Insect Pest Management in Eggplant

While eggplant production in Maryland is rather small, they are grown over the entire state to supply vegetable stands with many varieties. Because of its value growers frequently apply pesticides regularly in order to protect their investment. This often leads to development of insect resistance, environmental contamination, worker and food safety issues and poor management of a pest. The key to any successful pest management program is to develop a regular scouting plan to gain information on insect pest populations that may be used to determine if insecticide applications are needed. Monitoring can consist of sampling groups of 10 plants which are randomly selected at a minimum of 4 different locations in a field. Samples should be evenly distributed throughout the field so that plants near the edges and middle of the field are examined. It is critical to properly identify the pest to be controlled and to determine its potential for damage. The only way to obtain this information is through routine scouting of fields. The purpose of this guide is to serve as a reference for insect pest identification and for general management guidelines. Specific information on insecticides is available from EB-236 the pesticide recommendation guide for the mid-Atlantic region. Cultural controls, reduced risk pesticides as well as other pesticides are recommended for each pest.

Colorado potato beetle (*Leptinotarsa decemlineata*) (CPB) is a serious insect pest of potatoes but will also attack eggplant, tomato and pepper in that order of preference. Both the adult striped beetle and the black-spotted, hump-backed red larva are foliage feeders. Their feeding damage can greatly reduce yield and in some cases kill plants. The Colorado potato beetle has the ability to rapidly develop resistance to insecticides that are used repetitively for their control. This has been a serious problem on the east coast for many years. Colorado potato beetles overwinter as adults in the soil. They become active in the spring as temperatures rise and begin to feed on weeds or early planted potatoes. Female beetles lay elongated oval orange-yellow eggs on the underside of foliage. Each female can lay 500 or more eggs over a 4-5 week period. Eggs hatch in four to nine days and the larvae begin to feed
on eggplant foliage. They usually feed in groups and damage can be severe. The larval stage lasts two to three weeks. Full grown larvae burrow in the ground to pupate. In five to 10 days, the adult beetle emerges. This insect can go from egg to adult in as little as 21 days. The newly emerged adult female feeds for a few days before egg laying begins. There are two full generations each year.

**Management** Insecticides in the same chemical class usually have the same method of killing the insect. Resistance develops more rapidly when that insecticide is used repeatedly as the only control measure. Overuse of one insecticide may favor the development of resistance to other insecticides in the same chemical class. Consequently, to delay or prevent resistance it is important to avoid repeated use of one particular insecticide by rotating insecticides (see EB-236, CPB under white potatoes). Timing of sprays is critical for control. Overwintering beetles are attracted to fields over a period of several weeks; in the early season adults do not fly, but must walk to the nearest food source. That is why rotating at least ¼ mile away works so well. Eggplant plants can withstand considerable defoliation (20%) without yield loss. Generally, insecticides do not need to be applied unless there is more than one beetle or larva per plant. Bt *Bacillus thuringiensis tenebrionis* (Novodor) is the organic chemical that controls only small CPB larvae and should be first applied when 30% of CPB eggs hatch followed by applications on a 5-7 day schedule. Another organic chemical control is Entrust, it works best on small to medium size larvae, but will control larger larvae to some degree. Reduced risk pesticides for CPB control are: imidacloprid, or Platinum at-planting. DO NOT use any of the at-planting chemicals again during the season. Foliar chemicals include Actara, Assail, Rimon, SpinTor or Radiant.

**Flea beetles** All solanaceous plants are susceptible to flea beetle attack, but eggplant is especially vulnerable and to a lesser extent pepper and potato. There are many different species of flea beetles that will attack solanaceous and cruciferous crops. The more common species that attack solanaceous plants are the eggplant (*Epitrix fuscula*), tobacco (*Epitrix hirtipennis*) and potato (*Epitrix subcrinata*) flea beetles. The eggplant flea beetle adult is an oval, black; 1/10 inch long beetle that has thickened, "jumping" hind legs. Its antennae are about 2/3 the length of its body. This species resembles the potato flea beetle but has black legs and slightly hairy wing covers. The potato flea beetle is also about 1/10 inch long and brownish black. The tobacco flea beetle is about the same size, but is yellowish brown with a dark band across its wings. All eggs of these species are <1/250 inch long and pointed at one end. Though white at first, they gradually become yellowish-gray. A typical flea beetle larva is white with a brown head and three pairs of brown legs near
its head. Larvae become 1/16 inch long when fully grown. In general, flea beetles overwinter as adults in soil or crop debris and emerge from hibernation in mid- to late March. Weedy hosts such as horsenettle and pokeweed are infested until crop hosts become available. Eggs laid in soil near the bases of plants hatch in about one week. Larvae emerge from eggs and feed on roots for 2 to 3 weeks. After developing through three instars, larvae pupate in the soil. The pupal stage lasts 7 to 10 days. Beetles emerge from the soil, and feed on leaves for 2 months or more. Flea beetles complete 1-3 generations each year in Maryland. Adult flea beetles feed on both leaf surfaces but usually on the underside where they chew small, circular holes through to the upper cuticle, which frequently remains in place for a time before falling out. The circular holes give the plant a “shotgun” appearance; large numbers of these shotgun holes may destroy entire leaves. Flea beetles can be serious pests early in the season when plants are small, less than six inches tall. As plants grow larger they can withstand substantial flea beetle damage without loss of yield. Flea beetle larvae feed on roots where they seldom cause any yield loss to eggplant. **Management** Cultural practices such as destruction of crop residue, weed control and late planting help minimize flea beetle problems. The removal of crop residue reduces the number of favorable overwintering sites for flea beetles. Controlling weeds such as horsenettle and pokeweed around field sites eliminates important early beetle food sources. Delayed planting favors the development of host plants over the establishment of flea beetles. If defoliation becomes severe on small or medium sized plants one application with a pyrethroid will usually take care of the problem. There are no good organic chemicals available that will control flea beetles.

**Tomato Fruitworm** (*Helicoverpa zea*) is a minor problem in eggplant, usually after corn has dried down in the area. The larvae are variable in color, ranging from pale yellow, to red, to green, to brown with pale stripes running lengthwise. Young larvae have several rows of black bumps along their backs and two bristle-like hairs in each bump. Older larvae are densely covered with microscopic spines that make them feel rough. Fruitworms overwinter as pupae in the top 2-6 inches of soil. Adults emerge from early May to early June and have 2-3 generations per year in Maryland. The moths lay eggs at night on leaves near fruit. Eggs are white when first laid and develop a reddish brown band 24 hr before hatching. After the egg hatches, the larvae feed for a short period of time on the foliage before attacking the fruit. Damage consists of small holes in the stem of the fruit when larvae are small but the larvae are cannibalistic, so there is rarely more than one larva per fruit. The tomato fruitworm has a wide host range and the attractiveness of eggplants for egg laying vary with the time of year. The most severe fruitworm damage in eggplants frequently occurs after dry-down or harvest of adjacent corn as eggplant now becomes a site for egg laying. **Management** Calendar-based insecticide sprays are not recommended. Though it may appear that a calendar-based program is a preventative strategy this program is not cost-effective. A
more effective strategy for managing fruitworm and armyworms is to monitor fields regularly for signs of the pests or their damage and to apply an insecticide only when necessary, i.e., at 10% infestation or 5% fruit damage. Field trials in Maryland have demonstrated that use of the insect monitoring program will reduce pesticide applications and any damage by the pest. Reduced risk chemicals for fruitworm control include: Avaunt, Confirm, SpinTor, and Proclaim. Other chemicals include: Pyrethroids, Renounce, and Coragen.

Yellowstriped Armyworm (YSA) (*Spodoptera ornithogalli*) and Fall Armyworm (FAW) (*Spodoptera frugiperda*) become pests later in the season in eggplant. YSA larvae usually have a yellow or cream colored strip running along the length of their body which can be pale gray to black. On the first abdominal segment there are two large dark spots. FAW larvae vary in color from light tan or green to nearly black. Along the sides of its body is a longitudinal, tan or yellow stripe; while down the center of its back is a reddish-brown stripe. The head of the fall armyworm is usually marked with a pale-white inverted "Y." Eggs are laid in groups of 20-30 near fruit. Small larvae feed on leaves for a short time and then attack fruit. Feeding damage to fruit consists of 1/8 – 1/4 inch wide holes. **Management** Leaves must be inspected in June so that these pests can be found when small and before they feed on fruit. Growers should watch for each pest in their eggplants each year, because their populations will fluctuate greatly from year to year and field to field. If damaging populations are found and larvae are small Bt or XenTari can be used effectively. If larvae are larger then reduced risk pesticides such as Confirm, Avaunt, and SpinTor can be used. Other pesticides that will work are bifenthrin, Warrior, and Lannate.

European corn borer (ECB) (*Ostrinia nubilalis*) is a minor pest of eggplant in Maryland. It is more of a problem in sweet peppers than in eggplant. European corn borer eggs are laid in small flat masses, each with about 20 white eggs. Each egg mass is about 1/4 inch in diameter. Larvae are creamy white to light pinkish brown with several light brown spots on each segment and often with two faint white lines down the back. They have a small, dark brown head. Larvae start out about 1/16 inch long, and they reach a length of about 7/8 inch when fully grown. The European corn borer overwinters as fully grown larvae inside corn stalks or corn cobs. In the spring, they go through
Moths spend most of their time in moist grassy areas, where they rest during the day and mate at night. Second generation adults begin to emerge in July and these moths lay eggs on either corn, peppers or sometimes eggplant. If there is corn in the fresh silk stage nearby, the moths are more likely to lay eggs on corn than anything else. European corn borer larvae bore into the top of the eggplant fruit, usually under the calyx. Infested fruits are usually rotten by harvest and marketable yield is reduced. The third generation of ECB can cause economic damage to eggplant because it is one of the only viable crops they can lay eggs in.

Management. Eggplant will rarely have economic levels of ECB damage in Maryland. The best way to monitor ECB is to check fruit for the presence of the larvae. If 5-8% of the fruit has ECB damage a spray application is probably needed. The organic pesticide Entrust or the reduced risk pesticides Confirm or Spintor can be used as well as Pyrethroids for control. If ECB pressure is high (although it has not been very great over the last 5-7 years in Maryland) then a greater volume of water (>100 gal/a) at a greater pressure (50-100 psi) is needed to get the type of coverage that is required to stop ECB larvae from entering fruit.

Aphids There are many different species of aphids that could be found in an eggplant field. Aphids are small, soft-bodied insects that vary in color from pale yellow to red to green to black, depending on the species (with one species capable of having several colors), the host plant, and time of season. Direct-feeding damage by aphids is rarely severe enough to kill plants. They pierce plant tissue with needlelike mouthparts, which may result in blossom shed or curling or stunting of new growth. They also produce a sticky material called honeydew that supports growth of a black sooty mold fungus, if the honeydew gets on the fruit it is difficult to remove making the fruit unmarketable. Three species of aphids can be found on eggplant in Maryland, the melon, potato and green peach aphids. The green peach aphid (*Myzus persicae*) is pale yellow to green with cornicles (long, slender tailpipe-like appendages) that are light in color and much shorter than in the potato aphid. Melon aphids (*Aphis gossypii*) are pear-shaped and vary from yellow to dark green, but have dark colored cornicles (red arrow). Potato aphids (*Macrosiphum euphorbiae*) are soft-bodied, tear-shaped insects that may be solid pink, a green-pink mottle or a light green with a dark stripe. Usually wingless, they are about 1/8 inch long. Adult females give birth to live young, called nymphs. Although slightly smaller than adults, nymphs are similar in color and shape.
Management  Aphids usually are not an important pest in eggplant unless too many pesticide applications have been made. Pyrethroid and carbaryl insecticides if used too often can cause an outbreak of these pests. These pesticides are broad-spectrum and kill many beneficial insects. These beneficial insects or natural enemies, such as predators (lady beetles and their larvae, syrphid fly and lace wing larvae), and parasitic wasps keep aphid populations under control most of the time unless their populations are disrupted. If aphid populations do increase to damaging levels there are several reduced-risk pesticides available that will give excellent control: Actara, Assail, Fulfill, imidacloprid, Platinum and Movento. Coverage of the foliage (under-side of leaves) must be thorough in order for best control of aphids.

Eggplant Lacebug (*Gargaphia solani*) is an occasional minor pest of eggplant in Maryland. Lacebugs are brown with transparent, lacelike veins in the wings and are about ¼ inch in length. Adults overwinter in plant debris. Eggs are black and glued in groups on the undersides of leaves. Nymphs hatch and feed on leaves. Nymphs and adults feed with a piercing-sucking mouthpart in groups on the underside of leaves; covering them with brown spots of excrement. The leaves become curled and turn pale. Damage is usually minimal, but sometimes can cause economic damage. They are not present every year and damage is usually negligible as they are easily controlled with the materials used for other insect pests. Reduced risk pesticides include: Entrust, SpinTor, Radiant, Venom, and other pesticides include: Malathion and Vydate.

Thrips (most being flower thrips *Frankliniella* spp) may infest peppers, including western (WFT) (*Frankliniella occidentalis*) and eastern (*Frankliniella tritici*) flower thrips, and tobacco thrips (*Frankliniella fusca*). Thrips are tiny (1/16 inch), slender insects that vary in color from yellow or orange (most common color) to dark brown or black. Thrips overwinter in plant debris or on weeds such as winter annuals found in or around fields. In the spring they fly to plants producing flowers where they feed on pollen and nectar. They prefer to feed in flowers but also occur in flower and leaf buds and, occasionally, on leaves. There are two larval stages and a pupal stage. Thrips have only the left mandible and use this mouthpart to punch a hole or scrape the leaf or fruit surface of the plant disrupting cells and feeding on the cell contents. This feeding method damages eggplants in several ways; feeding in blossoms may cause blossom drop, or fruit may
not develop properly and become deformed or scarred. **Management** to determine thrips presence; sample 20-40 flowers while scouting. Thrips will be visible inside the flower using a 10x hand lens, or the flower may be shaken over a piece of paper to dislodge the thrips for observation. The recommended thrips treatment threshold is ten thrips per flower. Reduced risk chemicals that will control thrips include: Assail, SpinTor, and Venom, with these other chemicals: pyrethroids, Renounce and Proaxis also working. DO NOT over apply chemicals for thrips control as this will increase the likelihood of resistance developing. Over application of pyrethroid insecticides favors the increase of western flower thrips.

**Twospotted spider mites** (*TSSM*) (*Tetranychus urticae*) are pests that very small, 1/80 - 1/60 inch long, with 2 spots on their back and are a problem usually in late July and August during hot dry weather. Mites overwinter in leaf debris in and around fields. In spring, mites feed on weed hosts, such as chickweed, clovers, and some grasses. Females find their way into fields by climbing to the top of their feeding site and releasing a long string of silk from their abdomen that catches a breeze and they become airborne. Because they have such a wide host range, wherever they land they can usually start to feed. Females can lay 50-100 spherical eggs. Unfertilized eggs turn into males, and fertilized ones turn into females. The life cycle of the mites can be as short as 5-7 days in the summer. Mite infestations usually start on the field edge and move towards the center over time. Hot, dry weather conditions favor rapid development of eggs, increases feeding of nymphs and adults, and decreases the abundance of pathogenic fungi. Dusty conditions also favor mite activity. Both nymph and adult mites feed by piercing the cell walls of the leaf and sucking out the juices. Twospotted spider mites damage appears as a yellow discoloration or a mottled sand blasted appearance on tomato leaves, which can take on a bronze, then brown color. **Management** During hot, dry conditions that continue for several weeks fields should be checked closely, especially along borders and near grassy areas. The underside of several lower leaves should be checked for mite activity. A 10X hand lens can be used to identify mites. Leaves also can be shaken over a piece of paper, and the dislodged mites can be seen crawling around. If mites are found along the border of a field, the whole field should be checked for the presence of mites. An exact threshold for mites has not been developed. If there are only a few mites along the field borders with little mite activity in the interior of the field, then a treatment is not necessary, or just the border around the field may be treated. If there are mites found in scattered areas throughout the field and there
is webbing found on the undersides of leaves, then a treatment will be necessary. Natural enemies help control and reduce mite populations under most circumstances and therefore, insecticide applications should be kept to a minimum. Natural enemies, however, can be overwhelmed by mite reproduction during hot, dry weather. There are two reduced risk chemicals available for mite control in eggplant: Acramite and Oberon. These other pesticides will also control two spotted spider mites: Vydate, Vendex and if populations are not large bifenthrin.