

INTRODUCTION

- ToBRFV is a new species of a well-known group of plant viruses, **tobamoviruses**.
- First observed in Jordan in 2014 and described in Israel in 2015, it has now been detected in Europe, the Middle East, North America (including California), and China. **The virus is spreading rapidly, representing a major concern for worldwide tomato production.**
- **No tomato varieties are known to be resistant to ToBRFV** as it breaks or is not recognized by the Tm-2² or any other resistance gene currently used to protect tomatoes genetically against tobamoviruses.
- **The available evidence to date suggests that ToBRFV is primarily a threat to tomato production in protected culture** (greenhouses and screenhouses). However, outbreaks in open fields have been reported in Mexico.

ToBRFV CHARACTERISTICS

As a member of the genus *Tobamovirus*, ToBRFV, shares several properties and symptoms with the more familiar members of this genus relevant to California production, *Tobacco mosaic virus* (TMV) and *Tomato Mosaic Virus* (ToMV).

Survival & Transmission

- These viruses (ToBRFV included) **can survive in dried leaf tissue > 20 years.**

- Survival in soil and on other implements or surfaces (outside of infected plant tissue) used during any stage of production can range from months to years.
- These viruses are **transmitted extremely efficiently by contact**, particularly in protected culture (greenhouses and screenhouses) where plants are frequently handled.
- **There is no insect vector.**
- Tobamoviruses **readily contaminate the outside (seed coat) of seeds and can be spread long distance with seed**, but the viruses are not believed to infect the seed (i.e., invade the embryo).



Symptoms of distortion and mosaic and mottle in leaves of tomato plants infected with ToBRFV (above). Distortion and strap-leaf symptoms in a tomato plant infected with ToMV (below). (ToBRFV photos: N. Salem).



Browning of the veins of the calyx or drying out and browning of the end of the calyx tips are other possible symptoms. (photo credit: ASTA)

Symptoms

- These viruses cause similar symptoms and **it is impossible to identify the species involved based upon symptoms alone.**
- Symptoms do vary depending on the strain of the virus and the tomato cultivar.
- Generally, infected plants are stunted and leaves show some degree of distortion and mosaic or mottle.
- In some cases foliar symptoms include elongation or shoe-stringing
- Fruits show a range of symptoms including no symptoms, some degree of deformation and mottling or brown wall and necrotic lesions.
- Differentiating ToBRFV from other tobamoviruses: it breaks or is not recognized by Tm-2² or any other resistance gene, it induces more severe fruit symptoms, and it is commonly in mixed infections with *Pepino mosaic virus* (PepMV).

WHAT TO DO IF YOU THINK YOU HAVE ToBRFV IN YOUR FIELD

The commercially available TMV immunostrip will detect ToBRFV. So, **the first step if tobamovirus symptoms are observed or if ToBRFV is suspected is to run this test.**



Photo credit: Agdia

Unfortunately, the confirmation of ToBRFV (among tobamoviruses detected by the TMV immunostrip) currently requires RT-PCR and sequencing. **The Gilbertson Laboratory at UC Davis and the CDFA Plant Pest Diagnostics Center both currently have the capacity to rapidly detect ToBRFV.**

THE CALIFORNIA RESPONSE

This virus has spread globally in less than 5 years, is highly virulent and is not controlled by our existing genetics. Although ToBRFV is not currently established in California, it was detected in a greenhouse in southern California in 2018. Therefore, we should take the following precautions to maintain this status:

- Seed companies, as a standard practice, currently test for the presence of tobamoviruses. **Contact the seed company representatives you work with to know what precautions are being taken** to insure seed is not carrying ToBRFV.
- Monitor for virus symptoms to allow early detection if introduced into fields.

SUMMARY

- ToBRFV is a new species of highly virulent and aggressive virus which impacts both tomato and pepper production.
- ToBRFV is not currently established in California **but its rapid spread elsewhere should motivate preventative measures.**
- The available evidence to date suggests that **ToBRFV is primarily a threat to tomato production in protected culture** (greenhouses and screenhouses). However, outbreaks in open fields have been reported in Mexico.
- **Reliance on genetic resistance is not possible** as ToBRFV breaks or is not recognized by Tm-2² or any other resistance gene.
- ToBRFV is spread quickly and efficiently by contact with infected plant material. Although it is not believed to infect seed **it can readily contaminate the outside (seed coat) of seeds and can be spread long distance with seed.**
- **ToBRFV can survive for very long periods** (multiple years) in soil, in infected debris, or on contaminated equipment.
- Symptoms are similar to those of other tobamoviruses.
- If ToBRFV is suspected in field the commercially available TMV immunostrip will detect it but confirmation will require further testing.

If you have additional questions or need assistance in testing contact your County Farm Advisor or Bob Gilbertson at UC Davis (email: rlgilbertson@ucdavis.edu).

Tomato Brown Rugose Fruit Virus (ToBRFV)

A threat to field grown tomatoes in California?



ToBRFV fruit symptoms. (photo: N. Salem)

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