PLPM-PU-094 03/22

MOSAIC VIRUSES INFECTING CUCURBITS IN TEXAS

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INTRODUCTION

All growing regions of Texas can sustain the production of various cucurbit types, including watermelon, pumpkins, squash, melons, and cucumber. However, virus diseases are causing detrimental effects to production, reducing crop yields, fruit quality, and profitability. Mosaic and yellowing virus diseases (see AgriLife Extension publication PLPM-PU-093, *Yellowing Viruses Infecting Cucurbits in Texas*) are the two main virus disease types affecting cucurbits. Mosaic virus symptoms are distinguishable from yellowing viruses, but symptoms due to individual mosaic viruses are often indistinguishable from each other. Mixed infections of mosaic and/or yellowing viruses can also be present, making symptom-based diagnosis unreliable, and they also can cause severe losses to cucurbit production. Some mosaic virus-resistant varieties are available, but not necessarily for all desirable cucurbits.

SYMPTOMS

Mosaic viruses are commonly associated with yellow/green mosaic patterns (Fig. 1), leaf mottle, stunted growth, leaf curl, puckering, leaf distortion (Fig. 2), vein clearing, and blisters. Fruits can also exhibit symptoms, including cracking, fruit distortion, and mosaic patterns (Fig. 3).

CAUSAL AGENTS

Mosaic viruses that have been characterized from cucurbits include papaya ringspot virus-W (PRSV-W; genus *Potyvirus*, family *Potyviridae*), cucumber mosaic virus (CMV; genus *Cucumovirus*, family *Bromoviridae*), watermelon mosaic virus (WMV; genus *Potyvirus*), zucchini yellow mosaic virus (ZYMV; genus *Potyvirus*), squash mosaic virus (SqMV; genus *Comovirus*, family *Secoviridae*), cucumber green mottle mosaic virus (CGMMV; genus *Tobamovirus*, family *Virgaviridae*), and Moroccan watermelon mosaic virus (MWWV; genus *Potyvirus*). Among them, PRSV-W, ZYMV, CMV, and WMV have so far been detected in Texas cucurbit fields.

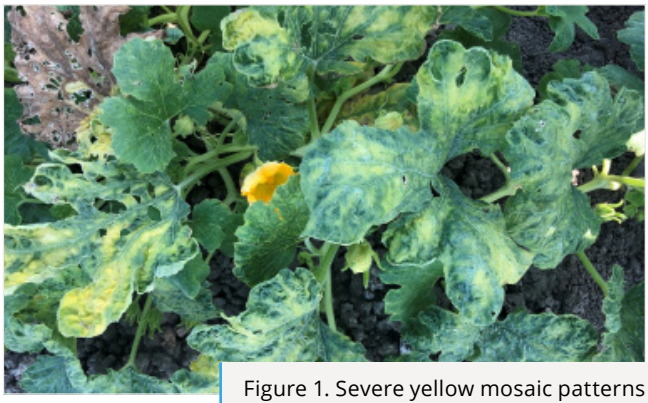

Figure 1. Severe yellow mosaic patterns on a butternut squash plant.

Figure 2. A yellow squash plant exhibiting symptoms of mosaic and leaf distortion due to mixed infection.

Figure 3. Symptoms of mosaic, ringspot, and distortion on zucchini squash fruits.

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MOSAIC VIRUSES PRESENT IN TEXAS CUCURBIT FIELDS

Papaya ringspot virus-W (PRSV-W). PRSV-W is transmitted by aphids (Fig. 4), and the insect can acquire and transmit the virus within short periods (seconds to minutes) of feeding. Infected transplants can cause long-distance spread. Cucurbit crops neighboring PRSV-W infected crops can also provide a source of inoculum for the virus. PRSV-W can also be mechanically transmitted to other cucurbits or host crops. The virus can infect all cucurbit types.

Figure 4. Life stages and mummified bodies of the melon aphid (*Aphis gossypii*). *Photo credit: M. Spellman, University of Massachusetts Amherst.*

Watermelon mosaic virus (WMV). In addition to being mechanically transmissible, WMV is also vectored by aphids in a manner similar to PRSV-W. Field orientation (being downwind) or environmental conditions can affect the spread of WMV. The virus can also travel far distances through transplants. WMV is now known to infect most members of the cucurbit family. Many monocots, dicots, and weeds can serve as reservoir hosts for WMV and its aphid vectors between seasons.

Zucchini yellow mosaic virus (ZYMV). ZYMV is transmitted by multiple aphid species, and transmission is rapid like PRSV-W and WMV. ZYMV is also mechanically transmissible (e.g., via farm equipment) and can be spread through plant-to-plant contact. The virus primarily infects members of the cucurbit family, wild cucurbits, and some weed species.

Cucumber mosaic virus (CMV). CMV is also transmitted by aphids in a similar mode as the potyviruses. CMV is detrimental to cucumber, summer squash, pumpkins, and melon. There are watermelon varieties with resistance to CMV, but some strains of the virus may be capable of breaking the resistance and causing severe infections. The very wide host range of CMV includes over 1,200 species of monocots and dicots—hence, potential inoculum sources for the virus are abundant.

Diagnosis. Symptoms are insufficient for the diagnosis of specific mosaic viruses, but pathogen test strips (immunostrips) are available for field diagnosis of PRSV-W, CMV, and ZYMV. All viruses mentioned have another serological method (double antibody sandwich enzyme-linked immunosorbent assay [DAS-ELISA]) and molecular techniques (reverse transcription polymerase chain reaction [RT-PCR]) available in diagnostic laboratories, using leaf tissue samples. Please contact the diagnostic laboratory for instructions on proper sample collection, handling, and shipping.

Management. Integrated pest management strategies must be implemented to delay the onset of mosaic virus infections and to properly manage the aphid vector. Monitoring/scouting of cucurbit crops is essential to time planting or chemical applications during the growing seasons.

Resistant varieties and avoidance of infection. Commercialized resistant varieties are available in various cucurbit crops, but alternative host crops may serve as virus reservoirs and inoculum sources. Cucurbit seedling transplants are preferred over direct seeding for virus disease management. It is important to ensure the propagation of clean (virus-tested) transplants and to protect them from vector infestations early in the season (e.g., using row covers). Other approaches to disease avoidance include the use of reflective mulch and shifting of planting date to avoid peaks of vector migrations and abundance.

Removal of wild cucurbits, alternative hosts, and weeds. Post-harvest field sanitization and/or pre-plant herbicide treatment is recommended to remove potential virus inoculum sources, such as volunteer weeds and other alternative host plants. Proper field sanitation will also aid in the suppression of vector populations and spread of mosaic viruses. It is important to ensure that cucurbit crops are not planted in rotation with susceptible hosts of mosaic viruses.

Chemical treatment. Contact and systemic action insecticides are available for managing vector populations in cucurbit crops and for disrupting aphid feeding. Stylet (horticultural) oils are good options for organic cucurbit production. Proper rotation of insecticides is essential for preventing insects from becoming resistant. It is important to use only insecticides labeled for use on cucurbits and to follow the product label for effectivity of the chemicals.