

Canadian Agri-Science Cluster for Horticulture 3



Update to Industry

Semi-Annual – Spring 2022

Activity title:

Development of Regional Management Strategies and Decision Making Tools for Control of Colorado Potato Beetle

Name of Lead Researcher: Chandra Moffat and Ian Scott, Agriculture and Agri-Food Canada

Names of Collaborators and Institutions:

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Activity Objectives (as per approved workplan):

OBJECTIVES: Our overall objective is to reduce economic losses to potato in Canadian growing regions due to the Colorado potato beetle (CPB). Specifically, we aim to determine local susceptibility of CPB populations to several classes of insecticides through a national resistance-monitoring network, improve resistance management, better characterize the molecular basis of developing resistance, and develop novel extension tools to improve management practices. To accomplish this, the deliverables are divided into four objectives as follows:

1. Determine susceptibility of Colorado potato beetle populations to multiple classes of insecticides in different potato growing regions in Canada;
2. Develop an interactive online mapping tool for growers to access results of susceptibility surveys to inform local decision making for optimal insecticide selection;
3. Identify molecular signatures of insecticide resistance that can be used to monitor the occurrence and spread of resistance in regional CPB populations and identify new pest control targets;

Research Progress to Date (use plain language, not to exceed 500 words):

A continued strength of this project has been the ongoing relationship building between the AAFC project team and our project partners, involved in extension and potato production across Canada. In 2021, we met virtually with our partners in Manitoba and Quebec, as well as had email and phone correspondence with partners in all 5 participating provinces. Hearing the shifting priorities of growers in each region, in 2021, we adjusted the composition of insecticides screened to ensure we were providing the most relevant results to the growers we serve.

Objective 1:

In the 2021 field season, a total of 31 populations of Colorado potato beetle (CPB) were obtained: PEI (8), Quebec (6), Ontario (7), Manitoba (6) and Alberta (4). Six insecticides from 3 different classes including: neonicotinoids (Titan), spinosyns (Delegate and Entrust) and anthranilic diamides (Exirel, Vayego and Harvanta) were tested. In MB, the populations showed reduced susceptibility to at least one product in the diamide and spinosyn insecticide classes, 5 of 6 were resistant to Titan (neonic) and 2 were resistant to spinosyns (Entrust and Delegate). Harvanta (diamide) was the only product where 4 of 6 populations remained susceptible. In ON, 2 of the 7 populations were resistant to Titan

(neonics), while 1 was resistant to Entrust (spinosyn), and only one of the 2 populations re-sampled remained resistant to neonicotinoids. In 6 of 7 populations, one or more products from 2 classes (diamides and spinosyns) showed reduced susceptibility. Harvanta, Vayego or both (diamides) remained susceptible in 6 of 7 populations. In AB, all 4 populations tested remained susceptible to insecticides from the 3 classes. Two colonies from eastern Canada showed resistance to Delegate (one in PEI and one in QC) with most populations screened showing reduced susceptibility to multiple other chemistries. A survey of insecticide use was also obtained from growers to provide further information on CPB pressure and insecticide exposure at each location.

Objective 2:

We are nearing the completion of the online mapping tool in advance of its release. In the past year, we worked to incorporate recent years' datasets into the mapping database and refinement of map projection in collaboration with the AgriGeomatics team. We provided a soft release of this tool during our recent SpudSmart webinar. We will use the final year of the project to work closely with AAFC's Agri-Geomatics team to provide grower/industry access to the online mapping tool through the ArcGIS Online environment.

Objective 3:

Previous work on this milestone has identified seven candidate genes potentially involved in diamide and spinosyn insecticide resistance in samples obtained from surveying. Progress in the last year was focused in 4 areas: determining relative mRNA levels of the seven target genes in populations available in 2021, developing tools for RNA interference testing to show effects of the target genes on resistance, bioassays to determine lethal doses of Entrust insecticide in an Entrust resistant population from QC, and RNA interference testing on a QC population of beetles using Entrust.

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

Presentations

1. Vickruck, J., Scott, I., Donly, C., Hann, S., MacKinley, P., Krolikowski, S., Morin, P.J., and C.E. Moffat. 2021. Regional variation of insecticide resistance in the Colorado Potato beetle, *Leptinotarsa decemlineata*. The Northeast Potato Technology Forum (virtual), 16-17 March, 2022.

Magazine articles

1. Bacque, T., C. Moffat, I. Scott. Colorado Potato Beetles are a Mile-High Headache. SpudSmart Magazine. August 9, 2021. <https://spudsmart.com/colorado-potato-beetles-are-a-mile-high-headache/>
2. MacKinnon. L. 2021 Colorado Potato Beetle Insecticide Resistance Monitoring Results. Update from PEI Department of Agriculture, for Prince Edward Island Potato News. Jan/Feb 2022. Volume 23 Issue 1. <https://peipotatoagronomy.com/wp-content/uploads/2022/02/pnv23n1.pdf>
3. Moffat, C., I. Scott, D. Sjolie. 2022. Regional management strategies for Colorado potato beetle. Tuber Talk Webcast, March 16, 2022. [Regional management strategies for Colorado potato beetle - Potatoes in Canada](#)

Webinars

1. Moffat, C., I. Scott, S. Hann. 2021. Controlling Colorado Potato Beetles. SpudSmart Innovation Webinar Series, November 30, 2021. <https://spudsmart.com/controlling-colorado-potato-beetles-on-your-farm-a-spud-smart-roundtable-webinar-podcast/>

Other Interviews:

The Western Producer (July 4, 2021)

Fresh Thinking Magazine (Jan 12, 2022)

Peer-reviewed articles

1. Ben Youssef, M., Christelle Ouédraogo, B., Bastarache, P., Dumas, P., Moffat, C. E., Vickruck, J. L., & Morin, P. J. (2022). Exposure to Temperature and Insecticides Modulates the Expression of Small Noncoding RNA-Associated Transcripts in the Colorado Potato Beetle, *Leptinotarsa decemlineata* (Coleoptera: Chrysomelidae). *Journal of Insect Science*, 22(1), 23.

- Bouafoura, R., Youssef, M. B., & Morin Jr, P. (2022). Silencing of Molecular Targets with Relevance to Insecticide Resistance in Colorado Potato Beetle Using dsRNA. In RNAi Strategies for Pest Management (pp. 49-58). Humana, New York, NY.

COVID-19 Related Challenges:

Overall, progress has again been slightly delayed by pandemic restrictions, primarily as a result of limits on facilities access. Lab access restrictions have primarily had an impact on the number of populations tested as well as impacted progress on molecular diagnostics.

We are on track to successfully deliver on milestones associated with Objectives 1, 2 and 3 by the end of 2023.

Key Message(s):

In preparation for the insecticide survey in the final year (2022-23) of the project, grower representatives, extension personal and other collaborators were contacted in the 5 participating provinces to ask their opinion re: the insecticide products that should be included in the testing. Based on the feedback provided, one new product, abamectin, will be included this year along with representative products in the neonicotinoid, spinosyn and diamide classes. Despite challenges, delays and resulting changes to the workplan due to COVID-19, we have made very good progress in 2021 towards all project objectives planned for 2021-2022. Our ongoing success is largely due to participation from project partners across Canadian potato growing regions and our fantastic technical staff and students. We continue to monitor insecticide resistance of Colorado potato beetle, work towards meeting each project deliverable on time and provide updates to industry. We are always happy to be contacted to further discuss regional stakeholder needs and how our workplans can be tailored to changing management practices or to discuss new iterations of the project for future years.

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