

## European Corn Borer in Sweet (Bell) Pepper

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### Introduction

The European corn borer, *Ostrinia nubilalis* (Hübner) (Lepidoptera: Crambidae), is a significant pest to over 200 different plant species. In Virginia, it is the number one pest of pepper, *Capsicum annuum* L. This pest can damage over 50 percent of pepper fruit if control measures are not taken.

### Biology

For a complete description of the European corn borer (ECB) and its life cycle, see *European Corn Borer*, Virginia Cooperative Extension publication 444-232, by Roger R. Youngman and Eric R. Day.

The European corn borer is a moth (Fig. 1) that deposits its egg masses on the underside of leaves (Fig. 2). ECBs damage plants by their extensive tunneling into plant structures (Fig. 3). After overwintering as a full-grown larva in plant stems and debris, the ECB begins to develop in the spring when temperatures exceed 50°F. Larvae pupate in late spring and emerge as adults after about two weeks. The first of three generations of moths usually appears from mid-May to early June in Virginia (Fig. 4) with the exact date depending on both location and weather conditions. The second generation of moths emerges from late June to mid-July. The second and third generations are considered to be the most damaging to crops like bell pepper.



Fig. 1. Female (left) and male (right) adult European corn borer moths. Photo courtesy of Iowa State Cooperative Extension.



Fig. 2. ECB egg mass on the underside of leaf. Photo courtesy of Iowa State Cooperative Extension.



Fig. 3. ECB larva tunneling into plant stem.

## Damage

After the eggs hatch, the newly emerged larvae feed on leaf tissue for a short period and then tunnel into stems or fruit. The ECB larvae often burrow into the fruit beneath the protection of the calyx. Once direct injury (Fig. 5) has occurred to the marketable portion of the pepper (i.e., the fruit) it is no longer acceptable for market. The ECB is a season-long pest that causes direct injury to the fruit as well as premature fruit ripening and fruit rotting as a result of pathogens such as *Erwinia carotovora* pv. *carotovora* entering the feeding wound. Controlling ECB larvae before they reach the pepper fruit is essential to effectively managing this pest.



Fig. 5. ECB larva tunneling in pepper fruit.

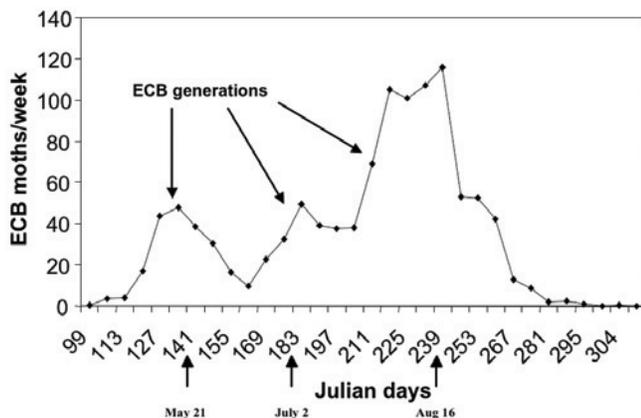


Fig. 4. Typical multi-generation ECB moth flights for Virginia.

## Chemical Control of ECBs in Pepper

ECBs in pepper can be adequately controlled in Virginia with multiple applications of insecticides beginning at early fruiting through final harvest. There are several insecticides currently labeled for ECB control in pepper. However, not all of them are proven to be effective. Table 1 lists selected products that Virginia Tech and other university researchers have tested and shows their overall effectiveness against ECBs. In Virginia, European corn borer trap catches above 2 per night with pepper fruit 1/2 inch in size or larger should be treated on a 7- to 10-day schedule. In fields with no fruit present, chemical applications should begin when trap catches are above 10 ECBs per week to prevent newly hatched larvae from feeding on leaves and then tunneling into the petioles and stems.

**Table 1.** Insecticides labeled for ECB control in peppers as of 2004<sup>1</sup>.

Product	Rate	Insecticide Class	Common Name	Control	Usage/Season
Orthene 97	12-16 oz/A	Organophosphate	Acephate	Excellent	32 oz/A (season max.)
Avaunt 30WDG <sup>2</sup>	3.5 oz/A	Pyrazoline	Indoxacarb	Excellent	14 oz/A (season max.)
SpinTor 2SC	6 fl oz/A	Spinosad	Spinosad	Excellent	Full season
Intrepid 2F	8-16 fl oz/A	Insect Growth Regulator	Methoxfenozide	Excellent	Full season
Mustang Max	4 fl oz/A	Pyrethroid	Zeta-cypermethrin	Good	Full season
Baythroid 2EC	1.6-1.8 fl oz/A	Pyrethroid	Cyfluthrin	Good	Full season
Warrior 1 EC	2.56-3.84 fl oz/A	Pyrethroid	Lambda-cyhalothrin	Good	Full season
Confirm 2F	8-16 fl oz/A	Insect Growth Regulator	Tebufenozide	Fair	64 fl oz/A (season max.)
Lannate LV	48 fl oz/A	Carbamate	Methomyl	Fair	Full season
Ambush 25W	12.8 oz/A	Pyrethroid	Permethrin	Fair	Full season
Asana XL	5.8-9.6 fl oz/A	Pyrethroid	Esfenvalerate	Fair	Full season

<sup>1</sup>Be aware that pesticide labels and registrations are constantly changing and that the information provided in this table may be out-of-date by the time you read it. Always read and follow current labels before applying any pesticides.

<sup>2</sup>Although not registered for ECB control, this product is registered for use in bell pepper.

## Biological Control of ECBs in Pepper

Controlling ECBs in bell pepper with insecticides is problematic because they do not kill eggs and do not control larvae once they tunnel into stems and fruit. Effective alternatives to chemical control of ECBs are essential for bell pepper production to be in compliance with the Food Quality Protection Act (FQPA), which already has and will continue to eliminate some of the pesticides used for control of *O. nubilalis* in the United States. Biological control agents such as *Trichogramma ostriniae* Pang et Chen (Trichogrammatidae: Hymenoptera) (Fig. 6a), a tiny parasitic wasp (Fig. 6b) newly imported from China, may reduce the need for chemical control in bell pepper. Research conducted in Virginia has demonstrated that approximately 100 to 170 *T. ostriniae* per plant/per week can significantly reduce the number of ECB-damaged peppers by over 70 percent. This is a significant reduction of damage. It is the result of the female *T. ostriniae* parasitoid wasp depositing her own eggs in the egg masses of the ECB. Once the female *T. ostriniae* locates an ECB egg mass, she will sting each of the eggs in the mass with her

ovipositor, thus destroying the ECB larvae within. After about 4 days the egg mass will turn black, indicating that it has been parasitized (Fig. 6c). At the end of 10 days, a new adult *Trichogramma* parasitoid will emerge from each ECB egg to begin the parasitization cycle again. Although control of ECBs with *T. ostriniae* has shown to be effective for control of the ECB in bell pepper, further work needs to be done to evaluate the use of insecticides with biological control organisms like *T. ostriniae*. Work is now being done to evaluate a spinosad product in combination with *T. ostriniae* releases to further increase control of the ECB in bell pepper.

## Additional Reading

Barlow V.M. and T.P. Kuhar. 2004. Within-plant Distribution of European Corn borer, *Ostrinia nubilalis* (Lepidoptera: Crambidae) egg masses on bell pepper. Submitted to the *Journal of Entomological Science*. June 16.

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Fig. 6. *Trichogramma ostrinae* parasitizing ECB eggs: **a**: adults ovipositing, **b**: close up of adult (scale = 1mm), **c**: parasitized ECB egg mass.

A. Ashley (eds.), *Northeast Pepper Integrated Pest Management (IPM) Manual*. University of Connecticut Cooperative Extension., Storrs, Conn.

Hoffmann, M.P., P.R. Ode, D.L. Walker, J. Gardner, S. van Nouhuys, and A.M. Shelton. 2001. Performance of *Trichogramma ostrinae* (Hymenoptera: Trichogrammatidae) reared on factitious hosts including the target host, *Ostrinia nubilalis* (Lepidoptera: Crambidae). *Biological Control* 21: 1-10.

Kuhar, T.P. and J. Speese. 2002. Evaluation of foliar insecticides for control of European corn borer in peppers, 2001. *Arthropod Management Tests*. 27: E56.

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Kuhar, T.P., V.M. Barlow, M.P. Hoffmann, S.J. Fleischer, E. Groden, J. Gardner, R.V. Hazzard, M.G. Wright, S.A. Pitcher, J. Speese III, and P. Westgate. 2004. Potential of *Trichogramma ostrinae* (Hymenoptera: Trichogrammatidae) for biological control of European corn borer (Lepidoptera: Crambidae) in solanaceous crops. Accepted (in press) *Journal of Economic Entomology*.