Canadian Agri-Science Cluster for Horticulture 3

Update to Industry

2020-21 – Semi-Annual

Activity title:

Activity 13 - Late blight: Tracking pathogen strains and their characteristics

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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:

Sub-activity 1.1 Tracking potato strains of *P. infestans* in Canada

Late blight was not a significant concern in much of Canada in 2020. 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 and Ontario, but no disease foci were observed, so samples could not be assessed. Some late season disease was observed in a potato field in Ontario, but the field was quickly top-killed and no samples could be obtained.

Several provinces took advantage of late blight forecasting programs in 2020, using a network of weather stations. In many instances, this was also complemented by the use of passive spore traps. In Manitoba, a "late blight sentinel plot" planted with various tomato varieties was also established. The sentinel plot was surrounded by corn rows to maintain high humidity longer and the plot was not sprayed with any fungicides. In Manitoba, there were two instances when *P. infestans* DNA was confirmed in passive spore traps, however, no late blight was observed.

Since no late blight occurred in New Brunswick in 2020, cultures of the predominant US-23 strain of the late blight pathogen were acquired from AAFC Charlottetown and are being sub-cultured and propagated at the potato pathology

laboratory in NB. Subcultures were also sent to Dalhousie University in Truro, Nova Scotia, Canada. A graduate student (Segun Babarinde) was hired and started his first semester at Dalhousie University in September 2020. Due to Covid-19, Segun was unable to travel to Canada, but is taking courses on-line while in his country of Nigeria. He hopes to be able to travel to Nova Scotia in November 2020. He is currently working on gathering information for a literature review and will soon be starting to write his admission to candidacy (ATC) exam. His advisory committee was assembled which includes the following members: Dr. Balakrishnan Prithiviraj at Dalhousie University (main advisor); Dr. Khalil Al-Mughrabi, an Adjunct Professor with Dalhousie (co-advisor); and Dr. Rick Peters of AAFC Charlottetown (advising committee member).

In 2020, late blight was observed in both potatoes and tomatoes in British Columbia, and a total of 90 isolates were obtained for further processing. Late blight symptoms were observed in several commercial potato farms (10) in Delta, Richmond, Surrey, and Abbotsford. Late blight occurred very early, between the last week of July to early August in commercial potato farms in BC. Late blight incidence was low to moderate and fungicides were sprayed at 8-10 day intervals in most fields. Late blight-infected samples were collected from these commercial potato fields in collaboration with industry partners and growers. Samples from several potato cultivars, including AC Peregrine Red, GemStar Russet, Russet Norkotah, Kennebec, and Warba were collected. A total of 40 isolates of *P. infestans* were obtained from late blight-infected samples of potatoes from seven commercial farms in the Fraser Valley area of BC in 2020.

Late blight symptoms were also observed in tomatoes grown in several community and home gardens in the Fraser Valley regions including Chilliwack, Abbotsford, and Pitt Meadow in August and September. Late blight severity in these home and community gardens was very high (many plots were wiped out). Diseased samples were collected from both cherry-type and big (Roma) tomatoes. From the infected tomato samples, a total of 50 isolates of *P. infestans* were established, purified and stored in long-term storage. All the isolates from potato (n = 40) and tomato (n = 50) will also be sent to AAFC Charlottetown for long-term storage and further characterization work. At AAFC Agassiz, all isolates are being cultured to harvest mycelium for genomic DNA extraction, which will be used for the molecular characterization of strain (identify the strain type).

Critical isolates of *P. infestans* from 2018 and 2019 were maintained as part of critical duties at AAFC Charlottetown and AAFC Agassiz during the Covid-19 pandemic. This has allowed renewed efforts at strain analysis to continue on these collections as we have re-entered the labs this fall. At AAFC Charlottetown, assessment of 2019 isolates for mating type, fungicide sensitivity, and allozyme and strain genotype is almost complete, and analysis of 2020 isolates will start shortly. Preliminary results of these analyses showed a high level of diversity in isolates from BC, and the potential for the presence of a number of strains, which has significant potential repercussions for disease epidemiology and management.

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

In New Brunswick, materials and supplies have been purchased, and greenhouse/growth chamber space has been leased to conduct pathogenicity and other late blight trials. Fungicides to be used in efficacy trials have been acquired from pesticide companies. Growth chamber trials to test the efficacy of various fungicides against late blight are being conducted at the potato pathology laboratory in NB, due to the temporary shutdown of facilities at Dalhousie University because of Covid-19. However, now that a grad student is in place and set to travel to Dalhousie, research activities at the university will resume. As well, studies on the impact of fungicides and the pathogenicity of various strains, will be conducted at the University of Manitoba this winter and pathogen isolates of major strains have been recently distributed to Dr. Daayf for use in these studies.

Studies to determine the sensitivity of pathogen isolates to fungicides were continued in PEI. Studies on the resistance to metalaxyl-m (Ridomil®) in the 2019 collection of pathogen isolates was completed. A baseline dataset on the response of isolates to oxathiopiprolin (Orondis®) was also 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. As well, studies on the impact of temperature on the pathogenicity of various strains, pathogen biology and reproduction will also be continued in BC and PEI this winter.

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

Presentations

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

Coming Soon: January 28-29, 2021. Pacific Agriculture Show.
Horticultural Growers' Short Course, Lower Mainland Horticulture Improvement Association
Invited Virtual Presentation:
Burlakoti, R. and R.D. Peters
National Late Blight Research Program: (in development)

Interviews Related to the Late Blight Program

August 14, 2020: Shel Zolkewich for SpudSmart
October 19, 2020: Ashley Robinson, Associate Editor for SpudSmart

News Releases

Irish potato famine disease still lurks in Canada. Shel Zolkewich for SpudSmart, Issues Ink. November 16, 2020.
https://spudsmart.com/irish-potato-famine-disease-still-lurks-in-canada/

Coming Soon: A flu shot for potatoes. Ashley Robinson for SpudSmart, Issues Ink.

Provincial Outreach

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

Although challenges due to Covid-19 often prevented in-person meetings, potato pest updates were discussed in various forums with growers and potato agronomists. These included phone calls, virtual meetings, radio interviews and email/website transmission of information.

COVID-19 Related Challenges:

- Extension activities and distribution of project information was challenging as many meetings were canceled (grower and scientific meetings) and others were reduced in a virtual format. Most outreach was virtual during early summer but this started to change as summer progressed for different project partners
- Lab-based activities were curtailed in spring 2020, but were gradually reactivated in summer for provincial and academic partners. Collections of pathogen isolates housed at AAFC facilities were maintained as part of critical duties during COVID-19 and are now being analyzed as lab re-entry has occurred this autumn
- COVID-19 caused delays for graduate students, especially for travel-related situations. As well, meaningful access to summer students was limited. This has caused delays in some project activities related to the characterization of pathogen strains

Key Message(s):

- Although COVID-19 has presented many challenges for project participants, the team is still on target to meet project goals, due to the excellent support of project partners
- Even though late blight was not prevalent in most of Canada in 2020, it played a significant role in the production of potatoes and tomatoes in BC
- Preliminary results indicate that multiple strains are present in BC, and the interaction and movement of strains on potato and tomato may play a key role; this is an important finding that will complicate disease control, and could lead to the production of over-wintering inoculum
- So far, resistance to late blight control chemistries, other than Ridomil, has not been found

- During the COVID-19 pandemic, there has been 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

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