Agronomic Spotlight

Watermelon

New Watermelon Viruses

- Cucurbit chlorotic yellows virus (CCYV), watermelon crinkle leaf-associated virus-1 (WCLaV-1), and watermelon crinkle leaf associated virus-2 (WCLaV-2) have recently been detected in watermelons growing in the United States.
- CCYV is known to be transmitted by the sweet potato whitefly, but the vector for the WCLaV viruses has yet to be determined.
- Research on the biology and management of these viral pathogens is in the initial stages.

Three viruses that are relatively new to North America have been recently detected in watermelon. Cucurbit chlorotic yellows virus (CCYV), watermelon crinkle leaf-associated virus-1, and watermelon crinkle leaf-associated virus-2 have been found on watermelon and other cucurbit crops in several states in the past few years.[1,2] CCYV was first described in Japan in 2004 on cucumber, melon, and watermelon. The virus was first detected in California on melon plants during a 2018 study on another virus, cucurbit yellow stunting disorder virus (CYSDV). Based on an analysis of archived plant samples, it is believed that CCYV was present in California as early as 2014 but was misidentified as CYSDV.[3,4] CCYV has since been detected in Alabama, Georgia, and Florida. A study on CCYV in Taiwan found incidence levels as high as 78% in some melon fields. These infections resulted in yield reductions of 12 to 33% and decreases in the degrees of Brix in melon fruit.[5]

Watermelon crinkle leaf-associated virus-1 (WCLaV-1) and watermelon crinkle leaf-associated virus-2 (WCLaV-2) were first found on watermelon plants in 2015 and 2016 in China.[5] Both WCLaV-1 and WCLaV-2 were detected in watermelon plants collected in Texas in 2020, and both viruses were detected in watermelons in Florida in the spring of 2021. WCLaV-1 was also recently detected in Georgia, and WCLaV-2 was detected in Oklahoma.[6,7,8]

Figure 1. Symptoms of interveinal chlorosis on a plant infected with cucurbit chlorotic yellows virus (CCYV). Katherine Hendricks, University of Florida.

Symptoms

Symptoms of CCYV infection usually appear first as chlorotic spots or mottling and as a general yellowing of older leaves.

Figure 2. Foliar symptoms of watermelon crinkle leaf-associated virus infection on watermelon leaves showing leaf distortion on newest growth. Pamela Roberts, University of Florida.

The spots then expand and coalesce resulting in symptoms of interveinal chlorosis, where the tissue between major veins is yellow while the tissue near the veins stays green (Figure 1).[3,9] The affected leaves are often brittle and thicker than normal. Later, symptoms gradually develop on younger foliage, usually as a complete yellowing. The foliar symptoms are similar to those caused by other yellows viruses, such as CYSDV and the cucurbit leaf crumple virus (CuLCrV), and distinguishing yellows virus diseases based on symptoms alone is usually not possible. Symptoms of CCYV infection can also be similar to symptoms resulting from some nutrient deficiencies. Yield levels are often lower on CCYV-infected plants, and the fruits have lower levels of soluble solids (degrees Brix).[2,3,9] Typical symptoms of WCLaV-1 and -2 infection include mottling, yellow mosaics, crinkling, upward curling, and elongation of leaves on affected plants (Figure 2). Some vein yellowing may also occur (Figure 3).[1,2,8,10,11]

Disease Cycle

CCYV is vectored by the sweet potato whitefly (*Bemisia tabaci*) MEAM1 (formerly biotype B, also called the silverleaf whitefly) and MED (formerly biotype Q).[3,9,12] The virus is transmitted in a semi-persistent manner, meaning that the insects can transmit the virus for several days (4 to 12 days with CCYV) after acquiring the virus by feeding on an infected plant for several hours. The MED biotype of *B. tabaci* is more efficient

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Figure 3. Yellowing and leaf crinkling symptoms on watermelon plants infected with one of the watermelon crinkle leaf-associated viruses. Pamela Roberts, University of Florida.

at transmitting CCYV than the MEAM1 biotype, and the efficiency of transmission increases with longer acquisition times (feeding periods). The whiteflies need to feed for at least six hours to acquire CCYV, but feeding for twenty-four hours results in transmission efficiencies of up to 80%.[2,3,12,13,14] CCYV is not mechanically transmitted (transmitted in plant sap), and it is not known to be seedborne.[3] An insect vector for WCLaV-1 and -2 has not been identified, and it is not known how these two viruses are transmitted.[2,10]

The known plant hosts for CCYV include cucumber, melon, pumpkin, watermelon, and zucchini. In nature, only cucurbit species have been found to be infected with CCYV. Other crop and weed species, belonging to at least twelve different plant families have been identified as hosts of CCYV in lab and greenhouse studies. Susceptible weed species may play an important role as reservoir hosts for CCYV, allowing the virus to survive in the area during non-crop periods.[3,9,12,13]

Management

Because these viruses have only been known and studied for a short time, research on their biology, factors that affect disease development and transmission, and methods of disease management are still in the initial stages. CCYV is known to be transmitted by whiteflies, and it is closely related to other whitefly-transmitted viruses, such as CYSDV, which have been more thoroughly studied. Some of the management strategies developed for those other viruses may also be effective for CCYV. The use of insecticides to suppress whitefly populations may help slow the spread of CCYV and reduce rates of infection. Treating seedings with insecticides one to three days before transplanting may help protect the seedings from becoming infected shortly after transplanting. The application of systemic acquired resistance (SAR) products that induce the plants' defense mechanisms may help the plant resist or minimize the effects of infection by the virus.[3,9]

Eliminating known reservoir hosts of all three of these viruses within and around the field may help delay and slow the spread of the pathogens to the watermelon plants. However, the vectors may be able to travel long distances after feeding on infected crop- or weed-species and introduce the viruses into watermelon plantings. There are no commercially available watermelon varieties with host resistance to any of these three virus pathogens. [3,9]

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Websites verified 10/19/2022

For additional agronomic information, please contact your local seed representative.

Performance may vary from location to location and from year to year, as local growing, soil and weather conditions may vary. Growers should evaluate data from multiple locations and years whenever possible and should consider the impacts of these conditions on the grower's fields. The recommendations in this article are based upon information obtained from the cited sources and should be used as a quick reference for information about vegetable production. The content of this article should not be substituted for the professional opinion of a producer, grower, agronomist, pathologist and similar professional dealing with vegetable crops.

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