

Insect pests of establishing canola in New South Wales

Identification and best management practices



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This guide is designed to assist in managing invertebrate pests in establishing canola. It is not a substitute for personnel with expertise in canola agronomy and/or integrated pest management. It is the responsibility of users to make their own decisions and judgements about the appropriateness and reliability of this guide's information.



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About this guide



Canola can usually recover and compensate in yield from some insect damage, however there are a few insects which can get the better of it – particularly at establishment when cotyledons and young plants are most vulnerable.

This guide has been created to encourage growers and advisors to have insects front of mind before and during establishment of autumn-sown canola. This guide does not exclusively consider pests – it focuses on the good insects too. Broadacre crop paddocks are home to a wide range of beneficial insects which help suppress pest outbreaks.

This guide promotes the use of integrated pest management strategies so that insecticides are not routinely used as the first line of defence. While insecticides are and will remain useful tools, insecticide resistance prevalence, the lack of selective options, and deregulation of some insecticides, means that non-chemical control strategies must become conventional practice.

This can be challenging. Very little is known about some pest and beneficial insects and this can cause a level of uncertainty and apprehension.

Yet, some of the most notorious canola establishment pests are well researched and understood.

While this guide focuses on canola grown in NSW, differences between farms (e.g. stubble retention, soil type, native vegetation) and the conditions that determine pest distribution (e.g. rainfall, temperature, humidity) mean there is no one-size-fits-all pest management plan for the state (or even one grower's paddocks!).

This guide brings together the big and sometimes seemingly small insect insights to assist growers and advisors in piecing together a best-bet strategy for canola establishment pests.

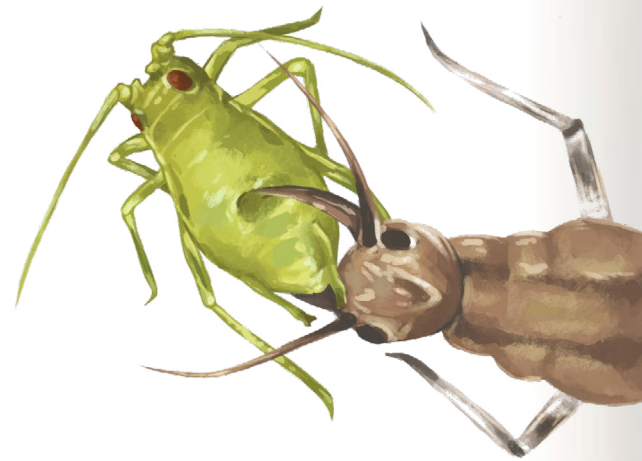
A note on terminology and scope

The term 'insect' is used colloquially in this guide. Taxonomically speaking, not all of the pests and beneficials mentioned are technically insects including slaters, millipedes, slugs, snails, mites and lucerne flea.

The term 'insecticide' is also used colloquially. When the term insecticide is used in this guide, it may also refer to miticides and molluscicides.

Mice often feed on and challenge establishing canola, and their damage can be confused with feeding by many establishment pests such as earwigs, slaters, millipedes and slugs. While mice are not addressed in this guide, further information on monitoring and management can be found in the Better Mouse Management Tip & Tactics listed under [Resources](#).

Integrated pest management (IPM)



This guide promotes the use of integrated pest management (IPM) – an approach which combines biological, cultural and chemical strategies to prevent and control pests. IPM does not aim to wipe out an entire pest population – rather it creates an environment which keeps its impact below economically damaging levels.

Using IPM replaces the reliance on any single strategy, particularly chemical use, to give long-term pest control. Relying on chemicals for pest management is not sustainable.

When adopting IPM for the first time, experienced consultants recommend trialling it in one or two low risk paddocks to help the grower or advisor gain experience and build confidence.¹

Biological control



Many naturally occurring insects in crops prey on canola pests. A cornerstone of IPM is to preserve and encourage these natural enemies – also known as the ‘beneficials’. Some beneficials are generalist predators which feed on a range of pests during their lifetime. Others are specialist [parasitoids](#) which invade a specific pest’s body to complete their lifecycle, eventually killing it.

Having said this, beneficials can be too slow to break the tide of establishment pests, which have a notorious reputation for their sudden impact. This is because, once germination commences, the pests can appear in high densities and can quickly overwhelm the small plants. There are times when beneficials simply cannot suppress pest populations before significant damage occurs (e.g. mites, millipedes and earwigs). A best bet approach to getting the most out of beneficials at establishment is through integrating cultural controls and strategic

use of insecticides. This will encourage greater biodiversity in paddocks, thereby making cropping systems more resilient to pests.

Transient good guys

Does the term ‘beneficials’ immediately conjure the image of a ladybird beetle? That is because ladybird beetles are the rock stars of biological control – they are the most well-known and recognised. Ladybird beetles belong to a suite of insects that are transient ([Table 2](#)). As a general rule, transient beneficials are highly mobile – they do not permanently live in the paddock, they tend to follow the whereabouts of pests, and they have a short generation time. Their impact is most noticeable during spring when there is a boom in ladybird beetles, lacewings, hoverflies, parasitic wasps and predatory bugs hunting aphids, moth eggs and [larvae](#) in crops.

Transient beneficials typically follow the ‘boom and bust’ cycle of pests during spring and summer – they are likely to be too slow to keep pests at bay during the cooler months.

Resident good guys

During autumn and early winter, it is largely resident beneficials that are relied upon to protect establishing canola. Resident beneficials live in the paddock all year round and compared to transient species, have much longer generation times and a limited dispersal capacity. They operate on or around the soil surface and are not highly visible like the transient cavalry that arrives in late winter/spring.

Resident beneficials are the least understood and their inconspicuous habits means it is easy to overlook them. But entomologists believe that they are equally as important as transient beneficials and

their success is largely dependent on the long-term health of their communities beyond the annual cropping cycle. If broad-spectrum insecticides, like synthetic pyrethroids and organophosphates, are used across whole paddocks routinely, resident beneficial communities will not be available to manage pest populations.

With the change of farming practices towards conservation tillage, paddocks have become more hospitable to pests (e.g. wireworms, slugs, snails and earwigs). Their habitat remains undisturbed, and there is an abundance of food, shelter and moisture – what more could a pest want? The good news is that this same environment is more hospitable to resident beneficial insects such as carabid beetles and spiders.²

[Carabids](#) are an interesting case study. Many species of carabid beetles (or ground beetles) are flightless, nocturnal predators ([Table 1](#)). These ground-dwelling beetles eat a wide range of soft-bodied prey such as moth eggs, caterpillars, aphids, wireworms, earwigs and slugs. However, they may only have one generation per year, and their capacity to assist in controlling establishment pests can be hindered when tillage and insecticides disrupt their breeding.³

It is not always easy to consider beneficials in pest management decisions. Monitoring and identification can be tricky, and there is little quantitative research estimating their impact in broadacre crops. What is more, there are many more beneficials beyond those listed in [Table 1](#) & [Table 2](#) – rove beetles, assassin bugs, stiletto fly [larvae](#), predatory thrips, red velvet mites, snakeflies, scorpions and terrestrial flatworms to name a few – but their precise impact on broadacre farms is unclear.

Nevertheless, it is possible to monitor and identify some beneficial species such as large predators and some [parasitoids](#). Some of these groups are night active and multiple monitoring approaches may be needed to gain a deeper insight into what is happening in paddocks (e.g. day-time visual inspections, pitfall traps and night inspections with a torch). All in all, considering beneficials in insect pest management decisions is a key activity of growers who run successful IPM programs.

Cultural control



Insect pest management is inextricably linked to wider farm management and practices. Practices which can stop pests from reaching economically damaging levels are called cultural controls. They include practices and decisions which (1) preventatively make paddocks hostile or unfavourable to pests, (2) encourage crop resilience, (3) directly kill pests, and (4) encourage growth and activity of beneficials.

Some cultural controls for canola establishment pests are:

Farm/paddock planning

• Crop rotations

Rotating canola with non-host crops or less favourable host crops, insect-resistant varieties, or bare fallow can disrupt the lifecycle of pests (and disease), delaying or stopping population growth. For example, chickpeas and lentils are not favourable hosts for the [redlegged earth mite](#) (RLEM) so mite numbers are generally low after such a crop. The benefits of crop rotation will be lost if canola pests can survive in and around a paddock on weeds and crop volunteers.

• Site selection

Some paddocks will be more susceptible to attack than others. If practical, avoid sowing canola in paddocks with a history of economic damage by resident establishment pests (e.g. earwigs), or adjacent to high risk areas (e.g. next to clover pasture paddocks which are prone to [RLEM](#)). If this is not feasible, assessing the site of a planned canola paddock can assist with an overall risk assessment and next steps (e.g. decision to use a seed treatment).

Prior spring

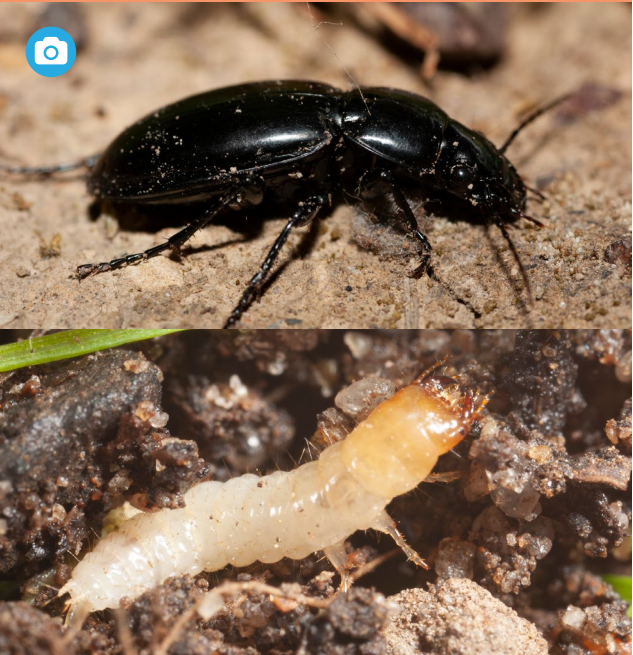
• Grazing management

In a pasture/canola rotation, grazing in spring can be used to reduce populations of some key canola pests (e.g. [RLEM](#) and [lucerne flea](#)) before they lay eggs for the following autumn. Intensive grazing of pastures reduces the abundance of these pests. Ideally graze to <1.4t/ha food on offer 3-4 weeks prior to the [Timerite](#)® date. Heavily grazed spring paddocks should not require an insecticide spray.

Table 1: Resident beneficials

[Return to text](#)

Carabid beetles
(various species)



Identification

Adults

- Large well-developed mouth parts which characteristically protrude forward
- Body shaped like a hot water bottle
- Large bulging eyes
- Thread-like [antennae](#)
- 3 pairs of long, well-developed legs
- 5 – 25 mm long

Larvae

- Long, segmented semi-flattened body
- Large well-developed mouth parts which protrude forward
- Body cream to dark brown in colour
- Two long hair-like projections on last body segment
- 3 pairs of well-developed legs
- Can be confused with [true wireworms](#) and [false wireworms](#) ([Table 6](#))

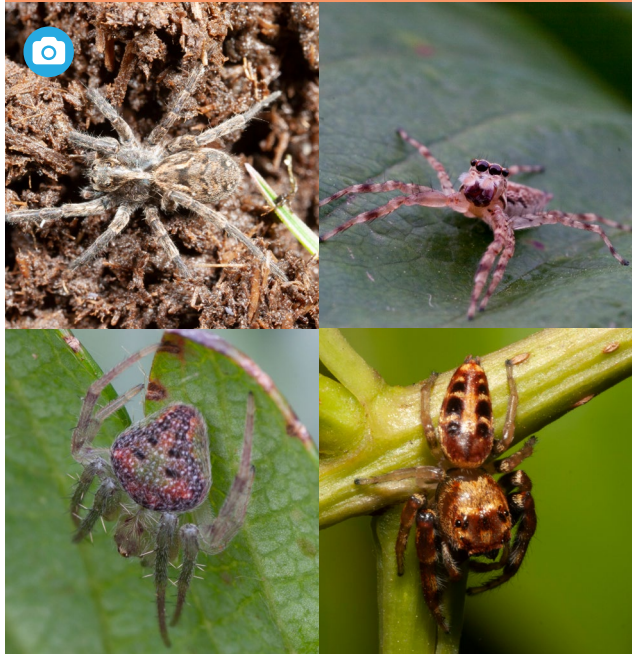
Behaviour

- Generalist predators – prey includes caterpillars, aphids, wireworms, earwigs and slugs (including eggs of many of these species)
- Fast moving
- Mostly active at night
- Common in undisturbed habitats

Monitoring

- Pitfall traps
- Shelter traps

Spiders
(various species)



Identification

- 4 pairs of legs
- Size varies greatly (up to 120 mm)


Behaviour

- Generalist predators – prey includes flies, crickets, aphids, caterpillars, moths, beetles
- Fast moving
- Prey eaten is generally relative to size of spider
- Can be web-builders, free-living or burrow-dwelling
- Prey catching and hunting strategy varies: ambush, sit-and-wait, stalk
- Many species are active at night

Monitoring

- Pitfall traps
- Visual inspections
- The absence of spiders in a crop is an indication of a disrupted system

Common brown earwig
(*Labidura truncata*)



Identification

Adults

- Reddish brown in colour
- Distinctive orange triangle behind the head
- Straw-coloured markings
- Dark [abdomen](#) and pincers
- 35 mm long
- 3 pairs of legs

Nymphs

- Look similar to adults, except they are smaller and lack wings, and are usually paler in colour


Behaviour

- Generalist predators – prey includes soft-bodied insects such as caterpillars, and eggs of pests such as slugs and moths
- Mostly active at night
- Solitary

Monitoring

- Pitfall traps
- Shelter traps

Snout mites
(various species)



Identification

Adults

- Orange-red in colour
- 4 pairs of legs
- 2 mm long
- Very pointy mouthparts

Nymphs

- Look similar to adults, but are smaller


Behaviour

- Generalist predators – prey includes mites, lucerne flea and other springtails
- Fast moving

Monitoring

- Visually check areas where populations of blue oat mite, redlegged earth mite and lucerne flea are present

Whirligig mites
(*Anytis* spp.)



Identification

Adults

- Red in colour
- 4 pairs of orange-red legs
- 3 mm long

Nymphs

- Look similar to adults, but are smaller

Behaviour

- Generalist predators – prey includes mites, springtails, aphids
- Fast moving
- Move in a circular motion

Monitoring

- Visually check where populations of blue oat mite, redlegged earth mite and lucerne flea are present

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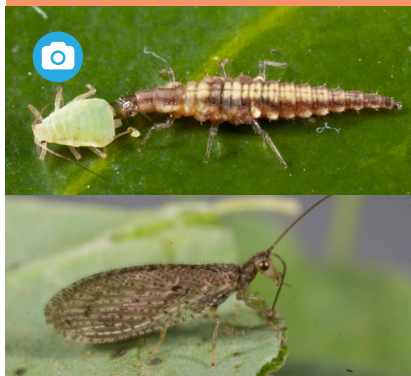
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Table 2: Transient beneficials

[Return to text](#)

Lacewings

Brown (BLW) and green (GLW)



Identification

Adults

- Pale/bright green or mottled brown
- 6 to 20 mm long
- Prominent **antennae** and eyes
- Clear membranous wings with lacey appearance
- GLW lay eggs singularly, attached to leaves by a slender stalk
- 3 pairs of legs

Larvae

- 5 – 8 mm long
- Protruding sickle-shaped mouth parts
- Long tapering body (BLW) or squat tapering body (GLW)
- Wingless
- 3 pairs of legs

Behaviour

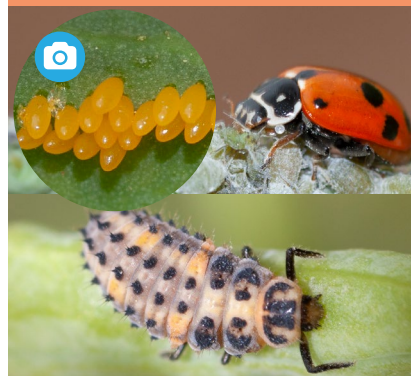
- Generalist predators – prey includes a range of soft-bodied prey including aphids, mites, thrips, whitefly
- BLW larvae and adults are predatory
- GLW larvae are predatory; adults are mostly non-predatory
- Suck out contents of prey
- GLW larvae impale prey's corpse and debris on their backs (BLW larvae do not)

Monitoring*

- Visually check plants close to aphid infestations

Ladybird beetles

(various species)



Identification

Adults

- Round to oval shaped
- Patterns of black spots, blotches or stripes on red, orange or yellow shells
- Winged
- 5 mm long
- 3 pairs of legs
- Lay cluster of yellow-orange, football shaped eggs

Larvae

- Grey-black with orange markings
- Elongated, bumpy bodies
- Wingless
- 3 pairs of legs
- Up to 6 mm long

Behaviour

- Generalist predators as larvae and adults – prey includes aphids, thrips, mites, moth eggs, small caterpillars
- Devour their entire prey

Monitoring*

- Visually check plants for larvae, adults and eggs close to aphid infestations

Parasitoid wasps

(various species)



Identification

Adults

- Vary in size (1-20 mm long; size is relative to host)
- 4 wings
- Constricted waist between the **thorax** and **abdomen**.
- 3 pairs of legs

Nymphs

- Not visible, immature stages develop inside host

Behaviour

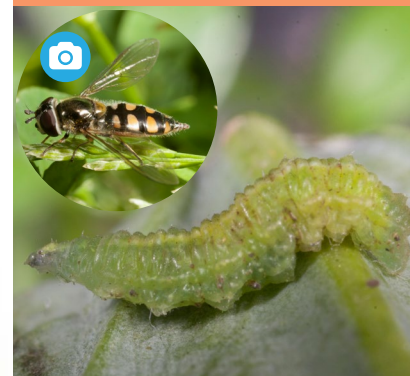
- Specialist **parasitoids** – prey includes moth eggs, caterpillar **pupae**, caterpillars, aphids, weevils and false wireworms
- Female wasps lay their eggs inside or on a host. The developing wasp larva feeds inside the host, eventually killing it. An adult wasp emerges from the parasitised host.

Monitoring*

- Bronze bloated aphid mummies are a sign of parasitic wasp activity (It takes about 10 days for parasitised aphids to become mummies)
- Clusters of white cocoons indicate caterpillar parasitoid activity (Braconid wasps)
- Monitor for parasitic wasps with sticky traps
- Visually check plants for wasps near aphid colonies

Hoverflies

(various species)



Identification

Adults

- 4 – 7 mm long
- Flattened bodies with yellow and black markings
- Two wings
- 3 pairs of legs

Larvae

- Green in colour
- Legless
- No apparent head; appear pointed at head end
- 8 – 10 mm long

Behaviour

- Larvae are predatory - aphids are the main prey
- Suck the contents of aphids and leaves the skeleton behind
- Adults hover and look similar to honey bees or the European wasp at first glance

Monitoring*

- Visually check plants for larvae close to aphid infestations

Predatory shield bug

Oechalia schellenbergii



Identification

Adults

- 12 mm long
- Grey brown
- Light marking in the middle of the back
- Prominent pair of spines on their 'shoulders'
- Lay irregular clusters of black eggs that have short white spines around the rim
- 3 pairs of legs

Nymphs

- Dark grey with a red ring on the back.

Behaviour

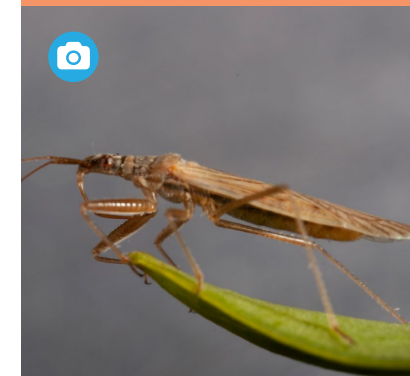
- Generalist predator – prey includes soft-bodied insects such as caterpillars, moth eggs and aphids
- Pierce and suck out the contents of their prey
- Adults and nymphs are predatory

Monitoring*

- Evidence of predatory bug activity is minimal in the field
- Most often in crop canopy
- Visually check plants for eggs, nymphs and adults

Damsel bug

Nabis kingbergii



Identification

Adults

- Up to 12 mm long
- 3 pairs of long legs
- Slender, light brown body that tapers towards the head
- Wings carried over the body
- Narrow, elongated head
- Long, thin **antennae**
- Long apparent 'snout'

Nymphs

- Similar to adults except smaller and lack wings

Behaviour

- Generalist predator – prey includes caterpillars, moth eggs, aphids, mites
- Holds prey with their slightly enlarged forelegs and pierce and suck out their contents
- Adults and nymphs are predatory

Monitoring*

- Evidence of predatory bug activity is minimal in the field

* Monitoring methods listed are specific to the establishment phase. Post-establishment, most transient beneficials can be effectively monitored with a sweep net and/or beat sheet. For more information on monitoring methods see the [ISPY manual](#) listed under [Resources](#).

Preparation for sowing

- *Weed (green bridge) control*

Summer and autumn weeds and crop volunteers provide food and shelter for pests to survive between the winter-cropping seasons. Insect pests have the strategic advantage to move from this 'green bridge' to establishing canola during autumn. Controlling weeds 4 – 6 weeks before sowing, in and around paddocks will help to create a break of at least 2 weeks in which there is no green material remaining to harbour pests. For example, removing green bridge hosts of [green peach aphid](#) is an important technique for reducing risk of turnip yellows virus infection.

- *Stubble management*

Many ground-dwelling insects favour undisturbed, stubble-retained paddocks as the environment is more hospitable. In some cases, stubble retention and reduced-till promotes growth of pests and their predator (e.g. [slugs](#) and [carabid beetles](#)). But they can encourage the build-up of pests which beneficials cannot effectively control e.g. [European earwig](#).

Stubble management practices (e.g. cultivation, burning, baling, grazing) kill pests directly and/or by destroying their habitat. Growers strategically use these approaches to get on top of particularly worrying resident pest populations, as they do with severe resistant weed infestations. But practices which reduce stubble loads have disadvantages (e.g. soil structure degradation, loss of soil moisture and erosion) – they may not be the best measures for all farms or in all years.

Sowing

- *Use of press wheels and rollers*

Using press wheels or rubber tyre rollers at sowing increases compaction of soil around the germinating seed to increase seedling vigour and, importantly, to reduce the movement of pests in the soil (e.g. [false wireworms](#), [slugs](#), and probably [weevils](#)). Soil pests find it more difficult to locate germinating seeds in compacted seedbeds. For example, slugs are known to move up uncompacted drill lines, under the soil, to locate germinating seed.

- *Time of sowing*

Time of sowing can impact the damage potential of insects in establishing canola; earlier planted crops often outgrow attack of pests like [RLEM](#), [lucerne flea](#) and [false wireworms](#), but can be more susceptible to virus infection from [green peach aphid](#), and [diamondback moth](#) damage in summer planted grazing canola species. While yield potential, variety and frost risk largely guide time of sowing, it can help to determine the risk of damage by a certain pest that season.

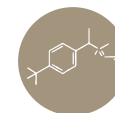
In-season

- *Control of winter weeds*

Weeds within a winter crop allow the build-up of insects. Weeds are a food source (sometimes their preferred choice) and provide pests the opportunity to move onto a crop in higher numbers or as a larger, damaging stage.

Not all cultural practices will be appropriate for every region or farming system. Rolling paddocks after sowing helps to control slugs, but is not compatible with controlled traffic farming systems. Likewise, burning stubble for slug control may not be a practical option; interplanting canola into standing stubble discourages aphid landings and can be important for virus control at early stages of the crop. It is important to plan and tailor IPM programs to each individual farm.

Chemical control



IPM does not do away with insecticides altogether. The aim is to reduce reliance on insecticides and maintain their efficacy so that they remain a useful tool. This can be achieved by reducing pest pressures by other means, such as preserving beneficials and letting them do the work, and through the use of cultural controls.

When chemical sprays are warranted, the key is to use insecticides that are less toxic to beneficials over broad-spectrum options (when they are available). These chemistries are often referred to as 'soft' or 'selective'. In reality, there are varying degrees of 'softness', and selectives are not completely harmless to all beneficial groups. But they are more IPM-compatible compared to broad-spectrum alternatives.

In practice, using [selective insecticides](#) is not always possible; soft chemistries are not always registered or available for every pest, or in every crop. In these circumstances, there may be ways to use broad-spectrum more strategically. Border or spot spraying (e.g. [RLEM](#), [lucerne flea](#)) are good examples of strategic spraying of broad-spectrum insecticides that would have minimum impact on beneficials.

Seed treatments (coatings of concentrated insecticide such as fipronil or imidacloprid) are also used in IPM programs to provide some control against a variety of establishment pests. Water availability is very important for insecticide transport from treated seed, as following germination, the insecticides move into growing roots and leaves of the seedling through the circulatory system of the plant. Many of the active ingredients in seed treatments are in fact broad-spectrum and although their method of delivery in crops makes them more IPM-compatible than foliar or bare-earth sprays, beneficials can be indirectly killed by eating insecticide-tainted prey.

Insecticide baits are also regarded as more IPM-compatible than broad-spectrum insecticide sprays. They are also the only chemical control available for [slugs](#) and [snails](#) and are a vital tool in their

management. However, like seed treatments, they are not completely harmless to beneficials. For example, carabids may eat bran-based slug bait or are indirectly exposed when eating tainted prey.^{4,5}

What about economic thresholds?

Economic thresholds help to rationalise insecticide use and ideally, they should take the guess work out of when to spray or bait a crop. It is not environmentally or economically sound to try to eradicate all pests from farms. The aim is to maintain them below economically damaging levels. An economic threshold should ideally be dynamic; considering the cost of the control, the value of the grain and the potential injury caused by a given pest density.

Currently most Australian thresholds for canola establishment are nominal or based on 'rules of thumb' – they have been estimated, based on observations and judgements of experienced consultants and researchers. As these thresholds are static and do not consider dynamic variables such as grain prices, insecticide cost or abiotic factors, use them with caution.

Monitoring



Monitoring is an integral part of IPM. Not only does it reveal if any damage is occurring, it also helps in determining pest and beneficial presence and abundance, increasing growers' and advisors' capacity to make an informed risk assessment and to decide if chemical control is warranted.

In the context of IPM, there are not any concrete predator:prey ratios that can help to inform monitoring efforts. For some pests (e.g. aphids), the focus of monitoring is to see if a pest population is increasing or decreasing. If it is building quickly, it is unlikely that the beneficials are having a major impact. If the pest population is building slowly, static or in decline, it is likely that the beneficials are having an impact, even if they are not visible. For other pests (and beneficials), especially resident insects, the focus of monitoring is confirming their presence and abundance or absence (e.g. [wireworms](#), [carabid beetles](#)).

Monitoring canola paddocks **prior to sowing** and for the **first 4-5 weeks of establishment** is an absolute must! As a grower once said, "An establishing canola crop is like a paddock of pregnant ewes. It has to be checked every day."

How to monitor

There are various monitoring techniques and their relevance depends on the time of the year and the type of pest or beneficial. This guide focuses on techniques that are relevant to monitoring canola during crop preparation and establishment.

Visual checks

Directly monitoring paddocks with visual checks is useful for detecting pests, beneficials and damage in plants and weeds.

Ensure the search is thorough – dig up the upper soil surface, sift and disturb stubble residue and leaf

litter, and turn over possible insect shelters such as clods, rocks or wood.

Night-time inspections with a torch are sometimes necessary as many pests and beneficials are night-active. This is particularly useful where damage is found but no pests are visible during day-time inspections.



Visual inspections in canola.

Sticky traps

Yellow sticky traps are made from cardboard and a coating of a non-drying sticky substance. They can be attached to a post and placed in a paddock to monitor flying insects such as [aphids](#) and [wasps](#). They are very useful for early detection of winged aphid migration and arrival in crops in autumn. Rolls of yellow sticky trap or yellow sticky cards can be purchased.

Shelter traps

Shelter traps are an effective tool in luring a range of ground dwelling pests such as [slugs](#), [cutworm](#), [earwigs](#) and [millipedes](#), and are easy to setup. These traps can be tiles, wet carpet, hessian squares or even old chemical drums (highly visible) placed on the soil surface in multiple locations across the paddock.

Bait traps

Use germinating seed baits in autumn to detect soil insects prior to sowing. These are particularly useful for species that cannot be controlled post sowing e.g. [false wireworms](#) and scarabs, or where there is a history of soil insect damage that occurs as the seed germinates e.g. [earwigs](#), [cockroaches](#).

Soak wheat seed in water to initiate germination. Then bury a small handful of seeds under 1 cm of soil at each corner of a 5 x 5 m square grid and give the immediate area a water with 1-2 litres. Mark the spot with a small stake. Immediately after seedling emergence, re-visit the bait site, dig up the plants and count the number of pests present. Repeat this at 5 locations per 100 ha to obtain an estimate of numbers. Alternatively, place pieces of raw potato (cut in half), cut side down, in the soil instead of seed baits.

Pitfall traps

Pitfall traps are useful for identifying ground-dwelling species such as beetles, spiders, caterpillars (e.g. cutworms), earwigs, slaters and millipedes, especially those that primarily attack crops at night.

To establish a pitfall trap:

- Bury a small disposable plastic container (eg. plastic cup) in the soil so that the rim is sitting flush with the soil surface. An option is to slide a second container inside the first, allowing it to be easily removed, inspected and replaced.
- Pour some water (1/4 cup) and a little detergent to immobilise the insects.
- Establish an elevated roof on top of the trap to stop small vertebrates falling in. A meat tray with the ends cut off and some skewers to hold it in place, or a piece of square of mesh that has gaps large enough for insects to fall through may be used.

- Setup multiple traps across the paddock. This can be especially useful where the damaged area meets the healthy crop.
- Inspect the traps after 24 hours (preferably longer).

See the finer details with a smartphone macro lens

Macro lenses can be clipped onto smart phones and are fantastic for getting a closer look at beneficials and pests, especially the finer details which are not always visible to the naked eye! These finer details can be crucial to correct identification.

There are many macro lenses available online to suit all budgets. Incredible details can be seen with lenses that are as cheap as \$10.



Images of a *Mandalotus weevil* (3 mm) taken on a smartphone without a macro lens (left) and with a macro lens (right).



Pitfall trap with a roof. Image: QDAF.

The who's who: key pests of canola



Redlegged earth mite



Blue oat mite



Bryobia mite



Slugs



Snails



False wireworms



Slaters



features visible by eye



features not visible by eye

This feature cannot be seen with the naked eye. A hand lens, smart phone, macro lens or microscope is needed.



Green peach aphid



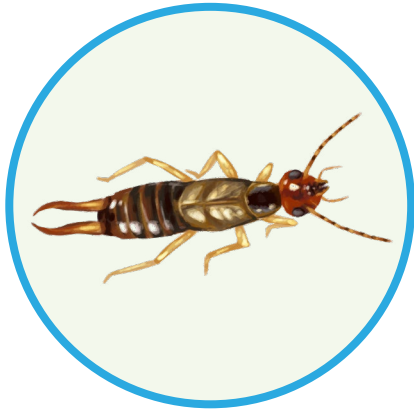
Lucerne flea



Cutworm



Weevils



European earwig



Black Portuguese millipede



Redlegged earth mite, RLEM

Halotydeus destructor

Occurrence

Widespread in southern Australia. Generally, they are not found further north of Dubbo, NSW.

Identification

Adult and immature forms	
Adult	Immature
<ul style="list-style-type: none"> 1 mm long Uniform, black velvety body 4 pairs of orange-red legs Tend to feed in distinct clusters 	<ul style="list-style-type: none"> Like adults but smaller



An adult RLEM (top). RLEM feeds in groups (bottom).



Redlegged earth mite feeding creates patches of silvering.

Damage to canola

Canola is highly susceptible to damage by RLEM.

Feeding symptoms

Feeding causes patches of silver-white discolouration on leaves and can result in shrivelled or distorted leaves.

High infestations can overwhelm establishing crops, leading to plant death, particularly if crops are already stressed. The mites can attack the germinating seed even before the cotyledons fully emerge.



Alternative hosts

RLEM attacks many crops and pasture, including clover, cereals, safflower and some pulses. Not all hosts are equally susceptible to damage by RLEM. Lentils, chickpeas and some lupin varieties are rarely damaged and, along with wheat, are poor hosts.

RLEM also feeds on a range of weeds including Paterson's curse, ox-tongue and capeweed.

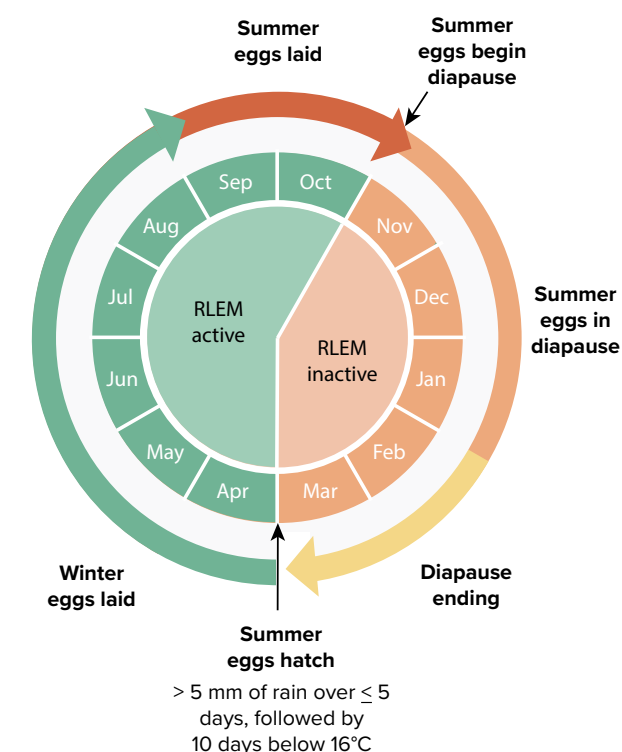
Paddocks that are rotated out of pasture are at most risk of damage.

Lifecycle and biology

Active period: April to November

RLEM survive summer as **diapause** eggs to avoid desiccation. Diapause eggs hatch in autumn, and mites reproduce sexually, having up to 3 generations per season. Two generations lay orange eggs on the underside of leaves or on the soil, which mostly hatch during winter. It takes approximately 4-6 weeks for **nymphs** to develop into mature adults in spring. A third generation produce diapause eggs that are retained in their bodies. When the female dies these eggs remain on the soil surface and will hatch the following autumn.

In south-east Australia, diapause eggs hatch when there is at least 5 mm of rain accumulated over five consecutive days or less, followed by 10 days of average daily temperatures remaining below 16°C.⁷



RLEM lifecycle in south-eastern Australia

Monitoring

Visual inspection

RLEM are most easily observed on foliage in the morning or when overcast. At other times of the day or prior to crop establishment, mites may be on/in the soil. Only a small proportion of RLEM populations feed on foliage at any one time, with the large majority remaining on the soil surface. When on foliage, they feed in large groups.

Economic threshold in canola

Based on field trials⁸


Cotyledon stage: 20% of plants with RLEM feeding damage and RLEM are present

1st true-leaf stage: 10 mites per plant

2nd true-leaf stage: fewer than 30 plants/m² and RLEM are present

Later plant development stages: Once plants reach the 3rd true-leaf stage there is no benefit in spraying, except when plants are under severe stress (moisture stress or waterlogging) coupled with mite numbers greater than 2000/m².

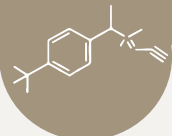
Management



Biological

The relative impact of predators on RLEM populations in canola is not clear. No one predatory mite has been identified to be adequately effective in managing RLEM populations.

Predatory mites such as [snout mites](#) and [anystid \(whirligig\) mites](#) are likely to help to suppress populations especially in (unsprayed) pastures where predator populations can be substantial.



Chemical

There are several seed treatment options available which will help suppress RLEM populations and subsequent damage at emergence. These may not provide adequate or sustained control under high pressure.

The [selective insecticide](#), diafenthiuron, is registered in canola for RLEM control. It is softer on some beneficials compared to broad-spectrum alternatives.⁸ It has a long withholding period (11 weeks for harvest) and is therefore suited to early season control.


All other foliar insecticides registered for control of RLEM are broad-spectrum, therefore they must be used strategically and only employed as the last resort.

Insecticides will not kill RLEM eggs.

Assess the distribution of RLEM - where they are colonising crop margins and fence lines in the early stages of population development, consider a barrier spray to retain beneficial species in the paddock.

If spraying of entire paddocks is unavoidable, the insecticide resistance strategy should be followed to ensure the life of available chemistries is prolonged (see the [Resistance Management Strategy](#) listed under [Resources](#)). Western Australian growers have been dealing with the evolution of resistance to synthetic pyrethroid and organophosphate insecticides in RLEM populations for over a decade. In 2017, cases of insecticide resistance were detected in South Australia. At the time of developing this guide, there are no known insecticide-resistant RLEM populations in NSW, but it is considered to be likely if chemicals are not used judiciously.

Strategic spraying of RLEM population during spring before egg hatch is an effective method of reducing RLEM the following autumn. This strategy, known as [TimeRite®](#) (see [Resources](#)), primarily uses day length to inform when RLEM will start to produce [diapause](#) eggs and provides location specific spray dates to ensure RLEM populations are targeted prior to this.



Cultural

Control weeds (especially capeweed) around fence lines and in paddocks prior to sowing and during the season. Having a clean paddock and fence lines prior to sowing is particularly important in years where there is a late break and RLEM have hatched prior to sowing or crop emergence. If feasible, do not sow canola into pasture or paddocks that have a history of RLEM. Alternatively, heavy pasture grazing in spring (prior to the Timerite® date; see below) can help to reduce mite numbers the following autumn.

Sowing at a higher seeding rates allows for some mite feeding damage and plant loss.

Rotating canola crops with less suitable hosts such as lentils and chickpeas may help reduce RLEM populations in paddocks as their ability to persist and reproduce on these hosts may be reduced.



Blue oat mite
Penthaleus spp.

Occurrence

Present in Mediterranean climates of New South Wales, Victoria, South Australia, Western Australia and eastern Tasmania. They are also found in parts of southern Queensland.

Identification




Blue oat mites have a small, oval-shaped mark on their backs that is red-orange in colour. This feature is useful in distinguishing blue oat mites from RLEM, which lack this marking.

Adult and immature forms	
Adult	Immature
<ul style="list-style-type: none">• 1 mm long• Blue-black, globular body• Eight red-orange legs• Distinctive red-orange oval-shaped mark on their backs (visible with a macro lens)• Typically feed singularly or in small groups	<ul style="list-style-type: none">• Pinkish orange in colour with six legs (newly hatched)• Change to brownish – green before becoming an adult.

There are three recognised pest species of blue oat mite: *Penthaleus major*, *Penthaleus falcatus* and *Penthaleus tectus*. As they are morphologically very similar, a microscope is required to distinguish the morphological differences between these species.

Damage to canola





Feeding symptoms

Feeding by mites causes patches of silver-white discolouration on leaves and can result in shrivelled or distorted leaves.

High infestations can overwhelm establishing crops leading to plant death, particularly if crops are already stressed.



Feeding damage by blue oat mites in canola. Note how blue oat mites feed singularly or in smaller groups. This feature is useful in distinguishing blue oat mites from [RLEM](#).

The three species of blue oat mites differ in their host preference. *Penthaleus falcatus* is the species that is most commonly associated with feeding damage in canola.⁹ Research has showed that *Penthaleus major* and *Penthaleus tectus* fail to persist on canola.¹⁰

Economic threshold in canola

None established

[RLEM](#) thresholds can be used as a guide only as blue oat mites have different feeding patterns to [RLEM](#).

Alternative hosts

Blue oat mites attack many broadacre crops, pastures and weeds. The main species associated with damage in canola, *P. falcatus*, can be found on broadleaf weeds such as Paterson's curse, bristly ox-tongue, smooth cat's-ear and capeweed.

Lifecycle and biology

Active period: April to November

Blue oat mites survive summer as [diapause](#) eggs to avoid desiccation. Diapause eggs hatch in autumn and mites reproduce [asexually](#), having two to three generations a year. Winter eggs are deposited either singly or in clusters of three to six on the leaves, stems and roots of food plants or on the soil surface.

Unlike [RLEM](#), blue oat mites start to produce diapause eggs during autumn/winter – they do not exclusively wait until spring.¹¹

Eggs hatch in autumn following cool temperatures and rainfall, however unlike the [RLEM](#), the specific requirements for egg-hatch are not known.

Monitoring

Visual inspection

Blue oat mite are most easily observed on foliage in the morning or when overcast. At other times of the day or prior to establishment, mites may be on or in the soil.

Management



Biological

There is no one effective predator that has been identified and the relative impact of predators on populations in canola is not clear.

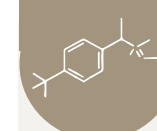
Predatory mites such as [snout mites](#) and [anystid mites](#) are likely to help suppress populations.



Cultural

Control weeds (especially capeweed) around fencelines and in paddocks prior to sowing and during the season. Having a clean paddock and fence lines prior to sowing is particularly important in years where there is a late break and blue oat mites have hatched prior to sowing or crop emergence.

Given that *P. falcatus* is most associated with damage in canola, crop rotation with a non-preferred host such as lentils or chickpeas may prevent the build-up of large populations.



Chemical

There are seed treatments available which will help suppress blue oat mite populations and subsequent damage at emergence, however these may not provide adequate control under high pressure.

All foliar insecticides registered for control of blue oat mite are broad-spectrum – use them strategically and only as the last resort. Insecticides will not control eggs.

Assess the distribution of mites – where mites are colonising crop margins and fence lines in the early stages of population development, consider a barrier spray to retain beneficial species in the paddock.

While blue oat mites have not evolved resistance to insecticides like the [RLEM](#), the three species differ in their susceptibility to insecticides. *P. falcatus* has a higher tolerance to a range of insecticides than *P. major* and *P. tectus*, and this is often responsible for reported chemical control 'failures'. If spraying of foliar insecticides is unavoidable, select the full registered rate for blue oat mite. Rate cutting may result in control failures if *P. falcatus* is present.



Bryobia mite

Bryobia spp.

Occurrence

Widespread in New South Wales, Victoria, South Australia and Western Australia. They have also been recoded in Tasmania and Queensland.

Identification

Adult and immature forms	
Adult	Immature
<ul style="list-style-type: none"> Up to 0.75 mm long Dark grey, brown, pale orange or olive in colour Oval, flattened body that looks like a pie dish 4 pairs of pale orange-red legs Front pair of legs are ~1.5 x body length 	<ul style="list-style-type: none"> Newly hatched mites are bright red Smaller than adults



Damage to canola

Feeding symptoms
<p><i>Bryobia</i> mites pierce and suck canola leaves, causing distinctive trails of whitish-grey spots.</p>

Extensive feeding damage can lead to plants shrivelling, delaying development or killing young canola.



Alternative hosts

Bryobia mites are well known pest of clover. Other preferred broadleaf plants and weeds include lupins, vetch, lucerne and capeweed. They will also attack cereals and grasses.

Lifecycle and biology

Active period: Warmer months

There are several *Bryobia* mite species in Australia and knowledge of their lifecycles is limited. They are most active in warmer months and unlike other pest mites, their activity declines substantially during winter.

Monitoring

Visual inspection

Monitor during the warmer parts of the day – *Bryobia* mites may be difficult to detect during the early morning or in wet conditions. Check the upper surface of cotyledons and plant leaves.

Economic threshold in canola

None established

Management



Biological

No one beneficial has been identified to be adequately effective in managing *Bryobia* mites.

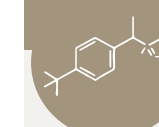
Generalist predators such as [predatory mites](#) and [spiders](#) are likely to eat *Bryobia* mites.



Cultural

Avoid planting canola in paddocks following a clover pasture rotation.

Control the green bridge, especially capeweed and clover.



Chemical

All foliar sprays registered for control of *Bryobia* mites in canola are broad-spectrum and will kill beneficials – only use them as the last resort. If mites are present in isolated patches, use spot or border spray. *Bryobia* mites have a natural tolerance to several chemicals. The recommended rates used against the redlegged earth mite and blue oat mites might be ineffective against *Bryobia* mites. If spraying of foliar insecticides is unavoidable, select the full registered rate for *Bryobia* mites. Generally, organophosphate insecticides provide better control against *Bryobia* mites than synthetic pyrethroids.



Green peach aphid, GPA *Myzus persicae*

More on TuYV

TuYV is not seed-borne and is mainly transmitted to establishing canola by GPA moving off summer and autumn virus hosts (e.g. wild radish and canola volunteers). GPA spreads TuYV by feeding and probing as they move between plants. Once a carrier of TuYV, aphids are infective throughout their life and it takes only 15-30 minutes of feeding to infect a plant. Young canola is most at risk of damage by TuYV; late infections have minimal impact on yield.¹² Earlier sown crops are at greater risk of TuYV infection as they are vulnerable for longer during peak aphid flight activity, and warmer conditions, in autumn.

[Turnip aphid](#) and [cabbage aphid](#) are also TuYV vectors, but they are far less efficient than GPA, and are more prevalent during spring well after canola has passed the most vulnerable stages of infection.

Alternative hosts

GPA has a very wide host range including oilseeds, lupins, pulse crops, broadleaf weeds and broadleaf pastures. They are common in many horticultural crops including crucifer vegetables. Non-crop hosts include the common weeds capeweed, marshmallow, wild radish, wild turnip, Lincoln weed and other cruciferous weeds. Wild radish and volunteer canola are the most important TuYV reservoirs, but perennials such as lucerne and many weed species are virus hosts.¹²

Lifecycle and biology

In Australia, GPA reproduces [asexually](#), and females give birth to live [nymphs](#) that are already pregnant. Young wingless aphid nymphs develop through several growth stages, moulting at each stage. When plants senesce or otherwise become unsuitable or overcrowding occurs, the population produces winged aphids which migrate to other plants or crops.

GPA is a year-round pest, although temperatures during spring and autumn conditions are most suitable for survival, development and movement.¹³

During autumn, winged aphids take flight and migrate from the green bridge to establishing canola crops. Flights also happen during spring.

Occurrence

Common throughout Australia.

Identification

Correct identification is crucial as GPA has evolved resistance to multiple insecticide groups. Focus on identifying wingless aphids; winged GPA look very different to the wingless form and generally it is too difficult to identify winged aphids in the field. Sometimes colour and size are not enough to distinguish GPA from other canola aphids, and it is necessary to take a closer look at their [tubercles](#), [siphuncles](#) and other unique features ([Table 3](#)).



Light green and pink wingless GPA. Note their glittery bodies.

Adult and immature forms	
Adult (wingless)	Immature
<ul style="list-style-type: none"> Glittery light or dark green, but sometimes yellow, pink or red 	<ul style="list-style-type: none"> Similar in appearance to wingless adults but smaller in size

Damage to canola

Indirect damage - virus transmission

GPA is a key vector of turnip yellows virus (TuYV, formerly beet western yellows virus), a serious canola virus which can cause losses in seed yield and oil content.

TuYV Symptoms
TuYV-infected canola is often pale and stunted. Leaves may turn yellow and purple, starting from the lower leaves. Other symptoms may include leaf mottling and cupping, thickening of leaves and premature bolting.

Detection of the virus is difficult in establishing canola as symptoms may not be evident for 2-5 weeks after infection, and the virus resembles nutrient deficiencies, herbicide damage and other disorders. Only laboratory tests can positively identify TuYV.

Direct damage - feeding

Direct feeding damage by GPA is often minimal compared to other aphid species, and in the absence of TuYV, GPA rarely requires any intervention.

Direct feeding symptoms

Occasionally, heavy GPA infestations can cause leaf distortion, wilting of cotyledons, leaf senescence and seedling death in establishing canola.



Winged GPA form.





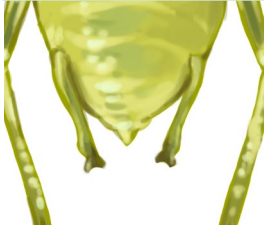
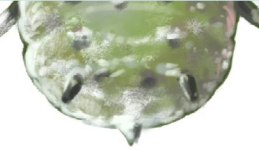






Monitoring

Visual inspection

Check the underside of leaves during early season growth as this is where GPA prefer to inhabit. Visual inspection will not be sufficient to prevent transmission of virus in high risk situations, but may assist with minimising the spread of virus in the crop.

Sticky traps

Sticky traps can provide warning of when aphids are arriving in establishing crops, and act as an early indication of the risk of virus transmission. Sticky traps can also indicate the changing status of parasitoids.

Table 3. Distinguishing canola aphids				
	Green peach aphid	Cabbage aphid	Turnip aphid	Potato aphid
Colour	Uniformly light and dark green, yellow, pink or red	Greyish-green	Yellow-green, grey-green or olive-green.	Green, pink, yellow or magenta.
Adult body length (mm) ¹⁵	 1.2 – 2.1	 1.2-2.6	 1.4-2.4	 1.7-3.6
Siphuncles (visible with a macro lens)	 Siphuncles mostly clear and longer than cabbage and turnip aphids and unevenly swollen	 Tips of siphuncles do not reach base of cauda	 Tips of siphuncles nearly reach base of cauda	 Very long
Tubercles (visible with a microscope)	 Well-developed tubercles, that turn inwards	 Weakly developed tubercles (they are quite flat).	 Weakly developed tubercles (they are quite flat).	 Well-developed tubercles that turn outwards.
Unique features	<ul style="list-style-type: none">• Glittery appearance	<ul style="list-style-type: none">• Dull, mealy appearance• Black transverse bars on abdomen• Often covered in greyish-white wax	<ul style="list-style-type: none">• Dull appearance• Often covered in white wax	<ul style="list-style-type: none">• Large for an aphid• Spindle or pear shaped

Economic threshold in canola

None established

Relatively few GPA individuals are required to transmit TuYV. Typically, transmission will have occurred before GPA populations are noticed in the field.

Management



Biological

Small spiders, carabid beetles, and predatory mites.

GPA is prey to a suite of very effective beneficials such as ladybird beetles, hoverflies, lacewings and parasitic wasps, however, depending on autumn conditions, beneficials may or may not be effective in suppressing aphid numbers. Warmer conditions favour the activity of both the aphid and the natural enemies.

During wet autumns, naturally occurring fungal diseases will suppress populations. Aphids infected with fungi have a pinkish, furry appearance.



Cultural

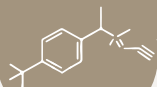
As a priority, control the green bridge (especially wild radish and canola volunteers), in and around paddocks during summer and autumn.

As winged GPA are less likely to land in paddocks with dense canopies, a high seeding rate and/or sowing into standing stubble may delay the build-up of aphids.¹⁴

Consider delaying sowing to avoid exposure of establishing canola to peak aphid flights if the risk of TuYV is high.

The arrival of cold temperatures in winter will slow aphid population growth and movement, decreasing the risk of virus spread.

Chemical



Researchers have found that 90% of all GPA populations collected from canola crops across Australia are highly resistant to synthetic pyrethroids (e.g. alpha-cypermethrin) and carbamates (e.g. pirimicarb). Applications of these chemicals, even at very high rates, will not control GPA if these resistances are present.

The majority of GPA populations have also evolved resistance to organophosphates (e.g. dimethoate) and neonicotinoids (e.g. imidacloprid). The mechanism underlying these resistances is unusual as it 'switches on' in response to stressors. Organophosphates can be effective in some instances, although complete control failures are frequent. Resistance to neonicotinoids is currently low and complete control failures are not expected at the time of writing this guide.

Currently, all available seed treatments for GPA control are neonicotinoid-based and growers do not have the option of rotating chemistries. To maintain the effectiveness of neonicotinoids, do not use a seed treatment every year. Ideally, neonicotinoid seed treatments should be used when the risk of TuYV transmission is high, and no more than one in three years in a single paddock.

Sulfoxaflor is a foliar insecticide that is registered for use and effective against GPA in canola – but use it judiciously. Currently, sulfoxaflor is the only effective insecticide that can be used during early season growth of canola. Sulfoxaflor is a selective insecticide and is softer on some beneficial groups.

If GPA is found moving into crops during autumn or early winter, a border spray may provide sufficient control.

Paraffinic oils are also registered against GPA in canola, but these sprays will only suppress populations. Oils have the advantage of being soft on beneficials.

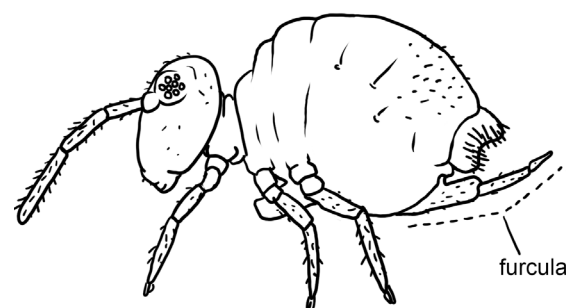
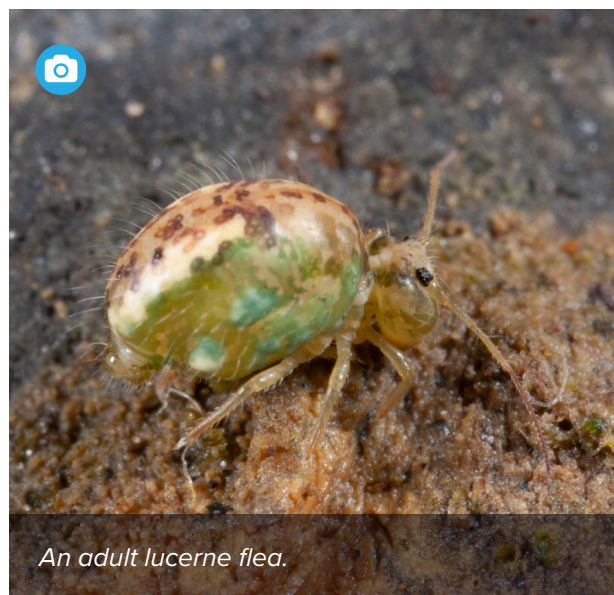


Lucerne flea *Sminthurus viridis*

Occurrence

Present in New South Wales (southern and central), Victoria, South Australia, Tasmania and Western Australia.

Identification



Damage to canola

Adult and immature forms	
Adult	Immature
<ul style="list-style-type: none"> 2-3 mm long Light green-yellow in colour, often with mottled darker patches Globular Three pairs of legs Forked appendage (furcula) under their abdomen (visible with a microscope) 	<ul style="list-style-type: none"> Smaller version of adults Newly hatched 0.5 – 0.75 mm long Light yellow

Feeding symptoms
<p>Lucerne flea chew distinct little holes in plants. Sometimes they leave behind a thin, clear leaf membrane layer giving a 'window' appearance.</p>

Severe infestations can stunt or kill young canola.

Alternative hosts

Lucerne flea attack most crops and pastures - clover and lucerne are particularly susceptible. Weeds including capeweed, shepherd's purse, chickweed, common sow thistle and wild radish are hosts.

Lifecycle and biology

Active period: March to November

Lucerne flea **diapause** eggs hatch in autumn. When **nymphs** mature, adults reproduce sexually, laying winter eggs of successive generations (up to 6). In mid to late spring, lucerne flea dies from the onset of warmer weather leaving diapause eggs on soil surface.

Growth rate is very moisture dependent; they do well in moist conditions or under dense canopies of pasture.

Lucerne flea are prevalent on heavier loam-clay soil types and are less common on sandy soils.

Monitoring

Visual inspection

Lucerne flea springs off plants when disturbed. Examine foliage for feeding damage and in soil for sheltering lucerne flea. Take note of the growth stages in the population – this is important for accurate spray timing. Monitor the entire paddock as lucerne flea typically congregate in localised patches, making spot spraying easy.

Economic threshold in canola

Rule of thumb¹⁶

> 10 holes per leaf



Management

Biological



Spiders, carabids and snout mites may help suppress lucerne flea populations.

Cultural

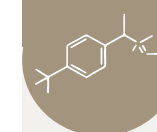


In pastures being rotated into canola, heavy grazing in early to mid-spring will significantly reduce the carry-over of diapause eggs.

Avoid sowing canola in paddocks with a history of lucerne flea if possible (e.g. certain soil types make a preferred habitat).

Control broadleaf weeds as they help to support population build-up.

Chemical



Seed treatments that suppress lucerne flea at establishment are available.

Guidelines for foliar sprays:

Spot spray localised populations; avoid blanket sprays where possible especially if spraying organophosphates.

Spray the area three weeks after lucerne flea first emerges in autumn to allow for the hatching of diapause eggs and intervention before they reach maturity and begin to lay the next generation of eggs.

Use a **selective insecticide**. Diafenthiuron is registered in canola and provides suppression against lucerne flea. It is regarded as relatively soft against beneficials.

Lucerne flea have a high tolerance to synthetic pyrethroids – do not use these insecticides.



Cutworm (*Agrotis* spp.)

Bogong moth/common cutworm
(*Agrotis infusa*)

Pink cutworm (*Agrotis munda*)

Black cutworm (*Agrotis ipsilon*)

Occurrence

Present in New South Wales, Victoria, Queensland, South Australia, Western Australia and Tasmania.

Identification



Cutworm *larvae* are hairless and plump and greasy looking.



Adult moth form of a cutworm.

Adult and immature forms	
Adult	Immature
<ul style="list-style-type: none"> Wings are patterned and varying in colour (black, browns and greys) with elliptical spots on darker splashes Wingspan is up to 50 mm Active at night 	<ul style="list-style-type: none"> Up to 40 – 50 mm long Appears hairless Plump, greasy appearance; indistinct markings Dark head, grey/brown with no stripes 3 pairs of legs 4 pairs of abdominal <i>prolegs</i> and 1 pair of anal prolegs Curl up and remain still if handled Feed at night

Damage to canola

Cutworm are occasional pests of canola.

Feeding symptoms
They feed on leaves and sever stems, and usually the first sign of activity in canola is patches of missing plants or cotyledons.

Alternative hosts

Cereals, pulses, oilseeds, pastures and several weed species.

Lifecycle and biology

Moths lay eggs on plant material on the soil surface, typically from early autumn to winter. They are creamy-white when laid and take three days to several weeks to hatch depending on the temperature. The newly emerged larvae grow with several moults over winter until they are full size and then *pupate* in the soil. Moths emerge from the pupae in mid spring.

These species tend to migrate long distances. For example, in spring, Bogong moths migrate to the Australian Alps where they *aestivate* in mass clusters in caves and crevices. They return to pasture and cropping areas to lay eggs in autumn.



The Bogong moth aestivates in mass clusters during summer. Image: CSIRO.

Economic threshold in canola

Rule of thumb¹⁶

Two or more large *larvae* per 0.5 metre row

Monitoring


Visual inspection


Larvae feed at night so a night inspection may be needed. Inspect for severed stems, especially near fence lines and weeds. During the day, larvae will be found under clods or nestled under foliage.

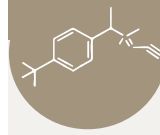
Shelter traps

Shelter traps can lure larvae. These are useful when finding cut stem, but the pest cannot be found during the day.

Management

Biological
 <p>Spiders, carabid beetles, predatory bugs, parasitoids and naturally occurring fungal diseases.</p>

Cultural
 <p>Remove the green bridge at least three weeks before crop emergence to prevent cutworm migrating off autumn weeds and volunteers onto emerging canola seedlings.</p>

Chemical
 <p>Clothianidin and imidacloprid coformulated seed dressing protects canola against cutworm for 3-4 weeks after sowing.</p>
<p>All insecticide sprays registered for cutworm control in canola are broad-spectrum and will kill beneficials. Outbreaks of cutworm will be patchily distributed. Spot spray the infested areas rather than spraying the whole paddock. Spraying at night when larvae are active may improve efficacy.</p>



Slugs





Black keeled slug
(*Milax gagates*)
Brown field slug
(*Deroceras panormitanum*)
Grey field slug
(*Deroceras reticulatum*)

Occurrence

Slugs are a problem in the higher rainfall climates (> 450 – 500 mm) of New South Wales, Victoria, Tasmania, South Australia, southern Western Australia and southern Queensland.

The black keeled slug was not thought to be present in northern NSW, however their presence has more recently been recorded in Coonabarabran and even further north in Brisbane.¹⁷

Identification

Adult forms*		
	Grey field slug	<ul style="list-style-type: none"> Up to 50 mm long Fawn to grey with mottled/netted dark brown markings Mainly surface active Produce a milky coloured-mucous when irritated 
	Brown field slug	<ul style="list-style-type: none"> Up to 35 mm long Uniformly brown Mainly surface active 
	Black keeled slug	<ul style="list-style-type: none"> Up to 60 mm long Uniformly grey to black Sharp ridge down the back Display burrowing behaviour 


*immature slugs look like smaller adults



Slug feeding damage in canola cotyledons.

Damage to canola

Establishing canola is very susceptible to slug damage.

	Feeding symptoms
	Slug feeding creates irregular, rough-edged chewing marks and shredded leaf edges.



They can eat young canola to ground level. Slugs can move down the partly exposed drill line damaging seedlings as they germinate. The damage is usually patchy within a paddock. The black-keeled slug attacks germinating seed.

Once canola has reached the six-leaf stage, it has the capacity to tolerate damage without economic impact.

Alternative hosts

All crops and pasture plants host slugs. Not all crops are equally susceptible to damage. Cereals are more tolerant to damage than canola. Faba beans are less susceptible to damage than most winter crops.

Lifecycle and biology

Active period: Autumn to late spring.

Slugs survive summer in the soil – the grey field slug and brown field slug shelter in cracks and crevices, and the black keeled slug burrows up to 20 cm in the ground. Black and brown field slugs emerge in mid-autumn, and adults begin to mate when there has been sufficient rain. The black keeled slug emerges slightly later due to its burrowing behaviour.

Slugs have male and female reproductive organs. Every individual can lay eggs. Eggs hatch within 3 – 6 weeks, and juveniles mature after 5 – 9 months depending on the temperature and species. Slugs will continue to mate throughout the season if moisture and temperature are suitable. If slugs have not matured with the onset of dry, hot weather in summer, they retreat to seek refuge in the soil and emerge the following autumn. Eggs do not survive the summer.

No-till practices and stubble retention provide a more favourable environment for slugs. The increased uptake of these practices is likely to be driving population growth and increased crop damage.

Slugs are more problematic in high rainfall zones – moisture availability is a key regulator of slug populations. Brown field slugs are more common in paddocks which include a pasture rotation.¹⁹

Monitoring

During spring, monitor for slugs to identify problem paddocks and zones and again pre-sowing the following season after it has rained.

Shelter traps

Slugs can be difficult to detect. If using shelter traps, place them in the paddock when it is visibly wet and check them early in the morning when it is still cool. The chance of finding slugs is much higher when it is wet.

Bait traps

Spread bran-based bait from corner to corner of paddocks after rain and check the following morning for dead slugs.

Visual inspection


Once canola germination has begun, monitor crops closely for feeding damage. If the cause of foliar damage cannot be determined, monitor at night when conditions are damp.

Economic threshold in canola

Field survey¹⁸

1 grey field slug/m² - Use this threshold cautiously. Slug population size is difficult to estimate. Monitoring techniques can underestimate or overestimate slug populations, depending on soil moisture.

Management



Biological

Carabid beetles are important predators of slugs.



Carabid beetles attack and eat slugs.

Cultural



Sowing a high vigour canola variety can decrease its vulnerability to damage as the crop establishes faster.

Rotate canola with less susceptible crops such as linseed or faba beans.²⁰

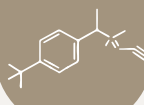
Control summer and autumn weeds and volunteers to reduce refuges.

The use of press-wheels or rolling to consolidate seedbed improves crop establishment and reduces soil refuges.

Consider sowing less susceptible crops in high risk paddocks.

Cultivation and stubble burning makes paddocks less hospitable for slugs. Note that burning is not an effective control tool for black keeled slug due its burrowing behaviour.

Chemical



Baits are the only chemical option available for slug control. Use them as crop protectant when slugs are active and feeding at sowing.²⁰ Rebaiting may be necessary if populations are high, if there is staggered slug emergence (more than one species present) or if baits degrade.

Baits vary in their active ingredient, formulation and field-life. Some general guidelines for their use are:²¹

- If > 10 mm rain is expected, do not use iron-based baits
- Rainfall (> 35 mm) erodes bran-based baits rapidly and reduces efficacy

If baits are disappearing with no corresponding dead slugs, this may indicate a mouse problem.



Snails

- White Italian snail (*Theba pisana*)
- Vineyard/Common white snail (*Cernuella virgata*)
- Small pointed snail (*Prietocella barbara*)

Occurrence




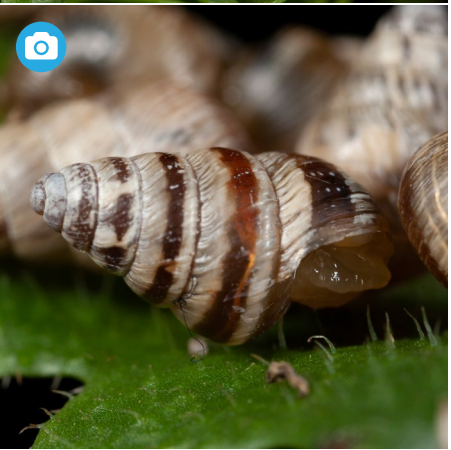
Present in South Australia, Victoria, New South Wales, Tasmania and Western Australia.

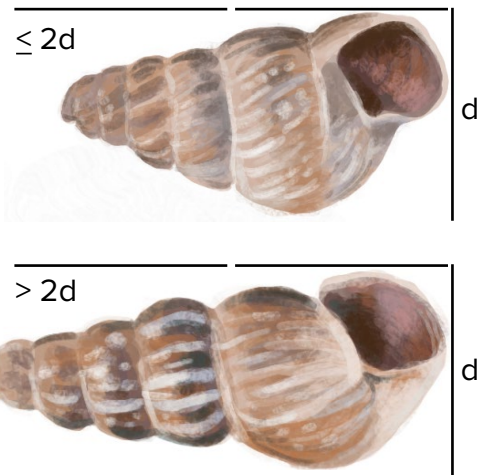
While snails have not historically been problematic in NSW, pest species are present in the state and incidences of large numbers encroaching on land show that there is a risk of their prevalence increasing.



The vineyard snail's umbilicus is circular (left), whereas the white Italian snail's umbilicus is semi-circular (right).

Identification

Distinguishing snails		
	Vineyard snail	<ul style="list-style-type: none">• Round, coiled shell• Mature diameter between 10 – 20 mm• White shell which often has a continuous brown band tracing the spiral, although this is not always present• Circular umbilicus 
	White Italian snail	<ul style="list-style-type: none">• Round, coiled shell• Mature diameter between 10 – 30 mm• The shell displays a spiral of broken brown bands, although this is not always present.• Semi-circular umbilicus 
	Small pointed snail	<ul style="list-style-type: none">• Cone-shaped• Up to 8 – 10 mm long• Shell is a blend of white, browns and greys• Shell length is no greater than twice the base diameter• May be confused with the pointed snail (<i>Cochlicella acuta</i>), which is a grain contaminate but does not damage crops. The pointed snail's shell length is always greater than twice the base's diameter. 



The small pointed snail's shell length is no greater than twice the base's diameter (d) (top). The pointed snail's shell length is always greater than twice the base's diameter (bottom).

Damage to canola

The vineyard snail, white Italian snail and small pointed snail feed on canola.



Feeding symptoms

Like slugs, snails have rasping mouth parts which shred leaves and defoliate plants. The damage can be confused with feeding by [slugs](#), [earwigs](#), [slaters](#) and [millipedes](#).

While plants are most at risk during establishment, snails are season-long pests as they are also a serious grain contaminate at harvest.

Alternative hosts

Snails feed on dead organic matter and many crops and pastures including cereals and pulses.

Lifecycle and biology

Active period: Autumn to spring.

Over summer, snails aestivate and avoid the hot paddock soils by taking refuge off-ground on crop stubble, fence posts and alternative vegetation in and around paddocks. The small pointed snail

can also take refuge in protected, ground-level environments e.g. under leaf litter, between soil cracks, under stones and clumps of grass.

In autumn, the onset of cool, moist conditions 'reactivates' the snails, after which they begin to search for food. Subsequently, within 2 weeks after the first heavy autumn rain, snails begin to mate and lay eggs. Snails have male and female reproductive organs. Every individual can lay hundreds of eggs each season. Brief showers prior to a heavy rainfall, or a series of dews, can also stimulate feeding and mating. This means that eggs may be ready to lay as soon as the soil is moistened with a decent rain. Most egg laying occurs in autumn or early winter although some laying continues to early spring. Eggs hatch after about 2-3 weeks. After steady growth through winter and spring, the snails [aestivate](#) through the following summer.

The white Italian snail and the vineyard snail thrive in sandy, calcium-rich soils (high pH), while the small pointed snail is not restricted to these environments. The small pointed snail is most abundant in the high rainfall zones (>500 mm).

No-till practices and stubble retention provide a more favourable environment for snails, and their increased uptake is likely to be driving population growth.

Moisture is a key regulator of snail populations – good autumn rainfall drives population growth.

Economic threshold in canola

The use of thresholds for snails is not relevant as good snail management requires population reduction at every opportunity.

Monitoring

Visual inspection

Monitor paddocks in early summer to assess and enact stubble management options.

Monitor during March/April to assess snail activity and the need for burning and baiting.

Bait traps

To assess when snail activity has begun in autumn, spread some bait along a fence line and check if there are dead snails the next morning.

Management

Good snail management requires population reduction at every opportunity. Once they become a problem, it is difficult to get rid of them.



Biological

There is no effective biological control agent which suppresses snail populations in Australia.

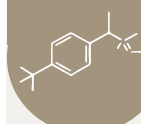


Cultural

Rolling, slashing and cabling stubble are important snail management tools and are covered in the [Bash' Em, Burn' Em, Bait' Em](#) guide listed under [Resources](#).

Manage summer weeds prior to stubble management, especially along fence lines and borders

Maintain good farm hygiene practices to prevent transportation of snails on farms.



Chemical

To maximise the benefits of burning and rolling, baiting should be used as a follow-up measure to further reduce snail numbers and the potential for population growth. Baiting should occur once snail activity begins in autumn, but prior to egg laying. This is advantageous for a number of reasons. Firstly, baits are far more effective at controlling adult snails than juveniles as there is an increased likelihood of the larger snails (> 7 mm) encountering baits. Secondly, there is less alternative feed and less complexity to the landscape prior to sowing, which increases the chances of snails encountering baits.

Ensure at least 30 bait points per m² and rebait if necessary.

Baits vary in their active ingredient, formulation and field-life. Some general guidelines for their use are:²¹

- If > 10 mm rain is expected, do not use iron-based baits
- Rainfall (> 35 mm) erodes bran-based baits rapidly and reduces efficacy

If baits are disappearing with no corresponding dead snails, this may indicate a mouse problem.





False wireworms

- Bronzed field beetle (*Adelium brevicorne*)
- Grey false wireworm (*Isopteron* spp.)
- Vegetable beetle/southern false wireworm (*Gonocephalum* spp.)
- Eastern false wireworm (*Pterohelaeus darlingensis*)

Occurrence

Common throughout Australia. Geographic distribution varies between species. See Table 5 for false wireworms found in NSW.

False wireworm larvae have three pairs of short, legs just behind the head. Their bodies are generally hardened, cylindrical, segmented and elongated. False wireworm larvae can be confused with true wireworm or beneficial carabid beetle larvae. See Table 6 for help distinguishing these beetle larvae.

Identification

Table 5. Common false wireworm species in canola in NSW			
	adult	larvae	
Bronzed field beetle	<ul style="list-style-type: none">Up to 11 mm longShiny black with a bronze sheen	<ul style="list-style-type: none">Up to 12 mm longShiny, uniformly dark brownSpines on their last body segment are prominent	
Grey false wireworm	<ul style="list-style-type: none">Up to 8 mm longDull brownSlender bodyOften covered in soil	<ul style="list-style-type: none">Up to 12 mm longShiny brown grey with paler parts underneathSpines on their last body segment are prominent	
Eastern false wireworm	<ul style="list-style-type: none">Up to 25 mm longDull blackShaped like an oval pie dish with broad flanges (rims) around the edges of their body	<ul style="list-style-type: none">Up to 50 mm longCream-tan to yellow orange with darker ringsHead darker than the rest of the body	
Vegetable beetle/ Southern false wireworm	<ul style="list-style-type: none">Up to 10 mm longMatte grey-blackOval shapedOften covered in soil	<ul style="list-style-type: none">Up to 20 mm longShiny, cream, yellow or tanHead darker than the rest of the body	

Table 6. Distinguishing false wireworm from true wireworm and carabids				
	Grey false wireworm and bronzed field beetle larvae	Southern false wireworm and eastern false wireworm	True wireworm	Carabid larvae
Head	<ul style="list-style-type: none">Mouthparts withdrawn and oriented downwards	<ul style="list-style-type: none">Mouthparts protrude outwardsHead flattened	<ul style="list-style-type: none">Mouthparts protrude outwardsHead slightly flattened	<ul style="list-style-type: none">Mouthparts protrude outwardsHead slightly flattened
Last segment of abdomen	<ul style="list-style-type: none">Two up-turned hooks	<ul style="list-style-type: none">No obvious protrusions	<ul style="list-style-type: none">Plate-like structure present with two projections at the endPlate is often serrated	<ul style="list-style-type: none">Two hair-like or spine-like projections often present (projections may be subdivided into further segments)

Adults have three pairs of legs and segmented, thread-like antennae. Appearance varies between beetles and they can be confused with carabid beetles (adults). Carabid beetle legs and mouthparts are generally more well-developed, and their mouthparts visibly protrude forward.

Damage to canola

False wireworm larvae attack seedlings above and/or below ground. Crop thinning or bare patches are usually the first sign of their damage. While the larvae are regarded as the more damaging life stage, adult beetles can attack crops as they move across the soil surface.



Feeding symptoms

Vegetable beetle adults (Table 5) are known to chew plants above ground, causing ring barking and cut stems.

Table 7. False wireworm lifecycles

Species	Lifecycle											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Bronzed field beetle			eggs			larvae			pupae			
		adult										
Vegetable beetle and Eastern false wireworm	eggs											
		larvae									pupae	
		adult										
Grey false wireworm	eggs											
		larvae								pupae		
		adult										

Alternative hosts

False wireworms often feed on soil organic matter. They are also known to attack cereals and some pulses.

Lifecycle and biology

See [Table 7](#) for a general guide on when [larvae](#) and adults are present.

No-till practices and stubble retention provide a more favourable environment for false wireworms. The increased uptake of these practices is likely to be driving population growth.

Economic threshold in canola

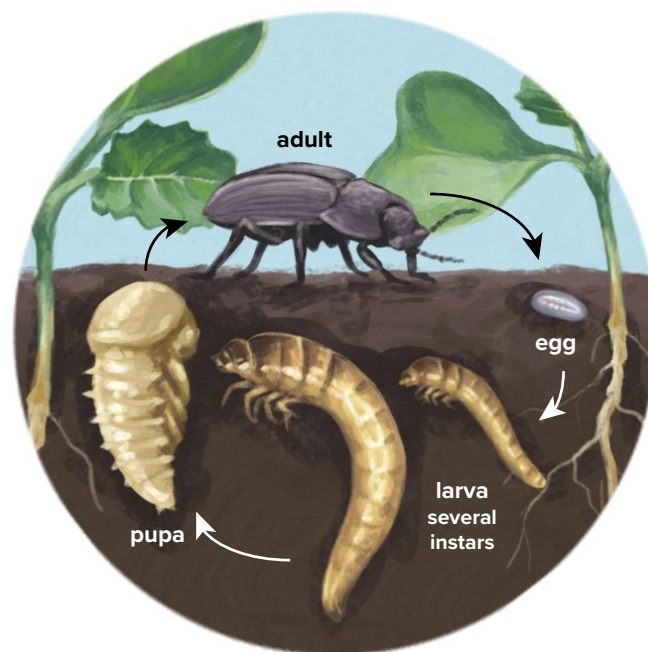
Rule of thumb¹⁶

Bronzed field beetle: 5 adults/m²

Grey false wireworm: 35 – 50 larvae/m²

Vegetable beetle: not established

Southern and Eastern false wireworm: 25 larvae/m²



A generic false wireworm lifecycle.

Monitoring

Pre-sowing assessment of false wireworm densities is important. If damage occurs after sowing, no treatment is available, other than resowing bare patches.

Visual inspection

Population size is difficult to estimate with visual inspections as larvae are subterranean and adults hide in the stubble during the day.

Traps

Germinating grain or potato bait traps are useful for detecting [larvae](#)

Pitfall traps and shelter traps will help detect adults.



Bronzed field beetle larvae and adults present in a 2-leaf canola crop in Victorian Northern Country. Image: Chris Dunn.

Management

Biological



[Carabid beetles](#) and the [common brown earwig](#) attack false wireworm larvae.

Cultural



Increasing seeding rate may help compensate for loss of seedlings.

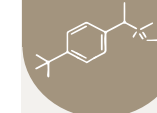
The use of press wheels will restrict the movement of larvae to germinating seed and seedlings.

Early sowing may minimise the impact of feeding damage as slow growing seedlings are more vulnerable.

As many false wireworm species feed on soil organic matter, managing stubble loads (e.g. the occasional strategic burn), may help reduce the pest load.

The role of crop rotation with a less preferred host in breaking the lifecycle is unclear as false wireworms feed on soil organic matter.

Chemical



Foliar or bare-earth sprays are discouraged due to

the subterranean habit of wireworms and the negative impacts on beneficials. Unless the larvae/beetles are active on the surface, bare-earth treatments will not be effective.

Seed treatments are available to help protect establishing canola from false wireworm damage. At high densities, seed treatments may not adequately prevent seedling loss.



Weevils

Various species

Occurrence

Common throughout Australia. Geographic distribution varies between species. See [Table 8](#) for canola weevils found in NSW.

Identification

Adult and immature forms	
Adult	Immature
<ul style="list-style-type: none"> • 3 – 10 mm long • Three pairs of legs • Usually have right-angled antennae • Head region always extends into a 'snout'. The snout shape varies between weevil types. • Pair of hardened forewings 	<ul style="list-style-type: none"> • Legless – true legs and prolegs are absent • Body cream, green or yellow in colour • Small, hardened head capsule



Damage to canola

Weevils are sporadic pests of canola and can do considerable damage when in large numbers. Both adults and [larvae](#) can feed on canola, depending on the species.

Feeding symptoms
<p>Damage symptoms include chewed sections of seedlings, scalloped leaf margins and ringbarking. In severe cases, weevils chew canola cotyledons off at ground level, thinning or destroying patches.</p>



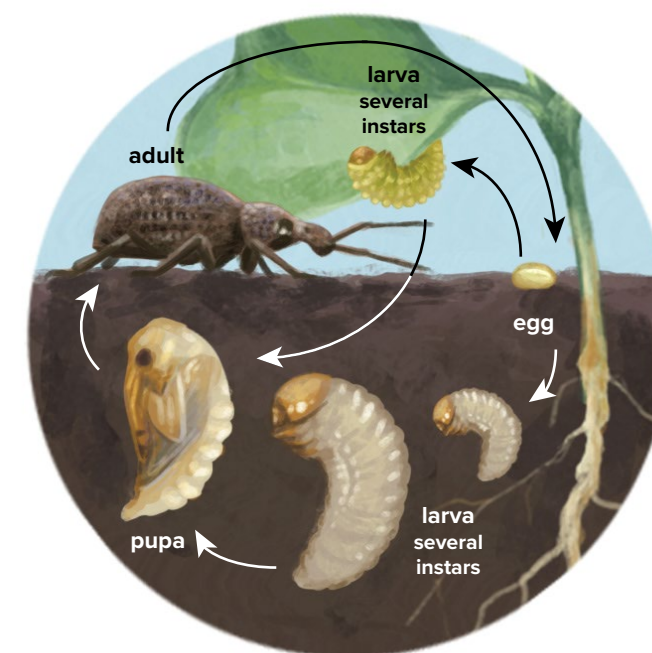
Lifecycle and biology

The lifecycles and biology of most canola weevils are poorly understood. Some key insights include:

- Mandalotus weevil are found primarily on 'rubby' or lighter calcareous soil types. The adults emerge onto the soil surface from mid-April onwards and begin feeding, mating and laying eggs.
- Vegetable weevil adults lay eggs on plants, surface litter or soil from mid-March until September. [Larvae](#) feed on leaves and [pupate](#) in the soil, and adults emerge between September and October. During summer and early autumn adults undergo a [diapause](#) period and are inactive in the soil.
- Spotted vegetable weevil adults lay eggs in soil that hatch in autumn after opening rains. In spring, larvae pupate and adults emerge during spring through to early summer.
- The larvae of many weevil species are subterranean with the exception of vegetable weevil and grey banded weevil, their larvae feed on leaves and stems above ground.

Economic threshold in canola

None established



A generic weevil lifecycle

Monitoring

Weevils that impact canola in NSW are flightless. They disperse slowly, and populations should recur in the same areas of paddocks across seasons.





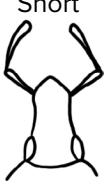
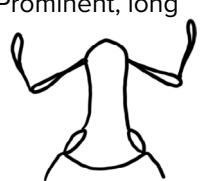
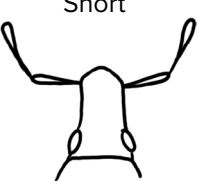
Visual inspections

Prior to sowing, inspect weeds and soil (with a shovel) for the presence of weevils.


Check canola crops one week after emergence for evidence of weevils and their damage. Monitoring at night with a torch is helpful. Weevils are most active at night and tend to take shelter during the day.




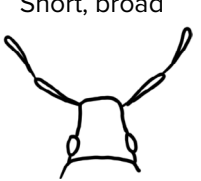
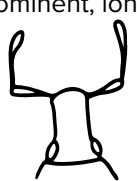

Pitfall traps

Pitfall traps can be used to capture adult weevils.

<div>  Table 8. Weevil species and life stage which have damaged canola in NSW. </div>			
	Mandalotus weevil (<i>Mandalotus</i> spp.) Adults	Spotted vegetable weevil (<i>Steriphus diversipes</i>) Adults	Grey-banded leaf weevil (<i>Ethemaia sellata</i>) Larvae & adults
		 Image: SARDI	
size	3-5 mm (quite variable)	7 mm	8 mm
snout	Short 	Prominent, long 	Short 
features	<ul style="list-style-type: none"> Dull brown, often camouflaged as a clod of dirt Covered with rows of short, stout, paddle-shaped bristles Flightless 	<ul style="list-style-type: none"> Mottled grey-black in colour Flightless 	<ul style="list-style-type: none"> Light brown-grey in colour Paler colour banding on the rear of the abdomen, covering about 25% of the elytra wing covers Thought to be flightless
larvae	<ul style="list-style-type: none"> Pale body Yellow orange head capsule 	<ul style="list-style-type: none"> Body white in colour Orange-brown head capsule 	<ul style="list-style-type: none"> Body yellow-green in colour Dark head capsule
other hosts ^a	<ul style="list-style-type: none"> Cereals Pulses Medic pastures 	<ul style="list-style-type: none"> Cereals^b Grasses Capeweed 	<ul style="list-style-type: none"> Lupins Malvaceous weeds e.g. marshmallow


Management

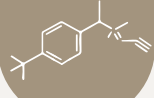
<div>  Cultural </div>		
<p>Ensure autumn and summer weeds are removed 3 weeks before crop emergence. Weeds are often the preferred host. If there is no gap between weed mortality and canola emergence, weevils migrate directly from their dying preferred host to establishing canola.</p> <p>Remember, most weevils are flightless, and have poor mobility. Therefore consider:</p>	<ul style="list-style-type: none"> Providing a prolonged weed-free fallow which may help to break the life cycle of weevil pests. Rotating the paddock with non-host crops. If feasible, sowing canola crops away from weevil problem paddocks to reduce the risk of damage. 	<p>Increasing seeding rates and planting canola varieties with early vigour to aid rapid establishment may help reduce damage.</p>

Fuller's rose weevil (<i>Naupactus cervinus</i>) Larvae & adults	Vegetable weevil (<i>Listroderes difficilis</i>) Larvae	Small lucerne weevil (<i>Atrichonotus minimus</i>) Adults
	 Image: Denis Crawford	
8 mm	8 mm	10 mm
Short, broad 	Prominent, long 	Short, broad 
<ul style="list-style-type: none"> Grey-brown in colour Short white stripes on either side of the abdomen Flightless 	<ul style="list-style-type: none"> Grey brown in colour V-shape marking (grey brown) on the wing covers near the rear of the body Flightless 	<ul style="list-style-type: none"> Light grey in colour with brownish mottling Flightless
<ul style="list-style-type: none"> Body yellow, white or cream in colour Yellow head capsule with black mouth parts 	<ul style="list-style-type: none"> Body yellow or green in colour Dark brown-orange head capsule 	<ul style="list-style-type: none"> Body creamy-white in colour Pale head capsule with brown pointed jaw
<ul style="list-style-type: none"> Lucerne Pasture 	<ul style="list-style-type: none"> Other brassicas Broadleaf weeds including capeweed and marshmallow 	<ul style="list-style-type: none"> Lucerne^b Pasture legumes

^aThis list is not exhaustive of alternative hosts – there are likely other hosts

^bLarvae cause damage

<div>  Biological </div>
<p>There are no recorded predators, parasitoids or pathogens in Australia, that effectively control weevils in canola, although there is every possibility that some natural occurring agents do regulate populations. Related weevils in New Zealand are attacked by parasitoids.</p>

<div>  Chemical </div>
<p>There are very limited chemical options available for weevil control in canola.</p> <p>There are broad-spectrum insecticides registered for vegetable weevil. They can be effectively controlled with a border spray, and without spraying whole paddocks as they are usually concentrated around crop edges around weeds.</p>



European earwig

Forficula auricularia

Occurrence

Common throughout southern Australia.

Identification

Adult and immature forms

Adult

- Up to 20 mm long
- Flat, elongated body
- Shiny, dark-brown **abdomen**
- Pale yellow-brown legs
- Yellow-brown **thorax**
- Red-brown head
- Segmented, thread-like **antennae**
- Pair of moveable pincers protruding from their abdomen – curved pincers in males, comparatively straight pincers in females.

Immature

- Smaller and paler than adults

Damage to canola

The European earwig feeds on leaves and stems at night. As social insects, they often live and feed in clusters and severe infestations can chew plants down to ground level.

Feeding symptoms

Moderate damage appears as irregular shaped holes in leaves or distinctively shredded leaves and leaf tips, which can be mistaken for [snail](#) and [slug](#) damage.

The European earwig can also feed underground on germinating seed in loose soil tilt.



Alternative hosts

The European earwig is extremely **polyphagous**, with cereals and legumes among susceptible crops.

Lifecycle and biology

As temperatures decline in March, and well before the average autumn break, female earwigs appear to individually enter paddocks and disperse to create and excavate nest sites/burrows in the topsoil under earthen clods.²²

Once mated, adult female European earwigs lay eggs. The first (and main) brood (batches of 20 to 80 white oval eggs) is laid from May and can take 4-6 weeks to hatch. The mother remains with the young for quite some time after they hatch. Earwig

juveniles hatch through June and July (temperature dependent) and progress through 4 stages of juvenile development, each taking approximately 4-6 weeks. The development from egg to adult takes nine to ten weeks at 25°C, but takes up to five weeks longer at 15°C. Late stage juveniles feed on canola pollen in early spring. Large numbers of young adults appear in November. There are multiple generation per season.

As crops senesce and are harvested, there is a mass exodus of earwigs from paddocks to neighbouring landscapes with diverse vegetation including trees. Earwigs show preference for sheltering in aggregations over summer under bark on standing or fallen trees. Early in autumn, they re-enter paddocks.

No-till practices and stubble retention provide a more favourable environment for the European earwig. The increased uptake of these practices is likely to be driving population growth.

Monitoring

Shelter traps

European earwigs seek shelter during the day. Use shelter traps (e.g. boards placed on the ground or corrugated cardboard rolls) to monitor for presence and approximate densities.



Visual inspections

Earwigs tend to feed at night and if numbers are high, they can be easily seen on crop edges.

Economic threshold in canola

None established

Management

Biological

No effective biological controls are known in Australia, although in Europe the species is attacked by parasites and fungal pathogens.

Known to be cannibalistic.

Cultural

Stubble burning, removal of trash and/or cultivation may help reduce earwig breeding sites.

Consider a high-vigour variety sown at high seeding rate to compensate for damage when sowing canola into earwig-problem paddocks.

Chemical

There are no foliar insecticides registered against European earwigs in canola.

Synthetic pyrethroids and organophosphates applied to control other crop establishment pests may not be effective against the European earwig which tends to shelter under stubble, rocks and clods of soil, avoiding contact with insecticide sprays.

A new product is pending registration. Refer to the [Australian Pesticides and Veterinary Medicines Authority](#) website for up-to-date registrations.



Black Portuguese millipede

Ommatoiulus moreleti

Occurrence

Present in southern Australia.

The furthest north on the east coast of Australia that the black Portuguese millipede has been found is at Mount Victoria in the Blue Mountains to the west of Sydney.²³

Identification



Black Portuguese millipedes.

Adult and immature forms	
Adult	Immature
<ul style="list-style-type: none"> Smooth, cylindrical body made up of 50 segments 30-45 mm long Dark grey to black in colour 2 pairs of legs on most body segments 	<ul style="list-style-type: none"> Light brown with a darker stripe along each side of their body

Damage to canola



Black Portuguese millipede damage in canola.

Feeding symptoms

The black Portuguese millipede can chew the leaves and stems of establishing canola. They remove irregular sections from the leaves and can kill whole plants if damage is severe.

They are most problematic to emerging seedlings.

Alternative hosts

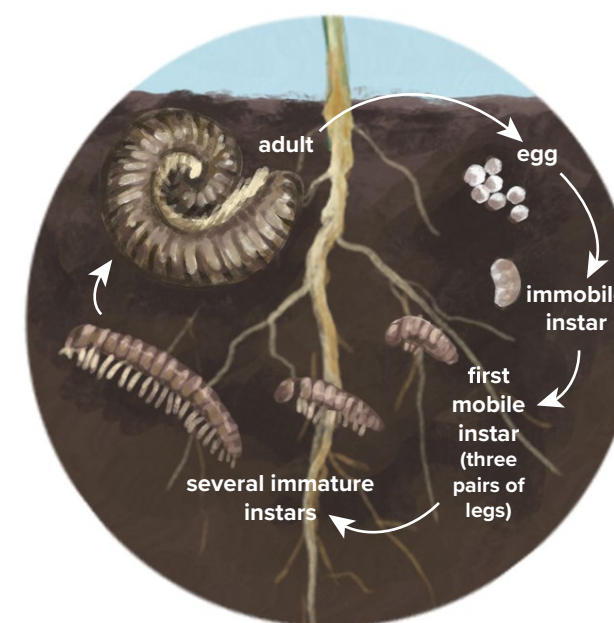
Millipedes are detritivores, feeding on organic material including leaf litter, damp decaying wood, fungi and plant roots, mosses, green leaves on the soil surface and pollen. This means they can be present in high numbers without causing crop damage. What triggers these species to turn their attention to living crop plants in some circumstances is unknown. Under what conditions damage is likely to occur is unclear.

Lifecycle and biology

Female black Portuguese millipedes commence mating with males and laying eggs in autumn. The eggs are yellow-white and the size of a pinhead. They are laid in clusters of 200-300 in the soil, from which legless, immobile juveniles hatch. After moulting for the first time, the juvenile has three sets of legs. The millipede undergoes 7-9 moults in the first year in which body segments and legs are added with each successive moult. After this they moult only during spring and summer. They reach adult size (tenth or eleventh moult) and maturity after approximately 2 years.

Black Portuguese millipedes congregate in large numbers and become quite mobile and conspicuous after the first rains in autumn. A temperature range 17-21°C and humidity of around 95% favour activity. Rainfall often stimulates activity of black Portuguese millipedes.

No-till practices and stubble retention provide a more favourable environment for the black Portuguese millipede. The increased uptake of these practices is likely to be driving population growth.



A generic millipede lifecycle.

Economic threshold in canola

None established

Monitoring

Visual inspections

Inspect crops for feeding damage during establishment. To search for millipedes during the day, it is best to search under rocks, stubble residue, wood, or to dig up the soil with a spade. To determine if black Portuguese millipedes are the cause of damage, monitor crops at night when they mostly like to be active.

Shelter traps

Carpet squares, tiles or pot plant bases can be used to detect millipedes.

Management

Biological

Natural predation of the black Portuguese millipede is likely to be very limited in NSW (and Australia). The pest is likely preyed upon by a few soil-dwelling predators (e.g. [spiders](#) and [carabids](#)) but not sufficiently to reduce numbers in favourable environments.

Cultural

Removal of trash and stubble management (e.g. burning) may help to reduce the pest pressure.

Early sowing of high-vigour crop varieties at a higher seeding rate should help compensate for loss of seedlings and some damage.

Chemical

There are currently no insecticides registered in canola for control of black Portuguese millipede.

A new product is pending registration. Refer to the [Australian Pesticides and Veterinary Medicines Authority](#) website for up-to-date registrations.



Slaters

Pill bug (*Armadillidium vulgare*)
Common rough woodlouse (*Porcellio scaber*)

Occurrence

Slaters are common throughout Australia.

Identification

Slaters have heavily armoured bodies that are flattened and segmented. They have 1 pair of prominent [antennae](#), 1 pair of inconspicuous antennae and 7 pairs of legs (1 pair per segment).

Common rough woodlouse



Image: Josh Douglas

- Pale grey, brown, yellow or orange in colour
- Up to 20 mm long
- Cannot roll itself into a ball

Pill bug



Image: Joseph Burger, Bugwood.org

- Dark brown to black in colour
- Up to 18 mm long
- Can roll itself into a ball

The flood bug (*Australiodillo bifrons*)

The flood bug is a native slater species associated with irregular bouts of damage in cereals in New South Wales. It displays a swarming behaviour of tens of thousands of individuals. Flood bugs have been recorded in parts of New South Wales and southern Queensland, particularly those areas that are prone to flooding (e.g. around Moree, Goondiwindi). However, there are no records of flood bug damaging canola at present.

The flood bug has a dark brown stripe down the middle of its back. It is a species adapted to low-land swampy soil or marshy environments.



Australian native, the flood bug is a sporadic cereal pest in NSW.



A pill bug feeding on a canola cotyledon.

Damage to canola

The pill bug and common rough woodlouse can cause significant feeding damage to establishing canola.



Feeding symptoms

Feeding results in uneven rasping-type damage that can appear similar to slug, snail, earwig and millipede damage. They can chew the tops of emerging cotyledons or leaves of crop seedlings, sometimes leaving only the seedling stumps. Other damage includes ring-barking of stems and young branches.



Pill bug damage in young canola.

Alternative hosts

Slaters are nature's recyclers, forming an important link in the food chain, and therefore they are also beneficial to cropping systems.

Research has shown that when presented with canola, wheat, oat, lucerne, red lentil, chickpea, faba bean and lupin plants, the pill bug damaged all species except faba beans.²⁴

Lifecycle and biology

Female slaters keep their eggs in a pouch until the young hatch. Upon emerging from the brood pouch, the young resemble adults but have only 6 body segments and 6 pairs of legs. Hatchlings then leave the parent and are completely independent. Slaters grow through a series of moults in which the outer rigid skeleton is shed, allowing growth to the next larger and finally adult stage. They will gain their last segment and seventh pair of legs at later moults. During moulting, the slater is very vulnerable and must find shelter.

Slaters require a damp environment and will die if exposed to open and dry conditions.



No-till practices and stubble retention provide a more favourable environment for slaters. The increased uptake of these practices is likely to be driving population growth.

Chaff lining may also provide a suitable habitat for slaters.

Monitoring

Visual inspections

Slaters are mostly active at night or under moist conditions. During the day, it is best to search under stubble residue, rocks, wood or to dig up the soil with a spade.

Sheltar traps

Carpet squares, tiles or pot plant bases can be used to detect slaters.

Economic threshold in canola

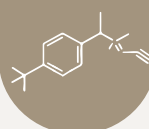
None established

Management



Biological

No effective biological controls are known in Australia, although carabids and some species of spiders are common predators in the United Kingdom.



Chemical

There are no insecticides registered in canola for control of slaters.

A new product is pending registration. Refer to the [Australian Pesticides and Veterinary Medicines Authority](#) website for up-to-date registrations.

Cultural



Consider sowing a less favourable crop in slater problem paddocks e.g. faba beans in paddocks with pill bugs.

Consider a high vigour variety of canola at an increased seed rate to compensate for damage.

Management options are limited after crop emergence, so prevention is a key part of control.

Managing stubble is likely to be the most effective strategy to reduce slater numbers. Note that while some growers have had success managing slaters ahead of canola rotations by burning crop residues, in other cases, crop damage seems to be more pronounced in burnt paddocks. In this situation, it is plausible that slaters that avoid the heat of a burn through harbouring in soil cracks become more voracious in the absence of stubble and attack emerging plants.



Other insect pests in young canola

Butterflies and moths

Brown pasture looper *Ciampa arietaria*



Identification

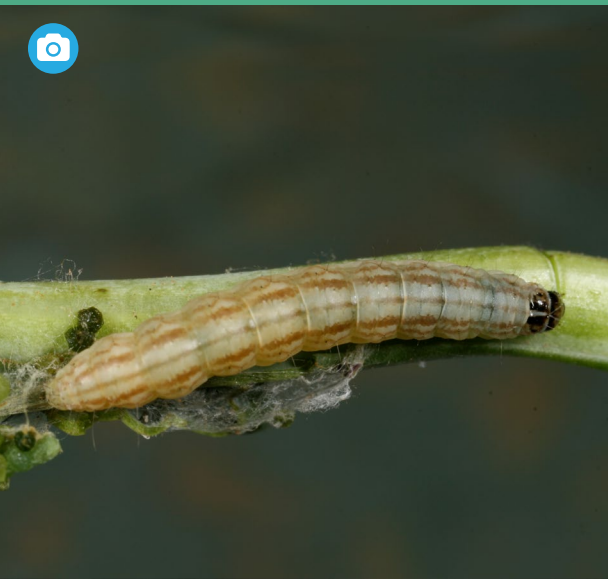
Larvae

- Up to 35 mm long
- 2 wavy yellow lines running down their backs
- 3 pairs of true legs
- 1 pair of abdominal prolegs
- 1 pair of anal prolegs
- Walks with a looping motion

Key points

- Occurs sporadically in canola from July to October.
- Canola is often established before brown pasture looper reaches a damaging size, therefore they are rarely an economic pest.
- Late sown or slow establishing canola is most vulnerable to damage.
- Keep paddocks and fence lines free of broadleaf weeds, especially capeweed and storksbill which they prefer.
- Only broad-spectrum insecticides are registered. To preserve beneficials, spot spray or perimeter spray affected areas.

Cabbage centre grub *Hellula* spp.



Identification

Larvae

- Dark head, cream body with longitudinal red-brown stripes
- Up to 12 mm long

Key points

- Present in brassica crops (forage rape) during warm and dry conditions.
- Larvae feed on the basal leaves and young developing floral parts and can tie the leaves together with webbing or create large blisters inside the leaf.
- Cabbage centre grubs are most problematic in forage brassicas during spring, summer and early autumn. They have multiple generations per year and adult moths can lay eggs in establishing canola crops during autumn.
- Establishment damage to autumn-sown canola is uncommon as their activity declines with cold, wet weather.

Butterflies and moths

Cabbage white butterfly
Pieris rapae



Image: Denis Crawford



Identification

Larvae

- Up to 30 mm long
- Velvety green body with faint yellow longitudinal lines

Adult

- Creamy white wings with one or two black spots
- 40 mm wingspan

Key points

- Occurs sporadically in canola, chewing large holes in leaves.
- They have multiple generations per year and are prevalent in warmer months.
- Establishment damage to autumn-sown canola is uncommon so they are rarely an economic pest. Their activity declines with cold weather.
- If chemical control is warranted during establishment, softer insecticides are available (e.g. *Bacillus thuringiensis*).

Diamondback moth
Plutella xylostella



Identification

Larvae

- Pale yellowish-green, slightly tapered at each end
- Up to 10 mm long

Adult

- Grey-brown in colour
- Characteristic whitish uneven whitish strip down the back, which resembles diamond patterns.
- 10 mm long

Key points

- An all-year-round pest, but it most abundant in brassica crops during spring and early summer, including in summer established grazing canola.
- It is uncommon for diamondback moth to challenge establishing autumn-sown canola. Cold temperatures slow population development.
- If chemical control is warranted during establishment, softer insecticides are available (e.g. *Bacillus thuringiensis*).
- Moderate to high levels of resistance is widespread in Australian populations - read the [Resistance Management Strategy for Diamondback Moth in Australian Canola](#) listed under [Resources](#), before choosing an insecticide.

Loopers
Chrysodeixis spp.



Image: QDAF

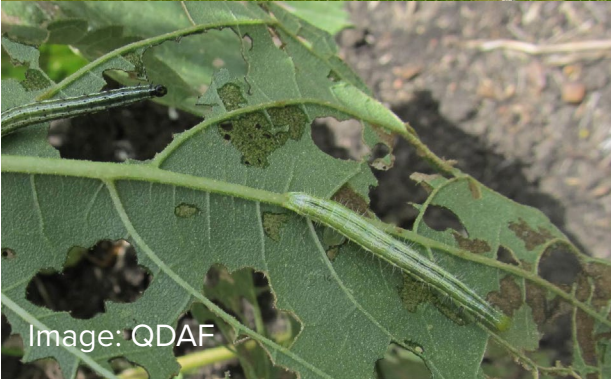


Image: QDAF

Identification

Larvae

- Up to 35 mm long
- Green with fine white longitudinal lines
- Two sets of abdominal **prolegs** cause a looping motion when walking.

Key points

- If chemical control is warranted during establishment, softer insecticides are available (e.g. *Bacillus thuringiensis*).

Beetles

True wireworms



Identification

Larvae

- Up to 40 mm long
- Long cylindrical body
- 1 pair of upturned projections protruding from a serrated plate at the end of their bodies
- Flat head
- 3 pairs of short legs and 1 anal proleg
- Creamy-yellow to red-brown in colour

Adult

- 9 – 13 mm long
- Mostly dark brown to black in colour
- Snap and flick themselves upright when laying on their backs
- Make a clicking sound

Key points

- Larvae are soil dwelling and prefer low-lying, poorly drained soils.
- Most commonly attack cereals but also sporadically attack establishing canola.
- Larvae can be confused with [false wireworm](#) or [carabid larvae](#) (see [Table 6](#) on how to distinguish these beetles larvae).
- For true wireworm management, see the [false wireworm management](#) section.

Bugs

Potato aphid
Macrosiphum euphorbiae



Image: InfluentialPoints.com

Identification
See [Table 3](#)

- Key points**
- Sporadically colonises canola.
 - May be confused with [green peach aphid](#) (GPA).
 - A vector of [turnip yellows virus](#), but it is not as efficient as transmitting the virus as GPA. TuYV transmission rate is 8.9% in canola, which is much lower than GPA (96.4%).²⁶
 - Has not evolved resistance to insecticides.
 - Unlikely to warrant control.

Turnip aphid and
cabbage aphid



Turnip aphid (*Lipaphis pseudobrassicae*)
Cabbage aphid (*Brevicoryne brassicae*)
Identification
See [Table 3](#)

- Key points**
- Infestations mostly occur in canola from earlier flowering to pod-fill. They colonise spikes and racemes, and direct feeding damages seed. Infrequently, they may also be found during autumn, especially when it is dry and warm.
 - They are vectors of [turnip yellows virus](#) (TuYV) but they are not as efficient at transmitting the virus as [green peach aphid](#) (GPA).²⁵ The TuYV transmission rates for GPA and cabbage aphid are 96.4% and 14.8%, respectively.²⁶
 - They have not evolved resistance to insecticides like GPA.
 - If spraying is warranted, there are [selective insecticides](#) available (e.g. pirimicarb and sulfoxaflo), which are softer on beneficial than broad-spectrum alternatives.

Rutherglen bug (RGB)
Nysius vinitor




Image: QDAF

Identification
[Nymphs](#)

- Dark red in colour
- Pear-shaped body
- Wingless

Adult

- 4 mm long
- Narrow body
- Grey-brown in colour
- Folded wings

- Key points**
- A sucking pest, most known for its status as a seed-feeding pest in canola during spring and early summer.
 - RGB can be a pest of establishing canola, particularly in northern NSW. There, RGB can breed up in canola crops in spring and migrate out into establishing summer crops in October-November, where they cause significant seedling loss.
 - In some seasons, large numbers of nymphs can also build up in summer weeds (e.g. wireweed and capeweed) and walk onto establishing canola in autumn. This is likely to occur during wet, mild summers during which weed hosts have flourished.
 - Feeding damage can kill young canola. Nymphs mostly damage canola around the crop border.
 - To prevent movement of RGB into paddocks, control weeds around paddocks prior to sowing.
 - All registered insecticides are broad-spectrum and will negatively impact beneficials. Border spraying may be effective where the migration from weeds to crop is limited. Where RGB populations are large, and the migration prolonged, repeated spraying will be necessary to prevent seedling damage.
 - Typically, significant crop damage occurs only to the first few rows around the edge of the paddock. Whilst RGB may be present further into the paddock, the pressure on seedlings is lower and seedling death is less likely. Treating the edge will slow the progression of the population into the susceptible paddock, but may not prevent seedling loss immediately adjacent to the source of RGB.
 - Beneficials such as egg [parasitoids](#) and spiders may help suppress numbers but are unlikely to offer sufficient control in outbreak years.

Bugs

Silverleaf whitefly
Bemisia tabaci



Image: CSIRO

Identification

Adult

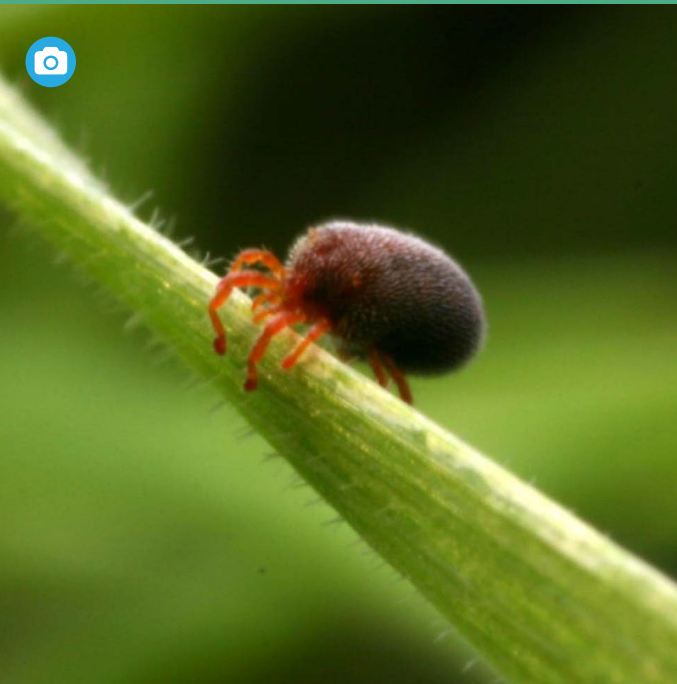
- 0.8 – 1.2 mm long
- Yellow body and white wings
- Wings orientated like a peaked roof

Key points

- Large numbers of silverleaf whitefly adults can settle on establishing autumn-sown canola in cotton-growing regions of NSW, when adults move out of summer cotton crops in search of alternative hosts.
- Feeding damage by silverleaf whitefly is negligible and control is not necessary.
- The colder autumn conditions slow silverleaf whitefly reproduction, and even if they lay eggs, the population will soon die or move on.
- There are no known viruses which are transmitted between cotton and canola.

Mites

Balaustium mite
Balaustium medicagoense



Identification

Newly hatched nymphs

- 0.2 mm long
- Bright orange
- 3 pairs of legs

Adult

- A large mite; up to 2 mm long
- Bulbous, round, dark red-brown body
- Body is covered with short, stout hairs
- 4 pairs of red-orange legs
- Forelegs have footpads

Key points

- Active from March to November, but can persist on green feed during summer if available.
- Attacks all crops and pastures – canola, lupins and cereals are particularly susceptible as seedlings.
- In canola when numbers are high, and crops are stressed, they can do considerable damage.
- Under good growing conditions, crops are often able to outgrow feeding damage.
- Damage symptoms in canola include distorted cupped cotyledons, which may have a leathery appearance.
- They have a high natural tolerance (not resistance) to insecticides; rates used against RLEM and blue oat mite will not be effective.
- The only registered foliar spray contains two broad-spectrum actives and will negatively impact beneficials.
- Focus on prevention tactics such as early control of summer weeds (especially capeweed and grasses).

Cockroaches

Wingless cockroach
Calolampra spp.



Image: QDAF

Identification

Nymphs

- Initially greyish-brown or tan, developing yellow markings when about half adult size.

Adult

- Males and females of *C. elegans* are large (25-35 mm long) and shiny brown with yellow stripes and margins.
- The male of *C. solida* is fully winged, whereas the females are wingless.

Key points

- These generalist establishment pests are common in summer crops in the northern region. There damage potential in canola is unclear, but early sown crops that are establishing under warm conditions may be at risk of damage. It is useful to be able to recognise these species in the event of unexplained seedling damage/disappearance.
- Wingless cockroaches can be detected prior to sowing (along with other soil insects e.g. wireworms) using germinating seed/potato baits. These species are difficult to monitor without baiting as they are active at night and shelter in the soil and under stubble during the day.

Earwigs

Black field earwig
Nala lividipes



Image: QDAF

Identification

Nymphs

- Resemble adults but are wingless and paler.

Adult

- 15 mm long
- Shiny black with a flattened body
- Have a pair of curved pincers at the end of the body

Key points

- These generalist establishment pests are common in summer crops in the northern region. There damage potential in canola is unclear, but early sown crops that are establishing under warm conditions may be at risk of damage. It is useful to be able to recognise these species in the event of unexplained seedling damage/disappearance.
- Earwigs can be detected prior to sowing (along with other soil insects e.g. wireworms) using germinating seed/potato baits. These species are difficult to monitor without baiting as they are active at night and shelter in the soil and under stubble during the day.

Glossary

Abdomen: the third and rear-most region of an insect's body. It is the largest division of the insect.

Aestivate: to spend the summer in a dormant state.

Antennae: a pair of sensory appendages attached to the head.

Asexual reproduction: reproduction of an organism without another individual and without sex.

Diapause: in a period of suspended development.

Larva (pl. larvae): the immature stage of an insect whose form differs greatly as an adult.

Selective insecticide: an insecticide that has fewer impacts on non-target organisms. Also called 'soft insecticides'.

Nymph: the immature form of an insect whose form does not differ greatly an adult.

Parasitoid: an insect whose larvae live on or in the body of another organism, eventually killing it. They are free-living as adults.

Proleg: a non-segmented 'leg-like' appendage which serves the purpose of a leg. Present on the abdomen of some larvae (e.g. moth and butterflies). When present on the final segment of the abdomen, it is called an 'anal proleg'.

Polyphagous: able to feed on many kinds of foods.

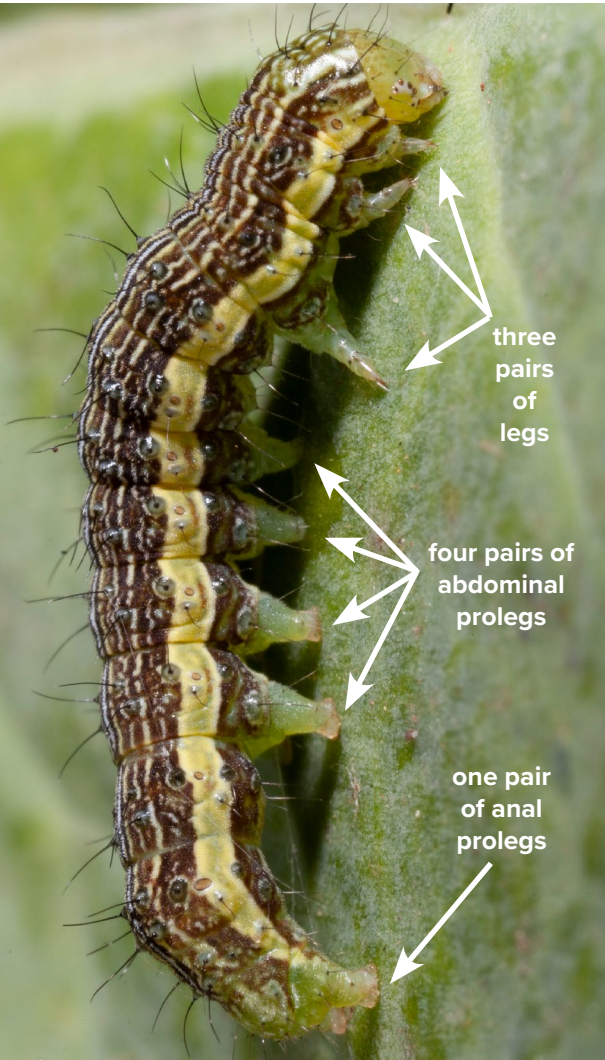
Pupa (pl. pupae): the inactive life stage of an insect occurring between the larval and adult stages.

Siphuncles: a pair of tubular projections on the abdomen of aphids. Sometimes called cornicles or colloquially, 'exhaust pipes'.

Thorax: the mid-section of an insect's body. The thorax is adapted for locomotion and is where the legs and wings are attached if present.

Tubercles: a small bump or projection. Aphid antennal tubercles are the projections in the space between the two antennae. The antennal tubercles can be weakly developed (relatively flat) or well-developed (a very bumpy landscape).

Umbilicus: The hole at the centre of the shell spiral in snails.



Prolegs on a caterpillar.

Resources

What	Where to find it
Bash' Em, Burn' Em, Bait' Em: Integrated snail management in crops and pastures.	www.grdc.com.au/GRDC-Snails-BashBurnBait
Beneficial Insects - Northern Region: The Back Pocket Guide	https://grdc.com.au/BPG-BeneficialInsects-North
Better Mouse Management Tips & Tactics GrowNotes™	https://grdc.com.au/tt-better-mouse-management
Good Bug? Bad bug? A quick identification guide for pest and beneficial insects in summer pulses, soybeans, peanuts and chickpeas.	https://thebeatsheet.com.au/resources/factsheets/
Insects of Southern Australian Broadacre Farming Systems Identification Manual And Education Resource 2nd Edition	https://grdc.com.au/I-SPY
IPM Guidelines for Grains	https://ipmguidelinesforgrains.com.au/
Northern Region Canola GrowNotes™	https://grdc.com.au/GN-Canola-North
PestNotes southern	http://cesaraustralia.com/sustainable-agriculture/pestnotes/
Resistance management strategy for diamondback moth in Australian canola	https://grdc.com.au/fs-resistancestrategydiamondbackmoth
Resistance management strategy for the green peach aphid in Australian grains	www.grdc.com.au/GPAResistanceStrategy
Resistance management strategy for the redlegged earth mite in Australian grains and pastures	https://grdc.com.au/FS-RLEM-Resistance-strategy
Seasons in Stubble	http://www.farmlink.com.au/project/maintaining-profitable-farming-systems-with-retained-stubble
Southern Region Canola GrowNotes™	https://grdc.com.au/GN-Canola-South
TimeRite®	https://www.wool.com/timerite

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