AWRI Australian Wine Research Institute

Fact Sheet
VITICULTURE

Vineyard scale insects: factors influencing their prevalence and control

Introduction

Scale insects are sap-sucking pests that draw nutrients from plants and excrete a sugary liquid called honeydew. In high numbers, grapevine scale insects can reduce the vigour of grapevines and the honeydew they secrete can promote the development of sooty mould. Scale insects are common in Australian vineyards, yet in most cases they do not cause significant economic losses and intervention is not required. In some circumstances, however, the population can reach a threshold where intervention is required to avoid fruit being downgraded or rejected, to minimise the spread of viruses that can be transmitted by scale, and avoid the debilitating effect on vine vigour from persistent attack. This fact sheet explores the factors that influence scale numbers and describes the chemical control options available to manage them when an outbreak has occurred. Because scale insects are generally not considered a major pest, the factors causing sporadic outbreaks are not well understood. Information about the scale species found in vineyards and their life cycle can be found in the AWRI fact sheet Scale – insect pests of vineyards.

Weather conditions

For many insect species, temperature has direct effects on life-cycle duration, the number of generations per year (voltinism), the timing of life-cycle events and range distribution. As temperature increases, the metabolic rate, consumption of food and subsequent reproduction of insects increases until the maximum critical temperature is reached, after which fertility starts declining.

For scale insects, the minimum critical temperature for survival is -13°C when conditions are dry and 0°C when conditions are wet. The maximum critical temperature for scale survival is unknown but temperatures above 40°C are thought to be fatal.

Seasonal weather conditions may play a role in scale numbers in the vineyard, but this has not been the subject of detailed research. Increases in scale numbers tend to occur when milder conditions are experienced at critical growth stages such as in winter and during egg production.

Grapevine varieties

Grapevine varieties appear to vary in their susceptibility to scale. Cultivars with apparent resistance include Pinot Noir, Sauvignon Blanc, Merlot and Cabernet Sauvignon, whereas Riesling, Chardonnay, Tempranillo, Sangiovese and Shiraz can be severely affected. The difference in susceptibility may be a result of the volatile compounds produced by the cultivar and/or the tendency of the cultivar to drop leaves when scale are present, eliminating the problem. Cabernet Sauvignon produces volatile compounds in response to scale attack, which makes the affected leaves less palatable to scale and turns infected leaves red, causing them to drop off. Shiraz vines do not produce these volatile compounds.

Natural enemies

There are many natural enemies of scale found in Australian vineyards, including parasitoid wasps, beetles, predatory moth larvae, lacewings and a predatory mite (Figure 1). A healthy population of these predators and parasitoids can prevent scale insects from reaching epidemic proportions. Actions that favour a healthy population of natural enemies include providing a habitat for their food and shelter and minimising the use of pesticides known to be toxic to beneficial insects.

The most common and effective parasite of grapevine scale is the minute wasp, *Metaphycus maculipennis*. The grub of native ladybird beetle, *Rhyzobius submetallicus*, the caterpillar of the native moth *Mateomera dubia* and the larvae of green lacewings are useful predators of the eggs and crawlers of grapevine scale. As such, these are probably most effective in reducing high populations of soft scales on grapevines.

The natural enemies of scale have been found in association with Christmas bush (*Bursaria spinosa*), prickly tea-tree (*Leptospermum continentale)*, wallaby grasses (*Rytidosperma* species), creeping saltbush (*Atriplex semibaccata*), fragrant saltbush (*Rhagodia parabolica*), windmill grass (*Chloris truncata*) and kangaroo grass (*Themeda triandra*). Planting these species in and around a vineyard may help to reduce scale populations.

The natural enemies of scale are sensitive to elemental sulfur, particularly at high rates (≥400 g/100 L) and if used frequently. Insecticides such as clothianidin, carbaryl, methomyl, fipronil, indoxacarb, organophosphates, pyrethroids and spinosad can also reduce beneficial insect populations. Reducing broad-spectrum pesticide use, keeping sulfur rates below 400 g/100 L and only using targeted applications of selective insecticides to reduce pest populations to below damaging levels can help to encourage populations of natural enemies in your vineyard.

It is common to find ants tending soft scale in vineyards. Ant activity strongly inhibits parasitism by *Metaphycus maculipennis*. Planting a cover crop such as vetch that provides a good source of nectar for ants has improved the biological control of soft scale in Californian vineyards by attracting the ants out of the canopy and away from the scale. Ant populations can also be reduced through strategic cultivation and baiting but these practices may have off-target impacts on natural enemy populations.

A variety of organisms are available for release as biological control agents for various pests. *Metaphycus maculipennis* is not currently available in Australia; however, a number of other species are available which claim to be effective against various soft scale insects. More research needs to be conducted to determine the efficacy of these species as biological control agents for the scale species present in Australian vineyards.

Figure 1. Examples of beneficial insects in the vineyard – green lacewing adult (left) and larvae (right). Photos courtesy: Mary Retallack.

Chemical control options

When scale numbers are high or sooty mould has caused an economic loss in the previous season, it may be necessary to use pesticides to bring the scale numbers under control. Table 1 lists the active constituents registered for scale control or suppression in Australia. Except for dormancy sprays and soil applied systemic products, chemical control of scale insects is always improved when sprays are timed at crawler emergence.

To minimise disruption to the beneficial insects present in the vineyard, a chemical application that targets areas where a scale problem was noted in the previous season is preferable to a whole of vineyard or block approach. It is recommended to apply targeted sprays during dormancy using active constituents that are least toxic to beneficial insects.

The use of winter or summer mineral oil during vine dormancy is likely to have the least impact on beneficial insects. Spot-spraying areas where scale was observed last season is preferred to broad-scale applications. The oil must smother the scale and requires thorough coverage of the

cordon and canes. This is best achieved after pruning and, if possible, the oil should be applied when scale insects are moving from under bark. As the oil is toxic to green tissue, it should not be applied after growth stage E-L 2, when bud scales start to open.

If monitoring indicates that the oil spray was not able to adequately control the scale population, another control agent may be required. Acetamiprid + pyriproxyfen is registered for the control of scale and spirotetramat is registered for suppression of scale only. Spirotetramat is not expected to provide a high level of control where scale infestation is severe. Using a program that includes a dormancy spray with mineral oil, followed by an application of acetamiprid + pyriproxyfen at the onset of crawler emergence, followed by an application of spirotetramat 21 days later may be sufficient to control scale without the use of broad-spectrum insecticides. A second application of acetamiprid + pyriproxyfen can be applied 21 days after the spirotetramat application if monitoring shows that crawlers are still present. Spirotetramat is a systemic insecticide, while acetamiprid + pyriproxyfen is a contact insecticide, which requires good coverage to be effective. The best results are achieved when the application of these products effectively targets the first generation of crawlers as they emerge in late winter/early spring. A hand lens may be required to see the crawlers.

If monitoring indicates that the mineral oil + acetamiprid + pyriproxyfen + spirotetramat combination has not achieved sufficient scale control, three broad spectrum insecticides are registered for use. It is recommended that growers use these insecticides as targeted sprays and seek approval from their winery or grape purchaser before use.

Table 1. Active constituents registered for use against scale insects in Australia, the label and export wine withholding period (WHP) and comments on their use. The table is arranged in order of the label WHP from dormancy to harvest. Growers must follow label directions unless a current APVMA permit applies. It is recommended that growers consult with their winery/grape purchaser about any specific chemical-use restraints.

Active constituent (some registered products)	Label withholding period – can be followed for domestic wine production	Withholding period for export wine	Comments
paraffinic oil petroleum oil (BioPest, CropCover, D-C-Maax nC24, isoCLEAR HPO, Trump Spray Oil)	Dormancy application	Dormancy application	• Summer and winter oils work by suffocating the scale insects, so thorough coverage of the crown, cordons and spurs is required. • These oils are phytotoxic to vines and should only applied during full dormancy. • A recapture spray unit may reduce off-target losses while facilitating the drenching of the dormant vine.

chlorpyrifos	Dormancy application	Contact your winery/grape purchaser prior to application	• Chlorpyrifos is under review by the APVMA and its registration for use on grapes is expected to be removed in 2024. • It is registered for scale control as a dormancy spray. • The rate of chlorpyrifos is halved when mixed with 1 L/100 L water of miscible winter oil. • Chlorpyrifos is highly toxic to bees and birds.
clothianidin (Samurai)	Use no later than E-L 19, about 16 leaves separated; beginning of flowering (first flower caps loosening)	Contact your winery/grape purchaser prior to application	• This is a soil application delivered through irrigation systems. • If undervine sprinklers are used, the chemical can be applied by band spraying followed by thorough wetting of the banded area. • The soil in the irrigation zone should be free of weeds and heavy debris. • This agrochemical is not compatible with IPM programs using beneficial arthropods. • Clothianidin is highly toxic to bees, with bee brood development also harmed by exposure to residues. Bee mortality is also most likely if bees drink from irrigation water or dew on the ground after irrigation. • Do not apply if heavy rains are expected within 48 hours. • Do not apply more than one soil application per block per season.
buprofezin (suppression only) (Applaud, Uptown, Buprofezin 440, Scale & Bug)	Use no later than E-L 25; 80% capfall	Use no later than E-L 25; 80% capfall	• Monitor crops from budburst and spray when crop monitoring indicates the first onset of crawler release. • Do not target applications on populations that are well-established where mature adult insects dominate the population. • Apply as a dilute (high volume) spray to the point of run-off. Dilute spraying is important as thorough coverage is critical for control.
acetamiprid + pyriproxyfen (Trivor)	Use no later than E-L 31; berries pea-size (7 mm diameter)	Use no later than E-L 19, about 16 leaves separated;	• Monitor crops from budburst and spray when crop monitoring indicates the first onset of crawler release. For best results, apply from early in the season when crawlers are active and good coverage can be achieved.

		beginning of flowering (first flower caps loosening)	• Do not target Trivor applications on populations that are well-established where mature adult insects dominate the population. • Apply Trivor as a dilute (high-volume) spray to the point of run-off, ensuring thorough coverage. Dilute spraying is important as thorough coverage is critical for control.
spirotetramat (suppression only) (Movento 240 SC, Viento 240)	Use no later than 4 weeks before harvest.	Use no later than E-L 18, 14 leaves separated; flower caps still in place, but cap colour fading from green	• Monitor crops following budburst and commence applications at the onset of crawler emergence. • Foliage is required to take up the chemical, so do not apply prior to E-L 13. Continue to monitor crops and apply a second application 21-28 days later if necessary. • Applications to an established pest population where mature adults are present and dominate the population will be ineffective.
maldison/malathion (Fyfanon 440 EW, Hy-Mal)	Use no later than 3 days before harvest.	Contact your winery/grape purchaser prior to application	• Spot-spray where possible to minimise the impact on off-target species. Time sprays to coincide with crawler emergence if beneficial insect numbers are low.

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