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D3761: Monitoring, forecasting, risk warning systems for field crop insects in the Canadian prairie ecoregion

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Introduction

- The Prairie Ecoregion contains a large expanse of cultivated land; about 29 million hectares of crop, are planted each growing season. Insect pest outbreaks are periodic/cyclical in nature.
- Production risks from insect pest outbreaks can be minimized through a coordinated monitoring program that provides decision-support to the agriculture industry in a timely manner.
- Also, monitoring of beneficial organisms is critical to their conservation and to the development of reduced-risk strategies for management of pest species.
- Climate change, new agronomic practices and new crops affect pest populations and diversity of beneficial arthropods.
- The agricultural industry needs research-based information and updates for insect pest populations since it affects their ability and willingness to protect and manage arthropod risk AND diversity.

Objectives

The **Prairie Pest Monitoring Network** is a area-wide, coordinated program designed to keep the Canadian agriculture industry informed of crop production risks from pest species and to highlight and conserve their natural enemies. The objectives are to:

- develop and implement standardized monitoring protocols,
- develop populations forecasts and risk warnings for major insect pests,
- develop population database and analyze factors influencing population increase and decrease,
- develop tech-transfer tools to efficiently relay field crop insect pest risk and research-based management techniques.

Pests

- Pea leaf weevil (*Sitona lineatus*)
- Swede midge (*Contarinia nasturtii*)
- Bertha armyworm (*Mamestra configurata*)
- Cabbage seedpod weevil (*Ceutorhynchus obstrictus*)
- Wheat stem sawfly (*Cephus cinctus*)
- Diamondback moth (*Plutella xylostella*)
- Wheat midge (*Sitodiplosis mosellana*)
- Lygus bug (*Lygus* spp.)
- Flea beetle (Chrysomelidae)
- Cereal leaf beetle (*Oulema melanopus*)
- Grasshoppers (Acrididae)

Natural enemies

- *Entomophthora grylli* (grasshoppers)
- *Macroglenes penetrans* (wheat midge)
- *Peristenus digoneutis* (lygus bugs)
- *Diadegma insulare* (diamondback moth)
- *Tetrastichus julis* (cereal leaf beetle)

Methods

- Wind trajectory model output and sex pheromone traps (diamondback moth)
- Area-wide network of pheromone traps (bertha armyworm, wheat midge)
- Plant damage assessments (pea leaf weevil, cereal leaf beetle, wheat stem sawfly)
- Sweep-net samples (adult cabbage seedpod weevil, lygus bugs)
- Area samples (adult grasshoppers)
- Soil core analysis (overwintering wheat midge larvae)
- Spatial analysis systems (map formatted phenology models and insect distribution/density)
- Bioclimate models (assess potential for successful establishment of pests and natural enemies)

Figure 1. Map of all insect monitoring sites (left); Long-range wind movements using 3D wind trajectory model identify potential *Plutella xylostella* introductions (right).

Results: Research-Based Information and Updates

- Standardized monitoring protocols developed and implemented (Western Forum 2014; Prairie Pest Monitoring Network Blog 2016)
- Timely risk warnings provided in map format (provincial and regional) with interpretive text and published on internet sites, in agricultural publications, presented at agricultural trade shows (Western Forum 2014; PPMN Blog 2016)
- Bioclimate models described potential distribution and relative abundance of pest and beneficial species (Haye *et al.* 2012)
- Monitoring of beneficial organisms contributed to conservation and to development of reduced-risk strategies (Olfert *et al.* 2009)
- Industry informed of new or emerging pest problems in timely manner via Network participants and development of a Blog (PPMN Blog 2016)
- Bioclimate models incorporating environmental and biological data used to predict occurrence of pest and natural enemy stages then summarized into Weekly Update e-bulletins also organized into Blog Posts to keep agricultural industry informed (PPMN Blog 2016)
- Publication of Identification and Management Field Guide to support arthropod monitoring and identification (Philip *et al.* 2015)
- ***Blog subscription for updates!***

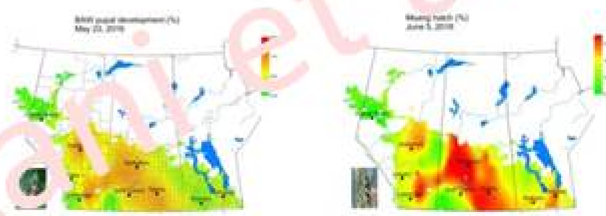

Figure 2. Predicted *Mamestra configurata* pupal development maps support pheromone trap deployment (left); Predicted *Melanoplus sanguinipes* hatch maps support in-field scouting (right).

Conclusions

The market impact of successful implementation of this project contributed to preserving and enhancing the economic and environmental benefits of agro-ecosystems in western Canada. Producers, who were able to minimize agricultural input costs, and minimize environmental impacts, are more viable and competitive in the agricultural marketplace. There are few constraints to adoption of these technologies.

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