

Common Diseases of Cucurbits

Cantaloupe, cucumbers, squash, pumpkins, and watermelons are all members of the cucurbit family. This publication discusses the most important diseases afflicting cucurbits in Alabama.

Fusarium Wilt

Fusarium wilt, caused by soil-borne fungi in the genus *Fusarium*, affects most cucurbits. Although several *Fusarium* species and physiological races have been identified on cucurbits, this publication will only discuss Fusarium wilt of watermelon and cantaloupe.

Fusarium wilt of watermelon is caused by the fungus *Fusarium oxysporum f. sp. niveum*. The fungus also attacks summer squash but not cantaloupe or cucumber. Plants infected early in their development often damp-off at the soil line. Older plants may first exhibit temporary wilting only during the heat of midday but will die within a few days (Figure 1). Wilt symptoms develop in one or more lateral vines,



Figure 1. Watermelon infected with Fusarium wilt.

starting at the tip. When you cut back the epidermis and cortical tissue (bark) on a section of the main stem slightly above the soil line, you will see a light-brown discoloration of the vascular tissue (area just beneath the epidermis). In wet weather, a white-to-pink fungal growth may be visible on the surface of the dead stems.

The causal fungus survives from season to season

in old infected vines, on seed, or in soil. The fungus can live on dead plant material (saprophytically) or on the roots and stems of other plants, such as tomatoes and several weeds. Infection occurs through the root tip, natural openings, or wounds. Eventually, the fungus invades and plugs the plant's water conducting vessels, reducing water movement and leading to plant wilt and death. Disease incidence and severity increase during warm, dry weather.

The only practical method of control in Fusarium-infested soils is to plant Fusarium-resistant varieties and to rotate to nonhosts. Resistant varieties should be planted in the same field only once every 5 to 7 years and susceptible varieties no more than once every 15 years.

Fusarium wilt of cantaloupe is caused by the fungus *Fusarium oxysporum f. sp. melonis*. The fungus infects only cantaloupe, crenshaw melon, and honeydew melon. Symptoms are similar to those described on watermelon. However, on cantaloupe, streaks may develop externally on the runner at the soil line and extend for some distance up the vine. Streaks are at first light brown, turning yellowish tan, then dark brown with age. This symptom is diagnostic for the disease. As with watermelon, a white-to-pink fungal growth may develop on infected stems during wet weather. Resistant varieties, along with rotations with nonhosts, offer the most reliable control of this disease.

Anthracnose

Anthracnose, caused by the fungus *Colletotrichum lagenarium*, can be a destructive disease of cucurbits during warm, wet growing seasons. The disease attacks watermelon, cantaloupe, cucumber, and gourds. Squash and pumpkin are almost immune to *C. lagenarium*.

All above-ground plant parts are susceptible to infection, and plants can become infected at any stage in their development. Older leaves first show small, water-soaked, or yellowish areas that enlarge rapidly and turn tan to reddish brown (most cucurbits) or black (watermelon). Spots are often circular to angular (Figure 2). Later, spots may merge, blighting large



Figure 2. Anthracnose leaf spot on watermelon.

sections of the leaf. These areas become dry and tear away, typically giving the foliage a ragged appearance. Often the leaves at the center of a plant are attacked first, leaving the stem and runners bare. Tan-to-black, elongated, slightly sunken streaks (cankers) form on petioles and stems that can girdle the vine, causing death of the tissue beyond the lesion.

Fruit, if infected early, may turn black, shrivel, and die. Round, water-soaked spots, $\frac{1}{4}$ to $2\frac{1}{2}$ inches in diameter, develop on the older fruit (Figure 3). Spots turn a dark green to brown with age and may become sunken. Under wet conditions, pinkish spore masses can be seen oozing out of the sunken spots.

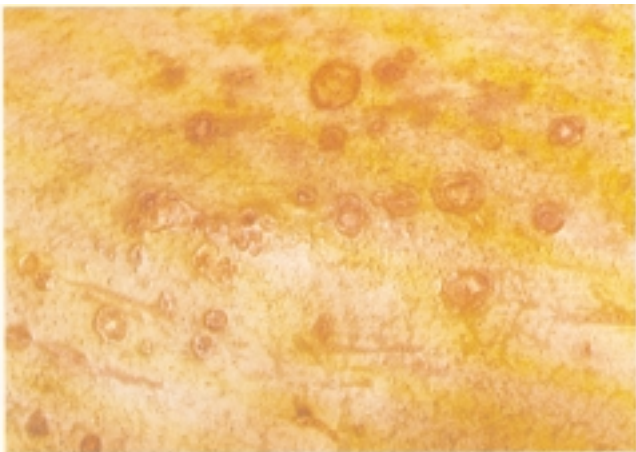


Figure 3. Anthracnose fruit spot on watermelon.

The fungus overwinters in old cucurbit vines, in seed, or in weeds in the cucurbit family. Warm (75°F), wet conditions (frequent rains, poor drainage) favor rapid development and spread of the disease. Anthracnose can appear anytime during the season, but most damage occurs late in the season after the fruit is set. At least three races of *Colletotrichum* have been reported.

Control of anthracnose begins by planting certified, disease-free seed of a variety resistant to the races of *Colletotrichum* reported in your area. Plant in well-drained soil free from surface run-off water. Follow a weekly spray program with a recommended fungicide, beginning at the first true leaf stage. Continue spraying at recommended intervals throughout the season, spraying just before rainy periods (See Extension publication ANR-500, "Alabama Pesticide Handbook"). Practice clean plow down after harvest or discard all plant debris. Practice crop rotation by planting cucurbits only once every 4 years. And, finally, control cucurbit weeds and volunteer cucurbit plants during this period.

Gummy Stem Blight

Gummy stem blight, caused by the fungus *Mycosphaerella melonis*, is a common disease of cantaloupe, watermelon, and cucumber. Symptoms first appear as grayish-green, circular spots between the veins in the lobes of leaves. Spots turn a dark brown to black with age (Figure 4). The leaf-spot stage can be confused with anthracnose, however, gummy stem lesions are darker with target-like or zonate patterns and less deterioration of the leaf tissue. Disease spread begins in the center of the plant and spreads outward. Lesions develop first on the vines at the nodes and elongate into water-soaked streaks that



Figure 4. Gummy stem blight leaf spot on watermelon.

become pale brown to gray with time (Figure 5). Stem tissue often cracks and a characteristic gummy ooze exudes from the wound. Infected vines die eventually, and entire plants die occasionally. The disease, unlike anthracnose, does not attack fruit.



Figure 5. Gummy stem blight lesion on watermelon vine.

Although the fungi that cause gummy stem blight and anthracnose are two completely different organisms, their spread and control are similar. Refer to the section on anthracnose for information on the environmental conditions that favor their development and the cultural and chemical practices that will lead to their control.

Choanephora Wet Rot

Wet rot, caused by the fungus *Choanephora cucurbitarum*, is a fruit rot of summer squash. Fruits rot rapidly and fungal mold appears on the infected area. The fruit resembles a pin cushion with numerous small, black-headed pins stuck into it (Figure 6). Initially, the heads are white to brown but turn pur-



Figure 6. Pin-cushion symptom of wet rot on squash.

plish black within a few days. Affected flowers, pedicels, and immature fruit become water-soaked, and a soft wet rot develops. An entire fruit can rot in a 24- to 48-hour period. Symptoms begin usually on the blossom end of the fruit.

The fungus overseasons as a saprophyte (living on dead plant tissue) or in a dormant spore form. In spring, fungal spores are spread to squash flowers by wind and by insects, such as bees and cucumber beetles; infection occurs through the blossom and spreads into the fruit and stem. Development of wet rot is favored by high relative humidity and excessive rainfall.

No effective control practices are available for wet rot. Fungicide sprays are impractical because new blossoms open daily and need to be protected soon after. Drip irrigation (beneath the foliage) watering may reduce development and spread of the disease during dry seasons.

Bacterial Wilt

Bacterial wilt, caused by the bacterium *Erwinia tracheiphila*, is a destructive disease of plants belonging to the cucumber family. Although bacterial wilt is most common on cucumber and cantaloupe, it can also infect squash, pumpkins, and a number of wild cucurbit plants. Watermelons and most gourds are highly resistant to the disease.

Bacterial wilt is characterized initially by wilting and drying of individual leaves. Within a day or two the wilting symptoms spread to leaves up and down a runner (Figure 7). The bacteria spread within the plant from infected runners to the main stem and then to other runners. The entire plant collapses eventual-



Figure 7. Cantaloupe infected with bacterial wilt.

ly. Two diagnostic techniques can be used to identify bacterial wilt in the field:

1. Cut a wilted stem near the crown and squeeze sap from the newly cut stem. Watch for a white ooze from the vascular bundles. Then touch a clean knife blade to the cut surface and slowly withdraw the blade from the stem. Watch for a white ooze that strings out in a fine thread between the newly cut stem surface and the knife blade.

2. Cut two stem sections from near the crown of a recently wilted vine. Squeeze sap from the cut stem ends and press the two ends together. Continue to squeeze, then slowly draw the two sections apart. The presence of a thin, sticky, white strand or strands between the two sections is a positive test for bacterial wilt (Figure 8).



Figure 8. Positive bacterial ooze test for bacterial wilt.

Positive test results appear to be easier to obtain for cucumber and for some squash than for cantaloupe. The striped and spotted cucumber beetles are both common carriers of *Erwinia tracheiphila*. The bacterium overwinters in the digestive tract of the insect and can be transmitted to susceptible plants the following spring when the beetles become active. Transmission occurs through wounds on leaves created by the feeding beetles.

Because the bacteria are spread by cucumber beetles, the best and most logical management of the disease is by controlling the insect vector. Insecticides have proved to be an effective method of controlling cucumber beetles and therefore spread of the disease. In small plantings, wilted plants should be removed at the first sign of disease and destroyed after first spraying them with a suggested insecticide.

Bacterial Fruit Blotch

Fruit blotch is caused by a bacterium that has yet to be classified. The disease, cause of “exploding watermelons,” has occurred in one or more states on the eastern seaboard, and in Alabama since 1989.

The fruit blotch bacterium can cause a seedling blight, leaf spot, and a fruit disorder. Initial symptoms on seedlings consist of dark, water-soaked areas on the lower surface of cotyledons and leaves. Lesion development is often accompanied by a yellow halo. Lesions may form on the hypocotyl, causing death of the plant. Foliar symptoms can occur throughout the growing season but are difficult to detect. Leaf lesions, which act as a reservoir of bacteria for subse-



Figure 9. Fruit blotch lesions along midrib of leaf.

quent fruit infection, are tan to reddish brown and appear usually along the midrib (Figure 9). Defoliation does not commonly occur.

Fruit symptoms begin as small, greasy-looking, water-soaked areas a few millimeters in diameter. Spots enlarge rapidly to dark-green, water-soaked lesions of several centimeters with irregular margins. In a few days these lesions may expand to cover the entire upper surface of the fruit. Fruit lesions do not extend into the flesh of the melon initially (Figure 10). In time, the centers of the lesions turn brown and crack. A white bacterial ooze, or an “effervescent exudate,” often can be seen on the fruit. Fruit decay usually follows.

The bacterium can be introduced into a field on infested seed, infected transplants, or volunteer watermelons, or bacteria can be spread naturally from



Figure 10. Fruit blotch lesion on watermelon.

alternate hosts. Seed harvested from infected fruit often harbor the pathogen. Undetected infestations can spread rapidly in transplant houses, resulting in high numbers of infected transplants going into fields. Volunteer watermelons act as hosts in fields that were infested with blotch the previous year.

Bacterial fruit blotch is favored by warm, moist environmental conditions. Hot, sunny days accompanied by thundershowers appear to promote its development and spread. Under favorable conditions, the disease spreads rapidly; 100-percent field infection by harvest is common. Symptoms do not appear to develop in cool, rainy weather. Young fruit (2- to 3-weeks old) are most susceptible with bacteria entering through stomata. Infection of mature fruit, once the wax layer forms, can occur only through wounds.

Preventing the introduction of the pathogen into a field is the best method of control for fruit blotch. Buy and plant seed and transplants only from a reliable company and inspect transplants for fruit blotch symptoms. Crop debris, including watermelon culls from a field infected previously with fruit blotch, should be plowed under, and the current field should be planted as far away as possible from last year's site. Volunteer watermelons and wild cucurbit weeds in and around the current season's crop should be destroyed. The most susceptible fruit are those with light-green rinds, such as Charleston Gray; more tolerant are those with a solid dark-green rind, such as Sugar Baby. However, the level of tolerance currently available will not ensure freedom from the disease when environmental conditions favor its development.

The bacterium, once it is present in a field, can be spread by wind, rain, and equipment. Avoid working in wet, infested fields. Applications of copper fungicides have reduced disease incidence when applied

before fruit set. Two to three applications are necessary. Be aware, however, that copper can result in stunted watermelons.

Mosaic Viruses

Of the many viruses that attack cucurbits in Alabama, three commonly found viruses are cucumber mosaic virus (CMV), squash mosaic virus (SqMV), and watermelon mosaic virus-2 (WMV-2). These viruses differ in their host range, method of transmission, and in how they overwinter. Symptoms produced by these viruses are similar, making field identification impossible. Special laboratory testing is required for positive identification.

Cucumber mosaic virus (CMV) attacks more than 40 families of plants worldwide, including all vine crops. Strains of CMV differ in their host range, symptoms, and method of transmission. Cucurbits are susceptible at any stage of growth. When plants become infected in the 6- to 8-leaf stage, symptoms first appear on the youngest, still expanding leaves. A mosaic pattern develops—healthy, dark-green leaf tissue intermingled with light-green and yellow tissue (Figure 11). Leaves are often distorted, crinkled, curled, and stunted. Vines may appear bunched because of the shortening of the internodes. In severe cases, older leaves may die. Typical mosaic symptoms develop only on actively growing leaves. When



Figure 11. Mosaic symptom on squash leaf.

a plant becomes infected at midseason, previous growth remains normal and produces healthy fruit. Few fruit set on plants infected early in the growing season. Fruit that do set are often of poor quality and may be mottled green and yellow or have dark-green warts (Figure 12).



Figure 12. Mosaic symptom on watermelon.

CMV can infect more than 800 species of plants, including many weeds found in Alabama. These weeds can act as reservoir hosts and allow the virus to overwinter. CMV can be spread and transmitted by more than 60 species of aphids. Transmission is in a nonpersistent manner, meaning that the aphids need to feed on a CMV-infected plant for only a few seconds to pick up the virus.

Squash mosaic virus (SqMV) affects most cucurbits but is rarely a problem in watermelon. Initial symptoms on squash include yellow spotting of the younger leaves. Infected leaves cup upward and develop a light-to dark-green mosaic pattern. Squash leaves may



Figure 13. Malformed, mosaic-virus-infected leaf on squash.

become distorted (Figure 13), and fruit are often malformed with raised, dome-like swellings.

On cucumber, SqMV causes a yellow spotting followed by a yellow vein banding on the first true leaves. Young leaves may cup upward. Leaves that form later develop few or no symptoms and the original symptoms fade as temperatures increase, making it difficult to detect infection during hot summers.

On cantaloupe, SqMV causes yellow spotting, a green and yellow mosaic, and green vein banding on the leaves. A few leaves may become malformed with veins protruding beyond the leaf margin.

SqMV can overwinter in weeds, seed, and in cucumber beetles. Cucumber beetles are efficient vectors of SqMV, spreading the virus during feeding.

Two strains of watermelon mosaic virus (WMV) have been identified, although only strain 2 (WMV-2) has been reported in Alabama. WMV-2 affects all cucurbits and a few other plants, including peas and alfalfa. Symptoms vary depending on the host and plant age at the time of infection. Symptoms on most cucurbits may include stunting, leaf malformation, yellowing or light-green mottling, and marginal chlorosis. Plants that are infected when they are young produce few marketable fruit. Fruit that are produced may be dwarfed, mottled, or spotted.

WMV overwinters in seed or in infected weeds. In spring, the virus can be spread by many species of aphids in a nonpersistent manner. Later plantings risk greater damage as disease incidence and aphid populations increase during the growing season.

Control of mosaic viruses in cucurbits begins with eradication of biennial and perennial weeds and wild reservoir hosts in and around gardens and fields. Applications of insecticides to prevent the buildup of large aphid and cucumber beetle populations, as well as other insects, will reduce virus incidence and spread. When possible, plant certified virus-free seed and plant resistant cucumber varieties. Isolate later plantings as far away as possible from earlier settings, especially if virus incidence was high. Removing infected plants when symptoms first appear may reduce or delay spread of the disease.

Root-Knot Nematodes

Root-knot nematodes, *Meloidogyne* spp., can attack cucurbits as well as more than 2,000 other species of plants. Nearly 40 species have been described, and physiological races exist among many of them. When root-knot nematode populations are high, plants are often stunted and may wilt during dry conditions or during the hottest part of the day. Nematodes damage the root system by disrupting the flow of water and nutrients and by causing wounds

that give access to diseases such as Fusarium wilt. Detecting root-knot in the field is done easily by

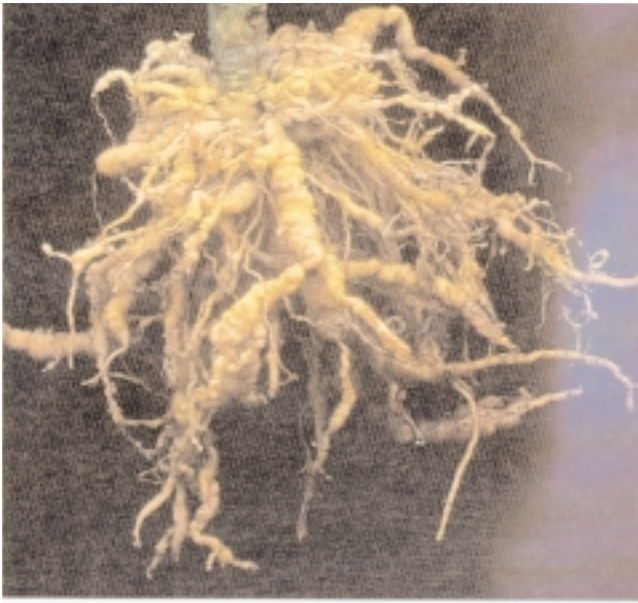


Figure 14. Root galls of root-knot nematodes.

examining roots of symptomatic plants. The nematodes cause knots or galls (Figure 14) to develop on both large and small roots. Knots range in size from the head of a pin to an inch in diameter.

Root-knot nematodes have a wide host range that includes many cultivated crops as well as many weed species. Nematodes survive in soil from year to year and become active as temperatures increase in the spring. The most effective control of root-knot nematodes is through the use of resistant varieties. Also, rotation with grasses and clean fallowing during the off-season will reduce nematode populations. Soil fumigation is an effective means of reducing damaging population levels temporarily (one growing season). Soil solarization has been shown to be effective in reducing nematode populations when environmental conditions are favorable for its use (See Extension publications ANR-30, "Nematode Control in the Home Garden"; ANR-500, "Alabama Pest Management Handbook"; and ANR-713, "Soil Solarization for the Control of Nematodes and Soil-borne Diseases").

Other Foliar Diseases

Cucurbits are also attacked by other, less damaging foliar diseases that we will describe in brief. Common diseases that may appear on the foliage or fruit include powdery mildew, downy mildew, *Alternaria* leaf spot, and angular leaf spot.

Powdery mildew, caused by the fungus *Erysiphe cichoracearum*, affects cucumber, cantaloupe, pumpkin, and squash. The fungus produces a white, powdery growth on leaves. Crown leaves are infected ini-

tially and may wilt and die. Disease development is favored by high temperatures and high relative humidity.

Downy mildew, caused by the fungus *Pseudoperonospora cubensis*, affects cucumber and cantaloupe. The fungus produces yellow to brown spots on the upper leaf surface. Under moist conditions, a fluffy, gray fungal growth appears on the underside of the leaf corresponding to the leaf spots above. Infected leaves may die, as the disease spreads from the crown outward. Moist conditions favor downy mildew development.

Alternaria leaf spot, caused by the fungus *Alternaria cucumerina*, affects cantaloupe and cucumber as well as other cucurbits. The fungus causes tan to brown leaf spots ($\frac{1}{2}$ inch in diameter) that contain dark concentric rings within the lesions. Spots merge and defoliation occurs, beginning with the crown leaves. Weak plants are most susceptible to *Alternaria* leaf spot. The fungus is spread by wind and rain and is favored by warm, wet conditions.

Angular leaf spot, caused by the bacterium *Pseudomonas lachrymans*, affects cucumber, squash, and pumpkin. Leaf spots are angular in appearance (limited by major veins), water soaked initially, and they eventually turn grayish brown. Leaves take on a shot-holed appearance as spots drop out. The bacteria also produces small, water-soaked spots on fruit, which can lead to rotting of the fruit. The disease is favored by warm, wet conditions.

Control of these diseases consists of practicing disease-control strategies including crop rotation; planting certified, disease-free seed; planting in well-prepared, fertile soil; controlling weeds; planting resistant varieties when available; practicing clean plow down after harvest; and following a fungicide spray program when recommended (see Extension publication ANR-500, "Alabama Pest Management Handbook").



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