

## Bertha Armyworm

**B**ertha armyworm (*Mamestra configurata*) is one of the most significant insect pests of canola in Canada. It occurs throughout Manitoba, Saskatchewan, Alberta and the interior of British Columbia. Severe infestations can occur throughout most of this area but are usually limited to the parkland area of the Prairies and the Peace River region of British Columbia and Alberta.

Bertha armyworm is native to North America and belongs to a group of insects referred to as "climbing cutworms." Also included in this group are the true armyworm and variegated cutworm.

In most years, populations are kept low by unfavorable weather conditions such as cold winters and cool wet weather, and by parasites, predators and diseases. But when these natural regulators fail, populations can increase dramatically, creating the potential for widespread damage to a variety of broad-leaved crops.

In extreme situations, infestations of more than 1,000 larvae per square metre have been reported while densities of 50 to 200 larvae per square metre may be common.

Infestations may be localized or spread over millions of acres. Widespread crop losses can be minimized with insecticides if the infestation is detected early. However, failure to detect infestations early may result in insufficient time to apply the chemicals before severe damage is done. Also, there may be temporary insecticide shortages if suppliers are not aware of the potential outbreak.

### Life Cycle

Bertha armyworms develop through four distinct stages: adult, egg, larva and pupa. In Canada, there is one complete generation per year.

### Adults

The adult stage is a moth. Moths begin emerging from the over-wintering pupae in early to mid-June and continue until early August.

It is suspected that moths are strongly attracted to canola fields that are in bloom and secreting nectar. Adult moths mate within five days of emergence and lay their eggs on the host plants. Each female moth will lay about 2,150 eggs but numbers as high as 3,500 eggs per female have been recorded.

The moth has a wing span of about 4 cm (1.5 in.) and is active only at night. The forewing is predominantly gray, and flecked with patches of black, brown, olive and white scales. Near the middle of the forewing, towards the leading wing margin (front), there is a prominent, white, kidney-shaped marking defined with a ring of whitish scales. Near the tip of the forewing, there is a conspicuous white and olive-colored, irregular transverse marking that is characteristic of the species.

### Eggs

Bertha armyworm eggs are laid in single-layered clusters of about 50 to 500 eggs on the lower surface of the host plant leaves. The eggs are sculptured, ridged and pinhead in size. When first laid, they are white but become darker as they develop. At average temperatures, the eggs hatch within a week.

### Larvae

Newly hatched bertha armyworm larvae are about 0.3 cm (1/10 in.) long. They are pale green with a pale yellowish stripe along each side. Because of their size and color, they are difficult to see on the underside of leaves.

When disturbed, small larvae may drop off the leaves by a fine silken thread. This behavior makes it difficult to distinguish small bertha armyworm larvae from those of the diamondback moth, which

display a similar behavior. Large larvae may drop off the plants and curl up when disturbed, a defensive behavior typical of cutworms and armyworms.

Larvae take approximately six weeks to complete their development, depending upon temperature. During this period, they moult five times and pass through six growth stages. As they mature, their color becomes variable. Some remain green, but many become brown or velvety black.

At maturity, the larvae are about 4 cm (1.5 in.) long, with a light brown head and a broad, yellowish-orange stripe along each side. The velvety black larvae have three narrow, broken white lines on their backs.

At maturity in late summer or early fall, larvae burrow into the ground and form pupae.

## Pupae

Bertha armyworms survive the winter as pupae in the ground at depths of 5 to 16 cm (2 to 6 in.). The pupa is a pod-like structure that protects the bertha armyworm while it transforms from the larval stage to the adult moth.

Pupation usually begins in mid to late August. All larvae will have pupated by early to mid September. If the autumn is unusually warm, some pupae may continue their development and emerge as moths in late August or September, only to perish when winter arrives.

Pupae are reddish brown in color, about 0.5 to 1.8 cm (0.2 to 0.7 in.) in size and tapered with flexible, terminal abdominal segments. Bertha armyworm pupae are indistinguishable from other cutworm pupae.

## Host Plants and Damage

Larvae are the only development stage of the bertha armyworm to cause crop damage. They feed on a variety of crops and weeds. Canola, rapeseed, mustard, alfalfa, lamb's quarters and related plants are preferred host plants. Bertha will also feed on a range of secondary hosts including flax, peas and potato.

The degree of crop damage varies with the crop, the plant's growth stage, the growth stage of the larvae and the number of larvae present. Significant crop damage usually occurs within a three-week period between late July and late August, depending on the season and crop location.

Small larvae feed on the underside of the leaves, chewing irregularly-shaped holes in the leaves. They usually cause little damage at this stage, even when

population levels are high. Crop damage occurs rapidly once the larvae moult to the second-last stage. These larvae are about 1.3 cm (2 in.) in length. Larvae in the last two larval stages eat about 80 to 90 percent of the plant material consumed during the life of the larvae.

If the plants, especially canola, drop their leaves before the larvae are mature, the developing larvae will feed directly on the seed pods. Seed pods may be "debarked," but more commonly, the larvae chew holes in the pods and eat the seeds. At high numbers, the entire seed pod may be consumed. Even if the pods are only stripped of their outer green layer and not eaten entirely, crop losses may still occur because of premature shattering.

In flax, the larvae eat the flowers and developing bolls. Once the flax bolls are full-size and start to ripen, larvae usually feed on the calyx below the boll. Occasionally, larvae will feed on the green stems of ripening bolls, causing them to drop off.

## Monitoring

The number of bertha armyworm larvae in a crop one year is not a reliable indicator of what to expect the following year. Bertha armyworm populations fluctuate widely from year to year. To assist producers with making crop protection decisions, a monitoring program has been implemented for the Canadian Prairies.

### Adult populations

The development of the overwintering stage of bertha armyworm, the pupae, into moths is monitored using accumulated degree-days. The flight of bertha armyworm moths is monitored using pheromone-baited traps which attract the male moths. The number of moths collected by these traps gives an indication of the risk of bertha armyworm larval infestations. Generally, higher numbers of moths during the flight period (around mid June through July) indicate greater risk of larval damage (in July and August). Crop protection recommendations for producers based on data for the current year are given as a bertha armyworm risk assessment.

### Larval populations

Regular monitoring of bertha armyworm larvae will allow early detection and minimize crop losses. Larval monitoring should begin about two weeks after peak trap catches and continue until either the mean number of larvae per square metre exceeds the economic threshold (at which point the crop is sprayed) or the crop is swathed.

It is important to monitor larval numbers in each field. Adjacent fields may have very different larval densities, depending upon how attractive the crop was when the moths were laying their eggs. Adjacent fields may also have different-sized larvae, depending on when the eggs were laid.

For accurate larval estimates in a crop, sample at least three locations a minimum of 50 metres apart. Do not sample headlands (20 metres wide) and areas within the crop that are not representative of the field.

At each location, mark out an area of one metre square and beat the plants growing within that area to dislodge the larvae. Push the plants aside or remove them and count the number of larvae in the square metre area. It is important to take your time while counting larvae. Carefully search the soil and leaf litter. The larvae are difficult to see and may be hidden underneath clumps of soil, in cracks in the soil or within curled leaves. Use the average number of larvae at the sites surveyed within each field to determine if the economic threshold has been exceeded and an insecticide is necessary.

## Economic Thresholds – When to Take Action

Insecticide application is recommended when bertha armyworm larvae are abundant enough that the value of the crop they consume is greater than the cost of controlling them. This number is called an economic threshold.

The economic threshold for bertha armyworm varies with the cost of the insecticide, the method of application and the crop's value. For instance, spraying would not be economical if larval counts were less than 19 per square metre given a crop price of \$8.00 per bushel and a spray cost of \$9.00 per acre.

## Control

In most years, bertha armyworms are controlled naturally by biological or environmental factors.

### Environmental control

Environmental conditions have a significant impact on bertha armyworm populations, especially on the overwintering pupae. During harsh winters in snow-free fields, most bertha armyworm pupae die. Bertha armyworm outbreaks appear to be favored by snow accumulation, which protects pupae from prolonged exposure to temperatures below -10°C.

The trend toward reduced tillage and stubble conservation results in more snow accumulation on infested fields and could favor bertha armyworm survival, especially in years with early snowfall.

Newly hatched larvae are especially vulnerable to inclement weather and diseases.

### Biological control

A number of diseases and parasites attack the bertha armyworm, including:

- a nuclear polyhedrosis virus
- an ichneumonid wasp (*Banchus flavescens*)
- a tachinid fly (*Athrycia cinerea*)

However, these natural enemies often do not destroy larvae until after considerable crop damage has occurred. They have their greatest impact on bertha armyworms produced a year or two after the peak of an outbreak. This is probably why severe infestations only last two or three years.

Their presence in a crop does not indicate, however, that control measures are unwarranted.

### Chemical control

Chemical control is the producer's last line of defence against the bertha armyworm. For best results, apply an insecticide as soon as economic thresholds are reached.

A single, well-timed application of any registered insecticide applied with aerial or high clearance ground equipment is usually effective.

The following table lists the insecticides registered for the control of bertha armyworm. Indicated are the recommended application rates and the number of days that must elapse between application and harvest.

Product	Rate (product per acre)	Preharvest Interval (days)		
		Canola	Mustard	Flax
Decis*	40-60 mL/acre	14	14	
Lorsban	350-405 mL/acre	21		21
Lannate	360-500 mL/acre	8		8
Monitor	230-500 mL/acre	10		
Pyrinex	305-405 mL/acre	21		

\* Do not apply at temperatures greater than 25°C.

## Cultural control

Bertha armyworm populations can be manipulated to reduce crop loss. Methods include planting alternative crops, effective weed control, early swathing and fall cultivation.

Fall cultivation can kill many bertha armyworm pupae by mechanical damage. Tillage can also reduce the amount of snow trapped on a field by removing or flattening stubble and exposing pupae to sub-zero temperatures over the winter. This practice may be effective for individual fields but is not likely to be effective unless it is adopted by all producers in an area. Adult moths are strong flyers and can easily move to adjacent fields. Fall cultivation should not be used on light-textured soils susceptible to erosion.

Effective control of weeds such as lamb's quarters and wild mustard can reduce bertha armyworm infestations in flax, peas, lentils and sugar beets. Larvae will first feed upon these weeds and then move onto these crops after the weeds have been destroyed.

## For best control

- The larvae should be at least 1.3 cm (about ½ in.) long.
- Apply the insecticide early in the morning or late evening when the larvae are actively feeding. Do not apply during warm afternoons.
- Use enough water to ensure adequate coverage.
- Use high water volumes in crops with dense canopies such as canola.
- Use the higher label rates of application when a range is indicated.

To avoid killing foraging honeybees, delay insecticide applications until after the crop has finished blooming. If this is not possible, select Decis 7 to control the bertha armyworm larvae, and apply during the evening.

*This information was prepared as a combined effort of*

- *Manitoba Agriculture*
- *Saskatchewan Agriculture and Food*
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