

# Canadian Agri-Science Cluster for Horticulture 3



## Update to Industry

Semi-Annual – Spring 2022

**Activity title:** Integrated management of the pepper weevil, an invasive pest of greenhouse pepper crops in Canada

**Name of Lead Researcher:** Roselyne Labbe, AAFC

**Names of Collaborators and Institutions:**

*Félix Longpré, Insect rearing biologist, London Research and Development Centre, Agriculture and Agri-Food Canada*

*Cara McCreary, Greenhouse Vegetable Integrated Pest Management Specialist, Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA)*

*Miyuki Santiago, Business Development, Koppert Biological Systems*

*Niki Bennett, Science Coordinator, Ontario Greenhouse Vegetable Growers*

*Dr. Cynthia Scott-Dupree, Bayer Chair in Sustainable Pest Management School of Environmental Sciences University of Guelph.*

*Bruce Power and Nordion, producers of Cobalt-60 isotopes required for weevil irradiation.*

*Tim McDowell, Chemist, , London Research and Development Centre, Agriculture and Agri-Food Canada*

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

- 1) Develop improved rearing methods for the pepper weevil.
- 2) Evaluate reduced-risk conventional and biopesticides for the management of the pepper weevil.
- 3) Evaluate non-target impacts of management products on beneficial insects used in greenhouse pepper biological control.
- 4) Establish the efficacy of parasitoid *Jaliscoa hunteri* for the management of the pepper weevil. Establish and compare the efficacy of rearing methods for *J. hunteri* production. Explore alternate crop delivery methods for *J. hunteri*.
- 5) Conduct laboratory and greenhouse trials investigating the potential of the Sterile Insect Technique (SIT) for managing the pepper weevil.

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

**1. Improve pepper weevil rearing methods**

In this project year, Felix Longpre has made significant advances in the development of apparatuses that greatly improve rearing efficiency and facilitate rapid mass-production of pepper weevils and its natural enemy *Jaliscoa hunteri*. In addition, during the fall of 2020, Félix conducted trials, which examined the potential for a low intervention pepper weevil rearing system involving a continuous supply of ornamental pepper plants used in rotation in the rearing cages. This method is promising and will be improved further as we are currently working on optimizing plant yield. Trials are also been conducted to examine the potential of CO2 and other gases to accelerate the collection pepper weevils from the plants.

## 2. Evaluate pepper weevil control agents

Objective met and completed in 2021.

## 3. Non-target testing / cold tolerance of pepper weevil

We have now met this objective, having produced a metadata summary of the non-target impacts of products tested for pepper weevil control.

## 4. Parasitism of the pepper weevil

We have now completed research on the parasitoid, *Jaliscoa hunteri*, including all controlled environment and greenhouse trials that demonstrate that this wasp can reduce pepper weevil populations both in lab and commercial facilities. In addition, volatile Y- tube wasp attraction trials helped elucidate the chemical cues mitigating parasitoid attraction to pepper weevil. These trials showed that female wasps have a strong attraction to pepper weevil infested peppers, especially when these contained 3<sup>rd</sup> instar larvae. Along with plant headspace volatile captures trials (Tim McDowell AAFC London), this groundwork will better elucidate the chemical cues mitigating parasitoid attraction to pepper weevil and contribute to develop this new biocontrol tool for use on greenhouse pepper crops.

## 5. Evaluate Sterile Insect Technique (SIT) for pepper weevil management

In this project year, we have made significant advances in our evaluation of the Sterile Insect Technique (SIT) for pepper weevil management. We have now successfully developed an effective pepper weevil irradiation and dosimetry protocol in collaboration with Nordion Inc., and have demonstrated that, among many doses tested, male and female weevils irradiated at 110Gy were nearly 100% sterile. Work to assess irradiated weevil competitiveness, flight and mating capacity is proceeding well and will be complete in the next and final project year. Overall, this SIT strategy represents a potentially very effective and sustainable new method to mitigate the pepper weevil, and potentially other greenhouse crop pests in Canada.

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

1. Leo, S., Scott-Dupree, C., and Labbe, R. 2022. Putting Pressure on a Pepper Pest: How *Jaliscoa hunteri* can suppress the pepper weevil. Ontario Fruit and Vegetable Convention (Niagara Falls) Poster presentation February 23 2022
2. Labbe, R., Longpre, F., Des Marteaux, L., Leo, S., Desloges-Baril, P., Basso, J., Laffair, A. Van Laerhoven, S., and Scott-Dupree, C. 2022. Greenhouse Entomology Research Update. Harrow RDC Virtual Open House Presentation. February 23, 2022.
3. Basso, J., Labbe, R. and Scott-Dupree, C. 2022. The sterile insect technique: A novel tool for control of pepper weevil in greenhouse pepper crops. Ontario Fruit and Vegetable Convention (Niagara Falls) Poster presentation February 23 2022
4. Labbé, R., Brazil, M. and McCreary, C. Research Update: Pepper weevil studies bring new products to light in Canada. Greenhouse Canada Magazine, October 2021.
5. Basso, J., Labbé, R. and Scott-Dupree, C. 2021. Potential new tool for pepper weevil management in Ontario greenhouses: Sterile Insect Technique. Entomology 2021 Annual meeting of the Entomological Society of America. (Virtual Presentation) Award winning presentation.
6. Leo, S., Scott-Dupree, C. and Labbé, R. 2021. Parasitoid wasp *Jaliscoa hunteri* Crawford (Hymenoptera: Pteromalidae) can effectively suppress pepper weevil (*Anthonomus eugenii* Cano) at both first and third larval instars. Entomology 2021 Annual meeting of the Entomological Society of America. (Virtual Presentation) Award winning presentation (honourable mention)
7. Basso, J., Labbé, R. and Scott-Dupree, C. 2021. Potential new tool for pepper weevil management in Ontario greenhouses: Sterile Insect Technique. Ontario Pest Management Conference. (Virtual Presentation)
8. Award winning presentation (honourable mention)
9. Leo, S., Scott-Dupree, C. and Labbé, R. 2021. Evaluating the parasitoid *Jaliscoa hunteri* as a biological control agent for the pepper weevil *Anthonomus eugenii* on Canadian greenhouse pepper crops. Ontario Pest Management Conference (Virtual Presentation)
10. Basso, J., Labbé, R. and Scott-Dupree, C. 2021. Potential new tool for pepper weevil management in Ontario greenhouses: Sterile Insect Technique. Entomological Society of Canada Joint Annual Meeting. November 17, 2021. (Virtual Presentation)

11. Leo, S., Scott-Dupree, C., Fernandez, C., Gagnier, D., Rizzato, R. and Labbé, R. 2021. Evaluating the parasitoid *Jaliscoa hunteri* as a biological control agent for the pepper weevil (*Anthonomus eugenii*) on greenhouse pepper crops. Entomological Society of Canada Joint Annual Meeting. November 17, 2021. (Virtual Presentation)
12. Leo, S., Scott-Dupree, C., Fernandez, C., Gagnier, D., Rizzato, R. and Labbé, R. 2021. The pepper weevil parasitoid *Jaliscoa hunteri* is attracted to volatiles released by host weevil pests. Canadian Greenhouse Conference. (Virtual Poster Presentation)
13. Basso, J., Labbé, R. and Scott-Dupree, C. 2021. Potential new tool for pepper weevil management in Ontario greenhouses: Sterile Insect Technique. Canadian Greenhouse Conference. (Virtual Poster Presentation)
14. Leo, S., Scott-Dupree, C. and Labbé, R. 2021. Evaluating the parasitoid *Jaliscoa hunteri* as a biological control agent for the pepper weevil (*Anthonomus eugenii*) on greenhouse pepper crops. School of Environmental Sciences Graduate Student Virtual Conference – University of Guelph. Aug 26, 2021 (Virtual Presentation) Award winning presentation.
15. Basso, J., Labbé, R. and Scott-Dupree, C. 2021. The sterile insect technique as a novel tool for control of pepper weevil (*Anthonomus eugenii* Cano) in greenhouse and field pepper crops. Graduate Students Association Virtual Conference – University of Guelph. Aug 26, 2021
16. Fernandez, D. C., VanLaerhoven, S., Sinclair, B. and Labbé, R. 2021. Cold tolerance of the pepper weevil (*Anthonomus eugenii*). Ontario Fruit and Vegetable Convention. (Virtual Poster Presentation)
17. Leo, S., Labbé, R. and Scott-Dupree, C., 2021. Biological control of the pepper weevil using the parasitoid wasp, *Jaliscoa hunteri*. University of Guelph School of Environmental Sciences Graduate Student Virtual Conference. May 27, 2021
18. Fernandez, D., VanLaerhoven, S. and Labbé, R. 2021. Host utilization by the pepper weevil (*Anthonomus eugenii*): suitability, preference and offspring performance. Pest Management Science. 77:10: 4719-4729.
19. Fernández, D. C., VanLaerhoven, S. L., Rodríguez-Leyva, E., Zhang, Y. M., & Labbé, R. 2022. Population Structure and Genetic Diversity of the Pepper Weevil (Coleoptera: Curculionidae) Using the COI Barcoding Region. Journal of Insect Science, 22(1), 25. <https://doi.org/10.1093/jisesa/ieac012>

### COVID-19 Related Challenges:

Work associated with non-target product testing (**objective 3**) was affected by continued limitations in access to research facilities in 2021 and was therefore adjusted to conducting a metadata analysis for non-target effects of products, as well as a study on the overwintering potential of pepper weevil.

### Key Message(s):

We have shown that parasitoid *Jaliscoa hunteri* clearly demonstrates potential for suppressing pepper weevil in both lab and commercial greenhouse trials. With regards to the SIT, we are also now well underway to clarifying the variables that could contribute to the development of an SIT strategy for pepper weevil.

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