Improving semiochemical attraction for management of Colorado potato beetle in solanaceous field crops

Andrew Colton, Angela Gradish, Rebecca Hallett

School of Environmental Sciences, University of Guelph, Guelph, ON, Canada

Introduction

- The objective of this research was to investigate the attractive potential of solanaceous compounds in combination with a pheromone to attract Colorado potato beetle (CPB), *Leptinotarsa decemlineata*, (Chrysomelidae: Coleoptera).
- CPB is a global pest of solanaceous crops, primarily field potatoes and tomatoes[1,4].
- Increasing regulation of insecticides and the development of resistance to many of them by CPB warrants the development of novel management tactics for CPB.
- A pheromone-kairomone-based lure for CPB mass trapping may offer an alternative to insecticides for CPB management.
- CPB males produce an aggregation pheromone [(S)-3,7-dimethyl-2-oxooct-6-ene-1,3-diol or (S)-CPB I], and it has been synthesized[1].
- In field trials, five-fold more adult CPB were collected in pitfall traps baited with (S)-CPB I than without, highlighting the pheromone's potential for use as a CPB attractant[4].
- The attractant potential of host plant kairomones alone, and as an additive to the pheromone, has been demonstrated in lab assays and field trapping studies[2,3,5].

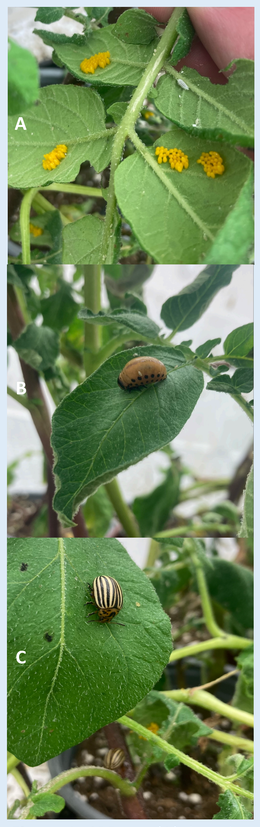

Figure 1. CPB egg (A), larval (B) and adult (C) life stage

Methodology

- An open Y-track olfactometer was used for all assays[3,6].
- All beetles were starved for 24 h and sexed prior to the experiment.
- The pheromone and plant compound combinations (See Table 1) were pipetted onto filter paper discs in Erlenmeyer flasks and delivered to each arm of the device with humidified, hydrocarbon-free air at 1 L/min.
- For each assay, 1 µg of pheromone and/or 16.67 µg of each solanaceous compound dissolved in hexane or mineral oil was tested.
- Beetles were released at the bottom of the vertical section of the rod and a light was placed above the apparatus to draw beetles upwards.

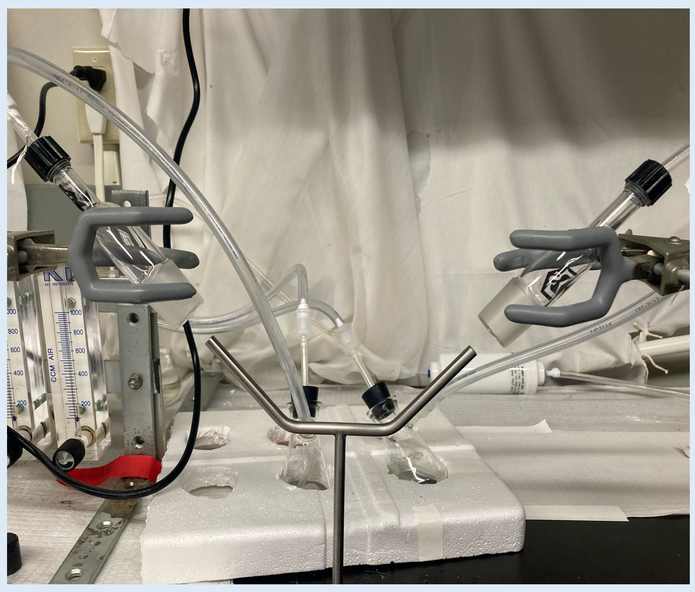

Figure 2. Bioassay arena used for trials . choice.

Figure 3. Beetle moving toward a

- Treatments and controls were replaced every block (30 min); glass and metal parts of the apparatus were washed and the position of the treatment altered halfway through each block to avoid any bias associated with each arm.
- A minimum of 20 replicates (10 males and 10 females) was completed for each treatment combination.
- Beetle choice was recorded and a Chi-squared test was used to determine if adult CPB had a preference for any of the tested compounds.

Table 1. Associated abbreviations of treatment combinations containing (S)-CPB I pheromone and solanaceous compounds.

Abbreviation	Components
Pher	(S)CPB-I aggregation pheromone
3blend	(Z)-3-henenyl acetate, linalool, methyl salicylate
2blend	2-phenyl-ethanol, nonanal
Pher+3blend	(S)CPB-I aggregation pheromone, (Z)-3-henenyl acetate, linalool, methyl salicylate
Pher+2blend	(S)CPB-I aggregation pheromone, 2-phenyl-ethanol, nonanal
5blend	2-phenyl-ethanol, nonanal, (Z)-3-henenyl acetate, linalool, methyl salicylate
Pher+5blend	(S)CPB-I aggregation pheromone, 2-phenyl-ethanol, nonanal, (Z)-3-henenyl acetate, linalool, methyl salicylate
Blank	Blank solvent carrier hexane or mineral oil

Results

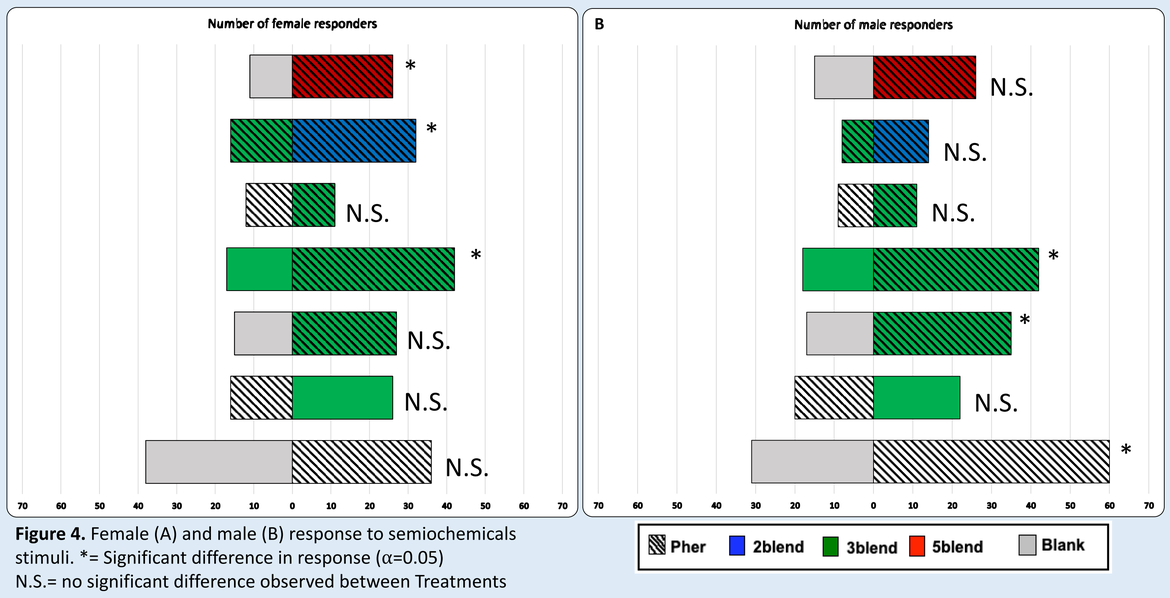

Figure 4. Female (A) and male (B) response to semiochemicals stimuli. *= Significant difference in response (α=0.05)
N.S.= no significant difference observed between Treatments

- More males responded to pheromone over a blank control. No difference was observed in female response to pheromone over the control.
- No difference in response was observed in the choice of 3blend over pheromone alone, for both sexes.
- More males responded to pheromone and the 3blend over a blank control. No difference was observed in female response.
- Both sexes responded more to pheromone and 3blend over the 3blend alone.
- No difference was observed in the choice of pheromone and 3blend over pheromone alone, for both sexes.
- More females responded to the pheromone and 2blend combination over the pheromone and 3blend combination. No difference was observed in male response.
- More females responded to the pheromone and 5blend over a blank control. No difference was observed in male response.

Discussion and Conclusions

- Results support previous research highlighting the potential of CPB host-plant kairomones to increase CPB attractancy when added to the pheromone.
- CPB demonstrated moderate attraction to the (S)-CPB I pheromone and several combinations of host kairomones in laboratory bioassays.
- Sexual differences were observed in response to several treatment combinations.
- There appears to be combinations of pheromone and kairomones that illicit sex-specific responses from CPB adults.
- Further investigation is needed to identify alternative combinations that illicit a monomorphic response from both sexes.
- Future research in this area will involve determination of optimum blend ratios of pheromone to solanaceous compounds, enantiomeric configurations, release rates, and lure densities.
- To develop an economically viable and effective trapping system for CPB in field tomatoes and potatoes, an optimal blend of lure components must be established.
- The results above highlight the potential of (S)-CPB I and host plant kairomones for use in future CPB control programs.
- A CPB lure could be deployed in spring to reduce first generation adult entry to fields as they migrate from overwintering sites in the field perimeter.

Figure 5. CPB adults displaying negative geotactic behavior

References

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University of Guelph
Ontario Agricultural College
School of Environmental Sciences