

# Virus Diseases of Tomato

**V**irus diseases affect tomato production to some degree every year in Alabama. The amount of damage they cause varies, depending on the particular virus or combination of viruses present, the virulence of the virus strains, the susceptibility of the variety, the timing of infection, the abundance of insect vectors, and environmental conditions.

Disease incidence can range from a few scattered plants in a field to total crop failure. The tomato virus epidemic in North Alabama in 1992, in which hundreds of acres of tomatoes were lost, is an example of the latter. Mixed infections of viruses in a plant or field may also occur. Mixed infections may cause symptoms that are more severe than either virus might cause alone. Virus diseases are difficult to control because of complex interrelationships among virus, host, vector, virus source, and environment. This circular describes the five most common viruses that affect tomato production in Alabama and suggests various control strategies.

## Tobacco Mosaic Virus

Tobacco mosaic virus (TMV), also known as tomato mosaic virus (ToMV), can be a problem when resistant varieties are not used and frequent handling of plants is involved. Many strains of the virus exist, affecting many unrelated plants in different families. TMV is a very stable, persistent virus that is readily spread by human activities. TMV can be a severe problem during production of tomato transplants in greenhouses. Handling plants during standard production practices such as transplanting, tying, and pruning can effectively spread the virus. Infected leaf and root debris and seed are common sources of TMV. The virus can survive in plant debris for varying periods (up to 2 years under dry conditions), depending on soil moisture.

Symptoms of TMV first appear about 10 days after plants become infected. Symptoms appear as light and dark green mottled areas on leaves. Leaves on infected plants are often small, curled,

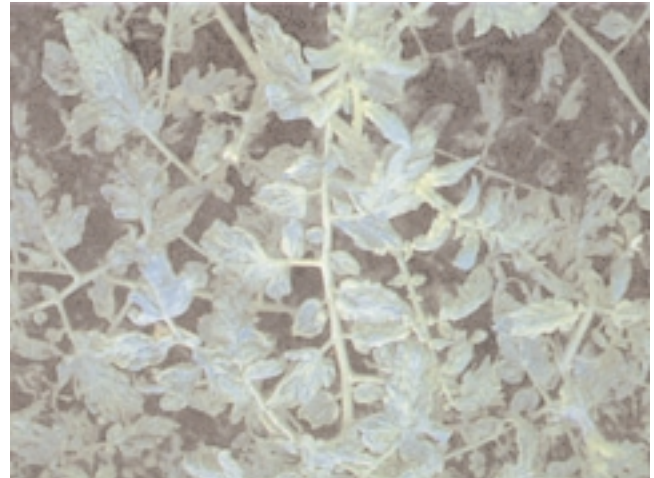


Figure 1. Leaves infected with TMV.

and puckered (Figure 1). Plants infected early in their development are stunted and have a yellowish cast. Symptoms may vary depending on virus strain, time of infection, variety, and environmental conditions. In hot weather, symptoms may not be as obvious although plants remain infected.

Certain strains of TMV can cause dark, longitudinal streaks of varying lengths on stems. Affected stems are brittle and appear brown internally.

TMV can reduce size and number of fruit produced. The earlier a plant becomes infected, the greater the loss. Fruit usually do not show any malformation. Occasionally, mottling, bronzing, and internal browning of fruit occur. Internal browning is evident on mature but unripened fruit.

Various strategies may be used to control TMV. Control practices should begin before planting. Eradicate perennial and biennial weeds from the garden, field, greenhouse, and surrounding areas. Continue weed control during and after the growing season. Use TMV-resistant tomato varieties when feasible. Make sure that transplants are healthy and certified as disease free. Discourage use of tobacco by workers, and encourage the practice of washing hands with soap and water

before and after handling plants. Do not transplant seedlings into fields where root debris is present. Destroy infected plants found at transplanting and during the season. Use a 2-year rotation between susceptible crops. Contact your county Extension agent for more information concerning TMV control for greenhouse tomato production.

### **Tomato Spotted Wilt Virus**

Tomato spotted wilt virus (TSWV) was first reported in Alabama in 1986. The host range of TSWV includes more than 170 species of plants, including many herbaceous ornamentals, in more than 35 plant families. TSWV is usually spread by thrips. Once thrips acquire the virus, they remain infective for the rest of their lives (30 to 45 days).

Tomato plants infected with TSWV are stunt-



Figure 2. Plants infected with TSWV.

ed and often die (Figure 2). Initially, leaves in the terminal portion of the plant stop growing, become distorted, and turn pale green. In young leaves, veins thicken and turn purple, causing the leaves to appear bronze (Figure 3). Necrotic spots or ring spots frequently occur on infected leaves. Stems of infected plants often have purplish-brown streaks. Infected fruit may exhibit numerous ringspots and blotches and may become distorted if infected when immature (Figure 4).

Currently, there is no effective way to control TSWV. To reduce the source of infection, control weeds adjacent to the field. (TSWV can overwinter in weeds.) Apply systemic insecticides to the soil at planting to slow initial spread of the virus into the field. Spray bordering weeds and the tomato crop with insecticides to suppress thrips populations and spread of TSWV. Remove and destroy infected plants as soon as symptoms appear, to further reduce virus spread.



Figure 3. Leaves infected with TSWV.

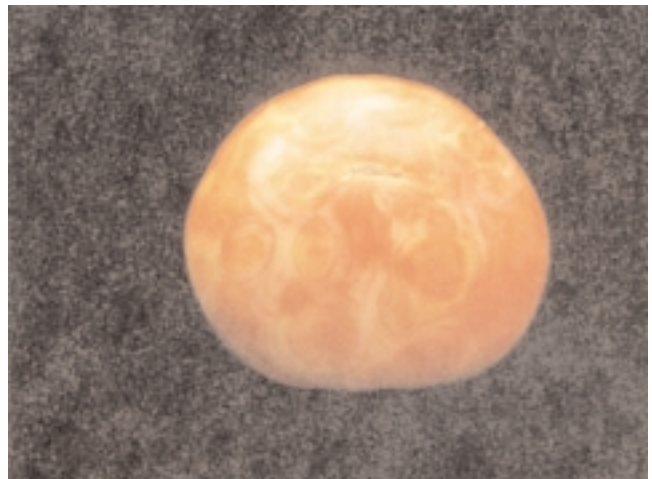


Figure 4. Fruit infected with TSWV.

### **Cucumber Mosaic Virus**

Cucumber mosaic virus (CMV) can occur wherever tomatoes are grown. The host range of the virus consists of more than 750 plant species including many vegetables (such as tomato, pepper, cucurbits, and legumes), weeds, and ornamentals. Strains of CMV have been reported which are specific for tomato.

The extensive host range of CMV includes many weeds, which can serve as sources of CMV and contribute to spread of the virus to crops. CMV is usually introduced to cultivated tomatoes by aphids after they have fed and acquired the virus from a wild reservoir host. More than 60 aphid species are capable of transmitting the virus



Figure 5. Plant infected with CMV.



Figure 6. Leaves infected with CMV.

in the nonpersistent manner. Generally, the virus is acquired by the aphid within 1 minute of feeding on an infected plant, but the aphid's ability to transmit the virus quickly declines and is lost within several hours. Transmission efficiency varies with aphid species, virus strain, host plant species, environmental conditions, and time of year. CMV does not persist in crop debris or soil and, unlike tobacco mosaic virus, it is not readily

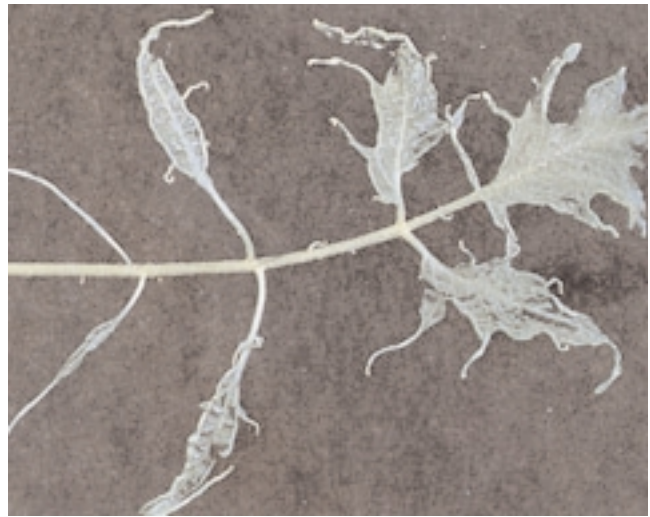


Figure 7. Characteristic of leaves infected with CMV: shoestringing.

transmitted by handling infected plants. The virus is not seed-borne in tomato but can be carried in the seed of 19 other plant species.

Tomatoes infected with CMV often are stunted and bushy (shortened internodes) and may have distorted and malformed leaves (Figure 5). Leaves may appear mottled (intermingling of dark green, light green, and yellow tissue), a similar symptom to those caused by other viruses (Figure 6). The most characteristic symptom of CMV is extreme filiformity, or shoestringing, of leaf blades (Figure 7). CMV symptoms can be transitory; that is, the lower or upper leaves can show symptoms while those in the midsection of the plant appear normal. Effect of CMV on yield depends on a number of factors, including plant age when infected and environmental conditions. Severely affected plants produce few fruit, which are usually small.

Refer to the control strategies section at the end of this circular for management of CMV.

### Potato Virus Y

Potato virus Y (PVY) occurs worldwide but has a narrow host range, affecting plants in the Solanaceae family (that is, tomatoes, potatoes, and peppers). It is transmitted by aphids. Near total crop failures have been reported when PVY was detected early in the season and high aphid populations were present.

PVY is transmitted in the nonpersistent manner by many aphid species. Aphids can acquire the virus in less than 60 seconds from an infected plant and transmit it to a healthy plant in less than 60 seconds. The virus may be retained by the aphid for longer than 24 hours if feeding does not occur. PVY can also be transmitted mechanically.



Figure 8. Leaves infected with PVY.

Potato is an important source of the virus for tomato and other solanaceous crops. The virus does not appear to be seed-transmitted.

Symptoms on tomato vary according to PVY strain, plant age, varieties infected, and environmental conditions. General symptoms on tomato are faint mottling and slight distortion of the leaves (Figure 8). Severe symptoms include dark brown, dead areas in the blade of nearly mature leaflets. Leaflets at the terminal end of a leaf usually are most adversely affected, often showing severe necrosis. In many cases, all leaflets are affected. Leaves formed after the onset of PVY exhibit mild wrinkling, slight distortion, and mild mottling. Leaflets of plants infected for some time are rolled downward with curved petioles, giving the plant a drooping appearance. Stems often show a purplish streaking but no symptoms are produced on the fruit. Mature plants are stunted and unthrifty and yield is reduced.

Refer to the control strategies section at the end of this circular for management of PVY.

### Tobacco Etch Virus

Tobacco etch virus (TEV) infects tomatoes and peppers along with other plants in the Solanaceae family. The occurrence of TEV in tomato fields is closely associated with other infected solanaceous crops, especially pepper, and natural weed hosts, which serve as virus reservoirs. Thistle, lamb's-quarter, sicklepod, jimsonweed, and black nightshade, among others, can act as alternate hosts for TEV. The virus can be transmitted by at least 10

species of aphid in the nonpersistent manner. There are no reports of seed transmission in any host plant.

Leaves of infected plants are severely mottled, puckered, and wrinkled. Plants infected at an early age are severely stunted. Fruit from infected plants are mottled and never achieve marketable size. The younger the plants are when infected, the greater the reduction in yield.

Refer to the control strategies section at the end of this circular for management of TEV.

### Control Strategies For CMV, PVY, And TEV

There are no good sources of resistance in tomato for CMV, PVY, or TEV, so other control strategies must be used. These include the following:

- Eradicate all biennial and perennial weeds and wild reservoir hosts in and around fields. Maintain a distance of at least 30 feet between susceptible crops, weeds, or other susceptible plants, including those in ditch banks, hedge or fence rows, and other locations.
- Plant earlier to avoid high aphid populations that occur later in the season.
- Plant late settings as far as possible from fields used to produce early tomatoes and peppers. These areas can act as sources of viruses and aphids for subsequent crops.
- Scout fields for the first occurrence of virus disease. Where feasible, pull up and destroy infected plants, but only after spraying them thoroughly with an insecticide to kill any insects they may be harboring.
- Use reflective mulches to repel aphids, thereby reducing the rate of spread of aphid-borne viruses.
- Monitor aphid populations early in the season and apply insecticide treatments when needed.
- Minimize plant handling to reduce the amount of virus spread mechanically.
- Avoid planting tomatoes near potato fields to control PVY.

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**For more information**, call your county Extension office. Look in your telephone directory under your county's name to find the number.

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