VEGETABLE PESTS: EUROPEAN CORN BORER

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The European corn borer, *Ostrinia nubilalis* (Order Lepidoptera: Family Crambidae, previously Pyralidae), is a common agricultural pest found abundantly in the American Midwest Corn Belt as well as the South and Mid-South. It is a severe pest of corn, *Zea mays*, and may infect other crops that include potatoes, peppers, lima and snap beans, cotton, oats, hops, soybeans, and tomatoes. Ornamental flowering plants, such as gladiolus and asters, are also affected by this pest. In fact, this invasive insect infests more than 200 plant species in the United States. Damage inflicted by European corn borers costs American farmers and horticulturalists upwards of $1 billion annually.

The European corn borer is an introduced North American pest that probably originated in Hungary or Italy and arrived in the United States in shipments of broom corn, which was used to manufacture brooms in the early 20th century. It was first discovered in the vicinity of Boston, Massachusetts. During the next 20 years, it spread from the Atlantic seaboard to Wisconsin, and soon after, moths were found throughout the eastern United States and southern Canada as far south as the Gulf states and west to the Rocky Mountains. After World War II, it became more established in the southern United States, including Tennessee. Currently, the European corn borer is found in all the major corn-producing states of the Plains, Midwest and South.

**Damage**

The European corn borer larva (Figure 1), which feeds on all succulent, above-ground tissues of corn plants, especially the ear, is the destructive stage of this insect. As young larvae feed, they bore into the whorl and cause a “shot hole” appearance as the leaves unfurl, which results in a decline of photosynthetic productivity and leaf durability (Figure 2). Larvae also feed directly on the corn ear, corn sheath and tassels. As larvae grow, they move down the leaves to the stalk and bore into it.

Figure 1. European corn borer larvae on corn (Images courtesy of S. Stewart, UT Extension)
which weakens the plant and potentially causes stalk breakage (lodging). They may also tunnel ear shanks, causing ears to drop. This stem boring produces granular excrement called frass (Figure 3). This damage usually occurs on the lower third of the plant below the corn ear and can cause the plant to become more susceptible to plant pathogens leading to stalk rot later in the growing season. Once inside the stalk, larvae feed until they reach maturity and pupate. Tunneling within the stalk can stunt plant growth, resulting in reduced ear and kernel size, and interfere with nutrient movement and photosynthesis. Direct feeding by tunneling into the side of the ear is especially problematic for sweet corn. All these types of damage will reduce yield and cause financial losses. This damage is similar to southwestern corn borer (*Diatraea grandiosella*), another invasive species that attacks corn.

Damage to beans includes tunneling in the vine and direct feeding damage to the bean pods, whereas damage to tomatoes is primarily done to the fruit. Damage to the fruit of peppers, especially green peppers, is problematic because the internal feeding is difficult to detect. The larva usually enters the fruit near where the stem attaches. The pinhole-size entrance may exude a small amount of sawdust-like frass (excrement) (Figure 4). The entrance hole is hard to see, especially if it is just under the edge of the stem attachment or cap. Inside the fruit, the larva feeds on seeds and other tissues (Figure 5).
**Description and Life Cycle**

The European corn borer life cycle is composed of an egg, five larval instars (stages), a pupa and adult.

**ADULT:** Adult male and female European corn borers have alternating yellow and brown wavy lines across each forewing (Figure 6). Males often have a darker wing pattern. Adult moths are night fliers and are about 1 inch (25 mm) in length. While resting, European corn borer moths tend to hold their wings in a delta wing shape.

**EGG:** Eggs are small, about 0.04 inch (1.02 mm) long by 0.03 inch (0.76 mm) wide, generally flattened and oval, whitish, and may appear iridescent (Figure 7). Eggs are laid in clusters of five to 50 in a layered appearance, resembling fish scales. They are laid on the underside of leaves near the midrib. As eggs age, they change from iridescent white to orange/beige. Dependent upon temperature, eggs hatch within four to nine days.

**LARVA:** Larvae undergo five larval instars in approximately 50 days, depending on weather and temperature. Initially, larvae range from light brown to pinkish gray, becoming creamy to gray, with a faint red stripe along the body and a dark brown or black head capsule (Figure 1). Several rows of minute, brown, round bumps, each with a tiny seta (hair) attached, are found running along the length of the body. Mature larvae are about 1 inch (25 mm) long with three pairs of jointed true legs on the three thoracic segments directly behind the head (Figure 1). The remaining body consists of the abdomen, which has five pairs of fleshy prolegs. These prolegs have small (0.02 inch [0.51 mm]) crochets (minute hooks) arranged in a circular pattern on the bottom of each one, which helps them adhere to plant surfaces. A black central dot on the tip of each fully extended proleg on abdominal segments three through six is visible from a side view.

**PUPA:** Pupae are reddish brown and approximately 0.52 inch (13 mm) to 0.68 inch (17 mm) long (Figure 8). Pupae are found within the stalk, and the pupal stage lasts for approximately 12 days.

**LIFE CYCLE:** European corn borer adults are typically observed in spring beginning in April and May. In Tennessee, they commonly have three generations each year, with the mature larvae (fifth instar) of the third generation overwintering in corn stalks, stubble, corn cobs and plant debris. In the spring when temperatures reach 50 F (10 C), overwintering larvae pupate. Adult moths emerge seven to 14 days later and move to field edges and other grassy habitats where they mate. Females return to corn fields or other hosts and lay 500-600 eggs in small masses (usually about 20-30 eggs/mass) on the underside of whorl leaves near the midrib. As young larvae feed in corn, they are often found within the whorl and tassel. As they grow, they move down and burrow into the midribs of leaves and into stalks and ears where they eventually pupate. Normal pupation periods occur during the spring and summer months.

**Monitoring**

Periodic sampling of fruit needs to be done by harvesting a representative sample of fruit and cutting each one in half. Look for the larvae feeding internally on seeds and adjoining tissue, which may cause the tissue to become brown.

For commercial vegetable production, monitoring for European corn borer moths is important. Blacklight and pheromone traps are the two best monitoring methods available. Blacklight traps attract and catch moths and many other kinds of insects as they fly at night. European corn borer pheromone traps use a specific sex pheromone to attract and catch male European corn borer moths. These traps should be checked daily to alert growers of pest activity.
The major egg-laying period begins with peak moth catches and continues for a period of up to three weeks. Moth trapping can give the growers the information needed to intensify scouting efforts or to better time insecticide applications to protect plants against larval infestation.

**Control**

**Nonchemical Controls**

Native predators of European corn borer larvae range from birds (woodpeckers and the yellow-shafted flicker) to insects, including green lacewings, *Chrysoperla* spp. (Neuroptera: Chrysopidae), lady beetles (Coleoptera: Coccinellidae), and the insidious flower bug, *Orius insidiosus* (Hemiptera: Anthocoridae). Although insect predators consume about 10-20 percent of larvae and birds consume another 20-30 percent of overwintering larvae, the introduction of nonindigenous parasitoids potentially can cause higher mortality of European corn borer larvae. Currently, about six species of parasitoids have been successfully introduced to the United States to aid in the control of European corn borers. Among the six species, *Lydella thompsoni* (Diptera: Tachinidae) has the potential to eliminate approximately 30 percent of second-generation borers in some areas. Other introduced parasitoids that have had a positive effect on reducing numbers of larvae are *Eriborus terebrans* (Hymenoptera: Ichneumonidae), *Simpiesis viridula* (Hymenoptera: Eulophidae), and *Macrocentris grandii* (Hymenoptera: Braconidae).

Plowing fields, postharvest burning, livestock grazing, mowing, and stalk shredding can be incorporated to reduce the overwintering population of European corn borers, but are typically only marginally effective unless practiced on a wide scale. Timely harvesting will reduce the chances of stem breakage and corn loss. Transgenic sweet corn varieties expressing *Bt* protein provide highly effective control of European corn borers.

**Chemical Controls**

Chemical control using granular or spray-applied insecticides targeting the whorls is best when applications are made to larvae while they are small (early instar) and before much damage has occurred. Proper timing of insecticide applications can be determined by regular field pest scouting for eggs and larvae. Once larvae bore into the plant, the efficacy of insecticide applications drops substantially.

When applying an insecticide to a specific crop, always follow the preharvest interval (PHI) on the insecticide label. The PHI states when the last insecticide application can be made prior to harvest. Commercial vegetable growers have access to more chemical control options. If the crop is flowering, it is best to apply chemical insecticides during the early evening hours when bees are not active to minimize toxic effects to bees.

The availability of chemical pesticides changes regularly. Always consult your local county Extension agent for a list of currently approved and recommended chemical insecticides for your area. The following links provide access to listings of recommended chemical control options for homeowners and commercial production growers:

- UT Extension “PB 1690 Insect and Plant Disease Control Manual (Redbook)” (vegetables, home garden insects): [ag.tennessee.edu/EPP/Pages/Vegetables.aspx](ag.tennessee.edu/EPP/Pages/Vegetables.aspx)

The above online recommendations are updated annually. Be sure that you refer to the most recent recommendations. Always use pesticides according to the label; also, be sure to use protective clothing and dispose of remaining pesticide in a properly approved manner.
REFERENCES


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DISCLAIMER

This publication contains pesticide recommendations that are subject to change at any time. The recommendations in this publication are provided only as a guide. It is always the pesticide applicator’s responsibility, by law, to read and follow all current label directions for the specific pesticide being used. The label always takes precedence over the recommendations found in this publication.

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