

# Canadian Agri-Science Cluster for Horticulture 3



## Update to Industry

### Semi-Annual – Spring 2022

**Activity title:** Evaluating biological control strategies for the tomato leaf mining moth (*Tuta absoluta*), a potential invasive greenhouse pest in Canada

**Name of Lead Researcher:** Dr. Roselyne Labbe and Dr. Lauren Des Marteaux, AAFC

**Names of Collaborators and Institutions:**

**Cara McCreary**, Greenhouse integrated pest management specialist, Ontario Ministry of Agriculture Food and Rural Affairs (OMAFRA)

**Dr. Sherah VanLaerhoven**, University of Windsor, co-director of MSc student working on this project.

Nature Conservancy of Canada

Thames Talbot Land Trust

Parks Canada

**Activity Objectives (as per approved workplan):**

1. Field survey for native natural enemies of the tomato leaf miner, *Tuta absoluta* (predators and parasitoids).
2. Establish rearing methods for predators and parasitoids.
3. Define the life history, predatory capacity and biological control potential of new agents on greenhouse crops.
4. Identify and apply novel molecular tools for identification and monitoring of the tomato leaf miner.

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

Despite COVID-related restrictions for onsite work and associated project delays, we have made substantial progress on the project as a whole. Placing greater emphasis on our field surveys was critical to our discovery of key predatory hemipteran species in Ontario, and we have successfully established colonies and mass rearing methods for multiple predatory nabids and mirids. Predatory capacity trials are now complete for the nabids and two mirid species against two moth species serving as proxies for *T. absoluta*. Life history trials are complete for the nabids and partially complete for two mirid species. Due to COVID-related delays, we extended this project by one year to complete life history work and greenhouse trials with the mirids. This extension will enable us to accelerate the commercial development of biocontrol agents with a focus on mirid predators for use in Canadian greenhouses (and potentially field crops). Among these candidate hemipteran biocontrol agents, we are confident that at least some will be effective against *T. absoluta*.

**Specific objectives / milestones**

**1 - Field survey for native natural enemies of *T. absoluta***

During previous reporting periods, we completed predatory hemipteran surveys in southern and northern Ontario (Sudbury and the Kawarthas), collecting ~1,300 specimens in total. Key predators were morphologically identified by the authority taxonomist at the Canadian National Collection.

## 2 - Establish rearing methods for predators

In the previous reporting period, we have successfully established colonies and rearing methods for two predacious nabid species: *Nabis americoferus* and *Hoplistocelis pallescens*, as well as three predacious mirid species: *Dicyphus discrepans*, *D. famelicus*, and *M. tenuicornis*. Overall, the *M. tenuicornis* colony was unsuccessful either due to small starting population size or because the species did not thrive on the laboratory host plant. However, rearing a colony for this species can be reattempted based on future need, as colony source material is readily available.

## 3 - Define the life history, predatory capacity and biological control potential of new agents on greenhouse crops

We have previously completed trials to characterize the developmental time and survival to adulthood for both nabids, and have completed longevity and fecundity trials for *N. americoferus*. We have now completed predatory capacity trials for *N. americoferus* and two mirid species (*Dicyphus discrepans* and *D. famelicus*) on *Ephestia kuehniella* moth eggs as well as eggs and first larval instars of *Trichoplusia ni* moths. We completed an additional study on the ability of the mirids to establish populations on field tomato. We have nearly completed life history characterizations for the two mirids.

## 4 - Identify and apply novel molecular tools for identification and monitoring *T. absoluta*.

Due to the publication of a real-time PCR assay for the identification of *T. absoluta*, we modified this objective to focus on DNA barcoding and databasing of native predatory hemipterans. We have completed optimization of hemipteran barcoding primer sets, and sequencing of surveyed hemipterans is underway.

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

### Conference posters

1. Desloges Baril, P., Des Marteaux, L., Labbé, R., and VanLaerhoven, S. 2022. Tomato defenders: evaluating two native predatory *Dicyphus* species as novel biocontrol agents on tomato crops. (Ontario Fruit and Vegetable Growers Convention, Niagara Falls, Canada)
2. Desloges Baril, P., Des Marteaux, L., Labbé, R. Mlynarek, J., and VanLaerhoven, S. 2021. Evaluation of native Hemiptera for biocontrol in Canadian tomato crops. Ontario Fruit and Vegetable Convention.
3. Laflair, A., VanLaerhoven, S., Des Marteaux, L., Mlynarek, J. and Labbe, R. 2021. Egg feeding potential of *Nabis americoferus*: a native biological control agent of greenhouse pests. Ontario Fruit and Vegetable Convention.
4. Desloges Baril, P., Des Marteaux, L., and VanLaerhoven, S. 2021. Evaluation of native Hemiptera for biocontrol in Canadian tomato crops. Canadian Greenhouse Conference.
5. Desloges Baril, P., Des Marteaux, L., and VanLaerhoven, S. 2021. Exploring native predatory hemipteran species. Ontario Pest Management Conference.
6. Desloges Baril, P., Des Marteaux, L., and VanLaerhoven, S. 2021. Exploring native predatory hemipteran species. Joint Annual Meeting of the Entomological Society of Canada and Entomological Society of Ontario.
7. Laflair, A., VanLaerhoven, S., Des Marteaux, and Labbé, R. 2021. Egg feeding potential of *Nabis americoferus*: a native biological control agent of greenhouse pests. Canadian Greenhouse Conference. (Virtual Poster)
8. Laflair, A., VanLaerhoven, S., Des Marteaux, and Labbé, R. 2021. Reproductive and life-history potential of *Nabis americoferus*: a native generalist biological control agent. Entomology 2021 Annual meeting of the Entomological Society of America. (Virtual Poster)
9. Laflair, A., VanLaerhoven, S., Des Marteaux, and Labbé, R. 2021. Functional response and predatory capacity of a native generalist biological control agent, *Nabis americoferus* Carayon (Hemiptera: Nabidae), towards lepidopteran pests. Ontario Pest Management Conference (Virtual Poster)

### Conference oral presentations

12. Desloges Baril, P., Des Marteaux, L., and VanLaerhoven, S. 2021. Exploring native predatory hemipteran species. Annual Meeting of the Entomological Society of America.

### Research Updates & Seminars

13. Labbe, R., Longpre, F., Des Marteaux, L., Leo, S., Desloges-Baril, P., Basso, J., Laflair, A. Van Laerhoven, S., and Scott-Dupree, C. 2022. Greenhouse Entomology Research Update. Harrow RDC Virtual Open House Presentation. February 23, 2022.

*Thesis publication*

17. LaFlair, A. (2022). Survey of native predatory hemipterans and assessment of *Nabis americoferus* Carayon (Hemiptera: Nabidae) as a biological control agent of lepidopteran tomato pests. MSc Thesis. University of Windsor. Pp. 173.

**COVID-19 Related Challenges:**

This year we continued to see COVID-related challenges; until November 22, 2022, a reduced number of staff allowed to work in the HRDC laboratory and greenhouse facilities meant that onsite work activities were scaled back. Overall, COVID restriction caused a year of delay to this project. In order to complete all planned greenhouse trials and life history work with the two *Dicyphus* species, we have extended the project by one year. We have reprofiled some funds from this fiscal year to the next to carry out this work (i.e. no additional funds are required).

**Specific impacts on work objectives:**

**Objectives 3:** In 2021 our work on these objectives remained limited due to personnel capacity limits in place at HRDC. Despite this limitation, we made substantial progress on life history trials and completed predatory capacity trials for the *Dicyphus* species. This work continues to accelerate as restrictions ease at HRDC.

**Objective 4:** Due to both COVID-related restrictions as well as the recent publication of a real-time PCR assay for the identification of *T. absoluta*, we have refocused this objective to DNA barcode and database native predatory hemipterans collected in our surveys. These activities are now underway. As with objective 3, we expect this work to accelerate as work restrictions are eased.

**Key Message(s):**

Our extensive surveys of predatory hemipterans across Ontario yielded a number of new candidate biocontrol species. We successfully established colonies of these species, assessed their predatory capacities against moth prey and other pests, and have partially characterized their life history traits. Our nabid and mirid predators are now tangible biocontrol products that are ready to be commercially developed for use in Canadian greenhouses (and potentially field crops) in the near future.

This project under the Canadian Agri-Science Cluster for Horticulture 3 is funded in part by the Government of Canada through the Canadian Agricultural Partnership's AgriScience Program, a federal, provincial, territorial initiative, with support from the Fruit and Vegetable Growers of Canada (formerly the Canadian Horticultural Council) and industry contributors.

