Canadian Agri-Science Cluster for Horticulture 3

Update to Industry

2019-2020

Activity title: Late blight: Tracking pathogen strains and their characteristics

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Names of Collaborators and Institutions:
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Activity Objectives (as per approved workplan):
The overall objectives of the project are to track the distribution of strains of the late blight pathogen in Canada, determine various important biological characteristics of isolated strains including fungicide sensitivity, with the overall aim of improving disease management and economic returns.

The specific objectives of this project are:
Sub-activity 1.1 Tracking potato strains of *P. infestans* in Canada
To identify strains of *Phytophthora infestans* causing late blight of potato in production areas across Canada and to develop a map showing the distribution of strains in this country.
Sub-activity 1.2 Characterization of novel strains including host/cultivar preference, environmental triggers, fungicide sensitivities, and control options
To assess novel late blight pathogen strains in Canada for their ability to cause disease in above and below-ground tissues of solanaceous plants, and to determine their sensitivity to registered and novel fungicides as well as the optimal environments for infection, spore production and survival (with the aim of understanding the impact of climate change on late blight pathogen population dynamics).

Research Progress to Date (use plain language):

Sub-activity 1.1 Tracking potato strains of *P. infestans* in Canada
Late blight was once again absent in much of Canada in 2019. This was likely due to the warm, dry growing conditions in most of the country. Some spores of the pathogen were captured in spore traps set up in Manitoba, Ontario and Quebec, but no disease foci were observed, so samples could not be assessed. Some late season disease was observed in potato crops in Newfoundland, but no samples could be obtained.

In New Brunswick, since no late blight occurred in 2019, cultures of the predominant strain US-23 and the old strain US-8 of the late blight pathogen were acquired from Agriculture and Agri-Food Canada and are being sub-cultured and maintained at our laboratory at Dalhousie University in Truro, Nova Scotia, Canada. An extensive survey of potato and tomato fields was carried out in Nova Scotia. Due to dry conditions there was no out break of late blight in Nova Scotia. A number of presumptive samples were collected and isolations of the pathogen

were attempted. However, no *Phytophthora infestans* isolates were recovered as the pathogen was absent from plant tissues.

In Manitoba, Infection of sentinel tomato crops (late blight susceptible and resistant varieties not sprayed with fungicide) established as part of the study did not occur. Travel was undertaken to commercial potato fields and home gardens and greenhouses to examine tomato crops for the presence of late blight, especially in low-lying and tree-shelter belt protected areas. Field inspections were repeated, often based on late blight risk forecasting, and in areas that could be prone to late blight after thunderstorms. Even though there were a number of weeks when the disease risk was high, and late blight spores were trapped and confirmed by PCR, no late blight was found during our inspections. Therefore, no late blight was reported from Manitoba and no samples were submitted for strain identification. A number of suspicious samples were received and were tested with the *Phytophthora* test strips and found to be negative for *Phytophthora infestans*. Incubation and sporulation of such samples showed many of the lesions were caused by *Botrytis cinerea*. For the 2020 cropping season, field and greenhouse inspections will be conducted again. If any sample are found to be positive (and confirmed by sporulation), the samples will be shipped to PEI for strain identification. A sentinel plot with susceptible and resistant tomato plants and no fungicide spray, will be planted again in 2020.

Late season disease was observed in both potatoes and tomatoes in British Columbia, and a total of 89 isolates were obtained for further processing. Isolates are currently being assessed for mating type, fungicide sensitivity, and allozyme and strain genotype. Preliminary results of these analyses showed a high level of diversity in this collection of isolates from BC, and the potential for the presence of a number of strains. Unfortunately, the covid-19 pandemic has delayed the final evaluation of these tests and therefore, final results are pending a return to the laboratory. Fortunately, the collection is being maintained under critical service protocols, so that the evaluations can be completed as ease back to more normal operations resumes.

Sub-activity 1.2 Characterization of novel strains including host/cultivar preference, environmental triggers, fungicide sensitivities, and control options

Studies to determine the sensitivity of pathogen isolates to fungicides were continued in PEI. Resistance to metalaxyl-m (Ridomil®) was found in many isolates in the 2019 collection of pathogen isolates from BC. A baseline dataset on the response of various prominent pathogen genotypes (US-8, US-23, and US-24) found in Canada over the last few years to oxathiopiprolin (Orondis®) was completed. So far, no resistance to this chemistry has been found. Assessments of a wider range of registered fungicide products and their effects on different pathogen strains are on-going. Studies on the impact of temperature on the pathogenicity of various strains, pathogen biology and reproduction were also continued in BC using the temperature gradient system that provides precise temperature control. There is also an effort in place in Charlottetown in collaboration with UPEI to build a similar unit for CRDC. This will increase our capacity to conduct studies on the impact of temperature on pathogen biology, pathogenicity and reproduction. These studies in BC and PEI are on-going.

Preliminary work with temperature gradient plates using an isolate of the US-8 strain was completed in BC. Growth of the pathogen in the lab was observed at a temperature range of 10 to 25 degree C (constant temperature) and was greatest in the 15 to 20 degree C range. Growth was also observed under fluctuating (maximum and minimum temperature) gradients from 35 (max) to 25 (min) degrees C and from 15 (max) to 5 (min) degrees C. The greatest growth was observed at a temperature gradient regimes of 25 (max) to 15 (min) degrees C and from 20 (max) to 15 (min) degrees C. Growth of the pathogen on tubers was observed at temperatures ranging from 5 to 35 degrees C (under constant temperatures). The greatest growth was observed from 15 to 25 degrees C. Growth was observed in tubers at all temperature gradient ranges. The greatest growth was observed at temperature gradient ranges of 25 (max) to 15 (min) degrees C and from 20 (max) to 10 (min) degrees C.

As well, studies on the impact of fungicides and the pathogenicity of various strains, will be spear-headed at the University of Manitoba (Fouad Daayf) and Nova Scotia (graduate student under the supervision of Khalil Al-Mughrabi (NB) and B. Prithiviraj (Dalhousie Univeristy) in 2020 as we return to laboratory- and greenhouse-based programs.

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

Presentations

January 24-26, 2019. Pacific Agriculture Show.
Tradex Exhibition Centre, Abbotsford, BC
Horticultural Growers' Short Course, Lower Mainland Horticulture Improvement Association
Invited Presentation:
Burlakoti, R. and R.D. Peters
Late blight in BC and across Canada

February 20-21, 2019. Ontario Fruit and Vegetable Convention.
Scotiabank Convention Centre, Niagara Falls, ON
Presentation: Trueman, C. and R.D. Peters
Lessons for late blight in field tomatoes

January 23-25, 2020. Pacific Agriculture Show.
Tradex Exhibition Centre, Abbotsford, BC
Horticultural Growers' Short Course, Lower Mainland Horticulture Improvement Association
Invited Presentation:
Burlakoti, R. and R.D. Peters
National Late Blight Research: Disease Prevalence and Tracking Pathogen Strains

Conference Proceedings

Burlakoti, R. R., and Peters. R.D. 2019. Late blight in BC and across Canada. In: Kabaluk, T. and Frey, L (Eds.) Proceedings of the Lower Mainland Horticulture Improvement Association 61th Annual Horticulture Growers' Short Course. Abbotsford, BC, January 24-26, 2019. ISSN 2560-7561. Pages 96-98.

Burlakoti, R. R., and Peters. R.D. 2020. National Late Blight Research: Disease Prevalence and Tracking Pathogen Strains. In: Kabaluk, T. and Frey, L (Eds.) Proceedings of the Lower Mainland Horticulture Improvement Association 62nd Annual Horticulture Growers' Short Course. Abbotsford, BC, January 23-25, 2020. In press.

Abstracts

Peters, R.D., K.I. Al-Mughrabi, F. Daayf, A. MacPhail, and L.M. Kawchuk. 2019. Fluctuating pathogen populations predicate the need for adjustment to potato late blight management strategies in Canada. Canadian Journal of Plant Pathology 41: 506.

News Releases

Keeping tabs on late blight. Carolyn King for SpudSmart, Issues Ink. Pages 34-38 in SpudSmart, Vol. 16, No. 1, Winter 2019.

Provincial Outreach

Weekly reports on potato diseases and insects were sent to the potato industry and information placed on-line (for example, in Manitoba reports were recorded on www.mbpotatoes.ca).

Potato pest updates were discussed in various forums with growers and potato agronomists. Home gardeners were also made aware of late blight and the importance of reducing the risk of spread to commercial potato farms.

Regular radio interviews were conducted by provincial staff during the growing season providing updates on the potato crop condition and pests.

Early Outcomes (if any) or Challenges:

- Late blight was sporadic or absent in much of the country in 2019, due to the warm, dry conditions that predominated during the growing season
- In BC in 2019, diverse isolates were recovered that likely indicate that several strains were present. Resistance to Ridomil was common among the isolates collected from BC in 2019

- Evaluation of some of the key strains found in recent years (US-8, US-23 and US-24) has found no resistance to Orondis® to date. Other registered fungicides are being evaluated as the project moves forward.
- Preliminary data shows that US-23 can infect plants and reproduce over a wider temperature range than US-8. Studies using the temperature-gradient control apparatus are continuing to gather more detailed information on pathogen biology.
- Late in this reporting period, the Covid-19 pandemic cut short a number of lab- and greenhouse-based studies at various locations. Fortunately, culture collections are being maintained under critical services so that this work can resume once the situation normalizes

Key Message(s):

Even though late blight was not prevalent in Canada in 2019, it can reappear at any time, and an understanding of the prevalence and characteristics of pathogen strains will be critical for successful disease management. Having multiple strains present in a growing region, as has occurred in BC in 2018 and again in 2019, will complicate disease control, and could lead to the production of over-wintering inoculum. Many strains are resistant to Ridomil, but fortunately, other late blight control chemistries remain effective and valuable tools for disease control. Classic control measures, including disposal of culls, destruction of volunteer potatoes and the use of clean/treated potato seed are still critical. During the covid-19 pandemic, there is increased interest among the public to grow food plants, including tomatoes and potatoes in home gardens. We are increasing our efforts to educate home gardeners to grow late blight-resistant tomato varieties and to destroy infected potato and tomato plants properly, so they are not a risk factor in spreading disease to surrounding commercial crop production areas.

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.

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