Canadian Agri-Science Cluster for Horticulture 3

Update to Industry

Semi-Annual – Spring 2021

Activity title: Generate and Evaluate Integrated Pest Management Tools for Wireworm Control in Potatoes in Canada

Name of Lead Researcher: Dr. Christine Noronha, AAFC

Names of Collaborators and Institutions:
Dr. Wim Van Herk (Agassiz Research and Development Centre)
Dr. Gerhard Greis (Simon Fraser University)
Dr. Haley Catton (Lethbridge Research and Development Centre)
Dr. Ian Scott (London Research and Development Centre)
Dr. Andrew Mackenzie-Gopsill (Charlottetown Research and Development Centre)

Activity Objectives (as per approved workplan):
Objective 1: Test the efficacy of new insecticides to control wireworms and click beetles.
Objective 2: Evaluate an integrated approach to manage wireworm damage.
Objective 3: Identify and apply novel click beetle monitoring tools.
Objective 4: Surveillance of click beetle expansion in Canadian potato growing regions.

Research Progress to Date (use plain language, not to exceed 500 words):
Restrictions due to the pandemic severely limited our ability to complete the 2020-21 milestones in some locations.
Objective 1: In PEI, in lieu of field trials, laboratory trials were conducted to test the efficacy of insecticides. Our results show that broflanilide (Cimegra) insecticide kills rather than paralyzes 65% of the wireworms within 8 days of application, compared to 70% with Thimet. Mortality ranged for 35-50% for wireworms feeding on corn seeds treated with the insecticide Tefluthrin (Force). In BC, soil samples were collected from the 2019-2020 research plots to determine if insecticide residues had persisted in the soil through the winter. Unfortunately, residue levels could not be assessed, and this work will be repeated. No insecticide trails were conducted in London Ontario.
Objective 2: PEI Trial 1. Potatoes were planted in plots following rotation crops Barley, Buckwheat, Sorghum Sudangrass (SSG) and Flax grown in 2019. Data shows wireworm damage to potato tubers was lowest following rotation crops buckwheat and sorghum sudangrass. Trial 2. Click beetles trapping continued in three rotation crops fields as part of an IPM strategy to reduce tuber damage. These fields are scheduled to be planted with potatoes in 2021 when tubers damage will be evaluated. In London RDC, a microplot field trial was setup to compare the effectiveness of two wireworm sampling methods under different cover crop conditions: bare soil, buckwheat or barley growth. We found a significantly higher number of wireworm in baits versus soil sampling in the buckwheat plots, which suggests that bait traps may be a better wireworm sampling method in buckwheat fields. In PEI, an experiment to evaluate wireworm suppressive cover crop effects on weed control was completed. Cover crop significantly impacted lamb's quarters and overall weed density, however, the response was cover crop specific. Buckwheat did not impact lamb's quarters in the rotation year but showed a carry-over effect into the potato year and it suppressed the density of all other weed species more than the other cover crop. The carry-over effects on weed could positively impact tuber yield.
Objective 3: We identified the major sex pheromone component of six click beetle species. These pheromones and their analogues were successfully tested at 27 field sites for *L. canus*, *L. infuscatus*, and *L. californicus* in BC, Alberta, Washington, Oregon, Idaho and Montana, and for *L. agonus, Selatosomus destructor and Agriotes mancus,* in Ontario. Attempts to isolate and identify a sex pheromone from *Hypnoidus abbreviatus* were again unsuccessful.

Objective 4: The long-running survey (2004 – 2019) of the distribution of pest wireworms in the Canadian Prairies has been completed and published, along with distribution maps, and a study into the genetic diversity of the main Prairie pest species, *Hypnoidus bicolor*, has also been completed and recently published in Pest Management Science. Distribution maps for the pest species of Alberta, Saskatchewan, and Manitoba have also been published on the Prairie Pest Monitoring Network website. A distribution map for the invasive Agriotes pest species in BC has been prepared for the Asia-Pacific Entomologist publication.

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

SCIENTIFIC PRESENTATIONS

Noronha, C. 2021. Utilizing a multi-pronged approach for the war against wireworms. CRDC seminar March 24, 2021 (30 participants)

K Singleton, AJ Blake, **W van Herk, G Gries**. 2020 "Spectral sensitivity of North American pest click beetle species (Coleoptera: Elateridae)." Entomological Society of America—Virtual Meeting. November 11-25 (10 min) 40

EA Lemke, **W van Herk**, **H Catton**, S Meers, K Wanner, R Cooper, J Serrano, A Rashed, JL Smith, **R Gries**, A Nikoukar, G Gries, S Alamsetti. 2020. "Efficacy of synthetic Limonius sex pheromone on trap captures of four Limonius spp. (Coleoptera: Elateridae) in various locations across North America. Entomological Society of America—Virtual Meeting. November 11-25 (10 min) 40

EA Lemke, **W van Herk, H Catton**, S Meers, K Wanner, R Cooper, J Serrano, A Rashed, JL Smith, R Gries, A Nikoukar, S Alamsetti, G Gries. 2020. "Efficacy of synthetic Limonius sex pheromone on trap captures of four Limonius spp. (Coleoptera: Elateridae) in various locations across North America." Entomological Society of Alberta—Virtual Meeting. October 22-23 (15 min) 40

K Singleton, AJ Blake, **W van Herk, G Gries**. 2020 "Spectral sensitivity of North American pest click beetle species (Coleoptera: Elateridae)." Entomological Society of British Columbia —Virtual Meeting. October 26 (15 min) 60

EA Lemke, **W van Herk**, **H Catton**, S Meers, K Wanner, R Cooper, J Serrano, A Rashed, JL Smith, R Gries, A Nikoukar, S Alamsetti, G Gries 2020. "Efficacy of synthetic Limonius sex pheromone on trap captures of four Limonius spp. (Coleoptera: Elateridae) in various locations across North America." Entomological Society of British Columbia—Virtual Meeting. October 26 (15 min) 60

Posters

Catton, H., **Van Herk**, W. 2020. Wireworm in southern Alberta spring wheat is dominated by 3 species and does not vary with crop rotation. Entomology 2020: Entomological Society of America Virtual Annual Meeting, November 11-25, 2020. Virtual meeting. Poster presentation (# of participants unknown)

INDUSTRY PRESENTATIONS

Noronha C. Management of Wireworms in Potatoes. SpudSmart Magazine Webinar, 26 November 2020, 200 participants

Noronha, C., Lorraine MacKinnon[2], Carol Banks[2] and Sebastian Ibarra[2]. 2021. Surveillance of click beetle populations on pei. NEPTF, virtual meeting, March 24th 2021 (80 participants)

EA Lemke, **W van Herk**, H Catton, S Meers, K Wanner, R Cooper, J Serrano, A Rashed, JL Smith, R Gries, A Nikoukar, G Gries, S Alamsetti. 2021. "Limoniic acid as a sex attractant of *Limonius* spp. (Coleoptera: Elateridae) pests across North America." Professional Pest Management Association of BC—Virtual Meeting. Feb 18 2021 (15 min) 40

Van Herk W, Vernon B, Mitchell T. "Insecticide efficacy studies for wireworm management in wheat and potato in Canada." National Alliance of Independent Crop Consultants (NAICC), Efficacy Research Workshop (Virtual) 10 February 2021. 180 participants

Vernon, R.S. and **W. van Herk**. 2021. Wireworm biology and control: In search of the silver bullet. Webinar hosted by 'Potatoes in Canada' and 'BASF Canada' on Feb. 10, 2021, to 130 growers and extension professionals across Canada.

Van Herk W, Vernon B, Mitchell T. "New tools for wireworm management." Lower Mainland Horticultural Improvement Association, Growers' Short Course (Abbotsford, BC) 28 January 2021. 75 participants

Vernon, R.S. and **W. van Herk**. 2021. Wireworm biology and control: In search of the silver bullet. BASF Webinar to 25 USA Marketing specialists. Jan. 12, 2021.

Vernon, R.S. and **W. van Herk**. 2020. Wireworm biology and control. Far West Agribusiness Association 2020 Virtual Conference (Dec 17, 2020). 50 Oregon and Washington Growers in attendance.

Van Herk W, Vernon B, Mitchell T. "Managing the wireworm complex in Canada: New challenges, new opportunities." BC Agricultural Climate Adaptation Research Network (ACARN) 8 December 2020. 75 participants

Van Herk W, Noronha C, Vernon B, Mitchell T. "Managing wireworms in potato-new tools and other developments" SpudSmart Magazine Webinar, 26 November 2020, 200 participants

Catton, H. 2021. Wireworms: where to find the newest info on management. Alberta Virtual Agronomy Update, Virtual. January 19, 2021. Attendance: 409 computers.

Catton, H. 2020. Wireworm control strategies. **Invited speaker** at 2021 Virtual Canadian Potato Summit, Virtual. February 3, 2021. (# or participants unknown)

Noronha C. 2020. Wirewrom practical research advice. Potato news. 21(3): 9-12 https://peipotatoagronomy.com/wp-content/uploads/2020/08/PEIPN_May-Jun20.pdf /

MEDIA INTERVIEWS

***Noronha** featured in agricultural magazine articles.*

Ashley Robinson 2020. Solving the Wireworm Problem . Spudsmart. 24-26. Fall 2020.

https://spudsmart.com/ss_fall2020/?page=26
Ashley Robinson. 2020. Working together on research. Spudsmart. 30-33. Summer 2020.
https://spudsmart.com/ss_summer2020/?page=32
Madeleine Baerg 2021, Hope for wireworm Control. Spud Smart Winter 2021. https://spudsmart.com/ss_winter2021/?page=22

Haley Catton *and wireworms featured in agricultural media articles:*
Barker, B. 2020. Searching for wireworms. Top Crop Manager Magazine, Western Edition. April 2020:28-30.
https://mydigitalpublication.com/publication/?m=1031&i=654792&p=28
Simes, J. 2020. Now is the best time to scout for cutworms, wireworms. Western Producer. May 28, 2020.
https://www.producer.com/2020/05/now-is-best-time-to-scout-for-cutworms-wireworms/
Arnason, R. 2020. Wireworms prove tricky to keep under control. Western Producer. September 24, 2020.
https://www.producer.com/2020/09/wireworms-prove-tricky-to-keep-under-control/
Arnason, R. 2020. Feds approve wireworm insecticide. Western Producer. October 23, 2020.
https://www.producer.com/2020/10/feds-approve-wireworm-insecticide/

SCIENTIFIC PUBLICATIONS

van Herk WG, Vernon RS, Richardson J, Richardson M, Beaton A. (2021) Evaluation of pheromone traps and lures for trapping male Agriotes sputator (Coleoptera: Elateridae) beetles in eastern Canada. Florida Entomologist
van Herk WG, Vernon RS, Labun T, Sevcik M, Schwinghamer T. (2021) Distribution of pest wireworm (Coleoptera: Elateridae) species in Alberta, Saskatchewan, and Manitoba (Canada) Environmental Entomology https://doi.org/10.1093/ee/nvab006
Gries, R, Alamsetti S.K., **van Herk, W.G**., **Catton, H,** Meers, S., Lemke, E., Gries G. (2021). Limoniic acid - major sex pheromone component of the click beetles *Limonius canus* and *L. californicus.* Journal of Chemical Ecology https://doi.org/10.1007/s10886-020-01241-y.
Drahun I, Wiebe K, Koloski C, **van Herk W**, Cassone B. (2021) Genetic structure and population demographics of Hypnoidus bicolor (Coleoptera: Elateridae) in the Canadian Prairies. Pest Management Science https://doi.org/10.1002/ps.6255
Vernon R, **van Herk W**, Borden J. (2020). Considerations in the development and selection of traps for the study and management of click beetles (Coleoptera: Elateridae) IOBC/WPRS Bulletin 153: 11-18.
van Herk WG, Vernon RS, Goudis L. (2020) Broflanilide, a Meta-Diamide Insecticide Seed Treatment for Protection of Wheat and Mortality of Wireworms (*Agriotes obscurus*) in the Field. J. Econ. Entomol. https://doi.org/10.1093/jee/toaa239
Andrews KR, Gerritsen A, Rashed A, Crowder DW, Rondon SI, **van Herk WG**, Vernon R, Wanner KW, Wilson CM, New DD, Fagnan MW, Hohenlohe PA, Hunter SS. (2020). Genomic analysis of three wireworm (Coleoptera: Elateridae) species reveals putative cryptic species, population structure, and adaptive responses to agricultural pest control. Communications Biology 3:1-13 https://doi.org/10.1038/s42003-020-01169-9
van Herk WG, Vernon RS 2020. Local depletion of click beetle populations by pheromone traps is weather and species dependent. Env. Entomol. 49: 449-460.
Scott I M, Hatten G, Asztalos A, Bechard A, Kim H W, Krolikowski S, Mabed E, Pranger J, Tuncer Y. 2020. Field evaluation of cyantraniliprole for the control of wireworm damage on early and late season potatoes, 2019. 2020 Pest Management Research Report - 2020 Growing Season. Agriculture and AgriFood Canada. March 2021. Report No. 3. Vol. 59: 7-10.

COVID-19 Related Challenges:

The Covid-19 pandemic restricted lab and field access at ARDC LRDC, London RDC and CRDC and in Atlantic Canada travel to other provinces for field sample collection. Attempts were made to conduct smaller scale laboratory trials where possible when restrictions and access to labs was granted. In some locations no trials could be run because wireworms could not be collected from the field.

Key Message(s):

A new insecticide, broflanilide, was registered for wireworm management in Canada in October 2020. This registration was based in large part on work conducted by Drs. Vernon, Noronha, and van Herk. Pheromones were identified and successfully tested for six click beetle species.

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