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Entomology

Striped Cucumber Beetle

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Native to North America, the striped cucumber beetle (STCB) (*Acalymma vittatum* F.) (Coleoptera: Chrysomelidae) is a significant arthropod pest of cucurbits (Family: Cucurbitaceae) such as squash, cucumber, gourds, zucchini, and other cucurbit species. It shows more preference for the host plants such as cucumbers, squash, zucchini, and gourds over other cucurbits such as pumpkins, muskmelon, butternut squash, and watermelon. The STCB can damage flowers, foliage, and fruits and is a vector of bacterial wilt. Both adults and larvae feed on cucurbits. The STCB is commonly found in the eastern part of North America, from as far south as Mexico and north into southern Canada. Though this species has been reported in western North America, its western range limit is the Rocky Mountains.

Figure 1: Striped cucumber beetles. Photo credit: Whitney Cranshaw, Colorado State University, Bugwood.org. (5596709).

Damage

Larvae feed on cucurbit roots and underground portions of the stems. Larval feeding does not affect plant health or cause any significant economic loss. Adults feed on the foliage, flowers, and fruits and feed on the stems when their populations are high. They also feed on the underside of fruits during summer when the temperature is high. Adult feeding is most damaging up to the third true-leaf stage of cucurbit seedlings. The seedlings are small enough that high populations can defoliate the plants completely or girdle the stem. Leaf feeding can result in severe defoliation. Several cucurbit species can tolerate some defoliation after the third true-leaf stage. The STCB will usually move off the foliage and begin feeding on fresh flowers and pollen. Feeding on fruit causes scarring, directly affecting the appearance of fruits and reducing the marketable yield.

Figure 2: Striped cucumber beetle damage to squash seedling.. Photo credit: Whitney Cranshaw, Colorado State University, Bugwood.org. (UGA1243172).

Figure 3: Striped cucumber beetle larvae in cantaloupe rind. Photo credit: Whitney Cranshaw, Colorado State University, Bugwood.org. (UGA1243177).

Figure 4: Striped cucumber beetle adult scarring of fruit skin of melon. Photo credit: Whitney Cranshaw, Colorado State University, Bugwood.org. (UGA5303025).

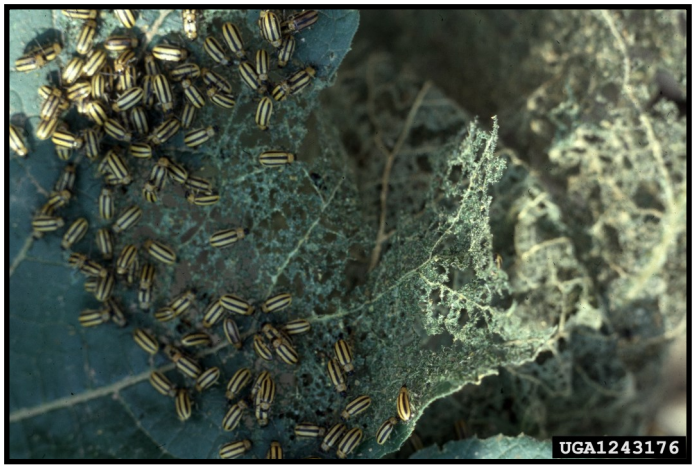

Figure 5: Striped cucumber beetle adults mass on squash leaf. Photo credit: Whitney Cranshaw, Colorado State University, Bugwood.org. (UGA1243176).

Figure 6: Striped cucumber beetle adults on pumpkin flower. Photo credit: Howard F. Schwartz, Colorado State University,

Bacterial Wilt

The STCB can carry the bacterium (*Erwinia tracheiphila*) that causes bacterial wilt. The bacterium overwinters in the gut of the STCB, and infects the plant's vascular system during feeding resulting in severe wilting. Bacterial wilt cannot be cured once the plant is infected, and they cannot be saved once infected.

The beetles contact the bacterium when they feed on infected weed hosts or cucurbits. A plant can become infected when damaged foliage contacts the beetle's frass or contaminated body parts. Inside the plant, the bacteria multiply and block the vascular systems, obstructing the flow of water and nutrients. Infected plants wilt, and leaves can discolor before eventually dying. Wilting can spread rapidly, and the entire plant can die within a few days. Not all cucurbits are equally susceptible: Cucumbers and muskmelon are most affected. Squash, pumpkin, and watermelon are generally tolerant or resistant to bacterial wilt. The yield loss from the bacterial wilt is more extensive than the feeding damage of the STCB. The beetle can also transmit cucumber, cowpea, and pumpkin mosaic viruses.

Cucurbitacins (chemicals produced by the cucurbit plants in response to herbivorous attack/damage) concentrations are high in the cotyledons and wilting plants and act as feeding stimulants for the STCB and attract them to cucurbit plants.

Figure 7: Bacterial wilt symptoms of pumpkin plant. Photo credit: Jim Jasinski, Ohio State University Extension, Bugwood.org. (5506264).

Figure 8: Bacterial stringing between vascular elements of the stem Photo credit: Charles Averre, North Carolina State University, Bugwood.org. (1563715).

Adults

Adult STCB is approximately 0.2 inch long, 0.05 inch wide, has a brown or black head, black antennae, bright orangish yellow prothorax (the first dorsal area behind the head), and black abdomen. The fore wings (elytra) are yellow with three longitudinal black stripes that run along the entire length of the wings. Adults of the western corn rootworm (*Daibrotica virgifera virgifera LeConte*) look similar to the STCB. However they are longer (~0.2 inch) than the STCB, and the black and yellow stripes on the forewings do not extend to the entire length of the wings.

Figure 9: Striped cucumber beetle adults Photo credit: Whitney Cranshaw, Colorado State University, Bugwood.org. (UGA5303048).

Figure 10: Adults feeding on cull pumpkins in early autumn Photo credit: Whitney Cranshaw, Colorado State University, Bugwood.org. (5506439).

The STCB overwinters as unmated adults in leaf litter and organic debris in hedgerows and surrounding fields where cucurbits were grown previously. The adults emerge in spring when soil temperatures reach 55˚F (13˚C) and feed on pollen and foliage of flowering plants. Some of its common alternative host plants are goldenrod, aster, hawthorn, apple, and willow. Although they can survive on these alternate host plants, they mate and lay eggs only on cucurbit plants. The adults feed, mate, and lay eggs in the soil at the base of host plants after seedlings of cucurbits are transplanted or emerge from the seeds sown. The STCB adults aggregate in large numbers in cucurbit plants to reproduce. They initially colonized field borders and spread throughout the field with time. Adult males produce an aggregation pheromone when feeding on cucurbits, which attracts more STCB to the area.

Figure 11: External symptoms of larval tunneling at plant crown and adult scarring of vine . Photo credit: Whitney Cranshaw, Colorado State University, Bugwood.org. (5506439).

Eggs

Oval-shaped eggs are pale orange-yellow, approximately 0.2 inch long, 0.01 inch wide, and have textured surface. Females lay eggs in groups of up to four eggs daily around the base of plant stems, into moist cracks about 5cm below the soil surface. A female can lay approximately 125 eggs in her lifetime. It takes 5-9 days for eggs to mature and hatch.

Figure 12: Striped cucumber beetle larva. Photo credit: Whitney Cranshaw, Colorado State University Bugwood.org. (UGA1243178).

Larvae

After egg hatch, larvae feed on plant roots and underground parts of stems. Larvae are slender and worm-like with a creamy white colored body (thorax and abdomen) and dark brown head capsule. The STCB larva has three instars; the first and third instars are approximately 0.05 and 0.4 inch long. They complete the larval development in 2-4 weeks before pupating.

Pupae

Larvae transform into pupae in the soil near the base of cucurbit plants and emerge later in the summer as the next generation of adults. Pupae are broader in the front and tapered to a narrow point at the back. They are 0.8-1 cm long and white.

Figure 13: Striped cucumber beetle feeding on cotyledon of newly emerged cantaloupe seedling. Photo credit: Gerald Holmes, Strawberry Center, Cal Poly San Luis Obispo, Bugwood.org. (5602258).

How to protect cucurbits from STCB

Transplants vs direct seed

Using transplants avoids exposure to cucumber beetle feeding during the most susceptible plant stages. This also reduces the total time that cucurbit plants are in the field each season, providing less time for cucumber beetle densities to build and for disease symptoms to develop.

Monitoring

Monitoring for the STCB during the early season when the most feeding occurs is critical, especially when the seedlings are transplanted or begin to emerge. Plants in the cotyledon and first to third true -leaf stage can suffer defoliation and bacterial wilt. Monitoring needs to be continued until fruiting as larger plants can be affected by bacterial wilt.

Resistant varieties

Cucurbit varieties with low cucurbitacin, such as watermelon, are less attractive/susceptible to STCB feeding and damage and more resistant to bacterial wilt. It is important to plant disease-resistant or less attractive cucurbit crops or a combination of both to reduce severe yield loss, allow greater tolerance for feeding damage, and reduce the use of synthetic pesticides.

Field sanitation

Keeping crop fields clean and removing weeds around them is crucial because they may be potential hosts for adult STCB. Apply a heavy layer of mulch around established cucurbit plants during the planting season to discourage egg-laying. If a plant shows signs of bacterial wilt, remove the symptomatic plant before more beetles can feed on the plant and spread the bacterium. After harvesting, remove garden debris and leaf litter to reduce sites where adults can overwinter.

Trap crops

A trap crop is a plant that attracts pests away from the primary garden plants. Plant a few highly attractive cucurbits before planting your garden cucurbits. Once striped cucumber beetle numbers build up in these traps, treat them with an effective pesticide to minimize further movement.

Rotate cucurbit crop field

Cucumber beetles often overwinter near to the previous year cucurbit crops. Plant cucurbits as far away from previous crops as possible. Barriers between previous planting sites, such as hedgerows and other non-cucurbit crop may help slow beetle colonization of the new crop. However, the beetles are highly mobile, so crop rotation alone is unlikely to entirely control cucumber beetles.

Physical barriers

Build a floating row cover or similar barrier during early to mid-June to keep the STCB away from the cucurbit plants. Be sure to remove the barrier when cucurbits start to flower to ensure access to pollinators.

Intercropping

Intercropping cucumbers with corn and broccoli can reduce the STCB and bacterial wilt substantially compared to plots planted in a monoculture of cucumber. A recent study suggests that intercropping watermelons or musk melons with radish, nasturtium, tansy, buckwheat, cowpea or sweet clover has a similar benefit, suggesting that many different types of intercrops can help reduce cucumber beetle densities on cucurbits.

Biological control-natural enemies

Predators

Wolf spiders have been shown to feed heavily on cucumber beetles in cucurbit crops. Also, cucumber beetles avoid wolf spiders, and feed less when spiders are around. Ground beetles sometimes also feed on adult cucumber beetles, as do other large predators such as bats. DNA evidence shows that arthropod predators such as harvestman, ground beetle, several species of spiders, and predatory mites feed on cucumber beetle eggs and larvae.

Parasitoids

A tachinid fly and a braconid parasitoid wasp parasitize striped cucumber beetle, and sometimes have large impacts on striped cucumber beetles. There is some anecdotal evidence that parasitoid populations may build up over several years in organic fields, such that parasitoid impacts in organic fields may be greater than in conventional fields.

Figure 14: A. Wolf spider. Photo credits: Joseph Berger (UGA 1252094). B. Ground beetle. Jim Jasinski, Ohio State University Extension, (5525994). Bugwood.org.

Figure 15: Fly parasitoids: A. *Celatoria* fly. (5526001). B. *Celatoria* fly pupa (5525999). Ben Phillips, Michigan State University. Photo credits: Joseph Berger Bugwood.org.

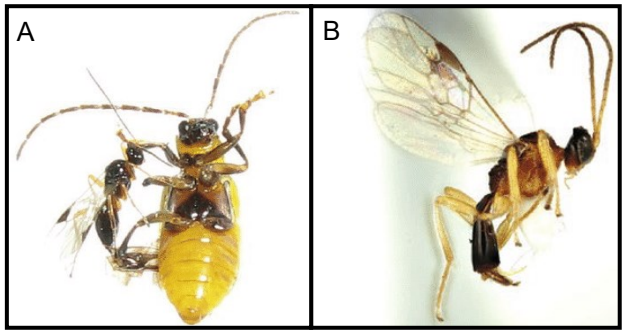

Figure 16: A. *Centistes diabroticae* (braconid wasp, Hymenoptera: Braconidae), photo Credits: Stefan Toepfer, CABI, Delémont, Jura, Switzerland; B. close-up of mounted specimen of *Centistes diabroticae* , photo credits: Angela Coco and Carolyn Trietsch, Frost Museum, Penn State University.

Chemical control

Use pesticides only when necessary. Monitor plants regularly for the STCB when new leaves emerge from seed leaves. If two or more beetles/plant are present on 25% of cucurbit plants in the cotyledon stage, apply a pesticide. Choose a pesticide that has a low-impact on natural enemies, such as ladybeetles, big-eyed bugs, spiders, ground beetle, lacewings, minute pirate bugs, flower flies (hover flies), rove beetles, and pollinators. Fungal pathogens and insect-attacking nematodes are both commercially available as bio-pesticides, and soil drenches of these bio-insecticides have shown some activity against cucumber beetle larvae feeding on roots. Neem is a plant-based pesticide that prevents insects from feeding, eventually killing them. Pyrethrins have no residues, and treatments must come in contact with the beetles to be effective. Conventional or broad-spectrum pesticides are longer lasting but can kill a variety of insects, including predators and parasitoids, so use them carefully and judiciously. Examples of broad-spectrum pesticides available include permethrin, bifenthrin, lambda-cyhalothrin, and carbaryl.

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