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IPM: Photosensitizer… Lights… Action!

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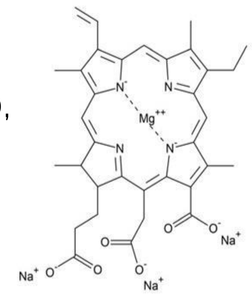
University of Guelph – Improve Life. | Suncor Energy

Need: Alternatives to synthetic insecticides that may cause pest and disease resistance, toxicity to non-target organisms, environmental contamination and harm to human health.

Possible solution: Photosensitizers (PS)

Novel formulations derived from food additive E140, anionic sodium magnesium chlorophyllin (Chl), developed by Suncor Energy Inc.



Pest: Western flower thrips (WFT)

Our first focus: WFT – the biggest contributor in growers switching to biocontrol. The most common and challenging pest, causing the most crop losses as indicated by greenhouse growers in Vineland Research and Innovation Centre's recent survey.

Laboratory assays:

1) Contact (direct contact with insects)
2) Ingestion (only exposed to PS by feeding)

Conditions: Maximum light penetration, agar, cabbage leaf discs. Temp: 25±2°C, RH: 70%±5%, Light: LED 450 µmol.m^{-2}s^{-1} PAR, 12L:12D
Trials: 4 x 10 reps, WFT mortality recorded: Day 2 & 5

Treatments:

- RO water control (negative control)
- Pure Spray Green Oil (PSG @ 0.25%)
- SUN-D-PS (Photosensitizer)
- SUN-D-PS + PSG (Combination)

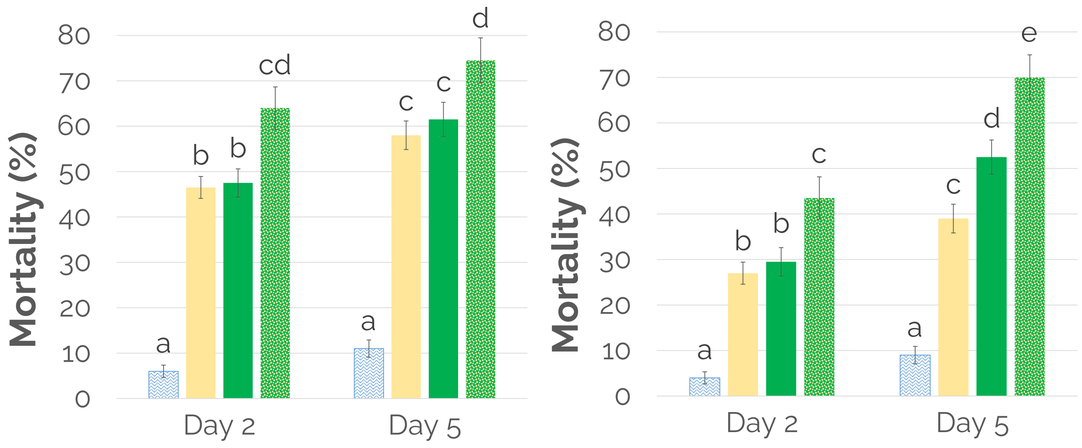
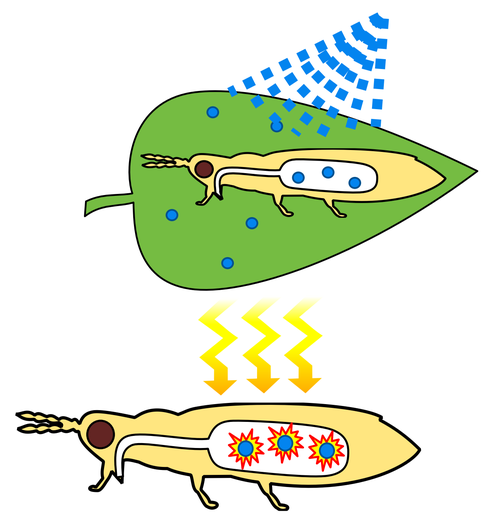


Figure 1. Mean percentage mortality of western flower thrips after feeding on sprayed cabbage leaf disks for two and five days. Left:: Contact assay. Right: Ingestion assay. Means with the same letter are not significantly different from each other.

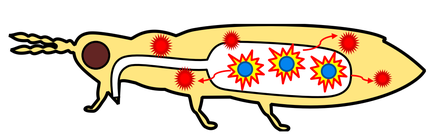
1 Spray with photosensitizer (PS)

2 Insects ingest treated plant

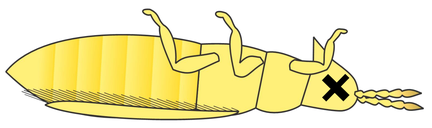
3 PS activated by visible light (sunlight/LED)



4 Reactive oxygen species (ROS) are produced



5 Multi-targeted damage leading to insect death



(Graphic design: Ashley Summerfield)

Greenhouse assays:

1) Spray treatments only
2) Integrated Pest Management (IPM)

Conditions: 9 peppers/cage, infested 50 WFT, 3 sprays 1 week apart. For IPM assay, 25 *Orius insidiosus* per cage. Temp: 23±2°C, RH: 0%±5%, Natural sunlight: ~ 1500+ µmol.m^{-2}s^{-1} PAR,
Trials: 3 x 15 reps, Destructive sampling – plants removed for thrips counts.

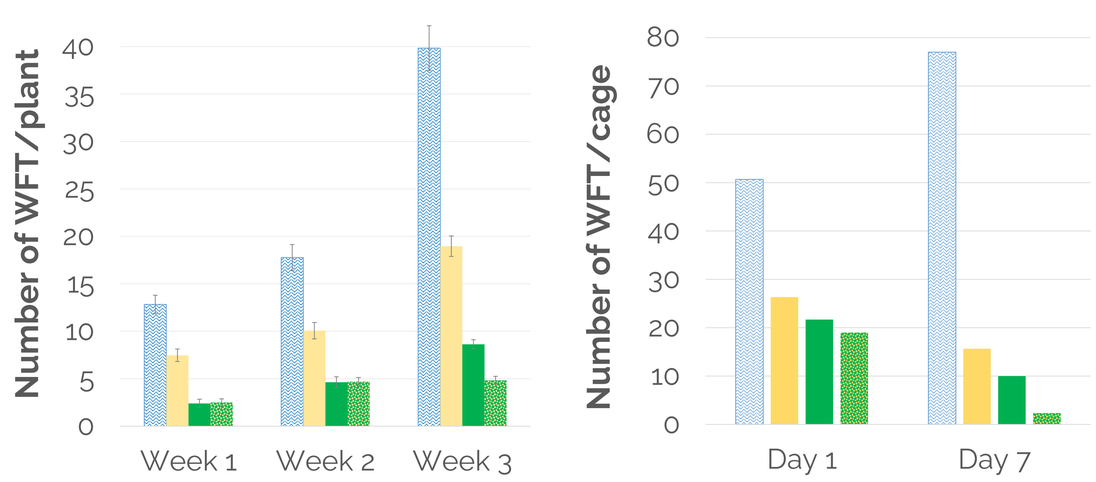


Figure 2. Average number of western flower thrips on sprayed peppers in greenhouse assays Left: Spray treatments only. Right: Integrated Pest Management (IPM) trial.

Highlights:

- The photosensitizer, SUN-D-PS, consistently killed >50% WFT in laboratory and > 70% WFT in greenhouse trials.
- When combined with Suncor's oil product PSG mortality of WFT increased to >85% in greenhouse trials.
- In our initial IPM study the combination of SUN-D-PS + PSG killed >95% within 7 days. The predator, *O. insidiosus,* survived the photosensitizer spray.

Take home message:

Photosensitizers have the potential to control WFT and work with bios and pollinators.

Acknowledgements

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