ToBRFV: A New Virus Mostly of Tomato to be Aware of

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All growers with tomatoes need to know about Tomato brown rugose fruit virus (ToBRFV), a new tobamovirus. Import restrictions now in place are expected to decrease the risk. Federal Order effective since 22 November 2019 imposes restrictions on imports of tomato and pepper seed lots, transplants, and fruit from all countries where ToBRFV exists. Concern remains for seed imported beforehand in 2019 from these countries and seed from other countries. Some seed companies are testing all tomato and pepper seed for tobamoviruses.

Facts about ToBRFV:

- It is seed-borne. This most likely is how this virus has been moved globally. While virus could get on hands from handling infected fruit, likelihood is very low that someone is going to get ToBRFV on their hands by handling infected fruit purchased in a store and then handle tomato plants without having washed their hands. Furthermore, workers at tomato production greenhouses, where ToBRFV is of greatest concern, typically are required to wash hands when entering.
- The outer layer of the viral particle (the coat protein which protects the viral RNA inside) is tough and thus impervious to standard chemical treatments for viruses. An effective seed treatment has not been found yet, but research on this is on-going. Concern is that trisodium phosphate (TSP) itself may not be sufficient.
- Transmission is mechanical. This virus can be moved very easily by workers handling plants. Consequently, ToBRFV is expected to primarily be a problem in greenhouse tomato crops due to the frequency that plants are handled by workers. Tomatoes in high tunnels are at greater risk than those outdoors.
- It may be moved by pollinators in particular bumblebees.
- Tobamoviruses may be able to be spread in irrigation water.
- It overcomes all known genetic resistances in tomato to other tobamoviruses.
- Affected tomato plants could produce fruits with brown discoloration symptoms rendering them unmarketable.
- Pepper is also a natural host. Petunia, tobacco, European black nightshade, and several species of Chenopodium and Chenopodiastrum may also be hosts based on demonstrated susceptibility through artificial inoculation; however, while helpful, this procedure is notorious for identifying potential hosts that are never found naturally infected. Eggplant and potato were found to not be susceptible.
- In general, tobamovirus can remain infectious in infested plant debris, in soil, and on surfaces for more than 20 years, which may also be the case for ToBRFV. This degree of stability is unusual for viruses.

Symptoms. Yellowing, bubbling, mosaic and mottling, fern leaf and leaf narrowing are all symptoms of ToBRFV on leaves. Symptoms most commonly develop on upper leaves.

Affected fruit may have rough surface; blotchy, pale, or yellow-brown spots; be undersized, deformed, and mature irregularly. Calyx veins can be brown and tips necrotic. Brown lesions also sometimes form on peduncles and pedicels. Flower abortion also occurs. Infected plants often are stunted. Symptoms of ToBRFV resemble those caused by related viruses including tobacco mosaic virus (TMV). Symptoms tend to be more severe during times of stress. Some varieties can remain symptom-free when infected. Photographs are posted at an MSU webpage and in brochure prepared by the American Seed Trade Association.

Known Occurrences. ToBRFV was first described in Israel in 2014. Since then it has been confirmed in China, Germany, Greece, Italy, Jordan, Palestine, Saudi Arabia, and Turkey plus unconfirmed occurrences in Belgium, Chile, Ethiopia, the Netherlands, Peru, Sudan, Thailand, and United Kingdom. To date in the USA ToBRFV has been detected in imported tomatoes in Florida and California, in a tomato plant within a community garden in Florida, and in greenhouse tomato production greenhouses in California and Arizona in 2018 and in New Jersey in fall 2019. ToBRFV has been found in field crops but only in Mexico. It is now considered eradicated from the USA greenhouses where detected and from Germany.

Management:

- Select seed that has been tested free from tobamovirues, including ToBRFV.
- Require workers wash hands before handling tomato plants.
- Have workers wear disposable gloves and routinely disinfect them and tools while working. Disinfecting between each plant worked on is recommended for greenhouse crops. Ideal is for each worker to have 2 sets of tools so that one can be sitting in disinfectant solution while other is in use. ToBRFV can also be moved on clothing that rubs against plants. Disinfect shoes at least once daily.
- Disinfectants currently recommended for greenhouse tomato production against virus and viroid infection are 2% Virkon S, 10% Clorox (disadvantage – corrosive), Lysol (for hand sanitation) and 20% non fat dry milk (disadvantage – odor). See on-line article for more information. Research is underway to evaluate ability of other disinfectants to deactivate ToBRFV.
- Routinely disinfect equipment that rubs against plants, including greenhouse carts.
- Use UV to treat recirculated water in greenhouses.
- Regularly inspect plants for symptoms.
- Submit samples with suspect symptoms to a diagnostic laboratory equipped to detect ToBRFV. Contact M.T. McGrath to find out which laboratories currently can test. Agdia has an immunostrip for TMV that also detects ToBRFV and an immunostrip that detects all tobamoviruses, including ToBRFV. Either is useful as an initial screen. Agdia is developing an immunostrip specific for ToBRFV.
- Notify local extension specialist and/or NYS Department of Agriculture and Markets about confirmed occurrence in your crop.
- Carefully remove and destroy (bury or incinerate) plants confirmed to have ToBRFV plus adjacent plants. Discontinuing irrigation for a day beforehand will decrease risk of sap transfer.

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