DOUBLE-DECKERS AND TOWERS: EMERALD ASH BORER TRAPS IN 2007

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ABSTRACT

Effective and efficient methods to detect and monitor emerald ash borer (EAB), *Agrilus planipennis* Fairmaire, have been a high priority for scientists since this invasive pest was identified in 2002. In 2006, our objectives included development of a practical trap design suitable for operational programs and evaluation of lures. In 2007, we continued this work and assessed additional trap designs. Here we briefly review results from 2006 and present data from our 2007 research.

In 2006, we designed a multi-component "double-decker" trap that incorporates both visual factors and olfaction. The double-decker trap consists of two of the purple plastic panel traps used by USDA APHIS. Panels are attached at 6 feet and 10 feet to a 10-foot-tall purple PVC pipe 4 inches in diameter. The pipe slides over the top of a t-post pounded into the ground (4-5 feet tall). No additional support is required. The three-sides of each panel trap are coated with clear Pestick and checked weekly from late May through August to collect EAB adults.

Visual factors integrated in the trap include a tall, vertical silhouette similar to that of a tree and the color purple, which has consistently been shown in numerous studies to attract EAB. In addition, the traps are set in the open, at least 10 m from the edge of a wooded area. This placement ensures that traps are highly visible to beetles and that the traps are exposed to full sun for all or nearly all of the day. Our observations of beetle activity plus data from previous studies have consistently shown that adult EAB are more active in sunny conditions than in the shade. For example, in a previous trap tree study, an average of 31 beetles per tree were captured on sticky bands on ash trees fully exposed to sun compared to less than three beetles per tree on ash trees in the same stand but growing under shade. Moreover, placing traps in the open away from nearby trees reduces potential competition between our lures and volatiles emitted by adjacent ash trees with varying but unknown levels of stress.

Like other buprestids, EAB are not known to use long-range pheromones. Lures for EAB are comprised of compounds associated with foliage or bark/wood from stressed ash trees. Placing traps in full sun and away from the edge of wooded areas provides a highly visible physical target for EAB beetles that is associated with a relatively unique volatile plume unlikely to be overwhelmed by those of nearby ash trees.

We initially tested the double-decker trap design in 2006 at six sites where EAB density ranged from moderate to low. Lures evaluated in 2006 included a four-component leaf blend lure (*cis*-3-hexanol, trans-2-hexanol, trans-2-hexanal, hexanal) (Poland et al. 2006) and Manuka oil, a commercially available product chemically similar to ash bark/wood volatiles (Poland and McCullough 2007, Crook et al. 2007). We also applied rough texture to some of the panels to simulate rough bark. Previous studies have shown EAB density is generally higher on ash trees with rough bark than on adjacent smooth-barked trees (Anulewicz et al. 2007a, 2007b). Five to ten randomized blocks were established at each site and checked weekly. We calculated the average number of EAB captured per trap on traps with all three baits (leaf blend lure, Manuka oil, and texture), with the leaf blend + texture, Manuka oil + texture, and with the leaf blend + Manuka oil. More than 4,060 EAB were collected from the 40 blocks of traps in 2006. Results showed that the leaf blend lure and the leaf blend lure plus Manuka oil caught significantly more EAB than traps with Manuka oil alone. Texture did not affect trap catch (see Poland and McCullough 2007).

In 2007, we again used the double-decker traps, leaf blend lure, and Manuka oil; however, we also evaluated a tower trap design, a single-panel trap design, and crude extracts of ash foliage and of bark/wood as lures. The tower trap consisted of two purple panels, 16 and 20-foot-high, on a 20-foot-tall purple PVC pipe braced against a t-post and supported by guy wires. Single panel traps were suspended from rebar poles 5 to 6 feet high. On June 7, we baited some traps with a crude extract made from foliage collected from ash trees girdled in May 2006. This extract was replaced on July 2 with an extract made from foliage of trees girdled in May 2007. A crude extract of ash wood/bark removed from the trees girdled in May 2007 was also added to traps in early July.

Using a randomized block design, we monitored EAB attraction to five different trap/lure combinations, including 1) an unbaited double-decker trap; 2) a double-decker with leaf blend and Manuka lures; 3) a double-decker with leaf blend, Manuka oil and crude extracts; 4) a tower trap with leaf blend, Manuka oil, and crude extracts; and 5) a single-panel trap suspended from a 4-foot-tall rebar with leaf blend, Manuka oil and crude extracts. A total of 31 blocks were established at eight sites; EAB densities were moderate at one site and low or very low at six sites. At one site, in Michigan State University's W.K. Kellogg Forest, EAB was not known to be present.

We collected a total of 4,172 EAB from the 155 traps used in 2007. Activity of EAB peaked in mid- to late June, roughly 1 to 2 weeks earlier than in previous years. We captured 80% of the beetles between June 15 and June 28, which corresponded to roughly 780 to 1,040 accumulated degree-days (base 50° F).

The double-decker traps baited with the leaf blend and Manuka oil lures captured significantly more EAB than any of the other trap/lure combinations. On average, double-decker traps that included the leaf blend lure and Manuka oil captured 39 to 46 EAB per trap. In comparison, the tower traps, unbaited double-decker traps, and baited single panels captured ≤ 20 EAB per trap on average. The crude extracts did not significantly increase EAB capture. There was little difference in EAB capture between the upper and lower panels of any of the traps. Average EAB capture was similar among the single panel traps, the lower panels of unbaited double-decker traps, and individual panels on the tower traps. Individual panels on the baited double-decker traps, however, captured significantly more EAB per panel than individual panels on any of the other traps.

At the Kellogg Forest site, where EAB was not known to be established, a baited double-decker trap captured four EAB. This represents the first recorded "detection event" of EAB with traps and lures at this site. Two girdled trap trees roughly 150 m away from this trap were felled, debarked, and found to be uninfested.

In addition, at another site, one block of traps were installed on a slight rise 300 m away from the nearest ash tree. Despite this distance, we collected a total of 67 EAB on the two baited double-decker traps (one with and one without crude extracts), 25 EAB on the tower trap, 15 EAB on the unbaited double-decker trap, and three EAB on the single panel trap. These results show that the traps effectively attracted dispersing EAB from at least 300 m away.

In summary, our 2007 results demonstrate that trap catch is enhanced by both visual and olfactory elements. The double-decker traps (positioned in full sun) baited with the four-component leaf blend lure and Manuka oil detected EAB in very-low-density settings and attracted EAB from roughly 300 m away. Some operational issues should be considered if traps are to be used programmatically for EAB detection or monitoring. Pestick was re-applied to several traps following heavy rains and occasionally when an accumulation of flies or other insects obscured a panel and had to be scraped off. We noticed that EAB occasionally fell off the panels, especially after rains. Checking traps at two-week intervals may be desirable during peak EAB activity periods if resources permit.

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