Squash Vein Yellowing Virus, Causal Agent of Watermelon Vine Decline in Florida[1]

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INTRODUCTION: Plants from the cucurbit family (Cucurbitaceae) are grown throughout the world for their edible fruits. The family includes watermelons (*Citrullus lanatus)*, cantaloupes (*Cucumis melo*), cucumbers (*C. sativus)*, pumpkins (*Cucurbita pepo)* and numerous varieties of summer and winter squash (*C. pepo, C. moschata* and *C. maxima*). It also includes those grown as ornamental vines (*Luffa spp.*) and a few common weeds.

Thousands of acres of cucurbits worth millions of dollars are grown in Florida every year. For the past 30-40 years one impediment to cucurbit production in Florida has been the presence of aphid-transmitted viruses (Kucharek and Purcifull 1997). The most common aphid-transmitted viruses infecting cucurbits in Florida are *Papaya ringspot virus type W* (PRSV-W), *Watermelon mosaic virus* (WMV) and *Zucchini yellow mosaic* (ZYMV). PRSV-W and ZYMV are commonly found in the southern part of the state and WMV is found from Central Florida northward. Both yield and fruit quality can be significantly reduced by these viruses. *Cucumber mosaic virus* (CMV), another aphid-transmitted virus, occurs only sporadically (Webb *et al*. 2003).

PATHOGEN: In 2003, an unknown virus was detected in squash and later in watermelon (Webb *et al.* 2003, Adkins *et al.* 2007). The host range, mode of transmission and genome sequence indicate that this virus is a previously undescribed whitefly-transmitted plant virus. It belongs to family Potyviridae (Adkins *et al*. 2007; Li *et al*. 2008), the same virus family as the aphid-transmitted viruses PRSV-W, ZYMV and WMV. Its proposed name is *Squash vein yellowing virus* (SqVYV).

Fig 1: Vein yellowing symptoms of SqVYV in *Cucurbita pepo*. Photography credit: Jeffrey Lotz

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SYMPTOMS: The virus was originally isolated from a squash plant with vein yellowing symptoms (Fig 1) collected in Hillsborough County, FL in October 2003 (Webb *et al.* 2003). In 2005, this virus was linked to a watermelon vine decline (WVD) in Florida (Roberts *et al.* 2006). This disease has caused severe monetary losses to watermelon growers in South Florida since the spring of 2003 (Roberts *et al.* 2005). The symptoms of WVD start with a slight yellowing of the foliage (Fig 2A) followed by browning and the collapse of the entire vine within weeks of the first symptoms (Fig 2B). These symptoms appear as the fruit is approaching harvestable size. When cut open, the fruit often exhibit discolored blotches in the rinds (Fig 3). The flesh is often discolored (too red) and has an off taste. These same symptoms have been found in watermelons mechanically inoculated with the squash isolate of SqVYV in greenhouse studies (Fig 4) and by whiteflies in field trials (Adkins *et al*. 2007; Kousik *et al.* 2007).

Fig 2A: Early symptoms of WVD.
Photography credit: Scott Adkins

Fig 2B: Symptoms several weeks later.
Photography credit: Scott Adkins

Fig 3: Symptoms of WVD in watermelon fruit.
Photography credit: Scott Adkins

Fig 4: Healthy watermelon (left) and plants manually inoculated with SqVYV (right).
Photography credit: Scott Adkins

DISTRIBUTION: SqVYV is now widely distributed in watermelon, squash and cucurbit weeds in southwest and west central Florida, and has also recently been reported from southern Indiana (Adkins *et al.* 2008; Egle and Adkins 2007).

HOSTS: The host range of SqVYV appears to be limited to cucurbits including two weedy varieties of cucurbits found in Florida, *Momordica charantia* L. (Balsam-apple) and *Melothria pendula* L. (creeping cucumber) (Adkins *et al*. 2008). These weeds may be important reservoirs for SqVYV and help it to survive between crops.

DETECTION AND DIAGNOSIS: Diagnosis of SqVYV can be difficult. Typical potyvirus inclusions are not always found in leaf strips and leaf dips for the electron microscope can be negative. The virus seems to be unevenly distributed in its hosts and it often appears to have a low titer in many of the plants tested. There is no antiserum to this virus available at this time. Currently, the best test is a RT-PCR assay or a nested RT-PCR assay using primers based on the sequence of the capsid protein gene of SqVYV (Adkins *et al*. 2007, 2008). Plant samples for this test should be taken from the crown of the infected plant. Mechanical inoculation of watermelons with samples can also be useful for the detection of SqVYV as death of the inoculated plant is diagnostic.

VECTOR: SqVYV is transmitted by the whitefly *Bemisia tabaci* (Adkins et al. 2007; Webb *et al*. 2006).

CONTROL: Use of insecticides and silver plastic mulch are being explored for management of whiteflies and thus SqVYV (Roberts *et al*. 2007). Wild watermelon germplasm and watermelon grafted onto gourd rootstocks are also being evaluated for resistance to SqVYV (Kousik *et al*. 2008). The UF-IFAS-EDIS publication Webb *et al*. 2008 provides specific control recommendations for Florida.

SUMMARY: Growers of watermelons and other cucurbit crops in Florida should carefully monitor whitefly infestations in their fields. These insects can transmit not only SqVYV, but two other viruses recently found in Florida, *Cucurbit leaf crumple virus* (a Begomovirus) (Akad *et al*. 2008) and *Cucurbit stunting disorder* (a Crinivirus) (Jane Polston *et al.* 2008). In addition, cucurbuit weeds should be eliminated in and around crop fields as these weeds are reservoirs for SqVYV and likely all three of these viruses.

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DACS-P-01579