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CORN EARWORM PEST OF SWEET CORN

By
Timothy D. Waters, Regional Vegetable Specialist, Washington State University, Franklin and Benton County Extension. **Carrie H. Wohleb**, Regional Vegetable Specialist, Washington State University, Grant-Adams County Extension.

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Corn Earworm Pest of Sweet Corn

The corn earworm (*Helicoverpa zea*) is the most destructive insect pest of sweet corn in the US and has been noted to be one of the most destructive plant feeding insects in the world. Preferred crops for earworm include corn, tomato, sorghum, vetch, and cotton (McMillan et al. 1966). On these crops, the pests are called corn earworm, tomato fruitworms, sorghum headworm, vetchworm, and the American cotton bollworm, respectively. Corn earworm will also feed on numerous other crops, including alfalfa, oat, soybean, sunflower, asparagus, cabbage, cantaloupe, cucumber, eggplant, bean, pea, pepper, potato, pumpkin, and watermelon as well as some weed hosts (Martin et al. 1976). Corn earworm occurs throughout the Americas, being a native insect pest occurring from Argentina in the south to Canada in the north (IIE 1993). The goal of this publication is to discuss the biology of corn earworm and to aid commercial producers and crop consultants by providing scouting techniques and control options for this pest in sweet corn.

Description and Biology

The complete life cycle of the corn earworm consists of egg, larva, pupa, and adult. Adults are light to dark brown, or light olive green moths with a wing span of about 1 1/2 inches (Figure 1). The wing color pattern of the earworm moth can be highly variable. Eggs are about half as large as a common pinhead, globular, and vary from light yellowish green to dusky brown. Newly hatched larvae are yellowish white with black heads. Larvae, when full grown, are about 1 1/2 inches long with conspicuous cream, yellow, brown, slate, or black stripes on pink, green, cream, or yellow backgrounds (Figure 2). The pupae, or resting stage, are reddish brown and about one-inch long.

Figure 1. Corn earworm adult moths (left); false corn earworm adult moths (right).

Figure 2. Corn earworm larva.

Adults first appear in June after overwintering as pupae in the soil. Corn earworm is highly dispersive and is known to migrate to the Pacific Northwest from warmer southern areas in the midsummer. Although corn earworm has not been definitively documented as overwintering in Washington, there is informed speculation that it does overwinter in southern portions of the Columbia Basin of Washington. As adults, corn earworms sip nectar from flowers and are attracted to lights at night. On corn, female moths lay single eggs, generally on the silk, though they may lay eggs on other parts of the plant, including the leaves and tassels. Each female lays from 500 to 3,000 eggs.

Larvae hatch in two to ten days and start feeding immediately. They pass through several stages of development (five larval instars) during growth and, when they have completed feeding, crawl or fall to the ground. The last instar larvae burrow two to six inches into the soil, construct protective cells, and change to the pupal or resting stage. Adults emerge from the pupae after 10 to 25 days, depending upon soil temperature (development is faster with warmer soil temperatures). Pupae of the last summer generation spend the winter in the soil in areas where they overwinter, and adults emerge in the spring.

The number of generations—or life cycles from egg to adult—occurring per year depends upon the climate; warmer areas tend to have more generations per season. In southern states, a complete life cycle only takes about a month, so there may be seven generations a year. In Washington, there are one to three, and perhaps four, generations per season. (Depending on the location within the state, warmer microclimates tend to have more.) Infestations in northern areas, such as Washington, often result when adult moths migrate from southern areas. Prevailing winds can rapidly carry adult moths several hundred miles north.

Damage

Only the larvae cause damage. Early in the crop season, earworms attack the buds or central shoots of young corn by feeding on the tender, unfolding leaves or, later in the crop season, on the tassels. Serious damage occurs when earworms attack corn ears (Figure 2). They first feed on silk, preventing pollination and kernel development. They may penetrate down the ear, and often eat all the kernels halfway down the ear. Larvae leave moist castings from their feeding (Figure 2). These castings, frequently visible at the tip of the ear, render the corn unsalable. Injury caused by earworms can also leave plants more susceptible to infection by the common smut fungus, *Ustilago zeae*.

Scouting and Treatment Thresholds

Populations of corn earworm can be monitored by scouting for eggs, larvae, or adults. Egg and larvae scouting can be difficult and laborious. Look for eggs or small larvae when silks can first be seen. Adult monitoring can be done using a light trap or a pheromone trap. Light traps are effective but not selective, so several species of moths can be found in traps making identification and quantification of populations difficult and time consuming. Pheromone traps are more selective (i.e., will only catch *Heliocoverpa* spp.) and are the industry standard.

In Washington State, it is not uncommon to catch both corn earworm and false corn earworm (*Helicoverpa phloxiphaga*) in pheromone traps (Figure 1). False corn earworm is not a pest of corn and does not require control measures. False corn earworm moths can be distinguished from corn earworm by their smaller size and the presence of a dark spot and dark margins on the hind wing.

An inverted cone trap, sold commercially as a Heliothis trap (the old species name for Heliocoverpa), is an effective tool for monitoring corn earworm (Figure 3). Traps should be mounted on a stake or post so that the bottom of the cone is three to five feet off the ground and upwind of the corn field. The pheromone is placed at the bottom of the trap, and males searching for females to mate are attracted to the pheromone and get caught in the trap. Trap catches should be monitored two or more times a week during peak flight activity and when the crop is most susceptible to damage (i.e., when corn is silking).

The number of moths caught will determine when and if insecticide applications should be made to control the pest. The treatment threshold for corn earworm in sweet corn varies by the end use of the crop. Fresh market sweet corn generally has a much lower threshold than processed sweet corn.

Figure 3. Heliothis trap used for monitoring populations of adult corn earworm.

Processing plants can remove damaged tips in some circumstances. Early infestations are much more damaging than late infestations because ears infested early will contain more damaged area as larvae will have fed for a longer period of time. Generally, five to ten adult earworms per day, per trap is a standard treatment threshold for fresh market sweet corn. For processing sweet corn, the treatment threshold is 20–30 adult earworms per day, per trap.

Control

Cultural, biological, and chemical techniques are available for corn earworm control. Sometimes a mixture of techniques is best. The type(s) of control selected depends on the situation.

Cultural Control

Placing a clothespin at the point where silk enters the ear helps keep worms out of ears. This should be done soon after the first silk emerges, but it is not practical on a large scale. Early plantings (prior to April) generally escape severe infestations of corn earworm while mid-to-late season plantings tend to have higher levels of damage due to migrations of the pest from southern states and overwintering populations having built up during the growing season. It has also been observed that cultivars that silk at times between major flights of migratory corn earworm oftentimes escape infestation (Metcalf et al. 1962). In the fall, plow or dig up the soil where corn was grown. Plowing exposes pupae to killing winter temperatures and destroys the exit tunnels through the soil that the larvae constructed before they pupated. Any adults surviving the winter are then trapped under the soil.

Biological Control

Many beneficial insect parasites, predators, and several diseases attack corn earworm. An egg parasite wasp, *Trichogramma*, lays eggs inside the earworm egg. This wasp occurs throughout North America. Releases of this parasite into corn fields to control corn earworm have been successful in small scale plantings, under ideal circumstances, achieving 50% to 100% parasitism, although natural infestation levels are typically low (Archer and Bynum 1994). Several firms specialize in rearing Trichogramma parasites and offer these biocontrol agents for sale.

General predators, including lacewings (Chrysopidae), minute pirate bugs (Anthocoridae), ladybird beetles (Coccinellidae), big-eyed bugs (Geocoridae), and damsel bugs (Nabidae), feed on eggs and small larvae of the corn earworm. Green lacewings and ladybird beetles are available from different firms for release in grower fields.

Another predator of corn earworm is a native soldier beetle (Cantharidae) that enters the earworm tunnel and eats the worms. However, predatory insects are not usually effective at controlling large infestations of corn earworm and releases of predators or parasites are oftentimes unsuccessful. Detailed descriptions and images of many of the abovementioned natural enemies of corn earworm are available in *Beneficial Insects, Spiders, and Other Mini-Creatures in Your Garden* (James 2014).

Biological insecticides are also available for corn earworm control. Hazzard and Westgate's *Organic Insecticide Management in Sweet Corn* provides an in-depth description of the use of organic insecticides in sweet corn (2005). *Bacillus thuringiensis* (Bt) is a natural bacterial pathogen that can kill earworm larvae. Bt is formulated as an insecticide sold under the trade name DiPel. This insecticide kills only moth larvae and does not harm beneficial insects. In general, this product works better when combined with feeding stimulants because it can be difficult to get the larvae to ingest a toxic dose. It is generally better at controlling younger, small larvae than older, large larvae. Apply this material after 4 p.m., as it breaks down rapidly in heat and sunlight. Sweet corn varieties that have been genetically modified to produce Bt are now being grown commercially in some areas, though very few acres have been grown in Washington to date.

Grandivo, *Chromobacterium subtsugae*, is another biological insecticide that has proven to be effective at controlling corn earworm and poses little risk to beneficial insects. When pressure is high, multiple applications will be required to achieve adequate control.

Chemical Controls for Small Plantings

Applying mineral oil to the silk just inside the tip of each ear can provide effective control. Mineral oil suffocates young larvae. Mark treated corn ears with tape so later developing ears can also be treated. Oil applied before the silk starts to dry may interfere with pollination.

Chemical Controls for Commercial Plantings

For large, commercial fields under heavy earworm attack several commercial products are available, including Coragen, Sevin XLRPlus, Lorsban, Besiege, Rimon, Radiant, Lannate, and pyrethroids (e.g., Asana, Baythroid, Mustang, Warrior, and others). Consult the *Pacific Northwest Insect Management Handbook* for a list of organic and conventional products registered for corn earworm control (Rinehold et al. 2016).

Always read the product label, follow state and federal laws, and consult your local Extension office for specific insecticide recommendations. Many insecticide labels contain cautionary statements regarding bee safety. These should be closely followed since many applications to control earworm will be made when pollen is abundant in the field, increasing the likelihood for bees to be present. In most cases, it is best to apply insecticides before 6 a.m. or after 3 p.m. to reduce the likelihood of damage to bees.

Time insecticide sprays to control the larvae and eggs on the corn silk because the key to protecting sweet corn from earworm damage is to control the larvae before they enter the ear. Under heavy pest pressure, make the first application before 10% of the plants are in silk. Applications may need to be made on as short as a five-day interval, especially under high pressure and in situations with low tolerance to crop damage. Not all labeled insecticides can or should be used consecutively on short intervals; be sure to check the label. Remember that different insecticide classes should be rotated if multiple applications are needed. This will help to avoid insecticide resistance development in the corn earworm population. Less severe infestations and crops with higher tolerance will require less frequent applications. A single application made at first silk when infestations are large is often sufficient for processing sweet corn.

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Use pesticides with care. Apply them only to plants, animals, or sites as listed on the label. When mixing and applying pesticides, follow all label precautions to protect yourself and others around you. It is a violation of the law to disregard label directions. If pesticides are spilled on skin or clothing, remove clothing and wash skin thoroughly. Store pesticides in their original containers and keep them out of the reach of children, pets, and livestock.

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