TOWARD THE DEVELOPMENT OF SURVEY TRAPPING TECHNOLOGY FOR THE EMERALD ASH BORER

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ABSTRACT

Improved survey tools are essential for accurately delimiting the infestation of emerald ash borer (EAB), *Agrilus planipennis* Fairmaire (Coleoptera: Buprestidae) and for detecting new infestations. Current survey methods including visual surveys for damage, girdled trap trees, and trunk dissections are less than ideal because newly infested trees typically do not display external symptoms and trap trees and trunk dissections are destructive and labor intensive. Here we present a summary of research conducted by scientists from several organizations on the development of efficacious trapping techniques for *A. planipennis*. Studies included the identification of host attractants and testing responses by *A. planipennis* in the laboratory, field trapping experiments evaluating different trap designs and baits, and trap tree studies comparing girdling, baiting, and different colored bands.

Ash leaf extracts were prepared and volatiles were collected from girdled and healthy ash trees. Volatile components were screened for *A. planipennis* antennal activity using coupled gas chromatographic electro-antennal detection (GC-(GC-EAD) in the USDA APHIS and CFS laboratories. Several antenally-active compounds were identified. Volatile compounds were tested using *A. planipennis* adults in a two-choice walking olfactomter bioassay in the USDA Forest Service laboratory. Significant attractive responses were found to green ash leaf extract, nonanal, pentadecane, trans-2-hexenol, and trans-caryophyllene.

Field trapping experiments conducted by USDA APHIS and Tennessee State University compared different colors, trap designs, and trap placement. A four panel 'hanging box' design made of corrugated plastic coated with Pestick insect glue was used to test four colors simultaneously. Colors tested included black, yellow, white, purple, red, green, navy and silver. More beetles were caught on purple traps than any other color. In another study 19 colors were tested including colors produced by the plastic manufacturer, purple-colored glue, glue containing small green or purple metallic objects, metallic foils, and paints reflecting in the 400-450 nm range. Purple-colored glue caught the most beetles followed by glue mixed

with green glitter, and the manufacturer's purple. In the trap design experiment, several sizes, shapes and colors were tested. Most traps were made from purple or black corrugated plastic covered in Pestick insect glue. The Lindgren funnel trap and IPM Tech Intercept Panel trap (both black-colored), a new purple-colored elm bark beetle trap placed around a host tree, and girdled trap trees were also tested. Girdled trap trees were significantly more attractive than any of the trap designs. The purple elm bark beetle traps placed around host trees were more attractive than any other trap design except for the large purple panel 'prototype' traps. Traps with larger surface areas were the most effective. The Lindgren funnel trap, the IPM Tech Panel trap and another black-colored corrugated plastic trap caught no EAB. To test trap location, traps composed of two Pestick-coated purple corrugated plastic strips were placed along the edge of a woodlot, 25 m into the woods, or 25 m from the woodlot in an open field. On two dates, the number of beetles captured was significantly greater on traps located along the forest edge compared to traps in the open field or woods. No beetles were captured on traps in the woods. In a field trapping experiment conducted by University of Guelph traps that employed various patterns of purple and magenta were compared including stripes, ovals and metallic ovals. There was a slight discrimination between different patterns with magenta and green patterns being more attractive than magenta alone or green alone; striped patterns catured more beetles than oval patterns; and metallic ovals were more attractive than nonmetallic ovals. The USDA Forest Service, CFS, and MSU compared baited and unbaited traps and traps of different shapes. Purple panel 'prototype' traps baited with a blend of host volatiles (α-humulene, pentadecane, *trans*-3-hexenol, and *trans*-caryophyllene) captured significantly more beetles than traps baited with individual compounds. Cross vane, triangular, and flat purple corrugated plastic traps baited with a blend of host volatiles (hexanal, *trans*-2-hexenol, and *cis*-3-hexenol) captured significantly more beetles than unbaited traps.

Several trap tree studies were conducted by USDA APHIS, USDA FS, MSU, University of Guelph, and CFS comparing girdled or healthy trap trees with different colored bands. Colored bands did not increase attraction to trap trees in any of the studies. USDA APHIS and Tennessee State University tested attraction of *A. planipennis* to green ash nursery trees of three varieties ('cimmaron', 'patmore', and 'urbanite') that were injured by crown decapitation, trunk scraping, root pruning, or girdling. The number of beetles captured did not differ significantly between treatments but there was a trend toward higher catches on girdle and trunk-scraped trees and on the 'urbanite' variety. A trap tree study conducted by CFS found that open-grown trap trees captured significantly more *A. planipennis* than trap trees located in a closed canopy stand. The number of beetles captured on trap trees along the edge of a stand was intermediate. The USDA FS and MSU compared healthy trap trees and trap trees that were girdled by removing a 6"-wide band of bark, wounded by removing a vertical strip of bark with the same dimensions as the horizontal girdle, or stressed by spraying the bark of the lower 1.5-m section of the bole to run-off with the herbicide, Garlon-4. Significantly more *A. planipennis* adults were captured on the trees stressed with herbicide than the healthy trap trees. Captures on girdled trees or trees with a vertical wound were intermediate. Trap trees were felled and completely peeled during the fall. The density of larval galleries was significantly higher in girdled trees compared to healthy trees or trees stressed with herbicide. The number captured on trees with vertical wounds was intermediate. Although trees stressed with herbicide captured more adults and appeared to be more attractive initially, they died very quickly, and thus may not have been suitable for subsequent attacks and larval development. Overall, girdled trap trees are currently the most effective survey tool; however, *A. planipennis* is attracted to some ash volatiles and the color purple. A combination using a large purple-colored sillouhette, baited with an optimal host volatile blend and optimal trap placement, may lead to the development of new survey tools.