Sugarcane Mosaic[1]

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Mosaic symptoms in sugarcane are currently associated with four diseases that are caused by several viruses (Rott et al. 2008). These diseases are the following:

1. Mild mosaic—caused by *Sugarcane mild mosaic virus* (SCMMV).
2. Streak mosaic—caused by *Sugarcane streak mosaic virus* (SCSMV).
3. Striate mosaic—caused by *Sugarcane striate mosaic-associated virus* (SCSMaV).
4. Mosaic—caused by *Sugarcane mosaic virus* (SCMV) and *Sorghum mosaic virus* (SrMV).

Since SCMV and SrMV can each cause mosaic symptoms on their own, they should be considered as responsible for two different diseases. However, these two sugarcane diseases (caused by *Sugarcane mosaic virus* and by *Sorghum mosaic virus*) are commonly referred to as "sugarcane mosaic" (Grisham 2000).

Sugarcane mosaic has, at one time or another, occurred in virtually every important sugarcane-growing country worldwide with the exception of Mauritius. Estimated yield losses due to the disease vary greatly depending on the time period and sugarcane-growing area involved. Historically, it has been a serious disease problem in Louisiana. In fact, mosaic, superimposed on already established diseases in Louisiana, caused a near collapse of the industry in the mid-1920s.

Until 1996, mosaic had not been a problem in Florida. In 1996, sugarcane mosaic was observed in grower fields on CP72-2086, a major commercial cultivar. The epicenter of the disease was near the intersection of Hatton Highway and US 98. Presently, because of the limited acreage of CP72-2086, there are only few observations of mosaic in commercial fields, and the disease is only a potential threat. Only traces of mosaic have been found in other cultivars. The western region of the south Florida sugarcane growing area remains essentially free of mosaic.

Symptoms

Mosaic is identified primarily by its leaf symptoms. As with most sugarcane diseases, the symptoms may differ in intensity with the sugarcane variety, growing conditions, and the species or the strain of the virus involved. In Florida, however, only SCMV has been identified so far.

The most distinctive symptom is a pattern of contrasting shades of green, often islands of normal green on a

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background of paler green or yellowish chlorotic areas on the leaf blade (Figure 1). Generally, the chlorotic areas are diffuse, but they may be sharply defined in some sugarcane clones infected with certain strains of the virus. The infection may be accompanied by varying degrees of leaf reddening or necrosis. Chlorotic areas are most evident at the base of the leaf. Chlorotic areas may also be present on the leaf sheath but rarely on the stalk. Young, rapidly growing plants are more susceptible to infection than more mature, slower-growing plants.

Figure 1. Leaves showing contrasting shades of green characteristic of sugarcane mosaic
Credits: Philippe Rott, UF/IFAS

Causal Agent

Historically, the causal agent of sugarcane mosaic was attributed to a single potyvirus called sugarcane mosaic virus or SCMV with numerous strains, or it was possibly attributed to a complex of potyviruses (Handley et al. 2001). Differentiation of the strains was based on symptom expression on differential hosts and serological properties. In this system, the various strains differed with respect to their host range, their ability to cause infection, and the degree of injury they caused. Strains were identified and designated by the letters A through N.

Within the last two decades, these sugarcane-infecting potyviruses were included in a SCMV subgroup consisting of five related but distinct species of potyviruses: *Sugarcane mosaic virus* (SCMV), *Sorghum mosaic virus* (SrMV), *Maize dwarf mosaic virus* (MDMV), *Johnsongrass mosaic virus* (JGMV), and *Zea mosaic virus* (ZeMV). Among these viruses, only SCMV and SrMV are known to infect sugarcane under natural conditions and are considered as the causal agents of sugarcane mosaic.

In the United States, sugarcane mosaic is found in Florida and was previously attributed to strains A, B, D, and E of SCMV. Mosaic is also found in Louisiana and Texas and was previously attributed to strains H, I, and M of SrMV. New strains are continually being identified in Louisiana. Natural infections caused by SCMV have been reported in a number of cultivated and wild grass species. Corn and sorghum, if planted next to sugarcane, may serve as an infection source. The importance of transmission of the disease from alternate hosts is not well understood. In Florida, certain weed species have been infected with strain E of SCMV for over 20 years with no extensive build-up of mosaic in a commercial sugarcane cultivar until 1996, when it became problematic on CP72-2086.

Spread of the Disease

There are three essential modes of spread of SCMV and SrMV: (1) by aphid vectors, (2) by infected stalk cuttings, and (3) by mechanical inoculation. Only aphid vectors and infected stalk cuttings used as seed cane for new plantings are important in the field. Mechanical transmission, for the most part, is important only in greenhouse and laboratory research.

There are several aphid species that can transmit SCMV and SrMV from diseased sugarcane plants to healthy sugarcane plants. The spread of these viruses is most rapid when aphid vector populations are high, susceptible sugarcane varieties are grown, and virus-infected plants are plentiful. Mosaic is primarily disseminated by planting infected seed cane in Florida. The relative importance of disease spread by seed cane was demonstrated in the 1990s by the incidence of mosaic in adjacent fields of CP72-2086 established from different sources. The incidence of SCMV in one of the fields was 95% but only 22% in the adjacent field planted with seed cane from another source. The two seed cane sources of CP72-2086 had been in proximity to each other for 15 to 20 years, clearly indicating that aphid transmission had not been extremely rapid.

Prevention and Control

The use of resistant varieties is the most effective method of mosaic control. Planting mosaic-free seed cane is also essential. Presently, there are only trace amounts of plants showing mosaic symptoms in grower fields in Florida.

Management practices targeting insect vectors and control methods aimed at eradication have not been very effective. For example, applications of insecticides have thus far failed to prevent the aphid vectors of SCMV from spreading the virus. Also, the practice of roguing (digging out and destroying diseased plants) is generally not considered feasible if the infection level exceeds 5%. Control of mosaic through heat treatment of cuttings is partially effective but is only practical in quarantine situations. The use of tissue culture–derived, disease-free cane for seed fields is also an effective method of control.

It has been noted that some sugarcane plants appear to recover from mosaic. A sugarcane plant that has recovered is not only symptomless, but the virus can no longer be detected in the plant. However, these recovered plants remain susceptible to reinfection by the same strain or by other strains of the virus.

There has not been any evidence of sufficient levels of mosaic to merit evaluating yield losses in recent years. Previously, there was no evidence indicating that there is yield loss in CP 72-2086 due to sugarcane mosaic.

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