Greenhouse Vegetable Research Activities

The greenhouse vegetable sector has two research activities with the Canadian AgriScience Cluster for Horticulture Cluster 4. These two activities are focused on protecting vegetables against pests and managing disease in tomatoes.

THE CLUSTER 4 GREENHOUSE VEGETABLE RESEARCH ACTIVITIES ARE:

ACTIVITY 9

Developing a systems approach to pest management on greenhouse vegetable crops: mirid predator selection

LEAD RESEARCHER – Roselyne Labbé, research scientist in greenhouse entomology with Agriculture and Agri-Food Canada at the Harrow Research and Development Centre

ACTIVITY 10

Novel approaches for the management of tomato brown rugose fruit virus (ToBRFV)

LEAD RESEARCHER – Aiming Wang, research scientist with Agriculture and Agri-Food Canada at the London Research and Development Centre

This project is generously funded through the Canadian AgriScience Cluster for Horticulture 4, in cooperation with Agriculture and Agri-Food Canada's AgriScience Program, a Sustainable Canadian Agricultural Partnership initiative, the Fruit and Vegetable Growers of Canada (FVGC), and industry contributors.

Sustainable Canadian Agricultural Partnership
Competitive. Innovative. Resilient.

FRUIT & VEGETABLE GROWERS OF CANADA | PRODUCTEURS DE FRUITS ET LÉGUMES DU CANADA

Canada

Developing a Systems Approach to Pest Management on Greenhouse Vegetable Crops: Mirid Predator Selection

LEAD RESEARCHER

Roselyne Labbé
Research scientist in greenhouse entomology with Agriculture and Agri-Food Canada at the Harrow Research and Development Centre

To find new integrated pest-management strategies to protect greenhouse vegetable crops, a research team is studying two native North American mirid species: *Dicyphus discrepans* and *Dicyphus famelicus*, and one adventive species: *Nesidiocoris tenuis*.

The researchers are raising the native *D. famelicus*, *D. discrepans* and *D. hesperus*. Current work is focusing on the selective breeding of *D. famelicus* as there is a large amount of genetic diversity available. *Nesidiocoris tenuis* has shown itself as an important adventive mirid species affecting many greenhouse producers globally. Researchers are now studying this species for its interactions with other native mirids and comparing their preferences and reproductive capacities on multiple host plants.

In greenhouse trials, researchers have found differences in host plant choices for mirid species. *D. discrepans* and *D. famelicus* will lay their eggs on mullein and tomato plants, while *Nesidiocoris tenuis* prefer tomatoes. This suggests there is likely a strong genetic difference between species that determines their host plant preferences. The researchers plan to study this through future genetic breeding efforts.

Mirid breeding is continuing this winter, along with starting interaction studies between mirid species in the lab. These will be adapted to greenhouse trials over the next year. The research team is also working through phytophagy and predation assessment of isofemale lines established for *D. famelicus* from different geographic and genetic sources.

KEY TAKEAWAYS:

- *Nesidiocoris tenuis* has shown itself as an important adventive mirid species affecting many greenhouse producers globally. Researchers are studying this species for its interactions with our native mirids and comparing their preferences and reproductive capacities on multiple host plants.
- Researchers have found differences in host plant choices for mirid species. *D. discrepans* and *D. famelicus* will lay their eggs on mullein and tomato plants, while *Nesidiocoris tenuis* prefer tomatoes. This suggests there is likely a strong genetic difference between species that determines their host plant preferences.
- Mirid breeding is continuing this winter, along with starting interaction studies between mirid species in the lab. These will be adapted to greenhouse trials over the next year.

A female *D. discrepans*. Photo: Carly Demers

A female *D. famelicus*. Photo: Carly Demers

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

LEAD RESEARCHER

Aiming Wang
Research scientist with Agriculture and Agri-Food Canada at the London Research and Development Centre

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.

To date, researchers have been able to create a tomato mutant population with more than 10,000 plants screened. Three lines resistant or tolerant to ToBRFV infection have been identified with confirmation of resistance being passed to the next generation. The resistance gene Tm22 and ToBRFV movement protein (MP) gene have been cloned with confirmation of the interaction of proteins encoded by Tm22 and ToBRFV. Researchers also found that both ToBRFV MP and Tm22 proteins are located in the cytoplasm and are not stable with very short turn-over time.

A number of mutations have been introduced into the different coding regions of ToBRFV. Both replicase proteins found to be essential for viral viability and infectivity. The ToBRFV susceptibility gradient test was done to test ToBRFV resistance across 12 tomato varieties. Seedlings were prepared and inoculated with researchers finding symptom severity varying on leaves across several varieties, ranging from mild to severe. ToBRFV diversity was assessed with the ToBRFV genetic sequence found to be largely stable.

Researchers are conducting resistance screening to confirm ToBRFV resistance is inherited from generation to generation of plants. Researchers are continuing to monitor ToBRFV diversity in Canada, decode the mechanism underlying ToBRFV break-down of Tm22 resistance, and do transcriptomic profiling on tomato lines responsive to ToBRFV infection and viral protein expression.

Tomato plants infected with tomato brown rugose fruit virus (ToBRFV).

Tomato plants infected with typical tomato brown rugose fruit virus (ToBRFV) symptoms.

Photos: Aiming Wang

KEY TAKEAWAYS:

- Both ToBRFV MP and Tm22 proteins are located in the cytoplasm and are not stable with very short turn-over time.
- ToBRFV diversity has been assessed with the ToBRFV genetic sequence found to be largely stable.
- Researchers are conducting resistance screening to confirm ToBRFV resistance is inherited from generation to generation of plants.