Investigating the mechanism of natural repellents and miticides for *Tetranychus urticae* Koch using electrotarsogram and behavioral studies

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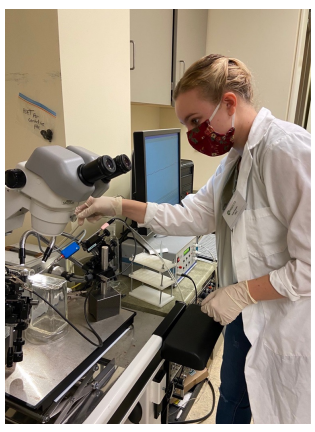
The Study

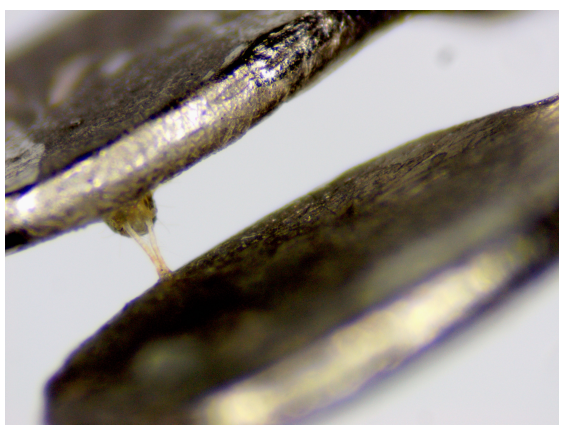
This study was in partnership with the Canadian company Nutrilife Plant Products Limited. Nutrilife's Product 102 is the most effective of their pesticides for control of *Tetranychus urticae* Koch (two-spotted spider mite). The main goal of this project was to investigate the mechanism of action of Product 102 in *T. urticae*. In addition, the project assessed the impact of the pesticide to beneficial species, such as bumble bees, and explored the potential of the product as a fungicide.

Electrotarsogram and Behavioural Studies

Electrotarsogram technology was used to identify potential natural-based products that *T. urticae* are sensitive to. Female mites were dorsally mounted on a fork electrode and a Gas Chromatogram-Flame Ionization Detector (GC-FID) linked to the electrotarsogram (GC-ETD) was used to apply stimuli to the mite. After identifying compounds that elicit a response from *T. urticae* , a two-choice behavioural assay was used to identify compounds as a repellant or an attractant.

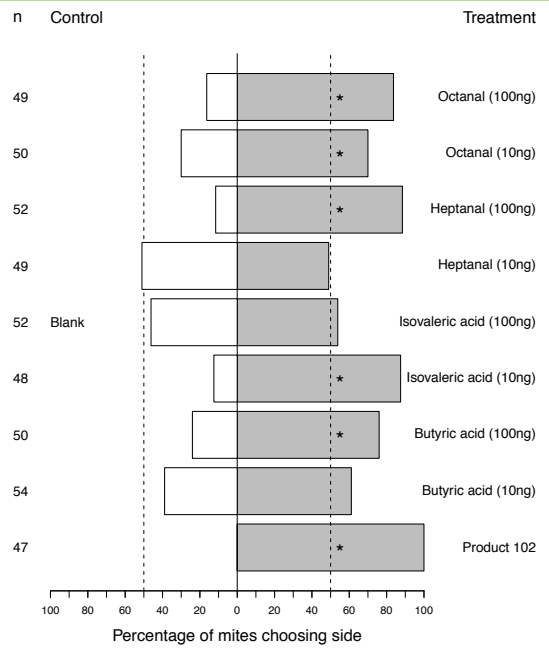


Testing preparation of *Tetranychus urticae* prior to stimulus injection on GC-FID.



Female *Tetranychus urticae* mounted on fork electrode dorsally to be tested on GC-FID.

Setup for *Tetranychus urticae* behavioural assays, where half of the bean plant leaf is treated with a compound of interest, and half of the leaf is untreated.

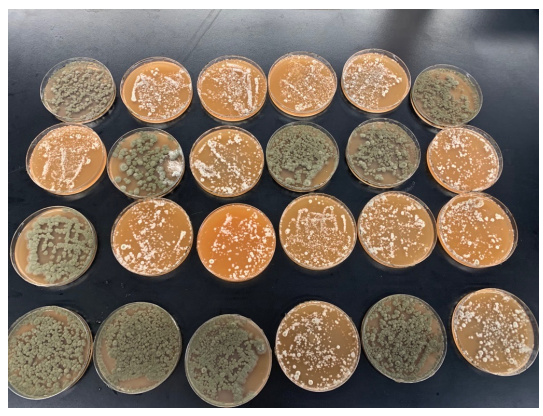


Percentage of adult female *Tetranychus urticae* choosing to feed on treated side of bean leaf after 20 minutes in two-choice behavioural assay.

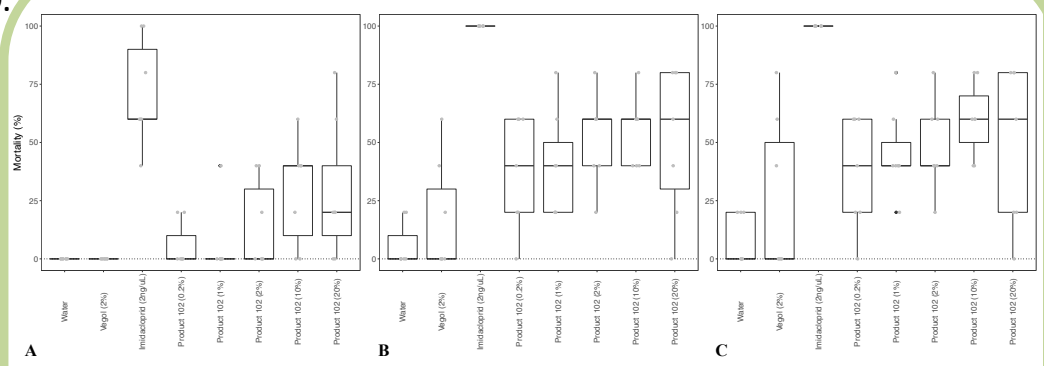
Alternative Uses / Secondary Impacts

Product 102 was tested as a potential fungicide using *Cladosporium herbarum* and *Botrytis cinerea.* This experiment was conducted to test for both the prevention and killing of fungus species. Finally, contact toxicity trials were performed using *Bombus impatiens* to test for potential toxicity of product 102.

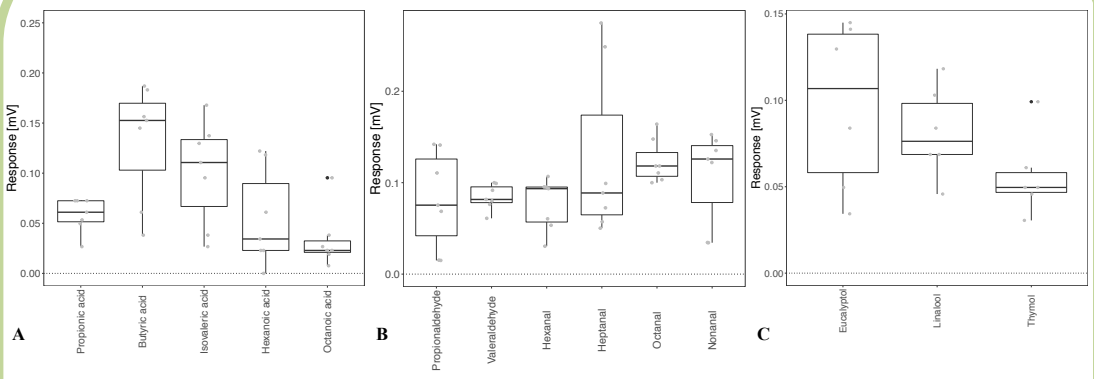
Daily feeding of Bombus impatiens.



Positive control group of *Cladosporium herbarum* 1-week after inoculation.



Mortality of *Bombus impatiens* from contact toxicity. Mortality is shown for A) 4 hours, B) 24 hours, and C) 48 hours after treatment.



Electrotarsal response of adult female *Tetranychus urticae* to a master mix of (A) carboxylic acids at a concentration of 1 µg/µL (n = 7), (B) aldehydes at a concentration of 1 µg/µL (n = 7), (C) essential oil mixtures at a concentration of 100 ng/µL (n = 6).

Summary: We have developed a new mounting procedure to record the electrophysiological response of mites, and we have designed a behavioural assay to evaluate the behaviour induced by compounds detected through ionotropic receptors.

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