

DIAMONDBACK MOTH IN CANOLA FACT SHEET

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WESTERN AND SOUTHERN REGIONS

Diamondback moth a sporadic but serious pest

Crop monitoring from July is key to the control of diamondback moth.

KEY POINTS

- DBM can be a serious pest of canola and is found in all grain growing regions.
- DBM outbreaks have become more frequent and severe in recent years, particularly in areas and seasons with mild winters.
- The key to DBM control is to monitor crops from mid July onwards.
- Resistance to commonly used insecticides is a major concern.
- In high-risk situations two or more sprays may need to be applied within seven days of each other to control DBM.
- Spray application withholding periods before harvest and at windrowing are the same.

Diamondback moth (DBM) is an occasional pest of canola, brassica vegetables and forage crops. Diamondback moth larvae feed on plant foliage, stems, flower heads and pods, and can be responsible for yield losses of up to 80 per cent.

In some regions, the frequency and severity of diamondback moth outbreaks have increased markedly in the past decade. This is exacerbated by mild, dry winter conditions and the ability of the moth to rapidly develop insecticide resistance.

About diamondback moth

Diamondback moths (*Plutella xylostella*) are 10 millimetres long and grey-brown in colour. They have a white diamond patterned stripe of uneven width down



Diamondback moth

the centre of the back when the wings are folded over the body.

Eggs are pale yellow, oval and about 0.5mm in length.

DBM larvae grow to 12mm in length, are pale yellowish-green and tapered at both ends. The larvae go through four growth stages and have a dark head in the first two stages. Larvae wriggle when disturbed and often drop from a plant on a silken thread.

Mature larvae spin gauze-like cocoons, usually on the underside of leaves. The pupa visible inside the cocoon starts off green and turns

brown before emerging as an adult moth.

DBM are active at dusk and throughout the night, but usually do not fly far within a crop. They can migrate long distances on prevailing winds, especially when their host plant has died.

Lifecycle

DBM survive between growing seasons on summer brassica weeds such as wild radish and Lincoln weed. Summer rainfall will increase the 'green bridge' and DBM populations.

In autumn to early winter DBM fly from alternate hosts into canola crops.

Female moths can lay more than 100 eggs in their lifetime, singly or in small clusters along the leaf vein on both sides of plant leaves. Eggs hatch after four to six days with the first stage of the larvae burrowing into the leaf tissue.

The next three stages of the larvae feed on the plant surface and are usually found on the underside of the leaves.

The rate of development from eggs to moths depends on temperature; quicker in warm weather and slower in cool weather.

At 28°C the lifecycle takes 14 days, whereas at 12°C the lifecycle takes more than 100 days.

In warm weather there is often considerable overlap in generations, and all stages of the DBM lifecycle may be present in a crop at any one time.

DBM populations can suddenly crash and the reason for this is only partially understood. One factor is likely to be the outbreak of fungal diseases during wet, warm weather.

Damage

DBM larvae can cause extensive damage to canola, but this does not happen in all years.

The damage caused by newly hatched larvae appears as characteristic pale white traces. Older larvae feed on the underside of the leaves and cause holes with the upper leaf surface intact, often creating a 'window'.

Larvae can be found at any stage of a canola crop's development, with their numbers often increasing in the lead up to flowering. Canola can tolerate considerable leaf damage before crop yield is affected. However, severe infestations of DBM larvae can cause complete defoliation and substantial yield losses.

As flowering progresses, increasing numbers of larvae move to the floral buds, flowers and pods. Large larvae may feed on small young pods while mature pods are usually only surface grazed.

Damage to mature canola plants during the late spring by rising populations of DBM often causes visible scarring of the outer pod walls, but this rarely results in any economic loss.



PHOTO: SARDI

Monitoring for infestations

Crops should be monitored using an insect sweepnet at the first sign of damage and at intervals throughout the growing season from mid July through to late spring/early summer. Numbers are likely to increase quickly if DBM infest canola early in the season and there is a strong chance of prolonged warm weather for the pest to complete three or four generations.

Sampling should be carried out at a minimum of four separate locations within each canola crop to gain an estimate of DBM numbers and how they vary throughout the paddock.

Two sets of 10-sweep samples should be taken at each of the four locations, giving a total of eight 10-sweepnet samples. Empty the contents of each set of 10-sweeps onto a white or light coloured surface, for example the bonnet of a white ute, and count the number of larvae. Note the sizes of the DBM larvae and the presence of other insects, especially native budworm caterpillars.

At least three estimates of larval density over 12 days will determine whether the number of larvae is increasing or decreasing. On each occasion, eight or more 10-sweep samples should be taken throughout the crop. If no DBM are detected the crop should be monitored again in a fortnight.

Cool, wet, windy weather can reduce DBM numbers. Numbers of larvae can also decline from the impact of beneficial insects and insect diseases.

When to act

There is no simple 'one figure fits all' for spraying. Thresholds varying from 50 to 100 larvae per 10-sweeps, depending on the crop growth stage, grain price and the cost of spraying. The higher the grain prices the lower the threshold and conversely the higher the spray cost the higher the threshold. Variation in regional and seasonal conditions also influences spray threshold levels.

As canola develops, it can tolerate increasing numbers of DBM without any significant yield loss. The following levels are a guide to spray decisions.

- Pre to early-flowering – if average numbers exceed 10 larvae in 10-sweeps then a major outbreak could develop. Continue weekly monitoring if average numbers are less than 10 and twice a week monitoring if numbers exceed 10.
- Early to mid-flowering and pod formation – if average numbers reach 50 or more larvae in 10-sweeps, spraying should be considered. This threshold increases later in the season.
- Late flowering and most pods are formed – if the average number of larvae is greater than 100 per 10-sweeps, spraying should be considered.

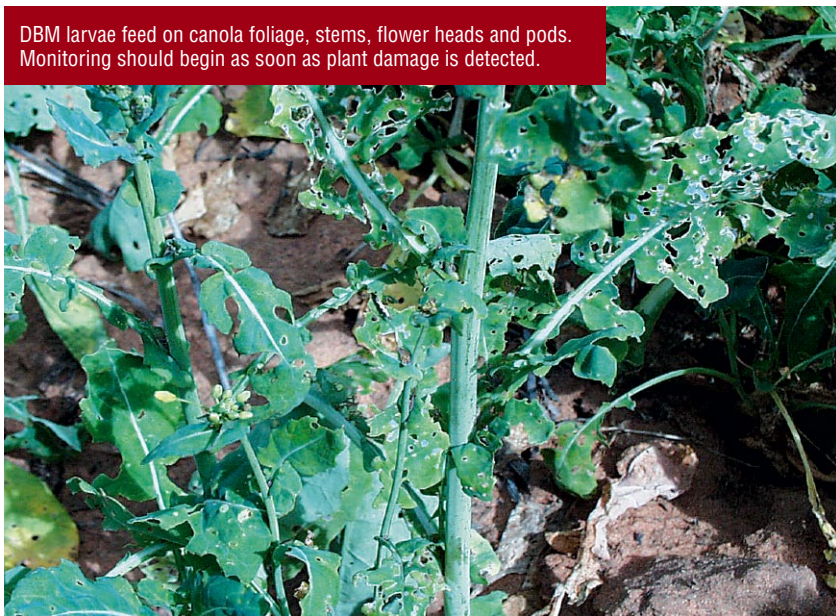
A high number of small larvae (less than 3mm long) indicates numbers are likely to increase further.

Crops should be monitored with an insect sweepnet throughout the season.



PHOTO: EMMA LEONARD

DBM larvae feed on canola foliage, stems, flower heads and pods. Monitoring should begin as soon as plant damage is detected.



Moisture-stressed crops are more susceptible to insect damage and a lower threshold may be used if extended dry periods are anticipated.

Control measures

No insecticide registered for control of DBM will completely eliminate the population.

DBM has developed widespread resistance to older insecticides such as synthetic pyrethroids and organophosphates, especially in horticultural areas, as a result of generational turnover and the frequent use of these insecticides. Poor application of insecticides is also likely to have contributed to the development of resistance.

Once sweepnetting indicates DBM larval densities are at the spray threshold, a quick response with two spray applications (three to seven days apart) can give adequate control of larvae and reduce yield losses. This two-spray strategy ensures DBM eggs and larvae that survive the first application are controlled.

Growers should note that withholding periods before harvest are the same as for windrowing, as it is considered a harvest event.

Research in the northern WA grain belt found a single spray in mid-August had little impact on the damage caused by DBM.

Many chemicals are registered for use

against DBM. The period between reapplication may vary with choice of chemical. Users must abide by registrations details on the product label.

Sweepnet sampling of the crop three to five days after the first spray should occur to assess the effectiveness of the spray and to determine surviving numbers before the second spray is applied.

Achieving good chemical penetration into a canopy crop is important as about 20 per cent of DBM larvae are found on the lower plant canopy.

Trials show aerial (CP90 nozzles with 30L/ha of water) and ground-based applications (flat fan 11015 nozzles with 50L/ha of water) are equally effective at providing water rates and droplet size to achieve good leaf coverage and spray penetration to lower leaves.

Where 'soft' chemicals are used that are less disruptive to beneficial insects, such as *Bt* (*Bacillus thuringiensis*), the majority of larvae should be less than 5mm in length. *Bt* is broken down by ultraviolet light so the best results are achieved when applied at dusk.

Integrated management

A number of beneficial insects attack DBM. These include parasitic wasps *Diadegma semiclausum*, *Apanteles ippeus* and *Diadromus collaris*. These wasps lay their eggs inside DBM eggs or larvae (depending on species), where the developing wasp larvae feed inside. The parasitised egg or larvae turns black and fails to develop.

Predators including brown and green lacewings, several predaceous bugs and a range of spiders feed on DBM eggs, larvae and pupae. In many years these insects can be enough to prevent economic damage to canola crops.

Beneficial insects should be encouraged by better targeting and reducing insecticide applications, as well as providing alternate food sources and refuge habitat around crops. A fungus, *Zoophthora radicans*, can cause a 90 per cent reduction in DBM larvae numbers. The fungus is favoured by rainfall, humidity and warm temperatures. Diseased larvae become yellowish, sluggish and swollen before dying. Dead larvae are white, brittle, flat and covered with fungus and attached to the plant leaves.

Summer weeds provide a 'green bridge' on which DBM can survive over summer. Controlling these weeds near paddocks to be sown into canola can help break the green bridge.

Frequently asked questions

When is the best time to look for DBM?

Start looking for DBM larvae and damage to leaves when crops start flowering. Check crops regularly. Monitoring is the key to assessing the risk of a DBM outbreak.

How do I know the extent of the infestation?

Crops should be monitored with a sweepnet to gain an idea of the prevalence of, and changes in DBM populations and stages of development.

Sampling should be done in at least four separate locations within a canola paddock. Two lots of 10-sweep samples should be taken at each location giving a total of at least eight 10-sweep samples. Empty the contents of each 10-sweep sample and count the larvae to establish an average number per crop.

If no DBM are detected then resample the crop in a fortnight.

Cool, wet, windy weather can reduce numbers. Numbers can also decline from the impact of beneficial insects and insect diseases.

When do I spray?

As canola develops it can tolerate increasing numbers of DBM without any significant yield loss.

In early flowering canola, if larval numbers exceed 10 in 10-sweeps then a major outbreak could develop. Continue crop monitoring.

During flowering and pod formation if average numbers of 50 or more larvae per 10-sweeps are found (and the numbers fail to decline after seven to 12 days) spraying should be considered. This threshold increases later in the season.

When crops are at late-flowering and most pods are formed the average number of DBM larvae needs to exceed 100 larvae per 10-sweeps to warrant spraying.

Are withholding periods before harvest the same as for windrowing?

Yes. Windrowing is considered a harvest event.

What is the best control option?

No registered DBM treatment completely removes DBM. Around 20 per cent of DBM larvae are found on the lower part of the canola canopy, which makes good spray coverage important.

In years when outbreaks of large DBM populations occur, two spray applications three days apart have given significantly greater control of caterpillars and reduced yield loss. This two-spray strategy ensures that DBM eggs and caterpillars that survive the first application are also controlled.

Sweepnet sample the crop three to five days after the first spray occurs to assess the effectiveness of the first spray and to determine surviving numbers before a second spray is applied.

Useful resources:

■ Greg Baker, SARDI	08 8303 9544 Email greg.baker@sa.gov.au
■ Peter Mangano, DAFWA	08 9368 3753 Email pmangano@agric.wa.gov.au
■ Svetlana Micic, DAFWA	08 9892 8591 Email smicic@agric.wa.gov.au
■ Paul Umina, CESAR	03 9329 8817 Email pumina@unimelb.edu.au
■ Ground Cover Direct:	free phone 1800 11 00 44, www.grdc.com.au/bookshop
■ <i>Canola: the Ute Guide</i>	
■ <i>Crop Insects: The Ute Guide (Southern Region Grain Belt edition)</i>	
■ <i>Crop Insects: The Ute Guide (Western Grain Belt edition)</i>	
■ <i>Crop Insects: The Ute Guide (Northern Grain Belt edition)</i>	
■ <i>Back Pocket Guide to Beneficial Insects (Western and Southern Grain Belt editions)</i>	
■ Other related GRDC Factsheets	www.grdc.com.au/factsheets
■ GRDC Pest Links	www.grdc.com.au/pestlinks
■ Pest Genie	www.pestgenie.com.au
■ CESAR Consultants	www.cesarconsultants.com.au/services/agriculture
■ <i>Integrated Pest Management for Crops and Pastures</i> (2008), Paul Horne and Jessica Page, Landlinks Press	www.ipmtechnologies.com.au

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