

Pest Alert: European Corn Borer in Hop

European corn borer (*Ostrinia nubilalis*) has been a minor pest of hop in Michigan over the last decade. Other Midwestern states have reportedly experienced more substantial damage from this introduced moth. Unfortunately, damaging levels of European corn borer (ECB) larvae are present in some Michigan hopyards this year. While it is unknown exactly what has caused the outbreak, it is possible that unusual weather patterns in the spring that delayed planting of its major crop host (corn) made hop an attractive alternative egg-laying site for the moth. According to the [USDA NASS Michigan Crop Weather progress reports](#), by the end of May only 33% of corn planting was completed compared to a 73% five-year average. Additionally, [according to the Farm Service Agency](#) almost 240,000 acres of Michigan corn acreage was submitted for [preventive planting](#) coverage (i.e. never planted) due to wet field conditions.

Lifecycle

ECB completes 1-2 generations per year in Michigan. Generally, populations in colder areas complete a single lifecycle and populations in warmer regions complete two. The geographic distribution of single and multi-generation populations, and their area of overlap, is not well defined in Michigan as reliable and widespread trapping data is not available.

ECB overwinters in the larval stage; pupation occurs in the spring as temperatures warm. The first flight of moths is expected at 450 degree-days base 50, based on a March 1 start date for degree day accumulation. This first flight of adult moths continues for 500 degree-days (through 950 DD base 50) with females laying 200-500 eggs over a period of 2-3 weeks. Development is driven primarily by temperature, but eggs hatch in approximately 12 days and then larvae feed externally on leaves for approximately 7 days before boring into stems and petioles where they continue development. Once inside the plant, observations in hop indicate that ECB larvae damage vascular tissue, disrupting the flow of nutrients and water and impeding plant development. This summer, damage to the vascular tissue in hop appears to have occurred in June before bines reached the top wire and affected the critical sidearm and cone development stages, greatly reducing yield and likely quality.

According to the [Enviroweather ECB Model](#), the first adult flight and egg-laying period in Michigan was estimated to have occurred between June 8 – July 5 in the southern tier of counties, and June 21-July 17 in the northwest. In single-generation locations, the larvae generated from this first flight of adult moths will overwinter. In warmer locations, larvae from the first generation pupate and a second adult moth flight and egg-laying cycle occurs between 1450 to 1950 DD base 50. In areas where both one- and two-generation corn borer co-exist, emergence and development may overlap or occur in succession, making scouting and management difficult.

Monitoring

Growers can scout for eggs, larvae, and pupae. ECB eggs are smaller than the head of a pin but are laid in visible groupings. Eggs are white when first laid, but change to yellow and then develop a black spot (the larval head capsule) just before hatching. Eggs are likely deposited on the underside of hop leaves in masses of 20 to 30 and covered with a waxy film. ECB larvae are light gray to faint pink caterpillars with a dark head and have dark spots along the sides on each segment and a pale stripe along the back. They grow to about one inch but start out very small at hatch and feed briefly on leaf tissue before boring into hop bines, and even hop leaf petioles. ECB pupae are smooth, reddish-brown, cylindrical and

about a half inch long and found inside bines. The European corn borer moth is about 1-inch-long and light brown with wavy bands across the wings. The male is slightly smaller and darker. The tip of the body protrudes beyond the wings. Adult moths are most active in grassy areas before dawn.

(A) European corn borer eggs with characteristic fish scale appearance, (B) hatching ECB larvae, (C) frass and pupae within stem, and (D) corn borer moths. Photo credit: Ronald Smith, Auburn University, Bugwood.org.



Symptoms of damage from ECB on hop appear as generalized stunting and in some cases wilt. Plants fail to thrive and may lose their ability to climb the coir. Check for stem wounds along bines, particularly where sidearms originate or bines contact each other or the coir. The larval frass (feces) appears a little like saw dust about the size of large sand grains and is trapped in webbing. You may also see holes or wounding. If you cut open the bines where borer is suspected, you will see discolored tissue, frass and likely the larvae itself.

Monitoring for adult flight is critical to properly timing the start of pesticide application to control ECB as small larvae are the intended target of insecticides. Unfortunately, simple wing or bucket traps used for other field crops moths cannot be used to trap ECB; instead, wire Hartstack or cloth Heliothis traps are used. These traps are cumbersome and expensive, and must be positioned carefully in 'action sites' (grassy locations where ECB gather to rest and mate). Growers should begin monitoring and trapping before predicted flight. Consider establishing a trapping and monitoring system with neighboring hop or corn growers to limit the workload on any one individual farm. In lieu of trap data, careful crop scouting based on the [Enviroweather prediction model](#) can be used as a loose guide. Growers can also work with neighboring corn growers to monitor their crop for egg masses as an indication of risk.



(A) Hopyard exhibiting stunted symptoms and failure to thrive due to ECB infestation. (B) ECB wound on bine with characteristic webbing and frass, note the affected leaves that have died. (C) ECB larva inside hop bine, note the necrotic damage to the tissue. Photo credit: Erin Lizotte, MSUE.

Management

There are a number of effective insecticides for managing ECB and they should be applied to control adults preventing egg laying and kill larvae before they enter the protection of the bine. Based on [research in peppers](#) and the [available pesticides to hop producers](#), it is likely that spinosad-based insecticides will provide the best control of ECB in hop. Registered spinosads for hop growers in Michigan currently include Entrust, Entrust SC, and SpinTor 2SC. Product containing cyfluthrin (Tombstone, Tombstone Helios) will also likely be effective though more disruptive to natural enemies, increasing the risk of two-spotted spider mite pressure. *Bacillus thuringiensis* products may also be used to target small, newly hatched larvae before they enter the protection of the bine. All of these products should be targeted to control larvae as they emerge from eggs, once inside the bine insecticides will be ineffective. Growers should scout to identify the current active lifestage before making management decisions.

Growers with substantial infestations should carefully dispose of crop waste including chopped bines at the picking line. Consider burying or hot composting crop debris both from the processing line and the field to limit carryover into the next season.

Managing for European corn borer takes a multipronged approach including careful monitoring and targeted pesticide applications. A regular schedule of insecticide applications based on insecticidal residual activity should be maintained from the beginning of egg hatch until two weeks before harvest or when larvae are no longer detected. For more information on the European corn borer, refer to the Iowa State University publication, [European Corn Borer – Ecology and Management and Association with other Corn Pests](#).

Information presented here does not supersede the label directions. To protect yourself, others, and the environment, always read the label before applying any pesticide. Although efforts have been made to check the accuracy of information presented, it is the responsibility of the person using this information to verify that it is correct by reading the corresponding pesticide label in its entirety before using the product. Labels can and do change. For current label and MSDS information, visit one of the following free online databases: greenbook.net, cdms.com, and agrian.com. The efficacies of products listed have

not been evaluated on hop in Michigan. Reference to commercial products or trade names does not imply endorsement by Michigan State University Extension or bias against those not mentioned.

Stay in touch!

Want to receive more pest management information for hop this season? [Sign up to receive the MSU Extension Fruit & Nuts Newsletter](#) or [follow us on Facebook](#).

This material is based upon work supported by the USDA NIFA under Award No. 2017-700006-27175. Any opinions, findings, and conclusions or recommendations expressed in this publication are those of the author and do not necessarily reflect the view of the US Department of Agriculture.