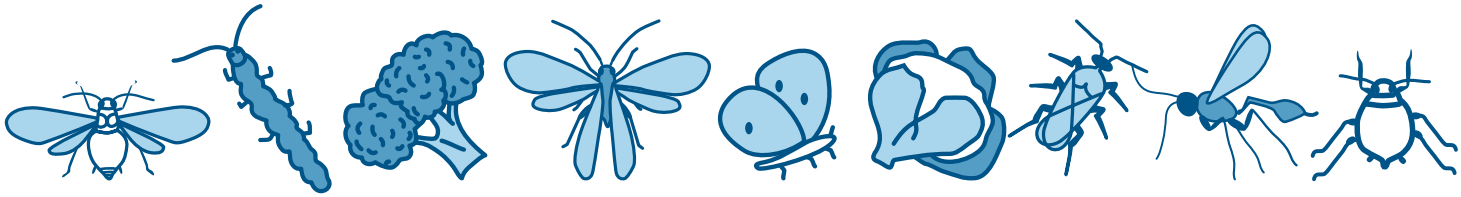
COMMON VEGETABLE INSECTS



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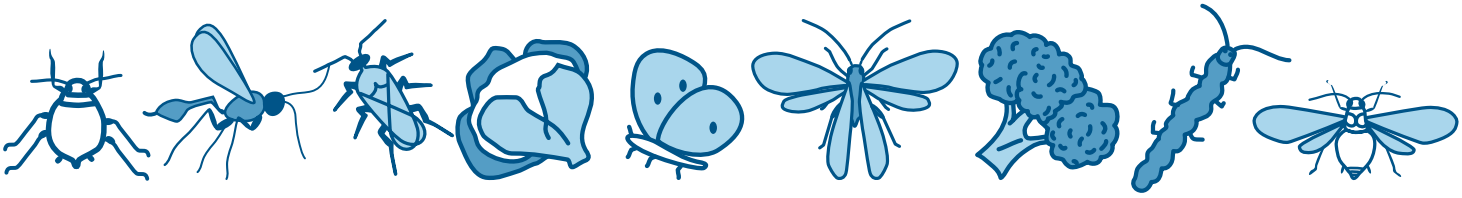


Common vegetable insects

This section should be used as an introduction to insect identification and insect management. It was not possible to cover every vegetable insect pest in this manual. However, at the end of the manual you will find useful references that will provide you with links to insect related information. Your local agricultural adviser should be able to provide more information regarding the management of specific insect pests.

Insects as pests

Only a small percentage of insects are actually 'pests' that cause some form of marketable damage to your crop. The majority of insects you see in your crop are either beneficials or other insects that live in or nearby your crop but do not damage it and are not attracted to the crop. Being able to distinguish between crop pests and beneficials, and understanding their feeding and living habits, is important in developing an integrated pest management program.

Insect feeding habits

Insect pests have certain feeding habits. Some chew, some suck sap, and some feed inside leaf tissue. Recognising feeding damage can help identify the insect pest. Chewing pests have specialised mouth parts to chew through the leaf, fruit and stem leaving holes in the plant. The larvae of the diamondback moth (Figure 4.1) is a typical example of a chewing pest.

Figure 4.1 Diamondback moth larvae are typical chewing pests (GRDC)

Sap sucking insects, like aphids and thrips, have specialised piercing mouthparts that they inject into the plant tissue to remove sap from the plant cells. The cells usually die, causing silvering or small spot symptoms to appear.

Some insects feed within the leaf tissue. The first instar (growth stage) of the diamondback moth feeds this way. It emerges from the egg and lives and feeds inside the leaf before emerging 3-4 days later to feed on the leaf surface. A squiggly mine trail of dead plant cells usually forms as a result of this type of feeding damage (Figure 4.2).

Figure 4.2 A mine trail from a sap-sucking insect

Insect life cycles

It is important to identify and understand the different stages of an insects' lifecycle when adopting an IPM approach. The lifecycle stage of the pest should be recorded when monitoring the crop, as this determines the most effective time to apply a control. Every pest has a particular stage of its life cycle at which it is most susceptible to effective control. This is important when applying costly insecticides, as some insecticides are more effective on eggs while others are more effective on young grubs.

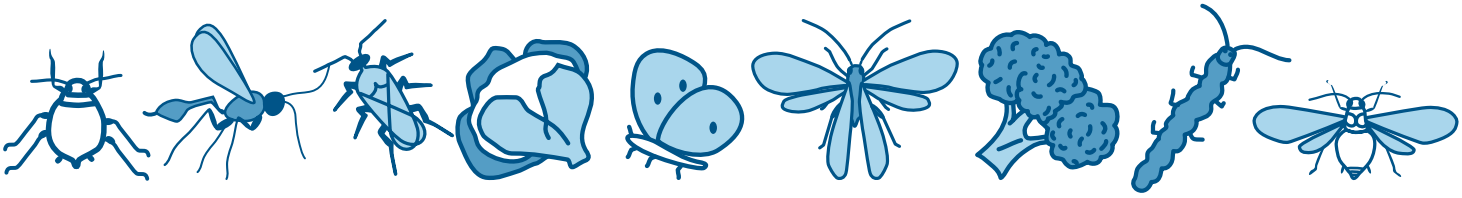


Figure 4.3 A nymph (GRDC)

Figure 4.4 Larvae or caterpillar (GRDC)

Figure 4.5 Instars or growth stages (GRDC)

Lifecycles of insects are classified into three groups; single metamorphosis, incomplete metamorphosis and complete metamorphosis

Most insect lifecycles involve an egg being laid by the adult, the egg hatches and a nymph or larvae emerges (Figures 4.3 and 4.4). The insect progresses through a series of growth stages (known as 'instars') before it reaches full maturity or adulthood (Figure 4.5). The degree of change from young larvae or nymph to adult classifies the insect into one of the three life cycle categories.

Insects with a single metamorphosis don't change much in appearance from nymph through to adult (eg.aphids). Incomplete metamorphosis insects show a significant amount of change from nymph or larvae stage to adulthood. Thrips fit into this category, as they go from being wingless nymphs to winged adults. Insects with a complete metamorphosis lifecycle, such as the cutworm in Figure 4.6, go through a complete physical change from larval, to adult to pupal stage.

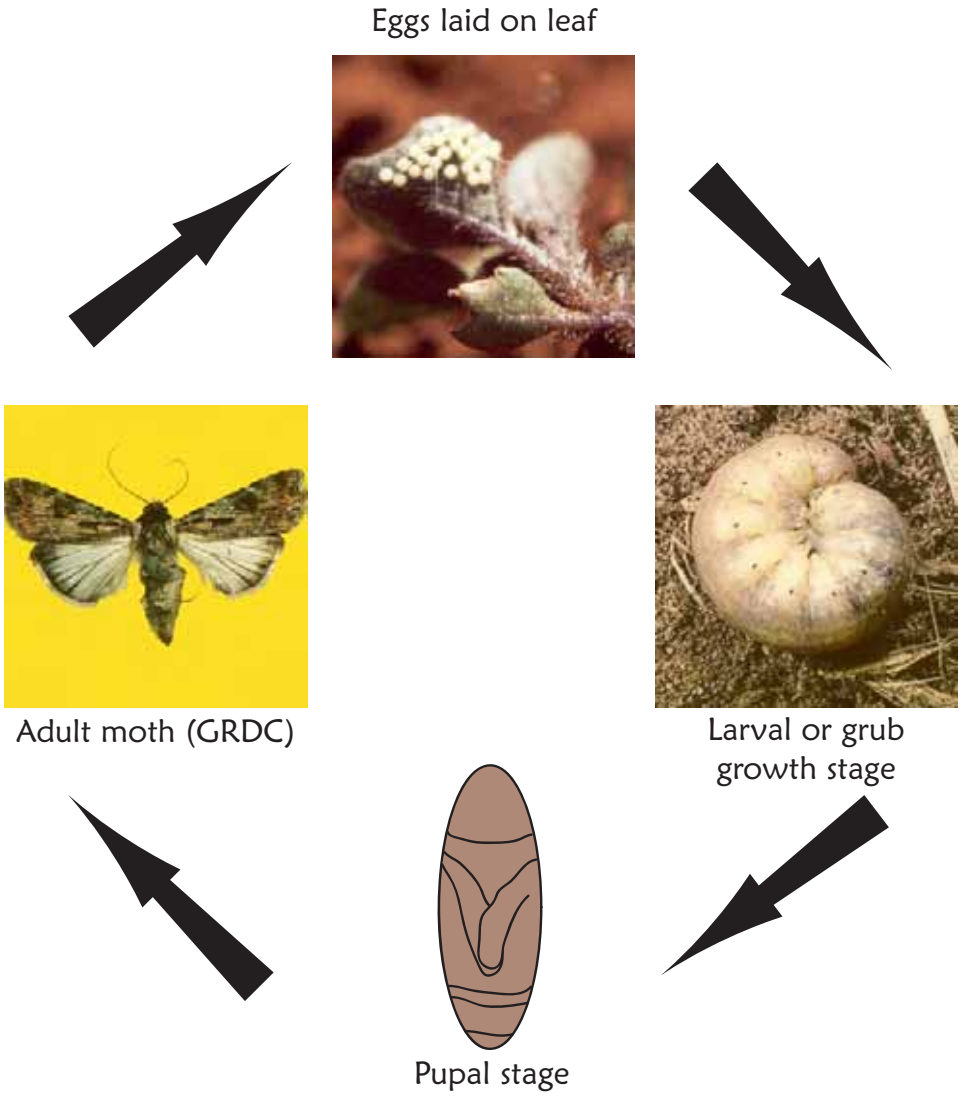


Figure 4.6 Life cycle of the cutworm, an example of a complete metamorphosis lifecycle

Identifying beneficial organisms

Beneficial organisms that are the natural enemies of pests are often mistaken for crop pests. In fact, they are the opposite. Encouraging beneficial insects and pathogens into the crop is an important component of controlling specific pests through IPM. Beneficials survive by eating or living within the host pest, eventually killing the pest.

Beneficial organisms are grouped into one of the following: predators, parasitoids or pathogens (fungal, bacterial and viral diseases). In practice, for the best control of crop pests, all three types of beneficials should be used in combination.

Beneficials help suppress pest populations once the pest has established. Care must be taken with the use of pesticides, as predators and parasitoids are susceptible to pesticides. Many pesticides can completely destroy the population of beneficial insects, spiders and mites. In many cases, if the beneficial has been removed, the pest population actually increases after a pesticide application.

Parasitoids

Parasitoids are often difficult to identify in crops due to their extremely small wasp like appearance and their ability to live inside the host pest. The adult stage is a flying insect while the larval stage is hidden in the host. They differ from predatory insects in that the adult parasitic wasp lays tiny eggs in or on the host, and when the eggs hatch, the larvae survive by slowly eating the pest internally.

Figure 4.7 Parasitoid wasps (GRDC)

Parasitoids are usually host specific and require the host to be present to enable the population to increase. Therefore, the pest infestation has to be already in progress before predators can increase in population. Achieving control through parasitoids is a gradual process, which requires time and suitable conditions for the population to increase. Adult parasitoids, like predators, are very vulnerable to being killed through unnecessary spraying.

Pathogens

Fungal pathogens attack the pest via the skin and gradually multiply within the pest. Viral pathogens need to be ingested to kill the pest. They multiply within the pest and gradually kill it.

Insect feeding bacteria are effective beneficial pathogens. *Bacillus thuringiensis* (Bt) biological insecticide is the most common bacterial pathogen. It is found naturally in the soil, but has been selected to provide various strains to target various pests. The pest digests the Bt, which contains protein crystals. The crystals are toxic to the stomach of the pest. The pest stops eating and eventually dies.

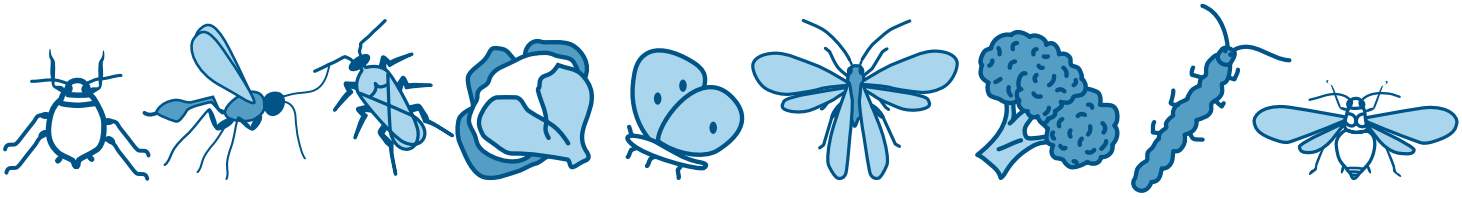


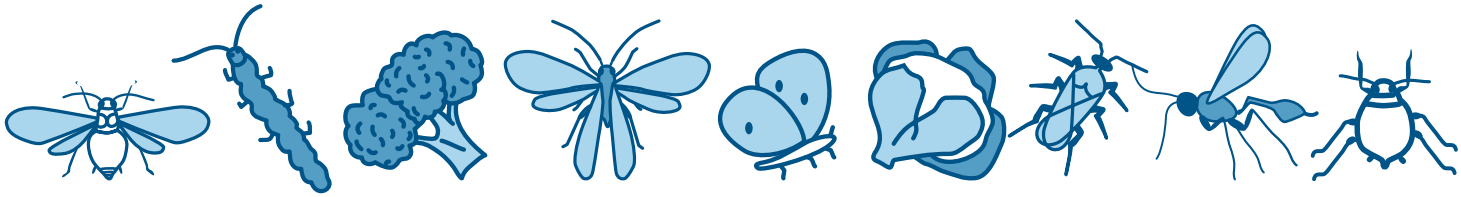
Figure 4.8 A hoverfly is an insect predator

Predators

Predators such as ladybirds, lacewings, damsel bugs and hover flies (Figure 4.8) are insects that feed on other insects, and can be effective at reducing pest populations if present in large numbers. The larvae or nymph stage of the predator is the stage that is always actively feeding on the host pests. Adults feed on the prey by sucking the juices from the eggs, larvae and adults of the pest. Spiders and some mites are also important predators.

Predators need time to build up the population to be economically effective. As they are susceptible to changing environmental conditions and pesticide exposure, their population can be easily destroyed.

Predators may impact on pest populations more rapidly than parasitoids, because they can move into a crop from an established population nearby and immediately attack the prey. Parasitoids can move into a crop from nearby, but need one reproductive generation to have an impact on the pest population. In practice, it has been found that predators are more valuable to IPM than parasitoids in short term crops like vegetables.



Predatory Insects	Target Pest
Brown Lacewing (*Micromus tasmaniae*)	• Diamondback moth egg and small larvae. • Cabbage white butterfly eggs and small larvae. • Aphids and thrips.
Damsel Bug	• Eggs and caterpillars of many insects such as common, brown and chevron cutworms, budworm and aphids. • Cabbage white butterfly – small larvae. • Diamondback moth – small larvae.
Hoverfly (*Melangyna sp*)	• Diamondback moth eggs and possibly small larvae. • Cabbage white butterfly eggs and possibly small larvae. • Aphids.
Ladybird	• Diamondback moth (DBM) egg and possibly small larvae. • Cabbage white butterfly (CWB) eggs and possibly small larvae. • Aphids.
Mite (*Anystis wallacei*)	• Red-legged earth mite.
Mite (*Neomolgus capillatus*)	• Lucerne flea.
Mite (*Neoseiulus cucumeris*)	• Thrip species - glasshouse environments only
Shield Bug	• Diamondback moth • Cabbage white butterfly • Heliothis • Common, brown and chevron cutworm caterpillars.
Spiders	• Generalist predators of moths, larvae and nymphs.
Parasitoids	**Target Pest**
Ichneumon wasp (Several genera)	• Many species – many caterpillars, varied level of specialisation.
Tachnid Fly (Several genera)	• Common and brown cutworm • Native budworm ('heliothis' or *Helicoverpa punctigera*) • Armyworm and green looper.
Wasp (*Aphidius colemani*)	• Aphids
Wasp (*Cotesia glomerata*)	• Cabbage white butterfly- larvae
Wasp (*Cotesia rubecula*)	• Cabbage white butterfly - larvae
Wasp (*Diadegma rapi*)	• Diamondback moth - larvae
Wasp (*Diadegma emiclausum*)	• Diamondback moth - larvae
Wasp (*Diadromus collaris*)	• Diamondback moth - pupae
Wasp(*Orgilus spp.*) & (*Apenteles subandinus*)	• Potato tuber moth larvae
Wasp (*Pteromalus puparium*)	• Cabbage white butterfly - pupae
Pathogens	**Target Pest**
Bacteria (*Bacillus thuringiensis*)	• Diamondback moth • Native budworm and others.
Fungal (*Zoophthora radicans*)	• Diamondback moth

Figure 4.9 Beneficial organisms and their target pests

A selection of beneficial insects of importance in the vegetable industry

Brown lacewing

Figure 4.10 Brown lacewing feeding on a young larvae (GRDC)

Figure 4.11 Adult brown lacewing (GRDC)

Common spotted ladybird

Figure 4.12 Eleven spotted ladybird (GRDC)

Hover fly

Figure 4.13 Hover fly larvae feeding on aphids (GRDC)

Figure 4.14 The adult hover fly feeding on nectar (GRDC)

Parasitoid wasp that attacks aphids

Figure 4.15 Wasp emerging from 'aphid mummy' (GRDC)

Figure 4.16 Mummified aphid. Aphid turns bronze colour when parasitised. Small emergence hole can be seen.

Parasitoid wasps that attack the cabbage white butterfly

Figure 4.17 Cotesia rubecula pupal cocoon (GRDC)

Figure 4.18 Cotesia rubecula adult wasp (GRDC)

Figure 4.19 Pupal parasite Pteromalus puparum(GRDC)

Parasitoid wasp that attacks the potato moth

Figure 4.20 Apenetels subandinus. One on left is female with a shorter antennae and ovipositor. Male is on right with longer antennae and no ovipositor(GRDC)

Predatory shield bug

Figure 4.21 Predatory shield bug (GRDC)

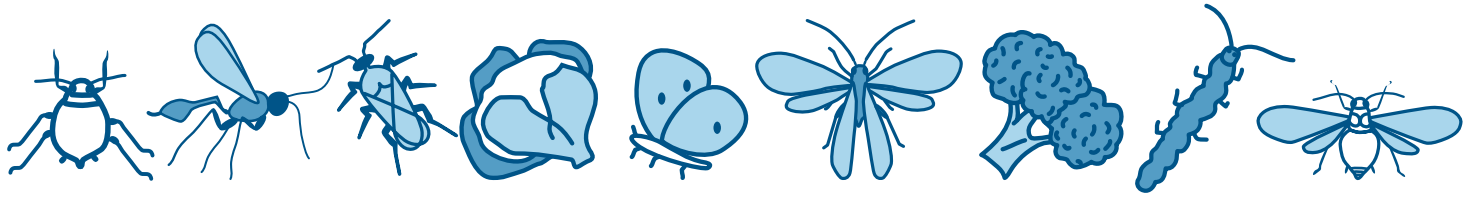


Figure 4.22 Cabbage white butterfly egg

Figure 4.23 Cabbage white butterfly larvae

Figure 4.24 Cabbage white butterfly moth

Insect pests in brassicas

Detailed descriptions on may of the insects mentioned are located in the appendix section of the manual.

Cabbage white butterfly (CWB) (*Pieris rapae*)

- Larvae cause the damage to the plant.
- Eggs are much larger than DBM eggs, conical shaped and raised 1-2 mm from the leaf surface.
- Larvae are docile and eventually grow much bigger than DBM grubs. They eat large holes in the leaves.
- Very common large white butterfly.
- No known resistance to insecticides.
- They are more abundant late in the season, whereas DBM are more abundant early in the season.
- CWB overwinters in Tasmania.
- See Figures 4.22, 4.23 and 4.24

Common cutworm (*Agrotis infusa*)/Brown cutworm (*Agrotis munda*)

- The first indication of damage is holes in weed leaves from the small larvae.
- Older caterpillars may lop and cut transplants.
- November and December are the most likely times to see damage.
- Larvae feed at night and hide in the soil by day.
- When the surface soil is scratched with fingertips, the grubs will tend to curl up and can be difficult to see.
- See Figures 4.25. 4.26, 4.27 and 4.28.

Figures 4.25 (above) Common cutworm adult and 4.26 (below) larvae (GRDC)

Figures 4.27 (above) Brown cutworm adult and 4.28 (below) larvae (GRDC)

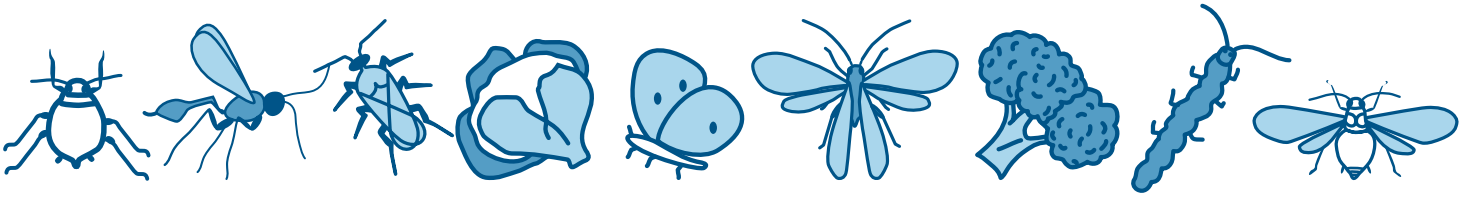


Figure 4.29 Diamondback moth larvae (GRDC)

Figure 4.30 Diamondback moth mine

Figure 4.31 Diamondback moth adult moth (GRDC)

Diamondback moth (DBM) (*Plutella xylostella*)

- Larvae cause feeding damage to the plant.
- Eggs are pale, laid on the top and bottom of leaves, often near veins.
- Small leaf mines will appear on the leaves shortly after egg laying. They leave a squiggly pattern, not to be confused with the fly leaf miner, which leaves large blister like mines.
- Larvae are active and will eat the leaves causing windows and shot-hole like damage. They also shelter in the broccoli head, making the crop unmarketable at harvest.
- Moths fly low through the crop, are fast moving, and will move from plant to plant when disturbed. They lay eggs at dusk.
- DBM has developed resistance to certain insecticides.
- See Figures 4.29, 4.30 and 4.31.

Green peach aphid (GPA) (*Myzus persicae*)

Grey cabbage aphid (GCA) (*Brevycoryne brassicae*)

- First indication of infestation is winged individuals that feed on foliage following spring flights.
- The winged aphids have many wingless daughters that form colonies around them.
- Infestations are initially patchy.
- Colonies cause leaves to pucker and roll inwards.
- GCA is distinguished by a grey-white, waxy coating on the body.
- GPA feeds on a wide range of plants and has developed resistance to many insecticides.
- GCA is restricted to brassica host plants and may have developed some resistance to insecticides.
- The presence of mummies indicates parasitism. Parasites of the GPA and GCA are badly affected by broad-spectrum sprays.
- See Figures 4.32, 4.33 and 4.34.

Figure 4.32 GCA adult (GRDC)

Figure 4.33 Colonies of GCA adults (GRDC)

Figure 4.34 Wingless GPA (©Denis Crawford – Graphic Science)

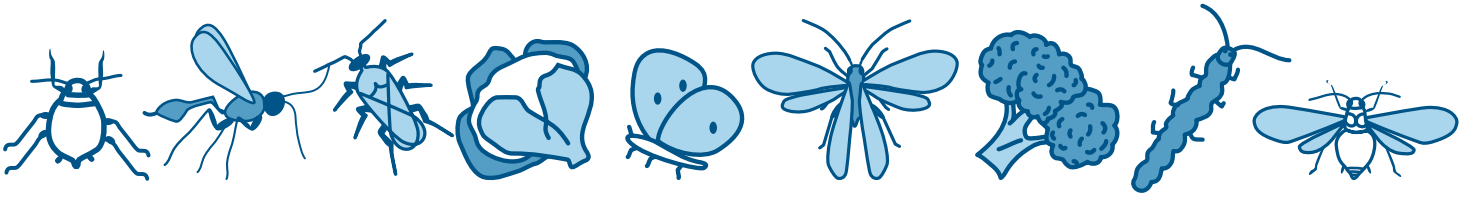


Figure 4.35 Heliothis eggs

Figure 4.36 Heliothis larvae

Native budworm (*Heliothis spp.*)

- Young larvae eat tender foliage while older larvae move to the head to feed.
- Similar to cutworm in that infestations originate from moths that immigrate in spring.
- Eggs are dome shaped and laid singly on foliage of the crop and weeds.
- They like to lay eggs on hairy leafed weeds like stagger weed and storksbill, which may act as nursery plants within crops.
- See Figures 4.35 and 4.36.

Figure 4.37 Rutherglen bug nymph

Figure 4.38 Rutherglen bug adult

Rutherglen bug (*Nysius vinitor*)

- Look for tiny grey bugs on the soft seeds of weeds, such as wire weed.
- The bugs may move into seed crops, especially if weeds mature or dry off.
- Nymphs do not have wings and are light-brown in colour.
- Adults have wings and are grey in colour.
- They suck sap from seeds by injecting digestive enzymes.
- See Figures 4.37 and 4.38.

Slug (*Deroceras spp.*)

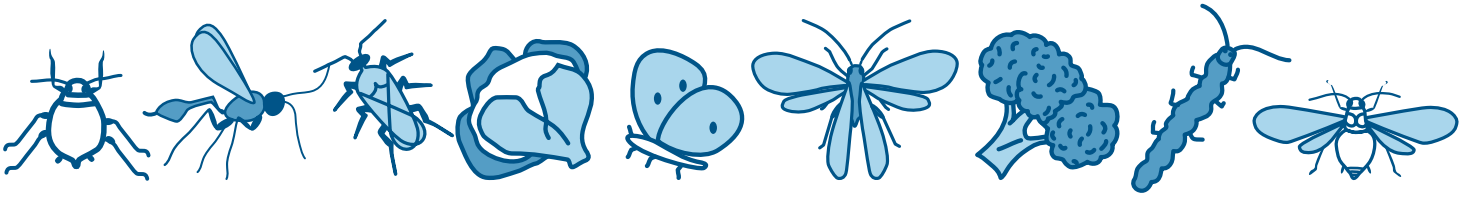
- Resembles snails in general appearance, except the shell is absent. This allows it to move down cracks in the soil and hide.
- Moves by producing clear, silvery mucus.
- Worst after long periods of pasture and minimal tillage.
- See Figure 4.39.

Figure 4.39 Slug

Snail

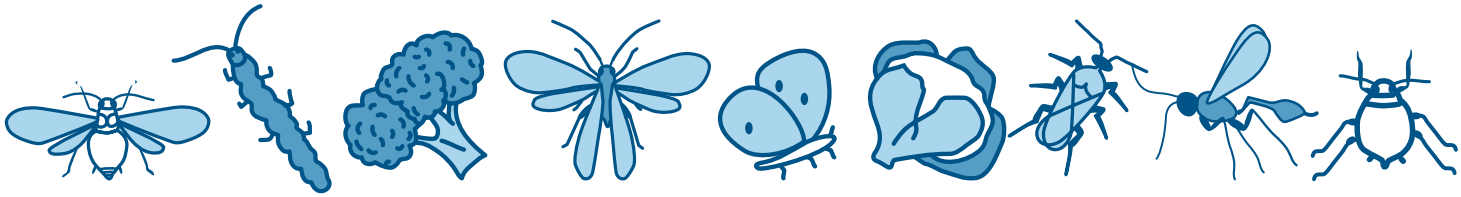
- Similar to a slug but carries a large hardened shell. This prevents it from moving down cracks in the soil to feed.
- Live under weed and debris, and tends to be restricted to near fence lines, whereas slugs occur more broadly.
- See Figure 4.40.

Figure 4.40 Snail



Management options for insect pests of brassicas

Insect	Biological	Cultural/Mechanical	Chemical
Cabbage white butterfly (CWB)	• Parasitic wasps (*Cotesia glomerata, Cotesia rubecula, Pteromalus puparum*). • Predators such as damsel bugs, spiders, hield bugs and ground beetles. • Birds.	• Remove brassica weeds and plant regrowth. • Monitor crop once a week. • Irrigation and rainfall may drown grubs and wash off eggs. • Insect exclusion netting on small scale crops.	• Resistance development is so far minimal. • Use resistant insecticides only after monitoring. • *Bacillus thuringiensis* (Bt) insecticides may be effective on very young grubs.
Cutworms – common, brown, chevron	• Attacked by some parasitoid wasps.	• Commence crop inspections once the crop is transplanted. • Look for cut off plant stems and damage on seedlings and weeds. • Juvenile weeds in fallow land favours egg laying. • Soil cultivation such as brush weeding shreds the grubs that hide in the topsoil during the day. • Irrigation and rainfall cause mortality.	• Insecticide should be applied in a band over the seedlings and adjacent soil late in the afternoon, when the grub is feeding.
Diamondback moth (DBM)	• Parasitic wasps (*Diadegma semiclausum* and *Diadromus collaris*) kill the grub by laying eggs inside the grub or pupa. • Fungal pathogen (*Zoophthora radicans*). • *Bacillus thuringiensis* (Bt) insecticide is only effective on the very young. • Predators such as spiders and damsel bugs.	• Remove brassica weeds and crop residues. • Monitor crop once a week. • Trap cropping using flowering plants to attract beneficials. • Pheromone traps to monitor moth activity within the paddock. • Irrigation and rainfall may drown grubs and wash off eggs.	• Use insecticides only after monitoring. • Spray only when caterpillar is present. Eggs and cocoon are immune to insecticides. Moths are difficult to kill. • Choose insecticides that protect predators and beneficials. • DBM has developed resistance to certain insecticides. Use a rotation of different chemical groups across generations.
Green peach aphid (GPA)	• Predators such as hoverfly and ladybird.	• Reduce plant nitrogen level to make the crop less palatable to the aphid.	• Registered aphicides available. Good coverage is required to obtain good results. • Broad spectrum insecticides commonly worsen aphid infestations.
Grey cabbage aphid (GCA)	• Parasitic wasp (*Diaeretiella rapae, Aphidius* wasps). • Predators such as hoverfly and ladybird.	• Reduce plant nitrogen level to make the crop less palatable to the aphid.	• Registered aphicides available. Good spray coverage is required to obtain good results.



Insect	Biological	Cultural/Mechanical	Chemical
Native budworm (*Heliothis sp.*)	• Parasitic wasp *Trichogramma* (not necessarily common in Tasmania) • *Bacillus thuringinesis* (Bt) as an insecticide. • Predators such as spiders, lacewings and damsel flies.	• Regular crop monitoring. • Pheromone traps to monitor moth activity in the crop.	• Registered insecticides – resistance has developed in certain areas of mainland Australia.
Rutherglen bug		• Regular crop monitoring. Assess surrounding weeds and watch for drying off and edge effects.	• Apply registered insecticides if infestation is high.
Slug/snail			• Slug pellets.

Figures 4.41 (above) Common cutworm adult and 4.42 (below) larvae (GRDC)

Insect pests in carrots

Detailed descriptions on may of the insects mentioned are located in the appendix section of the manual.

Chevron cutworm (*Diarsia intermixta*)

- Dark larvae rest on foliage or hide at the base of the plant.
- Heavy feeding by the larvae weakens the tops of plants, hindering lifting during harvesting.
- There are probably three generations per year, with the greatest risk being the autumn larvae.

Common cutworm (*Agrotis infusa*)/Brown cutworm (*Agrotis munda*)

- Small larvae cause the damage by chewing through leaves at night.
- First sign of infestation may be holes in the leaves of young weeds.
- Greatest damage occurs in late spring to mid-summer.
- The larvae hide in loose surface soil during the day.
- Moths fly in early spring and like to lay eggs on recently tilled soil.
- See Figures 4.41, 4.42, 4.43 and 4.44.

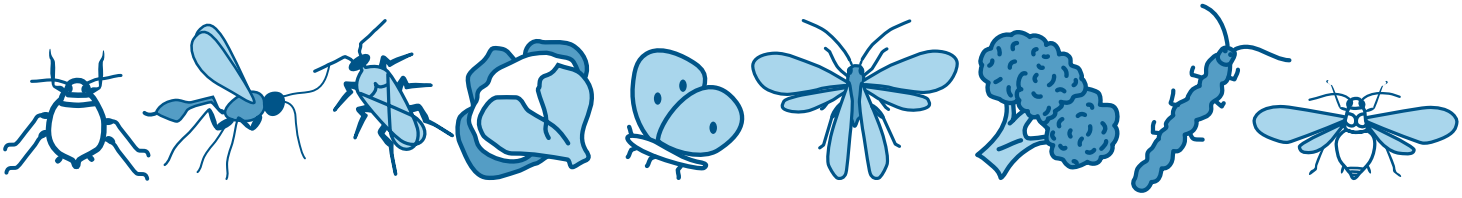
Figures 4.43 (above) Brown cutworm adult and 4.44 (below) larvae (GRDC)

Rutherglen bug (*Nysius vinitor*)

- Mostly a pest in carrot seed crops.
- Abundant in summer.
- Will converge from dying weeds to irrigated crops.
- Certain weeds (eg. bindweed) in crops sustain them.
- See Figures 4.45 and 4.46.

Figure 4.45 Rutherglen bug nymph (GRDC)

Figure 4.46 Rutherglen bug adult (GRDC)



Management options for insect pests of carrots

Insect	Biological	Cultural/Mechanical	Chemical
Cutworms – common, brown, chevron	• Attacked by some parasitoid wasps.	• Commence crop inspections after emergence, looking for damage on seedlings and fallen plant stems. • Soil cultivation shreds the grub as it hides in top soil. • Remove young weed growth in fallow land prior to planting, as this attracts cutworm.	• Apply registered insecticides in a band over the seedlings and adjacent soil late in the afternoon when the grub is feeding. Best results are achieved if plants are small.
Rutherglen bug		• Regular crop monitoring, looking for small clusters of the pest on the plant, and any sign of plant wilting. • Check nearby weeds in and outside of crop, especially those with small tender seeds. • Remove attractive weeds in or near crops.	• Use insecticides if there is a heavy infestation.

Insect pests in green beans

Detailed descriptions on may of the insects mentioned are located in the appendix section of the manual.

Common cutworm (*Agrotis infusa*)/Brown cutworm (*Agrotis munda*)

- The larvae cause the damage by chewing through the seedling stems near the soil line and causing the seedlings to die.
- Larvae or caterpillars are dark green-black and pinkish-brown in colour.
- Larvae are usually found curled up just under the surface of the soil near the plant.

Figures 4.47 (above) Common cutworm adult and 4.48 (below) larvae (GRDC)

Figures 4.49 (above) Brown cutworm adult and 4.50 (below) larvae (GRDC)

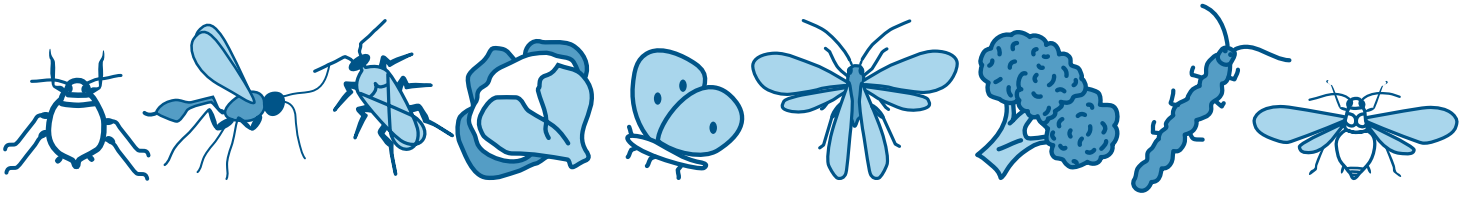


Figure 4.51 Native budworm egg on a pea flower

Native budworm (*Heliothis puntigera*)

- Larvae can cause damage by eating the leaves and flowers, but most damage is caused by boring into the pod, leaving a dark bullet like hole through the pod.
- Certain weeds may harbour caterpillars which may wander onto the crop as they age.
- See Figures 4.51 and 4.52.

Figure 4.52 Native budworm larvae

Figure 4.53 Maggot in onion seedling

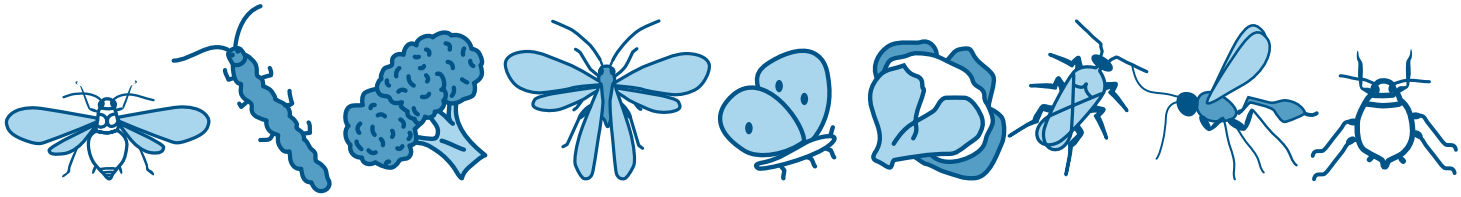
Seedling/Onion maggot (*Delia platura*)

- Seed occasionally attacked by seedling maggot.
- See Figure 4.53.

Figure 4.54 A thrip.

Thrip (*Thrip tabaci*)

- Can cause pod scarring which may be mistaken for wind damage.
- See Figure 4.54.



Management options for insect pests of green beans

Insect	Biological	Cultural/Mechanical	Chemical
Cutworms - common, brown, chevron	• Attacked by some parasitoid wasps.	• Start crop inspections once the seedlings have emerged to look for damage on seedlings and fallen plant stems. • Soil cultivation such as brush weeding shreds the grub as it hides in the top soil. • Irrigation tends to reduce severity of attack. • Manage weeds as juvenile weeds attract egg-laying female moths.	• Apply soil durable insecticide as a band over the seedlings and adjacent soil late in the afternoon when the grub is feeding.
Native budworm (*Heliothis sp*)	• Parasitic wasp: *Trichogramma* and *Telenomus* (not necessarily common in Tasmania) • *Bacillus thuringinesis* (Bt) as an insecticide. • Predatory insects such as lacewings, damsel flies and spiders.	• Regular crop monitoring. Scout for eggs and inspect flowers. • Pheromone traps to monitor moth activity in the crop. • Light soil cultivation to kill pupae in the soil.	• Use registered insecticides – resistance has developed in some areas of mainland Australia.
Seedling maggot			• Insecticides are best band applied near the row.
Thrips		• Irrigation and rainfall can wash thrips from plants. • Use yellow sticky traps to assist with monitoring, placing 3-4 traps in each paddock.	• Registered insecticides. • Pyrethrum applications have been effective.

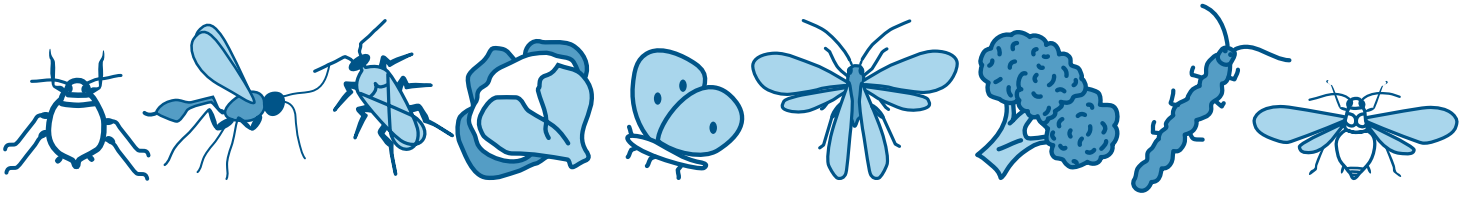


Figure 4.55 A native budworm egg

Figure 4.56 Native budworm larvae

Figure 4.57 A slug

Figure 4.58 A snail

Insect pests in green peas

Detailed descriptions on may of the insects mentioned are located in the appendix section of the manual.

Southern armyworm (*Persectania ewingii*)

Common armyworm (*Mythimna convecta*)

- Only a pest on exceptional occasions. They are mainly grass feeders.
- Damage is caused by the larvae and occurs when plants are older.
- Larvae will feed on foliage and can bite through the stems near the base of the plant.

Native budworm (*Heliothis spp.*)

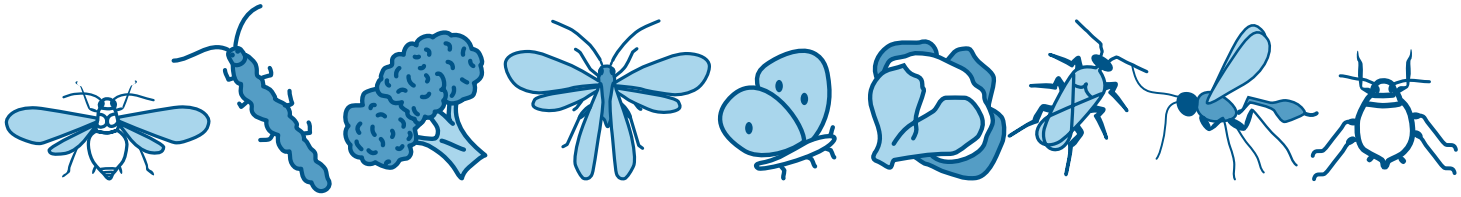
- The larvae can eat leaves and flowers, but the more important damage is cosmetic as the grubs are often found in frozen peas.
- Physical damage is caused by the grub boring into the pod, leaving a dark bullet like hole through the pod.
- Certain weeds may harbour caterpillars which may wander into the crop as they age.
- See Figures 4.55 and 4.56.

Slugs (*Deroceras*)/Snails (*Cochlicella spp.*)

- Will primarily feed on the foliage, with plants around the edge of the paddock more likely to be effected.
- Cosmetic damage is important as slugs are often found in frozen peas.
- Both are difficult to float, sieve or filter out of harvested produce.
- See Figures 4.57 and 4.58.

Soil springtail (*Onychiurus spp.*)

- Wingless insect with a body covered in minute hairs.
- Usually found chewing in damaged or rotting parts of the plant.
- Localised, possibly associated with slow germination in wet organic soils.



Management options for insect pests of green peas

Insect	Biological	Cultural/Mechanical	Chemical
Armyworm		• Only a problem in big outbreaks. Not a common pest. • Crop monitoring should be carried out weekly if there is an outbreak. • Look for small larvae at the base of plants and in the soil around the plant. • It moves from pasture to the crop. • Light soil cultivation may reduce numbers of caterpillars in the soil.	• Registered insecticides should be applied when the grubs/larvae are large and actively feeding. Smaller grubs hide and are difficult to contact with insecticide.
Native budworm (*Heliothis sp.*)		• Regular crop monitoring. • Pheromone traps to monitor moth activity in the crop. • Light soil cultivation to kill pupae in soil.	• Registered insecticides – resistance has developed in certain areas of mainland Australia. • *Bacillus thuringiensis* (Bt) insecticides can be used on very young grubs.
Slug/snail	• Parasitic wasps *Trichogramma* and *Telenomus* (not necessarily common in Tasmania) • *Bacillus thuringinesis* (Bt) as an insecticide. • Predators such as lacewings, damselbugs and spiders.	• Light soil cultivation around the border of the crop.	• Slug pellets distributed around the border of the crop.
Soil springtail	• Natural enemies and predators are various bugs, beetles, ants, brown earwigs and birds.	• Liming and light cultivation of the soil prior to crop planting may reduce numbers living in the soil. • Flushes of organic decay in spring following dry winters may occur and exacerbate soil springtail.	

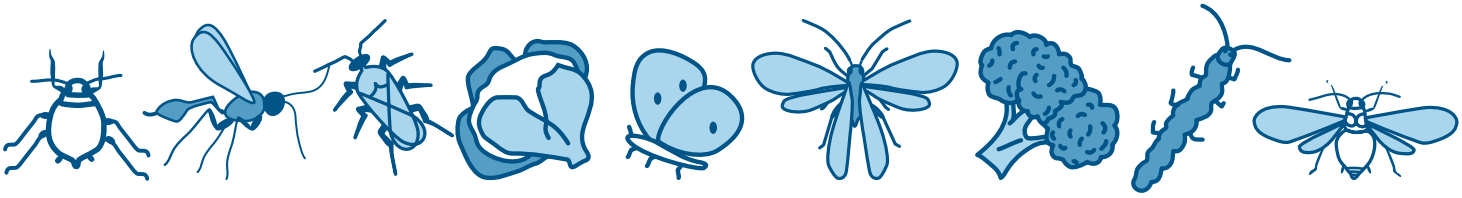


Figure 4.59 Cutworm damage in onions

Insect pests in onions

Detailed descriptions on may of the insects mentioned are located in the appendix section of the manual.

Common cutworm (*Agrotis infusa*)/Brown cutworm (*Agrotis munda*)

- The larvae live in the soil and feed at night.
- Most damage occurs in November/December as the larvae chew through young onion stems.
- See Figure 4.59.

Figure 4.60 Lucerne flea (GRDC)

Lucerne flea (*Sminthurus viridis*)

- Small (3 mm), yellow-green insects with rounded bodies.
- They chew small holes in seedling onions and jump when disturbed.
- They breed mainly on clover but can carry over after pasture is cultivated.
- See Figures 4.60 and 4.61.

Figure 4.61 Lucerne flea feeding damage (GRDC)

Onion thrips (*Thrips tabaci*)

- Small (1-2 mm) insects feed on the surface of the plant and cause small holes and silvery streaks on the leaf.
- The thrips are found in between leaf layers in the neck region of the plant.
- They will feed on green fleshy plants and move off the plant once it begins to desiccate.
- See Figures 4.62 and 4.63.

Figure 4.62 Onion thrip damage

Figure 4.63 Adult onion thrip

Redlegged earth mite (*Halotydeus destructor*)

- A sap sucking insect with a small, black body and red-orange legs which causes small, silvery, bronze spots to appear on foliage.
- Most active in autumn and spring following egg hatching.
- They breed on clover and may carry over after pasture is cultivated. They favour certain soils.
- Blue oat mite looks similar to reg-legged earth mite. They breed on broad leafed weeds and may carry over onto pasture and weeds.
- See Figure 4.64.

Figure 4.64 Redlegged earth mite (GRDC)

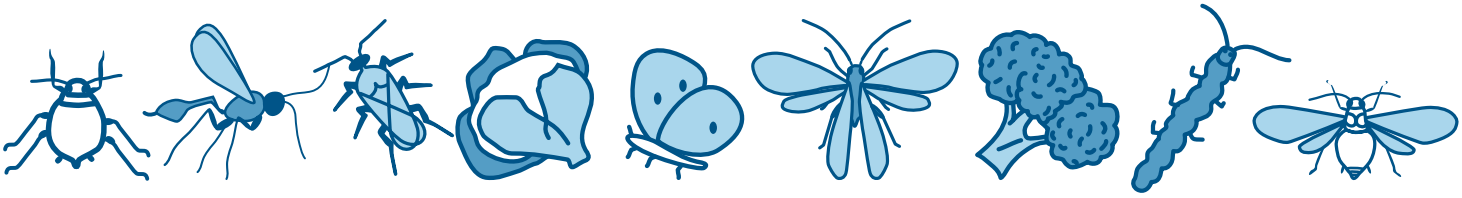


Figure 4.65 Rutherglen bug nymph (GRDC)

Figure 4.66 Rutherglen bug adult (GRDC)

Rutherglen bug (*Nysius vinitor*)

- Young bugs or nymphs are red-brown in colour and feed on the sap of newly emerged plants.
- Adults reach up to 5 mm in length and are grey-brown in colour with silvery wings.
- See Figures 4.65 and 4.66.

Figure 4.67 Onion/seedling maggot

Onion/seedling maggot (*Delia platura*)

- Eggs are white, elongated and are laid around the base of small onion plants and in the leaf sheaths.
- Larvae, which are small, white, legless maggots, emerge and bore into the leaf.
- The adult flies are small with darkened bodies, and look similar to the small housefly.
- See Figure 4.67.

Figure 4.68 Strawberry beetle

Strawberry beetle (*Clivinia sp.*)

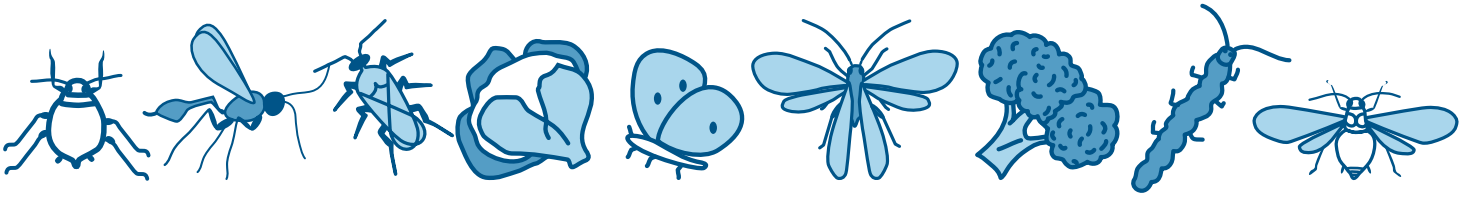
- Shiny, black beetle about 8 mm long.
- Adult and larvae live in the soil with the larvae stage causing damage to the crop.
- Importance of the insect is not completely understood, but it has been associated with causing damage to germinating seeds, in particular in seedlings of crops like poppies.
- See Figure 4.68.

White fringed weevil (*Graphognathus leucoloma*)

- Larvae chew off onion roots and plants and will bore holes into the bulb.
- Larvae are creamy-white, legless and 12 mm long.
- Adults have a grey body with distinct white stripes along the back and sides. They look like a sunflower seed on legs.
- All individuals are females, so one beetle carried in hay, machinery or drainage can initiate a new infestation.
- See Figures 4.69 and 4.70.

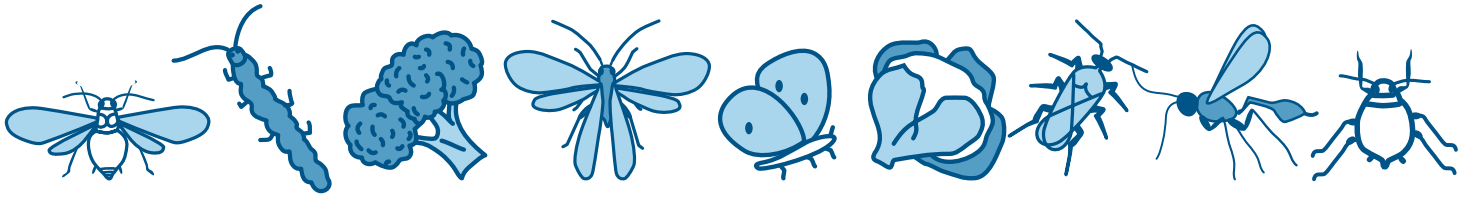
Figure 4.69 Feeding damage from white fringed weevil

Figure 4.70 Adult white fringed weevil



Management options for insect pests of onions

Insect	Biological	Cultural/Mechanical	Chemical
Cutworms – common and brown	• Encourage natural predators by reducing synthetic pesticide applications and planting pollen producing plants to encourage feeding and breeding by predators and ground beetles.	• Monitor crop edges as grubs can migrate from infested neighbouring crops and weeds. Look for holey leaves on weeds. • Monitor fallow paddocks, looking at the underside of surface soil clods. • Minimise the time window between fallow soil and planting. Moths are attracted to overgrazed and fallow paddocks. • Shallow soil cultivation (eg. brushweeding) can significantly reduce numbers by pulverisation.	• Registered insecticides should be applied if numbers are causing economic damage.
Lucerne flea	• Predatory mite - spiny snout (*Bdellodes lapidaria)*.	• Monitor infested pasture or crops following the autumn break. • Use a fallow period.	• Registered insecticides should be applied when all nymphs have emerged from the eggs, but before they become adults. The best time for application is usually in the autumn, 2-5 weeks after wet conditions.
Onion thrips		• Irrigation and rainfall can wash thrips from plants. • Use yellow sticky traps to assist with monitoring, placing 3-4 traps in each paddock.	• Use registered insecticides. • Pyrethrum applications have been shown to be effective.
Redlegged earth mite		• Remove weeds (cape weed and thistle plants) from neighbouring crops and crop edges.	• Registered insecticides can be applied. If infestation is localised, spot praying is recommended. • Insecticide treatment of seeds prior to sowing. • Insecticides should be applied late afternoon or early morning when the pest is actively feeding.
Rutherglen bug		• Irrigation and rainfall can significantly reduce numbers in highly populated areas. • Plough weeds prior to spring to reduce infestations.	• Insecticides will provide short term control if the pest is present in large numbers. • Apply spray during the warmer part of the day when the pest is most active.



Insect	Biological	Cultural/Mechanical	Chemical
Seedling maggot			• Insecticides are best band applied near the row.
Strawberry Beetle			• Insecticides may be beneficial, although they need to be applied so they penetrate the soil.
Whitefringed weevil		• Monitor the crop, particularly if the crop has been grown in old lucerne or weedy pasture paddocks.	• Insecticides are best applied at the time of crop planting.

Figures 4.71 (above) Common cutworm adult and 4.72 (below) larvae (GRDC)

Figures 4.73 (above) Brown cutworm adult and 4.74 (below) larvae (GRDC)

Insect pests in potatoes

Detailed descriptions on may of the insects mentioned are located in the appendix section of the manual.

Common cutworm (*Agrotis infusa*)/Brown cutworm (*Agrotis munda*)

- The larvae will chew through the seedling stems near the soil line and the seedlings will die.
- Larvae or caterpillars are dark, green-black and brown in colour.
- Larvae are usually found curled up just under the surface of the soil around the plant.
- See Figures 4.71, 4.72, 4.73 and 4.74.

Green looper (*Chrysodeixis argentifera*)

- The bright green caterpillar moves with a distinct arching and looping movement.
- The caterpillar causes the damage, with damage first appearing on the foliage.
- The smaller caterpillars will eat small holes in the leaf, while the larger caterpillars can skeletonise parts of the plant by eating much of the foliage.
- Unlikely to damage enough foliage to reduce yield.
- See Figure 4.75.

Figure 4.75 Green looper larvae (GRDC)

Potato moth (*Phthorimaea operculella*)

- The larvae or caterpillar damages the plant.
- The moth will first appear flying throughout the crop. They rarely enter dense, irrigated crops until the foliage dies off and irrigation ceases.
- The moth is small with a grey-brown speckled pattern on its wings.
- The moth will lay its eggs on the foliage or, more importantly, directly on tubers through cracks in the soil.
- The caterpillars emerge from the eggs and live and eat inside the leaf tissue or tuber.
- Distinct leaf blisters will develop where the grub is feeding. The amount of leaf damage itself is rarely consequential in dense irrigated crops, but is substantial in volunteer potato foliage which is the prime breeding site.
- Caterpillars feeding on the tuber will cause 'tunnels' as they feed their way through the tuber, usually near the skin.
- See Figures 4.76, 4.77 and 4.78.

Figure 4.76 Potato moth larvae

Figure 4.77 Adult potato moth

Figure 4.78 Tuber and leaf damage

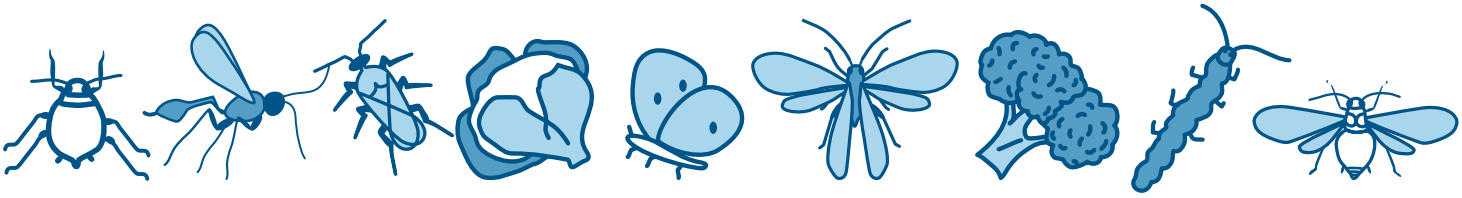


Figure 4.79 A slug

Slugs (*Deroceras*)

- Will primarily feed on the foliage and shallow potato tubers throughout the paddock.
- See Figure 4.79.

Figure 4.80 A whitefringed weevil

Whitefringed weevil (*Graphognathus leucoloma*)

- The larvae cause damage by boring holes into the tuber.
- Larvae are a creamy-white colour, legless and 12 mm long.
- Adults have a grey body with distinct white stripes along the back and sides and resemble a sunflower seed on legs.
- See Figure 4.80.

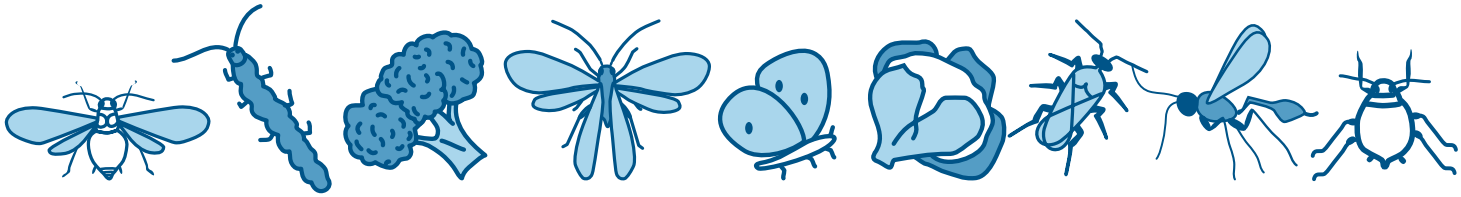
Figure 4.81 A wingless grasshopper (GRDC)

Wingless grasshopper (*Phaulacridium vittatum*)

- Damage is caused by the adult grasshopper.
- Damage will first appear in the summer months when small chewing holes may appear on the foliage.
- Damage tends to be more severe on plants on the crop border.
- The grasshopper tends to move only short distances from nearby dry summer pasture crops or woodlands to fresh, green crops.
- See Figure 4.81.

Wireworm (*Elateridae*)

- The wireworm is the immature stage of one of the click beetles. They prefer heavy moist soils and build up populations during long pasture phases.
- The wireworm is what damages the tubers. Tunnels and rounded cavities will appear on the tuber. This type of damage may then increase tuber fungal infections.
- Adult beetles can be found sheltering under soil, clods or trees.



Management options for insect pests of potatoes

Insect	Biological	Cultural/Mechanical	Chemical
Cutworms – common and brown	• Attacked by some parasitoid wasps and flies. • Earwigs.	• Crop inspection once planted. Look for damage on seedlings and weeds and look for cut off plant stems. • Weedy fallow land favours egg laying. • Soil cultivation shreds the grubs that hide in top soil during the day. • Irrigation and rainfall cause mortality.	• Apply registered insecticides in a band over the seedlings and adjacent soil late in the afternoon when the grub is feeding.
Green looper	• Attacked by some parasitoid wasps and flies.		
Potato moth	• 3 parasitoids - 1 egg, 2 larval. (Refer to the section on beneficials in this chapter)	• Water stress, volunteer potato plants and open canopies favour moths. • Re-hilling before canopy closure maintains the soil barrier over tubers. • Irrigation after senescence keeps the soil free of cracks, preventing the grub from entering the soil and attacking the tuber.	
Slugs	• Common brown earwig where it occurs.	• Long pasture phases encourage multiplication.	
Whitefringed weevil		• Cultivation to expose and disturb grubs.	• Soil fumigation
Wingless grasshopper		• Egg beds occur on sandy banks and bare woodland margins. • Check these for populations.	
Wireworm		• Check for wireworm before planting by collecting random soil samples throughout the paddock. Sift through soil for signs of the grub. • Wireworm is often present after cereal crops and in newly cultivated soils.	• Registered insecticides are best applied before planting as a band placement (7 – 10 cm below the seed) or a broadcast treatment.