Manitoba Entomology Research Summary – 2024

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There were 16 research projects from Manitoba submitted for the summary this year. Five are on insects of field crops, three are on insects in stored products, five on pollinators / beneficial insects, and three on medical / veterinary entomology.

Oilseed Crops

1) Effects of cover crops for flea beetle management – Project 1

Authors and Associates: Aleksandar Zashev, Alejandro Costamagna, Department of Entomology, University of Manitoba; Yvonne Lawley, Department of Plant science, University of Manitoba.

Abstract: Flea beetles are one of the major pests of canola in Western Canada. The major flea beetle management strategy is the use of broad deployment of insecticides, both as seed coatings and as foliar applications. However, it was noticed that a reduction of flea beetle damage is potentially possible when canola was seeded into cover crops. Therefore, this project aims to explore whether fall rye and oat cover crops exert influence on flea beetles and their natural enemies in canola. Two trials were conducted in RCBD with four replications, using oat and rye as cover crops, in Glenlea and Carman. Flea beetle abundance was quantified with sticky cards and flea beetle damage was estimated on the stem, cotyledons, and first true leaves of canola seedlings during the susceptible period.

Problem / Opportunity: Currently, flea beetle management is based largely on the use of insecticides, which can lead to development of insecticide resistance. Consequently, this study is aimed at possible alternatives in flea beetle control.

Objectives: Evaluated the impact of overwintering and spring planted cover crops on flea beetle damage to canola seedling and on the abundance of ground predators. Assessed the impact of

overwintering and spring planted cover crop on canola yield and quality.

Results: Initial results from 2023 showed low levels of defoliation in the plots (< 12%), but lower defoliation in plots with oats and with rye cover crops than control plots. Sample processing and data analysis for 2024 experiments are still on-going.

Funders: Canola Agronomic Research Program (CARP)

Contact: Alejandro Costamagna (Ale.Costamagna@umanitoba.ca)

2) Effects of cover crops for flea beetle management – Project 2

Authors: Raquel Chinchín, and Alejandro C. Costamagna (Dept. of Entomology), Yvonne Lawley (Dept. of Plant Science), University of Manitoba.

Abstract: Flea beetles are the most important insect pest of canola on the Canadian prairies. Currently the only strategy available to manage flea beetles is the use of insecticides. Cover crops are a promising management strategy that provide multiple benefits to cropping systems. Cover crops can contribute to make detection of the target crop more difficult for insect pests, reducing their damage. In addition, cover crops can increase the abundance of generalist predators in the field, contributing indirectly to reduce pest abundance. This project will evaluate the impact of fall rye and oat cover crops on flea beetles and their natural enemies in canola with on-farm strip trials and tests on the scale precision cover cropping experiment at the South East Research Farm in Year 3.

Problem: Currently, flea beetle management is based largely on the use of insecticides, which can lead to development of insecticide resistance. Consequently, this study is aimed at possible alternatives in flea beetle control.

Research Objectives: Evaluate the impact of overwintering and spring planted cover crops on flea beetle abundance, damage to canola seedlings and canola yield.

Summary of Results: Two on-farm experiments using cover crops, Italian ryegrass and fall rye, were conducted in 2024. Sampling consisted of visual estimates of defoliation, sticky traps to assess flea beetle abundance and pitfall traps to assess natural enemy abundance. Analyses of samples and results are ongoing.

Continuing Research: This is an ongoing MSc project (Year 1 of 2). Processing of collected trap data is currently underway.

Funding Sources: Foundation for Food & Agriculture Research (FFAR, USA) & PepsiCo / Mitacs.

Contact: Alejandro C. Costamagna (Ale.Costamagna@umanitoba.ca)

3) Development of RNA-based technologies to control flea beetles

Authors: Aditi Singh, Alison Tayler, Lauren Verhaeghe, Steve Whyard, Depart of Biological Sciences, University of Manitoba.

Abstract: Flea beetles (*Phyllotreta cruciferae* and *P. striolata*) are the most damaging pest insects to canola and other cruciferous plants. These insects are primarily controlled by various broad-spectrum chemical pesticides, including neonicotinoids, which adversely harm many non-target species. We are developing a new generation of RNA-based pesticides, which can selectively knock down a target gene, in a species-specific manner, and thereby control a pest without impacts to beneficial species.

Problem: Neonicotinoids have been banned in Europe and will be banned in Canada in the near future, leaving canola growers in need of new methods of flea beetle control. Different approaches of RNA-based technologies to control flea beetles need to be evaluated for their ability to protect this valued crop.

Objectives of research: Assess the efficacy of RNA-based technologies to control flea beetles using 1) foliar sprays of double-stranded RNAs (dsRNAs) on plants, and 2) transgenic plants that express flea beetle-specific dsRNAs.

Summary of results: In greenhouse settings, foliar sprays of dsRNA can kill flea beetles, and reduce damage to treated plants. The development of a cellulose-based adjuvant improves the durability of the dsRNA on leaves, even under simulated rain conditions. Transgenic plants expressing dsRNAs are similarly protected from flea beetle damage, with some lineages of transgenic plants performing as well as control plants exposed to no flea beetles.

Continuing research: Funding for this project ends in 2025. New funding will be sought to conduct field trials.

Funders: Manitoba Agriculture, Western Grains Research Foundation, CARP, NSERC, Bayer Crop Science, BASF

Contact: Steve Whyard (Steve.Whyard@umanitoba.ca)

Wheat

4) Examine the effect of flooding and drought conditions on wheat midge oviposition

Authors: Chaminda De Silva Weeraddana, Ramya Wijesundara, Alejandro C. Costamagna, Department of Entomology, University of Manitoba.

Abstract: The wheat midge, *Sitodiplosis mosellana* (Géhin) (Diptera: Cecidomyiidae) is a significant insect that feeds on wheat crop in Western Canada. Wheat midge damage can cause more than tens of millions of dollars annually in Canada. Climate change poses new challenges

to wheat crops, making it important to understand its impact on insect pests.

Problem / Opportunity: In western Canada, short-term drought and flooding conditions are more frequent in crops than ever. We hypothesized that these conditions influence the oviposition of adult wheat midges.

Objectives: Examine the effect of short-term drought and flooding conditions on oviposition of wheat midge on susceptible wheat.

Summary of Results:
- We have completed choice and no-choice oviposition experiments of wheat midge under short-term drought and flooding conditions on susceptible wheat.
- In both choice and no-choice experiments, a significantly lower number of eggs were laid on plants in the drought treatment.
- In the choice experiment, wheat midge preferred to lay more eggs on plants in the flooding treatment. However, in the no-choice experiment, flooding treatment did not influence wheat midge oviposition.
- Follow-up experiments are ongoing to evaluate wheat midge larval performance on these drought and flooding treatments.

Funder: Agriculture Development Fund Saskatchewan/Manitoba Crop Alliance/Saskatchewan Wheat Development Commission/Western Grains Research Foundation

Contact: Alejandro C. Costamagna (Ale.Costamagna@umanitoba.ca)

Pulse Crops

5) Evaluating insecticide seed treatments for pea leaf weevil management

Author: Laura Schmidt, Manitoba Pulse & Soybean Growers

Abstract: Pea leaf weevils (PLW) were first confirmed in Manitoba in 2019. Since then, they have quickly become established in western Manitoba and are found further east every year with confirmed reports as far east as Stonewall in 2024. Beginning in 2023, small-plot pea seed treatment trials were established near Roblin and Swan River in the Northwest region of Manitoba. Three insecticide seed treatments (*Cruiser 5FS* (thiamethoxam), *Stress Shield 600* (imidacloprid) and *Lumivia CPL* (chlorantraniliprole)) are compared to untreated peas in a four replicate RCBD design. Total notches per plant at V6, number of healthy nodules at R2-4 and pea yield have been measured. Through MPSG's On-Farm Network, field-scale on-farm pea seed treatment trials have also been established with interested farmers comparing treated (product choice determined by the farmer) vs. untreated peas.

Problem / Opportunity: Since PLW are a fairly new pest to Manitoba, farmers and agronomists have many questions on managing this pest and if seed treatments will provide a return on investment.

Objective: Evaluate the effect of insecticide seed treatments registered for pea leaf weevil management on PLW defoliation (assessed as the total number of notches per plant and number of healthy nodules) and pea yield under the moderate to high PLW populations that occur in Northwestern Manitoba.

Results: In 2023, Cruiser 5FS significantly reduced the number of notches per plant at V6 in Swan River. While a similar trend was observed in Roblin that year at both the small-plot trial and the on-farm trial, it was not significant. There were no yield responses to any of the seed treatments compared to untreated peas.
In 2024, there were no differences among seed treatments and untreated pea regarding total notches per plant, nodule counts or pea yield at any location.
One more year is planned for this trial, with potential expansion to Melita in the Southwestern region of Manitoba where PLW populations are lower.

Contact: Laura Schmidt (laura@manitobapulse.ca)

Stored Products

6) Survey of stored product insects on the Canadian prairies

Authors: Vincent Hervet, Paul Fields

Abstract: The presence and identity of stored product insects in farm grain bins across the Prairie Provinces of Canada is being assessed. This study is part of a biovigilance effort initiated by AAFC.

Problem: The occurrence of stored product insects in Canadian seeds are checked all along the transportation chain from farm, country elevator and terminal elevators for exported seed or by domestic end users. However, the movement of seeds crushes and eliminate most of the insects that are outside the seed so that novel or rare insect species on farms may not be detected. Knowing which species are frequently encountered in farms and if there are emerging pests would help focus research efforts.

Objectives of research: Determine which insect species associated with stored seeds currently occur in and around grain bins in farms on the Canadian prairies. Obtain parasitoids for further biocontrol studies.

Summary of results: The study was initiated in September 2020 and is ongoing. Wheat was the main commodity sampled. Most species collected so far are mold feeders. The main species encountered were the foreign grain beetle, the hairy fungus beetle, the plaster beetle, and the rusty grain beetle.

Continuing Research: This is the last year the survey is being conducted. 2023 data is still being processed so we don’t have new updates since last year. However, based on the data we have

gathered thus far, it appears that there are relatively little issues due to pests of stored products in stored grain in western Canada. The main issues that we noticed were related to:

- Lack of use of aeration fans in small grain bins. Although this is rare, it appears that some growers believe that grain in small grain bins will cool down on their own while ambient air cools down in the fall and winter. However, this is no the case because grain has very high insulating properties.
- Lack of use of aeration fans late in the summer/early in the fall, and waiting for cold ambient temperatures to turn on the fans. Doing this leads to grain being too hot and/or too moist for too long (at least one month) after harvest. This is particularly an issue during years where the fall has relatively high temperatures. When this occurred, high numbers of mould feeding insects were detected (particularly the foreign grain beetle, *Ahasverus advena*), which was a sign that mould had started to develop on the stored grain.
- Assumption that diatomaceous earth effectively controls insects in stored grain under any conditions. During this survey, large numbers of insects were typically found in grain bins where diatomaceous earth has been applied, indicating a probable lack of efficacy of this product. We are still unsure why this might be. A possible explanation would be that such grain was typically too moist and hot, and since diatomaceous earth kills insects by desiccating them, it may be that high grain moisture levels prevented insects from desiccating to lethal levels. Another possible explanation could be that conditions were favourable for insects to multiply too rapidly to be effectively controlled by diatomaceous earth—since insects have to be exposed to diatomaceous earth for several weeks to die, and since they often could have completed their life cycle in a shorter amount of time, their population would continue to increase over time.
- Carryover grain. Grain that is carried over to the next year was nearly systematically heavily infested with insects, particularly the rusty grain beetle (*Cryptolestes ferrugineus*) and the foreign grain beetle (*Ahasverus advena*). Carryover grain was most commonly found in seed farms, which is an issue because the rusty grain beetle feeds on the germ of seeds, thus rendering seeds unable to germinate. Temperature and grain moisture content measurements that we performed indicated that the grain was typically not properly managed for long-term storage. Only one farm did not have this issue, and in this instance, the grain had been cooled down during the winter and had remained untouched throughout the rest of the year. Our measurements found that the temperature of this grain was still sufficiently low during the following fall (5 °C to 15 °C) to prevent insect development and spoilage. Interestingly, there seemed to have been no issues related to convection currents and to water condensation on the top of the cold grain during the summer months.

Funders: AAFC

Contact: Vincent Hervet (Vincent.Hervet@agr.gc.ca)

7) **Identification and classification of pulses suitable for the development of the bean weevil.**

Authors: Vincent Hervet

Problem: The bean weevil, *Acanthoscelides obtectus*, can develop on a number of pulse species, but not all. The bean weevil is a quarantine species in India and China, the two main importers of Canadian pulses. Knowing which pulses are not at risk of containing bean weevils would ease trading with these countries.

Objectives of research: Determine which species of pulses are not attacked by *A. obtectus*, and rank pulse species by susceptibility of being attacked by *A. obtectus*.

Summary of results: This research is ongoing.

Continuing Research: This research will end in 2025.

Funders: AAFC

Contact: Vincent Hervet (Vincent.Hervet@agr.gc.ca)

8) **Use of edible insects to valorize spoiled grain**

Authors: Vincent Hervet, Hunter Slobodian, Thomas Netticadan, Srinivas Sura, Sijo Joseph, Lovemore Malunga, Emma Stephens

Problem: Spoiled grain is not valorized. Companies typically have to pay to get rid of their spoiled grain.

Objectives of research: Determine if edible insects, particularly the yellow mealworm (*Tenebrio molitor*), can be used to valorize spoiled grain. The yellow mealworm thrives on mouldy grain and is known to metabolize mycotoxins. We will rear yellow mealworms on spoiled grain and on DON-contaminated grain, then measure mycotoxin load and nutritional quality of these insects. The primary goal of this study is to assess if such practice can be used to provide edible insects to feed livestock, particularly poultry and fish, while monetizing a commodity that currently has no value: spoiled grain.

Summary of results: This research was just initiated as of September 2024.

Continuing Research: This research will continue until March 2027.

Funders: AAFC

Contact: Vincent Hervet (Vincent.Hervet@agr.gc.ca)

Pollinators / Beneficial Insects

9) Increasing pollination, biological control and beneficial insect diversity on farms using flowering habitats

Authors: Michael Killewald, Jason Gibbs, Alejandro Costamagna, Sophia Athanas, Dept. of Entomology, Rob Gulden, Yvonne Lawley, Dept. of Plant Science, University of Manitoba.

Abstract: Habitat loss has potential negative effects on beneficial insects in agricultural landscapes. Flowering habitat strips installed next to organic and conventional farms are being assessed for their effects on pollinators, natural enemies of pest insects, pest species, and weedy plants. Experimental plots are being used to evaluate preferred plant species for bees and best management practices.

Problem: Sustainable farming practices are needed to ensure food security in the long term. Habitat loss is a major driver of biodiversity loss, which can lead to loss of ecosystem services.

Objectives of research: Determine if flowering habitat increases beneficial insects on farms. Monitor potential negative effects of increased pest or weed pressure. Determine best practices for establishing plantings and plant species most attractive to bees. Examine any yield effects for farmers.

Summary of results: Project completed, but analyses continuing. One publication on early effects of pollinator habitats on pollinators and natural enemies published. https:/doi.org/10.1111/afe.12595

Continuing Research: Ongoing PhD project (year 5 of 5). New MSc (Jan. 2025) project. Additional data collection and analyses of insect diversity, weed abundance and crop yield.

Funders: Organic Federation of Canada (Organic Science Cluster III), with support from Western Grains Research Foundation and Agriculture and Agri-Food Canada. NSERC Alliance – Sustainable Agriculture.

Contact: Jason Gibbs (jason.gibbs@umanitoba.ca)

10) Taxonomy of sweat bees in western North America

Authors: Joel Gardner, Thilina Hettiarachichi, and Jason Gibbs, Dept. of Entomology, University of Manitoba.

Abstract: The bee genus *Lasioglossum* remains one of the most challenging taxonomic problems for pollinator research in North America. The species of western North America have never received a full taxonomic treatment. A combination of morphological and molecular approaches is being used to delimit and described species in this group.

Problem: Many of the most common bees in western North America are not identifiable.

Objectives of research: Document and describe western species of *Lasioglossum.* Provide morphological and molecular identification tools for western *Lasioglossum*.

Summary of results: PhD and MSc graduated. New species of sweat bee described: https://doi.org/10.3897/zookeys.1089.72645, https://doi.org/10.11646/zootaxa.5404.1.13, including a taxonomic monograph https://doi.org/10.5852/ejt.2023.858.2041. Generated phylogenomic data for a problematic species complex. Global phylogenomic analysis of genus currently in preparation for publication.

Continuing Research: Advertising for new students. Analysis of phylogenomic data. Applying for additional NSERC funding.

Funders: NSERC Discovery / University of Manitoba

Contact: Jason Gibbs (jason.gibbs@umanitoba.ca)

11) Taxonomy of *Pterosarus* (Andrenidae) bees in Canada and the USA

Authors: Steve Robinson and Jason Gibbs, Dept. of Entomology, University of Manitoba.

Abstract: The taxonomy of the bees of the genus group *Pterosarus* have never been fully revised. A combination of morphological and molecular approaches is being used to delimit and described species in this group.

Problem: Most species of *Pterosarus*, many of which specialize on crop plants such as *Helianthus*, are unidentifiable.

Objectives of research: Document and describe species of *Pterosarus.* Provide morphological and molecular identification tools for these bees.

Summary of results: DNA barcodes have been generated for a few species in North America. New Canadian species have been recognized and described in a thesis. Preliminary phylogenomic results provide the first support for the monophyly of *Pterosarus*. Steve Robinson completed thesis: https://mspace.lib.umanitoba.ca/xmlui/handle/1993/37299. Preliminary phylogenomic analysis supports monophyly of *Pterosarus*.

Continuing Research: Revising for peer-review publication. Continuing work on related taxa and phylogenomic studies of *Pterosarus*.

Funders: NSERC Discovery / University of Manitoba

Contact: Jason Gibbs (jason.gibbs@umanitoba.ca)

12) Bee diversity patterns across southern Manitoba

Authors: Gibbs, J., Hanuschuk, E., Miller, R., Martini, M., Robinson, S., Nakagawa, P., Thilina Hettiarachchi, Emmelyn Cullen University of Manitoba, Cardinal, S. Dubois, M Agriculture and Agrifood Canada, Sheffield, C. Royal Saskatchewan Museum, Onuferko, T. Canadian Museum of Nature)

Abstract: Habitat critical for Manitoba's wildlife must be assessed. Understanding the contributions of different landscapes for bees will be valuable for future planning of conservation efforts. Native bees are being collected from several dozen sites as part of independent diversity studies. Sites vary in extent of agriculture and semi-natural habitat. New records for Canada were identified. Phylogenetic diversity of prairie bees are being explored.

Problem: Manitoba's native bee fauna has been poorly documented. Landscape effects on native bees in the province has not been well studied.

Objectives of research: Document southern Manitoba's bee diversity, including functional and diversity measures. Relate diversity to landscape factors. Provide data to validate spatial models. Measure diversity supported by wildlife management areas and urban areas (Winnipeg).

Summary of results: More than 95,000 georeference native bee records were digitized. Small habitat patches in disturbed landscapes seem to preserve pollinator diversity. New Canadian records, such as *Dianthidium parvum*, were found. The first records of the endangered *Epeoloides pilosulus* in Manitoba in 95 years were reported in the Journal of the Kansas Entomological Society. Other new and rare species have been collected in wildlife management areas and Winnipeg. We recorded 392 species / morphospecies for the province, which is 154 more species than reported in 2015 and includes five new generic records since 2015. Thirteen new Canadian records were reported. New taxon concepts were proposed for some species. Provincial checklist published in the Canadian Entomologist https://doi.org/10.4039/tce.2022.45. Multiple MSc theses involved. One new MSc student recruited.

Continuing Research: Adapting theses for peer-reviewed publication. Analyzing recent survey data for publications. Future work will model data from J. B. Wallis / R. E. Roughly Museum of Entomology. New records and updated taxonomy are still expected. At least two new Manitoba records were found since checklist was published.

Funders: University of Manitoba, NSERC Discovery, The Manitoba Habitat Heritage Corporation/Critical Wildlife Habitat Program (Jason Gibbs), NSERC Alliance – Sustainable Agriculture (Marting Entz PI, Gibbs co-PI), Genome Canada (Jon Bennett PI, Gibbs co-PI); Agriculture and Agri-Food Canada (Melanie Dubois, PI); Beaty Postdoctoral Fellowship for Species Discovery (Thomas Onuferko);

Contact: Jason Gibbs (jason.gibbs@umanitoba.ca)

13) Evaluating how climate change, land use, and on-farm management practices influence the hydrological characteristics of a wetland and its ability to capture and store carbon

Authors: Erin Smith, David Pelster, Melanie Dubois, Sherry Fillmore, Keith Fuller, Aaron Glenn, Dale Hebb, Steven Javorek, Christopher Kirby, Vicky Leveque, Morteza Mesbah, and Henry Wilson – Agriculture and Agri-Food Canada.

Abstract: Agriculture depends on ecosystem services like nutrient cycling, pollination, and water regulation for productivity. Wetlands play a key role in these services, acting as natural filters, managing water flow, and storing carbon. Canada hosts 25% of the world's wetlands, many of which are tied to agricultural lands. However, climate change and extreme weather pose risks to wetlands' ability to store carbon, support agriculture, and is having an impact on the biodiversity found within and surrounding on-farm wetland systems. Understanding how remaining wetlands can contribute to agricultural sustainability is crucial for climate mitigation and biodiversity. This research will quantify species present in and surrounding each wetland system and evaluate population changes in relation to current management practices and alterations in land use.

Problem:
There is uncertainty about how changes in wetland hydrology will impact the ability of these systems to hold and store C, and influence the biodiversity of these environments. This leaves a significant gap in the knowledge with regards to the management of these ecosystems. Quantifying C storage and loss not only under a changing climate, but changing hydrology, and surrounding land use, is therefore important in helping to understand the role wetlands play in the agricultural ecosystem and mitigating the effects of climate change.

Objectives of research: Biodiversity data collected will help to define influencing factors for enhanced C sequestration in wetlands and also support the development of new biodiversity related agri-environmental indicators through the AAFC Sustainability Metrics Program. The project will also address the Government of Canada's Canadian Biodiversity Strategy by assisting farmers to undertake management and conservation strategies for on or near-farm biodiversity, and by educating farmers about the merits of biodiversity conservation for both production and environmental improvement. Native bees were sampled using cup and blue vane traps, breeding bird information was collected using automatic recording units and floral surveys were done adjacent to the bee trapping sites.

Summary of results: The field research will be completed 2024/25, and analyses will be continuing.

Funders: Agriculture and Agri-Food Canada

Contact: Melanie Dubois (melanie.dubois2@agr.gc.ca)

Medical / Veterinary Entomology

14) Establishment of bovine anaplasmosis in Canada: current status and development of rapid tests to control an emerging disease

Authors: S. Dergousoff (AAFC-Lethbridge), K. Rochon (U. Manitoba), N. Chilton (U. Saskatchewan), D. Douma (Manitoba Agriculture), J. Pahara. (AAFC-Lethbridge)

Abstract: Bovine anaplasmosis is a production-limiting disease caused by the blood-borne bacterium *Anaplasma marginale*, spread by blood-contaminated equipment and tools, re-use of needles, ticks, and biting flies. The project aims to 1) determine the occurrence of anaplasmosis within beef cattle herds in western Canada from blood samples, 2) survey herd management practices that may affect the risk of anaplasmosis, and 3) develop a chute-side test that can detect infected cattle quickly. The outcome will be the development of practical and appropriate methods for preventing the introduction and spread of anaplasmosis in beef cattle herds and a quick and effective response to infections for improved animal health and welfare.

Results: Research is ongoing. None of the blood samples collected in 2023 were positive for *A. marginale*. Analysis of flies and ticks collected on pastures in 2024 is ongoing.

Funders*:* Beef Cattle Research Council

Contact: Kateryn Rochon (kateryn.rochon@umanitoba.ca)

15) Diversity and prevalence of ectoparasites and pests in egg-laying facilities in Manitoba

Authors: K. Rochon

Abstract: Many factors influence the prevalence of parasites, including housing type and husbandry practices. We are particularly interested in the poultry red mite, *Dermanyssus gallinae*, as these mites are a re-emerging problem in egg-layer production systems and present a health and welfare concern for producers. The research will document poultry red mites as an emerging pest issue, and the information will be used to develop extension and research material relevant to the egg industry as it transitions away from conventional wire cages over the next decade.

Results: starting soon.

Funders: MSc student (M. Dupuis) supported by an RBC Scholar fellowship.

Contact: Kateryn Rochon (kateryn.rochon@umanitoba.ca)

16) Development of sterile insect technique to control mosquitoes

Authors: Daniel Heschuk, Michael Wood, Nazanin Amanat, Steve Whyard, Department of Biological Sciences, University of Manitoba.

Abstract: Mosquitoes are vectors of some of our most serious diseases, killing millions of people annual around the globe. Most mosquitoes are controlled using chemical pesticides, but a pesticide-free approach to controlling mosquitoes that is being developed is the sterile insect technique (SIT). SIT involves the release of large numbers of sterile male insects into region, which compete with wild males for female mates, to cause localized population crashes. We are using non-chemical, non-transgenic approaches to mass-produce sterile males for potential use in mosquito SIT applications.

Problem: Conventional SIT relies on radiation to sterilize male insects, but this method typically weakens the males in terms of mating competitive behaviours, which reduces their ability to suppress the population. New methods to safely sterilize the males and to sex sort the insects to ensure only males are released, must be developed.

Objectives of research: Assess the efficacy of RNA-based technologies to 1) sterilize male mosquitoes, without reducing their mating competitiveness, and 2) enhance the sex-sorting technique to ensure that no females are released with the sterilized males.

Summary of results: In laboratory settings, feeding mosquito larvae formulations of double-stranded RNA can either fully sterilize most males, with the remaining males having greatly reduced fertility. Effective sex sorting has been achieved on a small scale by feeding larvae dsRNAs that target female-specific genes.

Continuing research: Funding for this project ends in 2026. New funding will be sought to conduct field cage trials.

Funders: NSERC

Contact: Steve Whyard (Steve.Whyard@umanitoba.ca)