Almond IPM: Natural enemies of almond pests

INTRODUCTION

Natural enemies of crop pests are found in many agricultural systems. Almonds are no exception, and numerous species of predators and parasites can be found in almond orchards. Any activity by these species will be of benefit to almond producers, although the degree to which they contribute to pest suppression is generally not known. An exception to this is the effective control of pest mites in some situations by a range of predatory mites, thrips and ladybird beetles.

This fact sheet provides a visual guide to some of the predatory and parasitic species that have been observed in Australian almond orchards. It is intended to help growers identify insects that they may see in their orchards or when they are performing quality assessments on nuts. This sheet does not include microscopic species (mites).

The species shown in this factsheet are known to attack carob moth (and other moth species), or aphid or mite pests. Relatively little is known of the natural enemies of the major almond pest carpophilus beetle, and none have been observed during the almond IPM research activities.

Parasitoid wasps

Egg parasitoids *Trichogramma* species

Trichogramma are minute wasps that parasitise eggs of many different insects including carob moth. Several *Trichogramma* species have been collected from almonds in Australia, including *T. carverae* (Figure 1) which is reared commercially.

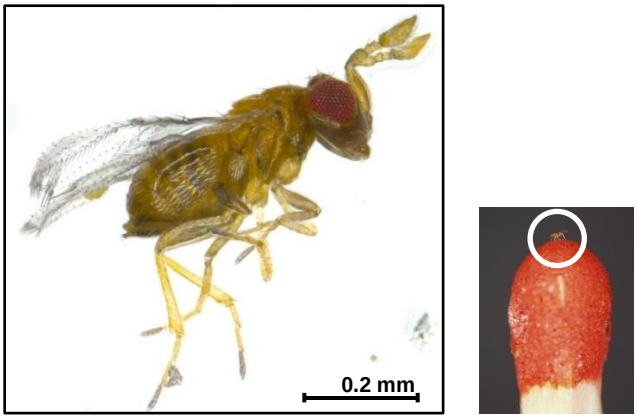

Figure 1. Trichogramma carverae.

Adult *Trichogramma* wasps feed on plant nectar and on fluid leaking from moth eggs that they have punctured with their ovipositor. The adult wasp lays its egg inside the moth egg, and after hatching, the developing wasp larva consumes the egg contents, eventually emerging from the moth egg as a new adult wasp.

Parasitised carob moth eggs are identifiable by a change in colour from white/pink to black (Figure 2).

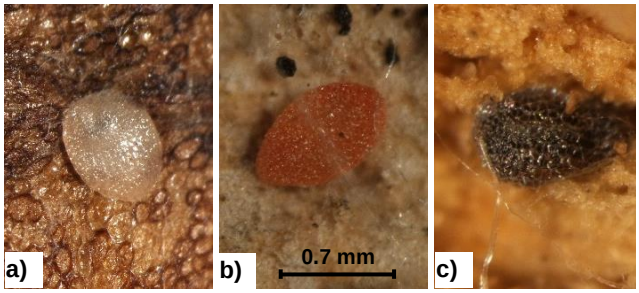

Figure 2. Carob moth eggs, a) freshly laid, b) mature and c) parasitised.

Larval/pupal parasitoids of carob moth

Globally, numerous species of wasps are known to attack carob moth larvae. Several of these including those shown below, occur in Australia, but not all have been formally identified.

Some larval parasites lay an egg inside their host, such as a carob moth larva, and as the wasp larva develops it gradually consumes the moth larva, eventually killing it. The mature wasp larva then spins its own silky cocoon (e.g. Figure 3b) in which it pupates before emerging as an adult wasp.

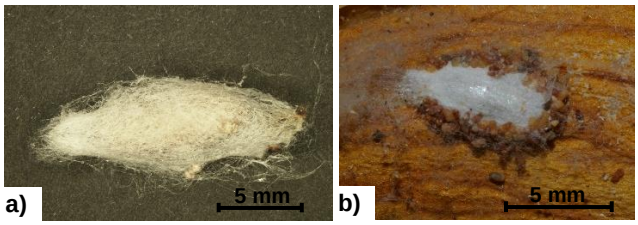

Figure 3. a) a loose-woven cocoon enclosing a healthy carob moth pupa, compared to b) a smoother, glossy cocoon enclosing the pupa of a larval parasite of carob moth.

Figure 4. A larval parasitoid (Family Braconidae) of carob moth from the cocoon shown in Figure 3b, collected in the Robinvale district.

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Figure 5. A second species of larval parasitoid (Family Chalcididae) of carob moth collected in the Robinvale district.

Larval-pupal parasitoid wasps typically lay an egg into a host larva, and that larva develops into a pupa before dying. The wasp larva completes its development inside the host pupal case (e.g. Figure 6 c) before the mature wasp emerges from the host pupa. Some pupal parasitoids lay their eggs directly into the host pupa.

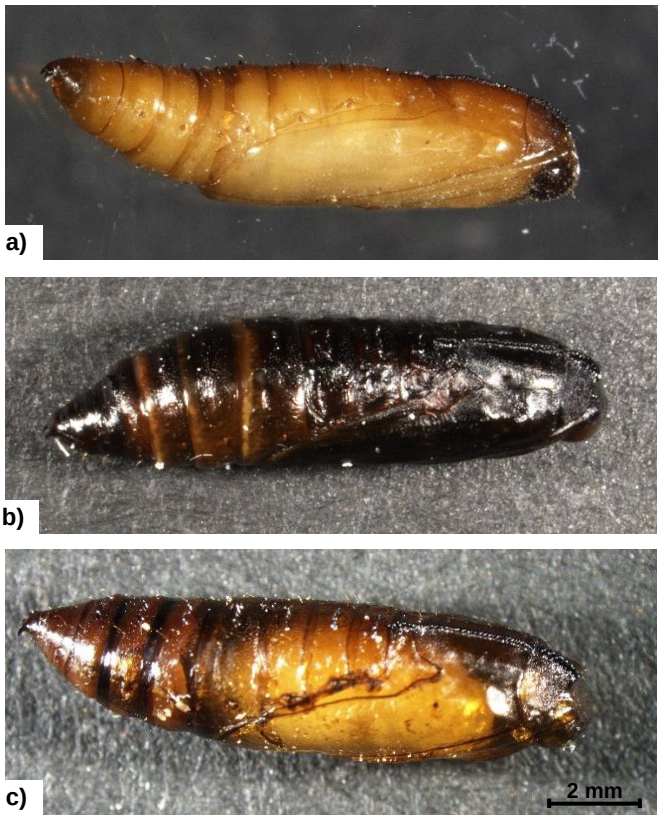

Figure 6. Carob moth pupae; a) healthy immature, b) healthy mature, c) parasitised, with a white wasp larva visible inside the pupal case.

Predators

Green lacewing *Mallada signatus*

Adult green lacewings (Figure 7) feed on pollen. Their eggs (Figure 8) are laid on short stalks that may help to protect the eggs from predation by their siblings.

Figure 7. Green lacewing adult.

Figure 8. Stalked eggs of green lacewing laid on a carpophilus beetle trap in an almond orchard. [Photo: Mary Cannard, Olam Orchards]

Green lacewing larvae use their hollow pincer-like mouthparts to suck out the body contents of a range of soft-bodied insects such as small caterpillars, aphids and scale insects. The larvae carry the remains of their prey on their back and this is thought to give them some protection as camouflage (Figure 9).

Figure 9. Green lacewing larva feeding on an aphid.

Brown lacewing *Micromus tasmaniae*

Brown lacewing adults (Figure 10) and their larvae (Figure 11) feed on small insects like aphids and tiny caterpillars. The adults also feed on plant nectar and pollen.

Figure 10. Brown lacewing adult and egg.

Figure 11. Brown lacewing larva.

Unlike green lacewings, brown lacewing eggs have no stalk and their larvae do not carry the remains of their prey.

Transverse ladybird *Coccinella transversalis*

Transverse ladybird adults (Figure 12) feed on a range of small insects including moth eggs, small caterpillars, aphids and mites. This species, like many other ladybirds, also feeds on pollen when their preferred prey is in short supply. Their larvae (Figure 13) have a similar diet.

Figure 12. Transverse ladybird adult.

Figure 13. Transverse ladybird larva.

Red and blue beetle *Dicranolaius bellulus*

Adult red and blue beetles (Figure 14) eat eggs and small larvae of insects including moths, and also feed on pollen. These beetles have been seen frequently in some almond orchards, but their eggs, larvae and pupae are rarely seen as they occur in the soil.

Figure 14. Adult 'red and blue' beetle.

Stethorus 'Mite destroyer' *Stethorus species*

Adults and larvae of tiny Stethorus ladybirds are well known as predators of mites and mite eggs, hence their nickname 'mite destroyer'. These predators are reported to feed on small insects, insect eggs, nectar and pollen when mites are scarce.

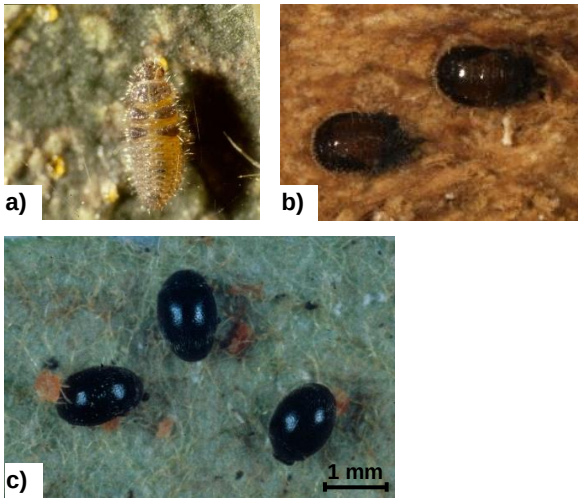

Figure 15. Stethorus ladybird; a) larva, b) pupae, c) adults.

Hoverfly *Melangyna viridiceps*

Hoverfly adults (Figure 16) are known to feed on nectar and pollen. Their larvae (Figure 17) are best known as predators of aphids but are also known to consume small caterpillars.

Figure 16. Adult hover fly.

Figure 17. Hoverfly larva feeding on aphids.

Minute pirate bug *Orius sp.*

Orius is a genus of omnivorous bugs in the insect family Anthocoridae. Anthocorid bug adults (Figure 18) and nymphs (Figure 19) feed on moth eggs and small insects like thrips, aphids, mites and small caterpillars. They are also known to feed on pollen as an alternative food source.

Figure 18. Orius bug adult & nymph. [Photo: Denis Crawford]

Figure 19. Anthocorid bug nymph on almond.

Eggs of anthocorid bugs (Figure 20) have often been observed on almond mummy nuts.

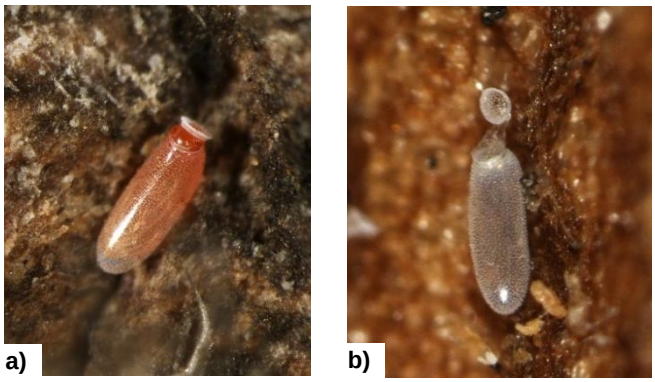

Figure 20. Anthocorid bug eggs on almond; a) hatching, b) empty egg case.

European earwig *Forficula auricularia*

European earwigs (Figure 21) do eat plant material including almond leaves as most growers would know, but they are also well known as general predators and feed on aphids, insect eggs, moth larvae and pupae.

Figure 21. Adult European earwigs (♂ upper, ♀ lower).

As noted above, at some stage during their life cycle, many of these parasites and predators rely on pollen or nectar for food. Because of this, the provision of appropriate pollen and nectar sources may help to support populations of those species in orchards. Some pesticides are toxic to parasites and predators and dust is known to inhibit the activity of some of these beneficial species, so minimising pesticide usage and dust is often recommended to help to improve the level of biological pest control in IPM systems in horticulture.

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