Novel Approaches for the Management of Tomato Brown Rugose Fruit Virus (ToBRFV)

LEAD RESEARCHER

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Researchers are working to stop Tomato Brown Rugose Fruit Virus (ToBRFV) from threatening Canadian greenhouse tomatoes and peppers. This research activity is studying the infection process and working to develop novel genetic resistance to ToBRFV. Researchers want to better understand how ToBRFV overcomes broad-spectrum resistance given by Tm-22 and bring back Tm-22 -mediated resistance to ToBRFV.

Approximately 16,000 individual tomato plants have been screened, with 30 lines found to have resistance/tolerance to ToBRFV. Resistance in one line has been confirmed after four generations, while resistance in other lines is yet to be confirmed. The research team has cloned the resistance gene Tm22 and ToBRFV movement protein (MP). It was found neither are stable as they have a very short turn-over time. A tomato protein involved in ToBRFV MP degradation was identified.

By investigating the deficiency of two ToBRFV proteins, including coat protein (CP) and MP on virus replication and infection by generation of CP- and MP-deficient mutants followed by protoplast transfection and plant infection assays, it was found both CP and MP provide supplementary but not essential roles in virus replication at the early infection stage. Both MP and CP are necessary for ToBRFV infection.

Researchers have sequenced the full genome sequences of 28 isolates and partial genomic sequences of an additional 100 isolates. Most Canadian isolates were found to be closely related to isolates from the United States and Mexico. However, several Canadian isolates seem to be distantly related, pointing to multiple introductions to Canadian production systems. Two conserved residues in CP were found to be essential for ToBRFV infection.

Researchers are working to finish screening for ToBRFV resistance from the tomato mutant population, confirm resistance in future generations of identified lines, and initiate genetic work to identify the genes needed for resistance. The team will continue to monitor ToBRFV diversity in Canada, and decode what causes ToBRFV break-down of Tm22 resistance. They are also assessing the incidence of ToBRFV and Pepino mosaic virus (PepMV) mixed infection.

Tomato plants infected with typical tomato brown rugose fruit virus (ToBRFV) symptoms.
Photo: Aiming Wang

KEY TAKEAWAYS:

- Approximately 16,000 individual tomato plants were screened with 30 lines found to have resistance/tolerance to ToBRFV. Resistance in one line has been confirmed after four generations, while resistance in other lines is to be confirmed.
- The research team has cloned the resistance gene Tm22 and ToBRFV movement protein (MP). It was found neither are stable, as they have a very short turn-over time. A tomato protein that is involved in ToBRFV MP degradation was identified.
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Tomato plants infected with tomato brown rugose fruit virus (ToBRFV). Photos: Aiming Wang