

Insect Management Update for Peppers & Eggplant

T. Jude Boucher, University of Connecticut Cooperative Extension System

24 Hyde Avenue, Vernon, CT 06066

Tboucher@canr.uconn.edu

PEPPERS: The European corn borer (ECB) is the most important and destructive insect pest of peppers throughout New England. The female moth lays many egg masses that consist of 15-30 eggs each. The egg masses resemble fish scales and are deposited mainly on the undersurface of leaves and on fruit. Eggs hatch in 3 to 14 days depending upon the temperature. The young caterpillars migrate to the fruit and enter just under the cap near the stem. Upon breaking the epidermis, they often inoculate the inner flesh with the pathogen for bacterial soft rot. The soft rot starts slowly near the entry wound, but soon engulfs the entire fruit causing it to drip from the plant as a mass of ooze. As the fruit begin to rot, the developing larvae will leave and migrate into adjacent fruit, bringing the soft rot bacterium with them. Sometimes 90% or 100% of the fruit in a field can be infested and destroyed by the borer and resulting epidemic. Large sweet peppers varieties, such as bells, tend to incur more damage than smaller, hotter varieties.

There is a single generation of ECB moths in northern New England and two generations in the southern part of the region. There may be no fruit present on the plants during the first generation in the south, so the second generation is usually the only one that requires management. The important moth flight(s) and peak oviposition or egg laying periods usually occur in July in the north and in August in the south. The ECB populations can be monitored over time using two Scentry Heliothis traps, baited with either the NY (E or II) or the IO (Z or 1) pheromone lures. Traps should be placed in the fields at least a couple weeks before the local moth flight is expected and checked weekly. The two traps should be spaced at least 50 yards apart in tall grass or weeds along the edge of the pepper field. The opening of the traps should be right at grass height to catch the maximum number of moths. If fruit are present on the plants, insecticide applications should begin one week after trap counts (sum of both traps) reach or exceed 7 moths per week. The fruit should be protected throughout most of the moth flight or until a week after trap captures decline below 21 moths per week. Some insecticides have longer residual periods of effectiveness than others. The spray interval for effective control depends upon the insecticide you choose to use (see table).

<u>Insecticide type/class</u>	<u>Common name</u>	<u>Trade name</u>	<u>Spray Interval</u>
Microbial	B.t. (<i>Bacillus thuringiensis</i>)	Javelin, etc.	3-4 days
Carbamate	methomyl	Lannate	3-4 days
Microbial/Naturalyte	spinosad	SpinTor/Entrust	7 days
Pyrethroids	permethrin, etc.	Ambush, Warrior	5-10 days
Organophosphate	acephate	Orthene	7-14 days
Insect Growth Regulators	methoxyfenozide, tenufenozide	Intrepid, Confirm	10-14 days

Choosing selective materials for ECB control that spare predators and parasites is an important part of a pepper IPM program. Products like B.t.'s, IGR's and spinosad, that spare beneficials help prevent aphid problems and other secondary pest outbreaks. There were two new selective products available for ECB control in 2003: Entrust and Intrepid. Intrepid is an insect growth regulator specific to caterpillars (moths and butterflies) which causes a premature lethal molt when ingested. Larval mortality may take a couple of days but feeding stops within hours of ingestion. Intrepid is labeled for control of many caterpillars on cole crops, leafy and fruiting vegetables and on sweet corn. Entrust is a new dry formulation of spinosad which meets USDA National Organic Standards. Entrust gives organic growers something they have been looking for a long time...something that will control many of the toughest pests on a variety of different crops, including ECB on peppers.

Having said that, I should diverge for a minute to update you on recent findings about spinosad. I guess there is never any good news without some bad news tagging along. Although harmless to most common insect predators in our fields, recent studies have shown that spinosad can produce near 100% mortality of some important parasitic wasps like *Trichogramma* species, *Encarsia formosa* the whitefly parasite, and *Diadigma insulare*, our most important natural enemy of the diamondback moth. Spinosad is much more lethal for these wasps when directly exposed during application or when they come in contact with residues less than 1-3 days old.

Here is an interesting story to go along with that. In 2002, two Connecticut pepper growers who used 5-6 applications of SpinTor for ECB control, experience major outbreaks of green peach aphid. These two growers had been using spinosad since it came on the market, specifically to help prevent aphid problems, and the strategy had worked up until that time. Normally, they only required 2-4 spinosad sprays to make it through the second generation moth flight, but unusual climatic events last year caused the ECB flight to last much longer than usual. I couldn't find any evidence of parasitized aphids in either field, but the wasp was present in pepper fields on a dozen other farms that I checked. In 2003, when these two growers broke up their SpinTor sprays with an application of Intrepid, or used fewer applications for ECB, they experienced few aphids, and most were parasitized. I guess the moral of the story is that too much of a good thing can get you in trouble.

For combined aphid and ECB management, the UConn Pepper IPM Program is now recommending alternating with an insect growth regulator and spinosad or B.t. All of these products will also provide effective control of sporadic caterpillar pests like fall armyworm, corn earworm and hornworms. The good news is that all these products can be applied within a day of harvest so that insecticide applications won't interfere with picking and marketing schedules. Two of the three materials also have long periods of residual activity so that in most years you should only need 2-3 sprays to get through the moth flight. Most important parasites and predators should survive this spray schedule and continue to work on your behalf. Also, by not relying on acephate (i.e. Orthene) for routine borer control, you will not have to worry about insecticide resistance if you ever have an aphid outbreak. Some other (newer) products that are effective for aphid control include the IGR Knack and the "reduced-risk" material Fulfill.

Another potential option for pepper ECB control in the near future would include periodic releases of the egg parasite *Trichogramma ostrinae*. Researchers at UMass, in cooperation with folks at Cornell, are using releases of 50,000 wasps per acre to reduce the number of insecticide applications necessary to manage ECB. This wasp has been very helpful with ECB management in sweet corn fields. Two years ago, this parasite was available from Canada at a cost of about \$25 per acre, but this wasp was not allowed to be imported in 2003, and was supplied to UMass researchers by Cornell University. This is a project that is being (at least partially) funded by your NEVB Association. If you would like more information about the project contact Pam Westgate or Ruth Hazzard at UMass.

The pepper maggot is also a major pepper pest on many farms in southern New England. In CT, there are four growers who have been using Perimeter Trap Cropping (PTC) to stop this pest on peppers for the last few years and one who tried it on eggplant in 2003. PTC involves planting one or more rows of hot cherry peppers around your bell peppers and treating (just) the trap crop with an effective insecticide when the cherry peppers begin to be stung. All these growers have had great results using this technique.

When they compared results using PTC with their conventional program of multiple full-field sprays, they were surprised to find they got much better control (<1% damage on most farms) and dramatically reduced insecticide use (90%). By not spraying the main crop with broad-spectrum insecticides for maggot control, they also preserved the natural enemies that help control aphids. Most of the PTC growers say that the system saves them time and money and is simpler to use than multiple full-field sprays. They found that using the new system simplifies, monitoring procedures, spray applications, and picking/marketing schedules because there are no reentry intervals or pre-harvest (dh) restrictions on unsprayed bell peppers. Some of these growers are now using PTC on multiple crops to help simplify their lives and improve farm profitability (see article on PTC for Summer Squash and Cucumbers).

EGGPLANT: Its unusual for pepper maggots to attack eggplant, and there are currently no effective insecticides registered to control the pest on this crop. One CT grower had 100% of his eggplant riddled by this pest over the past few years despite multiple full-field sprays. He switched to PTC in 2003 and marketed 100% of his crop this past season. On a post-season survey he said "I highly recommend PTC, especially for big commercial growers...you're crazy not to do it!"

Unfortunately, PTC does not work for pepper maggot on organic farms. One MA grower tried it the last couple of years, and at first got better control. However, this season the pest broke right through the trap crop barrier. That's because, without the perimeter spray to kill off the adult flies, the pest completes its life-cycle, and by providing thousands of host plants (cherry, bell or eggplant) the population grows to artificially high levels that are tough to control. Organic growers must rely on crop rotation, row covers or early harvests to prevent pepper maggot damage.

Colorado potato beetle is the most important and destructive pest on eggplant. The adult beetle overwinters and emerges in the spring to mate and lay eggs. A second generation of adults emerges in late July or August. Eggplants are one of the beetles favorite hosts. Numerous larvae are produced from each egg mass and can completely defoliate individual plants and even whole fields, if the population gets out-of-control.

In recent years CPB populations throughout the region have been relatively low due to the widespread use of effective insecticides like imidacloprid (Admire), thiamethoxam (Platinum), acetamiprid (Assail), spinosad (SpinTor), cryolite (Kryocide) and *B.t. tenebrionis* (Novodor). There are many other insecticides registered for CPB control, but most are rather broad-spectrum in activity and can lead to secondary pest problems on this crop.

Resistance management is a crucial component of any IPM program for CPB, since this pest will become resistant to any insecticide within as little as 3 years. The first three insecticides mentioned (above) are all in the nicotinoid class and should only be used on one generation every other year. Its best to use a nicotinoid on the first generation in alternate years, because the products are so effective there is usually no need to treat the second generation, unless resistance has already become a problem on the farm. Spinosad is a good choice for the first generation the second year because it controls both adult beetles and larvae.

Both of these products are expensive when used at the rates recommended for CPB. However, there are ways to dramatically lower the cost of using these materials. Fields rotated _ mile may not even need to be treated for this pest and many growers get by with spot sprays of just a few plants with a backpack sprayer. It takes a while for newly emerged beetles to develop flight muscles, so beetles tend to colonize nearby host plants primarily by walking. If long distance crop rotation is not practical, you can simply rotate to the other side of the field and plant and treat a trap crop (like early-planted potatoes) so that it intercepts the migrating beetles.

One of the best ways to reduce costs with a soil-applied systemic like Admire, is to apply below-label-rates to transplants before they go into the field. Use _ ounce of Admire to treat 1,000 plants and apply it with a standard watering can. It is recommended to harden the plants properly prior to treatment to avoid phytotoxicity and to dilute the chemical in one pint of water per flat. After you finish, rinse the foliage with a second can of water alone, to wash the chemical from the foliage into the growing media where it can be taken up by the roots. This treatment usually completely controls the first generation of susceptible beetles. If you want to spend even less money, just treat enough plants to ring the field with 5-10 rows of treated eggplant. Now your only spending a couple of dollars per acre and using a form of PTC. Thanks to a grant from you (NEVBA), we are currently working on PTC systems for CPB that utilize even more effective trap crops. We will discuss the results of our studies on eggplant and tomatoes next winter.

Potato leaf hoppers (PLH) have presented the biggest insect challenge on eggplant in the last half-dozen years, at least in southern New England. This is a migratory pest from the Gulf States

that began to arrive in huge numbers back in 1997. The saliva of this insect is toxic to crops like alfalfa, potatoes, beans and to a lesser extent, eggplant. When populations exceed 1 to 1.5 PLH per leaf on eggplant, the edges of the leaves begin to yellow and curl upwards, and yields are reduced. Some varieties of specialty eggplants are even more susceptible to damage by this insect.

The biggest problem is that most of the materials that are effective at controlling the PLH (like many synthetic pyrethroids) will almost certainly bring on problems with two-spotted mites, aphids or possibly other secondary pests. Two-spotted mites can be a huge problem on eggplant, especially in a dry season. The IPM consultant that works in CT has found the best way to deal with the combo PLH/mite problem is to use azadirachtin (i.e. Azatin) or neem oil (i.e. Trilogy) to control PLH nymphs and immature mites and to help repel adult leaf hoppers. Low-dose endosulfan sprays are used if adult PLH become too abundant, in an attempt to spare as many of the numerous mite natural enemies as possible.

There are many different sporadic insect pests of eggplant including: cutworms, flea beetles hornworms and, in rare cases, ECB. Even the “old fashioned potato bug” or margined blister beetle, and the three-lined potato bug, can occasionally consume a lot of foliage on a few plants in low- or no-spray situations. Finally, the newest arrival of them all, is the oriental beetle. It is the same shape and size as the Japanese beetle, but is brown with a lighter mottling on its back, and it lacks the green iridescent color. They were introduced into the country much later than Japanese beetles and spread through New England in the 1990's. Their numbers seem to be on the increase in the past few years and they tend to consume more foliage than their more-familiar cousin. They may become a problem on eggplant in the near future.

We wish to thank the Northeast IPM Program for funding the pepper maggot PTC research and both the Northeast Sustainable Agriculture Research and Education Program and the New England Vegetable and Berry Growers Association for funding current PTC research.