SARE 2019 FARMER/EDUCATOR GRANT

European Corn Borer Factsheet

Detection and control measures for New England Hop Yards

General Information

Over the last several years, the European Corn Borer (ECB) has caused concern for many hop farms in New England.

The ECB is an eastern pest extending west to the rockies. As most hop production has traditionally occurred in the Pacific Northwest, it has not been a major concern for the majority of hop producers in the country. Controlling crop damage caused by ECBs is unique to the Eastern states and has become a major concern with the recent revival of hop farming in the region. It's a critical problem for hop farms in the area made worse by the lack of specific information for control in hops.

The ECB moth is roughly an inch long with a resting wing- span of about an inch across. Females are yellowish-brown with dark irregular and wavy bands across the top of the wings. Males are typically smaller than females and tend to be darker in color. A tell tale sign of the ECB moth is a small lightly colored rectangle on the wing margin. Borer larvae have black heads and flesh colored bodies with brown round spots dotting the segmented sections of the worm.

Fresh ECB egg mass

ECB pupate in hop bine

ECB tunneling through bine

Life Cycle

During its lifetime, the ECB goes through four stages of development: egg, larva (borer), pupa, and adult (moth).

These four stages equal one generation. In southern Maine there are two generations of ECBs. The first appears in late May to mid June and the second in early August.

During the fifth (final) larval instar, all larvae either prepare to pupate and become adults or enter diapause. Diapause, the insect version of hibernation, causes suspended development and is triggered by day length, temperature, and the genetic makeup of the population. Diapause ensures survival through the fall and winter when diapause ends and the larvae resume development and pupate. Larvae spend the winter in hop bines or weed stems on the yard margins. ECBs that survive the winter in end diapause and then continue development to their adult stage.

Damage

The ECB prefers corn, especially sweet corn, but also attacks other vegetable crops like peppers, beans and tomatoes as well as many other herbaceous plants like some weeds.

The damage in hops is from internal bine feeding where larvae enter the center of the bine, usually at a leaf node or between bines that are tightly wound around the trellis string. Young larvae start by feeding on leaves until they are large enough to pierce the thicker bine tissue, which can occur as soon as three days after hatching. Larvae is full grown by fall and over winter in the bines.

Pinhole feeding from the first and second instars

Weakened bines are susceptible to breakage from wind or high powered mechanical sprays used for treatment applications, or results in a secondary bacterial infection. Once bines break, hops quickly dry up and do not mature properly, dramatically reducing yields. In some instances second generation ECB larvae will bore into hop cones themselves. Damaged hops can easily be mistaken for symptoms of downy mildew.

Monitoring

ECB adults are hard to detect because of their nighttime flight patterns.

Determining when the moth is active is crucial for controlling the larvae because this pest is the most susceptible to insecticides after the eggs first hatch. The initial generation in the spring is the most critical and compact in terms of flight and egg-laying, making them the ideal target. There are three main methods for monitoring ECB populations.

1

PHEROMONE TRAPS

Research suggests that *Heliothis*-type traps are the most efficient at catching ECB males compared to delta sticky traps and bucket traps. Maine has two known strains of ECB, a New York strain and and Iowa strain. Traps should be baited in the mid May before moths arrive. Traps should be hung just below the plant canopy because this location has the most accurate population count compared to traps placed just above the plant canopy. However, more research needs to be done to determine if this is true for hop plants that grow 25 to 30 feet. Traps should be checked weekly for the presence of ECBs and the

2

FIELD SCOUTING

Randomly sample plants every week for evidence of ECB eggs and/or larval infestations starting in the spring. Three leaves per plant can be searched and the bine of the plant inspected for bore holes.

3

CALCULATE DEGREE DAYS

Basic degree day models take the average between the maximum and the minimum daily temperature. Daily degree days (DD) accumulate throughout the season and correspond to relevant life cycle events. For more accuracy calculate modified degree days (MDD) by integrating the developmental threshold for ECB growth which is 50 degrees F.MDDs started to accumulate after the first moths was captured in a trap. Degree days continued to accumulate until the crop was harvested in early September and correspond to significant life cycle events

[(maximum temp. + minimum temp.)/2]-developmental threshold =MDD

	Stage	Activity	Accumulated MDD	Date of occurrence
First Generation	egg hatch	pinhole leaf feeding	242	**6/30**
	second instar	shothole leaf feeding	390	**7/8**
	third instar	midrib and stalk boring	N/A	
	fourth instar	stalk boring	N/A	
	fifth instar	stalk boring	829	**7/29**
	pupa	changing to adult	982	**8/6**
	adult	mating and egg laying	1110	**8/8**
Second Generation	egg hatch	pinhole leaf feeding	1219	**8/18**
	second instar	shothole leaf feeding	1335	**8/25**
	third instar	midrib boring	N/A	
	fourth/fifth instar	stalk boring	1471	**9/2**

Table 1. Modified days and the corresponding life cycle event for ECBs in a Maine hop yard.

Management

Controlling ECBs is a two part problem-- first you have to establish a scouting protocol and then you have to determine how to treat the pest once it arrives.

Understanding what protocols work the best and when treatment should be initiated would also help reduce the amount of pesticides used to control this pest. Timing is everything and rather than blanketing the fields as a precautionary measure, farmers could know exactly when to target the ECB. Reducing the amount of pesticides used on site will decrease environmental risks associated with these chemicals and lower farm inputs required for a profitable crop.

Moreover, hops are a perennial plant that stay rooted in the ground for many years and techniques like plowing stalks under to kill overwintering pests and altering spring planting dates used in annual corn production for controls are not applicable. Therefore determining effective control measure is paramount among New England hop yards as multiple yards report significant levels of damage and decreased yields due to this pest.

Only larvae that have not bore into the plant can be killed so the treatment window is very tight. In other words, between the time the eggs hatch and the larvae bore into the plant, there is a specific period, or window, when pesticides must be applied to be effective. Egg deposition in a given field may last three weeks. Insecticides like Bt and spinosad kill larvae over a relatively short period of time; therefore, they must be applied before all eggs are deposited. If the treatment is delayed, larvae from eggs deposited early in the egg-laying period will enter the plant and will not be controlled

effectively by the insecticide. This makes early detection of early emerging moths critical to properly timing applications.

Biological controls like the Trichogramma ostriniae wasps are also an effective means of control if they are released at the appropriate time of ECB egg disposition. You'll need approximately 800,000 wasps per acre.

COMMON ECB DAMAGE TO HOPS

Signs of damage include bore holes into the bine and saw dust like excrement called frass.