SOUTHERN
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GRAINS RESEARCH
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CORPORATION

LUPIN

SECTION 6

PESTS AND INSECTS

OVERVIEW | INTEGRATED PEST MANAGEMENT (IPM) PLANNING | COSTS OF INSECT AND PEST CONTROL | PEST IDENTIFICATION AND MANAGEMENT

MORE INFORMATION

IPM 'Guidelines for Grains – Lupins': http://ipmguidelinesforgrains.com.au/crops/winter-pulses/lupins/

CSIRO 'Insect Identification Resources Online': http://www.csiro.au/en/Research/Collections/ANIC/ID-Resources

CropLife Australia 'Resistance Management': http://www.croplife.org.au/industry-stewardship/resistance-management/

GRDC 'Ground Cover Supplement – Pest Resistance Drives Need for IPM': https://grdc.com.au/Media-Centre/Ground-Cover-Supplements/Ground-Cover-issue-94-SepOct-2011-Crop-Protection-Supplement/Pest-resistance-drives-need-for-IPM

cesar 'PestFacts Map': http://www.cesaraustralia.com/sustainable-agriculture/pestfacts-south-eastern/pestfacts-map/

GRDC 'Crop Pest Management for Farming Systems in High Rainfall Areas of Southern Australia': https://grdc.com.au/research/reports/report?id=1014

Pests and insects

6.1 Overview

Lupin crops are more prone to insect and allied pest damage than cereal crops and need to be checked and monitored at critical stages of development.

These stages are: crop emergence and for three weeks after sowing; during flowering; and during pod fill.

6.2 Integrated Pest Management (IPM) planning

An Integrated Pest Management (IPM) plan is recommended for southern region rotational cropping systems that include lupin.

It is advised that IPM practices include the following considerations:

- Crop rotations – some rotations can support pest presence (long-term pasture paddocks are more susceptible to many pests).
- Soil preparation – summer and autumn cultivation or herbicide use can eliminate pest feed sources.
- Sowing time – time planting windows when there is less likelihood of pest presence during critical crop development phases.
- Crop establishment – uniform crop establishment can assist crops withstand pest attack, as will appropriately treated seed.
- Crop choice and variety – varieties with disease and pest resistance are preferable, particularly those with seedling vigour and physiological features (such as hard seed coats) that deter pests.
- Weed management – some insects use weeds as host plants and weed control should be considered for adjacent paddocks, borders and roadsides – as well as in-crop control.
- Disease management – insects can be disease transmitters and damage exposes crops to infestations. Diseased plants are less competitive under insect attack.
- Hygiene and sanitation – machinery, vehicles and people can carry insects and it is important to minimise pest movement.
- Insecticide use – consider exposure of surrounding wildlife and beneficial insects.
- Environmental conditions – some weather, such as heavy rain, can affect the presence of insects on plants and reduce the need for insecticide use.
- Beneficial insect preservation.

FEEDBACK

MORE INFORMATION

IPM Guidelines 'Growing a Healthy Crop': http://ipmguidelinesforgrains.com.au/ipm-information/growing-a-healthy-crop/

IPM Guidelines 'Lupins': http://ipmguidelinesforgrains.com.au/crops/winter-pulses/lupins/

CropLife Australia 'Resistance Management': http://www.croplife.org.au/industry-stewardship/resistance-management/

GRDC 'Ground Cover Supplement – Pest Resistance Drives Need for IPM': https://grdc.com.au/Media-Centre/Ground-Cover-Supplements/Ground-Cover-issue-94-SepOct-2011-Crop-Protection-Supplement/Pest-resistance-drives-need-for-IPM

MORE INFORMATION

GRDC 'The Current and Potential Costs of Invertebrate Pests in Grain Crops': https://grdc.com.au/resources-and-publications/all-publications/bookshop/2013/02/the-current-and-potential-costs-of-invertebrate-pests-in-grain-crops

Economic damage from insects and pests can occur in lupin crops during all crop growth phases.

Typically, the lupin plant can compensate for moderate damage that occurs early in development by setting new buds and pods to replace those lost. But excessive early damage can reduce yields and potentially delay harvest.

Considering other control options for a lupin crop when planning insecticide use and crop rotations can help to reduce the risk of insecticide resistance.

Research is finding an over-reliance on broad-spectrum insecticides and pesticides, such as synthetic pyrethroids (SPs), is resulting in development of resistance in pests such as Green peach aphid, or GPA (*Myzus persicae*) and Redlegged earth mites, or RLEM (*Halotydeus destructor*).

Researchers advise that more strategic pest management is required to control resistant populations and minimise the risk of resistance developing further.

They are carrying out research to map insecticide and pesticide resistance in crop pests and insects across Australia, along with further development and promotion of IPM practices.

The basic IPM strategy for all legumes, including lupin, is to avoid non-selective insecticides for as long as possible in order to foster a build-up of predators and parasites (the industry message is to: 'Go soft early').

This helps to keep early pests, such as aphids (*Aphididae*) in check – as predators can stop populations from building up.

However, intervention may be required during podding, especially against native budworm (*Helicoverpa punctigera*) and aphid populations, which can peak during late pod fill.

6.3 Costs of insect and pest control

A 2013 report studied the costs of controlling major grain crop insect pests nationally.

It found that, while action thresholds drive treatment for most pests, very few of these have been derived from empirical (direct observation and experience) analysis.[1]

There was evidence to suggest a move away from tillage towards minimum or no-till farming systems and a changing climate had altered the status of invertebrate pests in the Australian grains industry.

In the southern region, snails represent the biggest current and potential threat to yield in all crops followed by balaustium mite (*Balaustium medicagoense*).[2]

1 Murray, Dave, Clarke, Michael, Ronning, David (2013) GRDC, The current and potential costs of invertebrate pests in grain crops, https://grdc.com.au/resources-and-publications/all-publications/bookshop/2013/02/the-current-and-potential-costs-of-invertebrate-pests-in-grain-crops

2 Murray, Dave, Clarke, Michael, Ronning, David (2013) GRDC, The current and potential costs of invertebrate pests in grain crops, https://grdc.com.au/resources-and-publications/all-publications/bookshop/2013/02/the-current-and-potential-costs-of-invertebrate-pests-in-grain-crops

FEEDBACK

Economic benefits of controlling pests should be closely analysed in an IPM plan because pesticide costs per pest can be high, as illustrated in Table 1.

Table 1: The potential costs of invertebrate pests in grain crops.[3]

Invertebrate pest	Representative pesticide control	Active ingredient	Chemical cost per ha
Snails			
Snails (various)	baits	metaldehyde	$12.00
Mites			
Redlegged earth mite	PSPE	bifenthrin	$1.60
Blue oat mite	PSPE	bifenthrin	$1.60
Bryobia (various) / Balaustium mite	pre-sowing and knockdown	omethoate	$1.90
Springtails			
Lucerne flea	PSPE	omethoate	$1.90
Aphids			
Aphids (various)	dimethoate	dimethoate	$6.25
Caterpillars			
Etiella moth	SP	alpha-cypermethrin	$2.55
Budworms	SP	alpha-cypermethrin	$2.55
Cutworms (various)	SP	alpha-cypermethrin	$0.64
Weed web moth	SP	alpha-cypermethrin	$2.55
Beetles			
Weevils (various)	SP	alpha-cypermethrin	$0.85
Earwigs			
European earwigs	no treatment*		
Additional Pests (N/A)			

PSPE: post sowing pre-emergent, SP: Synthetic pyrethroid
* Controls may be permitted under relevant State Pesticide Regulations

3 Murray, Dave, Clarke, Michael, Ronning, David (2013) GRDC, The current and potential costs of invertebrate pests in grain crops, https://grdc.com.au/resources-and-publications/all-publications/bookshop/2013/02/the-current-and-potential-costs-of-invertebrate-pests-in-grain-crops

FEEDBACK

MORE INFORMATION

GRDC 'Fact Sheet – Snail Management': https://grdc.com.au/Resources/Factsheets/2012/09/Snail-Management

DPIRD 'Identification and Control of Pest Slugs and Snails for Broadacre Crops in Western Australia': https://www.agric.wa.gov.au/grains/identification-and-control-pest-slugs-and-snails-broadacre-crops-western-australia?nopaging=1

IPM Guidelines 'Slugs and Snails': http://ipmguidelinesforgrains.com.au/pests/slugs-and-snails/

Pest Notes Southern 'Vineyard Snail': http://pir.sa.gov.au/__data/assets/pdf_file/0016/273004/Vinyard_snail.pdf/

Pest Notes Southern 'White Italian Snail': http://pir.sa.gov.au/__data/assets/pdf_file/0018/273006/White_Italian_snail.pdf

Pest Notes Southern 'Small Pointed Snail': http://pir.sa.gov.au/__data/assets/pdf_file/0011/272990/Conical_or_pointed_snail.pdf

6.4 Pest identification and management

In the southern region, there are many invertebrate pests that can cause damage to lupin crops.

The major pests of economic importance include:

- Snails
- RLEM
- Blue oat mites (*Penthaleus major*)
- Balaustium mites
- Lucerne flea (*Sminthurus viridis*)
- Aphids
- Lucerne seed web moth (*Etiella behrii*)
- Native budworm
- Cutworms (*Dasygaster discoideus*)
- Weed web moth (*Achrya affinitalis*)
- Grey-banded leaf weevil (*Ethemaia sellata*)
- European earwig (*Forficula auricularia*).

Most lupin crop pests can be controlled with appropriate insecticides, but resistance management should be carefully considered. Registered insecticides for pests of lupin crops are outlined in more detail in this chapter. It is advised to always check label actives and rates before use.

Some pests are better controlled using crop rotations, or other cultural means, as there may be no insecticide options available for use in lupin crops in the southern region.

6.4.1 Snails

There are several snail species that prey on lupin crops in the southern region. The main ones are:

Figure 1: *Conical or small pointed snail (Cochlicella barbara) on canola*

(SOURCE: GRDC)

FEEDBACK

Figure 2: *White Italian snail (Theba pisana)*

(SOURCE: GRDC)

Figure 3: *Vineyard or common white snail (Cernuella virgata)*

(SOURCE: GRDC)

Typical signs of snail presence in lupin crops include irregular pieces chewed from leaves and shredded leaf edges.

Cereal crops are likely to survive damage by slugs and snails, but canola and lupin typically cannot compensate for the damage or loss of cotyledons.

The rule of thumb is to monitor snail numbers on a regular basis and implement control prior to seeding. Baiting is the only option after the crop has been sown and germination has started.

FEEDBACK

Monitoring of snails in lupin crops involves:

- January/February – assess stubble management options for slug and snail management (including rolling or chaining paddocks to get snails to fall to the ground)
- March/April – assess options for burning and/or baiting
- May to August – assess options for baiting, especially along fence lines
- Three to four weeks before harvest – assess risk of snail contamination of grain and, if required, implement management tactics.

Control options should be considered when certain thresholds are met, as detailed in Table 2.

Table 2: Suggested thresholds for control of slugs and snails in broadacre crops.[4]

Species	Oilseeds	Cereals	Pulses	Pastures
Black keeled slug	1–2/m^2	1–2/m^2	1–2/m^2	5/m^2
Reticulated slug	1–2/m^2	5/m^2	1–2/m^2	5/m^2
Small pointed snail	20/m^2	40/m^2	5 per seedling	100/m^2
Vineyard snail	5/m^2	20/m^2	5/m^2	80/m^2
White Italian snail	5/m^2	20/m^2	5/m^2	80/m^2

Please note: the above thresholds are from limited data. It is essential to carefully monitor crops as distributions of snails and slugs are patchy. (SOURCE: DPIRD)

Pre-seeding management can help control snails in many areas.

An even burn of crop residues has been shown to achieve an 80-100 percent kill, but wind and water erosion risks should be carefully considered. Grazing stubbles during summer reduces ground cover and removes snail refuge areas. At seeding, the use of equipment with wide points, or full-cut discs to 5 centimetres, has been found to reduce snail numbers by up to 60 percent.[5]

Rolling or chaining paddocks can crush snails or knock them off stubble/plant material and on to the ground where there is little protection from heat. Rolling with a rubber or steel roller can crush a small percentage or snails, but eliminating elevated material – such as stubble – where snails aestivate and escape the heat is key to success.

Baits are a chemical control option for snails, but are only suitable for snails larger than seven millimetres in diameter. There is an associated kill rate of about 50 percent when bait is applied at a rate of five kilograms per hectare.[6]

Baiting can be more effective when carried out after rain in autumn, when snails are known to descend from the stubble or posts, begin to forage, mate and lay eggs.

Summer weed spraying and fence line weed control can assist in snail management.

4 DPIRD website (2016) Identification and control of pest slugs and snails for broadacre crops in Western Australia, www.agric.wa.gov.au/grains/identification-and-control-pest-slugs-and-snails-broadacre-crops-western-australia

5 DPIRD website (2016) Identification and control of pest slugs and snails for broadacre crops in Western Australia, www.agric.wa.gov.au/grains/identification-and-control-pest-slugs-and-snails-broadacre-crops-western-australia

6 DPIRD website (2016) Identification and control of pest slugs and snails for broadacre crops in Western Australia, www.agric.wa.gov.au/grains/identification-and-control-pest-slugs-and-snails-broadacre-crops-western-australia

FEEDBACK

MORE INFORMATION

Department of Agriculture Victoria 'Redlegged Earth Mite': http://agriculture.vic.gov.au/agriculture/pests-diseases-and-weeds/pest-insects-and-mites/redlegged-earth-mite

cesar 'Redlegged Earth Mite': http://www.cesaraustralia.com/sustainable-agriculture/pestnotes/insect/Redlegged-earth-mite

DPIRD 'Diagnosing Redlegged Earth Mite': https://www.agric.wa.gov.au/mycrop/diagnosing-redlegged-earth-mite

cesar 'RLEM Resistance Testing Service': email jmaino@cesaraustralia.com

6.4.2 Redlegged earth mites (*Halotydeus destructor*)

Figure 4: *Redlegged earth mites are a serious pest of lupin crops.*

(SOURCE: DPIRD)

Canola and pulse crops, including lupin, are most susceptible to Redlegged earth mite (RLEM) damage.

These mites also feed on broadleaf weeds in groups of about 30 and are most active between April and November in southern Australia.

The RLEM is called an 'earth' mite because it spends 90 percent of its time on the soil surface, rather than on the foliage of plants.

The mites feed on foliage for short periods and then move around to settle at the next feeding site.

When in high numbers, these pests are particularly damaging to seedlings of lupin, other legumes and oilseeds.

Monitoring of RLEM in lupin crops involves:

- Inspecting crops in autumn-spring for presence and damage
- Inspecting crops in the first three to five weeks after sowing
- Detecting in the morning or on overcast days
- Consider control if plants are not outgrowing damage.

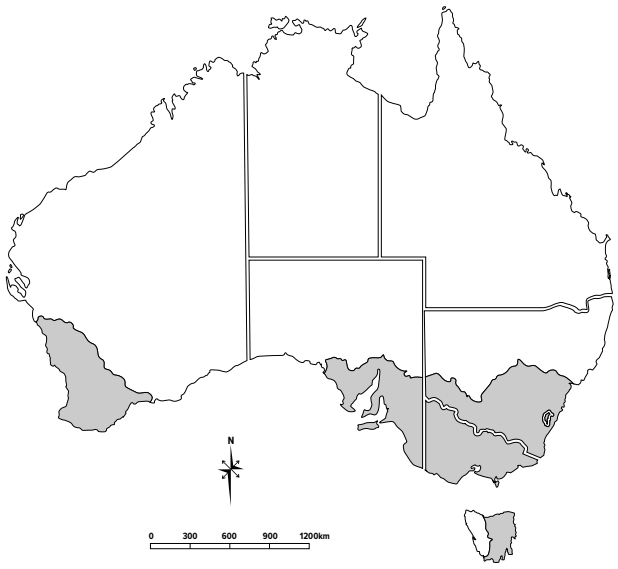

Figure 5: *Map showing occurrence of Redlegged earth mite.*

(SOURCE: P. Umina, **cesar**)

FEEDBACK

Early sown lupin crops have the best chance of getting away before populations of RLEM increase to damaging levels.

It is typically only necessary to treat RLEM with foliar insecticide if lupin seedlings are being attacked and damaged at emergence and cannot grow away from the damage.

Lupin seed can be treated with systemic insecticides to protect seedlings and contact insecticides can be used if severe attacks occur as plants emerge.

TimeRite® is an industry-developed management package that can be used for planning RLEM control in the spring (during a pasture phase) the year before lupin crops are sown.

RLEM with resistance to synthetic pyrethroids (SPs) have been detected by researchers in Australia and this is a risk for all southern region growers.

Management for resistance includes rotating insecticide actives in and between seasons.

Growers and advisers in the southern cropping region can access a testing service to determine whether RLEM populations in their paddocks are resistant to insecticides.

Knowing the resistance status of RLEM populations will assist in implementing appropriate and effective insect management strategies.

The RLEM insecticide-resistance testing service is being made available through a national project with GRDC investment led by the University of Melbourne in collaboration with **cesar**, CSIRO and Department of Primary Industries and Regional Development (DPIRD).

Any grower or adviser experiencing a chemical control failure involving RLEM, or suspecting issues with insecticide resistance, is encouraged to contact **cesar** and have specimens tested.

For low-moderate mite populations, insecticide seed dressings are an effective method of control. It is recommended to avoid prophylactic sprays and to apply insecticides only if control is warranted.[7]

Insecticides used at or after sowing should be applied within three weeks of the first appearance of mites, before adults start laying eggs. Insecticides do not kill mite eggs. Border spraying can be an effective way to control mites.

Pre and post-sowing weed management, particularly of broadleaf species, is vital when growing lupins.[8]

Non-chemical control options include grazing with livestock during summer or sowing non-susceptible crops in the rotation.

Approved insecticides for the control of RLEM in lupin crops in the southern region include:

- Beta-cyfluthrin (active approved, but no registered products are available)
- Lambdacyhalothrin
- Gamma-cyhalothrin
- Alpha-cypermethrin
- Methidathion
- Omethoate
- Dimethoate.

7 DPIRD website (2016) Diagnosing redlegged earth mite, https://www.agric.wa.gov.au/mycrop/diagnosing-redlegged-earth-mite

8 DPIRD website (2016) Diagnosing redlegged earth mite, https://www.agric.wa.gov.au/mycrop/diagnosing-redlegged-earth-mite

FEEDBACK

MORE INFORMATION

DPIRD 'Diagnosing Blue Oat Mite': https://www.agric.wa.gov.au/mycrop/diagnosing-blue-oat-mite

Pest Notes Southern 'Blue Oat Mite': http://www.herbiguide.com.au/Descriptions/hg_Blue_Oat_Mite.htm

Queensland Department of Agriculture 'Blue Oat Mite': https://www.daf.qld.gov.au/plants/field-crops-and-pastures/broadacre-field-crops/integrated-pest-management/a-z-insect-pest-list/mites-overview/blue-oat-mite

6.4.3 Blue oat mite (*Penthaleus major*)

Figure 6: *Blue oat mite are dark purple or blue with a red spot and can cause discoloration of crop leaves.*

(SOURCE: Andrew Weeks, **cesar**)

All crops, including lupin, are vulnerable to blue oat mite damage, particularly at the seedling stage.

Blue oat mites can be confused with RLEM, as they are dark purple/blue with a red spot on the back and eight orange legs.

Feeding by these pests on crops causes a silver or white discolouration of leaves and possible distortion or shrivelling if damage is severe.

Seedlings under stress from factors such as cold, waterlogging or dry conditions are more susceptible to damage.

To prevent population build up, insecticides should be applied within three weeks of the first appearance of mites before adults start laying eggs.

When monitoring for blue oat mite, consider these insects are active in winter and spring after hatching in autumn from summer laid eggs.

Mites are most easily seen in the late afternoon when they start feeding on leaves. Check from planting to early vegetative stage, particularly in dry seasons.

Blue oat mites have higher natural tolerance to a range of insecticides. The approved insecticide for control of blue oat mites in NSW (and WA) is chlorpyrifos..

Ensure sprays are applied at registered rates.

All currently registered insecticides are only effective when mites are at active stages.

For low-moderate mite populations, insecticide seed dressings are an effective option.

It is advised to avoid prophylactic sprays and apply insecticides only if control is warranted and mites are positively identified.

Insecticides used at or after sowing are best applied within three weeks of the first appearance of mites, before adults start laying eggs.

Foliar applications of insecticides may be cost-effective if applied within two or three weeks of emergence in autumn. The use of control tactics solely in spring will not prevent the carry-over of eggs into the following autumn.

FEEDBACK

MORE INFORMATION

Agriculture Victoria 'Balaustium Mite': http://agriculture.vic.gov.au/agriculture/pests-diseases-and-weeds/pest-insects-and-mites/balaustium-mite

DPIRD 'Diagnosing balaustium mite': https://www.agric.wa.gov.au/mycrop/diagnosing-balaustium-mite

HerbiGuide 'Balaustium Mite': http://www.herbiguide.com.au/Descriptions/hg_Balaustium_Mite.htm

6.4.4 Balaustium mites (*Balaustium medicagoense*)

Figure 7: *The balaustium mite adult reaches about 2 mm in length, with a rounded dark red-brown body and red legs with distinct short hairs on the body.*

(SOURCE: SARDI)

This emerging pest of the grains industry can be confused with other mites, but grows much bigger.

The adult reaches about 2 mm in length, with a rounded dark red-brown body and red legs with distinct short hairs on the body.

These insects are found across most agricultural regions in southern Australia, but are generally restricted to coastal areas.

They do not tend to be found too far inland or in the drier Mallee areas of Victoria and South Australia.

Balaustium mites can cause the cotyledons and leaves of lupin plants to have a leathery and silvered appearance. High numbers of the mites can give a bleached appearance.

Lupin crops can usually grow beyond the damage from these mites.

This insect is a concern in lupin in the southern region but the mites generally prefer feeding on grasses, cereals and weeds.

It is recommended to closely inspect susceptible pastures and crops from autumn to spring for the presence of mites and evidence of crop damage.

It is vital to monitor crops regularly in the first three to five weeks after sowing.

Lupin crops sown into paddocks that were grown to pasture the previous year should be regularly inspected for balaustium mites.

Weeds present in paddocks prior to cropping should also be checked for the presence and abundance of balaustium mites.

There is currently no chemical control registered in Australia for balaustium mite.

Alternative methods for control can be effective, such as removing summer weeds in and around paddocks. This mite particularly thrives when capeweed and grasses are present.

Crop rotation can also assist with control, by rotating susceptible crops such as cereals, lupins or canola, with a broadleaf plant such as vetch.

6.4.5 Lucerne flea (*Sminthurus viridis*)

Figure 8: *Lucerne flea typically moves up the lupin plant from ground level, eating tissue from the underside of foliage.*

(SOURCE: Andrew Weeks, **cesar**)

Lucerne flea is a green-yellow insect that has a furcula underneath its abdomen, which can be used to spring off vegetation when disturbed.

It is commonly found in South Australia and Victoria and is generally more problematic on loam/clay soils.

Lucerne flea pests are often sporadically distributed in paddocks and across a region.

The insect moves up the lupin plant from ground level, eating tissue from the underside of foliage.

It feeds through a rasping process, leaving behind a thin clear layer of leaf membrane that appears as transparent 'windows' through the leaf.

In severe infestations, this damage can skeletonise the leaf and stunt or kill plant seedlings.

Crops and pastures are most susceptible at the time of emergence.

The first soaking rains at the start of the growing season cause the over-summering eggs of lucerne fleas to hatch.

Several generations may develop during the growing season, depending on the weather. At the onset of warmer and drier conditions in spring, over-summering eggs are produced.

This pest is more common on heavier soils and rarely present on very sandy soils with low clay content.

SPs should be avoided for the control of lucerne fleas. Grazing management, border sprays or spot spraying can be sufficient to control populations.

Lupin crops are most likely to be damaged by lucerne fleas if planted in a paddock that grew a weed infested crop or a pasture in which lucerne fleas were not controlled during the previous spring.

Insecticides that control mites do not necessarily control lucerne flea.

MORE INFORMATION

Agriculture Victoria 'Lucerne Flea': http://agriculture.vic.gov.au/agriculture/pests-diseases-and-weeds/pest-insects-and-mites/lucerne-flea

DPIRD 'Diagnosing Lucerne Flea': https://www.agric.wa.gov.au/mycrop/diagnosing-lucerne-flea

IPM Guidelines 'Lucerne Flea': http://ipmguidelinesforgrains.com.au/pests/lucerne-flea-in-winter-seedling-crops/

cesar 'Lucerne Flea': http://www.cesaraustralia.com/sustainable-agriculture/pestnotes/insect/Lucerne-flea

Approved insecticides for control of lucerne fleas in lupins in the southern region include:

- Omethoate
- Methidathion
- Imidacloprid
- Dimethoate
- Chlorpyrifos.

6.4.6 Aphids (*Aphididae*)

Figure 9: *Aphids are a pest of lupin crops at the flowering stage.*
(SOURCE: GRDC)

Three main types of aphids can appear in southern region lupin crops during the flowering stage of growth. These are cowpea aphids (*Aphis craccivora*), Blue green aphids (*Acyrthosiphon kondoi*) and Green peach aphids (*Myzus persicae*).

Cowpea aphids are charcoal grey-shiny black and colonise single plants or groups in a 'hot spot' in the crop.

Blue green aphids are the same colour as lupin leaves and distribute evenly throughout the crop, but can congregate on some plants in larger population sizes.

Green peach aphids are pale green, similar to the lupin stem, and are usually found on the underside of older leaves. These usually cause less feeding damage than other aphid species.

Aphids cause the bulk of damage to lupin crops before plant symptoms are obvious. Typically, by the time symptoms are visible, yield loss that cannot be recovered by insecticide control will have occurred.

Winged aphids fly into lupin crops from surrounding vegetation and pastures.

Spring population size depends on autumn and winter conditions.

Long autumn growing periods allow early build-up and spread of aphids.

Mild (not cold) winters allow further development and spread of winged aphids, which can establish many small colonies across a crop.

Some lupin varieties are more susceptible to aphid feeding damage than others.

Aphids transmit two significant viruses in lupin: Cucumber mosaic virus (CMV) and Bean yellow mosaic virus (BYMV). More information about these diseases is outlined in Chapter 8.

MORE INFORMATION

DPIRD 'Identification of Aphids in Lupin Crops': https://www.agric.wa.gov.au/grains-research-development/identification-aphids-lupin-crops

IPM Guidelines 'Aphids in Pulses': http://ipmguidelinesforgrains.com.au/pests/aphids/aphids-in-pulses/

FEEDBACK

The threshold for aphid control with insecticide to produce a yield response in lupin crops is typically when 30 percent of flowering buds have more than 30 aphids.[9]

The best method to estimate numbers is to check at several points in the paddock and inspect flowering heads at random.

When deciding on control measures, it is advised to consider any other beneficial insects, such as hover flies, ladybirds, lacewings and parasitic wasps that attack aphids and keep populations low.

It is recommended to use targeted aphid insecticides only and leave beneficial insects unharmed.

Other aphid management strategies for lupin crops include:

- High seeding rates to generate dense crop stands
- Cereal barriers around the crop
- Heavy grazing of adjoining pasture paddocks to reduce aphid numbers
- Strategic aphicide/insecticide sprays.

Some aphid populations are resistant to pirimicarb, SPs and organophosphates (OPs). The level of resistance to OPs appears to have plateaued in southern Australia in recent years.

Populations of GPA were found to be resistant to neonicotinoid insecticides (commonly used in seed treatments) for the first time in Australia in late 2016.

Approved insecticides for control of aphids in the southern region include:

Cowpea aphid

Methidathion (SA only)

Dimethoate.

Blue green aphid

Dimethoate.

Green peach aphid

Pirimicarb

Petroleum Oil

Paraffinic Oil (suppression only in some states, check label)

Dimethoate.

6.4.7 Lucerne seed web moth (*Etiella behrii*)

Lucerne seed web moths are grey brown with a stripe on each forewing and an orange band across the wing base.

This pest is widespread throughout Australia and a serious problem in SA and VIC.

Lucerne seed web moths produce three to four generations each year in spring, summer and autumn.

Newly hatched larvae feed on the seed in lupin crop pods.

The damaged seeds have jagged edges similar to native budworm damage, but are distinguished by the presence of webbing in the pod.

In most seasons, this pest causes little damage to seed.

It is typically only in years when numbers are high that significant yield losses have been reported. But unless the crop is carefully monitored at regular intervals, considerable damage may occur.

MORE INFORMATION

IPM guidelines 'Etiella': http://ipmguidelinesforgrains.com.au/pests/etiella/

cesar 'Lucerne Seed Web Moth or Etiella': http://www.cesaraustralia.com/sustainable-agriculture/pestnotes/insect/Lucerne-seed-web-moth-or-Etiella

9 DPIRD-GRDC (2016) MyCrop Lupin diagnostic tool, Diagnosing aphids in narrow leafed lupins, https://www.agric.wa.gov.au/mycrop/diagnosing-aphids-narrow-leafed-lupins

FEEDBACK

MORE INFORMATION

DPIRD 'Diagnosing Native Budworm in Narrow-leafed Lupins': https://www.agric.wa.gov.au/mycrop/diagnosing-native-budworm-narrow-leafed-lupins

DPIRD 'Management and Economic Thresholds for Native Budworm: https://www.agric.wa.gov.au/grains/management-and-economic-thresholds-native-budworm?page=0%2C4#smartpaging_toc_p4_s1_h3

Pest Notes Southern 'Native Budworm': http://www.pir.sa.gov.au/__data/assets/pdf_file/0005/274181/Native_Budworm.pdf

IPM Guidelines 'Native Budworm in Winter Pulses': http://ipmguidelinesforgrains.com.au/pests/helicoverpa/native-budworm-in-winter-pulses/

Pulse Australia Southern 'Pulse Bulletin, Managing Native Budworm in Pulse Crops: http://www.pulseaus.com.au/storage/app/media/crops/2010_SPB-Pulses-native-budworm.pdf

Agriculture Victoria 'Native Budworm': http://agriculture.vic.gov.au/agriculture/pests-diseases-and-weeds/pest-insects-and-mites/native-budworm

There are several insecticides registered for use on lucerne seed web moth and it is advisable to carefully check labels for use in lupin crops in each State. Insecticides should be considered when moth activity is first observed in lupin crops.

When eggs have been laid and larvae have bored into seed pods, insecticide applications are mostly ineffective as the larvae are protected from sprays.

Time of sowing and variety selection (choosing early maturing lines) can result in crops flowering and setting pods prior to peak activity of lucerne seed web moths.

The risk period is when pods are green. Dry pods are not at risk.

6.4.8 Native budworm (*Helicoverpa punctigera*)

Figure 10: *The larvae of native budworm are shades of orange, brown and green with dark stripes on the body.*

(SOURCE: SARDI)

Budworm can develop big populations on native plants and then migrate into agricultural areas in late winter and spring.

The larvae are shades of orange, brown and green with dark stripes on the body.

Adult moths are about 15-18 mm in length and a buff, light brown to red-brown colour, with numerous dark spots and blotches.

The hind wings of the adult moth are pale, with a dark band along the lower edge, and span 30-35 mm.

Caterpillars feed on leaves and stems until the crop nears maturity, when they are attracted to the pods. These insect pests drill through the pod wall and eat the seeds.

Pod walls are not penetrated until the caterpillars are more than 15 mm in length.

Damage to narrow leafed lupin typically occurs when plants are close to maturity and the pods are losing their green colour. Symptoms include chewing to leaves, flowers and pods.

A decision to treat a lupin crop for budworm should not be made until damage is about to occur and the pods are beginning to mature.

Natural mortality of budworm populations is sometimes sufficient to prevent economic damage.

It is best practice to sample the crop to estimate the number of caterpillars present. If possible, use a sweep net.

FEEDBACK

The number of caterpillars caught in 10 sweeps of a sweep net is equivalent to about the number in one square metre of crop.

At least five lots of 10 sweeps are needed in several parts of the crop for an adequate sample.[10]

Approved insecticides for control of budworm in lupin crops in the southern region include:

- Zeta-cypermethrin (SA only)
- Spinetoram
- Nuclear Polyhedrosis virus of helicoverpa armigera
- Methomyl
- Lambda-cyhalothrin
- Esfenvalerate
- Deltamethrin
- Cypermethrin
- Beta-cypermethrin
- Bacillus thuringiensis subsp kurkstaki strain HD-1
- Alpha-cypermethrin.

6.4.9 Cutworms (*Agrotis* spp.)

Figure 11: *Larvae of cutworms can feed on young plants and stems at or below the soil surface and often cut off entire plants.*

(SOURCE: SARDI)

These pests feed on all crop and pasture plants, including lupin, causing damage near to the ground.

The caterpillars hide under the soil or litter by day. When mature, they pupate in the soil.

The common name 'cutworm' refers to the habit of large larvae feeding on young plants and stems at or below the soil surface and often cutting off entire plants.

Cutworm caterpillars grow to about 40 mm in length but cannot typically be seen, as they hide under the soil or litter. Often they can be located by scratching the surface near damaged plants, where they are typically curled up in a defensive position.

MORE INFORMATION

DPIRD 'Cutworms': https://www.agric.wa.gov.au/pest-insects/cutworm-pests-crops-and-pastures

DPIRD 'Diagnosing cutworm in canola and pulses': https://www.agric.wa.gov.au/mycrop/diagnosing-cutworm-canola-and-pulses

cesar 'Cutworms': http://www.cesaraustralia.com/sustainable-agriculture/pestfacts-south-eastern/past-issues/2014/pestfacts-issue-no-4-5th-june-2014/cutworms/

PIRSA 'Cutworm alert': http://www.pir.sa.gov.au/research/services/reports_and_newsletters/pestfacts_newsletter/pestfacts_issue_3_2016/cutworm_alert_for_the_sa_mallee

10 DPIRD website (2016) Managing insects, weeds and disease in albus lupin variety Andromeda, https://www.agric.wa.gov.au/lupins/managing-insects-weeds-and-disease-albus-lupin-variety-andromeda

FEEDBACK

These pests are most damaging in autumn when large caterpillars transfer from summer and autumn weeds on to newly emerged crop seedlings.

Whole paddocks of cereal, lupin or canola seedlings may be destroyed or severely thinned early in the season. Therefore, early detection is important.

If required, cutworms can be easily controlled with standard registered insecticides and spot spraying affected areas can often provide adequate control.

Early and complete control of the green bridge two weeks before planting will minimise survival of cutworm larvae.

Approved insecticides for use on cutworm in lupins in the southern region include:

- Zeta-cypermethrin (75 mL/ha Fury® 100EC)
- Deltamethrin (200 mL/ha)
- Beta-Cypermethrin (90 mL/ha)
- Alpha-Cypermethrin (75 mL/ha).

6.4.10 Weed web moth (*Achrya affinitalis*)

Figure 12: *Weed web moth larvae. This is a sporadic pest of lupin in the southern region.*

(SOURCE: Andrew Weeks, **cesar**)

Weed web moth larvae are slender and grow to 15 mm in length, are grey-green and pale brown in colour and have a distinctive black head.

These pests generally have a dark line down the middle of their back, with three rows of dark spots on either side above distinctive cream bands.

When disturbed, larvae wriggle violently or crawl around rapidly.

Moths are about 12 mm in length, with buff coloured wings that have darker brown or reddish flecks, mainly on the forewings.

When monitoring, check all young broadleaf crops for leaf feeding and webbing.

This sporadic pest is often abundant in seasons with early autumn rainfall and warm weather.

MORE INFORMATION

PIRSA 'Weed Web Moth':
http://www.pir.sa.gov.au/research/services/reports_and_newsletters/pestfacts_newsletter/pestfacts_issue_1_2016/weed_web_moth

cesar 'Weed Web Moth':
http://www.cesaraustralia.com/sustainable-agriculture/pestfacts-south-eastern/past-issues/2010/pestfacts-issue-no-1-28th-april-2010/weed-web-moth/

FEEDBACK

The weed web moth skeletonises foliage and web leaves together. Seedlings can be defoliated and die. Infested paddocks look wilted.

Monitor crops after emergence, as seedlings are at most risk of damage. Look for early infestation signs such as terminal damage, webbing and windowing of leaves. Moths can migrate from long distances and larvae can suddenly appear in very large numbers.

Insecticide use can be warranted if large numbers build up. This typically occurs where there has been an abundance of green plant material during spring and summer.

Management difficulties have occurred in the past in the southern region because this pest requires higher rates of insecticides than commonly used against cutworm and pasture webworm.

There are registered insecticides available for use in lupin crops and it is advised to closely check labels in each state.

6.4.11 Grey-banded leaf weevil (*Ethemaia sellata*)

Figure 13: *The Grey banded leaf weevil is widespread across the southern cropping region and tends to be found close to fence lines.*

(SOURCE: Andrew Weeks, **cesar**)

Adult grey-banded leaf weevils are known to attack several winter crops, including canola and lupin, and may also be a grain contaminant at harvest.

It is understood these pests may feed preferentially on malvaceous weeds (such as marshmallow, *Althaea officinalis*) and some ornamental plants that could be the source of infestations in crops.

This weevil species is widespread across the southern cropping region.

It is recommended that crops are monitored closely, particularly near fence lines, as adults tend to move into crops from host weeds and scrub.

Damage includes leaf scalloping, chewing of leaf edges and thinning of plants.

An insecticide border spray at crop emergence can help to control grey-banded leaf weevil before it moves into the crop.

MORE INFORMATION

DPIRD 'Diagnosing Weevils in Lupins and Field Peas': https://www.agric.wa.gov.au/mycrop/diagnosing-weevils-lupins-and-field-peas

cesar 'Grey-banded Leaf Weevil': http://cesaraustralia.com/sustainable-agriculture/pestfacts-south-eastern/past-issues/2009/pestfacts-issue-no-6-16th-july-2009/grey-banded-leaf-weevil/

Pest Facts 'Issue 5, 2015': http://www.pir.sa.gov.au/research/services/reports_and_newsletters/pestfacts_newsletter/pestfacts_Issue_5_2015/pestfacts_issue_5,_2015_-_single_page_view

FEEDBACK

Paddock boundaries should be checked every few days until the crop has four to five true leaves.

There are no insecticides registered to control grey-banded leaf weevils in lupin crops. Weevil numbers in crop can be reduced by controlling plant hosts, such as capeweed (*Arctotheca calendula*) and marshmallow, before sowing.

6.4.12 European earwig (*Forficula auricularia*)

Figure 14: *Parts of the southern cropping region have European earwig problems in lupin crops.*

(SOURCE: Nick Monaghan, lifeunseen.com)

Minimum and no-tillage farming operations have led to an increase in European earwig populations in some southern areas.

Adult earwigs range from 12 to 20 mm in size, with brown bodies and pincers.

These insects will usually complete one generation per year and can survive in a range of environments.

Adults are inactive during summer and juveniles become active in winter and then mature during spring.

European earwigs are nocturnal and crop monitoring should take place at night.

This pest mainly attacks canola but will also target cereals and lupin.

Damage will be scattered and clear chewing of the stems and leaves of emerging seedlings will be evident.

Earwigs can kill the crop plants, slow development and chew through seed pods.

In most years, control is not economical and there are no in-crop insecticide options for use in lupin.

Spread of these insect pests can be minimised by ensuring all machinery, vehicles and equipment are clean. Reducing stubble retention and burning stubbles are also successful methods to reduce populations, but it is advised to be mindful of the risks of wind and water erosion.

MORE INFORMATION

HerbiGuide 'European Earwig': http://www.herbiguide.com.au/Descriptions/hg_European_Earwig.htm

DPIRD 'Management of the European Earwig': https://www.agric.wa.gov.au/pome-fruit/management-european-earwig?page=0%2C1

DPIRD 'Diagnosing the European Earwig': https://www.agric.wa.gov.au/mycrop/diagnosing-european-earwig

cesar 'European Earwig': http://www.cesaraustralia.com/sustainable-agriculture/pestnotes/insect/European-earwig