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Pepper Maggot in Sweet (Bell) Pepper

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Introduction

The pepper maggot, *Zonosemata electa* (Say) (Diptera: Tephritidae), is native to eastern North America and is thought to have moved from the weedy perennial horse nettle, *Solanium carolinense* L., to domesticated crops like the bell pepper. Pepper maggot occurrence in pepper is patchy and sporadic. However, infestation can reach 100 percent of the fruit with only a single maggot causing the destruction of an entire pepper fruit.

Biology

Zonosemata electa undergoes a complete life cycle (metamorphosis, i.e. egg, larva, pupa, adult) and overwinters as a pupa in the soil. Adults emerge from the soil over a 10- to 14-day period and are active from June 1 through mid-August. Adult flies are brightly colored with a pale yellow head, green eyes, honey colored thorax, pale yellow abdomen, and clear wings with brown bands (Fig. 1). Female pepper maggot flies are about the same size as a housefly while males are slightly smaller. Females live an average of 23 days but can live up to 45 days. After mating, a female can lay 50 to 60 eggs, depositing them in punctures she creates with her ovipositor in the skin of the pepper fruit. Eggs are about 0.08 inches long, white, and "crook-neck" shaped. Maggots emerge from eggs in 8 to 10 days then burrow into the pepper fruit and feed there for about 2 to 3 weeks. Fully-grown maggots are 0.39 to 0.47 inches long and creamy white to yellow in color (Fig. 2). Mature maggots exit the pepper, drop to the

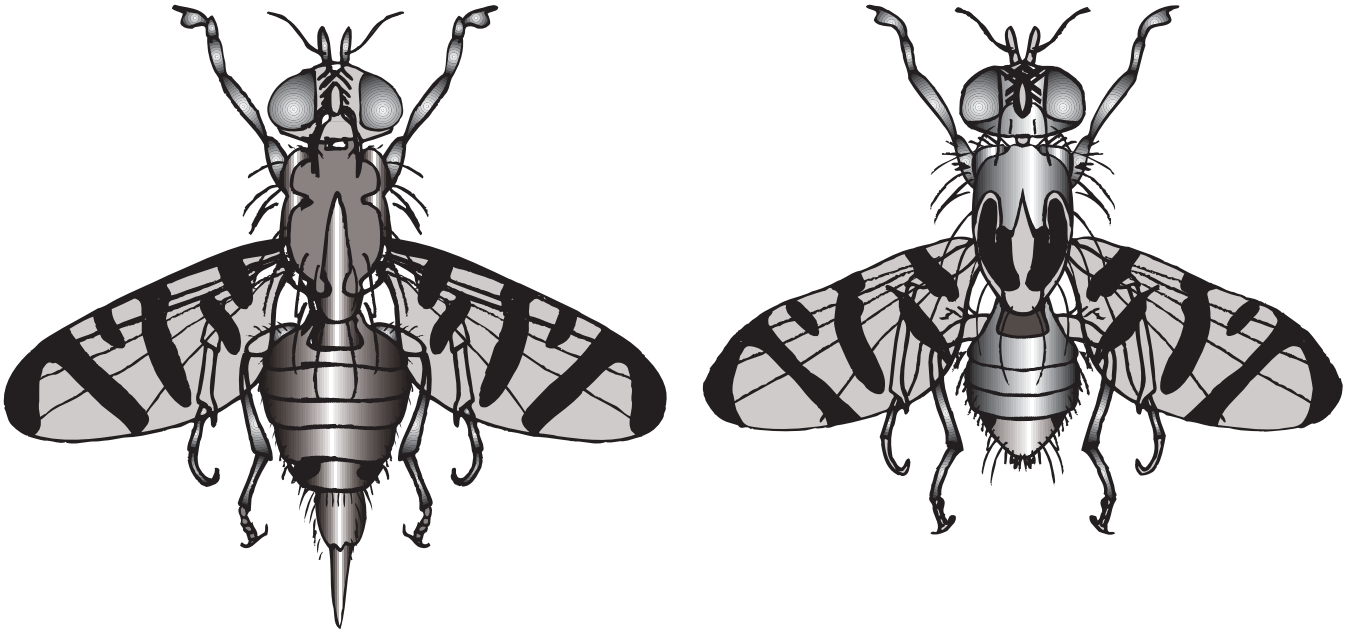

Fig. 1. Female (left) and male (right) adult pepper maggots.

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Fig. 2. Pepper maggot larva (left) and pupa (right) on green pepper.
Photo courtesy of R. Bessin, University of Kentucky.

soil, and burrow 2 to 5 inches into the soil. There they form a brown, oval-shaped puparium that is about 0.31 inches long (Fig. 2). In Virginia, there is one pepper-maggot generation per year.

Damage

Pepper maggots develop successfully only on plants in the family Solanaceae, including the vegetable crops pepper and eggplant. Larvae of both the European corn borer and the pepper maggot feed inside the pepper fruit by tunneling underneath the cap on the pericarp, and the damage they cause appears very similar. The first sign of a pepper-maggot infestation is the appearance of elliptical holes 0.02 inches long by 0.01 inches wide in peppers 0.39 to 1.57 inches in diameter. The female's ovipositor creates these holes as she inserts her eggs just beneath the skin of young peppers. Damage is greatest on fleshy, round or blocky fruit such as the horse nettle or cherry-, apple-, and cheese-peppers. Damage is limited on slender, thin-walled cultivars such as banana, long-hot, cayenne, jalapeno, Tabasco, and serrano peppers. As infested peppers enlarge, the egg punctures become shallow depressions in the fruit, rendering the pepper fruit unmarketable.

Peppers damaged by the pepper maggot are susceptible to premature fruit ripening and rotting, as a result of pathogens such as *Erwinia carotovora* that enter through the feeding wound. Although external damage to the pepper fruit is not always easily discernable, there is considerable internal tunneling and discoloration caused by the maggot. Maggots of some other fly species commonly feed on the decaying material in peppers that have succumbed to disease or European corn borer attack. These larvae should not be confused with the pepper maggot since they feed only on decaying material and do not injure healthy peppers.

Control of Pepper Maggot in Pepper

Field sanitation and rotation typically are used to control pepper maggot. Adult flies are attracted to rotting peppers; so removing rotting fruit from fields reduces the fields' attractiveness to egg-laying flies. Destroying infested fruit and cull piles, which act as reservoirs, can help minimize future infestations. Where possible, do not plant peppers in or near fields with a history of pepper maggot. Alternate hosts such as horse nettle also should be eradicated from field margins to remove sources of infestation. A combination of trap cropping with hot cherry-pepper varieties and border row insecticide applications has also been used successfully by some pepper growers to reduce the incidence of damage to bell pepper.

Monitoring Pepper Maggot in Pepper

Yellow sticky cards can be used to monitor the flight activity of adult pepper maggots. Traps should be placed around field margins and observed weekly. Traps baited with liquid ammonium hydroxide (Stills-style trap), and hung at a height of approximately 21 feet in the tree canopy on the edges of pepper fields have been shown to be effective monitoring tools for pepper maggot. Fruit oviposition scars also are useful site-specific indicators of pepper-maggot presence/absence and may aid in determining if insecticide applications are necessary and in timing sprays. In other states where pepper maggot has been a problem, sprays are applied when the flies are detected on the traps and reapplied weekly while the flies remain active.

Chemical Control of Pepper Maggot in Pepper

Several insecticides are currently labeled for pepper maggot control in pepper. Since chemical control measures should be applied prior to egg deposition by the pepper maggot, monitoring of adult pepper maggots is critical. Contact your local Extension agent for current chemical recommendations in your area. Products that have been useful in other areas are listed in Table 1.

Table 1. Insecticides labeled for pepper maggot control in peppers as of 2004[1].

Product	Rate	Insecticide Class	Common Name	Usage/Season
Acephate 97UP[2]	10.72 -21.28 oz/A	Organophosphate	Acephate	34 oz/A
Thionex 50W	16.0 – 32.0 oz/A	Chlorinated cyclodiene	Endosulfan	64.0 oz/A
Dimethoate 4E	8.0 - 10.56 fl oz/A	Organophosphate	Dimethoate	All season
Mustang Max	2.24 - 4.0 fl oz/A	Pyrethroid	Zeta-cypermethrin	24.0 fl oz/A
Warrior[2]	2.56 - 3.84 fl oz/A	Pyrethroid	Lambda-cyhalothrin	46.08 fl oz/A
Baythroid 2[2]	1.6 - 2.8 fl oz/A	Pyrethroid	Cyfluthrin	16.8 fl oz/A
Asana XL[2]	5.8 - 9.6 fl oz/A	Pyrethroid	Esfenvalerate	67.2 fl oz/A
Permethrin 3.2 EC[2]	8.0 fl oz/A	Pyrethroid	Permethrin	64 fl oz/A

[1]Be aware that pesticide labels and registrations are constantly changing and that the information provided in this table is not necessarily current. Always read and follow current labels before applying any pesticides.
[2]Although not labeled specifically for pepper maggot control, use of this insecticide for corn-borer control will reduce pepper-maggot infestations.

Additional Reading

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