EMERALD ASH BORER: CHEMICAL ECOLOGY AND VISUAL TRAPPING

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ABSTRACT

The emerald ash borer (EAB) (*Agrilus planipennis* Fairmaire (Coleoptera: Buprestidae)) is a serious invasive pest in North America. Previous work by our laboratory group showed that feral EAB males are attracted to potential mates by using visual cues once on a host ash tree. This attraction is not likely to be mediated by volatile compounds, because these feral male EAB will approach and attempt to copulate with dead EAB of both sexes. However, once they have landed on another EAB, males can clearly discriminate between the sexes, spending far more time attempting to mate with females than with males. Washing the dead EAB used as lures for this behavior results in a lowered, intermediate time period of investigation when compared to unwashed female beetles. Investigation of such washed lure EAB of either sex is greater than investigation of unwashed male lure EAB. This evidence suggests the use of a contact chemical cue by feral male EAB to discriminate between male and female conspecifics.

We have undertaken Solid Phase Micro-Extraction (SPME) collections from the cuticle of male and female, freshly eclosed and sexually mature EAB to determine the differences in cuticular chemistry between the sexes. We also performed collections of cuticular compounds by dipping whole adult beetles in solvent and analyzing these solvent washes for the chemicals present. With specific attention to differences in quantity or quality of cuticular compounds between mature males and females and between mature and immature females, we have identified and isolated several compounds of interest from the cuticle of female EAB. These compounds are sex-specific, and in at least one case, show an increase in concentration as the beetle matures.

After synthesizing samples of one of these compounds, we undertook field testing by applying the compound to the cuticle of dead female beetles that had previously been solvent-washed to remove cuticular compounds. We used three concentrations: one representing the approximate of a beetle-equivalent of the compound, another that is one-third of a beetle-equivalent, and a high dose of three beetle equivalents. As controls, both unwashed female beetles and female beetles washed in solvent with only hexane reapplied were tested simultaneously as elicitors of male behavior in the field. Investigation time of unwashed female EAB was high, while female EAB washed only in solvent elicited very short time periods of investigation. The high-dose treatment of three beetle-equivalents elicited time periods of investigation significantly higher than the washed-only control, but significantly lower than unwashed female EAB. Both one beetle-equivalent and one-third beetle-equivalent doses were indistinguishable from washed-only controls in terms of male investigation time; however, all treatments elicited statistically equivalent frequency of male landing behavior, reinforcing the idea that vision dominates long-range mate location in this species.

This work should have great importance in motivating future studies on luring and trapping this beetle using visual and perhaps contact chemical cues. Thus far, a species-specific lure has eluded the EAB research program, and here we report a significant step toward the establishment of a more specific lure for this pest. We have also shown that it is possible to trap emerald ash borers using pinned conspecifics as a lure. It is hoped that combining very high doses of cuticular compounds with the visual lure of dead EAB on a trap may help increase trap efficacy, especially in low density EAB population areas. A prototype trap under development that uses both visual and chemical cues will be tested during the 2008 EAB flight season.