

Canadian Agri-Science Cluster for Horticulture 3



Update to Industry

2020-21 – Semi-Annual

Activity title:

Activity 15 - Investigating the occurrence and distribution of potato tuber necrosis-inducing viruses in Canada and studies on varietal responses to the viruses for minimizing economic losses caused by the pathogens

Name of Lead Researcher: Xianzhou Nie, AAFC

Names of Collaborators and Institutions:

Mathuresh Singh, potato virology/pathology/diagnostics, ACS, Fredericton, New Brunswick;
 Jacques Lavoie, , potato specialist NBDAAF, Grand Falls, New Brunswick;
 Vikram Bisht, potato specialist, Manitoba Agriculture, Carman, Manitoba;
 Laixin Wang, principal scientist-global science, potato processing quality, McCain Foods, Florenceville, New Brunswick;
 Gary Hawkins, potato varieties, McCain Foods, Florenceville, New Brunswick;
 Huimin Xu, virologist, CFIA-Charlottetown Laboratory, Charlottetown, Prince Edward Island;
 Sean (Xiang) Li, soil pathologist, CFIA-Charlottetown Laboratory, Charlottetown, Prince Edward Island

Activity Objectives (as per approved workplan):

FY 2020-2021

- Unveiling the incidences/occurrences of necrotic viruses (mainly PMTV and PVY^{NTN}) in potatoes in the participating provinces (mainly Manitoba and New Brunswick) in 2020;
- Understanding the sensitivity of up to 6 potato cultivars to Alfalfa mosaic virus-induced internal necrosis and the sensitivity of up to 5 newly released potato clones/cultivars to PVY^{NTN}-induced potato tuber necrotic diseases;
- Unveiling the sensitivity to PMTV-induced necrosis in up to 12 potato cultivars – second year trial of group one cultivars (i.e., cultivars that were tested in the previous cropping year).

Research Progress to Date:

Objective 1: We completed the analysis of 379 tubers from Manitoba (MB, received in March 2020) of 2019's crop for the target viruses, namely potato mop-top virus (PMTV), tobacco rattle virus (TRV), alfalfa mosaic virus (AMV) and potato virus Y strain NTN (PVY^{ntn}). A total of 17 tubers from the province tested positive for PMTV by PCR, accounting for 4.5% of the total samples analyzed. One field (i.e., MB-1) had a significant higher PMTV-positive level (18.6%) than the rest, suggesting heavy infestation of the field with PMTV. PMTV was detected in samples from 4 out of the 7 fields, whereas none of the samples tested positive for AMV and TRV. It is noteworthy that PVY, one of viruses that occurs worldwide and impacts potato crops seriously in many regions, was only detected in one sample from one field. We are yet to conduct the molecular detection of the target viruses from the symptomatic tubers (9 tubers, received in March 2020) from NB. The tuber samples of 2020's crop from the participating provinces (i.e., MB and NB) are yet to be received.

Objective 2: (1) We completed an initial test of 9 cultivars for their sensitivity to AMV-induced tuber necrosis after inoculation (i.e., primary infection). Preliminary results suggest that two (Russert Burbank and Lamoka), five (Atlantic,

Kennebec, Russet Norkotah, Snowden and Goldrush) and two (Dark Red Norland and Shepody) cultivars are insensitive, intermediate sensitive and sensitive, respectively, to AMV-caused necrosis. The tubers from the secondary infection (i.e., tuber borne infection), which were harvested in mid-June 2020, and are yet to be examined. (2) We completed the first of the two trials/repeats on the sensitivity of 11 new release to PVYntn-caused tuber necrotic ringspot disease (PTNRD), and we found one (F15062) that is sensitive to PTNRD. For the tuber-borne (i.e., secondary) infection, the tubers were harvested in mid-June, and are yet to be examined for the PTNRD after a 3-month storage.

Objective 3: We were unable to conduct the planned field trial in a PMTV-infested field in New Brunswick in 2020 cropping year due to COVID-19 caused activity-restrictions. The activity has been postponed till the cropping year of 2021. Nevertheless, we have published the work on the development of a novel method called “high resolution DNA melting (HRM) analysis” for simultaneous detection of PMTV and its vector *Spongospora subterranea* (Sss, the potato powdery scab disease causal pathogen) from soil directly (Nie et al. 2019 Plant Disease 104:340-347 <https://doi.org/10.1094/PDIS-04-19-0827-RE>). We are still conducting the laboratory test for PMTV in the tubers obtained from the field trial 2019 and stored for 0, 3, 6 and 9 months. The tests for tubers stored at 4°C for 6 and 9 months have been delayed greatly due to the COVID-caused Centre closure.

Extension Activities (presentations to growers, articles, poster presentations, etc.):

One (1) peer reviewed article: Nie X, Singh M, D Chen, C Gilchrist, Y Soqrat, M Shukla, A Creelman, V Dickison, B Nie, J Lavoie, and V Bisht. 2020. Development of high resolution DNA melting analysis for simultaneous detection of potato mop-top virus and its vector, *Spongospora subterranea*, in soil. Plant Disease. doi: [10.1094/PDIS-06-20-1321-RE](https://doi.org/10.1094/PDIS-06-20-1321-RE).

One (1) poster presentation in a scientific conference: Nie X, Singh M, Chen D, Gilchrist C, Soqrat Y, Shukla M, Creelman A, Lavoie J, and Bisht V. 2020. Plant Health 2020 – American Phytopathological Society Annual Meeting Online <https://apsnet.confex.com/apsnet/2020/meetingapp.cgi/Paper/17140>.

COVID-19 Related Challenges:

- Lab/greenhouse based activities have been delayed significantly;
- The field trial on cultivar sensitivity to PMTV-induced tuber necrosis has to be postponed to next growing season;

Key Message(s):

Despite significant challenges, we have made good progress on the project. It is particularly worth of note that the PCR-based method termed high-resolution DNA melting (HRM) analysis for simultaneous detection of potato mop-top virus (PMTV) and its fungal vector *Spongospora subterranean* (Sss, the powdery scab-causing pathogen) from soil samples directly has an excellent potential to be used for large scale survey of fields for PMTV and Sss infestation.

This project is generously funded through the Canadian Agri-Science Cluster for Horticulture 3, in cooperation with Agriculture and Agri-Food Canada's AgriScience Program, a Canadian Agricultural Partnership initiative, the Canadian Horticultural Council, and industry contributors.



Agriculture and
Agri-Food Canada

Agriculture et
Agroalimentaire Canada



Canadian
Horticultural
Council

Conseil
canadien de
l'horticulture

The voice of Canadian fruit and vegetable growers