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PP282

Groundnut Ringspot Virus in Florida[1]

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Groundnut ringspot virus (GRSV) was recently identified affecting tomatoes in Florida. GRSV can infect tomato plants at all stages of growth and lead to unmarketable fruits or plant death. GRSV is related to tomato spotted wilt virus (TSWV; in the tospovirus group), which has been present in North Florida (and much of the southeastern United States) since the mid-1980s.

Symptoms typical of tospovirus infection have been sporadically observed on tomato plants in the Homestead area of Miami-Dade County in South Florida for about a decade, but TSWV (the only tospovirus known to infect tomato in Florida) was only occasionally detected. From November 2009 through February 2010, tospovirus symptoms were again observed in this area, and GRSV was detected by specific molecular and serological tests. This was the first report of GRSV in the United States and extends the known distribution of this tospovirus beyond South America and South Africa to North America.

Since the first diagnosis in Miami-Dade County, GRSV infections in commercial tomato fields have also been confirmed in Collier, Hendry, Lee, Manatee, Martin, and Palm Beach Counties. By the summer and fall of 2010, growers and scouts reported GRSV incidence in tomato fields across South Florida, mostly at low levels approaching 2% infection rate. Infected tomato seedlings were also found in plant houses (Figures 1 and 2). During the fall of 2010 and spring of 2011, GRSV infections of pepper, tomatillo,

Figure 1. Tomato seedlings infected with GRSV
Credits: Felicia Parks, Glades Crop Care

Figure 2. Tomato transplants infected with GRSV
Credits: Felicia Parks, Glades Crop Care

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and eggplant were confirmed at several locations in South Florida (Figures 3a, 3b, and 3c).

3a.

3b.

3c.

Figures 3a, b, c. a. Pepper with GRSV symptoms; b. Pepper displaying chlorosis on leaves due to GRSV infection; c. Necrotic areas on pepper leaves and fruit due to GRSV infection
Credits: a. Joel Allingham; b. and c. Scott Adkins, USDA

GRSV's appearance across a wider swath of South Florida in more crop species and with greater frequency is a concern.

Symptoms

Early symptoms of GRSV infection are difficult to diagnose visually in all crops. Later symptoms can be quite striking, but molecular or serological analysis is necessary for definitive identification of GRSV.

In tomato plants infected at an early age, characteristic symptoms consist of inward rolling of leaves and leaves that develop a bronze cast followed by dark brown spots or flecks. Irregular yellow areas are also sometimes present. As the infection progresses, additional symptoms develop, including brown streaks on the epidermis (skin) of the main stem and leaf petioles and wilting (or death) of the top portion of the plant (Figures 4a–6). Fruits may be deformed, show uneven ripening, and often have raised bumps, rings, or ring patterns on the surface (Figures 7a, 7b, and 7c).

4a.

4b.

Figures 4a, b.Tomato plant showing rolling and bronzing of leaves associated with GRSV infection
Credits: Glades Crop Care

Figure 5. Tomato plant showing necrotic flecking and lesions on foliage associated with GRSV infection
Credits: Glades Crop Care

Figure 6. Tomato leaves showing necrotic flecking associated with GRSV infection
Credits: Glades Crop Care

Similar types of symptoms are also observed following GRSV infection of tomatillo and eggplant, with brown streaks on the epidermis of the main stem and death of the top portion of the plant. Yellow (chlorotic) or brown (necrotic) rings or spots also are observed on leaves and fruit husks of tomatillos.

GRSV symptoms in pepper closely resemble those induced by TSWV in pepper and include yellow and brown (chlorotic and necrotic) spots on newly developed leaves, inward rolling of leaves, and overall stunting of plants (especially if infected at an early age). Fruits are also deformed and off color, often with characteristic rings.

The initial characterization of GRSV was from peanut in South Africa, where stunting of the plant and small, distorted leaves with severe yellowing (chlorosis) and concentric ringspots were reported.

7a.

7b.

7c.
Figures 7a, b, c.Tomato fruit displaying necrotic rings associated with GRSV infection
Credits: Glades Crop Care

Host Range

The relatively narrow reported host range of GRSV contrasts with the extremely wide host range of TSWV. Both viruses induce similar symptoms on tomato, pepper, and tomatillo, as noted above.

GRSV has previously been found in Argentina, Brazil, and South Africa infecting hosts such as tomato, pepper, peanut, soybean, and coriander. Alternate hosts for GRSV in Florida are being explored. Growers are advised to watch for and report suspicious symptoms on weeds and other solanaceous crops, like potato, and legumes (especially peanut).

Disease Transmission

GRSV is reported to be transmitted by several species of thrips, including the western flower thrips (*Frankliniella occidentalis*) and common blossom thrips (*F. schultzei* and *F. gemina*). The virus must be acquired by larval thrips from an infected plant for subsequent transmission as adults. Transmission occurs in a circulative propagative manner, meaning that the virus multiplies in the thrips as well as its plant host.

Transmission of Florida GRSV isolates by western flower thrips has been demonstrated recently. The ability of additional locally important thrips species to acquire and transmit GRSV is now being tested in the state.

Management

Management of this virus and its thrips vectors is difficult. Once a plant becomes infected with GRSV, it cannot be cured. To prevent spread of the virus, infected plants should be immediately rogued to prevent spread to neighboring plants. This is especially true in transplant production. Control of western flower thrips (and potentially other thrips vector species yet to be identified in Florida) is important to reduce spread of the virus by these vectors.

The close relationship of GRSV and TSWV likely indicates that integrated management strategies developed and currently used for TSWV in North Florida will also be effective for GRSV. These include the use of virus-free transplants (produced by excluding thrips from plant houses, which may prove to be very difficult to achieve) and the use of metalized (UV-reflective) mulch developed for TSWV control by scientists at UF's North Florida Research and Education Center in Quincy. This integrated management approach combines the use of insecticides to reduce thrips larval development (to limit secondary virus spread) with UV-reflective mulches and acibenzolar-S-methyl (Actigard®). It has provided excellent management of TSWV in commercial tomato fields in North Florida and may help control GRSV in South Florida.

Additional Resources

Webster, C. G., K. L. Perry, X. Lu, L. Horsman, G. Frantz, C. Mellinger, and S. Adkins. 2010. "First Report of Groundnut Ringspot Virus Infecting Tomato in South Florida." *Plant Health Progress.* doi: 10.1094/PHP-2010-0707-01-BR.

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Webster, C. G., W. W. Turechek, H. C. Mellinger, G. Frantz, N. Roe, H. Yonce, G. E. Vallad, and S. Adkins. 2011. "Expansion of Groundnut Ringspot Virus Host and Geographic Ranges in Solanaceous Vegetables in Peninsular Florida." *Plant Health Progress* doi: 10.1094/PHP-2011-0725-01-BR.