

EXOTIC PEST IDENTIFICATION & SURVEILLANCE GUIDE FOR TROPICAL HORTICULTURE



Australian Government
Department of Agriculture,
Water and the Environment



Plant Health
AUSTRALIA



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About this guide

The growing rates of world-wide travel and trade, the geographical spread of pests and the intensification of agriculture and horticulture means there are increasing risks of exotic pests entering and establishing in Australia.

The presence of several high priority exotic pests in countries in proximity to northern Australia also increases the risk through spread by natural and assisted pathways. Conducting surveys (inspecting) crops for signs of new pests is one way you can protect Australia's plant industries from exotic pests, as early detection and reporting can minimise the pest's impact by improving the chances of successfully containing or eradicating them.

This guide is in two sections:

- **Biosecurity and surveillance** – describes key aspects of on-farm biosecurity and how to undertake pest surveillance
- **Identification of key exotic pests** – provides information on the high priority exotic pests for several of the horticultural crops grown in northern Australia.

The guide has been developed to increase your awareness of these pests and provide you with information on what to do if you suspect you have found one.



Definitions

Biosecurity is the management of risks to the economy, the environment, and the community, of pests entering, establishing or spreading.

Biosecurity can be implemented off-shore, at the border and on-farm. By implementing biosecurity measures in your day-to-day operations, you will improve your own properties biosecurity and that of your region, while minimising production losses and unnecessary costs.

The definition of a **plant pest** used within this document covers any species, strain or biotype of invertebrate pest or pathogen injurious to plants, plant products or bees or impacting social amenity or the environment.

Exotic pests are those not currently in Australia.

Established pests are those present in Australia.

SECTION 1: BIOSECURITY AND SURVEILLANCE

Biosecurity is everyone's responsibility. This means whenever you enter a farm or other business you have a responsibility to make sure you are not accidentally moving pests or diseases onto or off the property.

The following information provides details on the procedures to follow when entering or leaving farms when conducting surveillance.

Entering and leaving the farm: key points to remember

Every farm is different. While some farms only grow a single type of crop, many will have a number of different crops. Each crop will have a range of pests, some that may be already present in or near the property. These established pests are managed by growers using a range of management controls. One of your roles is to make sure you do nothing to assist the movement of pests or diseases onto or off the farm.

While the focus of biosecurity is often on exotic pests, pests that are in another region within Australia or another farm are also important.

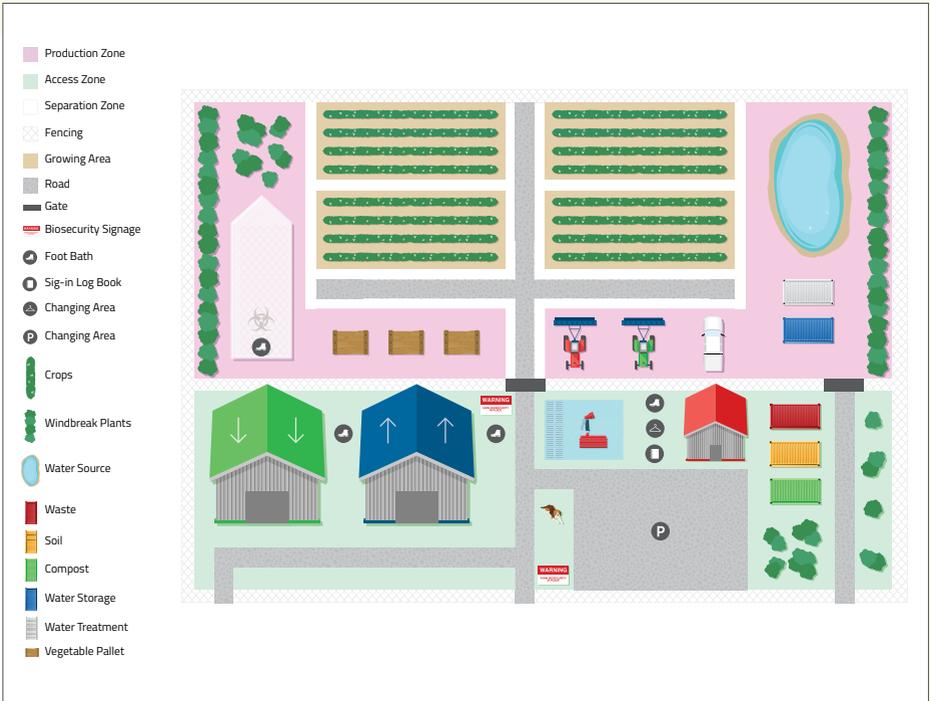
Using biosecurity measures on-farm improves the management of current pests and ensures that the entry of new pests is minimised. Keeping each farm free from new pests is the everyone's responsibility.

Before you travel onto a farm, follow these steps to help stop the spread of pests:

1. Make sure you have permission from the owner or manager before you enter.
2. Make sure things are clean – clothes, vehicles, equipment.
3. Never bring any plants or plant material onto the farm unless you have permission and know their history.
4. Make sure you visit the office or packing shed before you move to any other part of the farm.
5. Where possible, leave your vehicle in a designated parking area and use a vehicle provided by the business when moving around the farm.
6. Make sure you fully understand the biosecurity procedures in operation on each farm you visit.
7. If in doubt, stay out.



Source: AUSVEG



Source: AUSVEG

Farm Biosecurity

Follow all biosecurity policies when entering or leaving production areas. To minimise the risk of accidentally introducing pests into new areas there should be separation between production and non-production areas with steps in place, such as wash-down areas, to reduce the risk of pest entry.

Establishing zones within the property can be beneficial for reducing the risk of introducing or spreading pests within the farm.

For example, zones can be established between more public areas (e.g. houses, sheds etc.) and production (orchards, greenhouses, etc.) areas. Access between zones can be controlled. (e.g. ask people to disinfect or use foot baths/wash downs) in such a way as to minimize the risk of introducing or spreading pests.

Cleaning and disinfecting

The cleanliness you need to maintain should be based on the risk profile of the crop and range of new pests that may affect it.

1. Vehicles should be clean, including the tyres. There should be no mud or soil; no plants or plant material. Check for hitch hiking insects (e.g. leafhoppers) that may be on or in the vehicle. Where necessary, spray tyres with an appropriate disinfectant (or use a vehicle washdown facility to remove soil or mud, and then disinfect).
2. Machinery should be clean, with no mud or soil; no plants or plant material. For machinery that comes in contact with plants when used, cleaning should be followed by spraying with an appropriate disinfectant. This is also important for machinery such as mechanical hedgers which often move between orchards.
3. Equipment should be cleaned before leaving the farm. Disinfect equipment that comes into contact with plants such as pruning shears.
4. Clothing and footwear should be clean (fungal spores can travel on clothing). Footwear should be clean and disinfected when needed. For high-risk sites (like glass houses or nurseries), provide footwear for use on that site.
5. Plants and planting material should only be used if you know its history and where it comes from.

Remember: Clean first, then disinfect, because the presence of soil and plant matter may lower the effectiveness of the disinfectant



What type of disinfectant should be used?

There are a range of suitable disinfectants available. The type of crop and the diseases that can affect it will influence the type of disinfectant you choose to use.

The following (Table 1) is a selection of available disinfectants.

Note, products must always be used according to instructions on labels or in permits issued by the Australian Pesticide and Veterinary Medicines Authority (APVMA).



Table 1: Examples of suitable disinfectants

Active	Example products ¹	Notes
Didecyl dimethyl ammonium chloride (DDAC)	Steri-Max Biocide SporeKill Des-o-germ SP Path-X	A broad-spectrum disinfectant active against bacteria and fungi. Shown by Queensland Department of Agriculture and Fisheries (QDAF) to be effective against spores that cause Panama disease including chlamydospores, the longest-lived type of spores.
Potassium peroxymonosulfate and sodium chloride	Virkon S	Used for disinfecting footwear, surfaces and equipment. Is effective against viruses, bacteria and fungi.
Sodium hypochlorite	Household bleach	A broad-spectrum disinfectant, suitable for use in footbaths and for disinfecting tools. When disinfecting metal tools always rinse with fresh clean water afterwards as bleach can cause corrosion.

Please note: some disinfectants may not be effective against all fungal spores. Some diluted products need to be refreshed regularly as chlorine may volatilise causing the product to become less effective over time.

1. Note. These are examples only and this is not an endorsement of specific products.

For more information Check the APVMA Public Chemical Registration Information System Search (PubCRIS) database (portal.apvma.gov.au/pubcris).

Surveillance techniques

The sooner you find a pest or disease, the sooner you can act. That's why surveillance is so important. As the number of pest and disease incidents increases throughout the world, the importance of surveillance increases.

The following information has been developed to provide advice on methods of surveillance. These methods can be adapted to the particular crop you are growing.

The type of surveillance you do will depend upon the crop, the pest and the amount of time you have available.

For horticultural crops, there are broadly three types of surveillance:

1. Visual observation in the field
2. Trapping or sample collection in the field or adjacent facilities (e.g. packing shed)
3. Post-harvest inspection of fruit, which may include destructive sampling.

If you are a grower, agronomist, or crop consultant, it is likely most of your surveillance activities will be for established pests which impact production or affect access to markets.

Surveillance for exotic pests is equally important to protect Australia's plant industries and give the best chance of successful eradication.

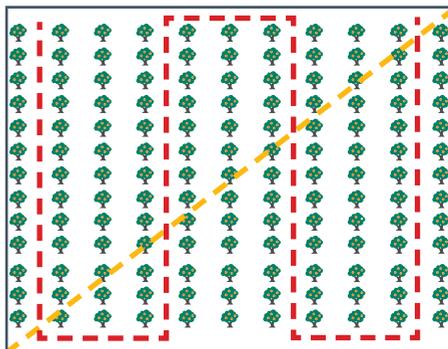
Recording the absence of exotic pests is important as it can be used to protect or maintain market access by showing that a pest is absent from a specific area.

Visual observation techniques

Visual surveillance is the most common surveillance technique and can be used to detect all pests. The following describes the basic methods for conducting visual surveys.

How to survey an orchard

1. If there are fewer than 50 plants, check each for symptoms.
2. If there are more than 50 plants, select blocks to survey based on which block is most likely to be infected. These include:
 - sites near entry points to the property
 - areas of higher traffic
 - blocks or edges of blocks facing prevailing wind and rain.
3. Survey trees randomly using a transect or W pattern across each block until up to 50 plants have been inspected. Also include plants along the sides of the block, especially the side that faces the prevailing wind and rain. Also focus on edges of blocks next to native vegetation or shelter belts.



If you have more than 50 plants, randomly inspect up to 50 plants per block following a transect (yellow), W pattern (red), or your normal scouting route. If symptoms of an exotic pest or disease are seen contact the Exotic Plant Pest Hotline

4. On each tree, scan leaves, twigs, branches and fruit (if present) for symptoms of the pest you are targeting, or if you are conducting general surveillance, look for signs of any pest or disease damage.
5. If the pest is a pest of fruit, randomly sample fruit to inspect for pests. It is also a good idea to inspect any fallen fruit for symptoms.
6. Record results, noting the:
 - name of the survey or
 - location of survey (geocode preferred)
 - date of the survey
 - number of targeted pests detected
 - life stage of pest
 - number of plants/percentage of crop surveyed
 - host crop
 - pest/s targeted
 - presence or absence of each pest being surveyed.

Geocoding

Geocoding refers to recording the geographic coordinates (decimal degrees of latitude and longitude) of a physical location.

When conducting surveillance, you can use your smart phone to capture the latitude and longitude of your position or you can use Google Maps on your computer and turn an address into geographic coordinates.

For further information on finding geographic coordinates for surveillance refer to: <https://www.planthealthaustralia.com.au/Finding-coordinates-for-use-in-surveillance-FS>

How to assess plants in the urban and peri-urban environment

1. Select host plants to sample at random.
2. Scan leaves, twigs, branches, flowers, fruit (if present) on the selected plant for symptoms.
3. If you are looking for a multiple pests and diseases, then inspect all parts of the tree/plant. If looking for a specific pest, then your surveillance will be influenced by the habit of the pest.
4. If the pest is in fruit, sample fruit for its presence. Sometimes, destructive sampling may be needed. It is also important to inspect fallen fruit for symptoms.
5. Record results, noting the:
 - name of the survey or
 - location of survey (geocode preferred)
 - date of the survey
 - host crop
 - pest/s targeted
 - life stage of pest
 - number of plants/percentage of crop surveyed
 - presence or absence of each pest being surveyed.



How to assess fruit in packing sheds

1. In packing sheds, inspect fruit for signs of pest activity or disease (Table 2).
2. Inspect a sample of fruit from each block or orchard (waste fruit may be appropriate for this).
3. Destructive sampling of fruit with blemishes or entry/exit holes plus a minimum number of fruit (sample size depends on the volume being packed).
4. Record results, noting the:
 - name of the surveyor
 - location of the survey (and origin of fruit if known)
 - date of the survey
 - host crop
 - pest/s targeted
 - presence or absence of each pest being surveyed.

Post-harvest sampling guidelines

The number of samples you need to take will depend on the surveillance rates that are needed.

For example, whether it's for the businesses own Quality Control standards, or a requirement for supplying a market. For some export markets, a 2 per cent (or 600 unit) sample is required. This rate is likely to be suitable for most packing shed surveillance activities.

Inspection inside packing sheds

Inspection of fruit should be undertaken in a clean quite area of the shed with good light and away from packing operations.

Lighting – either natural or artificial – must be adequate to ensure you can see pests or pathogens, and the entry or exit points for eggs, larvae etc.

Destructive examination of fruit

You may need to examine fruit – by cutting it open – if there is evidence of a pest, damage, or breakdown plant tissue. Even if there is no visible damage, randomly selected fruit should be cut open to verify that the pest is absent. The number of pieces of fruit required will depend on the business quality control standards or market requirements.

Usually, a conical cut will avoid damaging specimens of the pest. Magnification and /or cuts should be used to verify detections made by visual inspection.

Table 2: Pest and disease symptoms and possible causes

Symptom	Possible cause
Chewed product	Insects such as caterpillars
Soft spots and rot in fruit	Fruit fly or disease
Sting marks	Fruit fly
Holes	Borers or weevils
Webbing	Caterpillars such as loopers or leaf rollers
Speckling on the leaf or blemishes on product	Mites, thrips or aphids
Sticky honeydew and sooty mould (fine black powder)	Aphids, mealy bug
Uneven yellowing of leaf or spots on product	Virus
Powdery appearance	Fungus, mildew
Galls (swellings or nodules)	Gall wasp or nematodes

Trapping surveys

Trapping surveys are used to monitor for pests that are difficult to see or pests that need to be regularly monitored for management purposes.

Traps should be positioned according to instructions and must be regularly inspected. Generally, traps should be placed so they are easy to access (in terms of trap height and location on the property) and marked with flagging tape so they can be easily found again. For most pests weekly or fortnightly trap inspections are appropriate.

When using traps as a surveillance method, the catch needs to be linked to the trap. For this to occur, each trap needs to be labelled with a unique identifier and the catch from that trap must be identified with that unique identifier.



Recording survey results

It is important you record both presence and absence of the pests and pathogens that you are looking for. Data about the absence of a pest is important, as it can be used to prove that a pest is not present in a specified area. To help support claims of area freedom and facilitate trade in the event of pest detections.

Standards for recording need to be maintained and information collected according to national standards. Below is a list of the minimum data fields that should be collected:

- name of the person surveying
- location of the survey/site of traps – geocode is preferred
- date
- host crop
- pests being looked for
- presence or absence of each pest
- any additional notes.

All fields must be filled in. Where information for a field is not available, then that should be noted: the field should not be left blank as this may lead to confusion.

For packing shed surveys you should record:

- packing shed location, including physical location and GPS co-ordinates
- owner or manager's name and contact details
- sample date(s) and time(s)
- sample size e.g. total consignment (line) size and sample number
- description of fruit sampled and description of overall consignment (line)
- general comments on consignment or line quality.

Reporting

The early detection and reporting of a possible exotic pest or disease is critical to maximise the chance of eradication or containment. If you see a pest or disease you don't recognise, don't hesitate to seek advice.

If you see something that may be an exotic pest, then you need to report it. That means if you are working on-farm, you should report finds to the owner or manager.

The owner or manager is responsible for reporting it to the department of agriculture or primary industry, or to the Exotic Plant Pest Hotline **1800 084 881**.

MyPestGuide™ Reporter

MyPestGuide™ Reporter is a simple to use application for reporting observations of pests, including exotics. The application can be used online or downloaded from: www.agric.wa.gov.au/appsmypest-guide-reporter

What to do with a suspected pest!

Insects and arthropods

If you spot something unusual, there are steps you should follow.

- If it is an insect or similar, try to collect a sample of all life stages present (e.g. maggots, larvae, adults).
- Store the sample in a closed bottle or container to prevent escape.
- Record the location and time of collection. You can use a geocode or another method (e.g. row number, number of trees from end of row).
- Keep samples in a cool place.
- Contact your local department of primary industries, or if unavailable consult with an experienced person (e.g. crop monitor, horticulturist) for advice on identification or transport of samples.

Diseased plant material

If you do spot unusual disease symptoms, then there are steps you should follow.

- If the symptoms appear to be a disease, do not try to collect a sample until you have received advice on how to sample to avoid spreading the suspected pathogen.
- Take photos of the symptoms.
- Record the location and time of collection. You can use GPS coordinates or another method (e.g. row number, number of trees from end of row).
- If you do have samples, ensure they are double-bagged (i.e. a bag inside another bag) to minimise the risk of an accident spreading the pathogen.
- Keep samples in a cool place.
- Contact your local department of primary industries, or if unavailable consult with an experienced person (e.g. crop monitor, horticulturist) for advice on identification or transport of samples.





SECTION 2: IDENTIFICATION OF KEY EXOTIC PESTS

How to use this guide

The following pest identification pages provide images of the pest or images of disease symptoms, as well as a brief description of how to interpret the descriptions and icons. The brief descriptions include:

Where is it now?

The countries/areas the pest or disease is currently located. The list of locations is not comprehensive as some pests are widely distributed throughout the world.

How does it travel?

A brief description of how the pest/disease moves from one site to another.

Where will I see it?

A description of the part of the plant where the pest is usually located.

Alternate hosts in Australia

Many pests and diseases have multiple host crops. This lists some of the alternate hosts.

What will I see?

This is a brief description of the pest, crop damage and/or symptoms.

When will I see it?

A brief description of the crop stage when the pest/disease usually present.

What could it be confused with?

Some exotic pests and diseases can be confused with established pests and diseases, or other symptoms caused by environmental factors.

This guide principally contains information on the high priority pests of a range of crops grown in northern Australia. While there are many more exotic pests, most of the pests in this guide have been categorised as high priority pests by industry, based on a number of parameters, including:

- likelihood of pest entry
- likelihood of pest establishment
- likelihood of pest spread
- potential economic impact.

Once the probabilities of entry, establishment and spread have been estimated for the pest, and an assessment of the likely economic consequences has been made, this information is combined to achieve an overall risk rating. This guide highlights pests that have an extreme or high risk rating.

This guide highlights many important exotic pests. There are many more exotic pests, but at this time they are not rated as high priority pests. These ratings are reviewed regularly, and will be amended when circumstances demand.

Factsheets in this guide have been grouped by host plant and then sorted taxonomically and alphabetically by common name.

Pests appear in the following order:

- Mites (Order: Acari)
- Beetles (Order: Coleoptera)
- Flies and midges (Order: Diptera)
- True bugs (Order: Hemiptera)
- Snails (Class: Gastropoda)
- Butterflies and moths (Order: Lepidoptera)
- Thrips (Order: Thysanoptera)

Pathogens appear in the following order:

- Bacteria
- Fungi and water moulds
- Viruses and viroids.

Exotic fruit fly

There are over 4,000 species of fruit flies in the family Tephritidae, of which approximately 350 species are of economic importance. More than 300 species of fruit fly occur in Australia although only a few of these have been found to have any degree of economic impact, with Queensland fruit fly (*Bactrocera tryoni*) and Mediterranean fruit fly (*Ceratitis capitata*) being the species of primary economic concern. Because there are so many species of fruit fly and only some have importance to horticulture it is important that identification is undertaken by an experienced fruit fly taxonomist.

Australia is free from many species that impact horticultural production elsewhere. Neighbouring countries in south-east Asia the Torres Strait and the South Pacific are home to numerous species of fruit fly that pose a risk to Australia.

Rapid diagnosis of these flies, should they arrive in Australia, is therefore critical to containing and eradicating outbreaks. You can help by responding any unusual fruit fly detector to your state/territory department of agriculture.

For a description of many of these exotic fruit fly, see the Australian Handbook for the Identification of Fruit Flies (Version 3.1). This is available on the Fruit Fly ID Australia website fruitflyidentification.org.au/identify/handbook or the Plant Health Australia website planthealthaustralia.com.au

**IF YOU SEE ANYTHING UNUSUAL,
CALL THE EXOTIC PLANT PEST HOTLINE**

1800 084 881

Exotic fruit flies

Various species



Where is it now?

Species occur worldwide.

How does it travel?

Fruit, flight



Where will I see it?

Fruit



What will I see?

Adult fruit flies are around 5–6 mm long. Females oviposit (lay) eggs in fruit skin. Larvae hatch and burrow into the flesh of the fruit. Often associated with ripening fruit, although some exotic species can lay eggs in unripe fruit. Symptoms include entry holes on fruit and, where larvae have been active for some time, rotting fruit.

When will I see it?

Fruit development to harvest. Also on fallen fruit.



Alternate hosts in Australia

Most fruiting crops are vulnerable to exotic fruit flies.

What could it be confused with?

Fruit flies look very similar, especially in larval stages. Any unusual looking fruit flies or unusual behaviours should be investigated. For more information on exotic fruit flies, please refer to The Australian Handbook for the Identification of Fruit Flies. Identification of a suspected exotic fruit fly should be undertaken by an experienced taxonomist.



Melon fruit fly

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



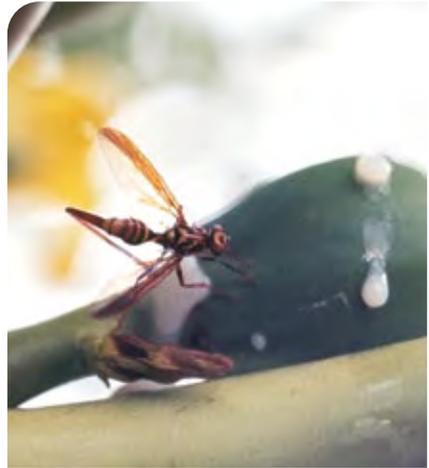
Melon fruit fly

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



Papaya fly

Jeffrey W. Lotz, Florida Department of Agriculture and Consumer Services, Bugwood.org



Papaya fly

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

Persea mite

Oligonychus perseae

Where is it now?

Mexico, United States, Costa Rica, Portugal, Spain, Israel, Canary Islands.

How does it travel?

Plant material



Where will I see it?

Leaves, stems, fruit



What will I see?

Adult mites are very small (about 0.5 mm long). Look for discrete circular chlorotic to brown spots on the lower leaf surface. These spots become visible on the upper leaf surface. Webbing resembles a silvery spot on the underside of the leaf. Heavily infested canopies can appear lighter coloured overall when viewed from a distance. Persea mite damage early in the season can be confused with six spotted mite damage.

When will I see it?

Throughout the life of the plant.



Alternate hosts in Australia

Host range includes citrus, stonefruit, acacia.

What could it be confused with?

Persea mites look similar to six spotted mites. However, six spotted mites do not form densely layered web canopies.



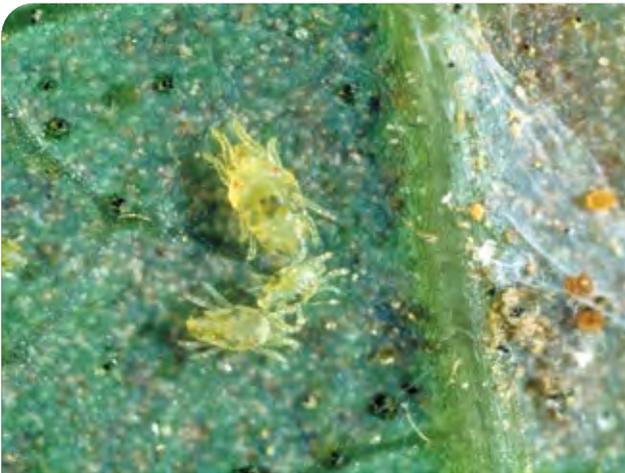
Persea mite damage seen on top surface of leaf

Scot Nelson, University of Hawaii



Persea mite damage seen on underside of leaf

Scot Nelson, University of Hawaii



Persea mites

Jack Kelly Clark, courtesy University of California Statewide IPM

Large seed weevil, avocado seed weevil

Helipus lauri

Where is it now?

Mexico, Central America.

How does it travel?

Plant material, fruit



Where will I see it?

Leaves, stems, fruit



What will I see?

Adult weevils are large (12-15 mm long) and feed on foliage. Larvae feed on the seed, damaging fruit, and can lead to premature fruit drop.

When will I see it?

Flowering to fruit harvest.



Alternate hosts in Australia

No other significant alternative hosts.

What could it be confused with?

Fruit drop can be caused by a range of pests, diseases and abiotic factors. Any seed feeding pests should be investigated.



Adult large seed weevil

Valentina Diaz Grisales, EPPO

Small avocado seed weevil

Conotrachelus aguacatae

Where is it now?

Mexico, Nicaragua, Florida.

How does it travel?

Plant material, fruit



Where will I see it?

Leaves, stems, fruit



What will I see?

Adult weevils are 3-4 mm long and feed on foliage. Larvae feed on the seed, damaging fruit, and can lead to premature fruit drop.

When will I see it?

Flowering to fruit harvest.



Alternate hosts in Australia

Guava reported as an alternative host plant.

What could it be confused with?

Fruit drop can be caused by a range of pests, diseases and abiotic factors. Any seed feeding pests should be investigated.



Small avocado seed weevil

Lindsey Seastone, Museum Collections: Coleoptera, USDA APHIS PPQ, Bugwood.org

Papaya mealybug

Paracoccus marginatus

Where is it now?

Widespread, including southern Africa, Asia, Florida, Hawaii, Central America.

How does it travel?

Plant material



Where will I see it?

Leaves, stems, fruit



What will I see?

Papaya mealybugs are 1-2 mm long and covered in a white substance.

Infestations cause leaf chlorosis (yellowing), distortion, stunting, early leaf and fruit fall, the production of honeydew, sooty mould and possibly the death of the plant.

When will I see it?

Throughout the life of the plant.



Alternate hosts in Australia

Wide host range including citrus, mango, papaya, pineapple.

What could it be confused with?

Other mealy bugs can be confused with papaya mealybug.



Papaya mealybugs. Note white material covering the bugs and leaf

Peggy Greb, USDA Agricultural Research Service, Bugwood.org

Avocado fruit borer, avocado seed moth

Stenoma catenifer

Where is it now?

Widespread, including countries in Central and South America.

How does it travel?

Plant material, fruit



Where will I see it?

Leaves, twigs, fruit



What will I see?

Adult moths have an 8-15 mm wingspan and yellow-tan coloured wings. Look for holes in the skin of the fruit where larvae bore into the pulp and seed. Frass is evident and the skin of the fruit becomes dark around the hole. White fungi can be seen around the hole and cover some of the skin. The fruit may drop prematurely. In more susceptible cultivars, fruits fall before the fungal infection occurs. In the absence of fruits, larvae can burrow into twigs and may kill small trees.

When will I see it?

Flowering to fruit harvest.



Alternate hosts in Australia

Camphor laurel is reported as an alternative host plant.

What could it be confused with?

Fruit drop can be caused by a range of pests, diseases and abiotic factors. Any internal fruit feeding pests should be investigated.



Adult avocado seed moth

Mark S. Hoddle, University of California



Avocado seed moth damage. Note holes in fruit

Mark S. Hoddle, University of California



Avocado seed moth larvae in fruit

Mark S. Hoddle, University of California



Avocado seed moth damage to fruit

Mark S. Hoddle, University of California

Brown headed leafroller

Ctenopseustis obliquana (syn. *C. herana*)

Where is it now?

New Zealand.

How does it travel?

Plant material, fruit



Where will I see it?

Leaves, stems, flower, fruit



What will I see?

Adult moths have a wingspan of up to 25 mm and are a gray-brown colour. Females lay up to 150 eggs in smooth masses. Look for shoot tips or rolled leaves webbed together. Larvae feed on leaves, buds, and fruit. Pupation occurs in the larval nest. Larval damage is nearly identical to that caused by light brown apple moth (*Epiphyas postvittana*).

When will I see it?

Throughout the life of the plant.



Alternate hosts in Australia

Wide host range including macadamia, stone fruit, eucalyptus, acacia.

What could it be confused with?

Leafroller damage on plants is very difficult to distinguish from damage by non-invasive leaf rollers such as light brown apple moth.



Brown headed leafroller

Todd M. Gilligan and Marc E. Epstein, Tortricids of Agricultural Importance, USDA APHIS PPQ, Bugwood.org



Brown headed leafroller

Pest and Diseases Image Library, Bugwood.org

Avocado thrips

Scirtothrips perseae

Where is it now?

Mexico, United States, Guatemala.

How does it travel?

Flight, plant material, fruit



Where will I see it?

Leaves, flowers, fruit



What will I see?

Avocado thrips are very small (0.5-1.5 mm long). Symptoms of leaf damage appear along leaf veins and, as the thrips increase in number, bronzing is observed in random patterns between leaf veins. Severe infestation can also cause leaf drop. Brown surface scarring on the fruit which, when severe, covers the entire fruit surface producing a characteristic 'alligator skin' appearance. When avocado thrips damage young fruit, elongated scars form as the fruit grows.

When will I see it?

Throughout the life of the plant.



Alternate hosts in Australia

No other significant alternative hosts.

What could it be confused with?

Avocado thrips are similar in colour to the Californian species *S. aceri*. However, this species is also exotic to Australia so any thrips fitting the above description should be sent to an entomologist for identification. Avocado thrips are also different from most thrips in that adult and immature stages are readily observed on upper leaf surfaces.



Fruit damage caused by avocado thrips

David Rosen, University of California Statewide IPM Project



Avocado thrips

Jack Kelly Clark, UC Statewide IPM Program



Fruit damage caused by avocado thrips

Mark S. Hoddle, University of California Riverside, Bugwood.org

Bacterial canker complex, avocado blast complex

Pseudomonas syringae pv *syringae*, *Pantoea agglomerans*, *Xanthomonas campestris*

Where is it now?

Mexico, United States (California).

How does it travel?

Plant material, soil



Where will I see it?

Whole plant



Alternate hosts in Australia

Wide host range including mango, passionfruit, some vegetables.

What will I see?

Bacterial cankers that are slightly sunken, dark areas on the bark that vary in size from 2-10 cm in diameter. Bark around cankers may be cracked. Fluid that often oozes and dries, leaving a white powder around or over the lesion. Cankers spread upward in a line on one side of a trunk or branch. There is a decayed, reddish brown necrotic pocket under the bark surface, which may contain liquid. Dark streaks in the wood radiate out above and below the lesions. Necrotic streaks in the bark, but sometimes extending deeper into the centre of branches or trunk. Severely affected trees may have pale, sparse foliage and low yields.

When will I see it?

Throughout the life of the plant.



What could it be confused with?

Symptoms are reasonably distinct.



Trunk symptoms caused by avocado bacterial canker

David Rosen, University of California Statewide IPM Program

Avocado scab

Elsinoe perseae

Where is it now?

Widespread worldwide including North, Central and South America, Morocco, southern Africa, Philippines.

How does it travel?

Plant material



Where will I see it?

Leaves, fruit



Alternate hosts in Australia

No other significant alternative hosts.

When will I see it?

Throughout the life of the plant.



What will I see?

Small discrete lesions which are often concentrated along the midrib and main veins, that may coalesce (merge) into star-like patterns. Shot-holes may also be present. As the disease progresses, leaves become distorted and stunted. Lesions on leaf petioles, twigs and fruit pedicels. Early spots on fruit are corky, raised, oval or irregular in shape, brown to purplish-brown. Spots enlarge and merge to form large rough areas over the fruit surface as the disease progresses.

What could it be confused with?

Avocado scab can be confused with physical damage such as wind rub.



Avocado scab symptoms

Randy Ploetz, University of Florida



Avocado scab symptoms

Randy Ploetz, University of Florida



Leaf symptoms caused by avocado scab

Ken Pegg, QDAF

Bark canker

Phytophthora menzei

Where is it now?

United States, Mexico.

How does it travel?

Plant material, soil



Where will I see it?

Trunk, branches



What will I see?

Discoloured bark, cracked or fissured at or below ground level. Symptoms resemble those of phytophthora root rot (*P. cinnamomi*), but may be 3 m up the trunk and branches. Also affects fruit.

When will I see it?

Throughout the life of the plant.



Alternate hosts in Australia

No other significant alternative hosts.

What could it be confused with?

Symptoms resemble those of *P. cinnamomi*, but may be 3 metres up the trunk and branches.



Symptoms of bark canker.
Note discolouration of bark

Randy Ploetz, University of Florida



Close-up of bark canker

John Menge, University of California



Symptoms of bark canker with bark removed

John Menge, University of California



Symptoms of bark canker with bark removed

Randy Ploetz, University of Florida

Phytophthora blight

Phytophthora kernoviae

Where is it now?

Chile, Europe, New Zealand.

How does it travel?

Plant material, soil



Where will I see it?

Whole plant



What will I see?

Young feeder roots that are black and brittle and dead. In advanced stages, only remnants of the root system remain. Trunk cankers, if present, appear dark brown and water soaked, at or below ground level. Fruit with stalks affected by ring-neck lesions commonly fall as they mature. The soil beneath affected trees remains wet long after rain, because the tree does not absorb the moisture.

When will I see it?

Throughout the life of the plant.



Alternate hosts in Australia

Wide range of hosts including radiata pine, magnolia, rhododendron, various other ornamentals.

What could it be confused with?

Some symptoms resemble Phytophthora root rot and poor drainage.



Symptoms of phytophthora blight with bark removed

Forest Research, United Kingdom Forestry Commission, Bugwood.org



Leaf symptoms of phytophthora blight

Forest Research, United Kingdom Forestry Commission, Bugwood.org

Sudden oak death, ramorum leaf blight

Phytophthora ramorum

Where is it now?

Parts of Asia, North America, Europe.

How does it travel?

Plant material, water, soil



When will I see it?

Throughout the life of the plant.



Where will I see it?

Whole plant



What will I see?

Leaves and whole plants may have blackened shoots, with dark brown spots or blotches with fuzzy margins, starting at the leaf tip. Trees may have stem cankers with red to black sap oozing on the bark surface. Stem necrosis (areas of dead tissue) leads to the death of whole crown.

Alternate hosts in Australia

Hosts include blueberry.

What could it be confused with?

Bleeding stem cankers can be caused by a number of fungal pathogens. Foliar symptoms can be confused with infections of other pathogens. In general, sudden oak death is characterised by irregular, necrotic lesions, instead of distinct leaf spots.



Leaf symptoms caused by sudden oak death

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



Trunk canker caused by sudden oak death

Bruce Moltzan, Missouri Department of Conservation, Bugwood.org

Laurel wilt

Raffaelea lauricola

Where is it now?

United States, south-east Asia, Japan, Myanmar.

How does it travel?

Insect vectors, plant material



Where will I see it?

Whole plant



What will I see?

Wilted stems and leaves and dark streaking in the wood.

When will I see it?

Throughout the life of the plant.



Alternate hosts in Australia

Various including camphor laurel and bay tree.

What could it be confused with?

Symptoms resemble those of verticillium wilt (caused by *Verticillium dahliae*). However, complete recovery of trees from verticillium wilt is common, whereas those affected by laurel wilt usually do not recover.



Leaf symptoms caused by laurel wilt

Andrew Geering, QDAF



Wood streaking caused by laurel wilt

Randy Ploetz, University of Florida



Branch dieback caused by laurel wilt

Randy Ploetz, University of Florida

Avocado sunblotch

Avocado sunblotch viroid

Where is it now?

Spain, Greece, Israel, southern Africa, North, Central and South America, Australia (sporadic outbreaks reported in the past).

As outbreaks of avocado sunblotch have been reported in Australia, Avocados Australia recommends growers source planting material from Avocado Nursery Voluntary Accreditation Scheme (ANVAS) accredited nurseries.

How does it travel?

Plant material



Where will I see it?

Stems, fruit



Alternate hosts in Australia

No other significant alternative hosts.

What will I see?

Discoloured and shunken stem streaks, grooves on older branches, lesions and discoloration of the fruit, and a variety of foliar symptoms. Some infected trees remain symptomless. Symptoms depend on host cultivar, the environment and the viroid strain. A consistent early symptom is the appearance of narrow white, yellow or pink streaks on the surface of green twigs or young stems. Fruit usually develop sunken white, yellow or pink blotches or streaks and are usually small, deformed and unmarketable. Bark on the trunk or larger branches can have a rectangular cracked appearance.

When will I see it?

Throughout the life of the plant.



What could it be confused with?

Sunburn can cause similar damage to fruit.

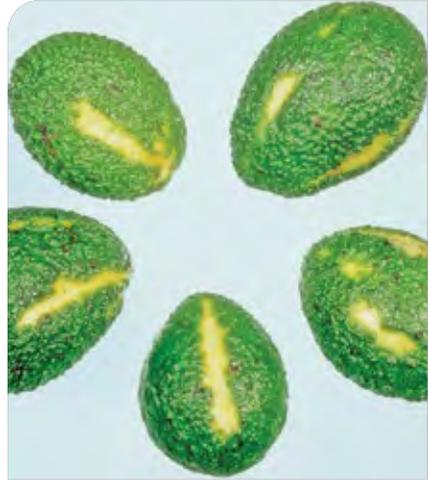
What to do if you see it?

Outbreaks of this viroid have been reported in the past but have not been seen for some time. Any detections should be reported to the **Exotic Plant Pest Hotline** or your local department of agriculture.



Symptoms caused by avocado sunblotch. Note streaking and distorted shape of the fruit

David Rosen, University of California Statewide IPM Project



Symptoms caused by avocado sunblotch. Note streaking of the fruit

Tony Cooke, QDAF



Symptoms caused by avocado sunblotch. Note streaking of the fruit

Tony Cooke, QDAF

Pierce's spider mite, banana spider mite

Tetranychus piercei

Where is it now?

Southern and south-east Asia including Malaysia, Indonesia, Papua New Guinea.

How does it travel?

Plant material, wind dispersal



Where will I see it?

Leaves



What will I see?

Pierce's spider mites are red coloured and very small (less than 1 mm long). Look for silky white webbing, small brown spots on leaves. The underside of leaves turn reddish brown; the upper surface turns yellow and eventually becomes necrotic and dry.

When will I see it?

Throughout the life of the plant.



Alternate hosts in Australia

Broad host range including papaya, passionfruit.

What could it be confused with?

Two-spotted spider mite is sometimes called banana spider mite when it attacks bananas in Australia.



Banana spider mite symptoms on a banana leaf

Jeff Daniells, QDAF



Banana spider mite

Don Wilkers, QDAF

Exotic mealybugs

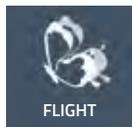
Including *Dysmicoccus neobrevipes*, *Pseudococcus jackbeardsleyi* and *Rastrococcus invadens*

Where is it now?

Exotic species occur from Africa to south-east Asia, including Indonesia and Papua New Guinea. Jack Beardsley mealybug (*Pseudococcus jackbeardsleyi*) has previously been detected on Torres Strait Islands and Cape York.

How does it travel?

Flight, wind, plant material



Where will I see it?

Leaves, stems, fruit



What will I see?

Mealybugs are very small (2-3 mm long). Look for white dusty residue; wilting leaves; honeydew and/or sooty mould.

When will I see it?

Throughout the life of the plant.



Alternate hosts in Australia

Broad range including citrus, vegetables, mangoes.

What could it be confused with?

Established mealybugs. Unusual mealybugs or behaviours should be investigated.

What to do if you see it?

Jack Beardsley mealybug have been found in the Torres Strait and northern Cape York Peninsula. Any detections outside of northern Cape York Peninsula (south of the Cape York biosecurity Centre near Coen) should be reported to the **Exotic Plant Pest Hotline** or your local department of agriculture.



Grey pineapple mealybug colony

Scot Nelson, Flickr



Grey pineapple mealybug colony

Scot Nelson, Flickr

Giant African land snail

Achatina fulica



Where is it now?

Widespread including Africa, south-east Asia and some Pacific islands.

How does it travel?

Soil and fertilisers, freight and containers, machinery



Where will I see it?

Whole plant



What will I see?

Large snail, with a shell 5–10 cm in length, but can be up to 20 cm. Eggs are oval, 4.5–5.5 mm in diameter, cream to yellow often laid in batches of 100–400 eggs.

When will I see it?

Throughout the life of the plant.



Alternate hosts in Australia

Broad range of hosts including citrus, papaya.

What could it be confused with?

Large size means it is unlikely to be confused with other species.



Giant African snail

Pest and Diseases Image Library, Bugwood.org



Giant African snail eggs

Pest and Diseases Image Library, Bugwood.org

Banana skipper butterfly

Erionota thrax



Where is it now?

South-east Asia, Papua New Guinea, Mauritius, Guam, Hawaii.

How does it travel?

Flight, plant material



Where will I see it?

Leaves



What will I see?

Adult banana skipper butterfly are light brown and have a wingspan of 70-80 mm. Look for rolled damaged leaves and large (up to 60 mm long) light coloured caterpillars. Adult butterflies are most active in the early evenings.

When will I see it?

Throughout the life of the plant.



Alternate hosts in Australia

Manilla hemp (*Musa textilis*).

What could it be confused with?

Rolled leaves are reasonably distinctive.



Banana skipper butterfly

Ken Walker



Leaf rolling caused by banana skipper butterfly larvae

Jeff Daniells, QDAF



Banana skipper butterfly larvae

Jeff Daniells, QDAF

Panama disease tropical race 4, Fusarium wilt

Fusarium oxysporum f.sp. *cubense*

Where is it now?

Widespread including southern and south-east Asia including Indonesia. Detections have also occurred in Australia in the Northern Territory and in the Tully Valley in north Queensland.

How does it travel?

Plant material, soil, water, insect vectors



Where will I see it?

Whole plant



What will I see?

Marginal yellowing of leaves, and a skirt of dead leaves around plant. Discolouration of the cut stem and corm.

When will I see it?

Throughout the life of the plant.



Alternate hosts in Australia

A range of broadleaf weeds, grasses.

What could it be confused with?

In the early stages it can be mistaken for nutritional problems or water stress. Also causes similar symptoms to moko or blood disease, neither of which are present in Australia. Therefore, any suspected symptoms should be reported.

What to do if you see it?

Panama disease has been found on a small number of farms in the Tully Valley in Queensland and parts of the Northern Territory. Due to the impact of this pathogen on the banana industry any new detections should be reported to the **Exotic Plant Pest Hotline** or your local department of agriculture.



Panama disease symptoms

Jeff Daniells, QDAF



Panama disease symptoms

Jeff Daniells, QDAF



Panama disease symptoms.
Note discolouration of cut tissue

Jeff Daniells, QDAF

Black Sigatoka

Pseudocercospora fijiensis

Where is it now?

Widespread in Central and South America, tropical Africa, the Pacific and south-east Asia including Indonesia and Papua New Guinea. It is also on several islands in the Torres Strait.

How does it travel?

Plant material, wind, water



Where will I see it?

Leaves



What will I see?

Narrow streaks and brown lesions on leaves.

When will I see it?

Throughout the life of the plant.



Alternate hosts in Australia

Parrot's beak (*Heliconia psittacorum*)

What could it be confused with?

Similar to yellow Sigatoka (caused by *M. musicola*) or eumusae leaf spot (caused by *M. eumusae*).

What to do if you see it?

This pathogen has been reported in the Torres Strait. Any detections on mainland Australia should be reported to the **Exotic Plant Pest Hotline** or your local department of agriculture.



Black Sigatoka symptoms on a banana leaf

Jeff Daniells, QDAF



Field symptoms caused by black Sigatoka

Jeff Daniells, QDAF

Banana freckle

Phyllosticta spp.

Where is it now?

Hawaii, Taiwan, Philippines, Indonesia, Vietnam.

How does it travel?

Plant material, soil and water



Where will I see it?

Leaves, flowers, fruit



What will I see?

Dark spots on leaves and fruit.

When will I see it?

Throughout the life of the plant.

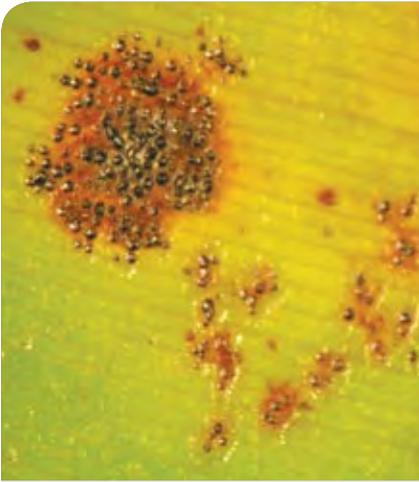


Alternate hosts in Australia

Other *Musa* species.

What could it be confused with?

Can be confused with banana freckle of lady finger and bluggoe. The Cavendish strain of banana freckle can be distinguished from the banana freckle strains already present in Australia as the other strains of banana freckle do not infect Cavendish bananas.



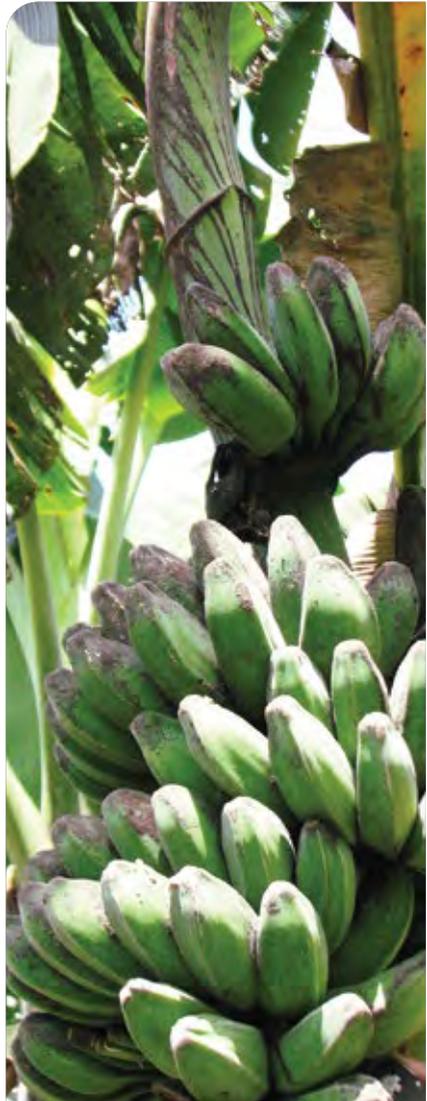
Banana freckle (Cavendish strain) symptoms on a leaf

Kathy Grice, QDAF



Banana freckle (Cavendish strain) symptoms

Kathy Grice, QDAF



Banana freckle (Cavendish strain) symptoms. Note spotting on leaves and fruit

Juliane Henderson, QDAF

Moko, bugtok

Ralstonia solanacearum

Where is it now?

Central and South America, Jamaica, Philippines.

How does it travel?

Plant material, soil, water, insect vectors



Where will I see it?

Leaves, fruit



What will I see?

Internal discolouration of fruit, with premature fruit ripening and splitting. Rapid yellowing, wilted and collapsed leaves. Wilting of small suckers. Black shrivelled flower buds.

When will I see it?

Throughout the life of the plant.



Alternate hosts in Australia

Heliconia, some weeds.

What could it be confused with?

Moko symptoms can be confused with those caused by Panama disease (caused by *Fusarium oxysporum* f. sp. *cubense*).



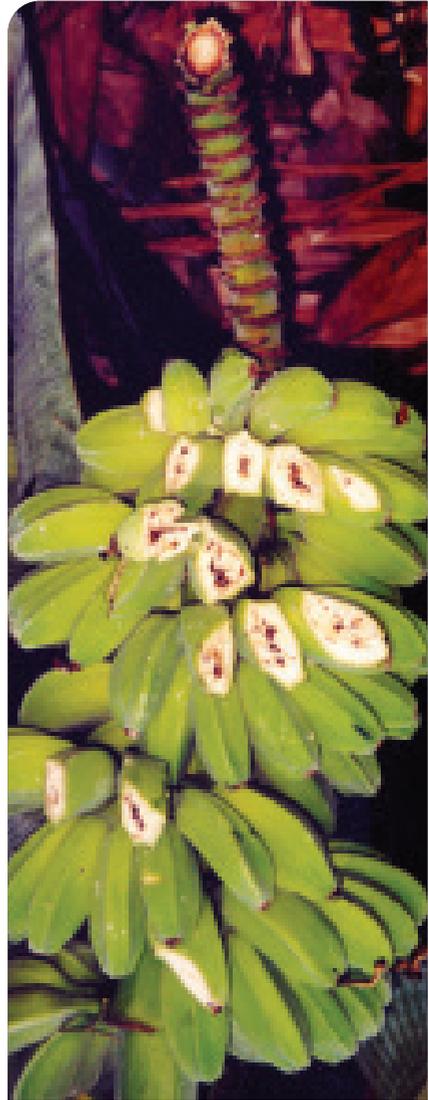
Symptoms of blood disease. Compare with moko symptoms right and below

Jeff Daniells, QDAF



Moko symptoms on cut fruit. Note discolouration of fruit

Chris Hayward, QDAF



Moko symptoms on cut fruit. Note discolouration of fruit

Chris Hayward, QDAF

Blood disease

Ralstonia syzygii subsp. *celebesensis*

Where is it now?

Indonesia.

How does it travel?

Plant material, soil, water, insect vectors



Where will I see it?

Whole plant



What will I see?

Wilted leaves, internal discolouration of fruit and black shrivelled flower buds.

When will I see it?

Throughout the life of the plant.



Alternate hosts in Australia

Other *Musa* species.

What could it be confused with?

The pathogen that causes blood disease is closely related to, but distinct from, the pathogen that causes moko and bugtok, and produces very similar symptoms. Moko (caused by *Ralstonia solanacearum* race 2) and Panama disease tropical race 4 (caused by *Fusarium oxysporum* f. sp. *cubense*) also cause general wilting of banana plants. Moko can also cause internal fruit discolouration.



Wilting caused by blood disease

Jeff Daniells, QDAF



Discolouration of internal tissue of a stem caused by blood disease

Jeff Daniells, QDAF



Wilting caused by blood disease

Jeff Daniells, QDAF

Eumusae leaf spot

Mycosphaerella eumusae

Where is it now?

South-east Asia, India, Africa.

How does it travel?

Plant material, soil, wind and water



Where will I see it?

Leaves



What will I see?

Streaking and dark spots on leaves.

When will I see it?

Throughout the life of the plant.



Alternate hosts in Australia

Other *Musa* species.

What could it be confused with?

Symptoms are very similar to black Sigatoka (caused by *M. fijiensis*) and yellow Sigatoka (caused by *M. musicola*).



Eumusae leaf spot symptoms on a banana leaf. Note spots and streaking symptoms

Kathy Grice, QDAF



Eumusae leaf spot symptoms on a banana leaf

Juliane Henderson, QDAF

Banana bunchy top

Banana bunchy top virus

Where is it now?

Philippines, Taiwan, Vietnam.
Note: Banana bunchy top virus (South Pacific subgroup) is present in northern NSW and south-east Queensland and there is a containment strategy in place.

How does it travel?

Plant material, insect vectors



Where will I see it?

Whole plant



What will I see?

Shortened, narrow upright leaves at the top of the plant, with a rosette or bunched top appearance.

When will I see it?

Throughout the life of the plant.



Alternate hosts in Australia

Other Musa species.

What could it be confused with?

Symptoms also caused by cold weather or water logging.

What to do if you see it?

This disease occurs in parts of northern NSW and south-east Queensland. Any detections outside of these areas should be reported to the **Exotic Plant Pest Hotline** or your local department of agriculture.



Bunchy top disease. Note bunched leaves

Scot Nelson, Wikimedia



Bunchy top disease symptoms. Note upright leaves

Jeff Daniells, QDAF



Bunchy top disease symptoms

Jeff Daniells, QDAF

Asian citrus psyllid

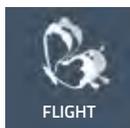
Diaphorina citri

Where is it now?

Widespread in North, Central and South America, Asia including in Indonesia, Timor-Leste, Papua New Guinea.

How does it travel?

Plant material, flight



Where will I see it?

Leaves, twigs, new growth



What will I see?

Adult psyllids of infested plants are small insects (3-4 mm long). Young leaves of infested plants can become curled and deformed. Long, white, waxy secretions produced by the psyllids may be visible. Leaf flushes most affected.

When will I see it?

Throughout the life of the plant. Leaf flushes most affected.



Alternate hosts in Australia

Citrus, Murraya, other plants in the citrus family.

What could it be confused with?

Psyllids can be confused with aphids. Psyllids are more active and jump at the slightest disturbance, whereas aphids are more sluggish. Psyllid nymphs (immature stages) can also be confused with soft scale insects, such as soft brown scale (*Coccus hesperidum*), a common pest of citrus, although on close examination the psyllid nymphs have clear body parts compared with scale.



Asian citrus psyllid

David Hall, USDA Agricultural Research Service, Bugwood.org



Asian citrus psyllids on citrus leaf. Note white secretions

Douglas L. Caldwell, University of Florida IFAS Extension

African citrus psyllid

Trioza erytreae

Where is it now?

Africa, Arabian peninsular, Portugal, Spain, Canary Islands.

How does it travel?

Plant material, flight



Where will I see it?

Leaves, twigs, new growth



What will I see?

Adult psyllids are small (3-4 mm long). Young leaves of infested plants are curled and deformed. Leaf flushes most affected.

When will I see it?

Throughout the life of the plant. Leaf flushes most affected.



Alternate hosts in Australia

Citrus, *Murraya*, other plants in the citrus family.

What could it be confused with?

Psyllids can be confused with aphids. Psyllids are more active and jump at the slightest disturbance, whereas aphids are more sluggish. Psyllid nymphs (immature stages) can also be confused with soft scale insects, such as soft brown scale (*Coccus hesperidum*), a common pest of citrus, although on close examination the psyllid nymphs have clear body parts compared with scale.



African citrus psyllid

S.P. van Vuuren, Citrus Research International, Bugwood.org



Leaf galls caused by African citrus psyllid

Peter Stephen, Citrus Research International, Bugwood.org

Glassy winged sharpshooter

Homalodisca vitripennis

Where is it now?

United States, Mexico, French Polynesia, Tahiti, Cook Islands, Easter Island.

How does it travel?

Fruit, plant material, flight



Where will I see it?

Leaves, stems, fruit



What will I see?

Adults are large (12 mm long), cigar shaped insects. When feeding these insects emit a sticky fluid. When the fluid dries, it is similar to white-wash on leaves and fruit. Also look for signs of egg masses on leaves.

When will I see it?

Throughout the life of the plant.



Alternate hosts in Australia

Wide host range including *Prunus* spp., grapes, macadamia, oleander.

What could it be confused with?

Australian leafhoppers from the Auchenorrhyncha suborder share some features with glassy winged sharpshooter including larger size, brown colour and a large head with prominent eyes.



Glassy winged sharpshooter

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



Glassy winged sharpshooter

Charles Ray, Auburn University US



Glassy winged sharpshooter egg mass

Jack Kelly Clark, University of California, Davis

Citrus fruit borer

Citripestis sagittiferella

Where is it now?

Indonesia, Malaysia, Singapore, Vietnam, Thailand.

How does it travel?

Fruit, plant material, flight



Where will I see it?

Fruit



What will I see?

Adult moths are about 10 mm long with yellow to grey-brown forewings. Look for holes in fruit rind and cavities under the fruit surface. Gum and frass may be present. Fruit drop may occur. May be confused with orange fruit borer, *Isotenes miserana*.

When will I see it?

Fruit development to harvest.



Alternate hosts in Australia

Various citrus species.

What could it be confused with?

Citrus fruit borer can be confused with the orange fruit borer (*Isotenes miserana*), present in Queensland, NSW and NT. However, the larvae of this borer are brown on top and light grey underneath, with a pair of brown stripes along the body.



Citrus fruit borer adult

P. A. C. Ooi, Tropical Press Sdn Bhd



Citrus fruit borer larvae

S. Anderson



Citrus fruit borer adult moth. Note yellow to grey-brown forewing and transparent hindwing

S. Anderson

Bean thrips

Caliothrips fasciatus

Where is it now?

Western United States, Mexico.

How does it travel?

Fruit, plant material, flight



Where will I see it?

Fruit



When will I see it?

Fruit development to harvest.



Alternate hosts in Australia

Mostly legumes.

What could it be confused with?

Bean thrips look similar to established species. Any thrips seen in the navel of navel oranges should be investigated.

What will I see?

Thrips are very small (~1 mm long). Adults shelter within the cavities of navel oranges leading to cosmetic damage and impacts on market access.



Bean thrips

CBG Photography Group, Centre for Biodiversity and Genomics

Blossom thrips

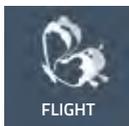
Frankliniella insularis

Where is it now?

Central America, South America, southern United States, Fiji, Singapore.

How does it travel?

Plant material, flight



Where will I see it?

Flowers



What will I see?

Thrips are very small (~1 mm long). Feeding causes damage to blossoms. Infested flowers turn brown-yellow before turning black and dropping from the plant.

When will I see it?

Flowering and fruit development.



Alternate hosts in Australia

Often feeds on mallows.

What could it be confused with?

Blossom thrips look similar to established species. Any thrips associated with flower damage should be investigated.



Blossom thrips

CBG Photography Group, Centre for Biodiversity and Genomics

Californian citrus thrips

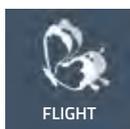
Scirtothrips citri

Where is it now?

Southern United States, Mexico, China, India, Iran.

How does it travel?

Plant material, flight



Where will I see it?

Fruit



What will I see?

Thrips are very small (~1 mm long). Californian citrus thrips feed on young fruit causing brown scaring.

When will I see it?

Flowering and fruit development.



Alternate hosts in Australia

Various citrus species.

What could it be confused with?

Kelly's citrus thrips (*Pezothrips kellyanus*) is the only established thrips that cause halo marks on citrus fruit. However, Kelly's citrus thrips is black and roughly double the size (2 mm). It is recommended that all thrips symptoms be investigated.



California citrus thrips

Joseph Morse, University of California, Riverside

Florida flower thrips

Frankliniella bispinosa

Where is it now?

Southern United States,
Bermuda, Bahamas.

How does it travel?

Plant material, flight



Where will I see it?

Flowers



What will I see?

Thrips are very small (~1 mm long).
Feeding causes damage to blossoms.
Infested flowers turn brown-yellow
before turning black and dropping
from the plant.

When will I see it?

Flowering and fruit development.



Alternate hosts in Australia

Wide host range including capsicum,
eggplant, corn, peanut, beans,
hibiscus.

What could it be confused with?

Florida flower thrips look similar
to established species. Any thrips
associated with flower damage
should be investigated.



Florida flower thrips

CBG Photography Group, Centre for Biodiversity and Genomics

South African citrus thrips

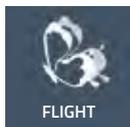
Scirtothrips auranti

Where is it now?

Africa and parts of southern Queensland, where it mostly affects mother of millions (*Kalanchoe delagoensis*).

How does it travel?

Plant material, flight



Where will I see it?

Leaves, flowers, fruit



What will I see?

Adult thrips are very small (~1 mm long). Thrips feeding on young leaves can lead to curling, distortion and brown scarring. The rinds of fruit also show grey or brown scarring which may appear as a halo around the apex.

When will I see it?

Flowering and fruit development.



Alternate hosts in Australia

Reported on acacia, citrus, mango, other plants.

What could it be confused with?

Kelly's citrus thrips (*Pezothrips kellyanus*) is the only established thrips that cause halo marks on citrus fruit. However, Kelly's citrus thrips is black and roughly double the size (2 mm). It is recommended that all thrips symptoms be investigated further.

What to do if you see it?

This pest occurs on mother of millions in southern Queensland. Any detections on citrus should be reported to the **Exotic Plant Pest Hotline** or your local department of agriculture.



Fruit scaring caused by South African citrus thrips

D. Vincenot, Bugwood.org



South African citrus thrips

Department of Entomology, University of Florida

Citrus canker

Xanthomonas citri subsp. *citri*

Where is it now?

Throughout Asia and South America, Africa, Middle East, Florida (United States), Pacific Islands. Has been eradicated from Australia several times.

How does it travel?

Plant material



Where will I see it?

Leaves, stems, fruit



What will I see?

Warty, rust-brown spots (cankers) that form on the leaves, twigs and shoots. The cankers on leaves are rough to touch on both upper and lower surfaces and are surrounded by a distinctive bright yellow halo. Scabby cankers also appear on the fruit. Symptoms more prominent when the weather is warm and humid (eg the northern Australian wet season).

When will I see it?

Throughout the life of the plant.



Alternate hosts in Australia

Various citrus species.

What could it be confused with?

Citrus canker could be confused with lemon scab (*Elsinoe fawcettii*) which occurs in coastal areas of Australia: however, lesions of lemon scab are drier than those of citrus canker and lack the characteristic yellow halo. The exotic citrus bacterial spot (*Xanthomonas alfalfae* subsp. *citrumelonis*) has similar leaf symptoms to citrus canker: however, the lesions are flat and rarely form on citrus fruit.



Symptoms of citrus canker. Note cankers surrounded by yellow halos

Timothy Schubert, Florida Department of Agriculture and Consumer Services



Citrus canker symptoms on fruit

Jonas Janner Hamann, Universidade Federal de Santa Maria (UFSM), Bugwood.org



Citrus canker symptoms on leaves

Yuan-Min Shen, Taichung District Agricultural Research and Extension Station, Bugwood.org

Citrus variegated chlorosis

Xylella fastidiosa subsp. *pauca*

Where is it now?

Originating in the Americas, this subspecies is now present in parts of Europe, South America. However, the pathogen is only reported on citrus in South America.

How does it travel?

Plant material



Where will I see it?

Leaves, fruit



When will I see it?

Throughout the life of the plant.



What will I see?

Symptoms similar to zinc deficiency, including yellowing and loss of leaves. Yellowing occurs on the upper surface of maturing leaves, particularly between the veins. As the leaf matures, small, slightly raised lesions appear on the underside of the leaf that correspond to the yellowing on the upper side. Lesions are initially light brown and later dark brown, and can become necrotic. Fruit from infected plants are smaller and harder than normal.

Alternate hosts in Australia

Wide host range including coffee, olive, acacia.

What could it be confused with?

Foliar symptoms may be confused with zinc deficiency, anthracnose or greasy spot.



Citrus variegated chlorosis symptoms on the underside of an infected leaf

USDA/APHIS/PPQ Center for Plant Health Science and Technology



Citrus variegated chlorosis symptoms

USDA/APHIS/PPQ Center for Plant Health Science and Technology



Citrus variegated chlorosis symptoms on the top surface of an infected leaf

USDA/APHIS/PPQ Center for Plant Health Science and Technology

Citrus stubborn disease

Spiroplasma citri

Where is it now?

Mediterranean Basin, southern Asia, southern United States, Mexico, New Zealand.

How does it travel?

Plant material



Where will I see it?

Leaves, fruit



Alternate hosts in Australia

Various citrus species.

What could it be confused with?

Symptoms of citrus stubborn disease can resemble huanglongbing, nutrient deficiencies, frost damage and insect damage. A combination of several symptoms suggests that citrus stubborn disease is present.

When will I see it?

Throughout the life of the plant.



What will I see?

Symptoms are variable and include short, broad leaves that are cup shaped and sit abnormally upright. Under very hot conditions, leaves on some shoots may have misshaped, blunted or heart shaped yellow tips. Leaves also show yellow mottling, similar to nutritional deficiencies and have shortened internodes leading to bunched type growth. Trees may also flower out of season and carry fruit at all stages of development. Fruit produced by the plant may drop prematurely and can be lopsided or acorn-shaped. Fruit colour may be inverted or uneven. Severely affected trees are stunted with thin canopies, tip dieback, bitter tasting fruit and aborted seeds.



Citrus stubborn disease symptoms on fruit. Note lopsided fruit

J.M. Bové, INRA Centre de Recherches de Bordeaux



Citrus stubborn disease symptoms. Note out-of-season fruiting

Jack Kelly Clark, University of California Statewide IPM Project

Huanglongbing (citrus greening)

Candidatus Liberibacter asiaticus, *Ca. L. africanus*, *Ca. L. americanus*

Where is it now?

Subspecies *asiaticus*: North, Central and South America, Asia including Indonesia, Timor-Leste, Papua New Guinea. Subspecies *africanus*: Africa and Arabian Peninsula. Subspecies *americanus*: Brazil.

How does it travel?

Plant material, insect vectors



Where will I see it?

Leaves, branches and fruit



What will I see?

Yellowing of citrus branches and leaves. Fruit may become deformed, sour and bitter tasting. Symptoms on leaves are subtle and hard to pick but one key sign is a blotchy yellowing that is not symmetrical or mirrored on both sides of the leaf. Often symptoms may only affect individual branches rather than the whole tree.

When will I see it?

Throughout the life of the plant.



Alternate hosts in Australia

Citrus, *Murraya*, other plants in the citrus family.

What could it be confused with?

Huanglongbing (HLB) can be confused with mineral deficiencies, particularly zinc: however, mottling of leaves crosses veins in HLB and is asymmetrical, whereas in zinc deficiency, mottling occurs symmetrically between or along leaf veins. With mineral deficiency, yellowing is distributed uniformly throughout the canopy, whereas in HLB it appears randomly arranged in the canopy. HLB may also be confused with other diseases such as Australian citrus dieback, citrus tristeza virus, *Phytophthora* root rot and citrus blight.



Huanglongbing symptoms.
Note yellowing of individual branches

P. Barkley



Fruit symptoms of Huanglongbing.
Note colouration

Hilda Gomez, USDA



Huanglongbing symptoms.
Note yellowing of individual branches

J.M. Bové, INRA Centre de Recherches de Bordeaux



Leaf symptoms of Huanglongbing.
Note asymmetrical yellowing of leaf

Hilda Gomez, USDA

Citrus leprosis virus

Citrus leprosis virus

Where is it now?

Central and South America,
South Africa, Hawaii.

How does it travel?

Plant material, mite vectors



When will I see it?

Throughout the life of the plant.



Alternate hosts in Australia

Various citrus species.

Where will I see it?

Leaves, stems, fruit



What could it be confused with?

Symptoms on leaves may be confused with herbicide or insect damage. Symptoms on fruit may be confused with citrus canker.

What will I see?

Localised spots on leaves, stems, and fruits. Leaves have light yellow to dark brown spots, 5-12 mm in diameter. Stem lesions start yellow and darken over time, bark becomes scaly and stems dieback. Infected fruit develops spots, may change colour early and may prematurely drop from the tree.



Leaf symptoms of citrus leprosis virus

Carlos Amadeu Leite de Oliveira, Universidade Estadual Paulista, Bugwood.org



Symptoms of citrus leprosis virus on fruit

Carlos Amadeu Leite de Oliveira, Universidade Estadual Paulista, Bugwood.org



Lesions and scaly bark on stems due to citrus leprosis virus infection

Carlos Amadeu Leite de Oliveira, Universidade Estadual Paulista, Bugwood.org

Citrus tristeza virus

Exotic strains

Where is it now?

Strains occur in most citrus producing countries including southern Europe, Asia, North, Central and South America, Africa, Australia.

How does it travel?

Plant material



Where will I see it?

Leaves, twigs, branches



Alternate hosts in Australia

Various citrus species.

What could it be confused with?

The symptoms of citrus tristeza virus (CTV) are similar to root injury, particularly when looking at the whole tree. However, if the bark of a branch or stem is stripped back, the pitted appearance of the wood will clearly distinguish CTV from typical root injury.

What will I see?

Pitting and gumming of the wood; twigs and branches become brittle. Leaves may show chlorotic flecking, vein clearing, leaf cupping and corking of veins. Limbs and trunks of chronically infected or larger trees may be bumpy or ropey in appearance. In addition, numerous fine pits in severely affected trees may lead to a honeycomb appearance. The severity of stem-pitting symptoms varies from a few small pits, to many fine sandpaper-like pits overlaid by abnormally thickened bark. Early stages of stem-pitting are only visible if the bark is removed.

When will I see it?

Throughout the life of the plant.



What to do if you see it?

Strains of this virus occur in Australia. However, there are many strains that also occur overseas that are not present in Australia. Any new or unusual citrus tristeza symptoms should be reported to **Exotic Plant Pest Hotline** or your local department of agriculture.



Citrus tristeza virus symptoms.
Note bumpy or ropey trunk

L. Navarro, Instituto Valenciano de Investigaciones Agrarias



Citrus tristeza virus symptoms.
Note ropey growth on branch

L. Navarro, Instituto Valenciano de Investigaciones Agrarias



Citrus tristeza virus symptoms. Note smaller fruit size

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

Lychee longicorn beetle

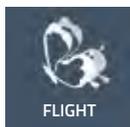
Aristobia reticulator (syn. *A. testudo*)

Where is it now?

Southern Asia including Laos, Myanmar, Vietnam, China, Bangladesh, Nepal, India, Thailand.

How does it travel?

Plant material, flight



Where will I see it?

Stems, branches



Alternate hosts in Australia

No other significant alternative hosts.

What will I see?

Adult beetles are large (20–35 mm long), black with yellow spots. Females girdle branches by chewing off 10 mm strips of bark; eggs are laid on the wound and are covered with exudate. Larvae live under the bark and bore into the wood, creating tunnels up 60 cm long.

When will I see it?

Throughout the life of the plant.



What could it be confused with?

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



Lychee longicorn beetle

Aleksey Gnilenkov, Wikimedia Commons



Lychee longicorn beetle

Sarefo, Wikimedia

Citrus longicorn beetle

Anoplophora chinensis

Where is it now?

China, Japan, Korea, United States.

How does it travel?

Plant material, flight



Where will I see it?

Trunk, branches



Alternate hosts in Australia

Broad range includes citrus, lychee.

What will I see?

Adults are large (25–35 mm long), dark coloured beetles with white spots and long antennae. Look for 6–9 mm wide exit holes in branches.

When will I see it?

Throughout the life of the plant.



What could it be confused with?

Australia has a number of large (>2 cm in length) endemic beetles that share characteristics with the citrus longicorn beetle, but none are as destructive on commercial plants. The exotic pest can be distinguished by the body markings and the antennae, which are longer than their body. The citrus longicorn beetle is also commonly confused with the Asian longicorn beetle. Any large, similarly coloured beetles with antennae longer than its body should be reported.



Citrus longicorn beetle

Plant Protection Service Archive, Bugwood.org



Citrus longicorn beetle damage.
Note round exit hole

Plant Protection Service Archive, Bugwood.org



Citrus longicorn beetle larvae

Plant Protection Service Archive, Bugwood.org

Coconut bug

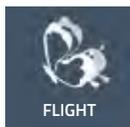
Pseudotheraptus wayi

Where is it now?

Sub-Saharan Africa.

How does it travel?

Plant material, flight



Where will I see it?

Leaves, flowers, fruit



Alternate hosts in Australia

Mostly feeds on coconut.
Also reported on mango,
camphor laurel, guava.

What will I see?

Adult coconut bugs are large (10-15 mm long), red-brown coloured insects. Saliva injected when feeding produces blackened, necrotic areas. The infested area has a gummy discharge, and young fruit drop prematurely.

When will I see it?

Throughout the life of the plant.



What could it be confused with?

Damage may be confused with that of other sucking insects.



Coconut bug adult

Infonet biovision

Hong Kong stink bug

Paradasynus longirostris

Where is it now?

China, Taiwan, Thailand.

How does it travel?

Plant material, flight



Where will I see it?

Leaves, flowers, fruit



Alternate hosts in Australia

Longan reported as an alternative host.

What will I see?

Adult Hong Kong stink bugs are large (12-15 mm long) brown coloured insects. Nymphs are red and black coloured. Saliva injected into the plant during feeding is toxic and produces blackened, necrotic areas. The infested area provokes a gummy discharge and, if it is on or associated with the young fruit, it can cause them to drop prematurely.

When will I see it?

Throughout the life of the plant.



What could it be confused with?

Adults are similar to endemic fruit spotting bugs.



Mature Hong Kong stink bugs

Lenny Worthinton Flickr



Hong Kong stink bug nymph

Anonymous, Flickr

Citrus blackfly

Aleurocanthus woglumi

Where is it now?

Widespread: South and Central America, Africa and Asia including Indonesia, Papua New Guinea.

How does it travel?

Plant material, flight



Where will I see it?

Leaves, twigs, fruit



Alternate hosts in Australia

Range of hosts including avocado, banana, citrus, mango, papaya.

What will I see?

Adults are dark coloured and very small (~1 mm long). Look for colonies, distorted leaves, honey dew and sooty mould.

When will I see it?

Throughout the life of the plant.



What could it be confused with?

Small moths and other whitefly. Unusual looking insects or behaviours should be investigated.



Colony of citrus blackfly

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



Close-up of citrus blackfly. Note adults are only about 1 mm long

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



Citrus blackfly nymphs on the underside of a leaf

Natalie Hummel, Louisiana State University AgCenter, Bugwood.org

Lychee fruit borer

Conopomorpha sinensis

Where is it now?

Southern Asia: China, India, Nepal, Taiwan, Thailand, Vietnam.

How does it travel?

Fruit, plant material, flight



Where will I see it?

Young vegetative growth, fruit, shoots



Alternate hosts in Australia

Longan reported as an alternative host.

What will I see?

Adult moths have a 12–15 mm wingspan and are grey-brown coloured with yellow-brown wing edges. Eggs laid on fruit, leaves and shoots. Emerging larva penetrate the leaf, shoot or fruit. Infestation causes premature fruit drop.

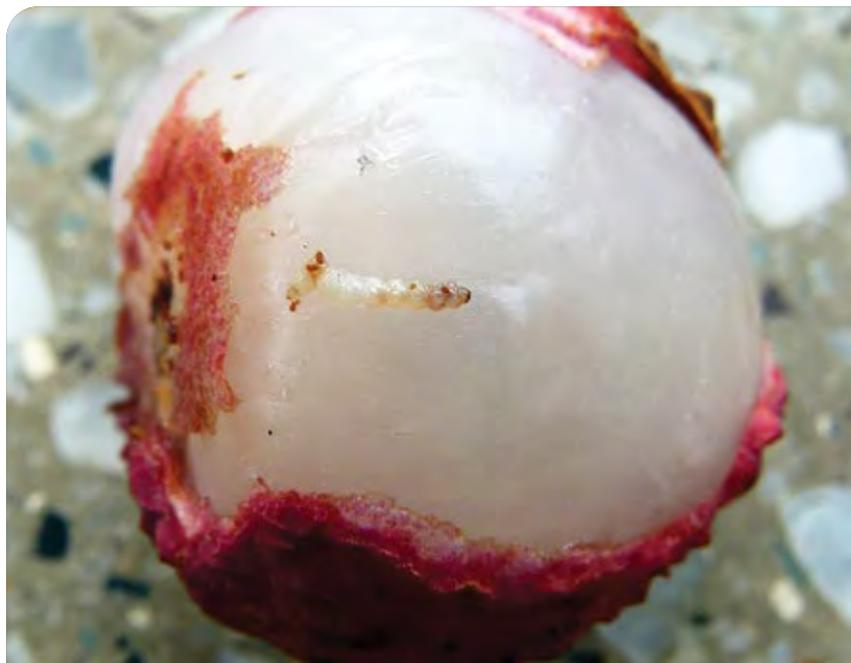
When will I see it?

Throughout the life of the plant.



What could it be confused with?

Any suspect insects in fruit should be investigated.



Lychee fruit borer larva

Surajit Koley, BioLib

Asian gypsy moth

Lymantria dispar

Where is it now?

Widespread: Northern Africa, North America, Europe, Asia.

How does it travel?

Flight, plant material, cargo and freight



Where will I see it?

Leaves, branches, trunk



What will I see?

Adult moths are 40-70 mm long, males are grey-brown and females mostly white. Caterpillars are 40-60 mm long, covered in fine hairs and have five pairs of blue spots and six pairs of red spots. Look for leaf damage. High numbers can defoliate plants.

When will I see it?

Throughout the life of the plant.



What could it be confused with?

There are a number of endemic and exotic moth species related to Asian gypsy moth, many of which are economically important pests. Unusual sightings of defoliation, moths or caterpillars should be reported.

Alternate hosts in Australia

Very broad range of hosts.



Asian gypsy moth caterpillar.
Note distinctive red and blue spots and fine hairs

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



Adult Asian gypsy moths (female upper left and male lower right)

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



Female Asian gypsy moths and egg masses on a tree trunk

Milan Pernek, Forestry Research Institute, Bugwood.org

False codling moth

Thaumatotibia leucotreta

Where is it now?

Widespread in Africa, reported in Israel.

How does it travel?

Fruit, flight



Where will I see it?

Fruit



Alternate hosts in Australia

Range of crops including mango, pineapple, vegetables.

What will I see?

Adult moths have a 16–20 mm wingspan and are dark brown to grey in colour. Larvae are pinkish coloured. The young larvae mine fruit just beneath the surface, or bore into the fruit causing premature ripening and fruit damage.

When will I see it?

Fruit development to harvest.



What could it be confused with?

False codling moth can look similar to other moths. Any unusual caterpillars in fruit should be investigated.



False codling moth

Pest and Diseases Image Library, Bugwood.org



False codling moth

JH Hofmeyr, Citrus Research International, Bugwood.org



False codling moth larvae in citrus fruit

JH Hofmeyr, Citrus Research International, Bugwood.org



False codling moth larvae

Marja van der Straten, NVWA Plant Protection Service, Bugwood.org

Longan witches broom disease

Longan witches broom disease

Where is it now?

China, Taiwan, Thailand.

How does it travel?

Plant material, insect vectors



Where will I see it?

Leaves, flowers, fruit



Alternate hosts in Australia

Longan reported as an alternative host.

What will I see?

Small, stunted shoots with curved, rolled-up margins, deformed leaves with blisters and hairy patches on the underside. Also abnormal development of flower structures, flower abortion, failure to produce any fruit or produce only small fruit.

When will I see it?

Throughout the life of the plant.



What could it be confused with?

Unlikely to be mistaken for other diseases.



Longan witches broom symptoms



Longan witches broom symptoms



Longan witches broom symptoms

Ambrosia beetle

Hypocryphalus dilutus

Where is it now?

North America, Africa, Asia, Israel.

How does it travel?

Plant material, flight



Where will I see it?

Twigs, branches



Alternate hosts in Australia

Various trees can be hosts.

What will I see?

Adult beetles are small (2-3 mm long) and brown coloured. Look for pin-sized entry holes on twigs, often on the underside of twigs, dying or dead twigs and small branches.

When will I see it?

Throughout the life of the plant.



What could it be confused with?

Boring damage may be confused with other small wood boring beetles.



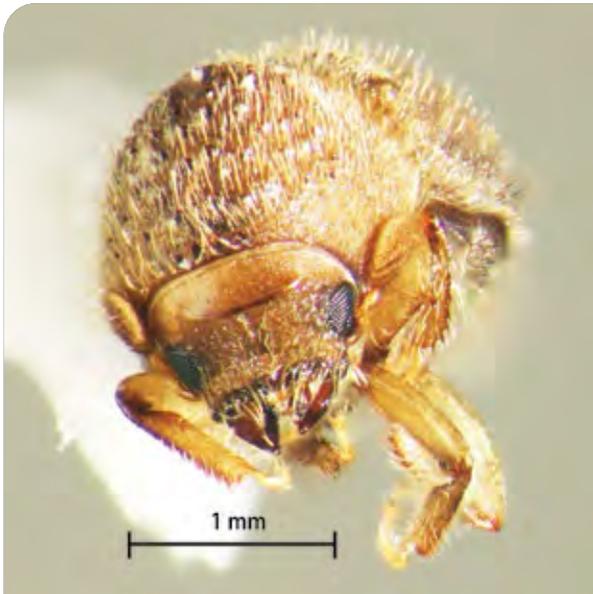
Ambrosia beetle

T.H. Atkinson, University of Texas Insect Collection, Austin, Texas



Ambrosia beetle

T.H. Atkinson, University of Texas Insect Collection, Austin, Texas



Ambrosia beetle

T.H. Atkinson, University of Texas Insect Collection, Austin, Texas

Black twig borer

Xylosandrus compactus

Where is it now?

Madagascar, tropical Africa, Sri Lanka, southern India, Thailand, Vietnam, Malaysia, China, Japan, Indonesia, New Guinea, Pacific Islands, United States, Brazil, Cuba.

How does it travel?

Plant material, flight



Where will I see it?

Twigs, branches



Alternate hosts in Australia

Various trees including camphor laurel, figs, coffee.

What will I see?

Adult beetles are small (2 mm long) and dark coloured. Larvae are white. Look for pin-sized entry holes in woody twigs, often on the underside of twigs, dying or dead twigs and small branches.

When will I see it?

Throughout the life of the plant.



What could it be confused with?

Boring damage may be confused with that of other small wood boring beetles.



Black twig borer

Pest and Diseases Image Library, Bugwood.org



Black twig borer

Lyle Buss, University of Florida, Bugwood.org



Black twig borer larvae inside twig

Dr. Agr. Raffaele Giurato (Vittoria, RG), EPPO

Lateral banded mango longhorn beetle

Batocera rubus

Where is it now?

Southern Asia including Indonesia.

How does it travel?

Plant material, flight



Where will I see it?

Twigs, branches



Alternate hosts in Australia

Various trees including figs, breadfruit.

What will I see?

Adults are large (30–60 mm long) beetles with long antennae. They are dark coloured with white spots on their wings and red markings on the thorax. Larvae are up to 80 mm long and bore into the trunk and branches. Look for large (20 mm) exit holes and the presence of frass (saw dust) near the holes.

When will I see it?

Throughout the life of the plant.



What could it be confused with?

The large size of the adult beetle is reasonably distinctive.



Lateral banded mango longhorn beetle

Udo Schmidt, Wikimedia



Lateral banded mango longhorn beetle

Wikimedia

Red spotted longhorn beetle

Batocera rufomaculata

Where is it now?

Widespread in Africa, Central America and Asia, including Indonesia, some Pacific islands (e.g. Solomon Islands).

How does it travel?

Plant material, flight



Where will I see it?

Twigs, branches



Alternate hosts in Australia

Various trees including figs, papaya.

What will I see?

Adults are large (35-70 mm long) tan coloured insects with reddish markings and long antennae. Larvae are cream coloured with a dark head and up to 100 mm long and bore tunnels in the trunk. Look for large exit holes and the presence of frass (saw dust) nearby.

When will I see it?

Throughout the life of the plant.



What could it be confused with?

The large size of the adult beetle is reasonably distinctive.



Red spotted longhorn beetle

Praveenp, Wikimedia



Red spotted longhorn beetle

Lenny Worthington, Flickr

Mango pulp weevil

Sternochetus frigidus

Where is it now?

Southern Asia including Indonesia, Papua New Guinea.

How does it travel?

Fruit, plant material, flight



Where will I see it?

Flowers, trunk, branches. Eggs on fruit. Larvae in fruit.



What will I see?

Adult weevils are about 5 mm long and grey-brown coloured. Look for small puncture wounds where the eggs are laid and exit holes on fruit.

When will I see it?

Flowering and fruit development.



What could it be confused with?

Mango pulp weevil larvae, pupae and adults look very similar to those of mango seed weevil.

Alternate hosts in Australia

No other significant alternative hosts.



Mango pulp weevil

Pest and Diseases Image Library, Bugwood.org



Mango pulp weevil damage

Dr Mohd. Shamsudin Osman, MARDI, Malaysia



Mango pulp weevil damage

Dr Mohd. Shamsudin Osman, MARDI, Malaysia

Blue striped nettle grub

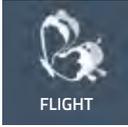
Parasa lepida

Where is it now?

Southern Asia, including Indonesia.

How does it travel?

Plant material, flight



Where will I see it?

Leaves



Alternate hosts in Australia

Various hosts including coconut, coffee, banana.

What will I see?

Adults are large (wingspan of 35 mm), green and brown coloured moths.

Caterpillars have fleshy green bodies with three pale blue stripes.

Spines on the caterpillars can sting.

Look for holes in leaves. In later stages the whole tree may be defoliated.

The first outbreaks of the blue striped nettle grub are usually localised, with only a few trees defoliated.

When will I see it?

Throughout the life of the plant.



What could it be confused with?

Leaf damage and defoliation of trees can be caused by other insect pests.

Positive identification requires detecting the moths or grubs themselves.



Blue striped nettle grub

Masaki Ikeda



Blue striped nettle grub adult moth

Dr V. Shubhalaxmi



Blue striped nettle grub

Dr V. Shubhalaxmi



Blue striped nettle grub adult moth

Show Ryu, Wikimedia commons

Squash bug

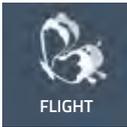
Acanthocoris scabrator

Where is it now?

Widespread: occurring in Ethiopia, Southern Asia including, Indonesia.

How does it travel?

Plant material, flight



Where will I see it?

Terminal branches, leaves, fruit



Alternate hosts in Australia

Vegetables including cucurbits, capsicum, tomato, eggplant.

What will I see?

Adult bugs are 13-14.5 mm long. Feeding puncture marks on fruit. Secondary infections causes black rings to form around the feeding punctures.

When will I see it?

Throughout the life of the plant.



What could it be confused with?

Potentially confused with other stinkbugs. The cause of fruit damage should be investigated.



Adult squash bug

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

Citrus blackfly

Aleurocanthus woglumi

Where is it now?

Widespread: occurs in South and Central America, Africa and Asia including Indonesia, Papua New Guinea.

How does it travel?

Plant material, flight



Where will I see it?

Leaves, fruit, twigs



Alternate hosts in Australia

Range of hosts including avocado, banana, citrus, lychee, papaya.

What will I see?

Adults are dark coloured and very small (~1 mm long). Look for colonies, honeydew and sooty mould on leaves and shoots.

When will I see it?

Throughout the life of the plant.



What could it be confused with?

Small moths and other whitefly.



Colony of citrus blackfly

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



Close up of a citrus blackfly. Note adults are only 1 mm long.

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



Citrus blackfly nymphs on the underside of a leaf

Natalie Hummel, Louisiana State University AgCenter, Bugwood.org

Mango gall midges

Procontarinia spp.

Where is it now?

Widespread in African and southern Asia including Indonesia, Papua New Guinea. Also found in Torres Strait and Cape York.

How does it travel?

Plant material, flight



Where will I see it?

Leaves, flowers



What could it be confused with?

Galls are distinctive raised spots or bumps. Other spots or lesions (not raised) may be caused by mango scab (a fungus), stigma leaf spot, fruit spotting bugs or mechanical damage.

What will I see?

Larvae feed on flowers and cause flowers to abort, preventing normal fruit set. Infested mango buds turn red before turning black. Infested leaves have galls ranging from red to black and cause leaf distortions.

When will I see it?

Periods of leaf growth (vegetative flushes), flowering.



What to do if you see it?

Mango leaf gall midge have been found in the Torres Strait and northern Cape York Peninsula. Any detections outside of northern Cape York Peninsula (south of Heathlands) should be reported to the **Exotic Plant Pest Hotline** or your local department of agriculture.

Alternate hosts in Australia

No other significant alternative hosts.



Mango gall midge damage

Matt Welner, QDAF



Mango gall midge damage

Matt Welner, QDAF



Mango gall midge damage. Note leaf distortion

Matt Welner, QDAF



Mango gall midge damage

Matt Welner, QDAF

Mango leafhopper

Amritodus atkinsoni

Where is it now?

Southern Asia including Myanmar, Bangladesh, India, Pakistan.

How does it travel?

Plant material, flight



Where will I see it?

Leaves



Alternate hosts in Australia

Reported on fig, Monstera.

What will I see?

Adult leafhoppers are about 5 mm long. Leaf florets turn brown and dry up. Honeydew and sooty mould present.

When will I see it?

Throughout the life of the plant.



What could it be confused with?

There are two species of mango leafhoppers in Australia that look similar to this species. Any unusual sightings should be investigated.



Adult mango leafhopper

Arian Suresh, Flickr

Mango leafhopper

Idioscopus nagpurensis

Where is it now?

Southern Asia.

How does it travel?

Plant material, flight



Where will I see it?

Leaves



Alternate hosts in Australia

No other significant alternative hosts.

What will I see?

Adult leafhoppers are yellow-green and about 4-5 mm long. Leaf florets turn brown and dry up. Honeydew and sooty mould present.

When will I see it?

Throughout the life of the plant.



What could it be confused with?

There are two species of mango leafhoppers in Australia that look similar to this species. Any unusual sightings should be investigated.



Adult mango leafhopper

Arian Suresh, Wikimedia



Adult mango leafhopper

Arian Suresh, Flickr

Red banded mango caterpillar

Deanolis sublimbalis

Where is it now?

Southern Asia including Indonesia, Papua New Guinea. Also in Torres Strait and Cape York.

How does it travel?

Fruit, plant material, flight



Where will I see it?

Fruit



Alternate hosts in Australia

No other significant alternative hosts.

What will I see?

Adults have a wingspan of about 20 mm with whitish forewings interspersed with darker scales. Larvae have distinctive red bands. On fruit, look for small darkened boreholes and liquid exudate.

When will I see it?

Fruit development to harvest.



What could it be confused with?

Dark streaks on the skin may be similar to those caused by mango pulp weevil and mango seed weevil.

What to do if you see it?

This pest has been found in the Torres Strait and northern Cape York Peninsula. Any detections outside of northern Cape York Peninsula (south of Heathlands) should be reported to the **Exotic Plant Pest Hotline** or your local department of agriculture.



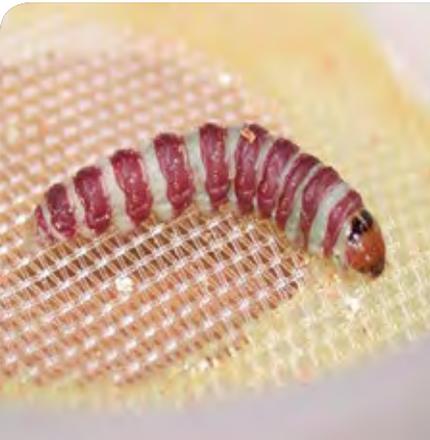
Red banded mango caterpillar damage

Lindsay Chandler, QDAF (www.padil.gov.au)



Red banded mango caterpillar damage.
Note hole and exudate

Lindsay Chandler, QDAF (www.padil.gov.au)



Red banded mango caterpillar larva

Glynn Maynard, DAWE (www.padil.gov.au)



Red banded mango caterpillar damage.
Note borehole and exudate

Matt Weinert QDAF

False codling moth

Thaumatotibia leucotreta

Where is it now?

Widespread in Africa, reported in Israel.

How does it travel?

Plant material, flight



Where will I see it?

Fruit



Alternate hosts in Australia

Range of crops including lychee, pineapple, vegetables.

What will I see?

Adult moths are grey-brown coloured and have a wingspan of 16–20 mm. Young larvae mine fruit just beneath the surface, or bore into the fruit causing premature ripening and fruit damage.

When will I see it?

Fruit development to harvest.



What could it be confused with?

False codling moth can look similar to other moths. Any unusual caterpillars in fruit should be investigated.



False codling moth

Pest and Diseases Image Library, Bugwood.org



False codling moth

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



False codling moth larvae and damage

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



False codling moth larvae are pink coloured and feed within fruit

Marja van der Straten, NVWA Plant Protection Service, Bugwood.org

Mango shoot borer

Chlumetia transversa

Where is it now?

Widespread in south and south-east Asia, Solomon Islands.

How does it travel?

Plant material, flight



Where will I see it?

Leaves, terminal shoots



Alternate hosts in Australia

Lychee reported as an alternative host.

What will I see?

Eggs are laid in spirals on the underside of leaves. Larvae eat young leaves then bore into leaf midribs or shoots. Heavy infestation causes shoots to wilt and leaves to fall from tree. Adult moths are small with a 1.5 cm wingspan.

When will I see it?

Throughout the life of the plant.



What could it be confused with?

Adult moths look similar to endemic species. Shoot wilting and leaf drop can be caused by other factors. Inspect wilted shoots for signs of larvae.



Mango shoot borer adult moth

Donald Hobern, Wikimedia



Mango shoot borer adult moth

Andrew Hardacre, Flickr

Grapevine thrips

Rhipiphorothrips cruentatus

Where is it now?

Southern Asia.

How does it travel?

Plant material



Where will I see it?

Leaves



Alternate hosts in Australia

Various hosts including grapes, rose, Syzygium, sea almonds.

What will I see?

Thrips are very small (1-1.5 mm long) and feed on the lower surface of leaves. Damage includes silvering that gradually turns brown; leaves become coated with brown spots.

When will I see it?

Throughout the life of the plant.



What could it be confused with?

Thrips do not usually cause leaf damage to mangoes in Australia. Suspect thrips seen on leaves should be investigated.



Grapevine thrips

Laurence Mound, PaDIL

Mango malformation disease

Fusarium mangiferae, *Fusarium* species

Where is it now?

Widespread, occurring in Africa, Central America, Asia, Spain and Florida.

How does it travel?

Plant material, soil



Where will I see it?

Flowers, shoots, leaves



Alternate hosts in Australia

No other significant alternative hosts.

What will I see?

Abnormal development of vegetative shoots and inflorescences. Panicles are thickened and produce enlarged flowers. Similar symptoms to paclobutrazol damage or bud mite infestation.

When will I see it?

During vegetative flushes and, importantly, during flowering and fruit development.



What could it be confused with?

The symptoms on vegetative tissue look like malformation caused by bud mites. Bud mites do not cause malformation of floral tissue, and tend to affect older trees, unlike mango malformation disease which affects younger trees.



Mango malformation disease symptoms

Barry Conde, Department of Resources Northern Territory



Mango malformation disease symptoms

Barry Conde, Department of Resources Northern Territory



Mango malformation disease symptoms.
Note the unusual flower development

Matt Weinert, QDAF



Mango malformation disease symptoms.
Note the unusual shoot development

Matt Weinert, QDAF

Mango sudden death syndrome

Ceratocystis fimbriata, *C. manginecans*, *C. omanensis*

Where is it now?

Brazil, Pakistan, Oman.

How does it travel?

Plant material, soil



Where will I see it?

Leaves, twigs, branches



Alternate hosts in Australia

No other significant alternative hosts.

What will I see?

Wilting or death of branches, complete tree death. Blue-grey staining of the vascular tissue or in more advanced cases a light brown to chocolate brown rot of the sap wood visible after removal of bark.

When will I see it?

Throughout the life of the plant.



What could it be confused with?

Can be confused with other fungal pathogens or termite damage that causes decline of major branches. The brown root rot fungus (*Phellinus noxius*) can also cause sudden wilting and death of mango trees.



Mango sudden death syndrome symptoms. Note staining of sapwood

Ali Obaid Al-Adawi, Ministry of Agriculture, Sultanate of Oman



Mango sudden death syndrome. Note branch death

Ali Obaid Al-Adawi, Ministry of Agriculture, Sultanate of Oman



Mango sudden death syndrome. Note wilting of leaves

Ali Obaid Al-Adawi, Ministry of Agriculture, Sultanate of Oman



Mango sudden death syndrome symptoms

Ali Obaid Al-Adawi, Ministry of Agriculture, Sultanate of Oman

Tomato leafminer

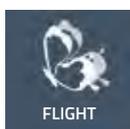
Liriomyza bryoniae

Where is it now?

Widespread in Europe: also Morocco, Egypt, southern Asia, Middle East, India, China.

How does it travel?

Plant material, flight



Where will I see it?

Leaves



Alternate hosts in Australia

Wide range of hosts including weeds, vegetables.

What will I see?

Adult leafminers are small (2-3 mm long), black and yellow coloured flies. Leaf damage occurs through puncture wounds from adult feeding and egg deposition, and tunnelling within leaf tissue by larvae.

When will I see it?

Throughout the life of the plant.



What could it be confused with?

There are a number of leafminers already present in Australia that have similar symptoms and adults. Any unusual leafmines (or chemical resistance) should be reported.



Tomato leafminer adult fly

National Plant Protection Organization, the Netherlands, Bugwood.org



Leaf mine caused by larvae of the tomato leafminer

National Plant Protection Organization, the Netherlands, Bugwood.org

Vegetable leafminer

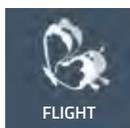
Liriomyza sativae

Where is it now?

Widespread in Europe, Asia, North and South America, Africa, Pacific islands. Found in Torres Strait and far north of Cape York.

How does it travel?

Plant material, flight



Where will I see it?

Leaves



Alternate hosts in Australia

Wide range of hosts including weeds, vegetables, cotton.

What will I see?

Adults are small (2-3 mm long), black and yellow coloured flies. Leaf damage occurs through puncture wounds from adult feeding and egg deposition, and tunnelling within leaf tissue by larvae.

When will I see it?

Throughout the life of the plant.



What could it be confused with?

There are a number of leafminers already present in Australia that have similar symptoms and adults. Any unusual leafmines (or chemical resistance) should be reported.

What to do if you see it?

This pest has been found in the Torres Strait and northern Cape York Peninsula. Any detections outside of northern Cape York Peninsula (south of Heathlands) should be reported to the **Exotic Plant Pest Hotline** or your local department of agriculture.



Vegetable leafminer adult fly

Pest and Diseases Image Library, Bugwood.org



Leaf mines caused by vegetable leafminer larvae

Jack Kelly Clark, University of California Statewide IPM Program



Vegetable leafminer adult fly

Jack Kelly Clark, University of California Statewide IPM Program

Mediterranean whitefly

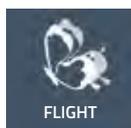
Bemisia tabaci (exotic strains and biotypes)

Where is it now?

Strains occur worldwide, including some in Australia.

How does it travel?

Flight, plant material



Where will I see it?

Leaves



Alternate hosts in Australia

Wide range of hosts including weeds, vegetables, cotton.

What will I see?

Adults are light coloured and very small (1 mm long). Symptoms may include reduced plant vigour, stunting, poor growth, defoliation and reduced yields. Honeydew and sooty mould may be present.

When will I see it?

Throughout the life of the plant.



What could it be confused with?

Some strains of whitefly are already in Australia. Any unusual pesticide responses or pest behaviour should be investigated.

What to do if you see it?

Strains of this pest occur in Australia. However, there are many strains that also occur overseas that are not present in Australia. Any new or unusual whiteflies, or infestations that don't respond to normal pesticide treatments should be reported to **Exotic Plant Pest Hotline** or your local department of agriculture.



Mediterranean whitefly adult

W. Billen, Pflanzenbeschaustelle, Weil am Rhein, Bugwood.org



Mediterranean whitefly

David Riley, University of Georgia, Bugwood.org

Cucurbit bacterial wilt

Erwinia tracheiphila

Where is it now?

Widespread in Europe, United States, South Africa, parts of Asia.

How does it travel?

Plant material, insect vectors



Where will I see it?

Whole plant



Alternate hosts in Australia

Other cucurbits.

What will I see?

Initial drooping or wilting of one or a few leaves on a vine, followed by wilting of the entire vine, then the remainder of the plant wilts, dies and dries up. Symptoms develop more slowly in less susceptible plants or under unfavourable conditions. Instead of rapid wilting, plants may have reduced growth, excessive blossoming and branching. Cut stems of infected plants may ooze a white liquid.

When will I see it?

Throughout the life of the plant.



What could it be confused with?

Wilt symptoms can be caused by a range of diseases. The cause of wilting should be investigated, especially if a white liquid is seen when stems are cut.



Cucurbit bacterial wilt symptoms

Edward Sikora, Auburn University, Bugwood.org



Cucurbit bacterial wilt symptoms

Gerald Holmes, Strawberry Center, Cal Poly San Luis Obispo, Bugwood.org

Fusarium root and stem rot

Fusarium oxysporum f.sp. *melonis* (exotic strains), *F. oxysporum* f.sp. *niveum* (exotic races), *F. oxysporum* f.sp. *radicis-cucumerinum*

Where is it now?

Worldwide, including some strains in Australia.

How does it travel?

Plant material, soil



Where will I see it?

Leaves, stems, whole plant



Alternate hosts in Australia

Other cucurbits.

What will I see?

Initial symptoms include a dull, grey-green appearance to leaves, then wilting, followed by yellowing of the leaves and finally leaf death.

When will I see it?

Throughout the life of the plant.



What could it be confused with?

Symptoms of Fusarium wilt and Verticillium wilt are similar. When the stem is cut lengthways, discolouration of the tissue is flecked for Verticillium wilt, but is continuous brown for Fusarium wilt. When the stem is cut diagonally, plants infected with Verticillium wilt show dark brown to black streaks through the centre. Any unusual wilting symptoms should be investigated.

What to do if you see it?

Some strains of this pest occur in Australia. However, there are many strains that also occur overseas that are not present in Australia. Any new or unusual root or stem rot symptoms should be reported to **Exotic Plant Pest Hotline** or your local department of agriculture.



Symptoms caused by Fusarium wilt of watermelon

David B. Langston, University of Georgia, Bugwood.org

Monosporascus root rot

Monosporascus cannonballus

Where is it now?

Tropical and subtropical areas of Asia, North and South America, Northern Africa, Southern Europe.

How does it travel?

Plant material, soil



Where will I see it?

Whole plant



Alternate hosts in Australia

Other cucurbits.

What will I see?

Infection can occur very early in the growing season, but above ground symptoms are not usually apparent until much later in the season.

The primary symptoms are necrosis of the small roots and lesions on the larger roots, typically around the root junctions, however the most dramatic symptom is the collapse of the vine late in the season.

When will I see it?

Throughout the life of the plant.



What could it be confused with?

Wilting and plant death can be caused by sudden wilt, Fusarium wilt and other established diseases, but these do not have the same root necrosis symptoms as Monosporascus root rot.



Monosporascus root rot symptoms

Gerald Holmes, Bugwood.org



Monosporascus root rot symptoms

Gerald Holmes, Bugwood.org



Monosporascus root rot field symptoms. Note symptoms often not seen until late in the growing season

Gerald Holmes, Bugwood.org



Monosporascus root rot fruiting bodies on dead root

Gerald Holmes, Bugwood.org

Coconut mealybug

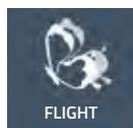
Nipaecoccus nipae

Where is it now?

Widespread in North, Central and South America, parts of Africa, Europe, Asia. Also on some Pacific islands.

How does it travel?

Flight, plant material



Where will I see it?

Leaves, stems, fruit



What will I see?

Adults are very small (1.5–2 mm long). Look for colonies of mealybugs, honey dew, sooty mould, and in severe cases leaf drop.

When will I see it?

Throughout the life of the plant.



What could it be confused with?

Several established mealybugs can potentially affect papaya. Any unusual mealybugs should be investigated.

Alternate hosts in Australia

Broad range including avocado, banana, citrus.



Coconut mealybug colony on palm leaf

Scot Nelson



Coconut mealybug colony

Scot Nelson



Coconut mealybug. Note adults are 1.5-2 mm long

Sam Fraser-Smith, Flickr

Papaya mealybug

Paracoccus marginatus

Where is it now?

Widespread including southern Africa, Asia, Florida, Hawaii, Central America.

How does it travel?

Plant material



Where will I see it?

Leaves, stems, fruit



Alternate hosts in Australia

Wide host range including citrus, avocado, eggplant, mango, coffee, beans.

What will I see?

Adult mealybugs are very small (2 mm long). Look for leaf yellowing, distortion, stunting, early leaf and fruit fall, the production of honeydew, sooty mould and possibly the death of the plant.

When will I see it?

Throughout the life of the plant.



What could it be confused with?

This species can be confused with other mealybugs, especially on alternative hosts.



Papaya mealybugs. Note adults are small (2 mm long)

Peggy Greb, USDA Agricultural Research Service, Bugwood.org



Papaya mealybug colony

Dale E. Meyerdirk, USDA APHIS PPQ, Bugwood.org



Papaya mealybug symptoms. Note yellowing of leaves

Dale E. Meyerdirk, USDA APHIS PPQ, Bugwood.org



Papaya mealybug colony

Dale E. Meyerdirk, USDA APHIS PPQ, Bugwood.org

Citrus blackfly

Aleurocanthus woglumi

Where is it now?

South and Central America, Africa and Asia including Indonesia, Papua New Guinea.

How does it travel?

Plant material, flight



Where will I see it?

Leaves, twigs, fruit



Alternate hosts in Australia

Range of hosts including avocado, banana, citrus, mango, lychee.

What will I see?

Adults are dark coloured and very small (1.5 mm long). Look for colonies, honeydew and sooty mould on leaves and shoots.

When will I see it?

Throughout the life of the plant.



What could it be confused with?

Small moths and other whitefly.



Citrus blackfly colony on leaf

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



Citrus blackfly. Note adults are only 1.5 mm long

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



Citrus blackfly nymphs

Natalie Hummel, Louisiana State University AgCenter, Bugwood.org

Citrus root weevil

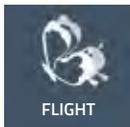
Diaprepes abbreviatus

Where is it now?

Central America, southern United States.

How does it travel?

Flight, plant material, soil



Where will I see it?

Adults and eggs on leaves. Larvae on roots.



What will I see?

Leaves damaged by adult feeding, roots damaged by larvae feeding. Adult weevils are approximately 1 cm long and striped.

When will I see it?

Throughout the life of the plant.



What could it be confused with?

Adult beetles are a distinctive colour. Root damage may be confused with other root feeding larvae. Unusual damage should be investigated.

Alternate hosts in Australia

Broad range of hosts including citrus, avocado, nursery stock.



Citrus root weevil adult

Sean McCann, Flickr



Citrus root weevil adult

Sean McCann, Flickr



Citrus root weevil adult

katja Schulz, Flickr

Bacterial crown rot

Erwinia papayae

Where is it now?

Widespread including Caribbean, Philippines, Indonesia.

How does it travel?

Plant material, machinery, footwear and clothing



Where will I see it?

Leaves, stem, fruit



Alternate hosts in Australia

No other significant alternative hosts.

What will I see?

Plant leaves turn yellow and die. Darkened, water-soaked areas where the leaves join the stem, the crown or the midrib of leaves. Fruit can also become infected and take on a water-soaked appearance.

When will I see it?

Throughout the life of the plant.



What could it be confused with?

Other exotic species of *Erwinia* can also cause significant damage to papaya plants. Symptoms include dark coloured cankers forming in the leaf axils and the leaves of young seedlings showing small wet lesions.



Bacterial crown rot symptoms on papaya. Note water soaked lesions

L. Vawdrey and R. Fullerton



Bacterial crown rot symptoms on papaya. Note leaf death

L. Vawdrey and R. Fullerton



Bacterial crown rot symptoms on papaya fruit

L. Vawdrey and R. Fullerton

Pierce's spider mite, banana spider mite

Tetranychus piercei

Where is it now?

Southern and south-east Asia including Malaysia, Indonesia, Papua New Guinea.

How does it travel?

Plant material, wind dispersal



Where will I see it?

Leaves



Alternate hosts in Australia

Broad host range including papaya, passionfruit.

What will I see?

Spider mites are very small (less than 0.5 mm long). Look for silky white webbing, small brown spots on leaves, reddish brown underside of leaves, upper leaf surface turns yellow and eventually dies.

When will I see it?

Throughout the life of the plant.



What could it be confused with?

Two-spotted spider mite is sometimes called banana spider mite when it attacks bananas in Australia.



Banana spider mite symptoms on banana leaf

Jeff Daniells, QDAF



Banana spider mite

Don Wilkers, QDAF

Flat foot bug

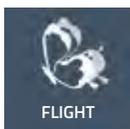
Anisocelis flavolineata

Where is it now?

North America.

How does it travel?

Plant material, flight



Where will I see it?

Leaves, fruit, stems



Alternate hosts in Australia

No other significant alternative hosts.

What will I see?

Adults are 20-30 mm long. Look for damage to terminal buds, leaves and fruit.

When will I see it?

Throughout the life of the plant.



What could it be confused with?

The colour of adult bugs and foot shape are distinctive.



Flat foot bug

Dirk van der Made, Wikimedia

Giant whitefly

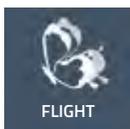
Aleurodicus dugesii

Where is it now?

North America.

How does it travel?

Plant material, flight



Where will I see it?

Underside of leaves



Alternate hosts in Australia

Broad range including avocado, banana, various vegetables.

What will I see?

Adults are up to 5 mm long. This species produces waxy, hairlike filaments on leaves leading to sooty mould and damaged leaves.

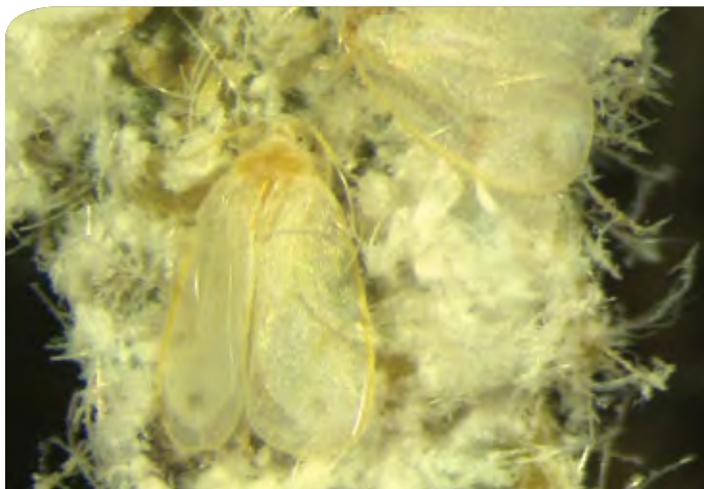
When will I see it?

Throughout the life of the plant.



What could it be confused with?

Other whitefly. Unusual looking whiteflies or behaviours should be investigated.



Giant whitefly adults are up to 5 mm long

Scott Nelson, Flickr



Giant whitefly. Note waxy, hairlike filaments

Scott Nelson, Flickr

Citrus blackfly

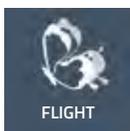
Aleurocanthus woglumi

Where is it now?

South and Central America, Africa and Asia including Indonesia, Papua New Guinea.

How does it travel?

Plant material, flight



Where will I see it?

Leaves, twigs and fruit



Alternate hosts in Australia

Range of hosts including avocado, banana, citrus, mango, papaya, lychee.

What will I see?

Adults are very small (1.5 mm long) and dark coloured. Feeding damage causes the production of honeydew and sooty mould on leaves and shoots.

When will I see it?

Throughout the life of the plant.



What could it be confused with?

Small moths and other whitefly. Unusual looking whiteflies or behaviours should be investigated.



Citrus blackfly colony on the underside of a leaf

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



Close up of a citrus blackfly. Note adults are very small (1.5 mm long)

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



Citrus blackfly nymph colony

Natalie Hummel, Louisiana State University AgCenter, Bugwood.org

Exotic passionfruit viruses

Various species

Includes east Asian passiflora virus, passionfruit ringspot virus, passionfruit severe leaf distortion virus, passionfruit Sri Lankan mottle virus, passionfruit vein clearing virus, passionfruit yellow mosaic virus.

Where is it now?

Distribution different for each virus, in South America, Asia, Africa.

How does it travel?

Planting material, vectors



Where will I see it?

Mostly leaves, fruit



Alternate hosts in Australia

Other Passiflora species.

What will I see?

Leaves generally show yellow flecking, spots or mosaic symptoms and may become distorted. Fruit may appear distorted.

When will I see it?

Throughout the life of the plant.



What could it be confused with?

Some passionfruit viruses such as passionfruit woodiness virus occur in Australia. If you see unusual symptoms, consult an agronomist or your state or territory department of primary industries.



Leaf yellowing symptoms caused by a virus. Report any unusual symptoms

Scot Nelson, Flickr



Leaf yellowing and distortion caused by a virus. Report any unusual symptoms

Scot Nelson, Flickr



Leaf yellowing and distortion caused by a virus. Report any unusual symptoms

Scot Nelson, Flickr

Grey pineapple mealybug

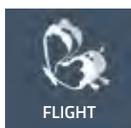
Dysmicoccus neobrevipes

Where is it now?

South-east Asia.

How does it travel?

Flight, plant material



Where will I see it?

Leaves, fruit



Alternate hosts in Australia

Broad host range including citrus, mango, pineapple.

What will I see?

Adults are very small (1.5 mm long). Look for whitish masses of mealybugs and their eggs on the underside of leaves, or fruit if infestation is severe.

When will I see it?

Throughout the life of the plant.



What could it be confused with?

Established mealybugs. Unusual looking mealybugs or behaviours should be investigated.



Grey pineapple mealybug colony

Scot Nelson, Flickr



Grey pineapple mealybug colony

Scot Nelson, Flickr

False codling moth

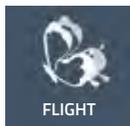
Thaumatotibia leucotreta

Where is it now?

Widespread in Africa, reported in Israel.

How does it travel?

Plant material, flight



Where will I see it?

Fruit



Alternate hosts in Australia

Range of crops including avocado, mango, pineapple, vegetables.

What will I see?

Adult moths are grey-brown coloured and have a wingspan of 16–20 mm. Young larvae mine fruit just beneath the surface, or bore into the fruit causing premature ripening and fruit damage.

When will I see it?

Fruit development to harvest.



What could it be confused with?

False codling moth can look similar to other moths. Any unusual caterpillars in fruit should be investigated.



False codling moth

Pest and Diseases Image Library, Bugwood.org



False codling moth

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



False codling moth larvae damage

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



False codling moth larvae are pinkish coloured

Marja van der Straten, NVWA Plant Protection Service, Bugwood.org

American serpentine leafminer

Liriomyza trifoli

Where is it now?

Widespread in North, South and Central America, Europe, parts of Asia, Africa.

How does it travel?

Plant material, flight



Where will I see it?

Whole plant



Alternate hosts in Australia

Wide range of hosts including weeds, vegetables.

What will I see?

Adult leafminers are small (2-3 mm long), yellow and black coloured flies. Leaf damage occurs through puncture wounds from adult feeding and egg deposition. The larvae tunnel or mine within the leaf tissue.

When will I see it?

Throughout the life of the plant.



What could it be confused with?

There are a number of leafminer species already present in Australia that have similar symptoms and adults. Any unusual leafmines should be reported.



Leaf mines made by the larvae of the American serpentine leafminer

Central Science Laboratory, Harpenden Archive, UK, Bugwood.org



American serpentine leafminer adult fly

Central Science Laboratory, Harpenden Archive, UK, Bugwood.org

Bean seed fly

Delia florilega

Where is it now?

Europe, North America.

How does it travel?

Soil, plant material



Where will I see it?

Seedlings, plants



Alternate hosts in Australia

Affect various crops including onion, beans.

What will I see?

Adult flies are 3–6 mm long and grey coloured. Larvae create mines in leaves. Unlike similar flies, the mines of bean fly harbour several larvae. Lower leaves are infested most often.

When will I see it?

Throughout the life of the plant.



What could it be confused with?

Adults look similar to other flies. Leafmines may be caused by a number of species: however, bean fly mines are distinct as they are often infested with several larvae rather than a single larva. Unusual leafmines should be reported.



Bean seed flies are 3-6 mm long

Janet Graham, Wikimedia

Tomato leafminer

Liriomyza bryoniae

Where is it now?

Widespread in Europe. Morocco, Egypt, southern Asia, Middle East, India, China.

How does it travel?

Plant material, flight



Where will I see it?

Whole plant



Alternate hosts in Australia

Wide range of hosts including weeds, vegetables.

What will I see?

Adults are small (about 2 mm long), yellow and black coloured flies. Leaf damage occurs through puncture wounds from adult feeding and egg deposition. The larvae tunnel or mine within the leaf tissue.

When will I see it?

Throughout the life of the plant.



What could it be confused with?

There are a number of leafminer species already present in Australia that have similar symptoms and adults. Any unusual leafmines should be reported.



Adult tomato leafminer are about 2 mm long

National Plant Protection Organization, the Netherlands, Bugwood.org



Leafmine created by tomato leafminer larva. Note mines increase in size along their length as the larva grows

National Plant Protection Organization, the Netherlands, Bugwood.org

Vegetable leafminer

Liriomyza sativae

Where is it now?

Widespread in Europe, Asia, North and South America, Africa, Pacific islands. Found in Torres Strait and far north of Cape York.

How does it travel?

Plant material, flight



Where will I see it?

Whole plant



Alternate hosts in Australia

Wide range of hosts including weeds, vegetables, cotton.

What will I see?

Adults are small (2-3 mm long), black and yellow coloured flies. Leaf damage caused by adult feeding and egg laying. Larvae tunnel or mine within the leaf tissue.

When will I see it?

Throughout the life of the plant.



What could it be confused with?

There are a number of leafminer species already present in Australia that have similar symptoms and adults. Any unusual leafmines should be reported.

What to do if you see it?

This pest has been found in the Torres Strait and northern Cape York Peninsula. Any detections outside of northern Cape York Peninsula (south of Heathlands) should be reported to the **Exotic Plant Pest Hotline** or your local department of agriculture.



Vegetable leafminer adult fly

Pest and Diseases Image Library, Bugwood.org



Leaf mines caused by vegetable leafminer larvae

Jack Kelly Clark, University of California Statewide IPM Program



Vegetable leafminer adult fly

Jack Kelly Clark, University of California Statewide IPM Program

Bean aphid, black bean aphid

Aphis fabae

Where is it now?

Widespread in Europe, Asia, North and South America, Africa.

How does it travel?

Plants and plant material, flight and wind



Where will I see it?

Whole plant, mostly leaves



Alternate hosts in Australia

Wide host range including vegetables, sunflower, weeds.

What will I see?

Aphids are small (2 mm long) and dark coloured. Feeding aphids produce honeydew which can result in sooty mould. Leaves can be yellow and curled.

When will I see it?

Throughout the life of the plant.



What could it be confused with?

Other aphids can be dark coloured. Any unusual aphids should be investigated, especially if pesticides are not as effective as usual.



Bean aphid colony

Mourad Louadfel, Homemade, Bugwood.org



Bean aphid

Alvesgaspar, Wikimedia

Brown marmorated stink bug

Halyomorpha halys

Where is it now?

Asia, North America,
Europe, Chile.

How does it travel?

Plant material, vehicles,
flight, cargo



PLANT MATERIAL



MACHINERY



FLIGHT



CARGO

Where will I see it?

Whole plant. Also on or in buildings,
containers, vehicles, machinery



WHOLE PLANT



SHED

Alternate hosts in Australia

This pest feeds on over 300 plants
including ornamental plants, apples,
berries, cotton, vegetables.

What will I see?

Adult bugs are 12-17 mm long,
brown mottled and shield shaped.
Feeding causes significant damage
to plant tissues.

When will I see it?

Throughout the life of the plant.
During winter they may aggregate
and infest buildings or machinery.



PLANT CYCLE

What could it be confused with?

The adults and larvae can be
confused with a number of other
brown coloured stink bugs present
in Australia. Any unusual stink bugs
should be reported.



Brown marmorated stink bug adults

Gary Bernon, USDA APHIS, Bugwood.org



Brown marmorated stink bug adults

Mohammed El Damir, Bugwood.org

Tomato potato psyllid

Bactericera cockerelli

Where is it now?

North and Central America, New Zealand, Norfolk Island, south-west Western Australia.

How does it travel?

Plants, plant materials, machinery and equipment, localised flight



Where will I see it?

Whole plant



Alternate hosts in Australia

A wide range of vegetables including tomato, potato, eggplant, sweetpotato.

What will I see?

Adult psyllids are very small (2 mm long) and can be difficult to see. Feeding causes the appearance of 'psyllid sugar'. Yellowing or purpling of the leaf midribs and margins. Leaves are often cupped, narrow and point upright, giving the plant a feathery appearance.

When will I see it?

Throughout the life of the plant.



What could it be confused with?

The adult psyllid is about the size of an adult aphid, but are more active and look like a tiny cicada when magnified. Leaf symptoms can be confused with those of the exotic disease zebra chip.

What to do if you see it?

This pest has been found in Western Australia. Any detections outside of Western Australia should be reported to the **Exotic Plant Pest Hotline** or your local department of agriculture.



Tomato potato psyllid adult

Whitney Cranshaw, Colorado State University, Bugwood.org



Tomato potato psyllid. Note size relative to a tomato

Whitney Cranshaw, Colorado State University, Bugwood.org



Tomato potato psyllid adults and nymphs

Whitney Cranshaw, Colorado State University, Bugwood.org

False codling moth

Thaumatotibia leucotreta

Where is it now?

Widespread in Africa, reported in Israel.

How does it travel?

Plant material, flight



Where will I see it?

Fruit



Alternate hosts in Australia

Range of crops including avocado, citrus, mango, pineapple.

What will I see?

Adult moths are grey-brown coloured and have a wingspan of 16-20 mm. Young larvae mine fruit just beneath the surface, or bore into the fruit causing premature ripening and fruit damage.

When will I see it?

Fruit development to harvest.



What could it be confused with?

False codling moth can look similar to other moths. Any unusual caterpillars in fruit should be investigated.



False codling moth

Pest and Diseases Image Library, Bugwood.org



False codling moth

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



False codling moth larvae damage on citrus fruit

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



False codling moth larvae are pinkish coloured

Marja van der Straten, NVWA Plant Protection Service, Bugwood.org

A glossary of terms used in this guide

Term	Description
Abiotic	Damage caused by something other than a pest or pathogen. For example, nutrient deficiencies, drought, flooding.
Axil	The area where a branch or leaf stalk joins the stem it is growing from.
Biotic	Damage caused by a pest or pathogen.
Canker	A dead, discoloured, often sunken area (lesion) on a branch, root, stem or trunk (e.g. left image).
	<i>Jonas Janner Hamann, Universidade Federal de Santa Maria (UFSM), Bugwood.org</i>
Chlorosis	Chlorosis is a condition in which leaves produce insufficient chlorophyll. This causes the leaves to become paler or yellow (e.g. left image).
	<i>Scot Nelson, Flickr</i>
Established pest	Established pests are those pests present within Australia.
Exotic pest	Exotic pests are those pests not present in Australia.
Exudate	Any substance that oozes out from the pores of diseased or injured plant tissue.
Frass	Fine powdery refuse or fragile perforated wood produced by the activity of boring insects or the excrement of insect larvae.
Honeydew	An excretion from insects, such as aphids, mealybugs, soft scales, and whiteflies, consisting of modified plant sap and composed mostly of sugars and water.
Lesion	Localised area of diseased or discoloured tissue.
Malformation	An irregular or abnormal structural development in a plant, often in vegetative and floral structures.
Mottling	A pattern of irregular marks, spots, streaks, blotches or patches of different shades or colours.
Necrotic	Dark discoloration and death of tissue.
Pest	The definition of a pest used in this document covers all insects, mites, snails, nematodes, pathogens (diseases) and weeds that may harm plants or plant products.
Terminal bud	Primary growing point.
Vascular tissue	Plant tissue that transports nutrients, photosynthesis products and water throughout the plant.





Australian Government
Department of Agriculture,
Water and the Environment



Plant Health
AUSTRALIA

This initiative is part of the Australian Government's *Agricultural Competitiveness White Paper*, the government's plan for stronger farmers and a stronger economy.

