure all orchard and hive equipment have 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 hives.• Prevent vehicles from driving in close proximity to the hives.• Secure honey stores and equipment so robbing bees cannot gain access.• Check reasons for poor fruit set to see if low numbers of bees may have caused poor pollination.• Report anything unusual to the Emergency Animal Disease Watch Hotline or the Exotic Plant Pest Hotline. <div data-bbox="798 1635 1212 1848" style="border: 2px dashed black; padding: 5px; margin-top: 10px;"><p>EXOTIC PLANT PEST HOTLINE 1800 084 881</p><p>EMERGENCY ANIMAL DISEASE WATCH HOTLINE 1800 675 888</p></div>

People and biosecurity

16 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 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 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.



A template for the above sign is available for download from www.phau.com.au/biosecurity

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 24), 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 for people entering or leaving your orchard, or moving from contaminated to clean areas of the property.
- Ensure budding and grafting crews are particularly diligent about cleaning 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 pruning, harvesting/picking and packing. While their contribution is highly valued, they are a particular biosecurity threat because they move 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 are well briefed on 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 are a threat to our biosecurity, especially if they have visited orchards, nurseries, or markets where plant material and produce was sold.

Several specimens carrying summerfruit 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

18 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 (nursery stock, fertiliser, etc.) and earth moving equipment should be requested to clean their vehicles and equipment before entering your orchard. Orchards 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.



Weedstop

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 19) before moving between properties.
- Ensure contractor equipment is washed down thoroughly to remove any plant material or soil before entering 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, pallets, cherry pickers, boxes, bags, trimmers and any other equipment used in the orchard, preferably with a disinfectant or bleach solution.



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, pests 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.
- 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. 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.

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.



Biosecurity best practice checklist

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To ensure your property has the best protection against the introduction and spread of new pests, identify the strengths and weaknesses of your orchard's 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: _____

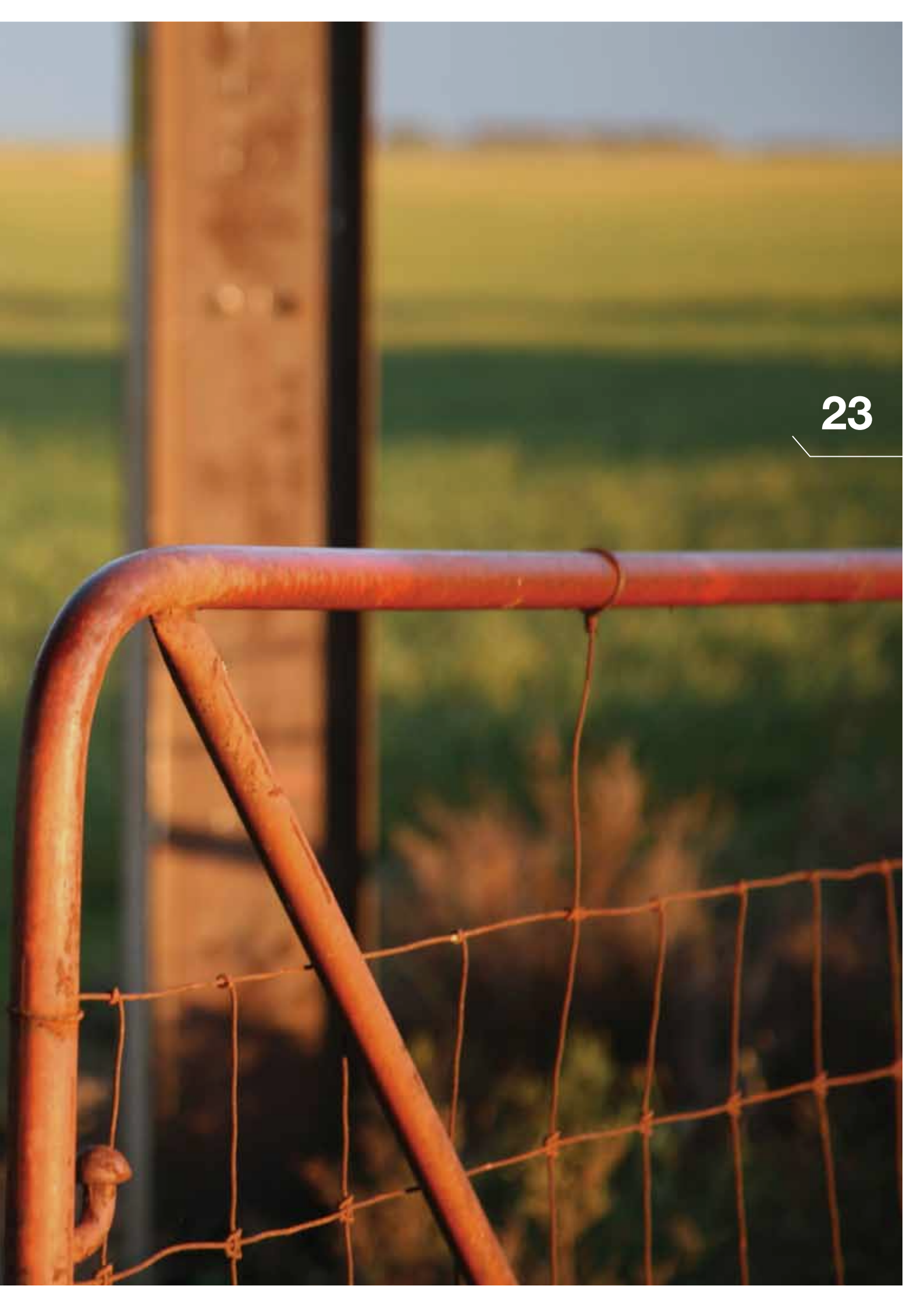
RECOMMENDED PRACTICES	YES	NO	COMMENTS
Pests			
Orchard staff know how and where to report pests			
Pest surveillance regularly conducted, with activities and results recorded even when nothing is found			
Orchard staff are familiar with common established pests and the high priority exotic pests of summerfruit			
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 receipt			
Records of planting material and its source are maintained			
Staff are aware of symptoms of summerfruit pests spread with propagation material			
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 orchard			
All people recently returned from overseas are checked to ensure they have clean footwear and clothing before entering orchard			
Footbaths and scrubbing brushes are provided			
Staff understand neighbouring enterprises and their activities			
Equipment and vehicles			
Designated parking area for visitors and contractor's 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 pests and 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 Summerfruit industry can be found through the following sources.

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	Useful contacts	Contact details
ORGANISATION	Summerfruit Australia	Phone: 02 6041 6641 Website: www.summerfruit.com.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	Phone: 02 6272 3933 Website: www.daff.gov.au
	New South Wales – Department of Primary Industries	Phone: 1800 808 095 or 02 6391 3100 Website: www.dpi.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
	Tasmania – Department of Primary Industries, Parks, Water and Environment	Phone: 1300 368 550 Website: www.dpipwe.tas.gov.au
	Victoria – Department of Primary Industries	Phone: 13 61 86 or 03 5332 5000 Website: www.dpi.vic.gov.au
	Western Australia – Department of Agriculture and Food	Phone: 08 9368 3333 Website: www.agric.wa.gov.au



Production record

Completing the following production value summary each year, and keeping supporting documentation records, will increase the accuracy of Owner Reimbursement Cost calculations if required during an eradication campaign for an Emergency Plant Pest under an approved Response Plan (see page 10 for details).

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Year/Season: _____

Crop value			
Area cropped	Total:		
	Breakdown by variety		
	Variety	Location	Area cropped
Yield	Variety	Yield	Comments
Market price	Market location	Variety	Price
Capital items			
Items installed on site (e.g. irrigation lines, harvest bins, protective covers, trellising, etc.)	Item details	Amount	Cost (depreciated)
Tree value			
Stock take of trees	Variety (and commercial life)	Tree age	Number of trees
Tree costs	Trees planted this season		
	Variety	Number	Cost

Stored products			
Products stored	Product/variety	Amount	Time period of storage
Pruning and harvesting costs			
Time	Total staff hours for harvest (including start and finish dates):		
	Total staff hours for pruning (including start and finish dates. If more than one round, list all dates):		
Machinery costs	Cost to run/hire machinery for harvest:		
	Cost to run/hire machinery for pruning:		
Contractor costs	Cost of employing a harvest contractor (if used):		
	Cost of employing a pruning contractor (if used):		
Net profit from season			
Total sales	Value:	Evidence (e.g. receipt):	
Total costs	Value:	Evidence (e.g. receipt):	
Total net profit	Value:	Evidence (e.g. receipt):	

Plum pox virus

What is plum pox virus?

Plum pox virus (also known as Sharka) is caused by the *Plum pox potyvirus*. It infects many *Prunus* spp., though there may be different strains of the virus that are host specific. It is one of the highest threats to the summerfruit industry and, should it become established in Australia, would cause significant yield losses, quality issues and loss of markets.

What should I look for?

Symptoms of mottling, spotting and yellowing can occur on leaves, fruit and tree trunks. Some may be confused with abiotic stress symptoms such as nutrient deficiency.

Plum pox virus can affect fruit quality, including causing reduced size of fruit, lower sugar content and production of tasteless or bitter fruit.

What can it be confused with?

Because the symptoms of Plum pox virus are so variable depending on season and location, it can be confused with other virus or physiological stress symptoms. Ultimately, the virus needs to be confirmed in plant tissue in a laboratory using molecular identification techniques. If symptoms such as those described in this factsheet are seen, get them checked.

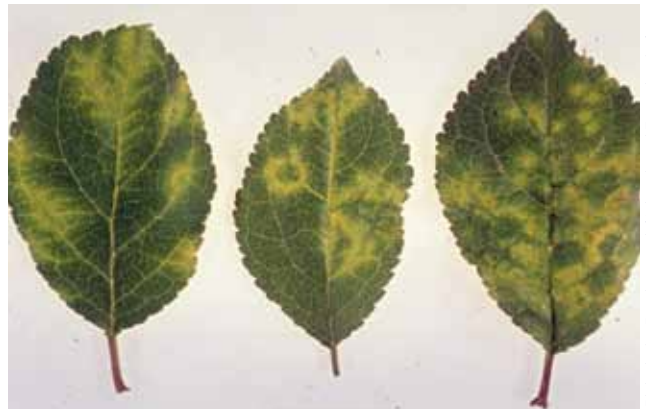
How does it spread?

Spread within orchards or to neighbouring orchards occurs via aphid vectors such as *Aphis spiraecola* and *Myzus persicae*. Long distance dispersal (and the most likely means of entry into Australia) is through illegal importation of propagation material that has been grafted with wood from infected *Prunus* trees.



The aphid vector *Myzus persicae*

Scott Bauer, USDA Agricultural Research Service, Bugwood.org



Virus symptoms on plum leaves

Biologische Bundesanstalt für Land- und Forstwirtschaft Archive, Bugwood.org



Vein clearing symptoms in peach leaves

Biologische Bundesanstalt für Land- und Forstwirtschaft Archive, Bugwood.org



Where is it now?

Plum pox virus is widespread throughout Europe and was found in Chile in 1992, but has since been eradicated.

How can I protect my orchard from Plum pox virus?

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 summerfruit diseases 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**



Spotting on apricot stones

European and Mediterranean Plant Protection Organization Archive, Bugwood.org



Chlorotic spots on peach fruit

European and Mediterranean Plant Protection Organization Archive, Bugwood.org



Severe symptoms on plum fruit

Biologische Bundesanstalt für Land- und Forstwirtschaft Archive, Bugwood.org



For more information visit www.planthealthaustralia.com.au

Brown rot

What is Brown rot?

Brown rot (*Monilinia fructigena*) is a fungal pathogen that develops similar symptoms to another Brown rot in stone fruits (*M. fructicola*), which causes serious economic problems in stone fruit in Australia.

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 rot and will be covered with pustules. Infected fruits become mummified and tend to remain on the tree.

Symptoms can spread to the stems resulting in blighted twigs developing into cankers. Leaves may turn dark brown and remain attached instead of falling. 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 will decay during storage and marketing.

What can it be confused with?

Brown rot produces similar symptoms to other *Monilinia* species that are present in Australia such as *M. fructicola*; however, Brown rot produces more severe symptoms in apples and pears than these species. Pustule development in concentric circles on the fruit surface may suggest the presence of Brown rot.



Stem blight symptoms of infection, including blossom rot

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

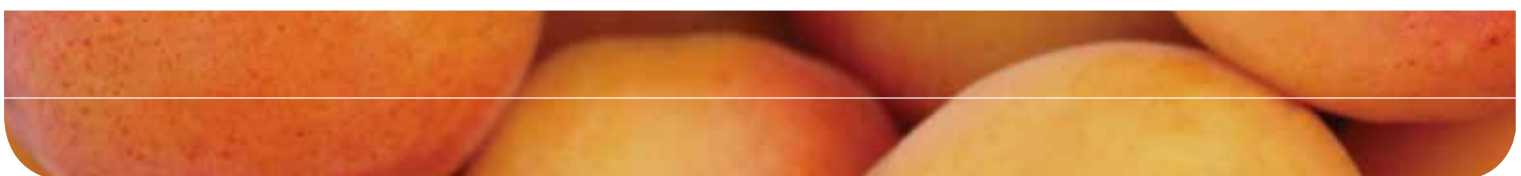


Concentric circles of conidial pustules on rotting fruit

Pavel Sinytyk



Infected fruit can become mummified





What should I look for?

The development of brown rotting areas on fruit, particularly when surrounded by pustules. Mummified fruit and brown leaves that remain on the tree are further signs of 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?

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 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 summerfruit diseases so you can tell if you see something different.

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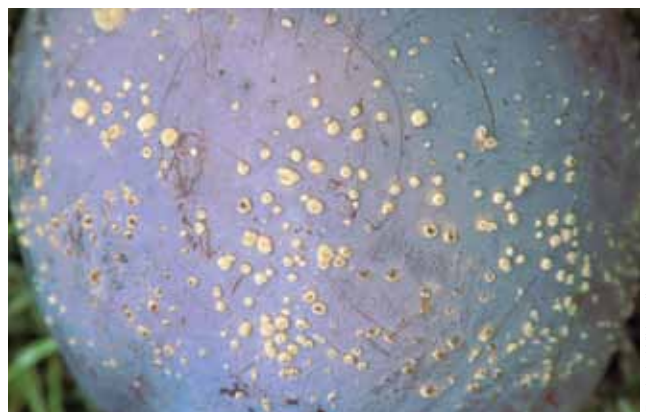


Brown rot on apricot

Michal Manas

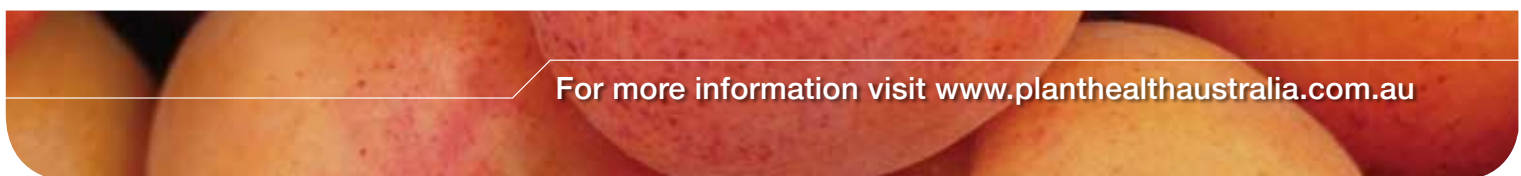


Conidial pustule formation does not always occur in concentric circles



Brown rot on plum

Rasbak, Wikimedia commons



False codling moth

What is the False codling moth?

The False codling moth (*Cryptophlebia leucotreta*) is an internal fruit feeding moth that can be found throughout the year in warm climates and has been recorded as feeding on over 50 different plant species. This moth causes economic loss in a range of crops in sub-Saharan Africa. Losses during infestations can be between 20-30%.

What does it look like?

Adult moths are 15-16 mm (males) and 19-20 mm (female) in length. Forewings have grey, brown, black and orange-brown markings. A triangular marking on the outer part of the wing with a crescent shaped marking above it distinguishes the False codling moth from other species.

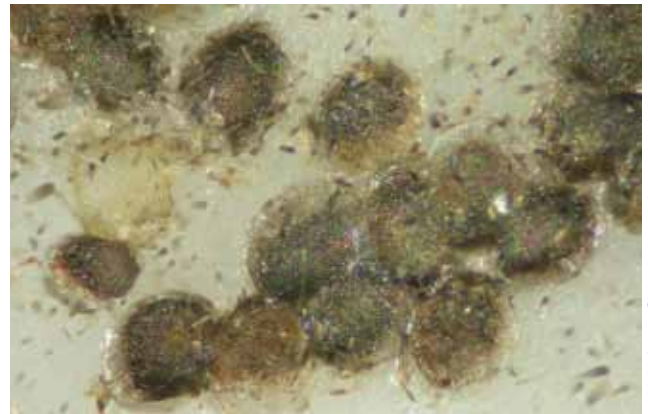
Young larvae are yellowish-white with dark spots but bright red or pink when fully grown (15 mm), with a yellow-brown head. Pupae are contained within a tough silken cocoon amongst debris or in the soil. Female moths lay 100-400 eggs (oval, flattened and almost 1 mm in length) singly on the fruits at night.

What can it be confused with?

False codling moth can look similar to other moths but can be distinguished by the triangular marking near the edges of the wings.

What should I look for?

The young larvae mine fruit just beneath the surface, or bore into the skin causing premature ripening of the fruit. When fully grown the larva descends to the ground on a silken thread and spins a tough silken cocoon, which can be seen in the soil or amongst debris.



Eggs are oval shaped and almost 1 mm long

J.H. Holmeyer, Citrus Research International, Bugwood.org



False codling moth pupae

J.H. Holmeyer, Citrus Research International, Bugwood.org



Forewings are brown with black markings and white dots

Pest and Diseases Image Library, Bugwood.org



How does it spread?

The general means of dispersal of False codling moth is through the movement of fruit infested with larvae.

Where is it now?

The False codling moth is widespread in Kenya and present throughout Africa.

How can I protect my orchard from False codling 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 stone fruit insect 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**



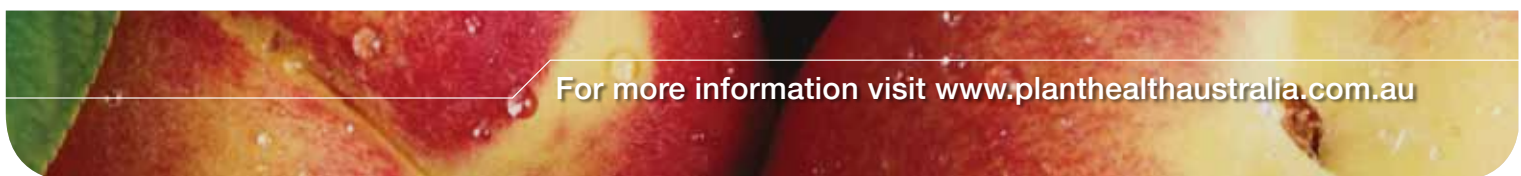
Mating adult False codling moths

J.H. Hofmeyr, Citrus Research International, Bugwood.org



Grown larvae are pink/red with yellow/brown heads

Teria Grové, Institute for Tropical and Subtropical Crops, Bugwood.org



For more information visit www.planthealthaustralia.com.au

Plum fruit moth

What is the Plum fruit moth?

The Plum fruit moth (PFM, *Cydia funebrana*), also known as red plum maggot and plum fruit maggot, is a serious pest of summerfruit, causing fruit losses of up to 50% in Europe.

What does it look like?

Adults have a wingspan of 13-15 mm. The triangular forewings are dark grey/brown with a paler area near the apex, which bears four short black dashes. The underside of the body and legs is grey, and hind wings are a brown/grey colour.

Eggs (0.6 x 0.7 mm, slightly elliptical) are laid singly and are initially translucent but later become yellow. Fully-grown larvae are 10-12 mm long with a red/pink back and a dark head, and are tapered at both ends. Pupae are 6-6.5 mm long and light brown.

What can it be confused with?

PFM may be easily confused with another moth pest, *Cydia molesta*, but PFM is larger than its relative. The fruit drop caused by PFM infestation may be mistaken for the physiological drop of unfertilised fruit.

What should I look for?

The entrance holes from young larvae are not easily spotted on the fruit, but sticky gum exuding from the holes may be visible. The most noticeable symptom in young fruit is a change in colour from green to violet, which is typically followed by fruit drop. In more mature fruit, infestation with larvae leads to premature ripening.



Larvae have red/pink backs and dark heads

Photo: Magnus Gammelgaard, www.plant-diseases.com



Fully-grown larvae are 10-12 mm long

Photo: Magnus Gammelgaard, www.plant-diseases.com



Internal damage is not seen unless the fruit is opened

Photo: Magnus Gammelgaard, www.plant-diseases.com





How does it spread?

PFM is usually dispersed through movement of fruit infested with larvae.

Where is it now?

PFM is widespread in Europe and northern Asia and is also found in northern Africa (Algeria).

How can I protect my orchard from Plum fruit 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 summerfruit insect pests so you can tell if you see something different.

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Internal damage caused by larval feeding

Photo: Magnus Gammelgaard, www.plant-diseases.com



Sticky gum may exude from the entry holes

Photo: Magnus Gammelgaard, www.plant-diseases.com

Spotted winged drosophila

What is Spotted winged drosophila?

Spotted winged drosophila (SWD, *Drosophila suzukii*) is a newly emerging pest in North America. SWD is a small fly that attacks a range of soft skinned fruit and reduces crop yield and quality through direct feeding damage and secondary infection of the fruit. This pest has a significant impact on fruit production as the larvae feed on maturing fruit, not just over-ripe, decaying or fallen fruit.

The preferred hosts in healthy fruit include a range of berries, cherries, nectarines, plums and grapes. Apples, pears and other fruit with thicker skins are also hosts when fruit begins to rot.

What does it look like?

Adult SWD are yellow-brown coloured flies with dark bands on the abdomen and red eyes. They are 2-3 mm in length and the female flies have an ovipositor at the tip of their abdomen, which allows them to lay eggs in healthy, thin-skinned fruit. Males have a small dark spot the front edge near the tip of each forewing (unlike females).

Larvae are cream or white coloured and about 3 mm long. Pupae are brown, 2-3 mm in length and cylinder shaped with two small projections on the end.

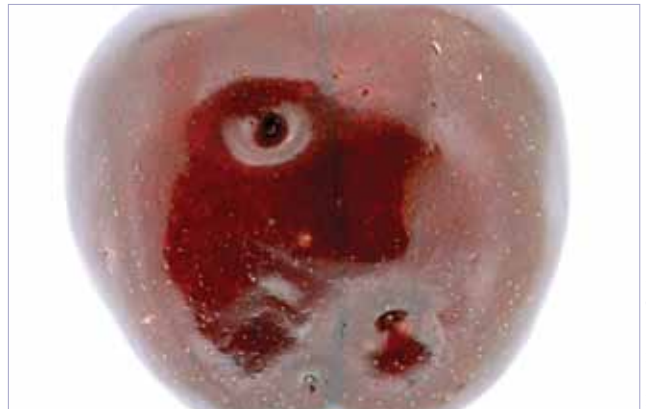
What can it be confused with?

Adult SWD look almost identical to the regular vinegar fly (*D. melanogaster*). SWD are distinguished from other *Drosophila* species present in Australia by the black spot on the wing tips in males and the females' ability to lay eggs in healthy fruit.



Larry L. Strand, UC Statewide IPM Program

Larvae feed internally on fruit making them hard to detect



Martin Hauser, California Department of Food and Agriculture

External damage symptoms on cherry fruit



John Davis

Adult male flies have distinct spots on the ends of their wings, which give the species their name



What should I look for?

Infested fruit show small scars and indented soft spots on the surface, which are left by the “stinging” (ovipositing) females. Larval feeding results in the fruit collapsing around the feeding site.

Detection of the SWD, as with a number of other insect pests that attack fruit, can occur following detection of fruit rot caused by secondary infection by moulds and bacteria.

How does it spread?

Adult SWDs can spread throughout a crop through flight, but longer distance dispersal occurs through movement of plant material (primarily fruit) infested with eggs or larvae.

Where is it now?

SWD are native to SE Asia but have recently become a pest in Japan and USA.

How can I protect my orchard from Spotted winged drosophila?

Source planting material and orchard inputs only from ‘clean’, accredited suppliers. Check your orchard frequently for the presence of new pests and unusual symptoms. Make sure you are familiar with common summerfruit insect 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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John Davis

Adult females do not have the spots present on their wings



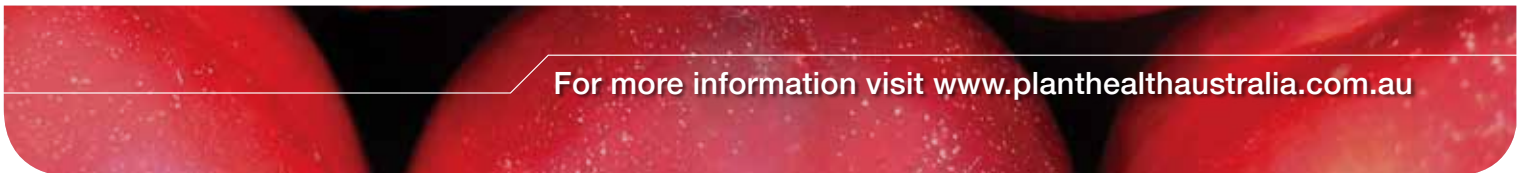
Martin Hauser, California Department of Food and Agriculture

Spotted winged drosophila pupae on damaged fruit surface



Martin Hauser, California Department of Food and Agriculture

Oviposition scars and secondary rotting in cherry fruit



For more information visit www.planthealthaustralia.com.au

Oriental fruit fly complex

What is Oriental fruit fly complex?

Papaya fruit fly (*Bactrocera papayae*), Oriental fruit fly (*B. dorsalis*) and Carambola fruit fly (*B. carambolae*) are all part of the Oriental fruit fly complex. All three species look extremely similar and can only be distinguished by a fruit fly expert.

Fruit flies are major pests and have been recorded on over 200 types of fruit and vegetables and can cause losses of up to 100% in unprotected fruit.

What does it look like?

Fruit flies are about the same length as a common housefly but more slender. They grow 6-8 mm in length and have clear wings, generally black chests and paler abdomens with a distinctive black T-shaped marking. The Queensland fruit fly, by comparison, is much the same size but is an overall reddish-brown colour. An expert eye is needed to identify Oriental fruit flies under a microscope.

Pupae are white to yellow-brown in colour and barrel shaped, whilst larvae are about 10 mm long and creamy white. Eggs are white, elongate and elliptical measuring about 0.9 x 0.2 mm.

What can they be confused with?

Symptoms are similar to those caused by endemic flies such as Queensland fruit fly. Papaya, Oriental and Carambola fruit flies look very similar to each other. Any fruit flies that look different from those regularly encountered should be reported and further examined by an entomologist.

What should I look for?

Adult female flies have exceptionally long ovipositors, allowing them to lay their eggs just under the skin of fruit, depositing fruit decaying bacteria at the same time. Within one to two days,



Scott Bauer

The female has a long ovipositor for penetrating the skin of fruit



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

A T-shaped mark is often visible on the abdomen



Pest and Diseases Image Library, Bugwood.org

Adult flies have a narrow brown band along the edge of their wings



the eggs hatch into maggots (larvae) which feed on the decaying fruit, causing premature fruit drop. Considerable damage can occur inside the flesh before obvious signs of infestation can be seen on the fruit. The most obvious signs of infestation are small discoloured patches on the skin, which develop from punctures or stings made by the female as she lays her eggs.

Infested young fruit become distorted, callused and usually drop; mature fruit develop a water soaked appearance. The larval tunnels provide entry points for bacteria and fungi that cause the fruit to rot.

How does it spread?

Adult flies can disperse over long distances through flight, while the transport of larvae in infested fruit can result in global movement.

Where is it now?

Papaya fruit fly is native to and widespread in south-east Asia (Thailand, Malaysia, Borneo, Singapore, and Indonesia). It is present in most provinces of mainland Papua New Guinea. It was detected in Cairns, Australia in October 1995 and was eradicated. Oriental fruit fly is widely spread throughout Asia and in the north of South America and parts of the South Pacific. Carambola fruit fly is found in South America.

How can I protect my orchard from fruit flies?

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 summerfruit insect pests so you can tell if you see something different.



Adults grow up to 6-8mm in length

Merle Shepard, Gerald R. Carner and P.A.C. Ooi, Insects and their Natural Enemies Associated with Vegetables and Soybean in Southeast Asia, Bugwood.org



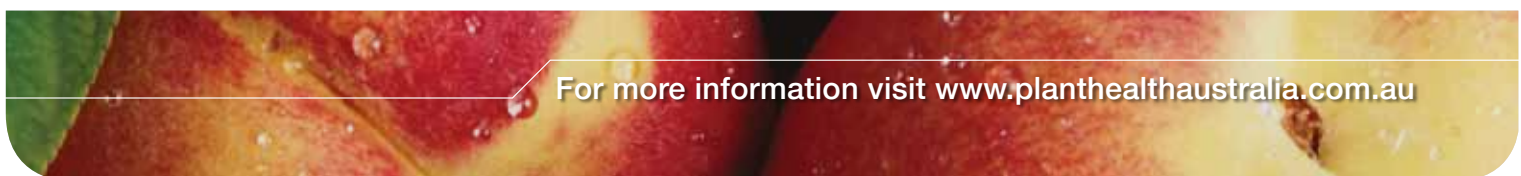
The thorax (chest) has yellow stripes on top and yellow marks on each side

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

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

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1800 084 881

For more information visit www.planthealthaustralia.com.au



Plum curculio

What is Plum curculio?

Plum curculio (*Conotrachelus nenuphar*) is an economically damaging pest that is regarded as the most serious pest of stone fruit after codling moth in eastern North America.

What does it look like?

Adult weevils are about 5 mm long and brown/grey in colour with four pairs of ridges on the forewings (elytra). The weevils' snouts are small, rough and speckled black, grey and brown. Larvae are curved, legless and 6-9 mm long and are typically white with brown heads. The minute eggs (0.4 x 0.6 mm) are elliptical and white, but aren't visible externally as they are laid in the fruit.

What can it be confused with?

The appearance of the Plum curculio is similar to the Apple weevil (*Anthonomus quadrigibbus*) and *A. pomorum*, both of which are exotic to Australia. Therefore, the detection of any weevil laying eggs in fruit should be reported.

What should I look for?

Adult weevils cause scarring and oviposition wounds on the fruit, but damage is highly variable. Larval feeding causes internal damage, so the most recognisable symptom of Plum curculio is rotted fruit on trees with possible fruit drop.

How does it spread?

Larvae can be spread in infested fruit, though a more likely means of spread is through contamination of packing material by adult weevils.



Larvae are white with a brown head

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



Adult weevils are brown/grey

Natasha Wright, Florida Department of Agriculture and Consumer Services, Bugwood.org



The weevil's snout is small, rough and speckled

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



Where is it now?

Plum curculio is currently restricted to North America.

How can I protect my farm from Plum curculio?

Source plant material only from 'clean', accredited suppliers. Check your farm frequently for the presence of new pests and unusual symptoms. Make sure you are familiar with common summerfruit insect pests so you can tell if you see something different.

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1800 084 881**



Ridges are prominent on the weevil's forewings

E. Levine, Ohio State University, Bugwood.org



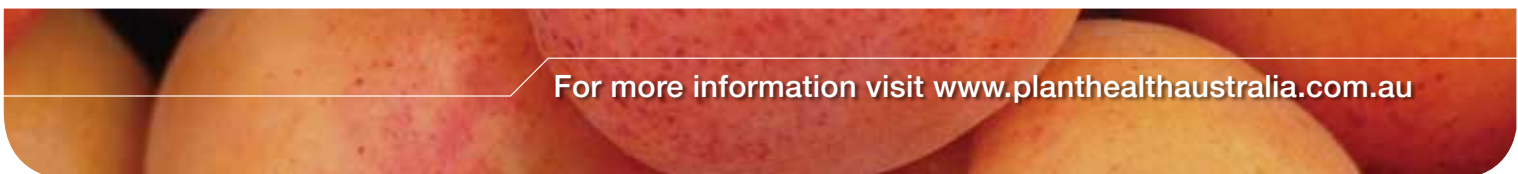
Larvae cause internal fruit rotting

P.J. Chapman, New York State Agricultural Experiment Station, Bugwood.org



The weevil causes scarring and rotting of fruit

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



For more information visit www.planthealthaustralia.com.au

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