



Bacterial Wilt of Cucurbits

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IMPORTANCE

Bacterial wilt is a common occurrence in commercial fields and residential gardens. This destructive disease can potentially result in complete crop loss even before the first harvest.

HOSTS

Cucumber and muskmelon (cantaloupe) are highly susceptible; squash and pumpkin are less susceptible; watermelon is resistant.

SYMPTOMS & SIGNS

Initially, individual leaves or groups of leaves turn dull green and wilt (FIGURE 1), followed by wilting of entire runners or whole plants. At first, plants may partially recover at night, but as disease progresses, wilt becomes permanent. Collapsed foliage and vines turn brown (necrotic), shrivel, and die (FIGURE 2). Wilt symptoms may be noticeable in as few as 4 days from infection on highly susceptible hosts but can take up to several weeks to become evident on crops that are less susceptible. Plant growth stage can also affect disease progress, which is more rapid on young, succulent plant tissues.

Diagnosing Bacterial Wilt

The key diagnostic feature for this disease is the emission of a slimy, sticky ooze (exudate made of polysaccharides and bacterial cells) from cut stems. Field diagnosis can be confirmed using a simple “bacterial ooze test.” With a sharp knife, cut through a wilted (but not dead) vine; use a section near the crown (FIGURE 3A). Touch the cut ends together, and then slowly pull them apart. Fine thread-like strands of bacterial ooze will be drawn out (FIGURE 3B) when bacteria are present.

This test works well for cucumber and muskmelon but is less reliable for squash or pumpkin. For these crops, place cut pieces of symptomatic stems into



FIGURE 1. EARLY WILTING FROM BACTERIAL WILT MAY BE TEMPORARY, WITH PLANTS RECOVERING AT NIGHT. HOWEVER, WILTING MAY QUICKLY BECOME PERMANENT.

FIGURE 2. WILTED VINES COLLAPSE, TURN BROWN, AND DIE.



FIGURE 3. TO TEST FOR DISEASE USING THE BACTERIAL OOZE DIAGNOSTIC TEST, LOCATE A SYMPTOMATIC VINE NEAR THE CROWN AND CUT IT WITH A SHARP KNIFE (A), PLACE THE CUT ENDS TOGETHER AND SLOWLY PULL THE ENDS APART TO CHECK FOR THE PRESENCE OF THREAD-LIKE STRANDS OF BACTERIAL SLIME (B). SIMILARLY, A POSITIVE BACTERIAL WILT WATER TEST WILL REVEAL BACTERIAL OOZE STREAMING FROM THE CUT END OF THE STEM (C).

FIGURE 4. ADULT SPOTTED (LEFT) AND STRIPED (RIGHT) CUCUMBER BEETLES SERVE AS PRIMARY VECTORS FOR THE BACTERIAL WILT PATHOGEN.

FIGURE 5. CUCUMBER BEETLES START FEEDING ON YOUNG CUCURBIT PLANTS AS SOON THEY EMERGE.

a clear glass container filled with water (thin glass is easier for viewing the results). If this disease is present, a cloudy string or mass of bacterial ooze will flow into the water from the cut stem pieces (FIGURE 3C).

Disease Look-alikes

The tunneling activity of squash vine borer will also result in wilting of cucurbit vines; generally single vines on otherwise healthy plants. The presence of a whitish caterpillar with a brown head inside wilted vines is indicative of squash vine borer activity. Additionally, a tell-tale wet, sawdust-like material (frass) may be found along infested vines or stems.

Fusarium wilt causes wilting and vascular discoloration, but the slimy ooze indicative of bacterial wilt will be absent. Fusarium wilt

symptoms include browning of vascular tissue on the lower stem and crown, which is evident when stems are cut lengthwise.

CAUSE & DISEASE DEVELOPMENT

Bacterial wilt is caused by *Erwinia tracheiphila*; striped and spotted cucumber beetles serve as vectors, carrying the bacterium from plant to plant during the growing season. The life cycles of the bacterial wilt organism and its vectors are closely associated, and bacterial wilt is directly correlated to striped and spotted cucumber beetle populations.

Adult striped cucumber beetles (*Acalymma vittatum*) are 1/5 inch long and yellow-green with 3 black stripes down their back (Figure 4). Spotted cucumber beetles (*Diabrotica undecimpunctata howardi*) are 1/4 inch long with 12 black spots

on their back (FIGURE 4). These beetles hibernate through winter under leaf litter and in other protected sites; all the while, the bacterial wilt pathogen overwinters within the gut of the striped cucumber beetle. The beetles become active once temperatures remain above 55°F in spring. As soon as cucurbit seedlings begin to break through the ground, the beetles begin to feed on cotyledons (FIGURE 5) and later feed on leaves, stems, and flowers. Striped cucumber beetle larvae also feed on root systems, causing damage that can result in wilt.

The bacterial wilt organism is deposited through beetle mouthparts and the frass deposited onto/into wounds created during beetle feeding. Once the bacterium invades a plant's water conducting vessels (xylem), it spreads rapidly throughout the plant. The matrix of bacteria and ooze obstructs water movement in the xylem vessels, which causes wilt symptoms. Further spread of the pathogen occurs when beetles feed on diseased plants and then feed on nearby healthy plants.

Close to harvest, a second generation of striped cucumber beetle may acquire the bacterium while feeding on infected plant tissues. Fall-planted cucurbits may be infected by this generation. These late-season adults will overwinter with the live bacterium in their gut and possibly transmit the pathogen to young plants the next spring. The bacterium cannot survive in infected plant debris from one season to the next.

DISEASE MANAGEMENT

Prevention of bacterial infections is dependent upon preventing cucumber beetle vectors from feeding on cucurbit plants. Early protection is critical for long-term disease management, which should begin as soon as seedlings emerge or when plants are transplanted into fields or gardens. Once it is evident that plants are infected, they should be removed from the site and destroyed. An early, aggressive management approach has been shown to reduce amounts of disease later in the season.

Resistant Cultivars

Wilt-resistant cultivars are limited, but some moderately resistant cultivars are available. Resistance can be used alone or in combination with insecticides, trap cropping and/or barriers.

Chemical Control

Start an insecticide program as soon as seedlings emerge or immediately after transplanting. This is critical to protecting very small plants from beetle feeding and, ultimately, from bacterial wilt.

There are two types of insecticides that can be used for beetle management.

- *Contact (non-systemic) insecticides* can be used to protect plants from beetle infestations. Applications of foliar insecticides may be required one or two times per week during peak beetle activity. A threshold of one beetle per plant is an effective indicator for initiating insecticide applications. During bloom, make applications in the late afternoon to avoid harming pollinators.
- *Systemic insecticides* applied as a single post-transplant soil drench can provide 3 to 5 weeks of protection.

Bactericides are not recommended for management of bacterial wilt disease. Current insecticide recommendations can be obtained at county Extension offices and in publications listed in Additional Resources.

Trap Cropping

Commercial growers may opt for planting trap crops on field perimeters. Trap crops, consisting of highly susceptible cucurbit cultivars (such as Blue Hubbard squash), provide a more desirable plant for cucumber beetles and squash bug. Trap crops work by intercepting insect pests before they colonize the interior main crop; they do not draw in pests that are already in the main crop. Insecticides are applied to the trap crop in order to reduce the need for applications to the harvestable crop. This technique has been used in the northeast, but has not been tested in Kentucky.

Physical Barriers & Mulches

Small plantings can be protected from cucumber beetles by mechanical means. Row covers, fine netting, or cones placed over small plants are effective ways of excluding cucumber beetles. Protective coverings must be removed once female flowers begin to open in order to allow for pollination.

Plastic mulches can reduce overwintering beetle populations by reducing larval survival. Reflective mulches have been shown to repel cucumber beetles; however, research is ongoing.

Rotation

Rotate crops on a 3-year cycle. Avoid susceptible or highly susceptible cucurbits 2 out of 3 years during this rotation.

Weed Management

Manage wild cucurbit species (such as bur cucumber and wild gourd) that can attract vector beetles and serve as reservoir hosts.

ADDITIONAL RESOURCES

- Bacterial Wilt of Cucurbits *Quick Facts* (PPFS-VG-11-QF)
<https://plantpathology.ca.uky.edu/files/ppfs-vg-11-qf.pdf>
- Cucumber Beetles (ENTFACT-311)
<http://entomology.ca.uky.edu/ef311>
- IPM Scouting Guide for Common Problems of Cucurbit Crops in Kentucky (ID-91)
<http://www.ca.uky.edu/agc/pubs/id/id91/id91.pdf>
- Home Vegetable Gardening in Kentucky (ID-128)
<http://www.ca.uky.edu/agc/pubs/id/id128/id128.pdf>
- Vegetable Production Guide for Commercial Growers (ID-36)
<http://www.ca.uky.edu/agc/pubs/id/id36/id36.pdf>

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