# TOWARDS ENLIGHTENED TOOLS FOR BIOLOGICAL CONTROL!

## Manipulating supplemental lighting to favor biological control while maintaining crop performance

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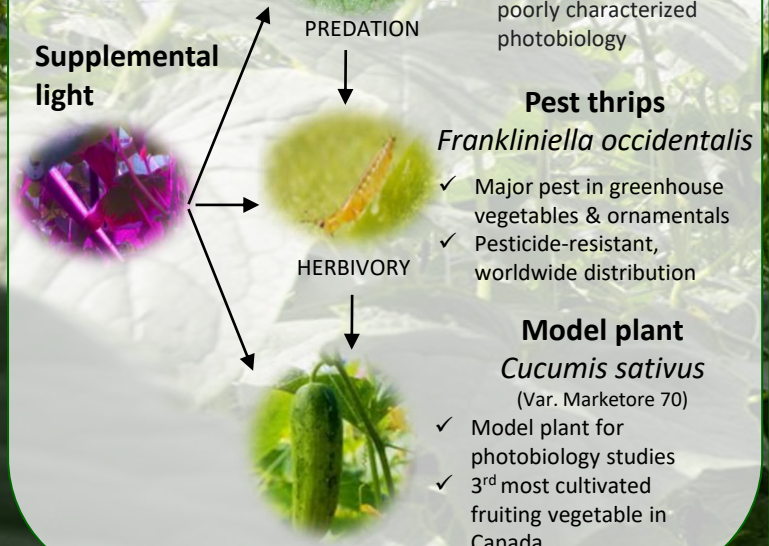
**ABSTRACT**: In greenhouses, light-emitting diodes (LEDs) are being adopted for supplemental lighting (SL) in diverse cropping systems. While managing pest outbreaks is an ongoing challenge in controlled environments, SL's potential to favor biocontrol agents, especially predators, has been overlooked. Our approach is to screen different SL environments (light spectra × intensity × photoperiod combinations) at various spatiotemporal scales to identify optimal lighting strategies that favor predators, as well as physiological and agronomic responses of crops plants. Here, we give an overview of our tritrophic study system as well as the objectives of our 3-year study and present some preliminary results. Globally, our observations will inform precise lighting recommendations that promote predator activity while maintaining agronomic performance, thus maximizing SL use in production context.

## STUDY SYSTEM




**Predatory bug**
*Orius insidiosus*
- ✓ Efficient & widespread agent
- ✓ Diapause problematic, poorly characterized photobiology

**Pest thrips**
*Frankliniella occidentalis*
- ✓ Major pest in greenhouse vegetables & ornamentals
- ✓ Pesticide-resistant, worldwide distribution

**Model plant**
*Cucumis sativus*
(Var. Marketore 70)
- ✓ Model plant for photobiology studies
- ✓ 3rd most cultivated fruiting vegetable in Canada

## PROJECT OVERVIEW

### 1 *"In vitro"* predation

- What are the **optimal combinations** of light intensity and spectral quality favoring predation at small scale?
- What is the most appropriate **time of exposure** to supplemental light?

*Metrics: successful captures, attack attempts, time before first capture*

### 2 Predator's life cycle

- Which light treatments **are best for predator development and reproduction**?

*Metrics: development time, survival, sex-ratio, intrinsic rate of population increase*

### 3 Crop's performances

- How does the model plant respond to the **combined effect of light treatments and arthropod activity**?

Light treatment optimization phase

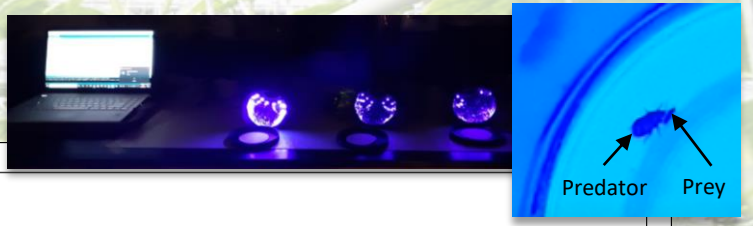
*Metrics: plant morphology & physiology, predator & prey densities, foliar damage severity*

### 4 *"In vivo"* validation

- Are our light supplementation treatments that optimize predator activity **effective in the long term** (thrips control & crop productivity), or under various **severities of thrips infestation**?

*Metrics: research & commercial greenhouses 12 month survey*

## PRELIMINARY RESULTS



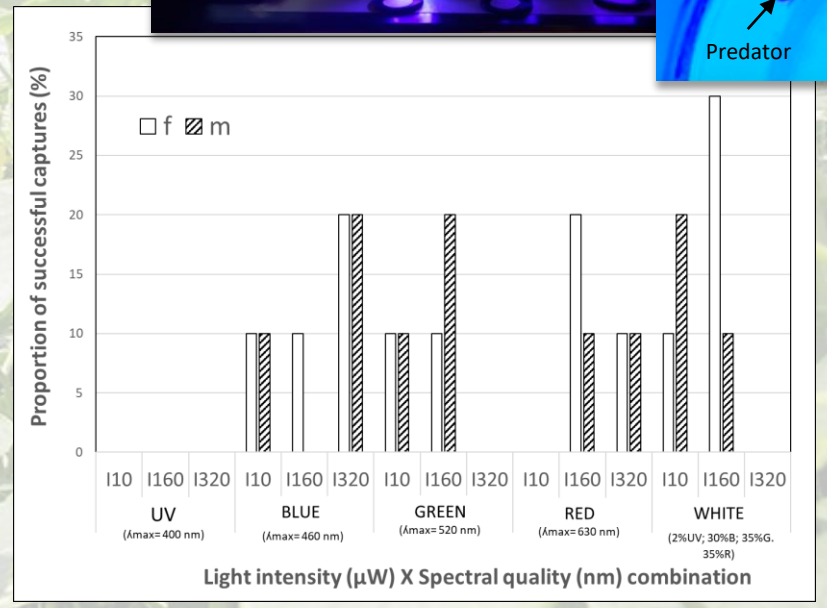




**Fig.1 Proportion of successful captures depending on light intensity x spectral quality combinations for both female (f) & male (m) *O. insidiosus* (n = 10 observations/combination/sex).** In a dark room, light conditions within three opaque chambers were dynamically manipulated by a microcontroller connected to LEDs. Predators and prey were individually exposed to darkness for 30 min before the 1 min exposure to tested light combinations. There were then both introduced in a 4 cm diameter transparent dish (1 predator/3 prey) for a 5 min video-monitoring of predation behaviors.