NSW DEPARTMENT OF
PRIMARY INDUSTRIES

Readers' Note

Other pests and diseases of Australian summerfruit

Armillaria

Heavy gumming associated with an Armillaria infection

Armillaria mycelium under the bark of an infected tree

Armillaria fruiting bodies (mushrooms)

Armillaria is a soil-inhabiting fungus that causes root rots. It can be a problem in Stanthorpe, the Perth Hills, the Goulburn Valley and the NSW Central West. There are no registered products for the control of *Armillaria* for Australian summerfruit. The presence of white, fan-shaped mycelia (fungal strands) under the bark distinguishes this disease from that caused by *Phytophthora* (page 98).

Armillaria infects a large number of native and imported tree species, including summerfruit. Many infections arise because blocks are planted on recently cleared land that contained infected native trees, especially wattles. Consider the history of any new block before planting.

No rootstock is resistant to *Armillaria*, although some are more tolerant. Australian growers have noted that summerfruit grown on peach stocks is less likely to become infected. Overseas research has shown that the infection progresses more slowly on slow-growing stocks, and these should be considered in areas prone to infection.

Management recommendations are similar to those for *Phytophthora* (page 98).

Remove infected trees from the orchard and burn them. A thorough and time-consuming clean-up of the tree-removal site must be done to ensure that the disease does not spread to uninfected trees. In addition to the above-ground portion of the tree, all root fragments larger than 2.5 cm must be removed and burnt. Be careful not to drop any infected tree parts as you remove them from the orchard, as this will spread the disease.

Crown gall

Crown gall, caused by the bacterium *Agrobacterium tumefaciens*, is common in Australian orchards (except Western Australia) but is not regarded as a serious problem. It is effectively controlled by a biological control agent. The pathogenic *A. tumefaciens* is believed to be present in most soils and can be spread by water, cultivation, insects and tools used in propagation. Wounds on susceptible trees may be colonised and infected by the pathogen. Once trees are infected nothing can be done to control the disease.

NoGall™ is a product based on a specific strain of another species of bacterium, *Agrobacterium radiobacter*. This organism is not disease causing and was found to be antagonistic to the crown gall-causing bacterium. When *A. radiobacter* gets to a wound first, it inhibits the development of crown gall. Nogall™ is part of an integrated pest and disease management strategy for crown gall. Other components are:

- good site selection to avoid waterlogging
- avoiding unnecessary damage to the roots
- frequently disinfecting pruning and propagating equipment
- avoiding nursery soils known to have pathogenic *Agrobacterium* or nematode infestation
- careful choice of rootstock.

Nogall™ is manufactured and distributed in Australia by:

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Crown gall caused by Agrobacterium tumefaciens

Fruit-sucking insects

A wide range of insects can become minor and occasional pests of Australian summerfruit. These include leaf hoppers (previously known as jassids), mirids (including apple dimpling bug), stink bugs, stainer bugs, chinch bugs (including Rutherglen bugs), squash bugs and rhopalid bugs.

These insects become pests because they suck on developing or mature fruit. Because of the range of insects involved the damage caused also varies, but it tends to involve pitting of the fruit. Sometimes gumming is also associated with the pitting. In peaches, some insect types (e.g. fruit-spotting bugs; *Amblypelta nitida*) cause fruit blemishes with collapsed areas that have gum pockets underneath.

These pest insects tend to become a problem in orchards that have reduced their insecticide applications through IPDM strategies (such as mating disruption) for Oriental fruit moth.

Insecticide options for control of these insects are limited and not recommended. The problem is rarely severe enough to warrant specific control measures.

Apple dimpling bug

More information on fruit sucking insects is available at the NSW Department of Primary Industries website at www.agric.nsw.gov.au

Fruit tree moth borer

Maroga melanostigma

Fruit tree moth borer can be a problem in the NSW Central West, Swan Hill, Riverlands, NSW North Coast, Adelaide Hills and Goulburn Valley. The moth is an Australian native species that attacks many native and ornamental trees, including summerfruit. It is usually regarded as a minor and occasional pest. However, in certain years it can cause severe losses. Although it has been known as a pest of fruit trees in Australia since the 1940s, it only really became noteworthy following the banning of DDT in 1987. Larvae tunnel into main limbs, secondary limbs and the tree trunk. Infestation can lead to ringbarking and the death of limbs.

There is no cost-effective control of this pest, and no insecticide is registered for spraying or injecting trees. Current practice by growers is to either leave the damage untreated or infiltrate the borer workings with a thin wire to pierce the larva. Treatment of large numbers of trees is therefore labour intensive. Severely infested trees approaching the end of their useful lives should be removed and burnt so that they do not serve as sources of infestation to surrounding trees. Use caution when planting orchards near stands of black wattle, as the pest can use other species such as this as alternative hosts. The use of *Trichogramma*, a small parasitoid wasp, as a biological control agent is currently under investigation in Australia.

For more information contact Sue Marte (NSW DPI; e-mail: sue.marte@dpi.nsw.gov.au)

Fruit tree moth borer adult

Fruit tree moth borer larvae

Damage caused by fruit tree moth borer

Fungal gummosis

Fungal gummosis is caused by the pathogen *Botryosphaeria dothidea*. In Australia it can be a serious disease in the Riverlands, Perth Hills, South East Queensland, Northern New South Wales and the Adelaide Hills.

Summer fruit trees produce gum as a result of a number of stresses, including mechanical damage, bacterial canker (page 14), *Phytophthora* (page 98), brown rot (page 27), *Armillaria* (page 90) and physiological stresses. Many orchardists refer to all of these conditions as 'gummosis'. This leads to confusion, as control measures for any one of these problems will not work for the others. In some cases the term 'gummosis' is also used differently in different regions.

The differences between the most frequently confused forms of gummosis are outlined in Table 5.

The pathogen infects through wounds or lenticels low in the tree on scaffold limbs or the trunk. As lesions grow older they exude a gummy resin. Tissue death is usually limited to the area immediately below the infection, and severely infected trees develop very rough-looking bark. If trees are kept healthy and the infection isn't severe they can remain productive, but research in the USA has shown that severely infected, stressed trees can suffer a 40% reduction in fruit production.

There are no pesticides registered for the control of fungal gummosis, but dormant application of copper formulations for bacterial canker may inhibit the disease.

Research in the USA has also shown that varieties show a range of susceptibility to this disease. Few of the American varieties studied are commercially common in Australia, but if fungal gummosis is a concern in your region, before you buy a specific variety you should ask your nursery if they are aware of its disease susceptibility.

Prune out all diseased wood during winter pruning. Remove the prunings from the orchard and burn them. Avoid summer pruning.

Fungal gummosis infection centred on a swollen lenticel

Table 5. Forms of gummosis

Common name of disorder	Caused by	Diagnostic features
Fungal gummosis	*Botryosphaeria dothidea* (fungus)	Young lesions centred on lenticels
Summer canker	*Phytophthora* (fungus; page 98)	Lesions appear in summer. Lesions smell sickly sweet. Infection moves from base of tree upwards
Bacterial canker	*Pseudomonas syringae* (bacteria; page 14)	Lesions appear in winter. Lesions smell sour. Infection often moves from the top of the tree downwards
Sour sap	Physiological condition (no pathogens involved)	Condition occurs when warm spring conditions are followed by a cold snap

Heliothis

Heliothis is an insect pest of a wide range of crops and is also commonly known as looper or budworm.

Although *Heliothis* is usually a minor problem, it can become serious if unmanaged. *Heliothis* is an occasional problem in many areas, including the Sydney Basin, Granite Belt, Goulburn Valley, South East Queensland and Northern New South Wales. Interestingly, growers report that problems emerge at different times of the season in different regions. In the Goulburn Valley *Heliothis* tends to be an early-season pest on developing shoots. In Western Australia problems arise in late spring and continue through to mid-summer. In South East Queensland and Northern New South Wales *Heliothis* problems occur late in the season, during and after harvest. This emergence of *Heliothis* is thought to coincide with reductions in insecticide application for fruit fly approaching harvest.

Heliothis larvae

Adult heliothis (Helicoverpa armigera)

Mealybug

Mealybugs are an occasional and minor problem in some areas. They tend to infect plums and can be a problem under netting, particularly where blocks are being converted from pome fruit.

Mealybugs belong to the same group of insects as scales and cause damage to fruit in two ways. They pierce fruit and feed through straw-like mouthparts known as stylets. They also excrete honeydew as a waste product following feeding, and this is a perfect medium for the growth of sooty mould fungi. Trees infected with mealybug tend to develop a coating of black soot-like fungus on the surfaces of branches, leaves and fruit. This blemish results in a reduction in quality and reduces the light available for photosynthesis.

Ants are also commonly associated with mealybugs, 'farming' them for the sweet honeydew they produce.

Many of the insecticides used against other orchard insect pests are effective and registered against mealybug. It would be rare for a responsibly cared-for orchard to have problems with mealybug. IPDM also helps to control mealy bug, as it is preyed upon by many natural enemies, including the predatory ladybird (*Cryptolaemus montrouzieri*). Predatory insects are available from a number of companies in Australia. See the 'Useful contacts' section in this manual (page 133) or phone the Australasian Biological Control Association on freecall number 1800 000 160.

Mealy bugs

Mites

In addition to two-spotted mite (*Tetranychus urticae*; page 84) Australian Summerfruit orchards are occasionally infested by *Bryobia* mite (*Bryobia rubrioculus*), peach silver mite (*Aculus fockeui)* or European red mite (*Panonychus ulmi*). Identification of the exact species of mite responsible for damage often requires a specialist taxonomist (see 'Useful contacts' page 133).

Bryobia mite

Bryobia mite tends to cause occasional problems on apricots and plums. Heavy infestations cause severe mottling of the foliage, with older leaves being affected more than younger ones. *Bryobia* mite rarely causes leaf browning or premature leaf fall but may reduce photosynthesis and subsequently affect fruit size and colour. *Bryobia* is rarely a problem in orchards, as it is susceptible to many of the modern pesticides used by orchards to control other insect pests.

Peach silver mite (PSM)

PSM Is rarely a problem in Australian summerfruit orchards. During the last 10 years it has reached problem levels only in the Riverlands.

PSM is a very small mite and is difficult to see even with the aid of a 10x hand lens. Therefore, confirmation of infestation may require a sample be submitted to a diagnostic laboratory. Adult PSM are present in infested orchards throughout the year, and populations sometimes reach damaging levels in mid- to late summer, when the leaves take on a silvery appearance.

Control is seldom required, as the mite-eating ladybird *Stethorus* often keeps populations at low levels. In some cases miticides used for other pests should be avoided, as PSM serves as early-season food for predatory mites.

European red mite adult female and eggs

European red mites

Although European red mite can be a problem in apples and pears it is rarely a serious problem in summerfruit. Its presence early in the season can be beneficial, as it acts as a food reserve for predators such as lacewings, allowing their numbers to build up. The increased numbers of predators help to control other pest mites later in the season.

Although this mite can become a pest when it causes pale green or yellowish stippling on leaves, premature leaf fall is rare. Well-managed young orchards are more susceptible, and the use of high rates of nitrogen fertiliser early in the season predisposes orchards to infestation.

Monolepta

Monolepta australis

Monolepta or red-shouldered leaf beetle can be a moderately serious problem in warmer coastal regions such as South East Queensland, Northern New South Wales and the Sydney Basin. The frequency of swarms in these regions varies from 'occasional years' to 2 or 3 infestations per season. The frequency and severity of the problem seems to be associated with the proximity of summerfruit orchards to other subtropical crops such as avocado and lychees. Swarms are also more common in stormy weather.

Damage can occur when fruitlets are very small. Check orchard and windbreak trees after rain for insect activity, and spot treat if beetles are present. Early detection is essential, as beetle numbers can increase quickly. *Monolepta* beetle not only damages green and ripening fruit but can severely damage foliage on young trees. Young leaves are particularly susceptible and infestation will leave only a fine network of leaf veins. Damage is generally more severe on nectarines than peaches.

Some growers feel that good weed management in the orchard and surrounds reduces the number and severity of swarms.

Insecticide registrations for this pest vary from State to State. Check the label of the product to ensure that insecticide application is legal in your State. Because of the swarming nature of this pest, spot sprays are the only efficient way to apply insecticides. It is essential that spot sprays are applied quickly after detection and that windbreak trees are checked in addition to orchard trees.

Adult Monolepta beetle (red-shouldered leaf beetle)

Nematodes

Nematodes can be a relatively severe problem in Swan Hill, the Granite Belt and the Riverlands. Nematodes penetrate roots and cause galling (lumps), resulting in overall lack of vigour, stunting and occasionally tree death. Australian growers also note that the damage caused by nematodes can predispose trees to attack by *Phytophthora* (page 97). Most Australian rootstocks are susceptible to nematodes. Even those bred for nematode resistance are not resistant to all Australian species of nematode. Although Nemaguard rootstocks provide protection against root knot nematode, they are not effective against root lesion nematode. Root lesion nematode is the predominant nematode species in some Australian regions (eg. Stanthorpe). There are no pesticides registered for controlling nematodes in summerfruit, but a number of precautions can be taken. Avoid planting orchards on blocks that were planted to nematode-susceptible crops such as grapes. Fallow sites for a period of time (up to four seasons) before replanting. Grains are not hosts of root lesion nematodes and can be planted on fallow blocks to reduce nematode numbers.

Galling caused by root knot nematode

Painted apple moth

Painted apple moth (*Teia anartoides*) is an Australian native insect that is a minor and occasional pest of Australian summerfruit orchards. It occasionally becomes a more serious problem for pines and acacias. It is found in south Queensland through to Victoria, the south-east of South Australia, and Tasmania. Painted apple moth is not established in Western Australia, where a surveillance program is maintained for this species.

The larva is up to 30 mm long and is covered with brown hairs, with four tufts of hairs on its back. These larvae graze on tender young leaves

Painted apple moth larvae

and are also know to occasionally feed on young green fruit. Painted apple moth infestations often recur at the same locations. This makes monitoring for this pest and subsequent control easier.

There are no insecticides registered for the control of painted apple moth. Control is seldom warranted. Should the larvae become a problem, they are easy to find because they are brightly coloured and the best control is to squash them.

In 1999 painted apple moth was found in Auckland, New Zealand—an incursion thought to have originated from Australia. An eradication and management campaign is ongoing, and further information on this moth can be found on the New Zealand Ministry of Agriculture and forestry website, www.maf.govt.nz[.]

Painted apple moth adult male

Pear and cherry slug

Caliroa cerasi

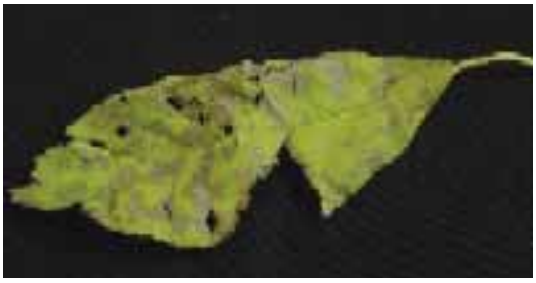
Pear and cherry slug is an occasional and minor pest in all regions, particularly those that are more temperate. Although it will infest all summerfruit commodities, it is most likely to cause problems on plums.

'Pear and cherry slug' is a misnomer. The slug-like pest commonly seen in orchards is the larval stage of a sawfly (a wasp-like insect), which exudes an olive-green coating shortly after hatching. This gives it its slug-like appearance.

Pear and cherry slugs feed on the upper surfaces of the leaves and skeletonise them; leaves appear lacy. They do not directly feed on or affect fruit. However, if an infestation is severe, defoliation (premature leaf loss) can occur and trees are subsequently weakened. In turn, this can reduce fruit size and quality.

Because the damage is relatively obvious, monitoring for this pest is easy and orchardists tend to notice damage before it becomes severe. Similarly, control of the pest is quite easy and a single, well-timed spray application is generally all that is required. Carbaryl and spinosad are registered in all Australian States for this purpose. Infestations can occur late in the season and after harvest because orchardists are reducing their use of insecticidal sprays. In such cases it is important to assess whether an insecticide spray is warranted.

Pear and cherry slug larvae on a peach leaf



Damage caused by pear and cherry slug on a peach leaf

Australian organic orchardists have noted that shield beetles (probably *Oechalia schellembergii*; Schellemberg's soldier bug) prey on pear and cherry slug. Minimising pesticide applications may encourage natural predators.

Phytophthora root and collar rots

Root and collar rots caused by *Phytophthora* can be a problem in all Australian summerfruit growing regions, but particularly in Swan Hill, the Goulburn Valley, Perth Hills, South East Queensland and Northern NSW.

In Australia the disease is caused by three species: *Phytophthora cactorum*, *Phytophthora cinnamomi* and *Phytophthora cambivora*. Regardless of the species causing the disease, the symptoms are identical. They are as follows.

Root rot

A reduction in the number of feeder roots. The roots remaining may be decaying, with brown black lesions. This lack of roots stunts trees and causes leaf yellowing and premature leaf drop and poor quality in fruit.

Collar rots

Infections originating in the roots or through rain splash to the lower part of the tree cause the trunk to develop oozing lesions, which often ring-bark the tree and kill it. When the bark is peeled away at the base of the tree there is a distinct brown margin to the diseased tissue.

Above-ground infection

If heavy rain, sprinklers or flooding move the disease-causing fungal spores into the above-ground parts of the tree, oozing lesions can occur.

Phytophthora can be distinguished from bacterial canker (page 14) by:

- smell: *Phytophthora* cankers smell sickly sweet; bacterial cankers smell sour.
- time of year. *Phytophthora* cankers occur during summer; bacterial cankers occur mainly during winter.
- direction of development. The first aboveground *Phytophthora* lesions occur at the base of the tree and progress upwards. The opposite is true for bacterial cankers.

Once established, *Phytophthora* is difficult to manage. Orchardists should therefore concentrate on preventive management. *Phytophthora* requires wet soil for root infection to occur. Irrigation should be managed so that soils are never waterlogged for prolonged periods.

In areas where *Phytophthora* is suspected, plant on mounds and avoid low spots in the orchard. Shallow planting will also expose less of the roots to suspect soil.

Root rot caused by Phytophthora

Above-ground infection of Phytophthora on apricot

A Phytophthora-infected apricot orchard

No rootstocks are resistant to *Phytophthora*, but susceptibility does vary. Plum rootstocks (e.g. Myrobalan H29C) are more tolerant of the three species of *Phytophthora* infecting Australian summerfruit than are peach or apricot stocks.

Several products are used by the Australian summerfruit industry, but registration varies from State to State. Fosetyl is registered for use on peaches in all Australian States except Queensland. It is recommended for use as a preventive foliar spray or as a curative soil drench for severely diseased trees. Always read the label.

More information

Lim TL (1997) *Phytophthora Root and Trunk Rot of Pome and Stone Fruits*. Agriculture Note AG0191. Department of Primary Industries Victoria.

Postharvest diseases

Postharvest diseases have the potential to cause more serious financial damage than any other pest or disease. If fruit is handled incorrectly, postharvest disease can emerge and spread quickly from fruit to fruit.

In addition to brown rot (page 27), a number of postharvest diseases can be damaging to Australian summerfruit. Orchardists have noted that *Rhizopus* or transit rot and grey mould (caused by *Botrytis*) cause occasional losses.

Fungicide options specifically for the control of these two diseases are limited. Iprodione is registered as a postharvest dip for *Rhizopus* rot but only suppresses the disease at the registered rate. Iprodione dips for the control of brown rot are also likely to reduce grey mould infections. Because of these limitations it is extremely important to carry out a number of good orchard practices that will minimise the impact of these diseases.

- Pick fruit at the correct maturity. Over-ripe fruit is more prone to disease.
- Minimise physical damage to fruit before harvest and during harvest and handling.
- Remove diseased or damaged fruit from the consignment.

Rhizopus or transit rot on nectarines

- Avoid packing wet fruit.
- Cool fruit as quickly as possible after harvest. Keep harvested fruit in the shade and transport it as quickly as possible to the shed. Avoid picking in the middle of the day on hot days.
- Lower the fruit's core temperature to 0 °C as quickly as possible.

More information on the correct handling of summerfruit after harvest can be found at the SARDI COOL Handling website, www.sardi.sa.gov.au/coolchai/[.]

Powdery mildew

Powdery mildew is a rare disease in Australian summerfruit caused by the fungal pathogen *Oidium*. During recent years it has been an occasional and minor problem in the Riverlands and Tasmania. Although all types of summerfruit can be infected, it is most common on apricots. It occurs during hot, humid weather. Some orchardists have observed that infections in summerfruit have occurred near grapes with powdery mildew. Grape powdery mildew is caused by a species of pathogen different from those causing powdery mildew on summerfruit, so this observation is most likely a result of the fact that all powdery mildew species tend to infect under similar weather conditions.

The disease primarily infects leaves, but young fruit (up to stone hardening) can be infected. Infected leaves become covered with a white mealy mass of fungal strands and spores. They are usually stunted and cupped. Older leaves may have only patches of this white material. Fruit becomes deformed, with raised or sunken spots.

There are no pesticides registered for the control of powdery mildew in summerfruit. It is likely that fungicide applications for brown rot will provide sufficient protection, even under conducive conditions. Management options taken to control other diseases are likely to also control powdery mildew. For example, row orientation to maximise breeze and lower humidity reduces all disease problems, as does pruning for an open canopy. Any measures taken to reduce humidity will help.

Powdery mildew on peach

Rutherglen bug

Nysius vinitor

Rutherglen bugs infest summerfruit in the majority of Australian summerfruit regions. They are regarded as minor pests. In some areas infestations occur only every 10 to 20 years.

Adult Rutherglen bugs are 3 to 4 mm long and greyish brown with dark cross marks on either wing. Rutherglen bugs invade orchards in swarms, and because they are sap suckers they cause damage similar to that caused by aphids (page 23). The feeding also spoils the fruits of summerfruit trees, leaving them pitted, with exudates of gum. In extreme cases young trees may be killed.

Rutherglen bugs breed on broad-leaved weeds and in some seasons will reach plague numbers in mid-summer through to harvest. Rutherglen bugs feed on a broad range of crops, such as field crops (including canola and sunflower), vegetables and grape vines, and swarms may migrate from these crops to summerfruit.

Swarms tend to happen during hot dry weather as weeds and pasture begin to hay off. Orchardists should monitor carefully for Rutherglen bug when these conditions occur.

The frequency of swarms can be minimised through broad-leaved weed control in and around the orchard.

In some regions insecticidal sprays won't be required, because the problem is never serious enough. In regions where Rutherglen bug occasionally becomes a significant pest, careful monitoring is required from ripening to harvest.

Adult Rutherglen bug

Where required, spray infestations with fenthion or trichlorfon. Respraying may be necessary within a few days during a plague. Fenthion will also help to control lightbrown apple moth, oriental fruit moth and wingless grasshoppers. Both insecticides will control Queensland fruit fly. Infested weed growth in and adjacent to the orchard should also be sprayed with insecticides.

Viral diseases

The incidence of viruses in the Australian summerfruit industry is probably underrated. Very few regions report significant problems with viral diseases. This is because:

- they can cause reductions in yield and quality without causing overt symptoms
- they can cause symptoms similar to those of other diseases (e.g. *Prunus* necrotic ringspot virus symptoms are similar to those caused by shot-hole) (page 77)
- even when specimens are sent for expert diagnosis, these diseases are often misdiagnosed
- high temperatures and high nutrient levels may mask virus symptoms.

In 1999 an Australian study showed that skin defects caused by viruses reduced the wholesale prices of Flavorcrest peach and Fantasia nectarine by two-thirds, resulting in losses of up to $30,000 a hectare.

Chemical control is totally ineffective against viruses. Therefore, the only options left to orchardists are to:

- avoid planting, propagating or top-working with virus-infected material or any material that has not been virus-tested
- plant healthy trees; infected trees cannot be cured.

More information on viruses is available in the 15th edition of the *Orchard Plant Protection Guide for Deciduous Fruits in NSW 2005/06*, available on the NSW Department of Primary Industries website, www.agric.nsw.gov.au[.]

Prunus necrotic ringspot virus on peach

Plum line pattern virus

Weevils

Weevils are widespread pests of the Australian summerfruit industry. The principal pest species is Fuller's rose weevil (*Asynonychus cervinus*). Apple weevil (*Otiorhynchus cribricollis*) and garden weevil (*Phlyctinus callosus*) are also reported to cause problems in Western Australia. They are considered relatively serious pests in Swan Hill, the Goulburn Valley, Perth Hills and Donnybrook/Manjimup regions. Additionally they are an occasional and minor pest in the Riverlands and Tasmania. Where weevils are a minor problem, control is rarely warranted or used. In some regions weevils are considered to be emerging as pests because of reduced parathion-methyl application as part of strategies for oriental fruit moth mating disruption (page 61).

Weevils can damage trees and fruit in a number of ways:

- **Irrigation blockage.** They lay eggs in irrigation equipment and the developing larvae block sprinkler heads.
- **Fruit damage.** Shallow feeding wounds appear and turn corky with time. These are easily mistaken for feeding wounds caused by European earwig (page 37).
- **Fruit blemish.** Fruit is fouled by weevil excreta, particularly around the stem end.
- **Leaf damage.** This is usually minor and is not considered a problem.

Poultry can be used to reduce weevil numbers (also useful against snails and wingless grasshoppers). Around 50 birds per hectare will appreciably reduce weevil numbers. Some weevils also breed successfully on weeds such as sorrel, capeweed, dandelion and stock, and these weeds should be removed from the orchard where possible. Avoid moving soil, prunings and fruit from infested areas in the orchard to uninfested areas.

Fuller's rose weevil

Pesticide registrations for this pest are limited. Gusathion (for Fuller's rose weevil) and alpha-cypermethrin (for apple and garden weevils) are registered only in Western Australia. Use of these chemicals should be physically targeted to butt sprays and the soil immediately around the trunk. Spraying should be done only when monitoring indicates that it is necessary. Use corrugated cardboard bands to monitor weevil numbers; wrap the bands in a single layer with the corrugations facing in. Although action thresholds have not been developed for summerfruit, the presence of five weevils in one of these cardboard monitoring traps is used in Western Australian vineyards to indicate a need to spray. Remember that these insecticides will harm other organisms and will possibly reduce the number of beneficial organisms in your orchard. They should be used as a last option.

Wingless grasshopper

Phaulacridium vittatum

Wingless grasshoppers tend to be pests in areas such as Swan Hill, the Granite Belt, the Riverlands, Perth Hills, NSW Central West and Donnybrook/Manjimup.

Unlike locusts, grasshoppers don't form large migratory swarms. Therefore, the source of the grasshoppers is likely to be close to the orchard (e.g. an adjacent paddock). This is borne out by Australian orchardists' observations that grasshoppers tend to turn up in the same spot every time there is an infestation. The orchard provides an alternative feeding source for grasshoppers as the grass and other food sources in the paddocks starts to dry of in summer. Grasshoppers move into the orchards from December to February and feed on tender young

shoots and leaves. The problem is worse along boundary rows, where they can completely defoliate trees. Young trees are particularly at risk.

Grasshoppers like bare sandy ground for egg laying. Look for emerging grasshoppers between September and November. If these egg beds can be found they can be cultivated and sown to tall pasture grasses such as rye grass. Grasshoppers do not like these plants. Remove weeds such as capeweed and flatweed, as they provide food for emerging and developing nymphs.

Poultry in the orchard such as guinea fowl and chickens can be an effective option for grasshopper control.

Pesticides should be seen as a last option where monitoring indicates the likelihood of significant damage. Pesticides can be applied to egg-beds, the orchard floor or trees. As pesticides are likely to disrupt IPDM for other pests and diseases it is best to use them in an extremely targeted way by baiting, spot spraying or spraying only boundaries. Because grasshoppers infest only a portion of the orchard it should be possible to leave the majority of the orchard untreated. A commercial bait (David Gray's Cricket and Grasshopper Killer Bait) is registered for this application. Always read the label.

Wingless grasshopper