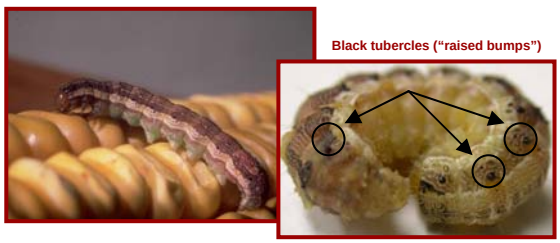
Corn Earworm (*Helicoverpa zea*)

Insect Fact Sheet — University of Illinois IPM integrated pest management

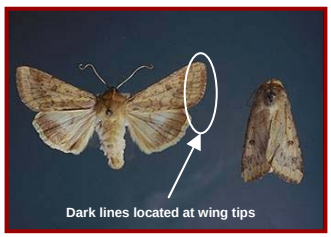
The corn earworm, also known as the tomato fruitworm and the cotton bollworm, feeds on a number of crops including corn, tomato, cotton, green beans, clover, vetch, lettuce, peppers, soybeans, and sorghum. The most severe infestations of corn earworm generally occur in the southern United States. Losses due to the corn earworm in field corn has been estimated at 2.5% annually, with losses in the southern United States ranging from 1.5-16.7%. Losses in sweet corn may be as high as 50%.

Description

Corn earworm larvae vary greatly in color ranging in from light green or pink to dark brown or nearly black. Alternating light and dark stripes run the length of the body. Double dark stripes can usually be seen down the center of the back are usually present and the underside of the larva is typically light colored. Distinct tubercles are present with two or three large hairs protruding from each. Larvae pass through five growth stages and are 1½ inches long at maturity. Pupa are oblong, ¾ to 1 inch in length and reddish or light brown. They can be found in the soil near the host plant at a depth as great as 6 inches. The adults are nocturnal moths about ¾ inch long with a wingspan of 1½ inches. The forewings are buff colored with dark lines or spots near the tips. Eggs are laid singly on the leaves of preferred food plants. Pubescent leaves are preferred, but corn tassels and silks are even more attractive. Eggs are hemispherical, ribbed, and less than 1/16 inch in diameter. White when first laid, they develop a red ring around the circumference in 24 hours and show the black head capsule of the larva just before hatching.



Corn earworm larva



Corn earworm adult


Corn earworm eggs

Life Cycle

Although corn earworm populations usually die out during the winter in most of the state, pupae in the soil survive the winter in the soil in far southern Illinois most years. In addition, populations can overwinter in other portions of the state when the winter is mild. Survival is greatly reduced when winter temperatures are less than 30°F. Generally, corn earworms do not overwinter in Illinois north of Interstate 70. Despite some local overwintering, summer populations of this insect in Illinois arise primarily from the immigration of moths from southern states in late spring and early summer. These moths arrive on weather fronts and lay their eggs in susceptible crops. Adults are usually found in June. Egg laying takes place primarily in the evening hours, with each female capable of laying 500 to 2000 eggs during her 2-week life span. Eggs hatch in 3 to 4 days at an average temperature of 77°F. Larvae feed on whorl stage corn and other host plants for a period of 3 to 4 weeks before burrowing in the soil to pupate.

Two full generations of earworm development can occur each year after the spring/summer migration into the state. Second generation larvae and moths occur during pollination. Population densities usually peak in late summer. Moths lay eggs on the silks of corn plants. Even though moths may lay more than one egg per ear, there is generally only one larva per ear because they are cannibalistic. Larvae will migrate down the silks to the ear tips within 1 hour of hatching. Larvae feed on the developing kernels under the protective husk for the entire larval stage. When larval development is complete, the larva chews through the husk and exits the ear. It then drops to the ground, burrows into the soil, and pupates.

Injury

Injury caused by the corn earworm ranges from destruction of the host crop to cosmetic damage that may cause a crop to be unmarketable. Larvae feed on the pods of snap beans. Their burrowing through the pod or chewing through the pod wall to feed on developing seeds causes cosmetic damage. These injuries can result in an unusable product for both the fresh and processing market. Although the corn earworm will feed on buds and flowers of tomato plants and may also bore into the stems, it prefers green fruits. Larvae often enter fruit under the calyx at the stem end and remain unnoticed until extensive damage is done. The deep cavity made by larval feeding is usually contaminated with wastes, becomes watery and soft, and serves as an entry point for diseases. Fruits that are damaged early in their development are most likely to rot before harvest.


Tomato injury


Tomato injury

Although the corn earworm is a severe pest of field corn in southern states, in Illinois its economic importance in corn is limited to sweet corn and seed corn. The corn earworm feeds not only on the whorl, tassel, and silks, but on the kernels of the ear itself. Severe feeding on the leaves gives the plant a ragged appearance. Feeding on kernels at the tip of the ear creates an avenue of entry for diseases, especially molds in seed corn. Similar damage in sweet corn results in an un-salable product, especially for the fresh market. Home gardeners and even some sweet corn processors often accept some damage by corn earworm because feeding is commonly limited to ear tips, which can be cut off before processing or home use. Unfortunately, the presence of damage and a live earworm beneath the husk is usually not acceptable in the fresh produce market. In seed corn production, damaged kernels represent yield loss. Just as importantly, removing damaged kernels from seed lots results in additional losses because substantial amounts of undamaged seed corn are also discarded during the mechanical sorting process.


Feeding on sweet corn ear

Scouting Procedure

Pheromone trap

Pheromone-baited traps can be used to monitor flights of corn earworm moths. Large, cone-shaped traps constructed of wire (Hartstack traps) or nylon should be baited with lures containing the sex attractant that is specific for male corn earworm moths. When using nylon traps, note that these traps catch a third to half as many moths as the metal Hartstack traps. Place traps along edges of fields before and during the susceptible stage of the host crop: silking in corn, or the presence of pods and fruit in green beans and tomatoes, respectively. Pheromone traps provide valuable but somewhat indefinite information about corn earworm populations. Fluctuations in counts from traps may be a result in changes of temperature or from rain and wind. Whenever a trap catches a few moths per night for two or three nights in a row, a "significant" moth flight is occurring. However, precise predictions of crop damage based on counts of moths in traps is not possible. Because females have emerged before males and are ready to begin egg-laying as soon as they mate, the capture of male moths in traps means that eggs will be deposited on susceptible hosts within hours. Both trap counts and scouting should be used in determining the optimal spray period. Scouting for eggs immediately after traps detect moths can help to indicate the potential for damage in a specific crop. When scouting for earworm eggs in corn, sample five areas of the field, 20 ears from each area (total of 100 ears). Clip silks from corn ear and place in plastic bag. Examine the silks for eggs by separating over a black or dark colored surface. Also examine ears for larval damage. Grasping the ear, pull it open, and check for the presence or absence of earworm damage. Determine the percent of ears with damage. A rescue treatment may be required if 5 to 10% of the ears are infested with eggs or larvae. If infestation levels are below the threshold, then it is advised to scout again in a couple of days. After scouting the field for a second time, if the cumulative infestation level (the infestation level from the first scouting plus the level from the second scouting) exceeds the threshold, an insecticide application may be recommended.

Stage	Days to Develop	
	75° F	80° F
2nd instar	2.9	2.0
3rd instar	4.7	4.0
4th instar	6.3	5.9
5th instar	8.7	7.9
6 instar	--	--
Prepupa	11.8	10.8
Pupa	14.9	13.1
Total	**49.3**	**43.7**

Producers sometimes use a threshold of 10 moths per trap per night for sweet corn grown for processing or 5 moths per trap per night for fresh-mark sweet corn. For seed corn, control is recommended if significant moth flights occur when fresh silks are present. The interpretation of moth counts from traps is less clear-cut when pest management decisions focus on commercial production of snap beans or tomatoes. If tasseling and silking corn is abundant in the area, corn earworm moths will deposit the great majority of their eggs in the corn, not in beans or tomatoes. In these instances, insecticide applications may be unnecessary in beans and tomatoes, even if pods or fruits are present. In corn, control may be necessary if earworm moth flights occur while fresh silks are present, but sprays are generally considered to be unnecessary after 90% of the silks have browned.

Management

Management of this pest in corn often lies with planting resistant hybrids and altering planting dates to avoid high densities of corn earworms. Resistant hybrids limit the amount of injury to both the leaf and the ear. A combination of silks that are antibiotic to larvae and husks that are tight around the ear to alter larval behavior offer the most effective type of resistance. Because of the tightness of the husk around the ear, feeding is limited to the ear tip, resulting in small larvae or larvae that leave the ear before completing development. Some Bt hybrids suppress corn earworm populations and reduce the amount of injury to the ear. Neither crop rotation nor tillage significantly influences corn earworm survival. However, early-planted crops are most likely to escape peak populations of egg laying moths. In addition, because egg-laying moths prefer corn to beans, tomatoes, and other crops, borders or strips of corn planted as a trap crop around or within fields of other vegetables may reduce earworm densities on these less preferred crops. This approach is likely to provide some benefit only if the corn is silking at the same time as the beans, tomatoes, or other crops are setting pods or fruit.

Chemical control of the corn earworm can be expensive; most spraying occurs in sweet corn fields where a majority of the market value is in the quality of the ears. Since larvae move down the silk channels as soon as they hatch, the timing of insecticide applications is very important. As the larvae move down the silks and under the husk of the ear, insecticide sprays become ineffective. For insecticides to work effectively, spray residues need to be present on the silks where the eggs hatch. There will be no insecticide residue on new silk growth. Many producers follow a regular spray schedule based on the number of captured moths from pheromone traps. Others base the spray schedule on the injury sustained to the whorl or tassel. To the right is a spray schedule for corn earworm in sweet corn (from the University of Minnesota) based on the number of corn earworm moths caught in a pheromone baited cone trap. (Counts are from a nylon trap; a full size Hartstack wire trap catches more moths, so multiply counts in the first column by 1.5 to get the approximate for a wire trap.)

Spray Frequency (when fresh silks are present)		
Average number of moths per trap per day	**Max temperature <80°F**	**Max temperature >80°F**
<0.2	**No Spray**	**No Spray**
0.2 – 0.5	**Every 6 days**	**Every 5 days**
0.5 – 1.0	Every 5 days	Every 4 days
1.0 – 13.0	Every 4 days	Every 3 days
13.0 (>20.0 in wire trap)	Every 3 days	Every 2 days

Bacterial insecticides containing *Bacillus thuringiensis kurstaki* (BT) represent a biological control approach. BT-based insecticides kill corn earworm larvae if the larvae ingest spray residues. Because BT residues break down quickly and because earworm larvae do little or no feeding before entering an ear of corn, BT sprays have not been effective for corn earworm control in sweet corn or seed corn. Rapid breakdown of BT (and the need for insects to ingest it) also renders it virtually ineffective for earworm control in snap beans. In tomatoes, however, BT can provide significant control of corn earworms if applications are well-timed and frequent.

Several natural enemies offer some control of the corn earworm. Predators such as the big-eyed bug (*Geocoris* sp.), the minute pirate bug (*Orius* sp.), and the spotted lady beetle (*Coleornegilla maculata*) consume corn earworm eggs and small larvae. Parasitoids such as *Trichogramma* species also attack earworm eggs.

Authors:

Kelly A. Cook (kcook8@uiuc.edu)
Rick Weinzierl (weinzier@uiuc.edu)