Important natural enemies in vegetable crops

This section describes common natural enemies found in Australian vegetable crops. They are listed according to order.

**Predators and parasites**

Predators hunt and capture their prey, killing it as they feed on it. Parasites invade the body of their host (endoparasites) or attach themselves to their host (ectoparasites), and feed on it while it is still living. They weaken the host but may not necessarily cause death. However, insect parasites (which feed on other insects) invariably kill their host and are known as parasitoids. Parasitoids have a free-living adult stage (i.e. the adults live independently of the host) and a parasitic immature stage.

Many parasitoids and predators are very susceptible to insecticides, while others have some degree of tolerance. Most parasitoids and predators are very important in the 'natural' control of pests. There are many that we don't know about, and many that may play only a minor role in some seasons.

Only a small selection of the many insect predators and parasitoids are mentioned here.

**Parasitic wasps and predatory wasps (Hymenoptera)**

**Parasitic wasps**

Parasitic wasps lay their eggs in a wide range of eggs, larvae and pupae of other insects and arachnids. The wasp larvae feed and develop inside the host, with some pupating inside and some outside the host. In vegetables, wasp parasites are important in controlling heliothis, potato moth, cabbage white butterfly, cabbage moth, whiteflies and aphids. The adult wasps feed on nectar and pollen from flowering plants. Some feed on the honeydew secretions of their target hosts.

**Large wasps (more than 10 mm long)**

Adults are often slender-bodied with long antennae, and are red or orange in colour with black or steely blue markings. Female wasps have a long ovipositor to penetrate the host insect when laying her eggs. Hosts include many moth, butterfly and beetle larvae. Some species included in this category are orange caterpillar parasite (*Netelia producta*), two-toned caterpillar parasite (*Heteropelma scaposum*), banded caterpillar parasite (*Ichneumon promissorius*) and yellow flower wasp (*Campsomeres tasmaniensis*). The female of the banded caterpillar parasite lays its eggs in moth pupae in the soil, while the yellow flower wasp parasitises scarab beetle larvae in the soil.
Small wasps (1–10 mm long)

A number of species of small wasps also parasitise a wide range of moth, butterfly and beetle larvae, as well as scale insects, aphids and mealybugs. The adults are slender-bodied and many of them are black. Examples are *Aphidius* spp. that parasitise aphids; *Orgilus lepidus*, *Apanteles subandinus* and *Copidosoma* spp. that parasitise potato moth; species of *Cotesia* that parasitise brassica pests; and *Diadegma* spp. and *Apanteles* spp. that parasitise diamondback moth. *Microplitis demolitor* and *Cotesia kazak* parasitise heliothis larvae.
Tiny wasps (less than 1 mm long)

There are also many species of tiny wasps that parasitise insect pests. Native species of *Encarsia* and *Eretmocerus* parasitise whiteflies. The introduced *Eretmocerus hayati* parasitises silverleaf whitefly. The adult wasps are 0.8–1 mm long and yellow to yellow-brown in colour. The females lay their eggs under young whitefly nymphs, and the wasp larvae penetrate the nymphs and feed and develop within them. *Encarsia formosa* is an important parasite of greenhouse whitefly. The wasps have a dark head and thorax and yellowish abdomen.

Other tiny wasp parasites such as *Trichogramma* spp., *Trichogrammatoidea* spp. and *Telenomus* spp. are important egg parasites of moths and butterflies. They are known to parasitise eggs of heliothis and looper caterpillars, although most species have a preference for a single-host species. Up to five wasps may emerge from each host egg. The *Trichogramma* wasp adult (which is a minute, black wasp) lays up to three eggs into the eggs of insect pests like heliothis. Host eggs turn black as the *Trichogramma* larvae develop within. The adults are too small to be easily seen in the field and often the first sign of their presence is when parasitised eggs turn black.

The imported *Trissolcus basalis* (green vegetable bug egg parasite) is an important parasitoid of green vegetable bug eggs.
Predatory wasps

Many wasps are predators of insect and arachnid eggs, larvae, nymphs, pupae and adults. Some are both predators and parasites. Predatory wasps usually collect a large number of prey and can be very effective in controlling pests. They build nests of paper or mud (which may be single or multi-celled) into which spiders, caterpillars, flies, bugs and other soft-bodied insects are placed. The prey is usually stung and then stored in the nest in a partly paralysed state. Adult wasps are usually yellow to orange in colour with black or brown markings.

Some species create a nest by burrowing in the soil. Others nest in cavities in plants or protected places. Mud-dauber wasps, also known as slender mud nest builders (*Sceliphron* spp.), are predators of a range of insects and spiders. Prey are sealed in mud nests where they are devoured by developing larvae. Adults are black and yellow with a long, threadlike waist. They are a relatively large wasp, between 12 mm and 20 mm long. Mud nests are built on stones and walls.

Parasitic and predatory flies (Diptera)

Many flies are predators or parasites of a range of insect and arachnid eggs, larvae, nymphs, pupae and adults. Some are both predators and parasites.

Parasitic flies

Tachinidae

Tachinid fly larvae are internal parasites of a wide range of insect larvae and adults. Larvae of moths and butterflies are often targeted, and bugs are also parasitised. The eggs are generally laid on the surface of the host. When they hatch, the larvae enter the host through openings such as breathing pores. In some species the eggs are laid in protected places and the newly hatched larvae have to find the host. After hatching, the maggots bore into the host and feed on its tissue. Adults are small- to medium-sized flies, 4–10 mm long. They are thick-bodied, hairy and may be dull black, grey or metallic in colour. Many have an abdomen with a checkerboard appearance. Examples include *Carcelia* spp. and *Chaetophthalmus* spp. The green vegetable bug parasitic fly (*Trichopoda giacomellii*) parasitises green vegetable bugs. Adult flies feed on nectar or honeydew secretions from other insects.
Predatory flies

Hover flies

Syrphidae

There are many species of hover flies. The larvae are sluggish, legless maggots, often green in colour, which feed by puncturing their prey and consuming the fluid contents. They are important predators of aphids and other small, slow-moving insects, including moth and butterfly larvae. All stages of the prey, including eggs, are attacked. Adult hover flies are up to 12 mm long and resemble bees and wasps due to the black and yellow bands on the abdomen. They feed on nectar and pollen, and are often seen hovering around weeds.

Robber flies

Asilidae

Both adults and larvae prey on a wide range of insects. Adults ‘pounce’ on their prey from the air. The adults range in size from 10 mm to 25 mm in length. They are slender-bodied and hairy, and are mainly grey or black in colour, sometimes with red or yellow markings.
Predatory bugs (Hemiptera)

**Spined predatory shield bug**

*Oechalia schellenbergii*

Adults and nymphs are predators on caterpillars like loopers and heliothis. The strong, piercing/sucking mouthparts are used to impale the prey and suck the body fluids. The adult is 9–12 mm long and mottled grey to brown with a large, lateral spike on each side of the thorax.

![Adult spined predatory shield bug piercing a heliothis larva](photograph courtesy of C Freebairn, DEEDI)

![Spined predatory shield bug egg raft](photograph courtesy of J Wessels, DEEDI)

![Spined predatory shield bug nymph](photograph courtesy of J Wessels, DEEDI)

**Glossy shield bug**

*Cermatulus nasalis*

Adults and nymphs are predators of caterpillars such as heliothis and loopers. The adults are similar to the spined predatory shield bug but without the spines on the thorax. The nymphs, like those of spined predatory shield bug, are dark red and brown.

![Adult glossy shield bug](photograph courtesy of J Wessels, DEEDI)

![Glossy shield bug nymph](photograph courtesy of J Wessels, DEEDI)
Assassin bug

Reduviidae

A number of species, including the beekiller (*Pristhesancus plagipennis*), are useful predators of pest insects. Adults and nymphs are predators of a range of insects, many of which are pests. They have very strong, curved, piercing/sucking mouthparts that are used to pierce the hard, outer skeleton of their prey. Adults range in size from 10 mm to 30 mm depending on the species. They are usually drab red-brown in colour and ambush their prey by waiting quietly near flowers and other places frequented by insects. Nymphal stages sometimes camouflage themselves with plant debris.

Bigeyed bug

*Geocoris* spp.

These bugs are easily recognised by their very large eyes. Adults are about 3 mm long, grey/steely black in colour with brown translucent wings and are very fast moving. They prey on small, soft-bodied insects and mites.

Damsel bug

*Nabis* spp.

Nymphs and adults pierce and suck the contents of eggs and caterpillars of heliothis and loopers, and also feed on leafhoppers, aphids and spider mites. Adults are 7–9 mm long, with a tan or grey, slender body and long legs and antennae.
**Mirids**

**Miridae**

A number of species of mirids are predators of other insects and also sometimes feed on plants. Most are less than 3 mm long and range in colour from brown and yellow to green. One common species is the brown smudge bug (*Deraeocoris signatus*). It will feed on heliothis eggs and aphids. Apple dimpling bugs (*Campylomma liebknechtii*) will feed on mites and heliothis eggs, although they also feed on soft plant tissue.

**Minute pirate bugs**

**Anthocoridae—*Orius* spp.**

These small bugs (2–3 mm) are dark brown to black in colour. They feed on insect eggs and thrips, and are an important predator of western flower thrips.
Ladybirds

Coccinellidae

There are a large number of ladybirds that are effective predators of vegetable pests. They prey on a wide range of soft-bodied insects and mites, including aphids, mealybugs, scale insects, two-spotted mites and European red mites. Most are small, between 2 mm and 4 mm in length. Their bodies are generally rounded with red, orange, yellow and black markings, although a few are predominantly black. Ladybird larvae have a tapered abdomen and some may be covered with a waxy substance and appear similar to mealybugs. Eggs are laid in clusters of 5 to 100, are generally yellow or cream in colour and are cylindrical with tapered ends.

The major ladybird species are:

- **mite-eating ladybird** (*Stethorus* spp.)—small, black ladybirds about 1.5–2 mm long, which are very efficient predators of mites and aphids
- **transverse ladybird** (*Coccinella transversalis*)—adults, which are about 4 mm long, are yellow-orange with black, V-shaped marks on each wing cover
- **striped ladybird** (*Micraspis frenata*)—adults are 4 mm long and have a striped pattern on the wing covers
- **maculate or three banded ladybird** (*Harmonia octomaculata*)—adults are 5 mm long with three rows of spots across the wing covers giving a banded appearance
- **minute two-spotted ladybird** (*Diomus notescens*)—adults are 2.5 mm long and dark in colour with two orange spots on the wing covers
- **common spotted ladybird** (*Harmonia conformis*)—larger species up to 7 mm long with prominent spots
- **variable ladybird** (*Coelophora inaequalis*)—adults are 5 mm long with variable wing cover pattern
- **spotted amber ladybird, also known as the white collared ladybird** (*Hippodamia variegata*)—adults are 5 mm long, with red to orange to yellow wing covers with several black spots. The front of the thorax (pronotum) is black with a white edge, or collar.
Ground beetles (or carab beetles)

Carabidae

This is a very large family of beetles, most of which are predators. Almost all are ground-dwelling, sheltering under rocks and other debris. They are mainly nocturnal feeders and because they are not often seen, their importance tends to be overlooked. They prey on a wide range of insects, spiders, worms, slugs and snails—all stages of which are consumed. Size varies from 5 mm to 25 mm in length and they are usually dull black or brown in colour. A few species have brighter metallic colours. They have long legs, strong mandibles and the protective plate behind the head has a distinctive ‘shield’ shape. Larvae are slender with strong mouthparts.

Lacewings (Neuroptera)

Green lacewing

*Mallada* spp.

Green lacewing larvae are predators of a wide range of caterpillars, aphids, scale insects and moth eggs. They are squat, six-legged voracious hunters that clamp their well-developed jaws on soft-bodied insects or eggs and then suck up the contents. They camouflage themselves with the carcasses of their prey. Adults are green to yellow, 10–18 mm long and have lacy, see-through wings. They lay their eggs on long, flexible stalks that may be 4–8 mm long.
Brown lacewing

*Micromus tasmaniae*

Adults and larvae are predators of moth caterpillars and aphids and their eggs. Larvae are smooth with brown and white markings. They are longer and thinner than green lacewing larvae and do not camouflage themselves with the corpses of their prey. They suck the contents of their prey through their large jaws. Adults are pale brown and smaller than green lacewings. Their wings have a brown, speckled appearance. Females lay their cream, oval eggs singly, attached by one side to the underside of leaves. Adults chew their prey.

**Brown lacewing larva feeding on aphids**

Dragonflies and damselflies (Odonata)

Adult dragonflies and damselflies feed on flying insects, which they catch ‘on the wing’. Their general importance as predators is not fully understood, but they do catch small moths and flies. The larvae are aquatic.

**Dragonfly**

Adults are predators of flying insects, including moths, bugs and beetles. The aquatic larvae feed on small water animals such as beetles and mosquito larvae. The larvae do not resemble adults. Adults are slender bodied with a large head. The forewings and hind wings differ in shape and venation.

**Damselfly**

Both adults and larvae prey on a range of insects. The adults catch various insects in flight and the larvae feed in the water on mosquito larvae and other small aquatic insects. Adults are similar in appearance to dragonflies (but are smaller) and the forewings and hind wings are the same shape and have similar venation. The larvae are aquatic.

Other insect predators

**Praying mantid**

*Mantodea*

Most species are green, brown or mottled in colour. Prey are caught in distinctive, strong, raptorial (adapted for seizing prey) front legs. They prey on a wide range of insects and other small animals.
Common brown earwig

*Labidura truncata*

The common brown earwig is a nocturnal predator of caterpillars and other small animals. It will also attack heliothis pupae in their chambers underground. Adults have distinct ‘forceps’ at the tail end of the abdomen and the large, membranous hind wings are folded beneath slate blue wing covers. They hide on and in the ground during the day. Adult females guard their oval, white eggs and young nymphs in burrows in the ground.

**Ants**

*Formicidae*

As stated in the previous section on pests (see p. 48), ants have a wide range of feeding habits, but some species are very effective as predators.

**Spiders and mites (Arachnida)**

**Spiders**

*Araneae*

**Web spiders**

Web spiders build sticky webs to entangle their prey. Orbweavers (*Araneus* spp. and *Argiope* spp.) build large, circular webs. Some species wait under nearby leaves, others in the centre of the web. Tangle web spiders (*Achaearanea veruculata*) build an untidy web, often with no recognisable pattern. Most species hide under nearby leaves.

Common brown earwig

(photograph courtesy of RH Broadley, DEEDI)

**Common brown earwig attacking a pupa**

(photograph courtesy of J Wessels, DEEDI)

**Orbweaving spider (Araneus sp.)**

**Tangle web spider**

(photograph courtesy of RH Broadley, DEEDI)
**Hunting spiders**

Hunting spiders rarely build webs, except for protection of eggs. They either stalk their prey or hide and ambush it.

Lynx spiders (*Oxyopes* spp.) are active near the tops of plants. The abdomen is narrow and pointed. Wolf spiders (*Lycosa* spp.) generally hunt on the ground. They may build a shallow burrow. Flower spiders (*Diaea* spp.) hide in flowers and ambush small insects. Nightstalking spiders (*Cheiracanthium* spp.) hunt at night. These spiders are pale yellow with a faint, grey mark on the abdomen. The ‘head’ of one species, the yellow nightstalking spider, is pale orange. Jumping spiders (Salticidae) hunt during the day. They have two very large forward-facing eyes that give them excellent binocular vision.

**Mites**

*Acarina*

**Chilean predatory mite**

*Phytoseiulus persimilis*

This predator is produced commercially for release into crops for the management of two-spotted mite. It is larger with longer legs than the two-spotted mite and has a shiny, orange, pear-shaped body. Eggs are elliptical in shape and also larger than two-spotted mite eggs. Juvenile predatory mites are a pale, salmon colour.
Montdorensis predatory mite

*Transepis montdorensis*

These predatory mites are useful predators of thrips, whiteflies and other small insects, particularly in protected cropping. The pale, pear-shaped adults are about the same size as two-spotted mites.

Cucumeris predatory mite

*Neoseiulus cucumeris*

These small, pear-shaped cream coloured mites are efficient predators of thrips larvae and some mites, particularly in protected cropping.

Hypoaspis predatory mites

*Hypoaspis spp.*

These soil-dwelling predatory mites are useful predators of fungus gnat larvae.

Centipedes (Chilopoda)

Centipedes are long animals with many segments and pairs of legs. Contrary to the name, very few centipedes have 100 or more legs. Most are voracious predators, feeding on insects, spiders and other small animals. They have a pair of poison glands (which are actually modified legs of the first body segment) underneath the head and they use these glands to paralyse their prey.
Pathogens

Insects and arachnids can become infected with a range of diseases. In nature, these diseases tend to have the most impact when pest numbers are high and the weather is humid or rainy. Some insect disease pathogens are available as commercial insecticides, and examples include the bacterial insecticides made from *Bacillus thuringiensis* and the insecticides made from the nuclear polyhedrosis virus specific to and effective against heliothis.

Viral diseases

Outbreaks of viral diseases, such as that caused by nuclear polyhedrosis virus, may be seen sporadically in vegetable crops. Viruses are usually specific to a particular insect species or group of related species. One nuclear polyhedrosis virus affects the larvae of heliothis and another the larvae of cabbage white butterfly. Infected larvae first become pale, then die, turning into liquidy sacks, and are often found with the head characteristically hanging down. Granulosis viruses infect some insects (e.g. potato moth larvae).
**Fungal diseases**

Fungal diseases affect aphids as well as larvae of some vegetable pests. The fungal spores invade the body of the host insect and give it a colour and sheen characteristic of that particular fungus. Prolonged wet or humid conditions favour the development of fungal diseases and infected larvae become stiff and are anchored to the plant by fungal threads.

**Bacterial disease**

Pests may become infected with bacterial diseases. One such disease is caused by *Bacillus thuringiensis*. Commercial preparations of this bacterium that are specific to moth and butterfly larvae are available.