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Geranium TSWV:

Noteworthy “Patient Zero” for North Carolina

Three geranium plants were observed with ring spots and upper-leaf mottling. These were typical signs of a viral infection, but the occurrence of a virus is uncommon.

When one thinks of the typical geranium diseases, the fungal root rots (*Pythium* and *Rhizoctonia*), *Botrytis* infections of the flower, leaf, and stem, plus the catastrophic bacterial wilt disease *Xanthomonas* are at the top of the list. With plant breeders having implemented clean stock programs and regular virus screening, rarely does one observe ring spots and mottling of a viral infection. On a visit to a grower, she highlighted 3 plants, all different cultivars from the same breeder, with ring spots and mottling.



Figure 1. An overall view of a geranium infected with tomato spotted wilt virus (TSWV). (Photo: Brian Whipker)

With distinct ring spots on the leaves, it was easy to know it was a virus, but it was uncertain as to which one.

One of the best geranium references is the 1993 book *Geraniums IV*, edited by John White of Penn State University. Even though the book is now 30 years old, it is an excellent authoritative guide. In chapter 28, Steve Nameth and Scott Adkins list 8 primary viral diseases and 4 additional minor ones. Virus identification at this time was laborious and difficult. Rosa and Moorman (2016) expanded the list to 16 notable and 9 minor viral diseases in their more recent, excellent, book chapter entitled “Diseases of

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Geraniums”. To confirm if this problem was one of the 25 listed viral diseases would be like shooting in the dark and an expensive proposition. The two most common viruses in greenhouses are impatiens necrotic spot virus (INSV) and tomato spotted wilt virus (TSWV). Because we had Agdia Elisa virus test kits on hand, that is where we started. With INSV occurring more frequently, that was tested first and a confirmation second line failed to appear. Surprisingly the TSWV test had 2 lines and confirmed that it was the malady.

TSWV is unusual and uncommon in geraniums, but not unheard of. TSWV is listed in both Geraniums IV and Diseases of Geraniums. In 1993, Charles Powell’s chapter in Geranium IV on seedling diseases states on page 218: “it is particularly noteworthy that even a virus as potentially damaging as tomato spotted wilt virus seems to behave in a rather benign manner in seedling geraniums”. This is a rather significant comment given that the senior author of this article just started as a Horticulture Agent around this period and the greenhouse industry had just been plagued with major, catastrophic TSWV (and later confirmed to also be INSV) problems. Also, Nameth and Adkins (1993) only list TSWV in a concluding virus paragraph of “Other Viruses”. Rosa and Moorman (2016) listed TSWV as a more important problem. They describe the disease as: “Symptoms associated with INSV and TSWV are mosaic, mottling, stem and leaf necrosis, ring spots on leaves, leaf deformation, and stunted growth.” In addition, a plant may not always show signs of the virus, “Symptomatology is driven by plant phenology and environmental conditions.” The senior author’s photo collection that spans 35 years does not contain any confirmed images of TSWV or INSV. Mike



Figure 2. The younger leaves with extensive mottling from a tomato spotted wilt virus (TSWV) infection of geraniums. (Photo: Brian Whipker)



Figure 3. Geranium leaf close-up exhibiting extensive mottling due to a tomato spotted wilt virus (TSWV) infection. (Photo: Brian Whipker)



Figure 4. A pronounced ring spot on a mid-section leaf of a tomato spotted wilt virus (TSWV) infected geranium. (Photo: Brian Whipker)



Figure 5. A close-up of the ring spot on a mid-section leaf of a tomato spotted wilt virus (TSWV) infected geranium. (Photo: Brian Whipker)

Munster of the NC State University Plant Disease and Insect Clinic stated that no sample had been confirmed in North Carolina. Thus this situation of TSWV in geraniums turns out to be “Patient Zero” for North Carolina.

The following images illustrate the signs of advanced TSWV in geraniums (Figures 1-5). These will aid in the identification of viral problems in geraniums, but a lab confirmation would be required for any suspected plant.

The grower was fortunate that only 3 plants exhibited viral signs and the plants were discarded. It was interesting that it occurred on 3 different cultivars from the same breeder. Given the oldest leaves were asymptomatic, the severity of the symptoms that had developed in only 4 weeks after transplanting, and that the problem was observed on 3 different cultivars, it was doubtful the infection had occurred in the mother stock. Testing protocols at the mother stock facilities also help to avoid problems. More likely infection occurred during rooting or at the greenhouse that reported the problem. Both TSWV and INSV are thrips vectored, with the Western Flower Thrips (WFT) being the most common thrips species observed in greenhouse operations. It has been observed by the authors that WFT will feed on geranium leaves and flowers, but it does not seem to be a preferred host. From a plant pathology standpoint, having a “Patient Zero” addition to the disease record is noteworthy, but given that no thrips were observed on the 3 isolated plants, we think we can borrow the quote from Charles Powell and modify it to “TSWV in this situation turned out to be a rather benign matter”.

References:

- Nameth, S.T. and S.T. Adkins. 1993. Viral Diseases, p. 267-275. In: J.W. White (ed.) *Geraniums IV*. Ball Publ. Geneva, IL
- Powell, C.C. 1993. Seedling Diseases, p. 215-219. In: J.W. White (ed.) *Geraniums IV*. Ball Publ. Geneva, IL
- Rosa, C. and G.W. Moorman, G.W. 2016. Diseases of Geranium. In: McGovern, R., Elmer, W. (eds) *Handbook of Florists' Crops Diseases*. Handbook of Plant Disease Management. Springer, Cham. https://doi.org/10.1007/978-3-319-32374-9_34-1

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