E-1347

Bertha Armyworm in Canola

Biology and Integrated Pest Management

Figure 1. Bertha armyworm adult. (Fauske, Department of Entomology, NDSU)

Janet Knodel, Extension Entomologist
Mangala Ganehiarachchi, Graduate Research Assistant

The bertha armyworm, *Mamestra configurata* Walker, belongs to the order Lepidoptera and family Noctuidae. It often is referred to as the "Miller Moth" or "climbing cutworm." Its geographical range extends as far south as Mexico City, Mexico, and as far north as Keg River, Alberta, Canada. It is native to North America and is an important insect pest of canola in the northern Great Plains. In North Dakota, bertha armyworm occurs primarily throughout the northern canola-producing counties. Severe infestations of bertha armyworm can be sporadic or widespread and usually occur every five to seven years. However, in years when outbreaks have occurred, larval feeding has caused economic crop losses and increased production costs from spraying insecticides.

Identification

Adult (Figure 1)

Adult bertha armyworm has a wing span of about 1½ inches (4 centimeters). The forewings are predominantly gray, with patches of black, brown, olive and white scales. Each forewing is characterized by a silvery kidney-shaped spot and silvery fringed margins. It has a conspicuous white and olive irregular transverse marking near the tip of the each forewing.

Eggs (Figure 2)

The eggs are sculptured, ridged and pinhead-shaped. Newly laid eggs are white and turn brown as they mature.

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Fargo, North Dakota 58105
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Larva (Figure 3)

Newly emerged larvae are about 1/10 inch (3 millimeters) long and usually green, with a pale yellowish stripe along each side of the body. Mature larvae are about 1½ inches (4 cm) long and vary from green and brown to velvet black. The head is pale brown with or without dark bands.

Pupa (Figure 4)

Pupation takes place in the soil. The pupa is a nonfeeding stage where the larva develops a protective casing around itself while it transforms to the adult stage. Pupae are typically reddish brown, podlike and about 0.2 to 0.7 inch (0.5 to 1.8 cm) long.

Life cycle (Figure 5)

Bertha armyworm has one generation per year in North Dakota and overwinters as pupae in the soil. Adults emerge in mid to late June and emergence continues through early August. Moths are strong fliers and are active at night. Adults usually mate within the first five days of emergence and are particularly attracted to blooming canola fields for nectar and egg-laying sites. Eggs are laid as clusters on the lower surface of canola leaves. Each cluster contains 50 to 500 eggs laid in a honeycomb pattern. Eggs hatch after four to seven days, depending on daily temperatures.

Larvae feed at night and often hide underneath leaf litter and clumps of soil during the day, which

Figure 2. Bertha armyworm eggs. (Knodel, Department of Entomology, NDSU)

Figure 3. Green (top) and black (left) phases of mature bertha armyworm larvae. (Knodel, Department of Entomology, NDSU)

Figure 4. Bertha armyworm pupa. (Beauzay, Department of Entomology, NDSU)

makes them difficult to see. Young larvae feed on the undersides of leaves, chewing irregular-shaped holes. The wind can disperse larvae by ballooning them on threads of silk to other plants. Larvae of the diamondback moth also exhibit a similar ballooning behavior with silk threads. When disturbed, mature larvae curl into a ball, a defensive behavior of cutworms and armyworms (Figure 6). Larvae develop for six weeks and pass through six larval instars before dropping to the ground in mid to late August to pupate.

Pupation usually begins in mid to late August and continues through early September. Pupae overwinter in the ground at depths of 2 to 6 inches (5 to 16 cm).

Figure 6. Larva curled into ball (a defensive behavior). (Knodel, Department of Entomology, NDSU)

Figure 7. Mature larva feeding on pods. (Knodel, Department of Entomology, NDSU)

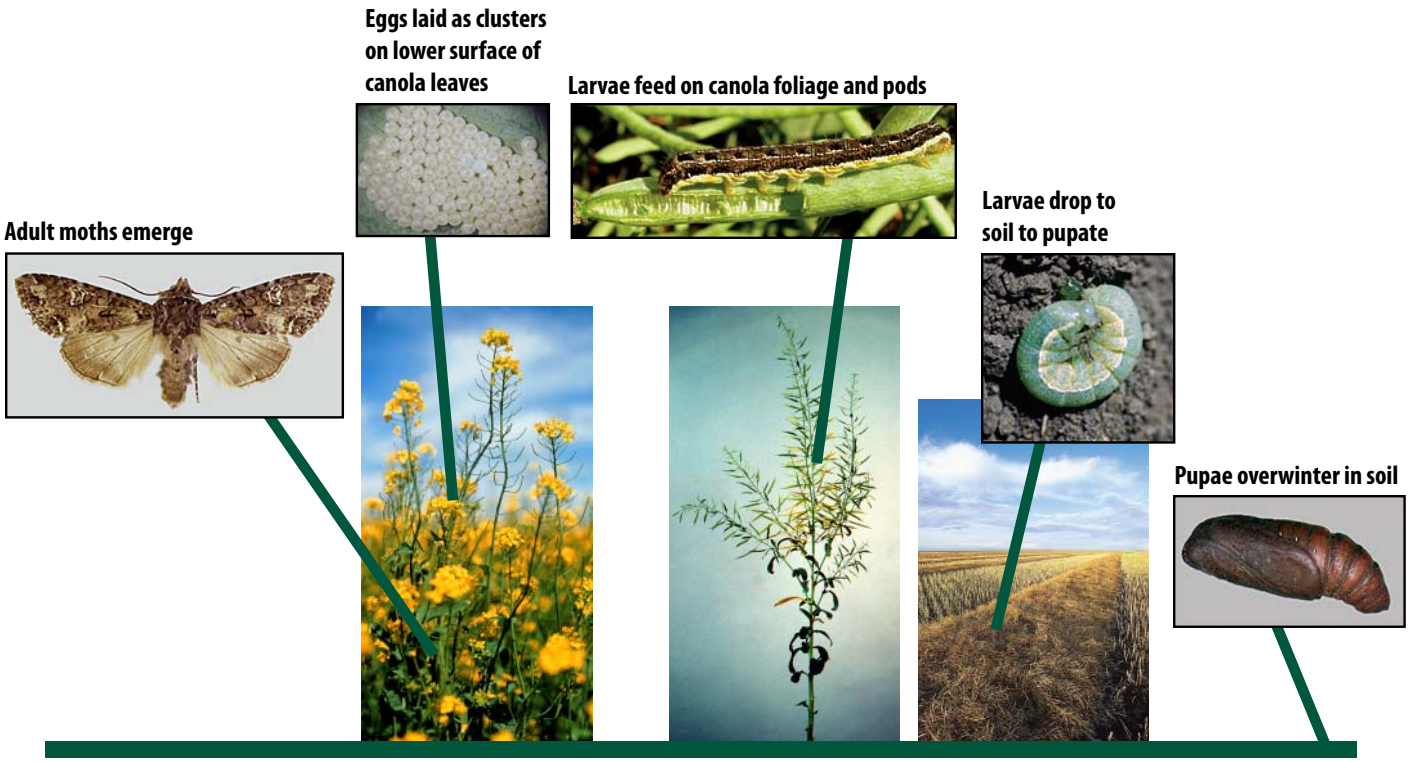

Figure 5. Life cycle of bertha armyworm. (Knodel, Department of Entomology, NDSU)

Host plants

Bertha armyworm is polyphagous and is known to feed on more than 40 plant species. A variety of crops and weeds serve as host plants for bertha armyworm. Canola, rapeseed, mustard, alfalfa and related plants are the preferred host plants. Flax, peas and potatoes serve as secondary host plants. Larvae also can feed on various weed species, including wild mustard, Canada thistle, sow thistle and lambsquarters.

Figure 8. Sex pheromone trap used to monitor bertha armyworm.
(Knodel, Department of Entomology, NDSU)

Damage

Economic damage is the result of significant larval feeding on foliage and developing seedpods of canola (Figure 7). First instar larvae feed on the underside of canola leaves, chewing irregular-shaped holes. They usually cause little damage, even when the population density is high. However, more mature larvae, greater than ½ inch (1.25 cm) long, can cause substantial crop damage. Mature larvae eat approximately 85 percent of the plant materials consumed during their larval development.

As canola drops its leaves, mature larvae begin to feed directly on the pods, which results in economically important yield losses and premature pod shattering. Larvae chew holes in the pods and eat the seeds. Mature larvae even will continue to feed on pods in the swath. The entire seedpod can be consumed under high population densities.

Integrated Pest Management

Field Monitoring and Economic Thresholds

1. Monitoring of adult moths

Sex pheromone traps (Figure 8) can be used to detect adult bertha armyworms in a general area. The recommended trap design is the green unitrap (or bucket trap) suspended above the crop canopy near the field's edge. Traps are monitored from mid-June through July. The number of moths captured is recorded weekly, and the cumulative number of captured moths is calculated each week until the end of the trapping season. The cumulative moth count serves as a predictive risk indicator of larval infestation (Table 1).

2. Monitoring of larval populations

Fields should be monitored regularly for larvae beginning about two weeks after peak adult trap catch. Check several locations per field and continue scouting until an economic threshold is reached or

the crop is swathed. At each location, mark an area of 0.25 square meter (50 cm by 50 cm) and shake the plants to dislodge any larvae that may be on the plants. Count the number of larvae on the ground. Carefully inspect under clumps of soil and leaf litter, where larvae hide during the day. Counts are multiplied by four to determine the average number of larvae per square meter for each field.

The economic injury level for bertha armyworm varies with the cost of insecticides, application costs and canola market value (Table 2). The economic injury level is the density or number of insects expected to cause damage that is equal in value to the cost of control. Growers can expect an economic loss of 0.058 bushel per acre for each larva per square meter (Source: Manitoba Agriculture, Food and Rural Initiatives, Canada). The following equation can be used to calculate economic injury levels for bertha armyworm in canola:

$$\textbf{Economic injury level} = \frac{\text{Management costs per acre}}{(\text{Market value} \times 0.058 \text{ bu/acre/larva/m}^2)}$$

Typically, bertha armyworms are kept below economic injury levels by environmental and biological control factors.

Table 1. Interpreting bertha armyworm cumulative moth counts from pheromone traps.

Cumulative Number of Moths Per Trap		Larval Infestation Risk Level
From	To	
0	300	**Low –** Infestations are unlikely to be widespread, but fields should be scouted for signs of insects or injury.
300	900	**Uncertain –** Infestations may not be widespread, but fields that were particularly attractive to egg-laying females could be infested. Check your fields.
900	1,200	**Moderate –** Canola fields should be scouted regularly for larvae and evidence of injury.
1,200	1,500+	**High –** Canola fields should be scouted frequently for larvae and evidence of injury.

Source: Manitoba Agriculture, Food and Rural Initiatives, Canada

Table 2. Economic injury levels for bertha armyworm in canola.

Insecticide + Application Cost ($ per ac)	Expected market value ($ per bushel)						
	6	7	8	9	10	11	12
	Number of larvae per square meter						
7	20	17	15	13	12	11	10
8	23	20	17	15	14	13	11
9	26	22	19	17	16	14	13
10	29	25	22	19	17	16	14
11	32	27	24	21	19	17	16
12	34	30	26	23	21	19	17

Source: Manitoba Agriculture, Food and Rural Initiatives, Canada

Integrated Pest Management Strategies

Environmental control

Environmental conditions play an important role in controlling bertha armyworm. Harsh winters with little snowfall provide little insulation and increase mortality of bertha armyworm pupae. However, heavy snow accumulation favors outbreaks of bertha armyworm by insulating overwintering pupa from prolonged exposures to low temperatures (-7 F or -10 C). Newly hatched larvae also are very susceptible to unfavorable weather conditions, such as heavy rainfall.

Cultural control

Weed control

Some weeds serve as secondary host plants for berth armyworm. Effective control of weeds, such as wild mustard, Canada thistle, sow thistle and lambsquarters, may help minimize bertha armyworm infestations in canola fields.

Tillage

Fall cultivation can kill pupae by crushing them or exposing them to predators and subzero temperatures. However, cultivation is not recommended on light-textured soils that are susceptible to erosion. The trend toward reduced and conservation tillage could favor bertha armyworm winter survival.

Early seeding with early maturing variety

One of the most successful cultural control methods is early seeding of an early maturing variety. Yield loss from bertha armyworm can be minimized if canola flowers before the peak moth flight.

Figure 9. Example of Lepidopteran larva (thistle caterpillar) infected with nuclear polyhedrosis virus, a natural biological control agent. (Knodel, Department of Entomology, NDSU)

Crop rotation

Producers are encouraged to practice crop rotation and plant an alternative crop the next season to reduce the risk of canola diseases, such as blackleg or Sclerotinia white mold. Crop rotation also breaks the life cycle of bertha armyworm since they overwinter as pupae in the soil. As a result, emerging adult moths must disperse to locate new canola fields.

Biological control

Biological control agents include an ichneumonid wasp (*Banchus flavescens* Cresson), a tachinid fly (*Athrycia cinerea* (Coquillett)) and a nuclear polyhedrosis virus (Figure 9). These are important biocontrol agents that naturally regulate populations of bertha armyworm in canola fields. Gulls and other birds are known to feed on larvae, especially during moth outbreak years.

Chemical control

The keys to controlling bertha armyworm are:

- Early detection of adult moths and their relative abundance in an area
- Monitoring fields for the presence of young larvae about ½ inch (1.25 cm) long
- Determining if fields are above economic thresholds

Insecticides that are registered in canola and labeled for bertha armyworm are listed in the "North Dakota Field Crop Insect Management Guide," publication E-1143, at

www.ag.ndsu.edu/pubs/plantsci/pests/e1143w1.htm.

Fields above the economic injury level ideally should be sprayed once the hatch is complete and just before larvae move to the pods to feed. Apply insecticide in early morning or late evening when larvae are feeding actively. High volumes of water should be used for good coverage of the dense canola canopy.

Typically, bertha armyworms are kept below economic threshold levels by environmental factors and biological control agents.

For more information on this and other topics, see: www.ag.ndsu.edu

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