Getting to know the predatory arthropods commonly found in and around Australian vineyards

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Vineyard biodiversity can be enhanced by including insectary plants, and their benefits can be measured using a surrogate indicator, such as the diversity of predatory arthropods and arthropods found in association, which have a direct effect on pest abundance.

Some terms used:

- **Functional biodiversity** can be assessed by measuring the richness (diversity) and abundance (number) of each predatory species.
- **Predatory species**, such as **arthropods**, which include insects, spiders and mites, contribute to the biocontrol of insect pest species.
- **Morphospecies** refers to visually distinct specimens that can be categorised with a number and possible functional group or family before being identified as genus and species.

Underpinning science

The diversity of predatory arthropods in vineyards was increased more than three-fold when native evergreen shrubs such as sweet bursaria (*Bursaria spinosa*) and prickly tea-tree (*Leptospermum continentale*) were present versus grapevines only. Additionally, predatory morphospecies increased by around 27% when native perennial wallaby grasses (*Rytidosperma* spp.) were planted with grapevines (Retallack et al. 2019a).

Predatory arthropods contribute to the biocontrol of grapevine insect pests.

SNAP

Arthropod habitat comes from insectary plants that provide 'SNAP' (Figure 112), an acronym for **shelter**, **nectar**, **alternative prey** and **pollen** (Barnes et al. 2010). Insectary plants can nourish predatory arthropods and encourage their presence (Gurr et al. 1998).

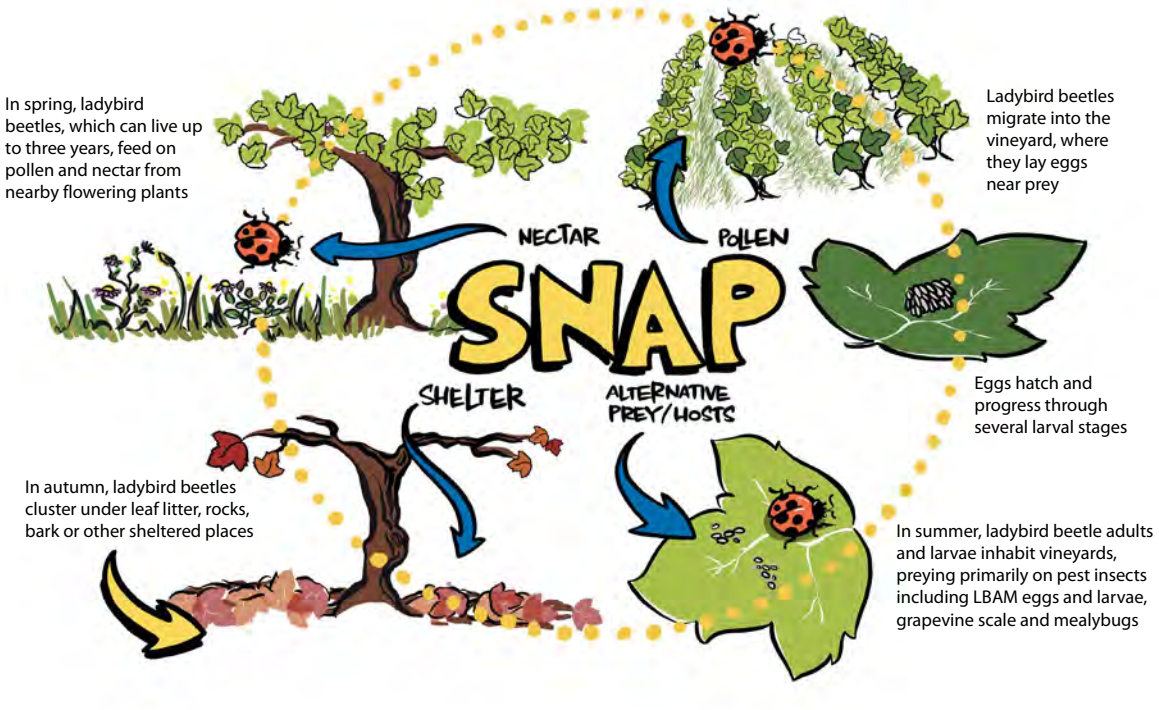

Figure 112. Ladybird beetle life cycle and the role of shelter, nectar, alternative prey and pollen (SNAP).

More than 90% of Australia's flora and fauna species are endemic. Many predatory arthropods are also endemic, having co-evolved with native plants.

Native plants are naturally adapted to the dry Australian conditions. They are also associated with low pest populations and high natural enemy populations. Planting diverse native plants provides a valuable habitat for predatory arthropods. This should give growers the confidence to trial native insectary plants in their vineyards to increase predatory arthropod populations.

Predatory arthropods

Some of the predatory arthropods (including parasitoid wasps) commonly found with insectary plants and on grapevines include:

Predators

Many predators, such as spiders, brown and green lacewings, ladybird beetles, and predatory bugs, are commonly found in vineyards (Thomson and Hoffmann 2007, 2008).

- Generalist predators are often voracious feeders of various pest species' eggs, larvae, and adult stages.
- The main predators of leaf-rollers, such as light brown apple moth (LBAM), include lacewing larvae, spiders, earwigs, ladybirds, carabid and rove beetles, predatory shield and damsel bugs (Hemiptera), predatory hoverflies and robber flies (Diptera), and parasitic wasps (Bernard et al. 2006a; Frank et al. 2007; Paull 2007; Thomson and Hoffmann 2009, 2010; Hogg et al. 2014; Yazdani et al. 2015; Yazdani and Keller 2017).
- Some predators feed on leaf-roller eggs (MacLellan 1973; Danthanarayana 1980; Paull and Austin 2006).

Up to 90% of newly hatched leaf-roller larvae can be killed by predators without toxic chemicals (Helson 1939; Waterhouse and Sands 2001).

Parasitoids

There are at least 28 known parasitoids of eggs, caterpillars, and pupae of LBAM (Paull and Austin 2006; Paull 2007). *Trichogramma* spp. wasps parasitise LBAM eggs (Glenn et al. 1997; Glenn and Hoffmann 1997) but no other life stage. This, along with low levels of parasitism and late-season activity, might limit their ability to control LBAM in isolation (Bernard et al. 2006b).

Young LBAM instars can be consumed by the predatory shield bug, *Oechalia schellenbergii* (Figure 113). They can also be parasitised by a braconid wasp (*Dolichogenidea tasmanica*: Hymenoptera: Braconidae; Figure 114), but parasitism is only possible up to and including the third instar (Yazdani et al. 2015), whereas *Gonozius* spp. (Hymenoptera: Bethylidae) can parasitise third and fourth stage instars (Danthanarayana 1980).

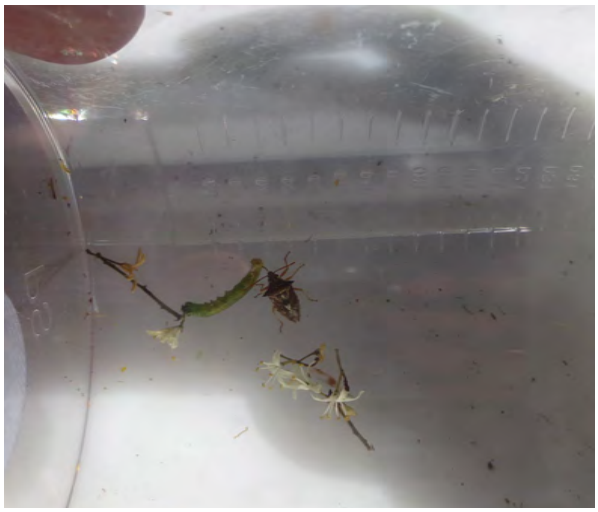

Figure 113. *Oechalia schellenbergii*, a predatory shield bug, consuming a leaf-roller larva. Photo: Mary Retallack.

Figure 114. *Dolichogenidea tasmanica*, a braconid wasp, parasitising a leaf-roller larva. Photo: Michael Keller.

Predatory arthropods found with native evergreen shrubs

The richness or diversity of predator morphospecies in evergreen shrubs was nearly double that found with grapevines alone.

> It might be possible to increase the functional diversity of predatory arthropods by more than 3× when native evergreen shrubs are present versus grapevines only (Retallack et al. 2019b).

Sixty-seven predatory arthropod morphospecies were found on sweet bursaria, including brown and green lacewings (Figure 115), spiders (Figure 116), predatory and parasitic wasps (Chalcid, Ichneumonid, Proctotrupoid, Tiphiid and Vespoid), predatory shield bugs (Figure 117), and many other 'good bugs' (Figure 118; Retallack et al. 2019b).

Figure 115. Brown lacewing adult (*Micromus tasmaniae*) left, and green lacewing larva (*Mallada signatus*) right, ambush their prey. Photos: Mary Retallack.

Figure 116. Jumping spiders (Salticidae) left, and flower or crab spiders (Thomisidae) right, ambush their prey. Photos: Mary Retallack.

Figure 117. Glossy shield bug (*Cermatulus nasalis*, photo: Landcare Research, NZ) left, and predatory shield bug (*Oechalia schellenbergii,* photo: Mary Retallack) right.

Figure 118. Pacific damsel bug (*Nabis kinbergii*) left, and big-eyed bug (*Geocoris* spp.) right. Photos: Mary Retallack.

Prickly tea-tree provides habitat for natural enemies that are attracted to sources of nectar and pollen, such as predatory and parasitoid wasps (Chalcid, Ichneumonid, Proctotrupoid, Tiphiid and Vespoid), lacewings, spiders (Figure 119), and other predators (Figure 120). At least 63 predatory arthropod morphospecies were found near prickly tea-trees and many species overlapped with sweet bursaria.

Figure 119. Bird-dropping spider (*Celaenia excavata*) left, and speckled orb-weaver (*Araneus circulissparsus*), right. Photos: Mary Retallack.

Figure 120. Common spotted ladybird beetle (*Harmonia conformis*) left, and orange assassin bug (*Gminatus australis*), right. Photos: Mary Retallack.

Predatory arthropods found with native wallaby grasses

At least 38 predatory arthropod morphospecies were found with wallaby grasses (*Rytidosperma* spp.) in vineyards (Retallack et al. 2019b).

Wallaby grasses provide a habitat for predators. Wolf spiders (Figure 121), earwigs (Figure 121), brown lacewings, glossy shield bugs (Figure 117), carabid beetles, parasitoid and predatory wasps (Ichneumonid, Vespoid, and Sphecidae) and others (Figure 122) are found abundantly in South Australian vineyards (Retallack et al. 2019a).

Predation of LBAM eggs increases when wallaby grasses are present. The difference between predatory and herbivore morphospecies was 2:1 predator: herbivore (Retallack et al. 2019a).

Figure 121. Garden wolf spider (*Tasmanicosa* sp.), left and European earwig (*Forficula auricularia*), right. Photos: Mary Retallack.

Figure 122. Transverse ladybird beetle (*Coccinella transversalis*) left, minute two-spotted ladybird (*Diomus notescens*) middle, robber fly (Asilidae) right. Photos: Mary Retallack.

When are arthropods most active?

Arthropod activity in and around vineyards often peaks from late October to mid-December, with populations declining when conditions become hotter and drier. This will depend on each season. While insectary resources and habitats are available, various predatory arthropods will persist all year and contribute to the biocontrol of grapevine insect pests.

We encourage you to look closely at the insects and spiders commonly found in vineyards during the growing season.

Further reading

For more information, please refer to:

EcoVineyards best practice management guide on functional biodiversity in Australian vineyards (https://ecovineyards.com.au/knowledge-hub/natural-predators-book/)

Natural predators of vineyard insect pests booklet (https://ecovineyards.com.au/wp-content/uploads/Key-predator-of-vineyard-pests-document-internals-V3-RV-full.pdf)

The EcoVineyards knowledge hub (https://ecovineyards.com.au).

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