# PEST ALERT

**FDACS-P-02114**
Pest Alert created May 2019

## Florida Department of Agriculture and Consumer Services
## Division of Plant Industry

### Tomato brown rugose fruit virus (*Tobamovirus*, ToBRFV)

**Kishore Dey;** Bureau of Entomology, Nematology and Plant Pathology
DPIHelpline@FreshFromFlorida.com or 1-888-397-1517

**INTRODUCTION**
*Tomato brown rugose fruit virus* (*Tobamovirus*, ToBRFV) is a highly virulent virus that can cause severe fruit loss in tomatoes and peppers. Although ToBRFV has not been detected in Florida, major outbreaks exist in many parts of the world. With Florida's increasing reliance on tomato imports, there is a potential risk of introducing ToBRFV into the state.

**DISTRIBUTION**
ToBRFV was first identified on tomatoes in Israel in 2014 (Luria et al., 2017) and has since been detected in Germany, Italy and Mexico in 2018. ToBRFV was detected in a tomato greenhouse in California and was eradicated in 2018 (Ling et al., 2018). In the Mexican state of Michoacan, Yurecuaro and Tanhuato municipalities, ToBRFV was found in commercial tomatoes and pepper crops (Beltran et al. 2019).

**HOSTS**
Tomato (*Solanum lycopersicum*) and pepper (*Capsicum* sp.) are the two major hosts for ToBRFV. However, the virus could be experimentally transmitted to European black nightshade, *Chenopodium* spp, *Chenopodiastrum* spp, and *Petunia* spp when directly inoculated.

**SYMPTOMS**
The symptoms are very similar to those caused by tobamoviruses including *Tobacco mosaic virus* (TMV) and *Tomato mosaic virus* (ToMV), which include yellowing of leaf veins, yellow spots and brown rugose symptoms on fruit (Figure 1) (Luria et al., 2017). Necrotic lesions may also be seen in calyx, peduncles and pedicels of the fruit (Figure 1). The disease is more severe at a young age and usually develops within 12 to 18 days of infection. It can result in 30 to 70% yield loss.

**TRANSMISSION**
This virus, just like other members of the Tobamovirus genus, are very stable outside their host and can be easily transmitted by mechanical means, such as contaminated tools, hands, clothing, direct plant-to-plant and propagation material (grafts, cuttings). They can also survive in crop debris, soil and on implements for years. Seed transmission of ToBRFV is strongly suspected but has not been verified. The pathogen is found in the seed coat and the endosperm, which might explain their presence even after rigorous seed disinfection treatment. Recent glasshouse experiments have shown ToBRFV could be carried by bumblebees (*Bombus terrestris* (Linnaeus)) and transmitted to healthy tomato plants during pollination (Levitzky et al., 2019). As bumblebees are routinely used in pollinating tomatoes, bees could be an important mode of spread.

Once the virus is introduced in an area, control measures are very limited and mainly rely on elimination of infected plants and following strict sanitation measures, such as regular hand washing of the workers, and cleaning boots before entering the green houses. The major resistance genes (Tm-1, Tm-2, Tm-$2^2$) in tomato that provide broad resistance to this group of viruses is not effective for this virus (Luria et al., 2017). Both molecular and serological test are available for detecting this virus.

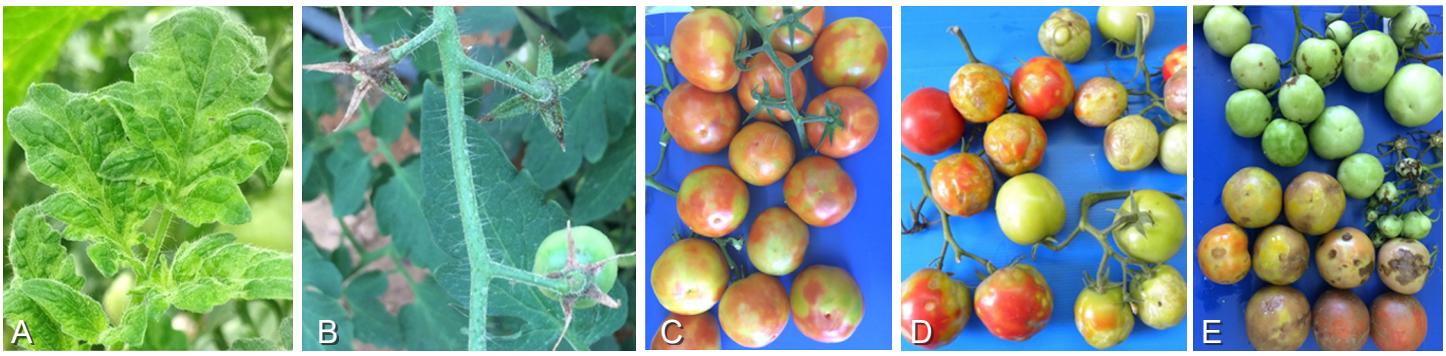


**Fig-1. (A)** Symptomatic mosaic pattern on leaves of tomato plants cv. Mose. **(B)** Dried peduncles and calyces on cherry tomato plants cv. Shiran leading to fruit abscission. **(C)** Typical fruit symptoms with yellow spots cv. Mose. **(D)** Symptoms of ToBRFV found at a single location in Italy. **(E)** Symptoms of mixed infections by the common tomato spotted wilt virus (TSWV) and ToBRFV.
Photo courtesy (Luria et al., 2017 ).

**REFERENCES**:

**Camacho-Beltrán, E., Perez-Villarreal, A., Leyva-Lopez, N.A., Rodriguez- Negrete, E.A., Ceniceros- Ojeda, E.A.,** and **Mendez-Lozano, J.M.** 2019. Occurrence of *Tomato brown rugose fruit virus* Infecting Tomato Crops in Mexico. Disease Notes. Published Online: https://doi.org/10.1094/PDIS-11-18-1974-PDN

EPPO Global Database. 2019. https://gd.eppo.int/taxon/TOBRFV

**Levitzky, N., Smith, E., Lachman, O., Luria, N., Mizrahi, Y., Bakelman, H., Sela, N., Laskar, O., Milrot, E.,** and **Dombrovsky, A.** 2019. The bumblebee *Bombus terrestris* carries a primary inoculum of Tomato brown rugose fruit virus contributing to disease spread in tomatoes. Plos One 14.

**Ling, K.S., Tian, T., Gurung, S., Salati, R.,** and **Gilliard, A.** 2019. First report of Tomato brown rugose fruit virus infecting greenhouse tomato in the United States. Disease Notes. Published Online: https://doi.org/10.1094/PDIS-11-18-1959-PDN

**Li, R., Miller, S.A., Baysal-Gurel, F., Ling, K.S.,** and **Kurowski, C.J.** 2015. Evaluation of disinfectants to control mechanical transmission of tomato viruses and viroids in greenhouse tomatoes. IV International Symposium on Tomato Diseases 1069:221-227.

**Luria, N., Smith, E., Reingold, V., Bekelman, I., Lapidot, M., Levin, I., Elad, N., Tam, Y., Sela, N., Abu-Ras, A., Ezra, N., Haberman, A., Yitzhak, L., Lachman, O.,** and **Dombrovsky, A.** 2017. A New Israeli tobamovirus isolate infects tomato plants harboring Tm-2(2) resistance genes. Plos One 12.

**Panno, S., Caruso, G.,** and **Davino, S.** 2019. First Report of Tomato Brown Rugose Fruit Virus on Tomato Crops in Italy. Disease Notes. Published Online: https://doi.org/10.1094/PDIS-12-18-2254-PDN

**Salem, N., Mansour, A., Ciuffo, M., Falk, B.,** and **Turina, M.** 2016. A new tobamovirus infecting tomato crops in Jordon. Archives of Virology 161:503-506.