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# MPSG ANNUAL EXTENSION REPORT

**PROJECT TITLE: Improved Integrative Pest Management Wireworm in Manitoba**

**PROJECT START DATE: 1 April 2018** **PROJECT END DATE: 31 March 2021**

**DATE SUBMITTED: 8 March 2019**

## *PART 1: PRINCIPAL RESEARCHER*

**PRINCIPAL**

| | | | |
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## *PART 2: EXECUTIVE SUMMARY*

*Outline the project objectives, their relevancy to pulse and soybean farmers, and a summary of the project to date, including methods and preliminary results.*

Following the government-issued ban of the pesticide lindane, wireworm (the larval stages of click beetles) have become major pests of economically important field crops in the Canadian Prairies, including soybean. Wireworm feed on seed and below-ground tissues during the early stages of plant growth, which can result in considerable yield losses. The overall objective of the research project is to evaluate the threat wireworm pose to present and future soybean production. In 2018, we scouted for wireworm in 22 crop fields across southern Manitoba at three stages in the production cycle. In each field, 18 wireworm bait traps (4 linear transects of 4-5 traps) were set and 45 soil cores were taken. Wireworm were present in 19 of the fields, and the average number per trap ranged between 0.11 and 9.6. Hypnoidus bicolor predominated, but five other known pest species were also found. We are currently performing molecular diagnostics to identify cryptic species and to determine the dispersal capabilities of wireworm from field to field. Since we have optimized wireworm rearing assays, we will now assess soybean seed/seedling damage by different wireworm species under various abiotic and biotic parameters (e.g., soil type, temperature, wireworm density).

Our 3-year project is beneficial to farmers because it will determine the true risks posed by wireworm to Manitoba soybean production, as well as the biotic, ecological, and agronomic factors that are the greatest contributors to these risks. This information will be critical to the development of a scouting protocol and economic thresholds, allowing farmers and agronomists to make informed decisions on management options.

## *PART 3: PROJECT ACTIVITIES AND PRELIMINARY RESULTS*

*Outline project activities, preliminary results, any deviations from the original project and communication activities. You may include graphs/tables/pictures in the Appendix*.

Wireworm are perhaps the most important pest species of soybean and other economically important crops in Manitoba. The overall objective of our research is to determine the true risks posed by wireworm to Manitoba soybean production, as well as the biotic, ecological, and agronomic factors that are the greatest contributors to these risks.

Wireworm Sampling. A total of 22 crop fields were scouted across southern Manitoba at three stages in the production cycle: spring (pre-planting), mid-summer, and fall (post-harvest). Figure 1 shows the regional distribution of fields surveyed. For each field/time, 18 bait traps composed of germinating wheat seed and vermiculite were placed 4.5 inches underground in four linear transects. Approximately 45 soil cores (each 10 cm diameter sampled to a depth of 15 cm) were also taken per field. Wireworm were extracted from the bait traps and soil cores manually and by using a funnel-heat lamp system (Figure 1).

Species Composition and Abundance. Wireworm were present in 19 of the scouted fields (86%), and the average number per trap ranged between 0.11 and 9.6. Hypnoidus bicolor predominated (94% of wireworm identified) but five other known pest species were also found. Table 1 displays the wireworm present in each field and their relative abundance. Wireworm were most prevalent and species-diverse in the southwest region of the province. Interestingly, some fields had a mixture of H. bicolor and H. abbreviatus; this is the first time we have found these two sibling species in the same field. We found no wireworm in the post-harvest sampling, likely because the unseasonably low temperatures delayed harvest and impacted soil temperature and seed germination in our bait traps. Our soil coring produced negligible wireworm, and efforts are being made to optimize this approach for 2019.

Molecular Diagnostics: DNA has been isolated from 350 field-collected wireworm, and the cytochrome oxidase (COI) and 16S rRNA genes have been amplified using PCR. These samples are currently being sequenced at the Génome Québec Innovation Centre. Once available, this data will inform on cryptic species and shed light into the dispersal capabilities of wireworm from field to field (Objective #2).

Rearing of Wireworm in the Laboratory. Protocols to successfully rear field-collected H. bicolor in the laboratory have been optimized. We are now able to assess soybean seed/seedling damage by different wireworm species under various abiotic and biotic parameters (Objective #3). This data will allow us to better determine the economic thresholds of wireworm in Manitoba, which are currently unknown.

Communication Activities: Farmers were made aware of their wireworm numbers and species composition as soon as results became available. The generated data has been presented at the Prairie University Biology Symposium (by M.Sc. student Ivan Drahun) and the Western Forum on Pest Management (by collaborator Dr. John Gavloski). Forthcoming research articles have been submitted to Pulse Beat and Grainews.

Deviations from the Original Project: We scouted more fields than proposed in both the spring and fall (22 vs. 15), but a reduced number in the summer (only those with >1 per trap). We determined that the competing carbon dioxide sources and elevated upper soil temperatures would dramatically decrease wireworm abundance in the summer. We also increased the number of bait traps per transect from 3 to 4 or 5 for better estimates of wireworm numbers. Finally, we processed more soil cores than proposed and also added 8 adult click beetles traps per field (this data is currently being processed by collaborator Dr. Wim Van Herk).

## *APPENDIX*

Include up to 1 page of tables, graphs, pictures.

**Figure 1.** Regional distribution of the crop fields scouted for wireworm in southern Manitoba in 2019 (left). Shown on the right are pictures from field scouting, a representative bait trap, and funnel extraction system.


**Table 1.** Relative abundance and species composition of wireworm sampled in 22 southern Manitoba crop fields in 2019. The numbers are based on bait trapping at three stages in the prodcution cycle.

| Field ID | Region | 2018 Crop | Wireworm per trap | | | Species Present |
|---|---|---|---|---|---|---|
| | | | SPRING | SUMMER | FALL | |
| 1 | Northwest | Soybean | 1 | 0.11 | 0 | *H. bicolor*, *H. abbreviatus* |
| 2 | | Canola | 0.78 | | 0 | *H. bicolor*, *Dalopius* sp. |
| 3 | Southwest | Soybean | 0.17 | | 0 | *H. bicolor* |
| 4 | | Spring wheat | 0.33 | | 0 | *H. bicolor*, *Hemicrepidius* sp. |
| 5 | | Corn | 1.83 | 0 | 0 | *H. bicolor*, *H. abbreviatus* |
| 6 | | Spring wheat | 1.83 | 0 | 0 | *H. bicolor* |
| 7 | | ?? | 2.33 | 0.44 | 0 | *H. bicolor*, *L. californicus* |
| 8 | | Soybean | 9.6 | 0.89 | 0 | *H. bicolor* |
| 9 | | Flax | 0 | | 0 | |
| 10 | | Soybean | 1.44 | 0.27 | 0 | *H. bicolor*, *H. abbreviatus*, *L. californicus* |
| 12 | | Soybean | 0.44 | | 0 | *H. bicolor* |
| 13 | | Corn | 0.06 | | 0 | *H. bicolor* |
| 14 | South-central | Canola | 0 | | 0 | |
| 15 | | Canola | 0.67 | | 0 | *H. bicolor* |
| 16 | | Corn | 0.11 | | 0 | *H. bicolor* |
| 17 | | Canola | 0.89 | | 0 | *H. bicolor* |
| 18 | | Forage crops | 0.11 | | 0 | *H. bicolor* |
| 19 | | Corn | 1.22 | 0 | 0 | *H. bicolor* |
| 20 | | Corn | 0 | | 0 | |
| 21 | | Corn | 0.27 | | 0 | *H. bicolor* |
| 22 | Southeast | ?? | 0.11 | | 0 | *A. mancus* |
| 22 | | Corn | 0.28 | | 0 | *H. bicolor* |