An identification guide for pest and beneficial insects in summer pulses, soybeans, peanuts and chickpeas

Hugh Brier
Joe Wessels
Kate Charleston
This guide aims to help growers and consultants correctly identify pest and beneficial insects in summer pulses (mungbeans, navy beans, adzuki beans, cowpeas and pigeon peas), soybeans, peanuts and chickpeas. The ‘good bugs’ are predators and parasitoids of the ‘bad bugs’, which are pests of these crops.

This publication is supported by

Disclaimer: This document is designed to be used as a tool to assist in identification of insects found in Australian pulse crops. It is not a substitute for personnel with expert knowledge of pulse production or of any aspects of Integrated Pest Management (IPM).

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Users of information contained in this publication must form their own judgements about appropriateness to local conditions.

Note that the term ‘bug’ in the title is used colloquially. Strictly speaking, the only insects that should be referred to as ‘bugs’ are the true bugs (Order Hemiptera) which include major pests such as the green vegetable bug and mirids, and major predators such as the spined predatory bug and damsel bugs.

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Good bug?
Bad bug?

A quick identification guide for pest and beneficial insects in summer pulses, soybeans, peanuts and chickpeas

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Note:
Insect sizes provided on photographs in this guide refer to the body length only (or wingspan if specified). They do not include antennae, legs, or other protruding body parts.

Insect information is shaded to indicate pest or beneficial status - good bugs (beneficials) in blue and bad bugs (pests) in orange. Major pests are highlighted with a warning symbol.

Very small insects (adults less than 3 mm) or eggs are indicated with a magnifying glass.
Commonly encountered insects

Pests

Helicoverpa

Helicoverpa (H. armigera and H. punctigera) is a very damaging pulse pest, attacking all plant parts including leaves, terminals, buds, flowers, and pods. In summer pulses in Northern Australia, the more difficult to control H. armigera is the dominant species. While crops can compensate for low to moderate early helicoverpa damage, very high populations in younger crops can destroy terminals, buds, flowers, and young pods, and have a major impact on yield and harvest maturity. Damage to well-developed pods directly affects yield and can reduce seed quality. It is important to accurately identify larvae so that the correct pesticides can be applied. H. armigera has resistance to many older pesticides and helicoverpa virus biopesticides (e.g. VivusMax® and Gemstar®) have no impact on non-helicoverpa caterpillars, e.g. loopers.

Loopers and other leaf-feeders

Cluster caterpillar (Spodoptera litura) is most common in the tropics and coastal regions. As well as feeding on leaves, it attacks flowers and pods, although not as voraciously as helicoverpa. However, in peanuts it sometimes causes significant damage to the pegs and any pods near the soil surface. Caterpillars can reach over 40 mm long and have smooth fat bodies with distinctive black half moons along the back and sides. They have 4 pairs of ventral prolegs.

The most common large leaf-eating caterpillars are the soybean, vegetable and tobacco loopers. These are easily differentiated from helicoverpa by their tapering bodies (towards the head end) and because they have 2 pairs of ventral prolegs. In Queensland’s tropical and coastal regions, a number of brown loopers are encountered, the most abundant being the bean looper (Mocis alterna), other Mocis sp., and Pantydia sp. (no common name). Brown loopers have elongated parallel (non-tapering) bodies with 2-3 pairs of ventral prolegs. All loopers move with a looping action. While predominantly foliage feeders, they also attack mungbean flowers. Loopers are readily controlled with Bt-based biopesticides such as Dipel®.

The grass blue butterfly’s slug-like larvae feed on soybean leaves but also damage vegetative terminals. Severe terminal damage (>25%) can have a significant impact on yield. Hoverfly larvae (important aphid predators) also have a slug-like appearance, and are often misidentified as grass blue butterfly larvae. Grass blue larvae have proper legs whereas hoverfly larvae are maggots and have no legs.

Leaf miners and webbers

All are small to medium caterpillars that feed inside (mine) leaves, or roll or web leaves together to form sheltered feeding sites. The most common species are soybean moth (Aproaerema simplexella), which feeds inside leaves and spasmodically occurs in plague numbers, and the larger legume webspinner (Omiodes diemenalis), which is common in coastal crops, but usually not in sufficient numbers to inflict economic damage. The beet webworm (Spoladea recurvalis) is rarely if ever an economic pest in summer pulses, but the adult stage (moth) is very often confused with that of the very damaging bean podborer (Maruca vitrata). Large populations of beet webworms often develop on more favoured weed hosts such as black pigweed.

Pod boring caterpillars

Bean podborer (Maruca vitrata) is a major pest of adzukis, mungbeans, navy beans and pigeon pea, but not soybeans and peanuts. It is most prevalent in coastal and tropical regions where populations of 20-30 per square metre are frequently encountered. The distinctive pale black-spotted larvae initially feed in flowers before moving to the pods. Early detection is critical (look for the webbing of flowers) as larvae are very difficult to control once they are inside the pods.

Etiella (Etiella behrii) is a major pest of dryland peanuts, particularly in end-of-season droughts. It is a lesser pest of soybeans, mungbeans and adzukis. In peanuts, larvae are able to reach and infest the below ground pods and once inside, are impossible to control. Etiella damage greatly increases the risk and level of aflatoxin contamination in peanuts. Irrigation reduces the risk of infestation, and early harvest reduces the level of aflatoxin.
Stem boring beetles

Lucerne crown borer (*Zygrita diva*) is a common stem boring beetle in soybeans. The distinctive orange beetles lay eggs in young plant stems, and the larvae tunnel inside the plant feeding on the pith. Pith feeding has no impact on yield, but larvae girdling (ringbarking) of the stem prior to pupation has a major impact if (a) it occurs before the completion of pod fill, or (b) girdled plants lodge prior to harvest. This pest is of increasing concern in the NSW Northern Rivers district.

Stem boring flies

Stem boring flies can also inflict significant damage. Beanfly (*Ophiomyia phaseoli*) is a major pest in seedling navybeans, and soybean stemfly (*Melanagromyza sojae*) has caused serious damage to soybeans in the Mackay region. The early indicator of infestations are numerous pale oviposition stings on the leaves (look like pinpricks of light when leaves are held up to the sun).

Podsucking bugs

Podsucking bugs (PSB) include green vegetable bug or GVB (*Nezara viridula*), red banded shield bug (*Piezoderus oceanicus*), brown shield bug (*Dictyotus caenosus*) and brown bean bug (*Melanacanthus* and *Riptortus* sp.). PSB are major pests of all summer pulses except peanuts. They can infest crops from flowering onwards, but crops are at greatest risk from early pod fill to late pod ripening. Damage at early pod fill can potentially reduce yield, but crops are often able to compensate for even moderate early damage. Damage at mid to late pod fill has a severe impact on seed quality and podsucking bug thresholds are consequently very low. GVB is the most common species, but others can predominate or contribute to overall PSB pressure. The brown bean bugs (large and small) are as damaging as GVB. While not as damaging as GVB, the red banded shield bug (= 0.75 GVB) and the brown shield bug (= 0.2 GVB) are more difficult to control. Deltamethrin alone gives zero control of either species but up to 66% control can be achieved with the addition of a 0.5% salt (NaCl) adjuvant. See page 40 for more information on converting to GVB equivalents.

Mirids

Green and brown mirids (*Creontiades* sp.) are small elongated bugs that feed on buds and flowers. Populations typically increase throughout budding and flowering and crops are consequently exposed to increasing and sustained pressure for 21-28 days. Summer pulses at greatest risk are mungbeans, adzukis and navy beans and thresholds are very low. Peanuts and soybeans are less susceptible to attack. Populations of up to 5 mirids per square metre (nymphs plus adults) can be tolerated in soybeans with no impact on yield.

Aphids

Small soft-bodied sap-sucking bugs. Soybean aphids (*Aphis glycines*) are bright green and restricted to soybeans. Now widespread in Queensland and coastal NSW, they are often kept in check by predators, especially ladybirds. Damaging outbreaks are more likely in cooler seasons or where predators are disrupted by non selective pesticides. Soybean aphid can have a severe impact on yield and evenness of crop maturity. Dark grey to black cowpea aphids are an occasional pest of mungbeans, peanuts and pigeon pea.

Silverleaf whitefly

Silverleaf whitefly or SLW (*Bemisia tabaci type B*) is an ever-present threat to soybeans and navy beans in Queensland and northern NSW. Peanuts are a less preferred host and SLW is not a problem in mungbeans or pigeon pea. The key IPM strategy is to delay spraying non-selective pesticides for as long as possible, particularly in the vegetative/flowering stages. Biopesticides are effective against small helicoverpa larvae and medium loopers, and mirid populations of up to 5 per m² can be tolerated in soybeans with no yield impact. Delay spraying for podsucking bugs with deltamethrin until the start of pod fill. Minimising disruptive pesticide use maximises the effectiveness of one of SLW’s natural enemies, the introduced small parasitic wasp, *Eretmocerus hayati*.

Soil insects and slugs

Soil insect problems are often related to soil type and stubble management. Peanut scarabs such as *Heteronyx piceus* are most prevalent in red volcanic soils of the South Burnett, whereas blacksoul earwigs are most active in heavy cracking soils. Field crickets are classed as soil insects but will attack soybean and mungbean pods, the damage being very similar to mouse damage. Slugs are an increasing problem in higher rainfall years where zero till is practiced and where there is increased stubble retention on the soil surface.
Mites
Two-spotted or red spider mites (Tetranychus sp.) can be a problem where a crop is in close proximity to earlier-maturing hosts such as cotton and maize. The risk of mite attack is greatly increased in regions where non-selective pesticides are widely used. Two-spotted mites are usually light green with two dark spots, but overwintering mites are red all over. Mite-damaged leaves are silvery with fine webbing. Peanut mites (Paraplonobia sp.) are a minor peanut pest and are dark green and much larger than two spotted mite.

Beneficials - predators
Predatory bugs
Two species of large predatory shield bugs are commonly found in summer pulses and attack helicoverpa and other caterpillars. The spined predatory bug (Oechalia schellenbergii) has distinctive spines on its shoulder. Its nymphs lack spines but have a distinctive red or orange ring on their backs. The glossy shield bug (Cermatulus nasalis) is larger and a more glossy brown than the pod-feeding brown stink bug (Dictyotus caenopus), which is a more ‘dusty’ brown. Cermatulus nymphs are dark with four red or orange spots on their backs. Eggs of both predatory bug species are laid in rafts similar in size to GVB rafts, but are dark and are fringed on top with spines. Oechalia eggs have longer spines than Cermatulus eggs.

Assassin bugs are more common in tropical regions, the best known is the large Pristesanscus sp. Assassin bug adults have concave abdomens (when viewed from above), and prominent recurved “beaks” to pierce their prey (and unwary fingers!). Assassin bugs are commonly mistaken for brown bean bugs.

A number of small predatory bugs attack small caterpillars and eggs. The damsel bug (Nabis kingbergii) is a small slender assassin type bug while the bigeyed bug (Geocoris lubra) is stout with prominent eyes. Being small, both species are often overlooked when scouting. Predatory mirids commonly seen in soybeans include the apple dimpling bug (or yellow mirid) (Campylomma liebknechti) and the brown smudge bug (Deraeocoris signatus). Nymphs of the latter are maroon in colour and look like aphids but have only one tube-like projection from their abdomen (as opposed to three for aphids).

Predatory beetles
Ladybirds are the most common predatory beetles. Large numbers of the highly visible bright orange adults indicate a crop is infested with aphids or silverleaf whitefly. Common species include the transverse and striped ladybirds, and the newly arrived white-collared ladybird (Hippodamia vari egata). Other predatory beetles attack moth eggs and small caterpillars and include red and blue beetles, carabs and soldier beetles.

Other important predators include ants, lacewings, predatory wasps, hoverfly larvae, wireworm larvae, spiders, frogs and birds.

Beneficials - parasitoids
Parasitoids of podsucking bugs
The introduced green vegetable bug (GVB) parasitoid Trichopoda giacomellii attacks large nymphs and adult GVB, laying large off-white eggs, usually on the bug’s back or thorax. Green vegetable bug eggs are also frequently parasitised by the tiny wasp Trissolcus basalis. Parasitised GVB eggs turn black and are easily distinguished from the dark eggs of predatory bugs, as they lack the peripheral dorsal spines of the latter.

Parasitoids of caterpillars
Helicoverpa eggs are frequently parasitised by very small Trichogramma sp. wasps. Parasitised eggs turn black before the tiny wasps emerge. Helicoverpa larvae are parasitised by a number of wasps and tachinid fly species. The most common wasps include the two-toned caterpillar parasite (Heteropelma scaposum) and Microplitis demolitor (no common name). Larvae of the former don’t complete their development until helicoverpa pupate but Microplitis larvae emerge from mid-sized helicoverpa larvae and pupate beside their victim. Looper larvae and armyworms are commonly parasitised by small wasps Apan teles, Coetesia and Litomastix sp., which lay large numbers of eggs in each host. Hundreds of parasites can emerge from a single larva.

Parasitoids of silverleaf whitefly
Silverleaf whitefly are parasitised by tiny wasps in the genera Encarsia and Eretmocerus including the imported Eretmocerus hayati.

NOTE: Unnecessary spraying results in the needless death of predators and parasitoids and can flare helicoverpa, whitefly, mites and aphids.
Insects commonly encountered in summer pulses

**Helicoverpa**
*Helicoverpa armigera* and *H. punctigera*
MAJOR PEST of leaves, buds, terminals, flowers and pods

![Large *H. armigera* larva - dark colour variant with yellow side stripe - note parallel body and four pairs of ventral prolegs](image1)

Large (*H. armigera*) larva - dark colour variant with yellow side stripe - note parallel body and four pairs of ventral prolegs.

![Large (late 5th instar) *H. armigera* larva - green variant - note white hairs and wide pale side (lateral) stripe](image2)

Large (late 5th instar) *H. armigera* larva - green variant - note white hairs and wide pale side (lateral) stripe.

![Medium *H. armigera* larva - note four pairs of ventral prolegs and dark saddle behind front legs](image3)

Medium *H. armigera* larva - note four pairs of ventral prolegs and dark saddle behind front legs.

![Small *H. armigera* larva in soybean terminal](image4)

Small *H. armigera* larva in soybean terminal.

![Medium (4th instar) larvae attacking mungbean buds](image5)

Medium (4th instar) larvae attacking mungbean buds.

![Medium (4th instar) *H. punctigera* larva - dark hairs and lack of dark saddle](image6)

Medium (4th instar) *H. punctigera* larva - dark hairs and lack of dark saddle.

**Cluster caterpillar**
*Spodoptera litura*
Moderate PEST of leaves/pods

![Large larva](image7)

Large larva.

![Medium larva (dark form)](image8)

Medium larva (dark form).

![Newly hatched from egg mass](image9)

Newly hatched from egg mass.

**Irrorated tabby**
*Anticarsia irrorata*
Minor PEST of leaves

![White-striped form](image10)

White-striped form.

![Red-striped variant](image11)

Red-striped variant.

![Medium larvae](image12)

Medium larvae.

Note pale bands between body segments and 4 pairs of ventral prolegs. Red-striped variant often has an ‘irrorated’ appearance – sprinkled with fine dark sand.
Leaf feeding caterpillars (Loopers)

Soybean looper
*Thysanoplusia orichalcea*
Moderate PEST

- Larvae have a pronounced looping movement, tapered body, and 2 pairs of ventral prolegs.
- Large larvae
- Medium larvae - note colour and stripes

Tobacco looper
*Chrysodeixis argentifera*
Moderate PEST

- Two pairs of ventral prolegs

Bean looper
*Mocis alterna*
Moderate PEST

- Long thin body with forward sloping head and two pairs of ventral prolegs.
- Very variable in colour.

- Typical colour variant
- Striped variant
- Orange variant

Three barred moth
*Mocis trifassiata*
Minor PEST mostly coastal

- Sloping head, 2 pairs of ventral prolegs

Pantydia capistrata
Minor PEST mostly coastal

- Two pairs of ventral prolegs

Pantydia metaspila
Minor PEST mostly coastal

- Three pairs of ventral prolegs

Castor oil looper
*Achaea janata*
Minor PEST

- Large very variable looper. Three pairs of functional ventral prolegs. Rarely occurs in damaging numbers.
- Purple variant
- Orange variant

Twig caterpillar
*Scopula perlata*
Minor PEST (infrequent)

- One pair of ventral prolegs - too small and infrequent to ever pose a threat

Insects commonly encountered in summer pulses
Small to medium caterpillars - leaf feeders, miners, webbers and flower feeders

**Grass blue butterfly**  
*Zizina labradus*  
Moderate PEST

- Attacks leaves and terminals; slug like - head tucked underneath
- Length: 10 mm

**Crotalaria moth**  
*Utetheisa lotrix*  
Minor PEST

- Hairy body – rarely in damaging numbers
- Length: 20 mm

**Nodaria externalis**  
Minor PEST - mostly coastal

- Reticulated pattern and four pairs of ventral prolegs
- Length: 13 mm

**Pea blue butterfly**  
*Lampides boeticus*  
Minor PEST of flowers

- Attacks flowers; slug like - head protruding in this specimen
- Length: 10 mm

**Tiger looper**  
*Gymnoscelis lophopus*  
Minor PEST of flowers

- Often striped (hence the common name), rough skin
- Length: 8 mm

**Plume moth**  
*Sphenarchus sp*  
Minor PEST of flowers

- Covered in short spines
- Length: 8 mm

**Cotton webspinner**  
*Achyra affinitalis*  
Minor PEST of seedling soybeans

- Dark head, grey body; wriggles violently
- Length: 15 mm

**Legume webspinner**  
*Omiodes diemenalis*  
Minor PEST of coastal crops

- Look for frass and webbed leaves; may have dark head when young
- Length: 14 mm

**Beet webworm**  
*Spoladea recurvalis*  
Minor PEST

- Rarely if ever present in damaging numbers
- Length: 20 mm

**Soybean moth**  
*Aproaerema simplexella*  
SPASMODIC MAJOR PEST soybeans

- Major pest only if in large numbers; only feed on soybeans
- Length: 5 mm

**Soybean leafminer**  
*Lithocolletis aglaozona*  
Minor PEST

- Larvae and damage - larvae are widest just behind the head
- Length: 2 mm

**Hydriloides lentalis**  
Minor PEST of peanut leaves

- Rough skin; often found at base of plants
- Length: 20 mm
### Caterpillars & other larvae - pod and stem borers

<table>
<thead>
<tr>
<th>Pest Name</th>
<th>Image</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bean podborer</strong></td>
<td><img src="https://example.com/image1.jpg" alt="Image" /></td>
</tr>
<tr>
<td><em>Maruca vitrata</em></td>
<td>Medium larva (note prominent spots) - feeds in flowers before moving to pods</td>
</tr>
<tr>
<td><strong>Etiella</strong></td>
<td><img src="https://example.com/image2.jpg" alt="Image" /></td>
</tr>
<tr>
<td><em>Etiella behrii</em></td>
<td>Larva damaging young peanut pod</td>
</tr>
<tr>
<td><strong>Sorghum head caterpillar</strong></td>
<td><img src="https://example.com/image3.jpg" alt="Image" /></td>
</tr>
<tr>
<td><em>Cryptoblabes adoceta</em></td>
<td>Larva (cream with brown stripe) and damage; very low incidence</td>
</tr>
<tr>
<td><strong>Endotricha puncticotalis</strong></td>
<td><img src="https://example.com/image4.jpg" alt="Image" /></td>
</tr>
<tr>
<td>Minor PEST</td>
<td>Dark larva are common under peanut bushes but little if any pod damage</td>
</tr>
<tr>
<td><strong>Lucerne crown borer</strong></td>
<td><img src="https://example.com/image5.jpg" alt="Image" /></td>
</tr>
<tr>
<td><em>Zygrita diva</em></td>
<td>Larva in mungbean pod</td>
</tr>
<tr>
<td><strong>Helicoverpa</strong></td>
<td><img src="https://example.com/image6.jpg" alt="Image" /></td>
</tr>
<tr>
<td><em>Helicoverpa armigera</em></td>
<td>The most damaging pod boring pest in terms of damage and abundance</td>
</tr>
<tr>
<td><strong>Sugarcane wireworm</strong></td>
<td><img src="https://example.com/image7.jpg" alt="Image" /></td>
</tr>
<tr>
<td><em>Agrypnus variabilis</em></td>
<td>Small larva in peanut pod</td>
</tr>
<tr>
<td><strong>Whitefringed weevil</strong></td>
<td><img src="https://example.com/image8.jpg" alt="Image" /></td>
</tr>
<tr>
<td><em>Graphognathus leucoloma</em></td>
<td>Larva and damage to peanut taproot</td>
</tr>
<tr>
<td><strong>Soybean stemfly</strong></td>
<td><img src="https://example.com/image9.jpg" alt="Image" /></td>
</tr>
<tr>
<td><em>Melanagromyza sojae</em></td>
<td>Larva and damage</td>
</tr>
<tr>
<td><strong>Beanfly pupa</strong></td>
<td><img src="https://example.com/image10.jpg" alt="Image" /></td>
</tr>
<tr>
<td><em>Ophiomyia phaseoli</em></td>
<td>Pupae and damage in mungbean</td>
</tr>
</tbody>
</table>

*GOOD BUG* | *BAD BUG* | *MAJOR PEST*
Insects commonly encountered in summer pulses

**Larval predators, parasitoids and diseases**

- **Common hoverfly**
  *Simosyrphus grandicornis*
  MAJOR PREDATOR of aphids and whitefly

  - Larva - note maggoty body tapering towards the head
  - Larva attacking cowpea aphids

- **Braconid wasp**
  *Agathis sp.*
  MAJOR PARASITOID of etiella

  - Larvae emerging from Etiella host
  - Insert: Adult wasp

- **Litomastix sp.**
  MAJOR PARASITOID

  - Scybean looper full of *Litomastix* pupae
  - Wasp pupae visible under caterpillar skin

- **Litomastix sp.**
  MAJOR PARASITOID

  - Microplitis pupa beside helicoverpa host
  - Microplitis larva squeezed from helicoverpa

- **Apanteles sp.**
  MAJOR PARASITOID

  - Characteristic fluffy white wasp pupal cocoons covering armyworm larva

- **NPV - Nucleopolyhedrovirus**
  PATHOGEN (VIRUS) of helicoverpa

  - Helicoverpa larvae killed by NPV (note how larvae has liquified) - commercial formulations of NPV are specific to helicoverpa

- **Beauvaria**
  PATHOGEN (FUNGUS)

  - Noticable in wet (La Nina) years

  - Helicoverpa larva killed by fungus

---

**GOOD BUG**

**BAD BUG**

**MAJOR PEST**
Insects commonly encountered in summer pulses

**Moths - large**

*Helicoverpa*  
*Helicoverpa* spp.  
**MAJOR PEST**

- *Helicoverpa armigera*  
- *Helicoverpa punctigera*

The small pale spots in the hind wing inner margins are indicative of *H. armigera*, and not present in *H. punctigera*. Note the forewings are brown in the female and cream in the male.

**Tobacco looper**  
*Chrysodeixis argentifera*  
**Moderate PEST**

- Silver markings on forewings

**Soybean looper**  
*Thysanoplusia orichalcea*  
**Moderate PEST**

- Large golden patch on forewings

**Vegetable looper**  
*Chrysodeixis eriosoma*  
**Moderate PEST**

- Similar to tobacco looper but with a gap between the silver wing spots

**Sugarcane armyworm**  
*Leucaena stenographa*  
**Minor PEST in coastal regions**

**Cluster caterpillar**  
*Spodoptera litura*  
**Moderate PEST**

- Note the distinctive criss-cross pattern

**Bean looper**  
*Mocis alterna*  
**Moderate PEST**

- Grey wings with dark markings

**Three barred moth**  
*Mocis trifasciata*  
**Moderate PEST**

- Note the distinctive brown bands

**Pantydia metaspila**  
**Minor PEST**

- Common in coastal crops

(W) = wingspan
Insects commonly encountered in summer pulses

Moths - large and medium

**Pantydia capistrata**  
Minor PEST mostly coastal  
- Similar size to helicoverpa but has different wing patterns

**Cotlala moth**  
*Utethesia lotrix*  
Minor PEST  
- Very distinctive red and black spots  
- 35 mm (W)

**Cotton webspinner**  
*Achyra affinalis*  
Minor PEST  
- Mainly a seedling pest  
- 20 mm (W)

**Beet webworm**  
*Spoladea recurvalis*  
Minor PEST  
- Often confused with bean podborer moths but hindwings are predominantly brown

**Cotton webspinner**  
*Achyra affinalis*  
Minor PEST  
- 20 mm (W)

**Bean podborer**  
*Maraea vitrata*  
MAJOR PEST  
- Normal resting pose - outspread wings and body raised at head end

**Irrotated tabby**  
*Anticarsia irrorata*  
Minor PEST of leaves  
- Note the distinctive fine line from wingtip to wingtip. Looks very similar to the moth of a major soybean pest in the Americas, the velvet bean caterpillar *Anticarsia gemmatalis.*

**Castor oil looper**  
*Achaea janata*  
Minor PEST  
- Very large but uncommon looper. Note the distinctive pattern on the hindwing of the pinned specimen.

**Nodaria externalis**  
Very minor PEST  
- 25 mm

**Moths - large and medium**  
(W) = wingspan

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MAJOR PEST  
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**Cotton webspinner**  
*Achyra affinalis*  
Minor PEST  
- Mainly a seedling pest  
- 20 mm (W)

**Twig caterpillar**  
*Scopula perlata*  
Minor PEST  
- Wings spread out at rest – typical for this moth family

12
Insects commonly encountered in summer pulses

**Butterflies and small moths**

**Grass blue butterfly**  
*Zizina labradus*  
**Moderate PEST**  
Wings closed at rest.  
Note - no eye spots or tails on wings.  
24 mm (W)

**Etiella**  
*Etiella behrii*  
**MAJOR PEST of peanuts**  
Prominent snout; orange bands and white streak on forewing folded back over body  
12 mm

**Pea blue butterfly**  
*Lampides boeticus*  
**Minor PEST**  
Wings closed at rest.  
Note prominent white bands under wings, eye spots and small tails.  
28 mm (W)

**Soybean moth**  
*Aproaerema simplexella*  
**SPASMODIC MAJOR PEST soybeans**  
Small, dark with white band; very jumpy - moth swarms 1st sign of a major outbreak  
6 mm

**Plume moth**  
*Sphenarchus sp.*  
**Minor PEST**  
Normal resting pose - note very narrow feathery outspread wings  
12 mm (W)

**Legume webspinner**  
*Omiodes diemenalis*  
**Minor PEST**  
Very distinctive brown/yellow colouration  
13 mm (W)

**Soybean leafminer**  
*Lithocolletis aglaozona*  
**Minor PEST**  
Smaller and more brightly coloured than soybean moth  
2 mm

**Tiger looper**  
*Gymnoscelis lophopus*  
**Minor PEST**  
Wings outspread at rest showing lovely cryptic colouration  
13 mm (W)

**Endotricha puncticotalis**  
**Minor PEST**  
Distinctive purple brown and cream bands  
14 mm (W)

**Sorghum head caterpillar**  
*Cryptoblabes adoceta*  
**Minor PEST**  
Drab little moth with wings folded over body  
9 mm

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### Eggs - single or small groups

<table>
<thead>
<tr>
<th>Insect Name</th>
<th>Image Description</th>
<th>Length (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Helicoverpa</strong></td>
<td><img src="image1" alt="Helicoverpa eggs" /> Left to right - fresh white, brown ring, and black larval head in nearly hatching eggs</td>
<td>0.6</td>
</tr>
<tr>
<td><strong>Soybean looper</strong></td>
<td><img src="image2" alt="Soybean looper eggs" /> Slightly flattened (about 0.4 mm high)</td>
<td>0.6</td>
</tr>
<tr>
<td><strong>Grass blue butterfly</strong></td>
<td><img src="image3" alt="Grass blue butterfly eggs" /> Marked central depression and bluish tinge</td>
<td>0.5-0.6</td>
</tr>
<tr>
<td><strong>Trichogramma</strong></td>
<td><img src="image4" alt="Trichogramma eggs" /> Adult wasp on helicoverpa egg (left) and unparasitised egg (top) vs parasitised</td>
<td>0.5</td>
</tr>
<tr>
<td><strong>Bean looper</strong></td>
<td><img src="image5" alt="Bean looper eggs" /> Slightly larger and more globular than helicoverpa eggs</td>
<td>0.7</td>
</tr>
<tr>
<td><strong>Twig caterpillar</strong></td>
<td><img src="image6" alt="Twig caterpillar eggs" /> Looks similar to lacewing egg but is vase shaped (i.e. not elliptical)</td>
<td>1.5</td>
</tr>
<tr>
<td><strong>Large brown bean bug</strong></td>
<td><img src="image7" alt="Large brown bean bug eggs" /> Usually laid singly</td>
<td>1.5</td>
</tr>
<tr>
<td><strong>Small brown bean bug</strong></td>
<td><img src="image8" alt="Small brown bean bug eggs" /> Laid singly or in small clusters</td>
<td>1.0</td>
</tr>
<tr>
<td><strong>Soybean moth</strong></td>
<td><img src="image9" alt="Soybean moth eggs" /> Elongated (0.2 mm diameter)</td>
<td>0.4</td>
</tr>
<tr>
<td><strong>Bean podborer</strong></td>
<td><img src="image10" alt="Bean podborer eggs" /> Eggs laid on flower bud - very hard to see</td>
<td></td>
</tr>
<tr>
<td><strong>Etiella</strong></td>
<td><img src="image11" alt="Etiella eggs" /> Flattened eggs on peanut leaf petioles</td>
<td>0.6</td>
</tr>
<tr>
<td><strong>Cluster caterpillar</strong></td>
<td><img src="image12" alt="Cluster caterpillar eggs" /> Egg cluster (left) and close up of eggs</td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**
- Helicoverpa sp. (MAJOR PEST)
- Thysanoplusia orichalcae (Moderate PEST)
- Zizina labradus (Moderate PEST)
- Trichogramma pretiosum (MAJOR PARASITOID of helicoverpa)
- Mocis alterna (Moderate PEST)
- Scopula perlata (Minor PEST)
- Melanacanthus scutellaris (MAJOR PEST)
- Etiella behrii (MAJOR PEST of peanuts)
- Aproaerema simplexella (Minor PEST)
- Spodoptera litura (Moderate PEST)
**Eggs - rafts**

**Green vegetable bug (GVB)**
*Nezara viridula*
MAJOR PEST

- Freshly-laid egg raft
- Egg raft ready to hatch - note orange colour
- Young GVB nymphs emerging from eggs

**Redbanded shield bug**
*Piezodorus oceanicus*
MAJOR PEST

- Distinctive dark eggs (elliptical in cross section) in twin-row rafts - hatching nymphs

**Brown shield bug**
*Dictyotus caenosus*
Moderate PEST

- Twin row rafts - note pale colour

**Green stink bug**
*Plautia affinis*
Minor PEST

- Note small raft size and olive green colour

**Spined predatory bug**
*Oechalia schellenbergii*
PREDATOR

- Note dark colour and long perimeter spines

**Glossy shield bug**
*Cermatulus nasalis*
PREDATOR

- Note dark colour and short perimeter spines

**Ladybird**
various species
MAJOR PREDATOR

- Note elongated football shape

**Assassin bug**
*Pristhesancus sp.*
PREDATOR

- Note tall, vase-like shape

**Green lacewing**
*Mallada signatus*
MAJOR PREDATOR

- Elliptical eggs on distinctive long stalks

---

The freshly-laid pale egg raft contains 66 eggs, the orange raft contains 123 eggs. Individual eggs are 0.75 mm wide x 1 mm tall.
Insects commonly encountered in summer pulses

**Shield bugs - adults (fully developed wings)**

- **Green vegetable bug (GVB)**
  *Nezara viridula*
  MAJOR PEST
  - Normal summer green form (top view) showing shield shape
  - Overwintering form - usually purple to brown in colour

- **Brown shield bug**
  *Dictyotus caenosus*
  Moderate PEST
  - Normal summer green form (side view) - note piercing/sucking mouth tube folded underneath the body
  - Uncommon orange summer form - often confused with an orange cockroach (see commonly confused insects section)

- **Green stink bug**
  *Plautia affinis*
  Minor PEST
  - Normal summer green form (top view) showing shield shape
  - Normal summer green form (side view) - note piercing/sucking mouth tube folded underneath the body

- **Redbanded shield bug**
  *Piezodorus oceanicus*
  MAJOR PEST
  - Male (pale cream band)
  - Female (red/pink band)

- **Trichopoda eggs**
  *Trichopoda giacomelli*
  PARASITOID
  - Eggs (4) laid on GVB adult

- **Spined predatory bug**
  *Oechalia schellenbergii*
  PREDATOR
  - Attacking a GVB nymph

- **Large spined predatory bug**
  *Andrallus spinidens*
  PREDATOR
  - Less common than *Oechalia* sp

- **Glossy shield bug**
  *Cermatulus nasalis*
  PREDATOR
  - Attacking a cluster caterpillar; darker and larger than brown shield bug
Insects commonly encountered in summer pulses

 Shield bugs - nymphs, and leafhoppers

**Green vegetable bug (GVB)**
*Nezara viridula*
MAJOR PEST
Nymphs can be green or black with numerous white, orange and red spots.

- Fifth instar nymph
- Fourth instar nymphs - dark form
- Third instar nymph

**Redbanded shield bug**
*Piezodorus oceanicus*
MAJOR PEST
Nymphs lack the spotting that is typical of green vegetable bug.

- Fifth instar nymph
- Fourth instar nymph
- Second instar nymph

**Glossy shield bug**
*Cermatulus nasalis*
PREDATOR

- Fifth instar nymph - note the 4 orange spots

**Spined predatory bug**
*Oechalia schellenbergii*
PREDATOR

- Note distinctive ‘ring of fire’

**Brown shield bug**
*Dictyotus caenosus*
Moderate PEST

- Fourth instar nymphs

**Green stink bug**
*Plautia affinis*
Minor PEST

- Fifth instar nymph

**Lucerne leafhopper adult**
*Austroasca alfalfae*
Moderate PEST

- Note yellow-green colour, rounded head and short antennae

**Vegetable jassid adult**
*Austroasca viridigrisea*
Minor PEST

- Bright green jassids and ‘stipling’ damage - note the rounded head and short antennae
Elongated bugs

**Large brown bean bug**  
*Riptortus serripes*  
**MAJOR PEST**

- **Adult female**
- **Adult male**
- **Fourth instar nymph**

Adults are flighty with muscley hind legs and a yellow band along each side. Nymphs look like ants.

**Small brown bean bug**  
*Melanacanthus scutellaris*  
**MAJOR PEST**

- **Adult**
- **Fourth instar nymph**
- **Third instar nymph**
- **First instar nymph**

Similar to but less robust than the large brown bean bug and with a cream band on each side. Brown bean bug nymphs are easily confused with ants (see right). Bugs have a thicker waist and piercing/sucking mouthparts (tucked under the body).

**Ant**

*various species*  
**PREDATOR**

- **5 mm**

Narrow waist and biting mouthparts.; ants are vastly underrated predators

**Assassin bug**

*various species*  
**PREDATOR**

- **30 mm**

Adult *Pristhesancus plagipennis* attacking a wasp. **Insert:** nymph (7 mm). Note thick concave abdomen, narrow head and recurved mouthparts. An agressive species; avoid handling

**Pacific damsel bug**  
*Nabis kingbergii*  
**MAJOR PREDATOR**

- **Adult**
- **Nymph**

Narrower than brown mirids with which it is sometimes confused, and with strongly recurved mouthparts.
Mirid-like bugs

**Brown mirid**  
*Creontiades pacificus*  
**MAJOR PEST**

Elongated delicate sapsucking bugs with long antennae. All nymph instars have banded antennae (see third instar below right).

**Broken backed bug**  
*Taylorilygus pallidulus*  
**Minor PEST - low incidence in pulses**

Shorter than green mirid; mainly green with brown wing tips - adult (left), nymph (right).

**Green mirid**  
*Creontiades dilutus*  
**MAJOR PEST**

Elongated delicate sapsucking bugs with long antennae. Nymphs have no bands on the antennae, unlike brown mirids.

**Australian crop mirid**  
*Sidnia kingbergi*  
**Minor PEST - low incidence in pulses**

Adult (left) and final instar nymph (right); shorter than the brown mirid.

**Chinese black mirid**  
*Tytthus chinensis*  
**PREDATOR**

Very small mirid; adult (left) and nymph (right).

**Bigeyed bug**  
*Geocoriss lubra*  
**MAJOR PREDATOR**

Note how far apart the eyes are.

**Apple dimpling bug**  
*Campylomma liebknechti*  
**MAJOR PREDATOR of helicoverpa**

Adult (attacks eggs & small larvae)

**Brown smudge bug**  
*Deraeocoris signatus*  
**MAJOR PREDATOR of aphids and whitefly**

Adult - often confused with broken backed bug, but are brown all over.

Insects commonly encountered in summer pulses
Beetles (adults)

Redshouldered leaf beetle
Monolepta sp.
Moderate PEST of coastal crops
- Attacks leaves and flowers - severe defoliation if in plague numbers

Peanut scarab
Heteronyx piceus
MAJOR PEST of peanuts in red soil
- Adult beetles are often found laying eggs under peanut seedlings

Lucerne crown borer
Zygrita diva
MAJOR PEST in some regions
- Adults lay eggs in soybean stems

Staphylinid or rove beetle
Paederus sp.
PREDATOR
- Can cause severe skin irritation

Soldier beetle
Chauliognathus pulchellus
PREDATOR
- Other species in this genus have red markings

Corrhenes stigmatica
Minor PEST of soybeans
- Not as common as Zygrita

White collared ladybird
Hippodamia variegata
MAJOR PREDATOR of aphids & SLW

Striped ladybirds
Micraspis frenata
MAJOR PREDATOR of aphids & SLW

Red and blue beetle
Dicranolaius bellulus
PREDATOR

Three-banded ladybird
Harmonia octomaculata
MAJOR PREDATOR of aphids & SLW

Mealybug ladybird
Cryptolaemus montrouzieri
MAJOR PREDATOR of mealybug

Carab beetle
Gnathophanus pulcher
PREDATOR

Insects commonly encountered in summer pulses
Beetles (weevils), flies, and wasps

**Whitefringed weevil**
*Graphognathus leucoloma*
MAJOR PEST of peanuts
- 9 mm

**Pod weevil**
*Apion sp.*
Minor PEST of flowers/small pods
- 2.5 mm

**Amnemus weevil**
*Amnemus sp.*
Minor PEST of soybeans
- 6 mm

**Tachinid fly**
*Carcelia sp.*
PARASITOID of helicoverpa
- 9 mm

**Common hoverfly**
*Simosyrphus grandicornis*
MAJOR PREDATOR of aphids & SLW
- 9 mm

**Trichopoda giacomellii**
PARASITOID of green vegetable bug
- 8 mm

**Beanfly**
*Ophiomyia phaseoli*
MAJOR PEST of seedlings
- 3 mm

**Microplitis demolitor**
PARASITOID of helicoverpa
- 5 mm

**Banded caterpillar parasite**
*Ichneumon prommissorius*
MAJOR PARASITOID of pupae
- 14 mm

**Orchid dupe**
*Lissopimpla excelsa*
MAJOR PARASITOID of caterpillars
- 25 mm

**Two-toned caterpillar parasite**
*Heteropelma scaposum*
MAJOR PARASITOID of caterpillars
- 20 mm

**Orange caterpillar parasite**
*Netelia producta*
MAJOR PARASITOID of caterpillars
- 18 mm

Insects commonly encountered in summer pulses
Mealybugs, beetle larvae, and lacewings

Peanut, pink or hibiscus mealybug
*Maconellicoccus hirsutus*
Minor PEST

![Adult mealybug - look for pink exudate when squeezed](image)

Colony massed on soybean stem

Mealybug ladybird
*Cryptolaemus montrouzieri*
MAJOR PREDATOR of mealybug

![Larva (right) attacking mealybug on cotton](image)

Ladybird larvae
various species
MAJOR PREDATOR of aphids & SLW

Often with distinctive black and yellow bands. Have three pairs of true legs but no prolegs.

![Larva on soybean leaf](image)

![Larva killing a cluster caterpillar](image)

Carab beetle larvae
*Gnathophanus pulcher*
MAJOR PREDATOR

![Larva on soybean leaf](image)

![Larva killing a cluster caterpillar](image)

Brown lacewing
*Micromus* sp.
MAJOR PREDATOR of aphids

Adult with delicate lace-like wings

Larva

Soldier beetle larva
*Chauliognathus pulchellus*
MAJOR PREDATOR

Adult with distinctive black and yellow bands. Have three pairs of true legs but no prolegs.

Green lacewing
*Mallada signatus*
MAJOR PREDATOR

Adult with delicate lace-like wings

Larva using prey remnants as camouflage

Insects commonly encountered in summer pulses
Pupae

Helicoverpa Helicoverpa sp. MAJOR PEST

Pupae are found in soil underneath host crop. Healthy (un-parasitised) pupae wriggle violently when touched; parasitised ones don’t. Helicoverpa species can be distinguished by the distance between the pupal tail spines (see below).

Helicoverpa punctigera pupa

H. armigera (left) and H. punctigera (right)

Castor oil looper Achaea janata Minor PEST

25 mm

Note white coating on pupa

Vegetable looper Chrysodeixis eriosoma Moderate PEST

25 mm

Pupa in loose cocoon on soybean leaf

Plume moth Sphenarchus sp. Minor PEST of flowers

9 mm

Note spiny appearance

Grass blue butterfly Zizina labradus Moderate PEST

8 mm

Note constriction and wing mouldings

Bean podborer Maruca vitrata MAJOR PEST (adzuki, navy & mung)

11 mm

Note leg and wing ‘mouldings’ and dark eye of developing moth

Soybean moth Aproaerema simplexella MAJOR PEST if in plague numbers

4 mm

7 mm

5 mm

Bottom: soybean moth pre-pupa (left), pupa (right), and parasitoid pupa (top)

Common hoverfly Simosyrphus grandicornis MAJOR PREDATOR of aphids & SLW

5 mm

Note - tear drop shape and no constriction or wing mouldings

Ladybird pupae various species MAJOR PREDATOR of aphids & SLW

Usually highly visible and stuck to the leaves

Beanfly pupa Ophiomyia phaseoli MAJOR PEST (navy bean seedlings)

2.5 mm

Crops at greatest risk (decreasing order) are navy beans, adzukis and mungbeans

Microplitis demolitor MAJOR PARASITOID

5 mm

10 mm (host)

Cocoon beside dying cluster caterpillar host

Insects commonly encountered in summer pulses 23
Whiteflies, aphids, thrips and mites

**Silverleaf whitefly (SLW)**
*Bemisia tabaci* type B
**MAJOR PEST**

When folded, the wings don’t quite touch revealing the pale orange body underneath. In contrast the folded wings of the green house whitefly touch (no gap). SLW nymphs also have a clean outline whereas GHW nymphs have long filaments.

**Soybean aphid**
*Aphis glycines*
**Moderate PEST**

A bright green aphid - mostly minor pest, but high populations have maked impact on yield and crop maturity; outbreaks more likely in cooler years.

**Cowpea aphid**
*Aphis craccivora*
**Minor PEST**

Note the paired honey tubes at the aphid’s rear, typical of all aphids.

**SLW Parasitoid wasps**
*Eretmocerus hayati*
*Encarsia* sp.
**MAJOR PARASITOID of SLW**

**Two-spotted mite**
*Tetranychus urticae*
**MAJOR PEST**

**Thrips**
various species
**PEST of seedlings and flowers**

Adult - note narrow feathery wings (2 pairs) folded back against small elongated body.

---

Insects commonly encountered in summer pulses
## Soil Insects and Slugs

### Sugarcane Armyworm
**Leucania stenographa**
Minor PEST of coastal soybeans

Pest where cane stubble is present

![Sugarcane Armyworm](image)

### Common Armyworm
**Leucania convecta**
Minor PEST

4 pairs of ventral prolegs. Older larvae have distinctive colouration; young are often pale

![Common Armyworm](image)

### Black Cutworm
**Agrotis ipsilon**
Minor PEST of seedlings

Larvae and damage

![Black Cutworm](image)

### Etiella
**Etiella behrii**
MAJOR PEST of peanuts

In soil under peanut bush

![Etiella](image)

### Peanut Scarab
**Heteronyx piceus**
MAJOR PEST of peanuts

Major pest in volcanic red soils - note typical C shape of larvae when disturbed

![Peanut Scarab](image)

### Peanut Mealybug
**Maconellicoccus hirsutus**
Minor PEST

![Peanut Mealybug](image)

### Sugarcane Wireworm
**Agrypnus variabilis**
Moderate PEST of tropical peanuts

Small larva in peanut pod

![Sugarcane Wireworm](image)

### Black Field Cricket
**Teleogryllus sp.**
Minor PEST

On soybean taproot

![Black Field Cricket](image)

### Sugarcane Wireworm
**Agrypnus variabilis**
Can also be a PREDATOR

Large larva found attacking helicoverpa pupae under mungbean crop

![Sugarcane Wireworm](image)

### Black Field Earwig
**Nala lividipes**
MAJOR PEST in cracking soils

Smaller and darker than the predatory earwig

![Black Field Earwig](image)

### Predatory Earwig
**Labidura truncata**
PREDATOR

Attacking a helicoverpa pupa

![Predatory Earwig](image)

### Slug
Various species
Increasing PEST in zero till

Best managed pre-planting with baits

![Slug](image)
Damage symptoms

**Beanfly**  
*Ophiomyia phaseoli*  
MAJOR SEEDLING PEST (in decreasing order) of navy beans, adzukis and mungbeans.

- Navybean seedlings killed by beanfly larvae - look for pupating larvae and pupae at the base of the stems
- Beanfly oviposition stings on navy bean leaf

**Cotton seedling thrips**  
*Thrips tabaci*

- Damage to mungbean seedlings (did not impact yield or time to flowering/harvest)

**Two-spotted mite**  
*Tetranychus urticae*

- Damage in peanuts - major pest where non-selective pesticides are widely used
- Damage in mungbeans - note silvering of leaves

**Cluster caterpillar**  
*Spodoptera litura*

- Windowing by small larvae; helicoverpa and grass blue butterfly also cause this

**Peanut mite**  
*Paraplonobia sp.*

- Damage in peanuts showing bleached leaves - mites are very large with a dark body and pale legs (minor pest)
- Close up showing very fine leaf stippling; peanut mites quickly drop off plant when disturbed

**Soybean aphid**  
*Aphis glycines*

- Early symptoms include cupped distorted leaves covered in sticky honey dew; ladybirds are also a good aphid indicator.

**Lucerne leafhopper**  
*Austroasca alfalfae*

- Hopper burn in peanuts - typical symptoms are yellowing and death from the leaf tip

**Sooty mould**

- Severe symptoms in soybeans heavily infested with silverleaf whitefly

**Tomato spotted wilt virus**

- Stunting and yellowing of peanuts in plants infested by western flower thrip

---

**GOOD BUG**

**BAD BUG**

**MAJOR PEST**
Insects commonly encountered in summer pulses

Damage symptoms

**Soybean moth**

*Aproaerema simplexella*

- Early symptoms showing leaf mines containing individual larvae
- Severe leaf damage caused by heavy infestations (8-12 larvae per leaf)
- Severe damage with many leaves killed outright

**Soybean looper**

*Thysanoplusia orichalcea*

- Damage to soybean leaves - holes are more angular than helicoverpa (right)
- Below threshold damage to soybean leaves - holes are more rounded than looper (left)

**Helicoverpa**

*Helicoverpa sp.*

- Damage to soybean leaves - holes are more rounded than looper (left)
- Shredding of leaves caused by monolepta beetle swarm - often occurs after rain

**Redshouldered leaf beetle**

*Monolepta sp.*

- Damage to soybean leaves - holes are more rounded than looper (left)
- Shredding of leaves caused by monolepta beetle swarm - often occurs after rain

**Bean podborer**

*Maruca vitrata*

- Damage to mungbean flowers - look for chewing, webbing and frass (poo)
- Damage to soybean pods - very similar to mouse damage

**Flower thrips**

*various species*

- Flower thrips damage to mungbean pods - curling makes pods difficult to harvest
- Damage to soybean pods

**Cluster caterpillar**

*Spodoptera litura*

- Damage to soybean pods
- Damage to soybean flowers - look for chewing, webbing and frass (poo)

**Silvery leaf whitefly**

*Bemisia tabaci type B*

- Damage to soybean pods
- Damage to soybean pods - very similar to mouse damage

**Field cricket**

*Teleogryllus sp.*

- Damage to soybean pods
- Damage to soybean pods - very similar to mouse damage

**Lucerne crown borer**

*Zygrita diva*

- Stem 'girdling' by lucerne crown borer larva that has killed the plant above the girdle

Early symptoms showing leaf mines containing individual larvae
Severe leaf damage caused by heavy infestations (8-12 larvae per leaf)
Severe damage with many leaves killed outright
Damage to soybean leaves - holes are more angular than helicoverpa (right)
Below threshold damage to soybean leaves - holes are more rounded than looper (left)
Damage to soybean leaves - holes are more rounded than looper (left)
Shredding of leaves caused by monolepta beetle swarm - often occurs after rain
Damage to mungbean flowers - look for chewing, webbing and frass (poo)
Flower thrips damage to mungbean pods - curling makes pods difficult to harvest
Damage to soybean pods
Damage to soybean pods
Damage to soybean pods - very similar to mouse damage
Stem 'girdling' by lucerne crown borer larva that has killed the plant above the girdle
Damage symptoms (seed and post-harvest)

Podsucking bugs
various species

- GVB damage to soybean seeds during early podfill (left) and late podfill (right)
- GVB sting marks on mungbean seeds. Will downgrade crop if >2% of seeds are stung
- Damage to navy bean seeds (left) compared with undamaged seed (right) - staining attracts a price penalty

Helicoverpa
_Helicoverpa sp._

- Damage to mungbean pods (similar to bean podborer, but more holes and less frass)
- Medium larva inside chickpea pod

Etiella
_Etiella behrii_

- Damage to harvested and shelled peanuts - note the small pinholes in the seeds; _etella_ damage greatly increases aflatoxin risk
- Damage to soybean pod - note frass inside pod and exit hole

Peanut scarab
_Heteronyx piceus_

- Damage is usually a single large hole at the distal end - note scarification around the hole

Sugarcane wireworm
_Agrypronus variabilis_

- Damage to peanuts - note numerous small holes

Post harvest pests

Cowpea bruchid
_Callosobruchus maculatus_
MAJOR PEST of stored mungbean

- Adult and eggs on mungbean seed - also called cowpea weevil, but not a true weevil

Bean bruchid
_Acanthoscelides obtectus_
MAJOR PEST of stored navybean

- Adult on navy bean seed - also called bean weevil, but not a true weevil

Bruchidius mackenziei
MAJOR PEST of stored soybean

- Adult on soybean seed
Commonly confused insects - larvae

Large green caterpillars

Helicoverpa (green variant) has wide pale lateral stripe and 4 pairs of prolegs

Soybean looper has a tapered body and 2 pairs of prolegs

Tobacco looper has less pronounced striping than the soybean looper

Large striped caterpillars

Helicoverpa (striped variant) has 4 pairs of prolegs, prominent side strip, parallel body and obvious body hairs

Common armyworm has 4 pairs of prolegs but is smoother and fatter, with more coloured bands than helicoverpa

Bean looper has only 2 pairs of prolegs, slender smooth body, bottom of head is angled forwards

Medium (10mm) helicoverpa (top) and cluster caterpillar (bottom); cluster caterpillars have a slight ‘hump’ behind the head and a smoother plumper appearance

Small fat green larvae

Grass blue butterfly head capsule and true legs evident if turned over

Common hoverfly has no head capsule or true legs and body tapers to head end; moves like a maggot because it is one!

Small mining and boring caterpillars

Soybean moth larvae are small with a grey green body and a dark head; they feed (mine) inside the leaves

Legume webspinner is larger, pale green, pale head and no spots; produce copious quantities of frass

Bean podborer has a dark head, numerous dark spots on cream body

Insects commonly encountered in summer pulses
**Commonly confused insects - bugs**

**Brown shield-shaped bugs**
- **Brown shield bug** (adult) is smaller and lighter brown than the predatory glossy shield bug.
- **Overwintering green vegetable bug** - larger than the others, and normally a purple or greenish brown - look for 3 pale spots across the middle of the shoulders.
- **Glossy shield bug** (adult) is larger and a darker brown than the brown shield bug (if unsure, feed it a small caterpillar and watch what happens!)

**Small bugs with ‘broken’ backs**
- **Broken backed bug** adult – mostly green with wing ends brown.
- **Brown smudge bug** adult – brown all over.

**Brown shield-shaped bugs**

**Small thin brown bugs**
- **Brown mirid** – similar to green mirid but brown or green/purple in colour.
- **Pacific damsel bug** – longer thinner head than brown mirid and with strongly recurved mouth parts.

**Large thin brown bugs**
- **Brown bean bugs** (large BBB pictured) – a yellow or cream band on each side, large muscley hind legs.
- **Rice or Paddy bug** – hind legs long and thin – *not a pest of pulses or grain legumes*.
- **Assassin bugs** - hind legs long and thin, strongly concave body and recurved proboscis – savage predators.

**Mirids versus leafhoppers** (small green elongated bugs)
- **Green mirids** – have long antennae and long legs.
- **Jassids/leafhoppers** – short antennae, rounded head and relatively shorter legs.

**Overwintering green vegetable bug** - larger than the others, and normally a purple or greenish brown - look for 3 pale spots across the middle of the shoulders.
Commonly confused insects

**Bug egg rafts**
- **Green vegetable bug** freshly-laid pale egg raft - 66 eggs
  - pest

**Flat orange insects**
- Commonly confused insects
  - **Mealybug vs cryptolaemus ladybird larvae**
  - **Smudge bug nymph versus aphids**
  - **Brown bean bug nymphs versus ants**
  - **Peanut mealybug** – sedentary on host plant, oval outline, shorter filaments
  - **Cryptolaemus** ladybird larva – mobile, body tapers towards rear end, very long filaments

**White patterend moths: bean podborer vs beet webworm**
- **Bean podborer** - outspread wings, body raised at head end, hindwings mostly translucent
- **Beet webworm** – wings not as outspread, hindwings are predominantly brown with white band

**Brown bean bug nymphs versus ants**
- **Brown bean bug nymph** - note the sucking mouthparts. Waist not as constricted as an ant’s waist
- **Ant** – biting mouthparts, very narrow constricted waist

**Mealybug vs cryptolaemus ladybird larvae**
- **Peanut mealybug** – sedentary on host plant, oval outline, shorter filaments
- **Cryptolaemus** ladybird larva – mobile, body tapers towards rear end, very long filaments

**Smudge bug nymph versus aphids**
- **Smudge bug** nymph - look like aphids, but lack the aphid’s paired honey tubes
- **Aphids** (cowpea aphids illustrated) – note the paired honey tubes at the aphid’s rear, typical of all aphids

Insects commonly encountered in summer pulses
Insect sampling - use a beat sheet

Sample insects with a ‘standard’ beat sheet, 1.3-1.5 m wide x 1.8-2 m deep. Butt one side of the sheet against the base of plants in the row to be sampled, and drape the sheet over the plants in the opposite row. Beat (shake) plants in the central 1 m of row with a 1 m long beat stick.

Sample 5 sites throughout the crop and take 5 one-metre (1 m) long samples at each site to get an accurate estimate of pest pressure in your crop. Compare your pest population to the relevant pest threshold to determine if spraying is required, i.e. if the pest is above threshold.

Thresholds quoted are standardized as pests per square metre, so you need to convert your counts to pests per square metre as follows:

1. Record the number of insects for each 1 m long sample taken at each sample site
2. Total counts at each sample site and calculate the average per site
3. Divide each sample site average by your row spacing in metres For example, if helicoverpa are averaging 2.25 larvae per row metre in a crop with 0.75 m row spacing, you have 2.25/0.75 = 3.0 helicoverpa per square metre
4. Compare pest numbers from all sampled sites to determine if only a portion of the crops needs spraying, e.g. if pests are above threshold only along one edge

How to make your own beat sheet

Use a sheet of white or yellow poly tarp (do not use cotton as it absorbs water and gets too dirty). Note that white sheets are a bit glary in bright sunlight (so wear sun glasses) and that some (yellowish) insects are harder to see on a yellow sheet.

Cut to a finished size of 1.3-1.5 m wide x 1.8-2.0 m deep. Use the larger size if you have large (tall) plants. Allow enough material for a folded re-enforcing hem on the longer sides and a sleeve to take an 18 mm dowel (or poly pipe) on the shorter side.

Dowels make the sheet more rigid, allow the sheet to butt firmly against the plants to be sampled, and hold the sheet in place when it is draped over plants in the row opposite to that being sampled.

You also need a 1 m long length of dowel or poly pipe to beat (shake) the bushes.

Determine the ‘size’ (number of seeds per square metre) of your crop to determine its susceptibility to podsucking bug damage.

- As podsucking bug thresholds are based on likely % seed damage, the number of seeds per square metre (seeds/m²) in your crop must be estimated to determine the threshold for your size crop.
- This is easily done as follows: Seeds/m² = seeds per pod x pods per plant x plants per row metre/row spacing in metres.

Determine the damage potential of mixed podsucking bug populations in your crop.

- Many podding pulse crops are infested with more than one species of podsucking bug.
- To determine the overall damage potential of your bug population, convert counts of species other than green vegetable bug (GVB) to GVB equivalents as follows; 1 brown bean bug (large or small) = 1GVB, 1 redbanded shield bug = 0.75GVB, 1 brown shield bug = 0.2GVB.
- Total the converted species counts (bugs per m²) to determine the population’s overall damage potential.

See page 40 for more information on converting to GVB equivalents.
### Example BUG CHECK SHEET

**Take 5 one-metre samples per site & 5-6 sites per crop**

<table>
<thead>
<tr>
<th>FARM/LOCATION:</th>
<th>SITE:</th>
<th>DATE:</th>
<th>TIME:</th>
<th>CROP/STAGE:</th>
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</thead>
<tbody>
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</table>

#### Pests

<table>
<thead>
<tr>
<th>Pests</th>
<th>Sample 1</th>
<th>Sample 2</th>
<th>Sample 3</th>
<th>Sample 4</th>
<th>Sample 5</th>
<th>Average</th>
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<tbody>
<tr>
<td>Helicoverpa</td>
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<td>13-23 mm</td>
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<td>&gt;23 mm</td>
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<tr>
<td>Loopers</td>
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<td>&lt;13 mm</td>
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<td>13-23 mm</td>
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<td>&gt;23 mm</td>
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<tr>
<td>Legume webspinner</td>
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<tr>
<td>Bean podborer (look in flowers)</td>
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<tr>
<td>GVB small nymph</td>
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<tr>
<td>GVB medium nymph</td>
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<tr>
<td>GVB large nymph</td>
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<tr>
<td>GVB adult</td>
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<tr>
<td>Redband shield bug small</td>
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<tr>
<td>Redband shield bug medium</td>
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<tr>
<td>Redband shield bug large</td>
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<tr>
<td>Redband shield bug adult</td>
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<tr>
<td>Brown bean bug nymph</td>
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<tr>
<td>Brown bean bug adult</td>
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<tr>
<td>Mirid nymph</td>
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<td>Mirid adult</td>
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<td>Thrips (in flowers)</td>
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<tr>
<td>Soybean aphid</td>
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<td>Silverleaf whitefly</td>
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<tr>
<td>Mites</td>
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#### Beneficials

<table>
<thead>
<tr>
<th>Beneficials</th>
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<th>Sample 4</th>
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<td>Apple dimpling bug</td>
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<td>Big eyed bug</td>
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<td>Spined predatory bug</td>
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<tr>
<td>Brown smudge bug</td>
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<td>Lacewings</td>
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<td>Ladybirds</td>
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<td>Red and blue beetle</td>
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<td>Hoverfly</td>
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**Insects commonly encountered in summer pulses**
The basic IPM strategy for legumes is to avoid non-selective pesticides for as long as possible in order to foster a build-up of predators and parasites, i.e. ‘GO SOFT EARLY’. This helps keep early pests in check and buffer the crop against pest attack during later crop stages. This is particularly important for soybeans because of the silverleaf whitefly risk.

However, intervention may be required during podding, especially against podsucking bug populations which peak during late podfill. Podsucking bugs cannot be ignored as they can drastically reduce seed quality, as well as yield. Over 90% of seeds can be damaged if bugs are left unchecked and crop value can be reduced by over $500/ha.

Regular monitoring of pest numbers is critical in soybeans and other pulse crops, especially with the onset of flowering and throughout podding, when crops become attractive to podsucking bugs, helicoverpa and other pests. While other legumes share many of the same pests as soybeans, some pest species are restricted to specific crops.

Comparing crops
From an insect management point of view, peanuts are easier to manage than soybeans whereas mungbeans, navy beans and adzuki beans (listed in order of increasing difficulty) are more challenging than soybeans.

Pest activity and IPM strategies for grain legume/pulse crops
Grain legume/pulse crops grouped by similarity in pest management requirements are:
• Soybeans
• Mungbeans, adzuki beans and navy beans
• Peanuts
• Chickpeas

Soybeans
Major pests in soybeans are podsucking bugs, helicoverpa (heliiothis), and potentially silverleaf whitefly. Other frequent pests include loopers, cluster caterpillar, soybean moth, soybean aphid, monolepta beetle and mirids.

Soybean leaves are more attractive to foliage-feeding pests (e.g. loopers and leaf miners) than leaves of the other summer pulses and their greater hairiness makes them more attractive to many ovipositing (egg-laying) moths than the leaves of other summer pulses.

While soybeans can be attacked by helicoverpa at any stage from seedlings onwards, the crop is most susceptible from flowering onwards. Soybeans can compensate for considerable insect damage during early podding because they set a large number of ‘reserve pods’. In addition, soybeans have thicker, hairier and less succulent pods than mungbeans, adzuki and navy beans and are therefore not attractive to loopers and bean podborer.

Podsucking bugs are major soybean pests. The most abundant species in order of damage potential are:
• green vegetable bug (Nezara viridula)
• brown bean bugs (Riptortus and Melanancanthus sp.)
• redbanded shield bug (Piezodorus oceani cus).

While many cultivars can compensate for yield loss caused by moderate bug populations, seed quality is adversely affected, particularly for edible soybeans where processors have very low damage tolerances (e.g. maximum of 2% damaged seed).

Silverleaf whitefly (SLW) poses a major threat to soybeans in tropical and subtropical regions. However the recently released SLW parasite Eretmocerus hayati, together with native parasites and predators, can reasonably be expected to stabilise whitefly populations, provided they are not disrupted by the overuse of non-selective pesticides.

A coastal pest that can suddenly appear in large numbers is monolepta beetle. DEEDI trials have helped secure a recent label extension for Steward® (indoxacarb) against monolepta in soybeans.

In a typical soybean crop, budget for one pyrethroid (e.g. Decis®) spray for podsucking bugs, and expect that you will probably have to apply at least one helicoverpa spray after flowering (preferably Steward® EC). Also prepare for infestations of leaf feeding caterpillars.
Insects commonly encountered in summer pulses

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Insects commonly encountered in summer pulses

(for monolepta in coastal crops). For caterpillars, use NPV+Aminofeed® for helicoverpa alone. Use Bt+Aminofeed for loopers or Bt+NPV+Aminofeed for mixed looper/helicoverpa populations.

**Mungbeans, adzukis and navy beans**

These crops have a similar pest spectrum to soybeans, however navy beans in particular are far more susceptible to beanfly attack during the seedling stage. Flowers and small pods are also more susceptible to looper damage, as they are larger and more succulent than soybean flowers and pods.

Large flowers and indeterminate growth (overlapping in time of flowering and podding) make these crops, and particularly adzukis, very attractive hosts to bean podborer (*Maruca vitrata*), a caterpillar pest which initially feeds inside flowers before moving into pods. Indeterminate flowering also makes these crops susceptible to mirid damage. Mirids attack the buds and flowers, which results in reduced pod-set. These crops are attacked by the same podsucking bugs as soybeans.

Navy beans are susceptible to SLW, but mungbeans and adzukis are not suitable SLW hosts. While adult SLW are often seen, very few SLW nymphs develop in these crops.

Mungbean seed can be infested in the field by bruchids but this is often not detected until 3 or more months post harvest. Bagged planting seed kept for any length of time out of cold storage is at particular risk of bruchid attack.

In a typical crop, you would budget for 1-2 dimethoate¹ sprays against mirids and/or bean fly, one helicoverpa spray (most likely using Steward® or Larvin®), and the possibility of a pyrethroid spray for podsucking bugs.

**Peanuts**

Peanuts are at risk from soil dwelling pests such as peanut scarabs (and possibly cane grubs) and whitefringed weevil. Whitefringed weevil can largely be avoided by not rotating peanuts with alternate weevil hosts which include other legumes, root crops (e.g. potatoes), and lucerne.

In dry seasons, pods can be attacked by *etiella* (*Etiella behrii*) larvae, which are able to reach the underground pods but only in dry soil. Etiella damage is a major risk factor for aflatoxin (a carcinogenic toxin produced by *Aspergillus* fungi), which gains entry through holes made by etiella larvae exiting pods to pupate in the soil.

Peanuts are not a favoured silverleaf whitefly host, and are only at risk in extreme SLW years or if growing close to early maturing SLW hosts.

Lucerne jassids are a problem in some regions, their feeding resulting in hopper burn (yellowing and death of leaf tips). Lucerne jassids are yellow green and should not be confused with the more common and bright green vegetable jassid which rarely if ever causes economic damage.

In a typical peanut crop, you would budget for one spray but hope to spray only every 2nd year. NPV would be the IPM product of choice for helicoverpa, provided larvae are small (<12 mm).

**Chickpeas**

The only significant insect pest of chickpeas is helicoverpa, though cane grubs have been known to cause damage in some cane areas. Acidic leaf secretions produced by chickpeas repel most other pests as well as beneficials.

To control helicoverpa target small-very small larvae (<7 mm) in podding chickpeas with a single, well-timed spray. Recommended thresholds are between 2-4 grubs per metre. Higher thresholds are only recommended in crops with adequate moisture where chickpeas can compensate for damage without suffering yield loss. Lower thresholds are often used for stressed crops late in the season (i.e. suffering terminal drought), but may also be appropriate for larger seeded kabuli-type chickpeas, such as Macarena.

A typical chickpea crop will require at least one helicoverpa spray. Steward® EC (indoxacarb) is a commonly recommended insecticide for helicoverpa control in chickpeas, and provides good residual control.

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¹ Please note: previous registrations of dimethoate were suspended in October 2011. Current use is as per APVMA permit 13155 (valid to 5-10-13).
## Summer pulse pest thresholds

### Soybeans

#### Table 1. Soybean yield loss thresholds by crop stage

<table>
<thead>
<tr>
<th>Crop stage</th>
<th>Pest</th>
<th>Threshold</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seedling/early vegetative</td>
<td>Helicoverpa &amp; grass blue</td>
<td>25% terminal loss</td>
<td>Terminal loss more likely if crops are moisture stressed</td>
</tr>
<tr>
<td></td>
<td>butterfly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mid-late vegetative</td>
<td>Helicoverpa</td>
<td>6/m²**</td>
<td>Lower threshold in early vegetative crops or take action if terminal loss exceeds 25%</td>
</tr>
<tr>
<td>Vegetative</td>
<td>Spodoptera, loopers &amp;</td>
<td>33% defoliation or</td>
<td>Refer to defoliation figure on page 39; terminal loss most likely if grass blue larvae present</td>
</tr>
<tr>
<td></td>
<td>grass blue butterfly</td>
<td>25% terminal loss</td>
<td></td>
</tr>
<tr>
<td>Budding, flowering</td>
<td>Thrips</td>
<td>4-6 per flower</td>
<td></td>
</tr>
<tr>
<td>Budding, flowering &amp; early podding</td>
<td>Mirids</td>
<td>5/m²*</td>
<td></td>
</tr>
<tr>
<td>Budding to podding</td>
<td>Spodoptera</td>
<td>3/m²*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Loopers</td>
<td>15-20% defoliation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Soybean aphids</td>
<td>250 aphids per plant</td>
<td></td>
</tr>
<tr>
<td>Budding to late pod fill</td>
<td>HELICOVERPA</td>
<td>See Table 2</td>
<td></td>
</tr>
<tr>
<td>Early to late pod fill</td>
<td>PODSUCKING BUGS</td>
<td>See Table 3</td>
<td></td>
</tr>
</tbody>
</table>

**Note:** + Thresholds are based on beat sheet sampling and are expressed in pests/m².  
* Replaces 33% defoliation threshold which still applies for other caterpillar species.

#### Table 2. Economic yield thresholds* for helicoverpa in podding soybeans

<table>
<thead>
<tr>
<th>Control cost ($/ha)</th>
<th>Helicoverpa thresholds* (larvae/m²) at soybean crop values listed below ($/t)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$350</td>
<td>1.1 0.9 0.8 0.8 0.7 0.6 0.6 0.5 0.5 0.5</td>
</tr>
<tr>
<td>$400</td>
<td>1.4 1.3 1.1 1.0 0.9 0.8 0.8 0.7 0.7 0.6</td>
</tr>
<tr>
<td>$450</td>
<td>1.8 1.6 1.4 1.3 1.1 1.0 1.0 0.9 0.8 0.8</td>
</tr>
<tr>
<td>$500</td>
<td>2.1 1.9 1.7 1.5 1.4 1.3 1.2 1.1 1.0 0.9</td>
</tr>
<tr>
<td>$550</td>
<td>2.5 2.2 1.9 1.8 1.6 1.5 1.3 1.3 1.2 1.1</td>
</tr>
<tr>
<td>$600</td>
<td>2.9 2.5 2.2 2.0 1.8 1.7 1.5 1.4 1.3 1.3</td>
</tr>
<tr>
<td>$650</td>
<td>3.2 2.8 2.5 2.3 2.0 1.9 1.7 1.6 1.5 1.4</td>
</tr>
<tr>
<td>$700</td>
<td>3.6 3.1 2.8 2.5 2.3 2.1 1.9 1.8 1.7 1.6</td>
</tr>
<tr>
<td>$750</td>
<td>3.9 3.4 3.1 2.8 2.5 2.3 2.1 2.0 1.8 1.7</td>
</tr>
<tr>
<td>$800</td>
<td>4.3 3.8 3.3 3.0 2.7 2.5 2.3 2.1 2.0 1.9</td>
</tr>
</tbody>
</table>

* Threshold based on a measured yield loss of 40 kg/ha for every larva per square metre. Cross-reference the cost of control versus the crop value to determine the economic threshold (ET), e.g. if the cost of control = $35/ha and the crop value =$450/t, the ET = 1.9.  
Spray helicoverpa only if they exceed the threshold which is the break even point.

#### Table 3. Economic quality threshold* for green vegetable bug (GVBAEQ) in edible soybeans

<table>
<thead>
<tr>
<th>Potential yield (t/ha)</th>
<th>0.5</th>
<th>1.0</th>
<th>1.5</th>
<th>2.0</th>
<th>2.5</th>
<th>3.0</th>
<th>3.5</th>
<th>4.0</th>
<th>4.5</th>
<th>5.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nato soybeans</td>
<td>0.1</td>
<td>0.2</td>
<td>0.3</td>
<td>0.4</td>
<td>0.5</td>
<td>0.6</td>
<td>0.7</td>
<td>0.8</td>
<td>0.9</td>
<td>1.0</td>
</tr>
<tr>
<td>Normal soybeans</td>
<td>0.1</td>
<td>0.1</td>
<td>0.2</td>
<td>0.3</td>
<td>0.3</td>
<td>0.4</td>
<td>0.4</td>
<td>0.5</td>
<td>0.6</td>
<td>0.6</td>
</tr>
</tbody>
</table>

*Threshold based on a rate of damage of approximately 80 harvestable seeds per adult bug per square metre. Spray bugs at the 2% action threshold, before the critical 3% damage level is reached. This allows for other insect damage not caused by podsucking bugs. Note that thresholds increase in 'larger' crops as more bugs are required to inflict a given percentage (%) of damage. When mixed bug populations are present (adults & nymphs) convert their damage potential to green vegetable bug adult equivalents (GVBAEQ) as per page 40.
# Mungbeans, adzuki and navy bean

## Table 4. Mungbeans, adzuki and navy bean thresholds by crop stage

<table>
<thead>
<tr>
<th>Crop stage</th>
<th>Pest</th>
<th>Threshold</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seedling seedling</td>
<td>Seedling thrips</td>
<td>none</td>
<td>Spring mungbeans only rarely sprayed</td>
</tr>
<tr>
<td></td>
<td>Beanfly</td>
<td>1 larval tunnel/plant</td>
<td>May need respray in 7 days</td>
</tr>
<tr>
<td>Vegetative</td>
<td>Helicoverpa</td>
<td>25% terminal loss or 33% defoliation or provisionally* 4-5/m²*</td>
<td>Refer to defoliation figure on page 39</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>The provisional 4-5/m² is for mid to late vegetative crops</td>
</tr>
<tr>
<td></td>
<td>Loopers</td>
<td>33% defoliation</td>
<td>Refer to defoliation figure on page 39</td>
</tr>
<tr>
<td>Budding, flowering</td>
<td>Thrips</td>
<td>4-6 per flower</td>
<td>Open and inspect flowers</td>
</tr>
<tr>
<td>Budding, flowering &amp; early podding</td>
<td>MIRIDS</td>
<td>See Table 7</td>
<td>Values are for ground and aerially sprayed crops respectively</td>
</tr>
<tr>
<td>Budding to podding</td>
<td>HELICOVERPA</td>
<td>See Table 5</td>
<td>New threshold model. Inspect flowers and terminals for small larvae</td>
</tr>
<tr>
<td></td>
<td>Spodoptera and loopers</td>
<td>3/m²*</td>
<td>A nominal threshold</td>
</tr>
<tr>
<td>Flowering to podding</td>
<td>BEAN PODBORER</td>
<td>7/m² (visual)</td>
<td>Major pest in coastal crops; look for young larvae in flowers - control before they attack pods</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.5/m² (beatsheet)</td>
<td></td>
</tr>
<tr>
<td>Early to late podfill</td>
<td>PODSUCKING BUGS</td>
<td>See Table 6</td>
<td>Thresholds for processing are double those for sprouting</td>
</tr>
</tbody>
</table>

**Note:**  
* Thresholds are based on beat sheet sampling and are expressed in pests/m².  
* Extrapolated from revised Helicoverpa thresholds in soybeans. Lower than the soybean threshold because mungbean plants are smaller than soybean plants. Needs to be verified in field trials.

## Table 5. Economic yield loss thresholds* for helicoverpa in podding mungbeans

<table>
<thead>
<tr>
<th>Control cost ($/ha)</th>
<th>Helicoverpa thresholds* (larvae/m²) at mungbean crop values listed below ($/t)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$400</td>
</tr>
<tr>
<td>$15</td>
<td>1.1</td>
</tr>
<tr>
<td>$20</td>
<td>1.4</td>
</tr>
<tr>
<td>$25</td>
<td>1.8</td>
</tr>
<tr>
<td>$30</td>
<td>2.1</td>
</tr>
<tr>
<td>$35</td>
<td>2.5</td>
</tr>
<tr>
<td>$40</td>
<td>2.9</td>
</tr>
<tr>
<td>$45</td>
<td>3.2</td>
</tr>
<tr>
<td>$50</td>
<td>3.6</td>
</tr>
<tr>
<td>$55</td>
<td>3.9</td>
</tr>
<tr>
<td>$60</td>
<td>4.3</td>
</tr>
</tbody>
</table>

* Thresholds based on a measured yield loss of 35 kg/ha for every larva per square metre. Cross-reference the cost of control versus the crop value to determine the economic threshold (ET), e.g. if cost of control = $35/ha and crop value = $450/t, the ET = 2.2. 
Spray helicoverpa only if they exceed the threshold which is the break even point.

**Please note:** Mirid thresholds in crop stage tables 1, 4 and 8 are based on the cost of dimethoate. Previous registrations of dimethoate were suspended in October 2011. Current use is as per APVMA permit 13155 (valid to 5-10-13).
### Table 6. Economic quality threshold* for green vegetable bug/m² in mungbeans

<table>
<thead>
<tr>
<th>Potential yield (t/ha)</th>
<th>0.25</th>
<th>0.5</th>
<th>1.0</th>
<th>1.5</th>
<th>2.0</th>
<th>2.5</th>
<th>3.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>GVBAEQ to damage 1.4% of seeds</td>
<td>0.1</td>
<td>0.2</td>
<td>0.5</td>
<td>0.8</td>
<td>1.1</td>
<td>1.4</td>
<td>1.7</td>
</tr>
</tbody>
</table>

*Threshold based on a rate of damage of approximately 50 harvestable seeds per adult bug per square metre. Spray bugs at the 1.4% action threshold, before the critical 2% damage level is reached. This allows for other insect damage not caused by posdsucking bugs. Note that thresholds increase in ‘larger’ crops as more bugs are required to inflict a given percentage (%) of damage. When mixed bug populations are present (adults & nymphs) convert their damage potential to green vegetable bug adult equivalents (GVBAEQ) as per page 40.

### Table 7. Economic threshold chart for mirids (*Creontiades* spp.) in mungbeans

<table>
<thead>
<tr>
<th>Control cost ($/ha)</th>
<th>$400</th>
<th>$450</th>
<th>$500</th>
<th>$550</th>
<th>$600</th>
<th>$650</th>
<th>$700</th>
<th>$750</th>
<th>$800</th>
<th>$850</th>
</tr>
</thead>
<tbody>
<tr>
<td>$10</td>
<td>0.4</td>
<td>0.4</td>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
</tr>
<tr>
<td>$15</td>
<td>0.6</td>
<td>0.6</td>
<td>0.5</td>
<td>0.5</td>
<td>0.4</td>
<td>0.4</td>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
</tr>
<tr>
<td>$20</td>
<td>0.7</td>
<td>0.7</td>
<td>0.6</td>
<td>0.6</td>
<td>0.5</td>
<td>0.5</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
</tr>
<tr>
<td>$25</td>
<td>0.9</td>
<td>0.8</td>
<td>0.8</td>
<td>0.7</td>
<td>0.6</td>
<td>0.6</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>$30</td>
<td>1.0</td>
<td>0.9</td>
<td>0.9</td>
<td>0.8</td>
<td>0.7</td>
<td>0.7</td>
<td>0.6</td>
<td>0.6</td>
<td>0.6</td>
<td>0.6</td>
</tr>
<tr>
<td>$35</td>
<td>1.1</td>
<td>1.0</td>
<td>1.0</td>
<td>0.9</td>
<td>0.8</td>
<td>0.7</td>
<td>0.7</td>
<td>0.6</td>
<td>0.6</td>
<td>0.6</td>
</tr>
<tr>
<td>$40</td>
<td>1.2</td>
<td>1.1</td>
<td>1.0</td>
<td>0.9</td>
<td>0.8</td>
<td>0.7</td>
<td>0.7</td>
<td>0.6</td>
<td>0.6</td>
<td>0.6</td>
</tr>
</tbody>
</table>

*Table based on a measured yield loss of 60 kg/ha for every mirid per square metre inflicted over a 28 day period. There is therefore no need to spray low mirid populations immediately at early flowering. Delaying sprays for low mirid populations by up to 7 days for low mirid populations will have no impact on yield, will reduce the risk of flaring helicoverpa and may mean you only have to apply 1 mirid spray. Cross-reference the cost of control versus the crop value to determine the economic threshold (ET), e.g. if cost of control = $15/ha and crop value =$600/t, the ET = 0.42. The higher the cost of control, and the lower the crop value, the higher the threshold. Note that if dimethoate* is phased out, the higher cost of the replacement thresholds will raise the thresholds considerably - e.g. x 2 or more.

### Table 8. Economic threshold chart for helicoverpa in podding navy beans

<table>
<thead>
<tr>
<th>Control cost ($/ha)</th>
<th>$400</th>
<th>$500</th>
<th>$600</th>
<th>$700</th>
<th>$800</th>
<th>$900</th>
<th>$1000</th>
<th>$1100</th>
<th>$1200</th>
<th>$1300</th>
</tr>
</thead>
<tbody>
<tr>
<td>$15</td>
<td>0.6</td>
<td>0.4</td>
<td>0.4</td>
<td>0.3</td>
<td>0.3</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
</tr>
<tr>
<td>$20</td>
<td>0.7</td>
<td>0.6</td>
<td>0.5</td>
<td>0.4</td>
<td>0.4</td>
<td>0.3</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
</tr>
<tr>
<td>$25</td>
<td>0.9</td>
<td>0.7</td>
<td>0.6</td>
<td>0.5</td>
<td>0.4</td>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
</tr>
<tr>
<td>$30</td>
<td>1.1</td>
<td>0.9</td>
<td>0.7</td>
<td>0.6</td>
<td>0.5</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.3</td>
<td>0.3</td>
</tr>
<tr>
<td>$35</td>
<td>1.3</td>
<td>1.0</td>
<td>0.9</td>
<td>0.7</td>
<td>0.6</td>
<td>0.5</td>
<td>0.5</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
</tr>
<tr>
<td>$40</td>
<td>1.5</td>
<td>1.2</td>
<td>1.0</td>
<td>0.9</td>
<td>0.7</td>
<td>0.6</td>
<td>0.6</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>$45</td>
<td>1.7</td>
<td>1.3</td>
<td>1.1</td>
<td>1.0</td>
<td>0.8</td>
<td>0.7</td>
<td>0.7</td>
<td>0.6</td>
<td>0.6</td>
<td>0.6</td>
</tr>
<tr>
<td>$50</td>
<td>1.9</td>
<td>1.5</td>
<td>1.2</td>
<td>1.1</td>
<td>0.9</td>
<td>0.8</td>
<td>0.7</td>
<td>0.7</td>
<td>0.6</td>
<td>0.6</td>
</tr>
<tr>
<td>$55</td>
<td>2.1</td>
<td>1.6</td>
<td>1.4</td>
<td>1.2</td>
<td>1.0</td>
<td>0.9</td>
<td>0.8</td>
<td>0.7</td>
<td>0.7</td>
<td>0.6</td>
</tr>
<tr>
<td>$60</td>
<td>2.2</td>
<td>1.8</td>
<td>1.5</td>
<td>1.3</td>
<td>1.1</td>
<td>1.0</td>
<td>0.9</td>
<td>0.8</td>
<td>0.7</td>
<td>0.7</td>
</tr>
</tbody>
</table>

* Table based on a measured yield loss of 67 kg/ha for every larva per square metre. Cross-reference the cost of control versus the crop value to determine the economic threshold (ET), e.g. if cost of control = $35/ha and crop value =$600/t, the ET = 0.42. The higher the cost of control, and the lower the crop value, the higher the threshold. ** Spray helicoverpa only if they exceed the threshold which is the break even point. The higher the const of control, and the lower the crop value, the higher the threshold.

---

1 Please note: Previous registrations of dimethoate were suspended in October 2011. Current use is as per APVMA permit 13155 (valid to 5-10-13).
Peanuts

Table 9. Thresholds by crop stage

<table>
<thead>
<tr>
<th>Crop stage</th>
<th>Pest</th>
<th>Threshold</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vegetative</td>
<td>Helicoverpa</td>
<td>33% defoliation</td>
<td>Refer to defoliation figure on page 39</td>
</tr>
<tr>
<td>Budding, flowering</td>
<td>Thrips</td>
<td>4-6 per flower</td>
<td>Open and inspect flowers</td>
</tr>
<tr>
<td>Budding, flowering &amp; early podding</td>
<td>Mirids</td>
<td>5/m²²</td>
<td>Trials show no yield loss for mirid populations up to 5/m²²</td>
</tr>
<tr>
<td>Budding to podding</td>
<td>Spodoptera</td>
<td>3/m²²</td>
<td>May chew through pegs</td>
</tr>
<tr>
<td>Flowering to podding</td>
<td>HELICOVERPA</td>
<td>4-5/m²²</td>
<td>A nominal threshold. Inspect flowers and terminals for small larvae</td>
</tr>
<tr>
<td>Any stage</td>
<td>Lucerne leafhopper</td>
<td>20% of leaves with hopper burn</td>
<td>Burnt leaves start yellowing and dying from the tip</td>
</tr>
</tbody>
</table>

Note: * Thresholds are based on beat sheet sampling and are expressed in pests/m².

Defoliation thresholds

Different levels (%) of defoliation are shown. Note that the measured defoliation seems to be less than suggested by the observer’s eye. Note also that the defoliation threshold is based on crop’s overall level of defoliation, and not just that of the most severely damaged leaves.
Green vegetable bug equivalents
Green vegetable bugs (GVB) and brown bean bugs (BBB) are equally damaging to pulse crops but green vegetable bugs (GVB) are considered a more important pest due to their abundance, widespread distribution and rate of reproduction. The damage potential of other pod sucking pests is not as great as GVB but they can cause severe damage when present in large numbers. To determine the damage potential of pod sucking bugs they must be converted to GVBEQ as shown in the table at the bottom of this page (Damage potential of pod sucking bug species relative to GVB):

For each bug stage (nymphs and adults) of each species, convert to GVBEQ by multiplying by the relevant conversion factor.

Green vegetable bug adult equivalents
Using the previous example - if you find that the three GVB and one RBSB are 2nd instars instead of adults and the two BSB are 4th instars - an additional calculation is required to convert these instars into adult equivalents. This is because bug nymphs are less damaging than adults.

The table below provides the conversion factors to convert instars to green vegetable bug adult equivalents. The example above shows 3.75 GVB equivalents as 2nd instars and 0.4 GVB equivalents as 4th instars.

Damage potential of nymphs in green vegetable bug adult equivalents (GVBAEQ) from 1-6 weeks prior to harvest

<table>
<thead>
<tr>
<th>Days to harvest</th>
<th>Small nymphs (I-II)</th>
<th>Medium nymphs (III-IV)</th>
<th>Large nymphs (V) and adults</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>0.1</td>
<td>0.5</td>
<td>1.0</td>
</tr>
<tr>
<td>14</td>
<td>0.2</td>
<td>0.6</td>
<td>1.0</td>
</tr>
<tr>
<td>21</td>
<td>0.2</td>
<td>0.7</td>
<td>1.0</td>
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<tr>
<td>28</td>
<td>0.3</td>
<td>0.8</td>
<td>1.0</td>
</tr>
<tr>
<td>35</td>
<td>0.4</td>
<td>0.8</td>
<td>1.0</td>
</tr>
<tr>
<td>42</td>
<td>0.4</td>
<td>0.8</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Each instar group is multiplied by the conversion factor and then added together to obtain the total damage potential. This can be calculated for days to harvest.
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## Identifying insects - general shape* and distinguishing features

<table>
<thead>
<tr>
<th>Insect type</th>
<th>Key identifying features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Immature stages: Larvae</td>
<td>Look nothing like the adults. Usually elongated with/without legs. Pass through a pupal stage before reaching adulthood.</td>
</tr>
<tr>
<td></td>
<td>• <strong>Moth larvae or caterpillars</strong>: Proper legs at front and fleshy prolegs at the rear, chewing mouthparts.</td>
</tr>
<tr>
<td></td>
<td>• <strong>Beetle larvae</strong>: Front legs only, chewing mouthparts.</td>
</tr>
<tr>
<td></td>
<td>• <strong>Fly and wasp parasitoid larvae</strong>: are maggots with no legs nor obvious mouthparts.</td>
</tr>
<tr>
<td></td>
<td>• <strong>Lacewing larvae</strong>: similar to beetle larvae.</td>
</tr>
<tr>
<td>Immature stages: Pupae</td>
<td>Intermediate stage between larvae and adults. Immobile, no external legs or wings. Found in soil or on host plants. Sometimes in a protective silken cocoon (some caterpillars) or exposed (e.g. helicoverpa and ladybirds).</td>
</tr>
<tr>
<td>Immature stages: Nymphs</td>
<td>Reasonably similar to the adults but lack wings.</td>
</tr>
<tr>
<td></td>
<td>• <strong>Bug nymphs</strong>: Look for sucking mouth parts, and distinctive colour patterns for each species.</td>
</tr>
<tr>
<td>Bugs</td>
<td>All have sucking mouthparts and if winged, 2 pairs of wings.</td>
</tr>
<tr>
<td></td>
<td>• <strong>Shield bugs</strong>: Shield shape, beetle like outline, only inner forewings are hardened, outer forewings and rear wings are membranous.</td>
</tr>
<tr>
<td></td>
<td>• <strong>Mirids, bean bugs, assassin bugs</strong>: Elongated, long antennae, only inner part of forewings are hardened., outer forewings and rear wings are membranous.</td>
</tr>
<tr>
<td></td>
<td>• <strong>Jassids, leafhoppers</strong>: Elongated, short antennae, rounded head, forewings of uniform hardness, jump/hop when disturbed.</td>
</tr>
<tr>
<td></td>
<td>• <strong>Aphids</strong>: Globular, pair of honey tubes at rear, wings if present are clear and not hardened. Usually present in colonies. Sooty mould may also be present.</td>
</tr>
<tr>
<td></td>
<td>• <strong>Mealybugs</strong>: Fluffy, sedentary on plant host.</td>
</tr>
<tr>
<td>Beetles</td>
<td>Can be rounded (ladybirds) or elongated (lucerne crown borer). Chewing mouthparts, forewings hardened into protective cover. Some like ladybirds are brightly coloured. Weevils have an elongated ‘snout’.</td>
</tr>
<tr>
<td>Moths and butterflies</td>
<td>Two pairs of scale-covered wings that are large relative to their body. Butterflies more brightly coloured than moths, have clubbed antennae and often rest with wings folded vertically. Moths rest with wings folded over body or outspread.</td>
</tr>
<tr>
<td>Flies</td>
<td>Most pest and parasitic flies are house-fly shaped. Sponging mouthparts, one pair of wings. Relatively large eyes.</td>
</tr>
<tr>
<td>Wasps and ants</td>
<td>Narrow waisted and biting mouthparts.</td>
</tr>
<tr>
<td></td>
<td>• <strong>Wasps</strong>: 2 pairs of wings, often with ovipositor at rear.</td>
</tr>
<tr>
<td></td>
<td>• <strong>Ants</strong>: Usually wingless, often in large numbers.</td>
</tr>
<tr>
<td>Crickets</td>
<td>Similar to grasshoppers but fatter. Chewing mouthparts, large jumping hind legs.</td>
</tr>
<tr>
<td>Earwigs</td>
<td>Elongated body. Large rear pincers, chewing mouthparts.</td>
</tr>
<tr>
<td>Lacewings</td>
<td>Delicate body, long antennae, 2 pairs large delicately-veined clear wings, chewing mouthparts.</td>
</tr>
<tr>
<td>Cockroaches</td>
<td>Flattened wide body. Chewing mouth parts, long wavy antennae.</td>
</tr>
<tr>
<td>Mites</td>
<td>Very small rounded body with eight legs, webbing on leaf. Usually present in colonies.</td>
</tr>
<tr>
<td>Thrips</td>
<td>Small narrow body. Adults with 2 pairs of narrow feathery wings. Usually found inside leaf terminals, buds or flowers.</td>
</tr>
<tr>
<td>Spiders</td>
<td>Variety of body shapes, eight legs, multiple eyes.</td>
</tr>
</tbody>
</table>

*Note that the shapes provided are examples only and are not necessarily a true representation of either the actual appearance or the relative sizes of these arthropods*
This guide is designed to help growers and consultants to correctly identify pest and beneficial insects in their summer pulses (soybeans, mungbeans, navy beans, adzukis and peanuts), and chickpeas. The ‘good bugs’ are predators and parasites (parasitoids) of the ‘bad bugs’, which are pests of summer pulses and chickpeas. Note that many of the minor pests rarely if ever cause economic damage because of their small size and/or (normally) very low abundance. In many instances, minor pests actually perform a useful role because they attract beneficial insects into crops.

The photographic ‘montage’ format is client-driven and largely follows that developed by Maureen McCarthy (Childers) for the very popular Isis Landcare Bug Book. Images of similar-looking good bugs and bad bugs are placed side by side to allow for a rapid diagnosis and comparison. The guide also contains photographs of damage, and a ‘commonly confused’ section for quick reference. Brief captions list key characteristics of all illustrated insects, as well as their status (e.g. MAJOR PEST or Minor PEST). Included are many caterpillar pests mostly found in new coastal cane/grain farming systems. Note that many of the minor pests illustrated have no common names.

Also included are outlines of the key pests and beneficials likely to be encountered in summer pulses, an example Bug Check Sheet (for readers to copy), and sampling guidelines and threshold tables for the most common pests in summer pulses and chickpeas.