



EUROPEAN CORN BORER IN FIELD CORN

Ostrinia nubilalis (Hübner)

The European corn borer (ECB), *Ostrinia nubilalis* (Hübner), was first identified near Boston, Massachusetts in 1917. It appears to have been introduced into the United States on broom corn imported from Hungary and Italy. Since its introduction, it has established itself as a pest in most states east of the Rocky Mountains. In Pennsylvania, ECB has been present as a pest for over 80 years. ECB has a very wide host range including, tomatoes, potatoes, snap beans, peppers, sorghum, corn, and many weed species. It is more commonly a pest of corn in Midwestern states, whereas losses in Pennsylvania field corn due to ECB are variable depending on historical infestation levels, weather conditions, and management. Instead, economic levels of ECB damage in Pennsylvania occur more commonly in sweet corn, peppers, and snap beans; however, occasional moderate damage in corn occurs in some southern Pennsylvania fields. Previous research in Pennsylvania suggested that corn borer was responsible for about a 5.5% yearly yield reduction in field corn; however, because of widespread adoption of insect-resistant, transgenic corn hybrids (i.e., Bt hybrids) beginning in 1996, ECB populations appear to have declined in many parts of Pennsylvania, reflecting national declines.

DESCRIPTION

The adults are yellowish to light tan in color. They have several dark zigzag marks across the wings, and their wingspan is 3/4 to 1 inch. During the day, adults take shelter in grass, weeds, and crop residue in and around crop fields. Adults are most active during late evening.



European corn borer adult male on corn leaf. Image by Dennis Calvin.



European corn borer adult females. Image by Faruque-Uz Zaman

The eggs are usually glued to undersides of leaves, in small irregular-shaped clusters that are white and very flat, containing about a dozen or more individual eggs. Clusters resemble fish scales overlapping one another. Each egg is about half the size of a pin head. After 3 to 5 days, the eggs change from white to a yellowish color, and then, just before hatching, a dark spot appears in each egg.



European corn borer egg mass. Image © M.E. Rice

The larvae are dirty white, often having a pinkish tinge. The skin is smooth and free of hairs. There are numerous dark spots scattered over the sides and top of the body. The head is dark brown to black. It is the larval (borer) stage that causes damage to crops.



ECB larvae on a corn ear. Image by Eric Bohnenblust



ECB larva tunneled into corn stalk. Image by Eric Bohnenblust

The pupal stage of the corn borer is rarely visible. Pupae remain inside the host plant, and adults emerge in late spring and in July. The pupae are smooth, light to dark brown in color, and 1/3 to 5/8 of an inch in length.

LIFE HISTORY

In Pennsylvania, there are two separate strains of ECB. One strain is univoltine (one generation per year) and is generally found in the mid-state and northern regions, and the other strain is bivoltine (two or more generations per year) and is found throughout the state, though more so in southern portions. In spring, diapausing larvae emerge from dormancy and pupate from late April to early June with the univoltine population tending to emerge later than the bivoltine population. First gen-

eration adult emergence occurs from early May in southeastern areas to late June in northern counties and mating is facilitated by sex pheromones emitted by female moths. Females lay eggs from mid-May to mid-June. The time required for first-generation egg hatch is approximately seven to ten days after being laid, but hatch is temperature dependent so it could occur earlier or later depending on local weather. Newly hatched larvae chew small, round holes in the leaves and then move to the main stalk. The larvae complete their growth inside the stalk in about three weeks. Univoltine larvae then enter diapause (developmental inactivity) when they reach the fifth instar, while the bivoltine larvae pupate inside the stalk during July and early August.

Second-generation adult emergence and egg laying begins during late July and continues through the end of August. Eggs of the second generation generally hatch five to seven days after deposition depending on weather conditions. Second-generation larvae attack the tassel and shank areas of field corn and in some varieties may cause ear drop. In autumn, they diapause and overwinter as fifth instar larvae inside stalks of their host plant. When warm weather conditions persist late into the growing season a third generation is possible. There are also two separate races of bivoltine ECB that emit different pheromones, an “E” race and a “Z” race named for the isomer of their main pheromone component. In Pennsylvania, both races are present. The “Z” race is more common south and west of Pennsylvania, while the “E” race is common north of Pennsylvania throughout the northern US and Canada. The univoltine strain, also present in Pennsylvania, emits the “Z” pheromone isomer.

MONITORING

Monitoring ECB populations is essential for effective control of this pest. Monitoring is usually done with pheromone traps or black light traps. Pheromone traps are generally easier to use because they tend to be species specific and need only be checked once or twice weekly. A variety of pheromone traps to monitor ECB are available including Scentry Heliothis™. Traps are baited with a rubber lure impregnated with ECB female sex pheromone that attracts male moths. When using pheromone traps for monitoring ECB, it is important to choose the correct pheromone lure due to the presence of the two different races described above. It is important to keep historical records of moth capture on your farm, so you can more easily predict when you might have a problem, and be able to adjust planting dates accordingly.

DAMAGE

Corn borer larvae will feed on many crop or weed species that have suitable stems or fruit sufficiently large for a boring larva. Evidence of corn borer infestation on corn plants appears a few days after first generation egg hatch. Early damage is characterized by small pin holes in the leaves and fine sawdust-like frass (excrement) scattered over the upper surface of damaged leaves. Another typical symptom is a noticeable amount of chewing damage and frass in the whorl of the plant. When larvae enter stalks, they leave visible, small, round holes with wet frass exuding from the holes. Stalk feeding can weaken the stalk to the point of breaking. Damage to field corn resulting from first generation corn borer larvae is seldom great enough to warrant insecticide application.

Activity of the second generation larvae, which appear from mid-July through August, is similar to the spring generation with several exceptions. Second generation larvae commonly move to the tassel area, causing infested tassels and the upper portion of the plant to break. Some larvae also enter the shanks and ears. Weakening of shanks often results in dropped ears that cannot be harvested. Greatest field corn losses from second generation corn borer appear to occur on either late-planted or late-maturing varieties. Field corn planted before May 20 is generally not damaged by the second-generation while corn planted later than May 20 is much more susceptible to damage because these plants are still attractive hosts.



Broken cornstalk due to ECB tunneling. Image by Eric Bohnenblust



Damage to ear shank due to ECB tunneling. Image by Eric Bohnenblust

CONTROL

Cultural Methods

Select a hybrid that performs well in your area, and avoid late planting as much as possible. The second generation is apt to attack late-maturing plants. Use good weed control programs. Adult ECB hide in grass and weeds during the day, thus a good herbicide program will keep many moths out of the fields. Keep weedy field edges and fence rows clipped to avoid harboring the moths. Many growers insist on shredding or burying old stalks to kill many of the overwintering larvae, however, the control benefit of this method is questionable.

Transgenic Varieties

If you have a known corn borer population in your area, the use of transgenic corn hybrids resistant to ECB can be very effective. Hybrids targeting ECB generally express at least one of the following Bt proteins for insect control: - Cry1Ab, Cry1F, Cry1Ac, Cry9c, or the newer Vip3A. Trade names for varieties that express these proteins and control ECB include YieldGard, Knockout, Bt-Xtra, Herculex, and SmartStax, and Viptera. Keep in mind that use of Bt varieties requires planting of non-Bt refuges as an insect resistance management strategy. Refer to the label of Bt varieties for specific requirements and read carefully because different varieties have different refuge requirements. Non-Bt refuge acres should be scouted for ECB damage and protected with insecticides if economic thresholds are exceeded. Refuge acreage can be useful for gauging the size of local ECB populations and assessing the need for insect-resistant varieties.

Chemical control

There is seldom appreciable economic loss from ECB to corn harvested for ensilage. Thus, insecticides are not recommended to control this pest on silage corn in Pennsylvania. Grain losses

from corn borer infestation have been relatively low in the state over the long term, particularly since widespread adoption of Bt varieties. However, a number of fields, especially in south-central Pennsylvania, have occasionally suffered moderate stalk breakage. Unfortunately, yield losses associated with stalk damage are not documented, so the value of insecticide application to control the pest is uncertain. There is some doubt on the level of infestation above which it is profitable to apply an insecticide. This minimum level of infestation is seldom reached in Pennsylvania corn fields for the first generation corn borer larvae, so it appears that insecticide applications against first generation larvae would seldom be profitable.

Yield losses can be associated with the second generation larvae, but it is difficult to predict when an insecticide application will be profitable. Recommendations from several neighboring and Midwestern states suggest applying insecticide when approximately 75 percent of the plants show pinhole feeding on the leaves and have sawdust-like frass in the whorl and tassel area.

Numerous insecticides are registered for corn borer control. Granular formulations are preferred. Aerial application is the most practical means of applying insecticides to large corn fields for second brood corn borer. Check the Agronomy Guide (<http://agguide.agronomy.psu.edu/>) or consult your county agent for details of pesticide use.

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