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Response of Predaceous Checkered Beetles (Coleoptera: Cleridae) to Pheromone Components of Longhorned Beetles

Introduction

Longhorned beetles (Coleoptera: Cerambycidae) are one of the most important pests of natural and managed forest systems. The larvae feed on trees of varying quality from healthy to decomposing. In spite of their economic and ecological importance, the mating systems of these beetles remain poorly understood. The objective of this project was to test the hypothesis that checkered beetles respond to components of known longhorned beetle pheromones. Checkered beetles are members of the family Cleridae and get their common name from their generally red and black patterns and appearance. These beetles are a few mimics of ants, wasps, and other beetles. There are approximately 290 species in North America and they can be predaceous in both the adult and larval stages. Adult females deposit eggs in galleries of wood boring insects. Upon hatching, the larvae follow the gallery, feeding on any insects they encounter. As adults, most are predaceous on other insects feeding either under the bark or on the outer surface of trees. Some species in the subfamily Clerinae have been known to feed on pollen.

Materials and Methods

This experiment was conducted at Purdue University Martell Forest, Tippecanoe Co., IN. This location is a mixed hardwood stand. Pheromone lures constructed of a polyethylene sachets (Bagettes™ model 14770, 5.1 × 7.6 cm, Cousin Corp., Largo, FL) loaded with 25 mg of synthetic pheromone diluted in 1 ml of 95% ethanol, or 1 ml of neat ethanol (negative control). Ethanol is an efficient carrier for these compounds, and at these volumes has little if any activity for cerambycid beetles (e.g., Hanks et al., 2007). Lures were attached to the central opening of black cross-vane flight intercept traps ("Panel Trap," AlphaScents, Portland, OR) that were coated with Fluon® PTFE (AGC Chemicals Americas, Inc., Exton, PA) to enhance trapping efficiency (Graham et al., 2010). Traps were suspended from frames constructed of PVC pipe (see Graham et al., 2010). Bioassays consisted of two transects of 11 traps (10 m apart). Lures used include (*R*)-3-hydroxyhexan-2-one, (*R*)-3-hydroxyoctan-2-one, (2*R*,3*R*)-hexanediol, (2*R*,3*R*)-octanediol, (2*R*,3*S*)-hexanediol, (2*R*,3S)-octanediol, (2*S*,5*E*)-6,10-dimethyl-5,9-undecadien-2-ol (Fuscumol), (*R*)-(–)-(*E*)-6,10-dimethyl-5,9-undecadien-2-yl acetate (Fuscumol acetate), 3,5-dimethyldodecanoic acid (Prionic acid), Undecyloxyethanol, and ethanol as a control. These compounds are known components of pheromones in the various subfamilies of Cerambycidae. To analyze the data a Friedman's Test was run followed by a REGWQ means-separation test. We blocked by date and transect and only included those dates that included two or more beetles caught. This allowed us to correct for dates before and after flight periods of the various beetles.

Results

136 beetles representing 10 species were caught over the span of the experiment. Of the ten species captured *Madonilla dislocatus* was significantly attracted to one of the lures, 3R C8 Ketone (Friedman's $Q_{(10,33)} = 23.3$ $P < 0.01$). There was a significant treatment effect for only one species.

Conclusion

Due to the fact we found significant attraction in at least one beetle, this allows us to run tests in the future to see if *M. dislocates* produces 3R C8 Ketone , which is a known component of a pheromone produced by the members of the subfamily Cerambycinae, or if they may be cuing in on and using lonhorned beetle produced compounds as kairomones. One way to test this is running aerations of *M. dislocatus* and checking for this compound. If not present we can then run bioassays in a Y-tube olfactometer with a known producer of 3R C8 Ketone in one end and *M. dislocatus* in the other.

References

Graham EE, Mitchell RF, Reagel PF, Barbour JD, Millar JG & Hanks LM (2010) Treating panel traps with a fluoropolymer enhances their efficiency in capturing cerambycid beetles. Journal of Economic Entomology 103: 641-647.

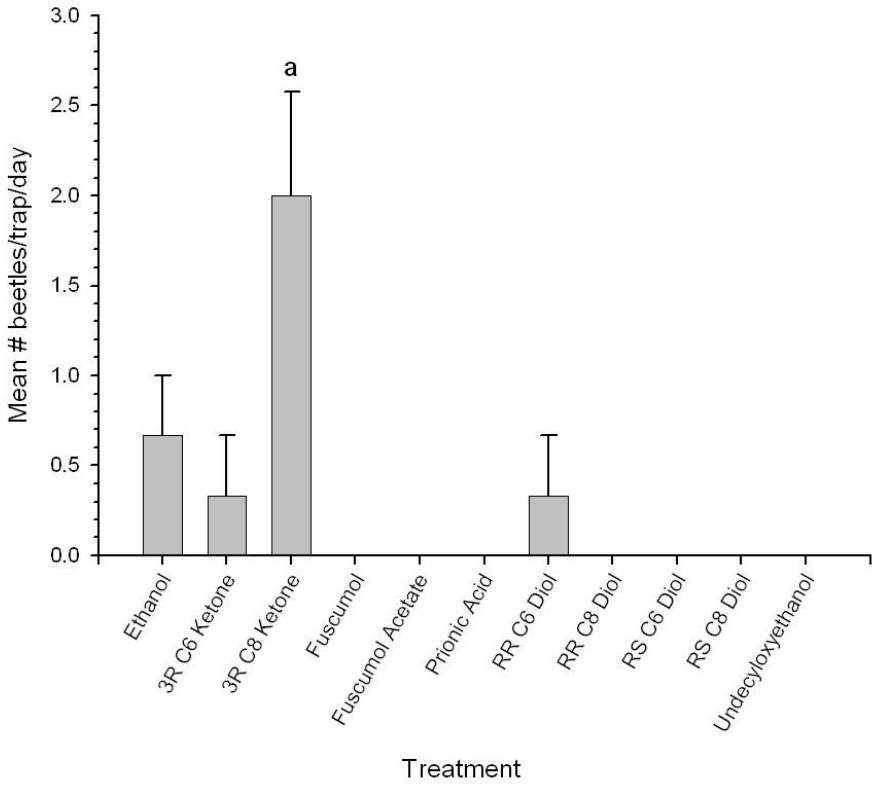
Hanks LM, Millar JG, Moreira JA, Barbour JD, Lacey ES, McElfresh JS, Reuter FR & Ray AM (2007) Using generic pheromone lures to expedite identification of aggregation pheromones for the cerambycid beetles *Xylotrechus nauticus*, *Phymatodes lecontei*, and *Neoclytus modestus modestus*. Journal of Chemical Ecology 33: 889-907.

Figure Legends

Figure 1) Mean (± SE) number of beetles captured (per panel trap) in Purdue University Martell Forest. Traps were baited with 25 mg of synthetic pheromone diluted in 1 ml of 95% ethanol, or ethanol alone (control). Means with different letters within species are significantly different (REGWQ means-separation test, $P < 0.05$).

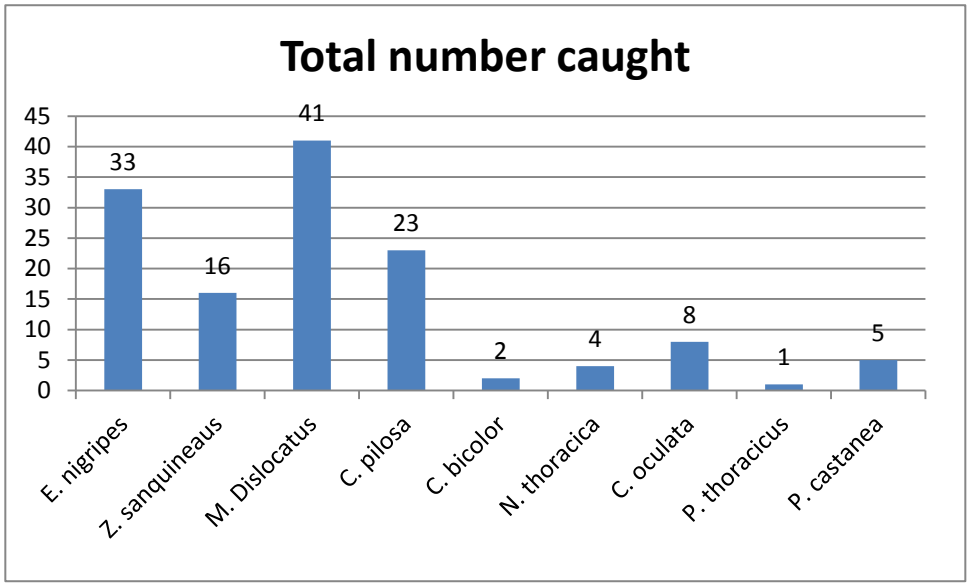
Figure 2) Total number of species caught during length of experiment from May 24th –October 5th, 2010

Figure 1



Friedman's $Q_{(10,33)} = 23.3$ $P < 0.01$

Figure 2


Total number caught
45
40
35
30
25
20
15
10
5
0
33
16
41
23
2
4
8
1
5
E. nigripes
Z. sanquineaus
M. Dislocatus
C. pilosa
C. bicolor
N. thoracica
C. oculata
P. thoracicus
P. castanea