

The Science of Organic Agriculture in Canada

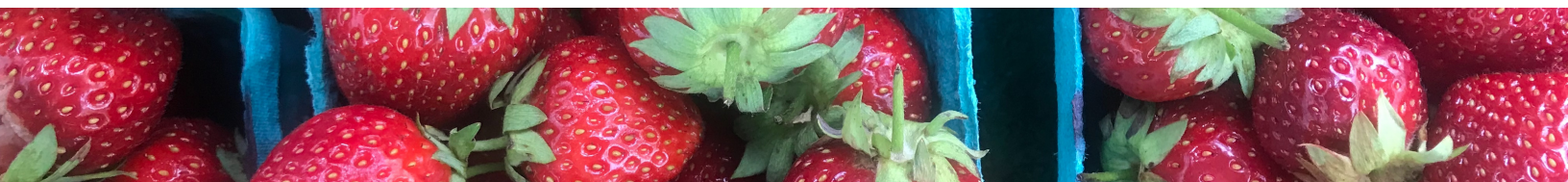
Latest Research Results



Potential of predatory bugs (Nabis and Orius) as biological control agents of the tarnished plant bug (Lygus lineolaris) in organic strawberry field

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Demand for organic strawberries has grown rapidly over the last decade. The tarnished plant bug (*Lygus lineolaris*, order Hemiptera, family Miridae) is one of the main barriers preventing conventional strawberry growers from adopting organic management practices. The tarnished plant bug is attacked by several predatory and parasitoid species, in particular predatory bugs and spiders. The predatory bugs, *Nabis americoferus* (Carayon, order Hemiptera, family Nabidae) and *Orius insidiosus* (Say, order Hemiptera, family Anthicoridae), naturally colonize tarnished plant bug patches and are thought to be the main contributors to tarnished plant bug mortality. The potential of these predators has yet to be exploited, but could form an important part of the solution for managing tarnished plant bugs in organic strawberry fields. The main objective of this project was to determine the potential of two predatory hemipterans, *N. americoferus* and *O. insidiosus*, as biological control agents against tarnished plant bug and to optimize their role in organic strawberry fields.

The two main objectives of the study were:

- 1) to establish the potential of predators in the laboratory and in the field; and
- 2) to explore the potential for genetic improvement of *N. americoferus* through artificial selection based on aggressiveness level.

For the first part of the project, we conducted laboratory tests to determine the voracity of adults and nymphs of *N. americoferus* and *O. insidiosus* for different growth stages of the tarnished plant bugs. Next, we conducted experimental field tests to define the optimal rate and timing of introduction. Finally, we

tested our approach in organic strawberry fields. For the second part, we developed an ethological test measuring the aggressiveness of adult *N. americoferus*. By positive and negative artificial selection, we developed aggressive and docile lines. The lines' propensity for intraguild predation on *O. insidiosus* (laboratory tests) and their effectiveness in the field were tested (experimental fields).



Nabis americoferus nymph on a strawberry leaf after release in an organic strawberry field. Ferme Patrice Coursol, Mirabel, May 2021. (Photo by Maud Lemay)



Nabis americoferus nymph dispatch device: small plastic pot containing buckwheat scales and *Ephesia* eggs. *Nabis* nymphs are still present on the surface. Laboratory of the Centre de recherche agroalimentaire de Mirabel, Mirabel, June 2022. (Photo by Maud Lemay)

We have shown that all growth stages of *N. americoferus* consume tarnished plant bugs of equivalent or lower stages. *O. insidiosus* adults attack young tarnished plant bug nymphs (growth stage L1-L2). In the field, all tested densities of *N. americoferus* effectively reduced tarnished plant bug populations for several weeks compared with the control, but *O. insidiosus* had a marginal effect on the pest. Moreover, for all the introduction periods tested, Nabís proved effective in reducing the tarnished plant bug population. In organic strawberry fields, *N. americoferus* introductions generally reduced tarnished plant bug densities and consequent fruit damage. However, the mortality of *N. americoferus* in transit has presented a challenge for the application of biological control with this predator. In the laboratory, the heritability achieved was 0.16 and 0.27 for aggressiveness and docility in *N. americoferus*. Males are more aggressive than females. Aggressive lines attack more *O. insidiosus*, resulting in more intraguild predation. However, docile lines have a better ability to adjust their response to conditions. When extraguild prey was available (tarnished plant bugs), which had the effect of increasing prey density (the total of tarnished plant bugs and *O. insidiosus*), docile Nabís adjusted their attack rate upwards. In the field, aggressive *N. americoferus* reduced the density of tarnished plant bugs more than docile *N. americoferus*. Damage to strawberries by tarnished plant bugs was reduced in plots with aggressive *N. americoferus*. The aggressive and docile character was maintained for several weeks in plots where *N. americoferus* were introduced.

N. americoferus are effective predators of tarnished plant bugs in organic strawberry fields. The introduction of late-stage nymphs (growth stage L4 - L5) or adults is preferable to the introduction of young nymphs (growth stage L2 - L3). Local effects (where *N. americoferus* are introduced) are observed for several weeks at a density of 0.25 Nabís per plant. It is advisable to treat outbreaks of tarnished plant bug infestation as soon as the young nymphs of the pest are observed (growth stage L1 to L3). The selection of aggressive *N. americoferus* could increase the benefits of this predator. However, aggressive lines are more difficult to rear, and they predate more on *O. insidiosus* than docile lines. *O. insidiosus* are secondary predators of tarnished plant bugs, and their effects are more limited in the field. It is advisable to design the landscape in such a way as to maintain and promote these two native predators. For example, mullein plants would be beneficial for *N. americoferus* in autumn.



Organic strawberry field at Patrice Coursol's Mirabel farm after a *Nabis americoferus* release. May 2022. (Photo by François Dumont)

For more information visit the [OSC3 Activity 18](https://osc3.activity18.org) webpage and/or [DAL.CA/OACC/OSCIII](https://dal.ca/oacc/osciii) & <https://organicfederation.ca/organic-science-clusters/>

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