Cucurbit Pest Management

Cucurbit (watermelon, summer and winter squash, cucumber, pumpkin, cantaloupe, etc.) are one of the most common vegetables grown in the mid-Atlantic. While the Eastern shore is best known for watermelon and pickle production all cucurbits are grown throughout the state with pumpkin being the most universally produced cucurbit. Although there are a large variety of cucurbits most have a few very important pests in common such as cucumber beetles, squash bugs, mites and aphids. Some pests are more specific such as squash vine borer, which attacks pumpkins and squash, but rarely watermelon, cucumber or cantaloupe. The timing of control tactics is critical for many of these pests--miss the window and the crop can be severely affected. Some growers choose to spray weekly thinking this will lead to good control, but not only does this lead instead to wasted resources and ineffective controls, excessive sprays also lead to secondary pest outbreaks and the development of resistance by pests to some chemical controls. The key to any successful pest management program is to develop a regular scouting plan to gain information on insect pest populations that is used to determine if insecticide applications are needed. Monitoring can consist of sampling groups of 10 plants which are randomly selected at 5-8 different locations in a field. Samples should be distributed throughout the field so that plants near the edges and middle of the field are examined. In recent years there has been a great increase in new control technologies available to growers, this makes management of insect pests in cucurbits an ongoing process. The new insecticides generally act against a narrower range of pest species than the older, broad-spectrum materials. Therefore, 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. 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 (found on this website). Cultural controls, organic and reduced risk pesticides as well as other pesticides are recommended for each pest.

**Striped cucumber beetles** are one of the most damaging pests on cucurbits, such as squash, cucumber, cantaloupe and pumpkin. The larvae can damage roots while the overwintering generation can transmit bacterial wilt disease. **Spotted cucumber beetles** do not vector bacterial wilt disease but can spread squash mosaic virus.

Striped cucumber beetles (SCB) are about 1/5 to 1/4 inch long, have black abdomens, with yellow and black stripes on their backs. The three black stripes have distinct straight edges. Larvae are approximately 3/8 inch long, have white worm-like bodies with brown heads and three tiny pairs of legs. SCB orange-yellow eggs are laid near the base of host plants. The slender
white larva grows to about 1/3 inch long and is dark on each end. There is one generation per year.

SCBs overwinter as unmated adults in bordering vegetation, plant debris, woodlots and fence rows and are active in the spring when temperatures reach 55 to 65° F. SCBs feed on alternate host plants until cucurbit plants appear in vegetable fields. They feed on pollen, petals and leaves of willow, apple, hawthorn, goldenrod, and aster. As soon as cucurbitbs, the preferred hosts, come up or are transplanted, the beetles move to these plants to start feeding and mating, for Maryland this can be anytime from late-April through mid-May. In a few days, the female lays eggs in the soil at the base of a cucurbit. The eggs hatch in about 10 days. The larvae work their way to the plant roots where they feed for the next 2 to 6 weeks, sometimes causing damage. The mature larvae pupate in the soil. The adults emerge in 7 to 10 days. These beetles spend the rest of the summer feeding in cucurbit flowers.

Spotted cucumber beetles (also known as the southern corn rootworm), are 1/4 inch long, yellow-green with 12 black spots on their backs. Spotted cucumber beetles are polyphagous during the larval and adult stages, both feed on multiple host plants. The larvae are commonly known as rootworms because they feed on roots of corn, peanuts, small grains and grasses. Adult spotted cucumber beetles feed on the pollen, petals and leaves of more than 200 alternate host plants. Adult spotted cucumber beetles overwinter in southern states and migrate into northern states in June and July, appearing two to four weeks later than striped cucumber beetles. Adults are strong fliers and disperse rapidly from field to field during summer. Spotted cucumber beetles produce two or three generations in a growing season.

Direct feeding by either cucumber beetle adult can kill or severely stunt young plants by feeding on stems and cotyledons or on fruit, but most importantly adult striped cucumber beetles can vector bacterial wilt disease of cucumber, cantaloupe, and squash and to a lesser extent pumpkins. Although feeding damage by adult beetles is less serious to plants that are large and already leafed out, feeding on fruits can result in scarring and decreases the marketability and storage life of the crop. Spotted cucumber beetle feeding can vector mosaic viruses, although this is not very common in Maryland cucurbit fields.

Bacterial Wilt The bacterium that causes bacterial wilt (Erwinia tracheiphila) overwinters only in the gut of some of the striped cucumber beetles (between 1-10% of the population may contain the bacteria). When beetles become active in the spring and begin feeding, they spread the bacterium through their feces. Feeding damage on young leaves or cotyledons can open entry points for the pathogen. Bacteria in the feces of the beetle enter the feeding wounds via moisture, i.e., rain, overhead irrigation or even heavy dew. Once inside the plant, the bacterium multiplies in the vascular system, producing blockages that cause the leaves to wilt. This wilting can
take place 2-5 weeks after the plant has become infected. The best chance for infection is when there are large numbers of beetles feeding and defecating on small plants, usually in the early part of the season. Beetles are attracted to infected plants and can pick up the bacterium and move it to healthy plants. The first symptom of bacterial wilt on cucumber and muskmelon is a distinct flagging of lateral and individual leaves. There usually is no feeding damage on wilted leaves. Soon, adjacent leaves wilt and finally the entire plant wilts and dies. Nothing can be done to save an infected plant. The only way to avoid bacterial wilt is to prevent large numbers of beetles from feeding on small plants. Fruit produced on a wilting plant usually is not marketable. One way to determine if bacterial wilt has infected a plant is to cut the stem and squeeze both cut ends. A sticky sap will ooze from the water conducting tissues of the stem. If you push the cut ends of the stem together and slowly pull them apart, you sometimes will be able to see a stringing effect if bacteria are present.

Management

Begin SCB control as soon as seedlings emerge. Early treatment is essential for beetle management in commercial muskmelon or cucumber fields. A single post-transplant soil drench with Admire or Platinum often can provide 3-4 weeks of control. If beetle numbers remain high or no neonicotinoid drench was used applications of foliar insecticides are necessary to protect muskmelon plants from beetle feeding and transmission of bacterial wilt. There is usually a peak in beetle activity each spring that lasts two to four weeks. This is the most important time to control beetles. Because watermelon is not susceptible to the wilt disease, protection is necessary only when plants are small and beetle populations are high. Seedlings of cantaloupe and cucumber need to be protected until the plants reach the 5-true-leaf stage or beyond. Protecting older plants generally does not reduce plant death due to bacterial wilt or direct feeding, but blossom or fruit feeding and excessive defoliation on more mature plants may delay growth, reduce yields or render fruit unmarketable. Crop rotation to a distant field (> ½ mile away) can help minimize the size of the beetle population. Simply rotating to new ground within a field, or to an adjacent field, is not effective due to the mobility of the beetle. Floating row covers can also be used to exclude the beetles from the plants, but must be removed by bloom to allow bees to pollinate the crop. Chemical controls There are no good organic insecticides available that will control beetles, although a rotenone-pyrethrum combination is the best choice. Reduced risk pesticides such as the neonicotinoids previously discussed when drenched can give protection for 3-4+ weeks, which is often as much protection as necessary. Foliar treatments consist of pyrethroids (Asana, Brigade, Warrior) applied only when plants are small and beetle populations average more than 1 per plant.

The squash bug, *Anasa tristis* is one of the most common and severe pests of cucurbits, especially squash and pumpkins. Adults are 5/8 inch long dark brown or gray with the edges of the abdomen having orange and brown stripes. Eggs are 1/16 inch long and are a yellowish brown to bronze color. Eggs are laid on the underside of leaves in groups of about twelve usually in a characteristic V shape pattern following the leaf veins. Eggs take 1-2 weeks
to hatch. Adult females continuously lay eggs until midsummer; this extended egg laying period results in all stages being present during much of the summer. Nymphs are \(3/16\) to \(1/2\) inch in length. Young nymphs have a red head and legs with a green abdomen; however as the nymphs age the red color turns to black. Late instar nymphs turn a greenish-gray in color with black appendages. Young nymphs are gregarious and feed together in groups. Nymphs require five to six weeks to mature into adults. Squash bugs spend most of their time around the base and stems of the plants and on the undersides of leaves. Only squash bug adults can overwinter, nymphs cannot. Adult squash bugs begin to move into fields in late May and early June. Squash bugs damage plants by removing sap with their sucking mouthparts and causing leaves to wilt and collapse. The foliage is the primary site of feeding but the fruit is also fed upon. Squash bugs secret highly toxic saliva into the plant as they feed. Young plants and infested leaves on older plants may be killed. Plants that are heavily fed upon can have leaves turn yellow around the leaf margin. These yellow areas become necrotic over time with the yellowing progressing into the leaf and the leaf eventually wilting, this is sometimes called “anasa” wilt. The amount of damage occurring on a plant is directly proportional to the density of squash bugs. Squash bugs are the vectors of a newly recognized disease of cucurbit crops, Yellow Vine Decline. Watermelon and pumpkins are susceptible to this disease. The bacteria that cause this disease are injected into the plant when squash bugs feed. The disease results in yellowing, wilting and death of the plant. Early infection by the bacteria can result in severe yield loss. This disease is not very common in the eastern United States and has not been documented to occur in Maryland or Delaware.

**Management** This insect can be very difficult to control if populations are allowed to build. Early detection of adult squash bugs is very important since they are difficult to kill and can cause considerable damage. Timing is the key to successful squash bug control. Because Yellow Vine Decline has not been found as yet in Maryland, growers should use insecticides to control squash bugs when 2 overwintering adults are observed feeding on small plants (< 5 leaves) or if two egg masses are found per plant when plants are larger. Sprays for adults should be directed at the base of the plant (down in the plastic hole) as this will increase control. **Chemical controls** There are no organic or reduced risk chemical controls that work well on squash bugs. Pyrethroids (Asana, Warrior, Brigade) will control squash bugs best if used on small instars and before populations build. **Biological control** *Trichopoda pennipes* is a parasitic fly about the size of a house fly that can be found sitting on squash plants in search of prey. It has a bright orange abdomen, velvety black head and thorax, and a fringe of short black hairs on the hind legs. The wings of male flies have a dark spot. The tip of the abdomen of female flies is black. They can be seen throughout the production period of squash and pumpkins. These Tachinid flies primarily parasitize squash bug and southern green stinkbug. Eggs are laid on the underside of the thorax or abdomen of the squash bug, but they can occur on almost any body part. Many eggs
may be laid on the same host (blue arrows), but only one larva will survive in each bug. The young larva that hatches from the egg bores directly into the host body. The maggot feeds on the body fluids of the host for about two weeks, during which time it increases to a size almost equal to that of the body cavity of its host. When it has completed its development, the third instar maggot emerges from the bug between the posterior abdominal segments. The bug dies after emergence of the fly, not from the feeding, but from the mechanical injury to its body. Adult flies feed on nectar, especially from plants such as wild carrot (Queen Anne’s lace) and meadowsweet (Spiraea salicifolia). The rate of parasitism can be as high as 95% on squash bug, but because the bugs continue to feed after parasitization, T. pennipes usually will not prevent crop damage. However, if parasitized early in squash bug development the reproductive organs of the host bug begin to atrophy when the parasitoid reaches the second instar, so pest population increase will be reduced. The fly is most effective when it parasitizes nymphs because 50% of the nymphs die before becoming adults and 65% of the remaining population that become adults will die before laying eggs. At this time, however, this parasitoid is not reliable enough to consistently prevent damage.

Aphids of many species can be found in a cucurbit field, but the most destructive species present are the melon and green peach. 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 is a substrate for the sooty mold fungus, if the honey dew gets on the fruit it is difficult to remove making the fruit unmarketable. Melon aphids (Aphis gossypii) are pear-shaped and vary from yellow to green to darker colors, but always have dark colored cornicles (slender tailpipe-like appendages, red arrows). The green peach aphid (Myzus persicae) is pear shaped and is pale yellow to green with its cornicles also being green. Adult females give birth to live young, called nymphs. Although slightly smaller than adults, nymphs are similar in color and shape. Melon aphid (also known as cotton aphid) has a very wide host range. At least 50 host plants are known in Maryland. Among cucurbits, it can be a serious pest on watermelons, cucumbers, and cantaloupes, and to a lesser degree squash and pumpkin. The overwintering host in Maryland is catalpa, Catalpa bignonioides. The green peach aphid also has a wide host range and moves into melon fields in large numbers from surrounding vegetation, carrying viruses as it moves and feeds from one plant to another.
Both aphids feed on the underside of leaves, or on the growing tips, sucking nutrients from the plant. The foliage may become chlorotic and die prematurely. The end result of feeding by these aphids is loss of vigor, stunting, or at times even death of the plant. Most importantly both aphids transmit potyviruses, and while there are several other aphid species that also are capable of vectoring viruses, melon and green peach aphids are very proficient at it. In Maryland watermelon mosaic virus, zucchini yellow mosaic virus and papaya ringspot virus are transmitted by these aphids despite numerous applications of insecticides because the viruses can be transmitted within seconds of the aphid landing on a plant.

**Management** Aphids are ubiquitous in the summer and will find cucurbit fields. To slow down the numbers that land on your plants silver reflective mulches have been used successfully to repel aphids from plants, thus reducing or delaying virus transmission by two to four weeks compared with no mulch or black plastic mulch. Biological control can have a significant impact on reducing aphid populations, but cannot stop virus transmission, so be sure to evaluate predator and parasite populations when making treatment decisions. **Biological Control** Naturally-occurring populations of the convergent lady beetle, *Hippodamia convergens*, may provide effective control throughout the summer. Do not purchase these predators as releases of this beetle are not effective because very few remain in the field following release. Other general predators, such as lacewing and syrphid larvae, and parasitic wasps, including *Aphidius*, *Diaeretiella*, and *Aphelinus* species, also attack aphids. You can maintain natural enemy numbers by not applying weekly or calendar-based insecticide applications. **Chemical Controls** Treatment is only needed to reduce large aphid populations and no or very few natural enemies are present. Chemical controls DO NOT stop virus transmission. Organic chemical controls include insecticidal soaps and horticultural oils as well as *Beauveria bassiana*, an insect fungal disease that will attack and kill aphids. The *B. bassiana* must be applied 3 times on a 5-7 day schedule to be effective. Reduced risk chemicals include pymetrozine (Fulfill) imidacloprid (Admire) or thiamethoxam (Platinum or Actara). Other chemical controls include endosulfan (Thionex).

**Twospotted spider mites** (*Tetranychus urticae* (TSSM)) are very small, 1/80 - 1/60 inch long, with 2 spots on their back pests that are a problem usually in July and August during hot dry weather. Mites are most problematic on watermelon and cucumber, less so on cantaloupe and rarely pose a problem on squash or pumpkin. Mites overwinter in leaf debris in and around fields. In spring, the reddish 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 mite damage appears as a yellow discoloration or a mottled sand blasted appearance on 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 crown leaves should be checked for mite activity as these leaves are a prime site for mite development. A 10X hand lens can be used to identify mites. Also, leaves can be shaken over a piece of paper, and the dislodged mites can be seen crawling about. 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 is 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. **Chemical controls** Organic controls include soaps and oils (moderate to poor results) as well as *Beauveria bassiana*, an insect fungal disease that will attack and kill mites. The *B. bassiana* (Botanigard, Naturalis) must be applied 3 times on a 5-7 day schedule to be effective. If mite populations are large the organic controls will give moderate to poor results at best. There are several reduced risk chemicals available for mite control in cucurbits: Acramite and Agri-mek. These other pesticides will also control two spotted spider mites: Oberon, Danitol, and if populations are not large bifenthrin (Brigade).

The **squash vine borer** (SQVB), *Melittia cucurbitae* is a clear-winged moth that is becoming more of a problem in vine crops in Maryland each year. Its preferred cucurbit crops are winter squash, summer squash, and pumpkins. They will attack cucumbers and melons much less frequently. Unlike many moths, they are daytime flyers that are sometimes mistaken for wasps.

Squash vine borers have stout bodies about 1/2 inch in length with a wingspan from 1 ¼ to 1 ½ inches. The adult body is reddish with black bands encircling the abdomen. The front wings are a metallic green. The hind wings are clear with dark veins and fringed with reddish brown hairs. The larvae are white to cream-colored caterpillars with brown heads which grow to about one inch in length. The adults emerge from June through July
from cocoons that overwintered in the soil. They typically lay their small (1/25 inch), oval, brown eggs singly on stems or leaf stalks near the base of the plant. Eggs hatch in 7-10 days. Upon hatching, the larvae immediately bore into the stem, leaving small almost invisible entrance holes and yellowish frass. After feeding for about a month the borers exit from the stem and burrow into the soil. They overwinter in a cocoon and pupate in the spring. There are 1-2 generations per year in the mid-Atlantic.

Larvae damage plants by cutting the water and nutrient conducting lines. As a result, the plants start to wilt or leaves begin to turn yellow and eventually brown around the leaf margins. Other pests also cause wilting symptoms such as squash bugs, aphids, bacterial wilt which is vectored by the striped cucumber beetle or several root diseases (which are quite prevalent in Maryland). In order to determine if the squash vine borer is causing the wilting, look for a large swollen stem and large amounts of yellowish-green frass extruding from holes. If these symptoms exist, split the stems apart with a sharp knife to look for the larvae. If several larvae have infested a plant, the plant may collapse and die.

**Management** You must control the newly hatching larvae (first instars) before they enter the plant. Once the larvae attack the stem, little can be done. Research over the last three years demonstrates that the best strategy is to walk through the field once a week and look for the adult moth flying around young pumpkin plants early in the year just as plants are beginning to run (~3rd week). If any SQVB moth is observed a spray of insecticide directed at the base of the plant should be made within 5 days. After this initial insecticide application pheromone traps can be used to monitor the moth. Pheromone traps and lures attract male moths, and are available from commercial suppliers (see below). Two traps should be placed on opposite sides of a field at 4-6 ft in ht, 20-50 ft. away from the edge of the field. When two SQVB moths are caught in the traps a spray should go out in 2-5 days. Pyrethroids (Capture and Warrior) should be sprayed at the base of the plant for control. **Cultural Control:** Do not locate your pumpkin field within 400 yards of a previous pumpkin field especially if there were SQVB problems in the field the year before. If no SQVB problems the year before this year’s pumpkin field can be located as close to last year’s field as wanted. If a field has a borer infestation, destroy infected crops and disk the soil in early fall exposing cocoons that are buried 1-6 inches deep. **Resistant Varieties:** Butternut squash exhibits a higher level of resistance than Hubbard and Acorn squashes, which are highly susceptible to borer damage. **Mechanical Control:** Floating row covers placed over the crops prevent the moths from laying eggs. Place the floating row covers over the plants as they start to vine or when you notice any squash vine borers in the area. Firmly anchor the row covers to the ground or the moths will crawl under it. Remove row covers during flowering to allow pollination.

Pheromone trap and lure supplier: Great Lakes IPM 10220 Church Rd. NE Vistaburg, MI 48891-9746 [http://www.greatlakesipm.com](http://www.greatlakesipm.com)
The seed corn maggot, *Delia platura*, is an occasional pest of many vegetable crops including cucurbits. They cause the most damage in early spring to newly emerging seedlings or new transplants, especially if wet, cold conditions are present.

The seed corn maggot overwinters as pupae in the soil. In early spring, the adults emerge; mate within 2-3 days and lay eggs in soil with abundant decaying organic matter and/or on seeds or transplants within the fields. Adults, which resemble small houseflies, are dark gray, with wings that overlap their bodies when at rest. Eggs hatch in 2-4 days in temperatures as low as 50°F. Maggots are yellowish-white, about ¼ inch in length, legless, and very tough-skinned with head-ends that are wedge-shaped and tail ends that are flattened. There are three generations in Maryland. The first generation causes almost all the crop damage. Seedlings are most susceptible to seed corn maggots during a wet, cold spring in which plant growth is slowed. Seedcorn maggot eggs are laid 1-2 inches below the soil surface in tilled ground that is high in organic matter or they can be laid in the root ball of a transplant. When eggs hatch maggots will attack the transplants and drill into the seedling’s stem. What is seen above ground are transplants suddenly wilting. If the stem of the transplant is split open when the wilting is first observed maggots will be found within the stem if SCM are responsible.

**Management** Once seed corn maggot damage is noticed—wilted plants, it is too late to apply control procedures. Thus, economic thresholds are not useful and all management options are preventative. Preventive measures will only be necessary if transplants are placed in fields that have large amounts of organic matter tilled in or soil temperatures that are cool (> 68°F) and remain cool and damp. Once soil temperatures are above 70°F at a 4-inch depth, SCM adults will lay few eggs. Most severe infestations of SCM in transplanted fields are due to SCM that oviposit directly into transplants. This can be seen in fields that have been fumigated and yet still have SCM damage. **Chemical control** There are few chemicals that are registered that will give control of SCM. Seed treatments give poor control of maggots of transplants. Cultural methods are the best management program for this pest.

**Pickleworms** (*Diaphania nitidalis*) are a tropical moth pest which survives the winter only in south Florida. Because of this they are only an occasional pest of melons in Maryland. Melon worms may also occasionally be found in cucurbit fields but as these pests usually confine their feeding to the foliage they are a minor problem. It may take one or two months for the dispersing pickleworms to move north from Florida to the Carolinas and sometimes to Maryland. Eggs are laid principally on the buds, flowers, and other actively growing portions of the plant. Hatching occurs in about 4-days. There are five instars and larval
development takes 2-weeks. Young larvae are nearly white in color with numerous dark gray or black spots. The dark spots are lost in last instar resulting in the larva being a dark copper color. Moths have the central portion of both the front and hind wings as a semi-transparent yellow with an iridescent purplish reflection. The wings are dark brown with a tannish-yellow central area. Summer squash are the most preferred host. Pumpkin is a moderate host, while cucumber, cantaloupe and watermelon are rarely attacked. When about half grown, pickleworms bore into sides of fruit and continue to feed causing internal damage. Both young and old fruits are attacked, but they prefer young fruit before the rind has hardened. **Management** Chemical treatment should rarely be necessary for control of this pest, however if there is a late planting of summer squash growers should watch for any feeding damage at the growing tip of vines. Organic chemicals consist only of Entrust. Reduced risk chemicals include SpinTor, Spinatoram, Intrepid and Avaunt. Other chemicals include pyrethroids (Brigade, Asana, Warrior), and Lannate.

**Rindworms** is a catch-all term for a complex of melon–surface feeding pests that sporadically become a problem in all cucurbits, but especially in watermelon, pumpkin and cantaloupe. This complex can consist of cucumber beetle adults or larvae, wireworms and caterpillar pests such as beet armyworm and others that feed on the surface or just into the rind. This causes scarring and a more rapid break down of the fruit all of which make the fruit less marketable. These pests usually appear in the latter part of the season a few weeks before and after harvest begins. Melons should be watched closely for any surface feeding on the rind. Fruit should be turned over and the area in contact with the ground examined for wireworm or cucumber beetle larval feeding. **Management** The most difficult to control pests are the wireworm and cucumber beetle larval pests as their feeding is difficult to detect unless the fruit is turned and even more difficult to control as it is not easy to reach the pests with chemical insecticides. Wireworm and cucumber beetle larvae come to the surface to feed on melon rinds when the ground is moist from the surface down. Melons sitting on plastic (not organic mulch) will not be fed upon from below. If feeding scars are found on fruit chemicals used for striped cucumber beetle control (Brigade, Asana, Warrior) or beet army worm (Synapse, Avaunt, Intrepid, SpinTor, Radiant or the organic pesticide Entrust) can be used. Large volumes of water (100-150 gallons/acre) are needed to ensure that the pesticide spray covers the entire fruit.

**Thrips** are generally a problem early in the season when plants are drought stressed. 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 near fields. In the spring they can be found on the undersides of leaves producing silver flecking near the large leaf veins. They are more likely to be found on leaves of cucurbits early in the season when these leaves have pine pollen or other
types of tree pollen on them. Pine pollen, as well as other tree pollen is quite commonly found on plants in the field in the spring. Thrips then feed on this pollen. These early season thrips populations rarely result in any problems unless plants become drought stressed. 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 surface of the plant disrupting cells and feeding on the cell contents. The **potato leafhopper** is the principal leafhopper species causing damage to cucurbits in Maryland. This pest moves from the southern U.S. appearing in our region in early May. Adults are about 1/10 inch long, wedge-shaped and greenish-yellow. The potato leafhopper has wings that are transparent green and are folded back when at rest. They also have a variable number of white spots on top of their head and along their thorax. Although generally a problem after bloom in cantaloupes and pumpkins, leafhoppers can damage watermelon during hot, dry weather. Injury starts with a yellowing along leaf margins with a slight upward rolling. This injury is soon followed by a gradual browning starting at the leaf’s tip and margin (“hopper-burn”), and expanding until the entire leaf is dead. Defoliation can occur that results in a reduction in yield. These symptoms are sometimes confused with drought stress. **Management** for thrips includes examining five crown leaves in 5-10 locations for their presence. Although no thresholds are available, controls may be needed if the thrips population is heavy, leaf feeding is present and plants are not actively growing. For leafhoppers examine runners in 5-10 locations for the presence of nymphs. A sweep net also can be used to sample for adults. Controls will be needed if hopper-burn is detected on leaf edges and injury is expected to retard fruit maturity and yield.

**Whiteflies** consist of several species (Silver leaf whitefly *Bemisia argentifolii*, Greenhouse whitefly and common whitefly). Although the silver leaf whitefly and other whitefly species are found in Maryland, they are only an occasional problem on cucurbits. The silverleaf whitefly is small, about inch long and whitish yellow. The head is broad at the antennae and narrow toward the mouthparts. The wings are held roof-like at about a 45-degree angle, whereas other whiteflies usually hold the wings nearly flat over the body. As a result, the silverleaf whitefly appears more slender than other common whiteflies. The eggs are whitish to light beige. The nymphal stage appears glassy to opaque yellow. Its body is flattened and scale-like. The pupa or fourth nymphal instar will be somewhat darker beige-yellow and opaque. This pest feeds on many different kinds of plants. The most common hosts in Maryland include poinsettia, tomato, squash, cucumbers, and melons. Silverleaf whiteflies damage plants directly and indirectly. Direct damage results from their feeding activity, which involves them sucking plant sap. Both the adults and nymphs contribute to direct damage. Chlorotic (yellow) spots sometimes appear at the feeding sites on leaves. Heavy infestations cause leaf wilting. In addition, as they feed they excrete honeydew (a sugary substance), which sooty mold fungi grow on. The resulting dark splotches on the leaves may reduce photosynthesis and other physiological functions of the plant. Indirect damage results from their activity as disease vectors. The silverleaf whitefly carries and spreads several important viral diseases of tomatoes, lettuce and melons in the southeastern United States, but
does not vector these viruses to any great extent to Maryland vegetable crops. **Management**

Whiteflies should not become a problem in most fields, but occasionally their populations can increase to such levels that they begin to directly damage the plant. If sooty mold is found on many plants or fruit an insecticide application is needed. This should only occur rarely and in the latter part of the season. Chemicals that work for aphids will also work for whitefly.