ECO VINEYARDS
GROWING RESILIENCE NATURALLY

FACT SHEET

BIOCONTROL OF COMMON GRAPEVINE INSECT PESTS: LIGHT BROWN APPLE MOTH

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Wine Australia

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FINDING THE BALANCE… NATURALLY!

Healthy and diverse populations of predatory arthropods (insects and spiders) and parasitoids (wasps and flies) can help prevent grapevine pests from reaching economically damaging thresholds.

Growers can support healthy predator populations by providing a habitat that provides food, shelter and alternative prey/hosts and minimise the use of pesticides that are toxic to natural enemies.

Biocontrol options for common Australian grapevine pests are explored in this series of fact sheets. For a broader discussion about functional biodiversity please see the EcoVineyards best practice management guide on functional biodiversity in Australian vineyards and to read the other fact sheets in this series please visit the EcoVineyards knowledge hub.

FAMILY TORTRICIDAE

Epiphyas postvittana, light brown apple moth (LBAM)

DESCRIPTION: Light brown apple moth (LBAM) is an Australian native leafroller belonging to the Lepidopteran (moth) order and Tortricidae (leafroller) family. LBAM is the principal insect pest that causes economic damage in Australian vineyards.

LBAM causes damage to flower clusters, resulting in yield losses and damage to berry skins. Damaged skins provide infection sites for Botrytis cinerea and other bunch moulds, which may result in a reduction in fruit quality and yield losses (Ferguson, 1995).

Annual losses from Botrytis and other bunch rots and LBAM were estimated at $52 million and $18 million, respectively, with a combined national economic impact of $70 million per annum. (Scholefield and Morison, 2010).

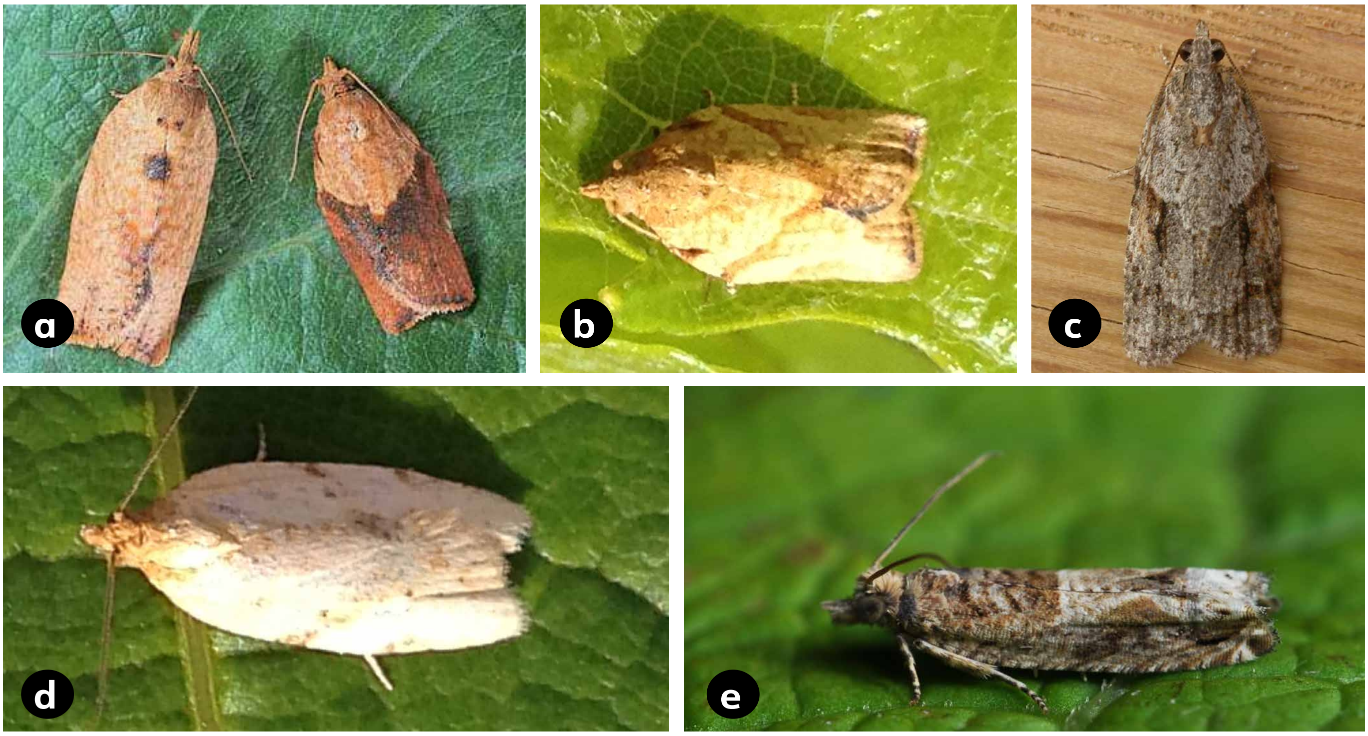

Figure 1. (a) Light brown apple moth female (L) and male (R) [Photo: Greg Baker], (b) male LBAM [Photo: Mary Retallack], (c) *Acropolitis rudisana* [Photo: D Hobern], (d) *Merophyas divulsana*, lucerne leafroller [Photo: Mary Retallack], (e) *Crocidosema plebejana*, cotton tipworm [Photo: uncredited at http://revtangen.blogspot.com.au/2016/09/].

DISTINCTIVE FEATURES: Adult moths are variable in colour and may be confused with other leafroller moths and similar species. Typically, males have a forewing length of 6 to10 mm with a light brown area at the base, which is distinguishable from a much darker, red-brown area above. The latter may be absent, with the moth appearing uniformly light brown, as in the case of females, which have only slightly darker, oblique markings distinguishing the area at the tip of the wing. Females have a forewing length of 7 to 13 mm.

The larvae of Tortricidae have no defining morphological features and molecular methods are required to determine with confidence the species identity. A practical alternative is to rear larvae in containers to adulthood. However, specialist knowledge is still required to ensure correct identification of adult moths.

Recent research found that other species of leafrollers from the tortricid family may also be present in grapevine canopies including *Acropolitis rudisana*, *Merophyas divulsana*, lucerne leafroller and *Crocidosema plebejana*, cotton tipworm,(Retallack et al., 2018).

BREEDING CYCLE: Typically, there are three (spring, summer and autumn-winter), and occasionally four LBAM generations.

WHEN TO MONITOR: Monitor for the presence of egg masses, larvae, and adult moths from early spring onwards with close inspection required in the lead up to flowering and fruit set. Pheromone traps and port lures can be used to trap adults.

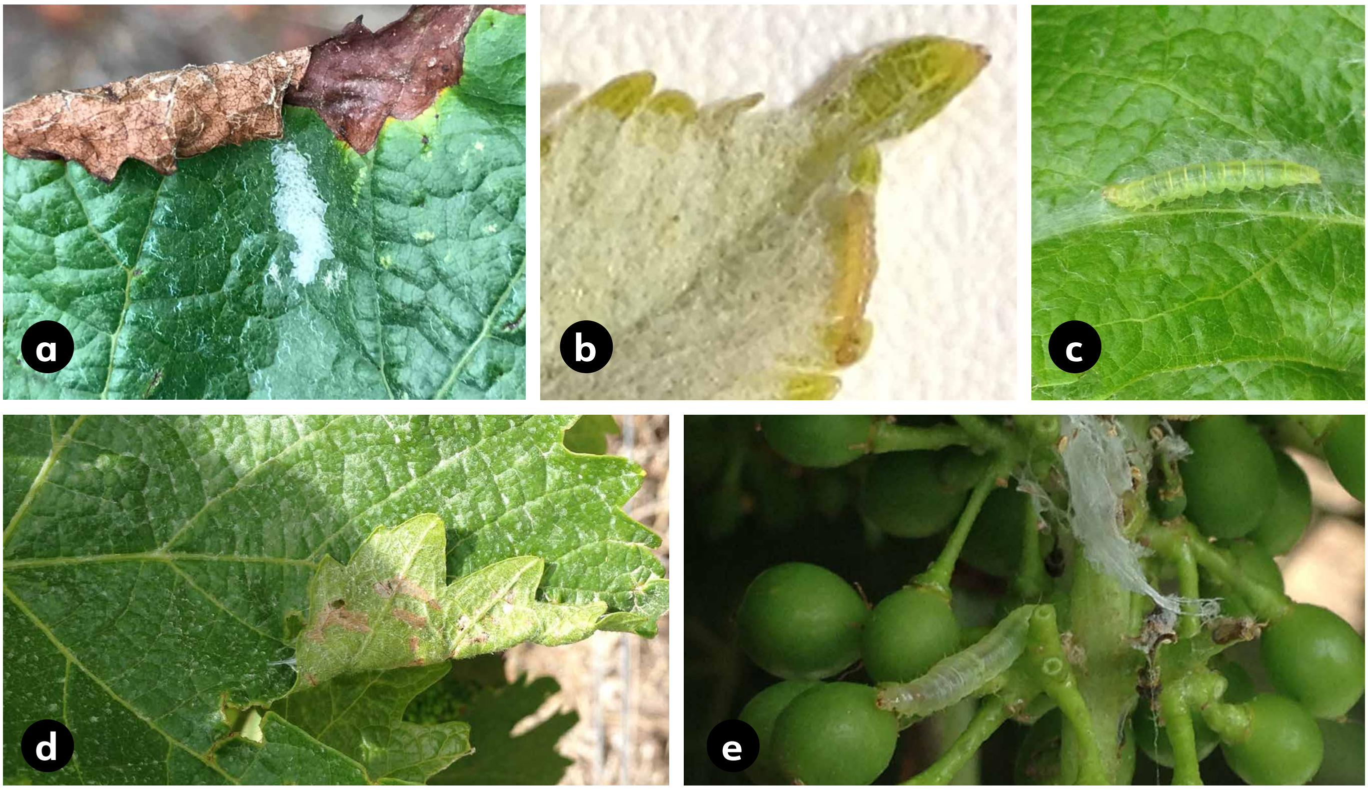

Figure 2. (a) leafroller egg mass, 1st or 2nd instar, (b) tortricid larva on a leaf tip, (c) 5th or 6th instar inside a silk refuge, (d) folded grapevine leaf providing shelter, and (e) larva inside a developing bunch of grapes [Photos: Mary Retallack].

CORRECT IDENTIFICATION OF LEAFROLLERS: Research has demonstrated that light brown apple moth is a key tortricid pest of South Australian vineyards. However, low densities of *Acropolitis rudisana*, *Merophyas divulsana* and *Crocidosema plebejana* have also been found on the canopies of grapevines (Retallack, 2019; Retallack and Keller, 2018; Retallack et al., 2018).

As these additional species are closely related to LBAM it is anticipated they can be managed through existing IPM strategies (Retallack and Keller, 2018; Retallack et al., 2018).

Australian vineyard managers often scout broadleaf weeds, including plantain and capeweed, in the mid-row for the presence of moth larvae to provide an indication of leafroller activity early in the growing season.

Acropolitis rudisana, *Merophyas divulsana* and *Crocidosema plebejana* may also provide alternative hosts for parasitoids and prey for predators when they are in vineyard mid-rows and don't migrate to the canopy.

This is especially important during the winter period and early in the growing season when alternative prey is needed to boost the presence of key predators of LBAM so they can provide natural biological control before LBAM populations reach damaging levels in the canopy.

The removal of broad-leaved weed monocultures is recommended to reduce breeding and overwintering locations for LBAM larvae.

Figure 3. Growers can rear leafroller larvae and determine the species once they emerge as adults [Photo: Mary Retallack].

SUGGESTED ACTION THRESHOLDS: Growers are encouraged to develop their own action thresholds based on data collected from monitoring and damage assessments at harvest over several seasons.

Monitor shoots for the presence of larvae on a weekly to fortnightly basis, scanning 100 shoot replicates from tip to base. Suggested action threshold levels that have been developed in cooler regions with higher Botrytis pressure (Braybrook, 2013), are:

- more than 3 viable egg masses per 1,000 leaves
- more than 10 caterpillars per 100 shoots
- more than 10 caterpillars per 100 bunches.

Biocontrol options

There are many species that can contribute towards biological control of LBAM, including microbats and insectivorous birds. Important parasitoids and predatory arthropods are discussed below.

PARASITOID WASPS: There are at least 28 species of parasitic wasps of LBAM in Australia (Paull, 2007). The most common parasitoids of LBAM in Australia are *Gonozius jacintae*, bethylid wasp, *Dolichogenidea tasmanica*, braconid wasp, *Australoglypta latrobei*, *Exochus* sp., and *Xanthopimpla rhopaloceros*, ichneumonid wasps, and *Brachymeria rubripes*, chalcid wasp (Suckling and Brockerhoff, 2010).

A specific strain of *Trichogramma carverae* wasp can 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, may naturally limit their ability to control LBAM in isolation (Bernard et al., 2006a).

However, young LBAM instars can be parasitised by *Dolichogenidea tasmanica*, but parasitism is only possible up to and including the third instar (Yazdani et al., 2015). Whereas, *Goniozus* ssp. (Hymenoptera: Bethylidae) can parasitise third and fourth stage instars (Danthanarayana, 1980).

Interestingly, research in Coonawarra also found a novel interaction between *Dolichogenidea tasmanica*, a parasitoid wasp that renders larval LBAM more susceptible to attack by *Anystis baccarum*, a predatory mite species (Paull, 2007).

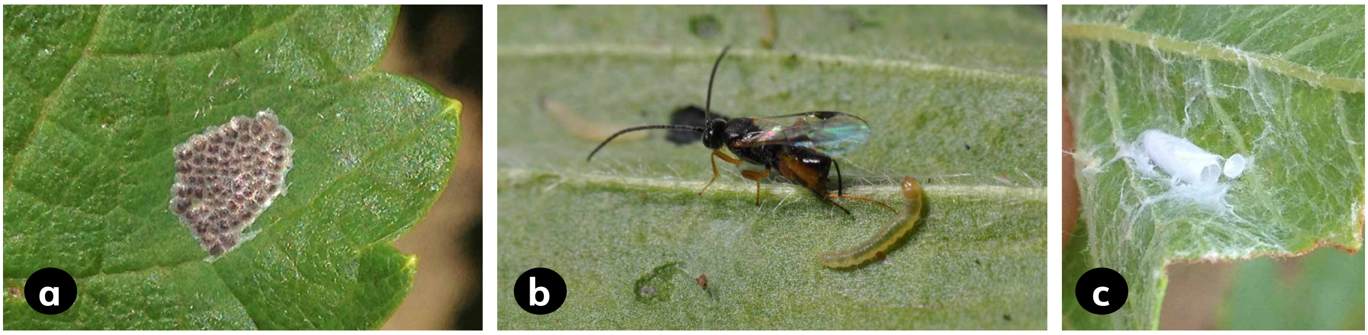

Figure 4. (a) parasitised egg mass [Photo: Mary Retallack], (b) *Dolichogenidea tasmanica*, braconid parasitoid wasp parasitising a LBAM larva [Photo: Michael A Keller], (c) a parasitic wasp, silk cocoon [Photo: Mary Retallack].

Previously, a strain of *Trichogramma carverae* was isolated that could parasitise flat LBAM egg masses (in preference to round eggs) and was made available for biocontrol (Glenn and Hoffmann, 1997).

The strain of *T. carverae* that parasitises flat LBAM egg masses has not been commercially available recently, but the producer is willing to culture *T. carverae* if there is a regular commitment from the wine community. Please contact Dan Papacek from Bugs for Bugs for more information.

Work done in collaboration with AgVic suggests that *Trichogramma pretiosum* is as efficient (perhaps more so) as *T. carverae* for management of LBAM (Dan Papacek, pers. comm. 4 October 2024).

PREDATORY ARTHROPODS: A range of generalist predators contribute to the control of LBAM (Bernard et al., 2006b). The main predators of LBAM include neuropteran larvae (lacewings), spiders, earwigs, ladybird, carabid and rove beetles, predatory Hemiptera (shield and damsel bugs), and predatory Diptera (hover flies and robber flies) (Bernard et al., 2006b; Frank et al., 2007; Thomson and Hoffmann, 2009; Thomson and Hoffmann, 2010).

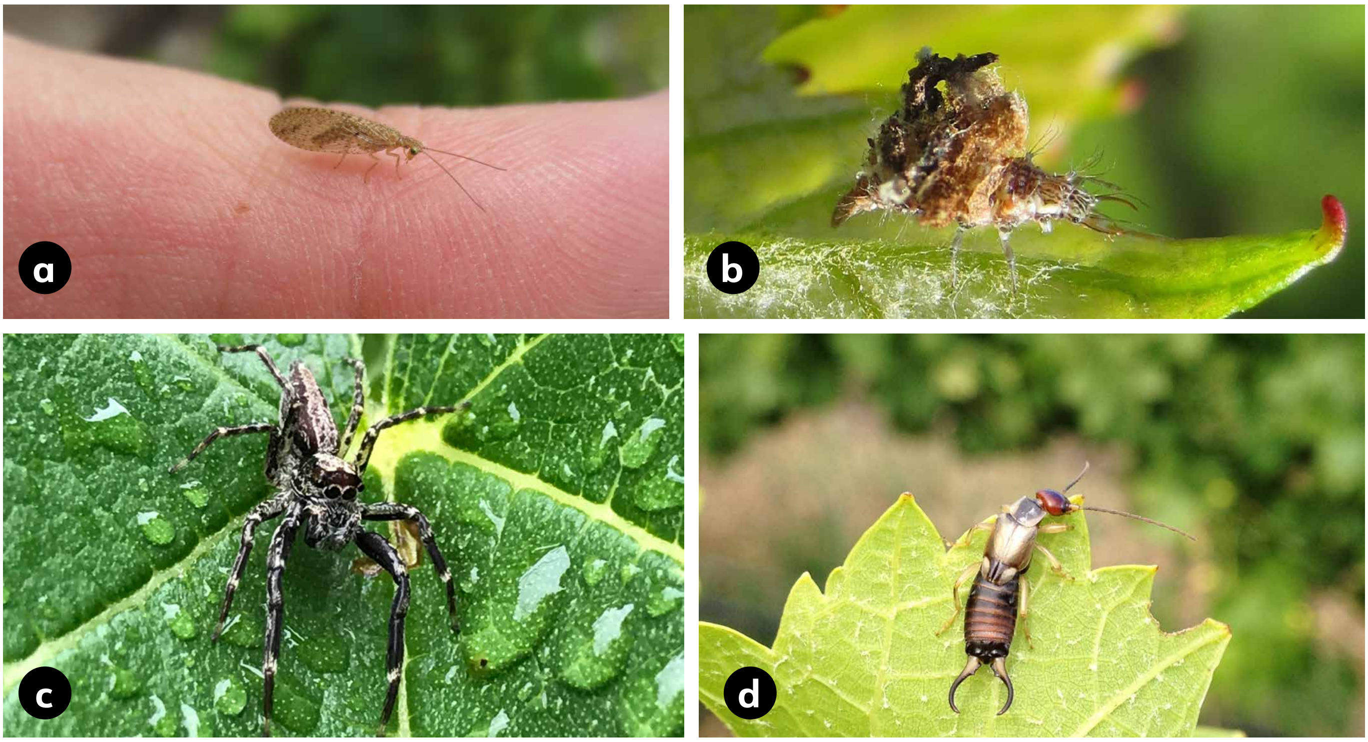

Figure 5. (a) *Micromus tasmaniae*, brown lacewing, (b) *Mallada signatus*, green lacewing larva, (c) jumping spiders (Salticidae) are active hunters, (d) *Forficula Auricularia*, European earwig [Photos: Mary Retallack].

Figure 6. (a) *Cermatulus nasalis*, glossy shield bug [Landcare Research CC-BY 4.0], (b) *Oechalia schellenbergii*, predatory shield bug, (c) *Harmonia conformis*, common spotted ladybird beetle, and (d) *Nabis kinbergii*, Pacific damsel bug [Photos: Mary Retallack].

Some predators feed on LBAM eggs (Danthanarayana, 1980; Paull and Austin, 2006). It is reported that up to 90% of newly hatched leafroller larvae may be killed by predators in the absence of toxic chemicals (Helson, 1939). A range of predators and parasitoids are available commercially as biocontrol agents, including green lacewings and common spotted ladybirds.

***Bacillus thuringiensis* (Bt):** *Bt* products can be used anytime throughout the growing season. The *Bt* bacterium is toxic to moth larvae and, once consumed, it results in the paralysis of the digestive tract and larvae starve to death.

PHEROMONES FOR MATING DISRUPTION: Pheromone-infused twist ties have been used successfully in large-scale mating disruption trials in south-eastern Australia to confuse the male moth's ability to track the female scent (Mo et al., 2006). However, they are not currently widely employed by vignerons in Australia.

Specialised pheromone and lure application technology (SPLAT): provides an alternative to existing pheromone application. SPLAT LBAM™ technology (available via the USA) provides a similar efficacy to pheromone-infused twist ties in disrupting the mating of light brown apple moth while streamlining the application of pheromones via manual or mechanical application (Suckling et al., 2012a; Suckling et al., 2012b).

A recent EcoVineyards trial in the Mornington Peninsula demonstrated the capacity for SPLAT to control LBAM below economically damaging thresholds when compared to the untreated control.

For more information see the EcoVineyards fact sheet: Specialised pheromone and lure application technology (SPLAT) control of LBAM.

FURTHER READING

For general information see the Wine Australia website page on light brown apple moth and AWRI website page on LBAM.

For more information on natural enemies, please see natural predators of vineyards insect pests booklet and associated articles and fact sheets on the EcoVineyards knowledge hub.

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ACKNOWLEDGEMENT OF COUNTRY

EcoVineyards proudly acknowledge the Aboriginal and Torres Strait Islander Peoples, and their ongoing cutural and spirital connection to this ancient land on which we work and live.

As the Traditional custodians we recognise their wealth of ecological knowledge and the importance of caring for Country.

We pay our respect to elders past and present and extend this respect to all Aboriginal and Torres Strait Islander Peoples.

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