Australian Summerfruit

Integrated Pest and Disease Management for Export

PROTOCOL MARKET FACTSHEETS

Version 7.1 – July 2024

Published July 2024

Disclaimer

Author credits: Charlotte Brunt and Russell Fox, Summerfruit Australia Ltd

Contents

1. Crop monitoring

Crop monitors must complete online training each year in accordance with registration of accredited properties as set out in Industry Advice Notices (IAN). The IAN contains the link to the online training course.

The DAFF online training does not generally deal with management options: It refers readers to several documents: The Summerfruit IPDM manual or the NSW DPI Plant Protection Manual. However, many protocol pests are not covered in these documents, hence the development of these factsheets. Section 8 "Information sources", describes where to find information on each pest.

Industry standard: The industry standard recognises trapping as the most effective monitoring measure for **Queensland Fruit Fly, Codling Moth and Light Brown Apple Moth**, **irrespective of destination**. Auditors will evaluate the monitoring practices acknowledged in the SAL standard as being effective.

Trapping: When setting up systems approach trapping in mixed blocks; the trapping density must always address the most stringent conditions where there is conflict to ensure requirements are met. For example, if there are mixed blocks containing apricots and nectarines, the 4 Ha nectarine systems approach density requirement overrides the 10 Ha requirement for apricots. The alternative is to separate mixed blocks into single commodities and only apply the relevant trapping density.

Crop monitors should also be familiar with the accredited property legislation relevant to their job function (https://www.agriculture.gov.au/biosecurity-trade/export/controlled-goods/plants-plant-products/accredited-properties), workplans and protocols. Workplans and protocols may be found in the "Documents" section of the Departments' Manual of Importing Country Requirements (MICoR https://micor.agriculture.gov.au/Plants/Pages/default.aspx). Users will need to register.

A crop monitor may be the grower, their employee or an external contractor. It is advisable to register at least 2 crop monitors for the export season in case one person gets sick or cannot undertake a full season of monitoring.

Some protocols and workplans specify control measures when a pest threshold has been breached such as degree day calculations, chemical or physical control, pruning etc. The crop monitor acts as an advisor to the grower. Any activities resulting from an inspection should be carried out by orchard staff under the instruction of the grower.

Growers or crop monitors must forward inspection results to the nominated packhouse prior to harvest and crop monitors must attend at least one grower audit each year.

Crop monitoring app

Results should be recorded in the GrowFruit App. When you open the app, blocks and traps will already have been set up. If you have any questions, please call or email Michael Crisera on growerservices@fgv.com.au or 04272 39871.

Maximum Residue Levels

Each country has their own MRL levels, which are often different to domestic MRLs. Caution is needed to ensure that MRLs are not exceeded as this can lead to diversion or destruction of product at the destination. Please consult the "Summerfruit MRL and WHP app" – available from your app store. A spreadsheet is also available from the SAL website (www.summerfruit.com.au).

2. Pests of quarantine concern

Carob moth (Ectomyelois ceratoniae)

Pest of concern to China & Vietnam

Protocol monitoring requirements

Monitor fortnightly from bud burst to harvest. Where pests or symptoms of such pests are detected during monitoring, biological or chemical control measures shall be adopted.

Vietnam requires trapping for moths in plums, degree day modelling to time interventions and a 600-piece inspection of fruit prior to harvest.

Description

- The greyish adult moth has a body length of 8 to 10 mm, and a wing span of 20 mm.
- Grey front wings have a wavy dark line, the rear wings are white-grey with light-brown veins. Larvae are unable to penetrate undamaged fruit. Female moths seek out hosts that have been injured or already infested to lay eggs.
- Eggs (0.75 mm long) are white when laid, turning deep pink before hatching. The eggs hatch in 3–7 days.
- The entire life-cycle takes 32-43 days depending on temperature, with adults living for 5-10 days and females laying up to 200 eggs during their lifetime.

Damage

Eggs are often laid on damaged fruit and nuts. On hatching the larvae tunnel into the fruit. Fleshy fruits are damaged by the larvae feeding on the seeds or near the stone.

Moths prefer to lay eggs on damaged fruit and larvae typically enter through cracks, rotten spots, or wounds caused by other pests.

Trapping and monitoring techniques

- Carob moth flights may be monitored with a species-specific pheromone lure in an industry standard delta trap. Place trap near top of tree where moths are active. Trapping is **mandatory for plums to Vietnam**.
- Replace lures each 4 weeks and sticky bases as needed to maintain 'stickiness'. Moths should be counted and removed from traps as you monitor.
- Check fruit for damage from shuckfall to rend of harvest.

Action and management

- **Vietnam plums**: Degree Day modelling must be undertaken once a biofix has been established. See page 25 for thresholds. Consult your agronomist for control options, MRLs and WHP.
- Routine spray schedules prevent build-up in commercial orchards. However, no pesticides are registered specifically for control of carob moth in Summerfruit, although insecticides used for other pests may control Carob Moth.



Scarlet mealybug (Pseudococcus calceolariae)

Pest of concern to Vietnam – Peaches and nectarines

The scarlet mealybug, has pronounced wax exudation on the median line which gives it a slight humped back appearance and their honeydew droplets are wine-red. It can have a considerable negative economic impact on apples and pears.

A high population of mealybugs can lead to fruit drop, fruit deformation and development of discolored welts on the rind of the fruit.

Mealybug secrete copious quantities of honeydew which is a substrate for a group of fungi, sooty mold. Sooty mold is black in color and may stain the fruit decreasing their market value as well as causing a delay in fruit color development. Photosynthetic potential, especially of young trees, may be negatively affected if sooty mold infection is severe. Mealybug is a phytosanitary pest in some export markets and if found on fruit destined for these markets, can result in rejection of the consignment and could place these markets at risk for the future.

There are specific natural enemies for different species of mealybugs.

See "mealybugs in IPDM manuals".

Potato aphid (Macrosiphum euphorbiae)

Pest of concern to Thailand

The potato aphid occurs on many crops such as potato, rose, tomato, aubergine, chrysanthemum and lettuce. It has a preference for potatoes, but can also be found on 200 other species.

Aphids are sap-sucking insects and can reproduce both sexually and asexually and thereby increase in numbers rapidly. Asexual reproduction does not involve eggs, but rather, the female produces live clones of herself. Aphids can transmit viruses.

Identification

The adult potato aphid is quite large, measuring approximately 4.0 mm, is pink or green in colour, and has a long tail. Winged females are slightly shorter than wingless ones. Pink wingless aphids have a yellowish head and a yellowish pink body.

*Photo on the left **showing** winged and wingless green potato aphids; on the right, pink forms*

Monitoring

Monitor fortnightly as required by export protocols, inspecting new leaves and shoots. Sticky cards are a useful monitoring tool for aphids and the presence of honeydew, or black from sooty mould growing on the honeydew is a sign of aphid activity.

Aphid distribution may be patchy, so monitoring should include at least 10 representative trees throughout the block.

Management

- Aphids have many predators, including ladybird beetles, lacewings, hover flies and parasitic wasps. The parasitic wasp *Aphidius colemani* effectively controls aphids and is commercially available.
- Ensure weed populations that are virus hosts (e.g. sow thistles) are controlled around crops.
- Aphid numbers can build up quickly during spring, but it is important to consider factors such as crop stage, soil moisture, forecasted weather conditions and beneficial insect activity before control measures are taken.
- Insecticides can be used if high numbers of aphids are present, but resistance can develop.

Plants cannot be cured once infected by a virus. Take the following measures to protect your crop from infection.

- Exclude or avoid the virus: Plant verified virus-free nursery stock and/or resistant varieties
- Reduce virus levels: Control weeds and other hosts of viruses and aphids around crops, headlands and farm buildings

Scale insects

- European brown scale (*Parthenolecanium corni)* - Thailand
- Pear scale (*Diaspidiotus pyri,* previously *Quadraspidiotus pyri)* - Vietnam
- Oleander Scale (*Aspidiotus nerii*) -- Vietnam
- Pear oyster scale (*Diaspidiotus ostreaeformis)* – Vietnam, China, Thailand
- San José scale (*Diaspidiotus perniciosus)* – Vietnam, Philippines
- Glover scale (*Lepidosaphes gloverii)* - Vietnam
- Oystershell scale (*Lepidosaphes ulmi)* - Vietnam
- Olive/plum scale (*Parlatoria oleae)* - Thailand
- Mulberry scale (*Pseudaulacaspis pentagona*) -Thailand
- Japanese baton shaped scale (*Lopholeucaspis japonica)* – Thailand

Protocol monitoring requirements

Must be monitored once every two weeks from the bud period to harvest by visual inspection of bark, trees and fruit. Where pests or symptoms of such pests are detected during monitoring, biological or chemical control measures shall be adopted.

Monitoring for the presence of crawlers is essential. The waxy coating excreted by scale insects makes control difficult, so control options must be targeted to the early crawler stages. Depending on scale type this may only last a few days to a week.

Heavily infested twig

Description

Scale insects can vary in size and appearance. There are 2 general forms of scale; hard-bodies and soft-bodies. Scales are usually circular, or oval- shaped, and secrete a waxy coating. Adults look like scales or shells, and are usually immobile. Females are often slightly larger than males. The immature insects (crawlers) have legs and are mobile while searching for an appropriate feeding site. They are usually pale (white to yellow/orange in colour).

Adult scale insects	***Colour***	***Shape***	***Size***
European Brown	*Brown, reddish-brown*	*Circular – oval*	*3mm*
Oleander	*White, yellow*	*Circular – oval*	*2.5mm*
Oystershell	*Dark brown, chestnut*	*Oval*	*2mm*
San Jose	*Gray, brown, black*	*Oval*	*1.5mm*
Pear Oyster scale	*Dark brown with central knob*	*Circular*	*2-2.5mm*
Oyster scale	*Greyish brown to dark brown*	*Oval*	*1.5-3mm*
Glover (long scale)	*Brown*	*Rod like*	*3mm*
Olive/Plum scale	*Grey to white*	*Sub-circular*	*1-2mm*
Mulberry Scale	*Mainly white, brown apex*	*Round-wedge*	*1.5-2.8 mm*
Japanese baton shaped	*White wax over brown scale*	*Rod like*	*1-1.8mm*

Life cycle

Scale can have several lifecycles within a season, up to 3 generations for San Jose scale. Brown scale usually only has one cycle per season. Female scales can lay over 1000 eggs, depending on type, and as such populations can grow rapidly. Crawlers usually appear in spring and start feeding within a day. Crawlers are mobile within a tree, but can also be transported between trees by wind. Once feeding starts, the crawlers become less mobile, and begin to secrete a protective waxy coating. The near mature crawlers can then overwinter and emerge as adults the following spring, once sap flow in the tree resumes.

Damage

Scale damage can be extensive. Scales can feed on leaves and twigs, and occasionally on fruit. When severe infestation occurs leaves can wilt, yellow and drop, and tree growth can become stunted. Like aphids, scale infestation can lead to the presence of a sweet 'honeydew' secretion. This secretion can additionally cause fungal problems

Action

A good winter program will help reduce numbers, and physical removal is possible but may not be practical. Chemical options are available. Refer to 'Integrated Pest and Disease Management for Australian Summerfruit' and industry notices and consult your agronomist for control options, MRLs and WHP.

Pear scale

Pear scale

Olive scale

San Jose Scale

European brown

Oystershell

Glover

Oleander

Oystershell

Oystershell scale insects. The tests of dead females (lower right) are surrounded by tiny, yellowish crawlers.

Photo by Whitney Cranshaw, Colorado State University, Bugwood.org

Mulberry scale

Japanese button shaped scale

3. Diseases of quarantine concern

Gumspot of stonefruit, aka shothole (*Stigmina carpophila* syn. *Wilsonomyces carpophilus*)

Pest of concern to China, Vietnam

Shothole or gumspot of stonefruit is caused by the fungus *Wilsonomyces carpophilus*. It is most common on apricot, peach, and nectarine. The fungus overwinters in infected buds and in small twig cankers. Infections can occur (via fungal spores) from spring to fall. Rainy weather spreads spores from infected tissue to leaves and fruit by splashed and wind-blown rain.

Symptoms

The most common symptoms of peach shot hole fungus are lesions on the twigs, buds, and leaves. These lesions start out as small, dark purple spots. Over time, these spots spread and turn brown, usually with a purple border. Eventually, dark bumps will form in the center of each lesion – these release spores that further spread the disease. Infected buds turn dark brown to black and shiny with gum. On infected leaves, the center of these lesions will often fall out, creating the "shot hole" appearance that earns the disease its name. In wet weather, the fungus will sometimes spread to the fruits, where it develops dark brown and purple spots on the skin and hard, corky areas in the flesh underneath.

Monitoring

During the growing season, check twigs and young leaves for small red spots. Check fruit for small purple-red spots.

Management

During spring pruning, remove twigs that have dead buds with a sunken, darkened area encircling them. Destroy infected wood. Try to keep trees dry, and never irrigate in a way that wets the leaves.

Shot can be treated with fungicides in the autumn just after leaf drop, or in the spring just before budbreak. For more information, talk to your agronomist.

Blight of grapevine (*Peyronellaea glomerata* formerly known as Phomo glomerata)

Pest of concern to China, Vietnam - Plums

Identification

Blight of grapevine is a globally distributed soil fungus that has been isolated from various plants (more than 100 host plant genera). Generally, it is considered a secondary invasive or opportunistic pathogen but is gaining economic importance as a pathogen in some crops in some locations where it can cause disease in pears, mangoes and wheat.

Symptoms

Blight of grapevine has been found causing canker (gummosis) and twig spot in peach trees from China. No photographs of leaf or trunk infection are available.

In mangoes, the symptoms of a blight of grapevine are visible only on older leaves.

Affected mango leaves display angular, yellow to brown irregular lesions scattered over the entire lamina. As the disease progresses the lesions grow and form larger patches that later turn into dull necrotic areas with grey centers and dark margins.

Mango leaves showing necrosis caused by Pryronellaea glomerata (blight of grapevine).

Monitoring

Inspect twigs, leaves and branches fortnightly.

Management

No registered products exist in Australia. Control using general principles of fungal disease management. Consult your agronomist.

Apple leaf, branch and fruit fungus (*Diaporthe eres*)

Pest of concern to China, Vietnam - Plums

Diaporthe eres is a minor fungal pathogen causing leaf spots, stem cankers and diseases of woody plants, mostly in temperate regions worldwide. It can infect apple, apricot, peach and plum trees.

Apple leaf, branch and fruit fungus symptoms, causing a walnut canker

Symptoms

The initial symptoms appear at the petiole, the leaf or a branch with discoloured areas. On leaves or petioles, streak lesions that are enlarged beyond the lesion margin sometimes produce black pycnidia on dead tissues. The inner bark and the bark above the infected cambium on branches may appear sunken and split along the canker margin. Thereafter, the fungus quickly kills branches and twigs, producing several prominent black pycnidia erupted through the bark, sometimes forming long neck-like rostrates. Perithicia are subsequently commonly found on diseased overwintering branches**.**

Monitoring

Monitor fortnightly as you would for other fungal diseases.

Management

Manage as you would for other fungal pathogens.

Powdery mildew of cherry (*Podosphaera clandestina var. clandestina*)

Pest of concern to China, Vietnam - Plums

Powdery mildew of cherry is a plant pathogen that causes a powdery mildew in apricots and peaches.

Powdery mildew is not normally a problem on apricots, but may **occasionally** cause fruit russeting. Primary inoculum is thought to originate mainly from nearby peaches and infected roses.

Symptoms

Powdery mildew appears in late spring or early summer as white mildew spots on the fruit and foliage. Later the spots on the fruit turn a tan colour. When severe, it may crack the fruit.

Flower infection is rare, although infected buds may be destroyed. The fungus mainly attacks the leaves, buds, green shoots and fruit, with different levels of infection in the different host species.

Leaves are commonly affected, with visible fungal growth on the leaf surface. As the infection develops, chlorosis, curling and necrosis begin to occur. Cleistothecia may become visible on leaves and shoots as specks that are yellow then reddish-brown, then black. Shoots may also appear stunted, and twigs show signs of white fungal growth. Young fruit will not form properly, and may show depressed or raised areas

Monitoring

Monitor fortnightly as you would for other fungal diseases.

Management

- Provide good air circulation through trees.
- Cling peaches, nectarines and seedling peaches are especially susceptible and can serve as a source of infection.
- Manage as you would for other fungal pathogens

White fungal growth of powdery mildew on leaves of sour cherry

Red blotches on Montmorency sour cherry caused by powdery mildew.

Plum pockets aka bladder plums (*Taphrina pruni*)

Pest of concern to China, Vietnam - Plums

Plum Pocket or Bladder plums are caused by a fungal infection of young European plums, causing them to develop abnormally, without stones.

The infection is caused by the fungus *Taphrina pruni*, which is related to the fungus which causes leaf curl.

After infection, the fungi prevent development of the stone and renders the fruit worthless. Distorted fruits appear from midsummer. Twigs can also become spongy.

Symptoms

First signs of the disease on fruit are small, white blisters. These enlarge rapidly and soon spread over the entire fruit. The fruit becomes spongy and tissues of the seed cavity wither and die. Fruit become bladder like, abnormally large, and misshapen with thick, spongy flesh. As their spongy interiors dry up, the plums turn velvety grey as spores grow on their surfaces. Infected fruit become hollow in the centre, turn brown, wither, and fall from the tree.

New shoots and leaves are usually infected as well as the fruit. Shoots thicken and often are curled or twisted. Diseased leaves are thickened and curled as in leaf curl.

Disease Cycle

Spores overwinter on twigs, and during cool, wet periods in early bloom can be splashed to the opening buds, where infection takes place. Developing ascospores give the infected fruit a velvety grey appearance, thus completing the disease cycle.

Disease Management

A spray program similar to the one for peach leaf curl also can control plum pockets.

Botryoshaeria diseases

- Grapevine trunk disease (*Botryosphaeria obtuse*)
- Apple canker (*Botrysphaeria ribis*)

Pest of concern to China, Vietnam- Plums

Identification

Botryoshaeria diseases are caused by species of fungi within the family *Botryosphaeriaceae*. These fungi are widespread and commonly associated with diseases of woody plants and fruit rots. Species of *Botryosphaeria* are found in most summerfruit growing regions of Australia. Botryoshaeria diseases are known to infect a wide range of hosts including native *Acacia, Eucalyptus* trees and shrubs and members of the protea family. Crop hosts include apples, grapevines, stonefruit and nut crops.

- The fungus over-winters as small dark 'pimple-like' structures (pycnidia) on diseased wood
- These structures release spores following hydration, throughout the growing season
- Spores are spread by wind, rain and irrigation water
- Infection occurs through fresh wounds in wood, e.g. pruning cuts
- The fungus can germinate at temperatures between 15-37oC and grows between 5-37oC.

Symptoms

- Infection by species of *Botryosphaeria* results branches in the form of gummosis.
- Infection by species of *Botryosphaeria* are favoured by conditions that reduce tree vigour, including drought, frost, hail, high summer temperatures, poor nutrition and poor pruning practices.
- Cankers can form around pruning wounds.
- Wounds (hail, freezing, insects, birds etc) serve as entrance points for the infection of twigs and trunks. The infection moves towards the ground from the wound site.

Monitoring

Monitor fortnightly inspecting twigs, trunks and leaves. Diagnosis is difficult and likely uncertain.

Management

- Remove and burn infected wood and protect fresh pruning wounds
- **Avoid pruning/wood damage in warm wet weather when spores are being released.**
- Practice orchard hygiene and general disease management.
- Prevention should focus on keeping stress factors low.
- See "Fungal Gummosis in Peach Factsheet" from the University of Florida and consul your agronomist

Verticillium wilt *(Verticillium albo-atrum)*

Pest of concern to Vietnam - Plums

Verticillium albo-atrum and *Verticillium dahliae* are two closely related fungi and have been reported as the same species, leading to much confusion.

Verticillium albo-atrum has not been reported as a pest of peaches, plums or apricots, whereas *V. dahliae* has (Walker 1990). In addition, *V. albo atrum* has only been isolated in Australia from potato cultures and many countries have reported geographic and host range differences, with *V. albo-atrum* preferring colder conditions and V*. dahliae* preferring warmer climates.

For the purposes of this crop monitoring module, Verticillium wilt will be based on information on *V. dahliae*, not V*. albo-atrum*.

Symptoms

The disease is usually observed in early summer as a progressive loss of leaves from infected limbs, starting at the base of each branch

Leaves may become yellow and dull in appearance before dropping prematurely. By late summer, only a tuft of leaves may remain at the tip of a severely affected branch.

Occasionally leaves may show a true wilt, and when the death of these leaves is very rapid they may remain attached to the plant for several weeks. An entire tree can show these symptoms, or infection may be confined to one side, or even one branch, of the tree.

The most important diagnostic symptom of this disease is found when the trunk, branches or twigs are cut open to reveal the internal wood. Diseased wood shows in the cross section as a series of light to dark brown, irregularly shaped spots that sometimes merge into a ring of stained tissue. In mild cases of infection, wood staining may occur in the absence of any leaf symptoms.

The disease is serious for commercial growers because, though affected trees rarely die quickly, they may remain stunted and unproductive for many years. There is also a strong probability that replacement trees will be attacked in later seasons.

Apricot tree showing loss of leaves at top of tree

Note tufts of leaves at top of twigs in severely affected branches

Disease cycle

Brown-stained wood (xylem tissue) in shoots from an infected tree

The fungus survives in the soil for many years as resting-bodies (micro-sclerotia) and as a root-parasite of many crop plants and weeds. Mycelium enters a healthy plant by penetrating the root hairs, or through any wound. The fungus then grows into the water-conducting wood, in which it forms spores.

These spores are carried upwards, with the flow of water, to the stem and leaves, giving rise to a continuous strand of infected wood from the invaded root to the branches and leaves vertically above it.

Management

Verticillium wilt is difficult to control because the source of infection occurs in the soil and the fungus spreads internally throughout the tree. No method is available for treating infected orchard trees.

To prevent *Verticillium* from attacking fruit trees, try to reduce the amount of fungus in the soil. You can do this in the following ways:

- Only plant new blocks of stone fruit on land that has been under grass for several years and avoid planting stone fruit into sites that have had a history of crops such as potatoes, tomatoes or strawberries.
- If fruit trees must be planted in soil known to be infested with *Verticillium*, then plant apples or pears, as these species show marked resistance to the disease. Apricots grown on plum rootstocks also show some resistance to the disease, and can be planted where other options are not available.
- Use only high-quality, disease-free planting material, because transmission of *V. dahliae* in vegetative planting stock is significant.
- Avoid intercropping blocks of young stone fruit with tomatoes, potatoes, peppers, strawberries or melons, as these susceptible crops can increase the population of *Verticillium* in the soil.
- Suppress weeds after planting or sow the block down to grass and clover to prevent a rapid increase of *Verticillium* in the soil. Important weed hosts of *Verticillium* belong to the families *Chenopodiaceae* (fat hen), *Solanaceae* (nightshade), and *Amaranthaceae* (red-root amaranthus).
- Remove seriously affected, unproductive trees and as much of their roots as possible. Fumigate or otherwise treat (for example, by soil solarisation) the area to kill any remaining fungus before replanting.
- Avoid subjecting young plants to water stress, root damage and excessive quantities of fertiliser.

4. Viruses of quarantine concern

Prunus necrotic ringspot virus (PNRSV)

Pest of concern to China, Vietnam

Protocol monitoring requirements

Orchards/blocks must be monitored for cankers and other symptoms every two weeks. During harvest, fruit must be checked for symptoms.

If these diseases are detected in-field or during harvest, cultural, biological or chemical control measures must be implemented.

Description

Prunus necrotic ringspot virus (PNRSV) is a plant pathogenic virus causing ring spot diseases affecting species of the genus Prunus. PNRSV is found worldwide due to easy transmission through plant propagation methods and infected seed.

PNRSV can be transmitted through plant propagation methods, making spread through tree nursery stock and root grafting in orchards problematic. The virus also has been shown to infect and transmit through pollen and seeds or by bees carrying infected pollen into orchards.

Damage

The common symptoms also include necrotic "shot holes" in leaves or rugosity and mosaic symptoms. It is important to note that symptom severity varies due to host cultivar and viral isolate.

Symptoms generally consist of chlorosis, necrosis, leaf deformity, and stunting. Entire plants may be affected, or only a limb or branch may show symptoms.

Monitoring technique

Symptoms on orchard trees can include death of buds and roots, reduced tree survival and uniformity.

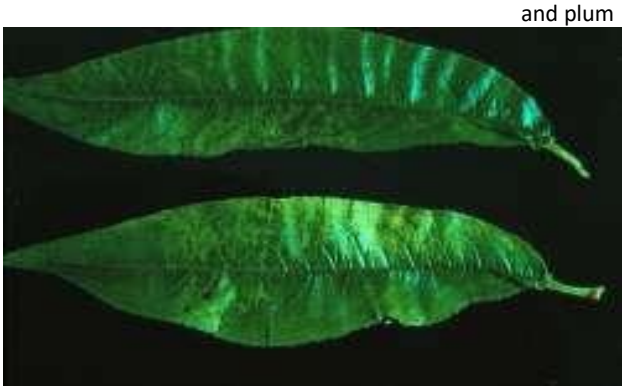
Monitor for the common symptoms of necrotic "shot holes" in leaves, especially in early spring for trees with weak aerial growth and the 'shothole' symptoms. Take care to confirm that other causes of 'shothole' are eliminated before diagnosis of PNRSV.

Action

- Control measures include appropriate chemical application (fungicides and copper sprays) and removal of infected plant material.
- The most important measure in controlling PNRSV is through planting of certified virus-free trees.
- Prune before and during winter. If PNRSV is detected during winter pruning, remove all mummies.

Refer to NSW DPI 'Plant Protection Guide' (2023), industry notices and consult your agronomist for control options, MRLs and WHPs.

Shothole symptoms of Prunus necrotic ringspot virus are very visible on cherry and plum



This the fungal Shothole disease – NOT Prunus necrotic ringspot virus

Prune dwarf virus (PDV)

Pest of concern to China, Vietnam

Identification

Prune dwarf virus is a systemic viral infection which can infect plums and other stonefruit. Prune dwarf virus (PDV) is spread by pruning with infected tools, budding or grafting. Infected trees can also produce infected pollen and seed. There is little spread of the virus in the orchard until the tree is old enough to flower. Due to pollen transmission, a high percentage of the seeds may carry the virus.

Some rootstocks exhibit hypersensitivity to Prune dwarf virus and Prunus necrotic ringspot virus, which results in death of the scion.

Symptoms of PDV in peach include **darker green foliage, rosette formation in developing shoots, shortened internodes, and reduction in both plant and fruit growth**. Frequently, PDV occurs in mix infections with other ilarviruses, like PNRSV.

Causes dwarf (narrow, leathery leaves) in Italian prune.

Monitoring and control

The best method of controlling prune dwarf disease is prevention. Whenever pruning, sanitise your tools between each cut. If you do any grafting or budding of cherry trees, use only certified disease-free plant stock. It is also a good idea not to plant new trees near any orchards with older, possibly infected stone fruit trees. Trees are more susceptible to contracting this disease naturally once they are mature enough to produce blooms and set fruit.

Once a tree is infected, there are no chemical treatments or cures for prune dwarf virus. Symptoms may be restricted to one limb or section of the tree. Despite this localisation, the whole tree is infected. Infected trees should be removed and destroyed

Refer to NSW DPI 'Plant Protection Guide' (2023), industry notices and consult your agronomist for control options, MRLs and WHP.

PDV symptoms on leaves include chlorotic rings, spots, mottle, mosaic, line patterns, necrotic spots and shot holes

Arabis mosaic virus

Pest of concern to Vietnam - Plums

Arabis mosaic virus is a viral plant pathogen that is known to infect multiple hosts: strawberries, hops, hemp, grape, geraniums, rhubarb, raspberries, sugar beets, celery, horseradish, lilac, lettuces **including peach**.

Infected plants typically exhibit symptoms such as mosaic patterns on leaves, leaf discoloration (yellowing or mottling), stunted growth, and reduced vigor. The severity of symptoms can vary depending on factors such as the viral strain, host plant species, and environmental conditions.

Symptoms

While it is common for the host not to show any symptoms, there are some symptoms that can occur. The most prevalent symptoms of Arabis mosaic virus are stunting of the plant and leaf flecking pr mottling and small abnormal growths (enations).

Disease cycle

This virus is transmitted mainly through the soil by nematodes, but it can also be transmitted by insects, seeds and pollen.

Monitoring

Monitor fortnightly from budburst to harvest, but pay particular attention in the middle of the growing season and observe plants for unusual leaf coloration.

Management

- Plant only certified disease-free material, and only propagate cuttings from healthy plants.
- If there is a concern about nematodes in the field, consider a diagnostic soil test.
- Remove plants with positive diagnosis.
- Before planting a new block, test to ensure blocks are not infected with disease causing nematodes
- Manage as per other viruses

Other viruses, genetic abnormalities, nutrient deficiencies (nitrogen, iron, magnesium), herbicide damage, stunted growth due to poor growing conditions.

Apricot pseudo-chlorotic leaf spot virus

Pest of concern to Vietnam - Plums

Apricot pseudo-chlorotic leaf spot virus (APCLSV) is a novel, still poorly known virus. It is most closely related to Apple chlorotic leaf spot virus (ACLSV) (2,4) and infects stone fruit trees of the Prunus genus. Its presence has so far been detected in apricot, plum, Japanese plum, and peach trees in Italy, Spain, France, Hungary, Turkey, Jordan, and Australia.

Symptoms

Infected trees exhibit chlorotic spots on the leaves, which can lead to premature leaf drop. The leaves may also show vein clearing and general chlorosis (yellowing).

The virus can cause reduced fruit size and quality. In severe cases, it may lead to fruit deformation and drop.

Infected trees often exhibit stunted growth and reduced vigour.

Transmission

APCLSV is primarily spread through vegetative propagation methods such as grafting and budding. It can also be transmitted by mechanical means through contaminated tools.

There is no known insect vector for APCLSV, which differentiates it from some other plant viruses.

Diagnosis

Diagnosis of APCLSV typically involves serological methods such as ELISA (Enzyme-Linked Immunosorbent Assay) and molecular techniques like RT-PCR (Reverse Transcription Polymerase Chain Reaction).

Management and Control

- Use of virus-free propagation material is crucial. Tools should be disinfected between uses to prevent mechanical transmission.
- Monitor fortnightly from budburst to harvest, but pay particular attention in the middle of the growing season and observe plants for unusual leaf coloration.
- Infected trees should be removed and destroyed to prevent the spread of the virus.
- Developing and planting resistant apricot varieties is a long-term strategy for managing APCLSV.

Impact on Horticulture

APCLSV poses a significant threat to apricot production due to its impact on tree health and fruit quality. Effective management practices are essential to maintain healthy orchards and ensure high-quality fruit production.

Monitoring

Monitor fortnightly from budburst to harvest, but pay particular attention in the middle of the growing season and observe plants for unusual leaf coloration.

5. Calculating degree days

From NSW DPI "Plant Protection Guide" (2023).

What are degree days?

Insect development is temperature-driven. Degree days (DD) are a measure of temperature over time and are used to predict the timing of life stages of certain insect pests. A degree day model counts the total time that temperature is above the minimum required for the pest to develop (lower developmental threshold).

There are established DD models for codling moth (CM), light brown apple moth (LBAM) and oriental fruit moth (OFM). These are best at predicting the first generation of activity and typically become less reliable with subsequent generations as the season progresses. For this reason, some insecticide labels for these key pests include DD recommendations for the timing of the first sprays. Knowing how to calculate DD will help the grower to time their first sprays effectively.

What do you need?

To use DD for your first spray timing, you will need:

- pheromone traps to determine biofix
- thermometer (max-min or weather station)
- calculator or spreadsheet

What is biofix?

Biofix is the date of the first sustained flight of adult moths recorded in pheromone traps. It is used as a starting point for the accumulation of degree days and to guide the timing of the first spray.

How to determine the biofix

Deploy traps at a density of about one per hectare, ensuring coverage of the warmest part of the orchard and any known hotspots where damage occurred in the previous season(s). Establish traps at least 1 week before bloom for CM and OFM, but budbreak for LBAM. The aim is to record at least 2 weeks with no moths in the traps before the first flights begin. This will increase confidence in determining the biofix when moths do emerge from their overwintering pupation sites and fly into the canopy.

Checking traps daily until the first sustained moth flight is recorded will increase the accuracy of the biofix date that you set.

Calculating and accumulating DD from biofix

A simple formula for calculating DD using daily maximum and minimum temperatures and the lower developmental threshold for the pest is:

$$\text{Degree days} = \frac{(\text{max temp °C} + \text{min temp °C})}{2} - \text{lower developmental threshold °C}$$

Example calculation

For codling moth (with a lower developmental threshold of 10 °C; see table below) on a day where the daily maximum temperature was 18 °C and the minimum 7 °C, the DD for that day would be 2.5, calculated as follows:

$$\text{Degree days} = \frac{(18\,°C + 7\,°C)}{2} - 10$$
$$DD = 25 \div 2 - 10$$
$$DD = 12.5 - 10$$
$$DD = 2.5$$

DDs are calculated daily from biofix and added together to give cumulative degree days (CDD). If using a max-min thermometer, this is best housed in a Stevenson screen (Figure 1) to ensure accurate measurement of ambient temperature, which can be recorded in a spreadsheet or on paper. Some weather stations with inbuilt models will track DD accumulation and predict first spray timing. Table 2 provides an example of how to accumulate degree days in a spreadsheet format.

Label recommendations for spray timing

Most insecticides for CM, OFM and LBAM target the start of egg hatch (i.e. larval stages). The active ingredient fenoxycarb (e.g. Insegar®) is a notable exception that only controls newly laid eggs. Codling moth and OFM egg hatch occurs on average at approximately 110 CDD from biofix, while egg hatch occurs around 140 CDD for LBAM and 687 DD for Carob moth. Refer to product labels for recommendations on timing applications based on cumulative degree days. Developmental thresholds are shown in table 1 below:

Table 1: Developmental thresholds for key moth species

Moth pest	Lower developmental threshold (°C)	Egg hatch (DD)
Codling moth	10.0	110
Light brown apple moth	7.0	140
Carob moth	11.0 C	687
Oriental fruit moth	7.5	110

Table 2: An example of a codling moth DD record sheet showing degree days (DD) and cumulative degree days (CDD).

Date of temperature recording	Maximum temperature (°C)	Minimum temperature (°C)	Degree days	Cumulative degree days
3.10.19 Biofix	12	5	0.0	0.0
4.10.19	22	6	4.0	4.0
5.10.19	25	10	7.5	11.5
6.10.19	19	8	3.5	15.0
7.10.19	27	12	9.5	24.5
8.10.19	24	10	7.0	31.5

Figure 1: A Stevenson screen -recommended housing for temperature recording in the orchard.

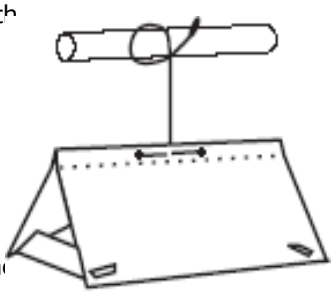
6. Delta trap & pheromone lures

Delta Traps are specially designed open-ended traps. The moths are attracted to the trap by the pheromone lure. Once inside the trap the moths stay attracted to the lure and they fly around until exhausted. The moths land onto the sticky inserts where they are caught.

This trapping kit contains the delta trap with two interlocking sections (the outer trap and the wire hangar), sticky inserts and lures.

Assembling the Trap:

- Fold the trap into a tent shape, and secure the top of the trap with the wire hangar. Peel the paper covering from the sticky insert. Open a foil pack of the pheromone lure.
- Using tweezers or the foil pack, drop the lure onto the centre of the sticky insert. Do Not touch the lure with your fingers as this may contaminate the pheromone scent of the lure
- Insert the sticky insert into the trap. Fold the ends of the trap up and clip into slots in the sidewalls.
- Twist the end of the wire hangar around a branch at the top of the tree.



CAUTION: Adhesive on the sticky insert is extremely sticky. Handle with care. Adhesive may be removed with vegetable or baby oil. Keep out of reach of Children and Pets

Storage: Spare pheromone lures should be stored in their unopened pack, in a refrigerator

Monitoring & Maintenance
Check traps fortnightly as required for export protocols

Count and record the number of moths caught.
Remove all moths and any other stray insects with a scraper or twig.

Monthly - Monitoring & Maintenance
Renew the pheromone lure monthly.
Place the lure onto the centre of the sticky insert.

Take the foil pack, old lure & old sticky insert out of the orchard.

Replace sticky insert when the stickiness is reduced (through dust or moth catches).

- Codling Moth Specific Directions: Place the trap in the very top of the tree at bud burst. The trap should be placed in the top of the tree.
- **Oriental Fruit Moth Specific Directions**: Place the trap in the tree at bud burst. Position the trap in the top 1/3 of the tree.
- **Light Brown Apple Moth Specific Directions**: Place the traps in the trees at bud burst. Position the trap 1.5 m above ground level.

General guidance on trap servicing

It is recommended that the servicing guidelines for traps from commercial suppliers be followed. In addition:

- Check traps every two weeks or after bad weather events (rain, strong winds etc.) which can damage the trap or blow the trap out of the tree.
- Remove any debris blocking trap entry ports or funnels, including leaves, twigs or laterals
- Ensure that all lures are still in place.
- Remove any suspect specimens from the trap each time the trap is monitored and record the number of insects.
- Change lures according to the length of effectiveness for each species and manufacturers recommendations. Record lure changes on monitoring records
- Lures should not be handled with bare hands. Gloves or tweezers can be used, but whatever tool is chosen, pheromone cross-contamination when working with lures for different moth species must be avoided.
- Spent lures and new lure packaging and replaced sticky pads must be removed from the orchard.

7. Monitoring summaries

Peaches and nectarines

Summerfruit pests of quarantine concern which have a crop monitoring requirement	
Peaches and nectarines	**Trapping**
Monitoring required	Trapping in recognised PFAs not required (*)
	Standard trapping density is 1 trap per 10Ha (or part thereof), unless sotherwise specified
	QFF and LQFF are attracted to the same lure
	Systems approach trapping: Cold treatment to Vietnam is 1 trap per 4 Ha for codling moth and OFM.
	Vietnam irradiation pathway: NO trapping required for treatment at 400 Gray (covers all pests)
	MFF trapping is covered by State based Government trapping
	QFF, LBAM and CM traps are required for all protocol markets as per the industry standard

Common name	China	Vietnam	Thailand	Philippines	Taiwan
Fruit flies					
&Mediterranean fruit fly	State	State	State	State	State
#Queensland fruit fly	Trap*	Trap*	Trap*	Trap*	Trap*
Lesser Queensland fruit fly					
Jarvis' fruit fly					
Moths					
Light brown apple moth	Trap		Trap		
Codling moth	Trap	Systems approach: 1/4Ha. DD modelling and 600 piece pre harvest inspection also required.		Trap	Trap
Carob moth					
Oriental fruit moth		Systems approach: 1/4Ha. DD modelling and 600 piece pre harvest inspection also required.			
Native budworm (*Heliothis*)					
Thrips					
Black plague thrips	Yellow sticky traps				
Western flower thrip					
Plague thrips					
Other insects					
Fuller's rose beetle/weevil					
Garden weevil / Vine calandra					
Black peach aphid					
Potato aphid					
Scarlet mealy bug					
Scale insects					
Oleander scale					
San Jose scale					
Pear scale/ pear oyster scale					
Oystershell scale					
Olive scale					
Glover scale					
European brown scale					
Plum scale					
Mulberry scale					
Japanese button shaped scale					

Diseases					
Brown rot / Blossom blight					
Crown rot (*Phytophora*)					
Bacterial blast (*Pseudomonas syringae*)					
Grapevine trunk disease (*Botryosphaeria obtuse*)					
Canker: apple (*Botryosphaeria ribis*)					
Gumspot of stone fruit (*Wilsonomyces carpophilus*)					
Blight of grapevine (*Phoma glomerata*)					
Rust: peach (*Tranzschelia discolor*)					
Viruses					
Prune dwarf virus					
Prunus necrotic ringspot virus					

Plums

Summerfruit pests of quarantine concern which have a crop monitoring requirement					
Plums	**Trapping**				
	Trapping in recognised PFAs not required (*)				
	Standard trapping density is 1 trap per 10Ha (or part thereof), unless otherwise specified				
Monitoring required	MFF traps are covered by State based Government trapping				
	QFF, LBAM and CM traps are required for all protocol markets as per the industry standard				
	QFF and LQFF are attracted to the same lure				
	Vietnam systems approach: Trapping required for cold treatment				
	#Vietnam irradiation pathway: NO trapping required for treatment at 400Gy treatment (covers all pests).				
Common name	**China**	**Vietnam**	**Thailand**	**Philippines**	**Taiwan**
Fruit flies					
&Mediterranean fruit fly	State	State	State	State	**P**
#Queensland fruit fly	Trap*	Trap*	Trap*	Trap*	**R**
Lesser Queensland fruit fly					**O**
Jarvis' fruit fly					**H**
Moths					**I**
Light brown apple moth	Trap		Trap		**B**
Codling moth	Trap	Systems approach: 1/4Ha. DD modelling and 600 piece pre harvest inspection also required.		Trap	**I**
Carob moth		Systems approach: 1/4Ha. DD modelling and 600 piece pre harvest inspection also required.			**T**
Oriental fruit moth		Systems approach: 1/4Ha. DD modelling and 600 piece pre harvest inspection also required.			**E**
Native budworm		SAL has prepared a pest list for Vietnam to allow growers to set up for trade in 2024, should the protocol be ratified shortly. We have done this to the best of our ability, but there is no guarantee that this list is correct.			**D**
Thrips					
Black plague thrips	Yellow sticky traps				
Western flower thrip					
Plague thrips					
Other insects					
Fuller's rose beetle/weevil					
Garden weevil / Vine calandra					
Black peach aphid					
Scale insects					
Pear scale/ pear oyster scale					
San Jose Scale					
Oystershell scale					
European brown scale					
Plum scale					
Mulberry scale					
Japanese button shaped scale					
Olive scale (Parlatorea olea)					

Diseases					
Brown rot / Blossom blight					
Crown rot (*Phytophora*)					
Grapevine trunk disease (*Botryosphaeria obtuse*)					
Canker: apple (*Botryosphaeria ribis*)					
Bacterial blast/canker (*Pseudomonas syringae, pv syringae & pv morsprunorum)*					
Pseudomonas viridiflava					
Gumspot of stone fruit (*Wilsonomyces carpophilus*)					
Verticillium wilt *(Verticillium albo-atrum*)					
Powdery mildew of cherry (Podosphaera clandestina var. clandestina)					
Peach rust *(Tranzschelia pruni-spinosae var. discolor)*					
Shothole (*Stigmina carpophila)*					
Apple leaf, branch and fruit fungus (*Diaporthe eres*)					
Pocket Plum *(Taphrina pruni)*					
Viruses					
Apricot pseudo-chlorotic leaf spot virus					
Arabis mosaic virus					
Prunus necrotic ringspot virus					
Prune dwarf virus					

Apricots

Summerfruit pests of quarantine concern which have a crop monitoring requirement					
Apricots	**Trapping**				
Monitoring required	Trapping in recognised PFAs not required (*)				
	Standard trapping density is 1 trap per 10Ha (or part thereof), unless otherwise specified				
	QFF and LQFF are attracted to the same lure				
	QFF, LBAM and CM traps are required for all protocol markets as per the industry standard				
	MFF traps are covered by State based Government trapping				
Common name	**China**	**Vietnam**	**Thailand**	**Philippines**	**Taiwan**
Fruit flies					
&Mediterranean fruit fly	State	**P**	State	State	**P**
#Queensland fruit fly	Trap*	**R**	Trap*	Trap*	**R**
Lesser Queensland fruit fly		**O**			**O**
Jarvis' fruit fly		**H**			**H**
Moths		**I**			**I**
Light brown apple moth	Trap	**B**	Trap		**B**
Codling moth	Trap	**I**		Trap	**I**
Carob moth		**T**			**T**
Oriental fruit moth		**T**			**T**
Native budworm		**E**			**E**
Thrips		**D**			**D**
Black plague thrips	Yellow sticky traps				
Western flower thrip					
Plague thrips					
Other insects					
Fuller's rose beetle/weevil					
Garden weevil / Vine calandra					
Black peach aphid					
Potato aphid					
Scale insects					
San Jose scale					
Pear scale/ pear oyster scale					
Oystershell scale					
European brown scale					
Plum scale					
Mulberry scale					
Japanese button shaped scale					
Diseases					
Brown rot / Blossom blight					
Crown rot (*Phytophora*)					
Viruses					
Prunus necrotic ringspot virus					

8. Information sources

P&D resources	
Pests of quarantine concern and where to find information and factsheets are shown below	
Fruit flies	
&Mediterranean fruit fly	IPDM for Australian Summerfruit; DAFF Online CM training
#Queensland fruit fly	IPDM for Australian Summerfruit; NSW DPI Orchard Plant Protection Guide; DAFF Online CM training
Lesser Queensland fruit fly	DAFF Online CM training
Jarvis' fruit fly	DAFF Online CM training
Moths	
Light brown apple moth	IPDM for Australian Summerfruit; NSW DPI Orchard Plant Protection Guide; DAFF Online CM training
Codling moth	IPDM for Australian Summerfruit; NSW DPI Orchard Plant Protection Guide; DAFF Online CM training
Carob moth	DAFF Online CM training; Summerfruit factsheets
Oriental fruit moth	IPDM for Australian Summerfruit; NSW DPI Orchard Plant Protection Guide; DAFF Online CM training
Native budworm	NSW DPI Plant Protection Guide
Thrips	
Black plague thrips	IPDM for Australian Summerfruit; DAFF Online CM training
Western flower thrip	IPDM for Australian Summerfruit; NSW DPI Orchard Plant Protection Guide
Plague thrips	NSW DPI Orchard Plant Protection Guide
Other insects	
Fuller's rose beetle/weevil	NSW DPI Orchard Plant Protection Guide; DAFF online CM training
Garden weevil / Vine calandra	NSW DPI Orchard Plant Protection Guide; DAFF online CM training
Scarlet mealy bug	Summerfruit factsheets
Potato aphid	Summerfruit factsheets
Black peach aphid	IPDM for Australian Summerfruit; NSW DPI Plant Protection Guide; DAFF online CM training
Scale insects	
Pear scale	Summerfruit factsheets
Pear Oysterscale	Summerfruit factsheets
San Jose Scale	IPDM for Australian Summerfruit; NSW DPI Orchard Plant Protection Guide; DAFF Online CM training; Summerfruit Factsheets
Oystershell scale	NSW DPI Orchard Plant Protection Guide
European brown scale	Summerfruit factsheets
Mulberry scale	Summerfruit factsheets
Japanese button shaped scale	Summerfruit factsheets
Olive (or Plum) scale (Parlatorea olea)	Summerfruit factsheets

Diseases	
Brown rot / Blossom blight	IPDM for Australian Summerfruit; NSW DPI Orchard Plant Protection Guide; DAFF online CM training
Crown rot (*Phytophora*)	IPDM for Australian Summerfruit; NSW DPI Orchard Plant Protection Guide; DAFF online CM training
Grapevine trunk disease (*Botryosphaeria obtuse*)	IPDM for Australian Summerfruit; Summerfruit factsheets
Canker: apple (*Botryosphaeria ribis*)	IPDM for Australian Summerfruit; Summerfruit factsheets
Bacterial blast/canker (*Pseudomonas syringae, pv syringae & pv morsprunorum)*	NSW DPI Orchard Plant Protection Guide; IPDM for Australian Summerfruit
Pseudomonas viridiflava	See factsheets for management of other *Pseudomonas spp*
Gumspot of stone fruit (*Wilsonomyces carpophilus*)	Summerfruit factsheets
Verticillium wilt *(Verticillium albo-atrum*)	Summerfruit factsheets
Powdery mildew of cherry (Podosphaera clandestina var. clandestina)	Summerfruit factsheets
Peach rust *(Tranzschelia pruni-spinosae var. discolor)*	IPDM for Australian Summerfruit; NSW DPI Orchard Plant Protection Guide
Shothole (*Stigmina carpophila)*	IPDM for Australian Summerfruit; NSW DPI Orchard Plant Protection Guide
Apple leaf, branch and fruit fungus (*Diaporthe eres*)	Summerfruit factsheets
Blight of grapevine (*Peyronella glomerata*)	Summerfruit factsheets
Pocket Plum *(Taphrina pruni)*	Summerfruit factsheets
Viruses	
Apricot pseudo-chlorotic leaf spot virus	Summerfruit factsheets
Arabis mosaic virus	Summerfruit factsheets
Prunus necrotic ringspot virus	DAFF Online CM training; Summerfruit factsheets
Prune dwarf virus	Summerfruit factsheets

Summerfruit Export

Integrated Pest Management Program