Department of Primary Industries
primefact

Grape vine pests and their management

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Introduction

Grapes are grown in several climatic zones in New South Wales (NSW). The main areas producing wine and table grapes are the Murrumbidgee irrigation area, the Hunter Valley, the central rangelands of Mudgee, Orange and Cowra and the area encompassing Wagga Wagga, Young and Gundagai. Table grapes are also grown in Sydney's south-west and grapes for dried fruit are grown in the lower Murray irrigation area.

Mites

Mites are in the order Acari within the class Arachnida, and are therefore closely related to spiders. Mites are not insects: they can be distinguished from insects as they possess two distinct body segments, no antennae and usually four pairs of legs.

The easiest way to distinguish between different mite pests of grapevines is by the damage that they cause. However, for accurate identifications of mite specimens, microscopic magnification of at least 40x is necessary. Recent Australian research examining the molecular biology of grapeleaf bud and blister mites suggests that they are separate species rather than different strains of the same species. For the purposes of this Primefact the scientific name *Colomerus vitis* is still applied to both bud and blister mites.

Mite diagnostic services are offered by NSW Department of Primary Industries (DPI). For more information contact your local NSW DPI office.

Grapeleaf bud mite (*Colomerus vitis*)

Grapeleaf bud mite is 0.2 mm long, creamy white in colour, wormlike and possesses two pairs of legs near the head. Adult females lay eggs during spring inside the swelling bud and these eggs hatch after five to 25 days. Immature bud mites feed under the bud scale and develop into mature adults in about 20 days. Up to 12 generations are thought to occur in a year, with later generations in autumn feeding deeper in the developing bud, damaging cells which would have become leaves and bunches in the next season. Bud mites over-winter as adults under the outer scales of buds. During budburst, mites move from the budding shoot to new developing buds. Within a month of budburst most mites have moved into developing buds.

Feeding by bud mite can lead to malformed leaves, aborted or damaged bunches, tip death and even bud death. Recent research has shown that symptoms similar to restricted spring growth can be caused by bud mite. Monitoring prior to budburst in vineyards that have a history of damage may be useful in gauging mite presence or absence. Dormant winter buds can be examined for characteristic tissue bubbling damage around the outer scales. Over-wintering bud mites may be seen by viewing dissected basal buds under a stereo microscope.

Grapeleaf blister mite (*Colomerus vitis*)

Grapeleaf blister mite is 0.2 mm long, white or creamy and worm-like with two pairs of legs at the anterior end of the body. Blister mite and bud mite, although morphologically similar, can be easily distinguished by the damage they cause.

Blister mites feed on the under-surface of leaves and cause very obvious blisters on the upper surface of leaves and white or brown hairy growths within the raised blisters on the lower surface of leaves.

Blister mite over-winters inside buds, but after budburst they move onto leaves to feed and complete their lifecycle within the hairy blister. Damage can be unsightly but does not usually have economic consequences.

Figure 1 Grapeleaf blister mite damage (Photo: A Loch)

Grapeleaf rust mite (*Calepitrimerus vitis*)

Grapeleaf rust mite is 0.2 mm long, cream to pink in colour, wormlike and possesses two pairs of legs near the head. Rust mites are in the same family (Eriophyidae) as bud and blister mites but are much more active. Rust mites over-winter under the bark of cordons or the trunk near the crown.

Smaller numbers can be found under the outer scales of dormant buds. Lower nodes of canes tend to have the most heavily infested buds. At mid to late chardonnay woolly bud (when less than 10% of buds are at the first green tip stage), the mites start to migrate to the swelling buds and produce the first generation. Two weeks after bud burst most of the mites have migrated to the developing shoots and leaves.

During the growing season, rust mites can disperse by active movement across overlapping parts of the canopy. Between three and 12 generations a year are likely. Mites start to migrate to their winter shelters from early February to mid March. This early migration could explain why post-harvest wettable sulphur sprays have been found to be ineffective in reducing over-wintering rust mite numbers.

There is increasing awareness of the damage that rust mites can cause. Early season rust mite damage can be confused with bud mite or cold injury, as the leaf distortion or crinkling symptoms and poor shoot growth can be similar. The damage is most obvious from bud burst to when five to eight leaves have emerged.

The damage then becomes much less visible as the shoots recover and grow out. Severe early spring damage can still be detected in mature leaves through the growing season. Symptoms resembling those of restricted spring growth have also been recently attributed to feeding by rust mite.

The most visible and easily recognisable symptoms of rust mite occur from January to March. The leaves start to darken and take on a bronzed appearance because of the presence of rust mites feeding on, and damaging, the surface cells of the leaf.

Bunch mite (*Brevipalpus californicus* and *Brevipalpus lewisi*)

Bunch mite adults are 0.3 mm long, flat, shield-shaped and reddish-brown in colour. Eggs are oval, bright red and deposited throughout the vine. The six-legged larvae, which are lighter coloured than the adults, subsequently moult to eight-legged nymphs, which moult into adults. In spring, bunch mites feed on developing canes, and later on the under-surfaces of leaves. Early season damage is characterised by small dark spots or scars around the base of canes. They then move to the bunch stalks, berry pedicels and berries. Damage to the bunch stalks and pedicels can partly starve the berries, preventing sugar accumulation. The adults spend the winter under the outer bud scales and under the rough bark at the base of the canes.

Two-spotted mite (*Tetranychus urticae*)

Two-spotted mite is 0.5 mm long and just visible to the naked eye. They are pale coloured and have two distinct dark spots on their body. Development of two-spotted mite can be as little as a week and many generations can be completed in a season.

Development is similar to bunch mite with six-legged larvae moulting into eight-legged nymphs before the eight-legged adult stage. These mites are sap suckers and cause chlorosis or yellowing of leaves. Severe infestations can lead to leaves dying. Associated with feeding is the characteristic webbing they spin on the underside of leaves. Outbreaks of two-spotted mite have occurred in the Lower Hunter Valley and can almost always be linked to applications of insecticides toxic to their natural enemies. The best strategy for control is to avoid the use of insecticides as much as possible.

Mite control

Although the broad management principles for the control of rust, bud and blister mites are similar, recommended control strategies differ for each species. Several predatory insects and spiders feed on mites but the most efficient natural predators of mite pests are predatory mites. Two species, *Euseius victoriensis* ('Victoria') and *Typhlodromus doreenae* ('Doreen'), are particularly important in several Australian viticultural regions for maintaining low pest mite populations.

Should chemical control be necessary to control severe infestations of pest mites, a registered chemical must be used and applied at an appropriate time to provide good control. Predatory mites are susceptible to several insecticides and fungicides, so chemicals that are friendly to predatory mites should be selected to ensure high numbers of predatory mites in the vineyard.

Control of bud mite is best conducted after budburst when mites are exposed on bud scales and leaf axils. Blister mite rarely requires control but, if necessary, control should be initiated at the woolly bud stage. Rust mite is most effectively treated by spraying very high volumes of wettable sulphur and oil to runoff at the time of chardonnay woolly bud stage and when temperatures reach at least 15°C. For control of all mite pests, use a registered chemical according to instructions on the label.

Insects

Lightbrown apple moth (*Epiphyas postvittana*)

Lightbrown apple moth (LBAM) is a native Australian leafroller moth, which is a serious pest of several horticultural crops. The species is found throughout Australia but does not survive well at high temperatures and is therefore a more serious problem in cooler areas with mild summers. Male moths are smaller than female moths and have a dark band on the hind part of the forewings. Eggs are laid in masses of 20 to 50 eggs, usually on upper surfaces of leaves or on shoots. Eggs are blue-green when newly laid but turn green-yellow close to hatching. The larvae or caterpillars are yellow when young but become green as they mature. Caterpillars roll shoots and leaves together with silken web, and feed on leaves and bunches. Pupation occurs on the vine at the feeding site either within webbed leaves and shoots or bunches. The pupa or chrysalis is brown and approximately 1 cm long.

LBAM undergoes three to four generations each year depending on the prevailing climatic conditions. In all areas, a winter generation occurs on several species of broad-leaved weeds. Large caterpillars of this generation can occasionally move onto vines at budburst and destroy new buds. The spring and summer generations are more damaging because direct feeding damage to bunches can occur. The spring generation begins when moths emerge in late winter and early spring, and can take up to two months to complete. Caterpillars emerging from eggs laid in spring feed predominantly on leaves but can cause extensive damage to flowers and setting berries if large populations are present. There are one to two generations during summer depending on temperature, with caterpillars feeding on leaves but also entering closing bunches. Damage to developing and ripening bunches by LBAM can also increase the incidence of *Botrytis* bunch rot infections, especially in cooler and wetter areas.

A number of control strategies are available for LBAM management. Cultural control practices of removing potential LBAM host plants such as broad-leaved weeds and planting non-host plants like grasses should reduce the size of LBAM populations, especially during winter. Several natural enemies such as lacewings, spiders and predatory shield bugs contribute to overall biological control of LBAM. Perhaps the best available natural enemy of LBAM is *Trichogramma*, a genus of very small wasps that parasitise and develop in LBAM eggs, thus killing the eggs. These wasps are commercially available from several companies.

Figure 2 Adult lightbrown apple moth

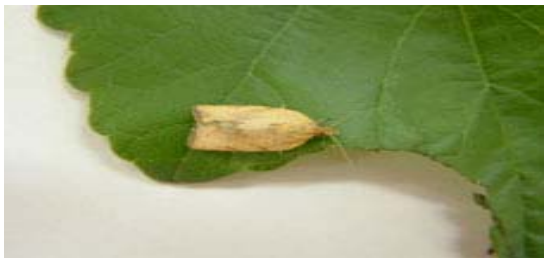


Figure 3 Newly laid egg mass of lightbrown apple moth

Figure 4 Lightbrown apple moth caterpillar (Photos: A Loch)

Figure 5 Botrytis bunch rot in chardonnay grapes following lightbrown apple moth feeding. Note hatched moth pupal case in centre of photo. (Photo: A Loch)

Recently a number of vineyards throughout Australia have reported successful control of LBAM through mating disruption by using slow-release dispensers containing a synthetic pheromone chemically identical to the natural pheromone produced by female moths to attract male moths. When these dispensers are placed throughout the vineyard, mating is disrupted, as males cannot locate females because their natural pheromones are swamped by the synthetic pheromones. Without mating, females cannot lay viable eggs and thus the lifecycle can be broken.

If chemical control is required, an insecticide registered for LBAM must be used. There are several new insecticides available that are 'softer' and specifically target caterpillar pests and have a negligible or minimal effect on non-target species. Spraying is most effective after eggs have hatched, but before caterpillars reach 3 to 5 mm and build feeding shelters. Caterpillars within rolled leaves and bunches are difficult to control because spray coverage in these concealed places is poor. Biological insecticides containing the bacterium *Bacillus thuringiensis* (Bt) specifically kill only caterpillars and not their natural enemies. Bt insecticides must be consumed by caterpillars to work.

Grapevine moth (*Phalaenoides glycinae*)

Grapevine moth is native to Australia and feeds on several native plants as well as grapevine leaves. The adult is an attractive black moth with white and yellow markings, a wingspan of about 6 cm, and tufts of orange hair on the tip of the abdomen and around the legs. Moths are day-flying, gregarious and feed on nectar and pollen. Moths emerge from over-wintering pupae in early spring and lay eggs on stems and leaves.

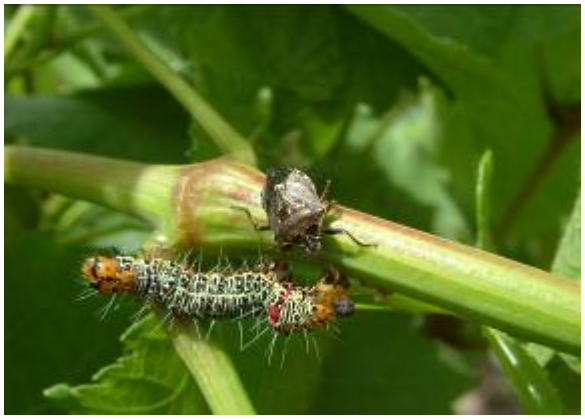
Eggs are round, sculptured and green to brown in colour depending on the stage of development. The larval or caterpillar stage goes through six larval instars or moults. The caterpillar is mainly black and white with red markings, covered in scattered white hairs, and can reach 5 cm in length. Pupation occurs in a silken cell in the ground or in fissures in the vine wood or strainer posts. The pupa is the over-wintering stage. There are two to three annual generations with larvae first appearing on vines in October, and the second generation of moths appears in December. In areas with warm to hot summers, a third generation may occur between late summer and autumn.

Figure 6 Adult grapevine moth

Figure 7 Grapevine moth caterpillar

Figure 8 A grapevine moth killed by parasitic wasps

Figure 9 Predatory shield bug, Cermatulus nasalis, feeding on a grapevine moth caterpillar (Photo: A Loch)



Grapevine moth is usually a minor pest, with little economic impact. However, if caterpillar numbers reach high levels, severe vine defoliation may result, which can affect berry development and carbohydrate storage. Caterpillars feed on leaves but may begin feeding in bunches if foliage is depleted.

Parasitoids such as tachinid flies and wasps, predatory shield bugs and birds provide some control against the pest. Several insecticides are registered for grapevine moth.

Grapevine hawk moth (*Hippotion celerio*) and Vine hawk moth (*Theretra oldenlandiae*)

Hawk moth caterpillars are voracious feeders of grapevine leaves but are only occasional pests in Australian vineyards. Mature caterpillars grow to a similar size as the grapevine moth but can be distinguished from the latter by their fleshy spine on the upper rear end of the body, and the characteristic coloured eye spots along the body. Pupation occurs on or just under the soil surface. Adult moths are night flying, have wingspans of about 7 cm, are largely grey or brown coloured, and are good fliers that can often be caught near lights. If insecticidal control is required use a registered chemical.

Vine borer moth (*Echiomima* sp.)

Vine borer moth (*Echiomima* sp.) is a native moth that feeds on native plants and also attacks horticultural crops including grape vines. Vine borer moths have become a pest issue in the Riverina and have been recorded in the Riverland, Hunter Valley and Queensland.

The life cycle of the vine borer takes a year to complete. Adult moths are approximately 10 - 15 mm long, creamy white to light brown in colour, possess a thick tuft of white hair under the head, and often have a distinct black dot on each forewing.

Moths are active at night during November and December. Eggs are white, cylindrical shaped and very small and in bark crevices around the dormant buds on spurs near the cordon.

Larvae feed on the surface of the bark or dormant buds before tunnelling into the heartwood. Most feeding occurs on the outer sapwood and bark around the spur and cordon, which effectively girdles the spur or cordon. Larvae feed beneath a protective blanket of Larval frass, which is webbed together with silk, and makes spotting this pest during pruning an easy task. Larvae grow to about 25 mm long and as they grow feeding and levels of damage increase.

A field research trial conducted on Merlot in the Riverina showed that damage caused by vine borer led to significant reductions of 43% for yield, 26% for bunch numbers per shoot, 46% for shoot length, and 58% for cane dry weights per vine spur (A.D. Loch, unpublished data). Feeding damage around vine spurs and dormant buds can even lead to death of buds or entire spurs. Continued feeding damage by vine borer moth over several seasons could potentially lead to loss of vigour, crop losses through loss of fruiting spurs, and dieback.

Vine borer moth has been found feeding on a range of red and white wine grape varieties in the Riverina but the pest shows a clear preference for the varieties Merlot, Ruby Cabernet and Pinot Noir.

Mealybug (*Pseudococcus* sp.)

Three species of mealybug are commonly found in Australian vineyards: longtailed mealybug (*Pseudococcus longispinus*), citrophilus mealybug (*Pseudococcus calceolariae*) and obscure mealybug (*Pseudococcus affinis*). Longtailed mealybug is the most serious pest and is prevalent in many Australian grape-growing regions.

Mealybugs are soft-bodied sucking insects covered in white filamentous wax. Adult females grow to about 5 mm in length and are wingless whereas males are much smaller and winged. Mealybugs over-winter as nymphs under the rough bark of older canes, in the crown of the vine and sometimes in the cracks in trellis posts. In spring they move on to new growth and quickly reach adult maturity.

Female mealybugs can lay enormous numbers of eggs, which quickly hatch into crawlers. In early summer, mealybugs are present mainly along leaf veins and do not usually enter bunches until January. Up to three to four generations may occur each year depending on climatic conditions. Mealybugs prefer mild, humid conditions and high rates of mortality can occur during hot, dry conditions.

Feeding by mealybugs does not usually cause economic damage. Excretion of sticky honeydew by mealybugs leads to sooty mould development on leaves and bunches if large populations arise. Sooty mould covering leaves can reduce photosynthesis and mould on grapes can make the fruit unsaleable or lead to rotting.

Longtailed mealybug has a number of natural enemies including predatory ladybird beetles and lacewings, and parasitic wasps. The native ladybird species *Cryptolaemus montrouzieri* preferentially feeds on mealybugs and is commercially available from several Australian outlets that sell biological control agents.

Figure 10 Longtailed mealybugs

Ants may feed on honeydew and encourage development of mealybug colonies by interfering with natural enemies. If large numbers of ants are present, sticky trap coatings applied to the trunk will exclude ants from vines, or insecticides may be used to reduce ant numbers. Sprays are rarely required on wine grapes; spray only where there is a history of economic loss and where damage or mealybug numbers are high. Use a registered chemical if insecticidal control is required.

Figure 11 Longtailed mealybug damage to grapes

Figure 12 Adult *Cryptoleamus montrouzieri* ladybird feeding on longtailed mealybug

Grapevine scale (*Parthenolecanium persicae*)

Grapevine scale is a small oval shaped sucking bug up to 6 mm long that lives beneath a protective dark brown wax cover. The insect feeds mainly on the stems or canes and if large populations occur, vine growth and grape production can be reduced. The major problem with grapevine scale is that scale excretes honeydew, which falls onto grapevine leaves and bunches leading to sooty mould development and photosynthesis reduction – with subsequent growth and productivity reduction.

Figure 13 Grapevine scale tended by ants

Figure 14 Sooty mould associated with grapevine scale feeding (Photos: A Loch)

Grapevine scale has one annual generation. Immature scales over-winter on the previous season's wood and begin maturing in spring. During late spring and summer, mature scales deposit hundreds of eggs under their bodies and then die. Crawlers hatch and move to the leaves to feed but later move back to the canes to feed, where they remain during winter.

Careful pruning of canes can provide excellent control by removing most of the over-wintering scale population. Several parasitic wasps and predators such as ladybirds and lacewings provide some control of grapevine scale. Ants that feed on the honeydew can hamper these natural enemies so ant control may be necessary on some vineyards to enhance levels of biological control. Insecticides work best after pruning in winter or early spring when populations are immature and low in number. Successful insecticidal control in summer can be difficult because of spray coverage problems in dense canopies. Use a registered chemical if insecticidal control is required.

Grape phylloxera (*Daktulosphaira vitifolii*)

Grape phylloxera is a small aphid-like insect that is only just visible to the naked eye. In Australia the species largely occurs on the grapevine roots although leaf-galling populations sometimes arise. Root feeding leads to vine debilitation and usually death on European Vitis vinifera vines. Rootstocks provide varying degrees of tolerance to the pest.

In New South Wales phylloxera is currently distributed only in the counties of Camden and Cumberland near Sydney and in the Albury-Corowa area. Several viticultural regions in Victoria including Rutherglen, Nagambie and King Valley are affected by the pest. Different phylloxera zones have been established within New South Wales that limit the movement of grapevines, grape material and machinery between different zones.

Figure 15 Phylloxera crawlers feeding on grape vine root

Wood-boring insect pests

Fig longicorn borer (*Acalolepta vastator*)

Figure 16 Fig longicorn borer larva and associated damage to grapevine trunk (Photo: A Loch)

The fig longicorn borer has become a major pest of grapevines in a small area of the Lower Hunter. The adult beetle is about 3 cm long and has antennae longer than the body. Adult emergence is protracted over the months between spring and autumn. Females lay eggs in fissures or cracks in the grapevine bark or near the base of canes. Larvae hatch and bore into the vine wood and can tunnel throughout the trunk and into roots. Larvae are cream coloured with a brown head and grow to 4 cm in length. Pupation occurs in the tunnel and the adult emerges from the trunk by chewing a hole. Larval excrement and sawdust are often visible in tunnels and around the vine trunk indicating an infestation.

Fig longicorn borer can cause extensive damage to the vine trunk, which can lead to dieback and significant crop losses. Borers are difficult to

control because the boring stage is usually not accessible to insecticides. Careful pruning and removal of prunings may remove many of the larvae. Retraining of vines may be necessary following pruning of vines with serious infestations. If insecticidal control is warranted use a registered insecticide.

Elephant weevil (*Orthorhinus cylindrirostris*) and vine weevil (*Orthorhinus klugi*)

Elephant weevil and vine weevil are native species that breed in many native trees, especially eucalypts. The adult elephant weevil may vary in length from 8 to 20 mm, and the vine weevil is about 7 mm long. The weevil body is densely covered with scales that may vary from grey to black. The larva or grub is soft, fleshy, creamy yellow and legless, and reaches a length of nearly 20 mm. The pupa is soft and white, with light brown wing buds.

Most beetles emerge during September and October, and lay eggs in holes drilled at the base of the vine with the proboscis. The larvae tunnel for about 10 months, the pupal stage lasts for two to three weeks, and the adults emerge a year after the eggs were laid. If chemical control is required use a registered insecticide.

Common auger beetle (*Xylopsocus gibbicollis*)

Common auger beetle causes damage principally in the Hunter Valley. The adult is 5 mm long and brown to black. Eggs are laid in the bark and the hatching larva bores into the wood. The hole size of the common auger beetle is only 1 – 2 mm diameter, which makes it easy to distinguish from the 8 – 10 mm holes of the fig longicorn borer.

Fruit-tree borer (*Maroga melanostigma*)

This native moth borer attacks a wide range of ornamental and commercial trees. Moths lay eggs preferentially in wound sites in bark and wood. Larvae feed on the bark surface after hatching, before tunneling into wood. Larvae can also ring-bark limbs and trunks, with heavy infestations leading to death of parts of vines.

Insect pests during grapevine establishment

The major insect pests of grape vines during grape vine establishment include African black beetle (*Heteronychus arator*), apple weevil (*Otiorhynchus cribricollis*) and garden weevil (*Phlyctinus callosus*). These species ringbark young vines, which can cause cane weakness and sometimes vine death. Garden weevil is also a major pest of established grapevines in southern parts of Australia but is not a problem in NSW.

Monitoring for these pests is best done at night when the majority of feeding occurs. Chemical control is best performed prior to planting especially on sites with a history of such pests. Chemical control after planting can be more difficult and not as successful. Cutworms (*Agrotis* spp.) and budworms (*Helicoverpa* spp.) are caterpillar pests that can also damage newly planted vines by feeding on leaves at night. Registered insecticides for these pests should be applied at night for effective control.

Nematodes

A number of nematode species attack grapevine roots. They include root knot (*Meloidogyne* sp.), citrus (*Tylenchulus semipenetrans*), root lesion (*Pratylenchus* sp.), ring (*Criconemella* sp.), spiral (*Helicotylenchus* sp.), pin (*Paratylenchus* sp.), dagger (*Xiphinema* sp.), stunt (*Tylenchorhynchus* sp.) and stubby root (*Paratrichodorus* sp.) nematodes. They all live in soil and feed on root cells as external or internal parasites.

Root knot, citrus and root lesion nematodes are very common and can be economically important in Australian vineyards. The dagger nematode transmits grapevine fan leaf virus, but is reported only in a small region of north-eastern Victoria. The economic importance of other nematodes is not known in viticulture.

Nematodes feed on root cells and disturb the uptake and movement of nutrients and water from the soil into the plant. The main symptoms of nematode damage are stunted growth, poor vigour and yellow leaves. These symptoms can be confused with nutrient deficiencies or moisture stress. A visual inspection of the roots and a soil nematode count from a laboratory will confirm whether nematodes are the problem.

Plant parasitic nematodes commonly feed on cortical cells and cause dark patches or death of the root surface. The root lesion nematodes make cavities and tunnels by destroying the cells. Thin and dense fibrous roots are the characteristic symptoms of stubby root nematodes. The root knot (endoparasite) and citrus (semi-endoparasite) nematodes feed on deeper cells.

Cells infected with root knot nematode swell into characteristic ‘galls’ or ‘knots’ in the roots whereas citrus-nematode-infected cells become thickened and discoloured.

Host preferences differ between plant parasitic nematodes. Root knot and root lesion nematodes can infect and reproduce in roots of many crops, fruit trees, ornamentals and weeds. The citrus nematode can infect grapevines, olive, citrus and pear. Many nematode species can survive for up to two years in soil without any host plants.

When establishing a new vineyard obtain a soil count of nematode numbers and species before you select vines, particularly if the site has been used previously for horticultural crops.

Nematode tolerant rootstocks can provide some protection from nematodes and other management benefits. Use nematode-free planting material that has been treated with hot-water to eliminate any possible introduction of nematodes from nursery to vineyards.

For established vineyards, biofumigation may provide effective control by planting Brassicas in the cover crop. Brassica species suppress nematodes through the release of a chemical known as isothiocyanate as they break down in the soil.

The mustard cultivar Nemfix is one of the members of this group that is commercially available. The best reduction of nematodes is achieved if the mustard is grown close to the vine row, slashed and covered with soil under the vine rows. If chemical control is required use a registered chemical.

Birds

Several species of birds can cause severe damage to ripening grapes. Scaring devices and the use of netting provide some control. A chemical repellent is also available.

Acknowledgments

This Primefact incorporates information from the first edition of H7.AE.1 *Pests of grapes*, 1986, (S. Goodwin) and First Edition 511 Grapevine pests and their Management.2007 (A. Loch).

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