FIELD ATTRACTION OF EMERALD ASH BORER TO ANTENNALLY AND BEHAVIORALLY ACTIVE ASH VOLATILES

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ABSTRACT

Early detection of emerald ash borer (EAB), *Agrilus planipennis* Fairmaire (Coleoptera: Buprestidae), remains a major challenge for regulatory officials due to the delay in onset of visual symptoms of attack. Currently, regulatory and resource management agencies rely on girdled trap trees for statewide survey and detection programs. However, locating suitable detection trees can be difficult, and felling and debarking trees to locate galleries is labor intensive and costly. Development of effective traps and attractants is a high priority for the EAB management program. Understanding EAB host location behavior and attraction to host volatiles can lead to the development of attractive traps and lures. Our objectives were to compare responses of EAB to visual and olfactory cues in host location, identify ash leaf volatiles associated with EAB attraction to different ash species, and test EAB attraction to various ash leaf and bark volatiles in traps in the field.

To compare EAB attraction to visual and olfactory cues associated with host location, we conducted an experiment using live potted ash trees and artificial trees (approximately 1 m tall) in an outdoor arena. Artificial nursery trees were created using 2.5-cm diameter PVC pipe painted taupe for the stem, into which branch and leaf material from an artificial indoor fig tree was inserted. The amount and size of the branch material was similar to the live trees. The outdoor arena was constructed using T-posts set out in two concentric rings (approximately 5 m and 7 m in diameter). Rolled paper (1.5 m wide) was used to encircle the inner ring of T-posts, forming a low "wall." The paper wall was ventilated by cutting holes (approximately 10 cm in diameter) in the paper. Clear plastic sheeting encircled the outer ring of T-posts and extended over the top to create an enclosed arena. Small holes were cut in the plastic sheeting to provide ventilation and prevent over-heating inside the arena. Live and artificial ash trees were set in a ring just inside the paper wall of the arena or between the paper wall and the plastic sheeting for "hidden" trees.

Treatments included: a) live ash nursery tree (visual and olfactory cue), b) artificial ash tree (visual cue only), c) live ash nursery tree hidden behind the ventilated paper wall (olfactory cue only), d) artificial ash tree baited with manuka oil (visual and olfactory cue), and e) the paper wall (control). Manuka oil is a steam distillate from the New Zealand tea tree that has a similar volatile profile as ash bark and has been shown to be attractive to EAB.

We released 100-120 EAB adults at a time in the center of the arena and then recorded the number of beetles on each tree (real or artificial) and on the paper every 20 min for 4 hours. A total of 20 replicates were conducted. We found that significantly more beetles landed on the real trees, exposed or hidden behind the paper, than on the artificial trees with or without the manuka oil. The number of beetles that landed anywhere on the paper wall was not significantly different from the number of beetles that landed on the real trees. However, the numbers were not adjusted for surface area (i.e., there was not adjustment for the surface area of the paper wall, which was much greater than that of the trees). The results indicate that olfactory cues from live ash trees are important in host location by EAB.

To identify particular volatiles that may be associated with host preference by EAB, volatiles were collected from green, white, black, blue, European, and Manchurian ash seedlings. We quantified the amounts of several volatile compounds in the different ash species, including hexanal, *E*-2-hexenal, *E*-2-hexenol, *Z*-3-hexenol, butoxyethanol, *Z*-3-hexenyl acetate, hexenyl acetate, *E*- -ocimene, nonanal/linalool, nonatriene, and *Z*-*E*- -farnasene. The amounts and proportions of the different volatile compounds varied by ash species. For instance, *Z*-3-hexenol was present in significantly higher quantities in European ash than in any of the other ash species, while *Z*-3-hexenyl acetate was significantly less prevalent in green ash than in any of the other ash species. Differences in volatile profiles between the ash species may be related to differences in preference of EAB for different species of ash. The results may lead t

We conducted several field trapping experiments comparing EAB attraction to three-sided purple "prism" traps baited with various ash volatiles. Overall, we found that traps baited with a blend of green leaf volatiles, including hexanol, *E*-2-hexenol, and *Z*-3-hexenol, captured significantly more EAB than unbaited traps. Traps baited with *Z*-3-hexenol at a high or low release rate captured significantly more EAB males than unbaited control traps; however, the number of EAB captured in traps baited with low or high release rates of *E*-2-hexenal was the same as that for control traps. Several individual compounds present in ash that have been found to have behavioral activity in other forest insects were also tested. None of these compounds, including chalcogran, myrtenol, nonanal, octenol, pityol, verbenone, *exo*-brevicomin, heptanol, phenyl ethanol, or *trans*-conophthorin, captured more EAB than unbaited control traps. However, traps baited with manuka oil or a four-component leaf blend comprised of hexanal, hexanol, *E*-2-hexenal, and *Z*-3-hexenol, captured significantly more EAB than unbaited control traps. To date, the most promising lures for EAB are manuka oil and a blend of green leaf volatiles.