

STUDIES ON MICROBIAL INSECTICIDES FOR SUPPRESSION OF EMERALD ASH BORER POPULATIONS

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Abstract

Programs designed by regulatory agencies to eradicate localized infestations of emerald ash borer (EAB), *Agrilus planipennis*, involve detection and removal of infested ash trees (*Fraxinus* spp.) and creation of an ash-free zone surrounding the epicenter. Conventional insecticides are being tested to aid in the eradication effort and to protect landscape ash trees, however, the use of such products is not an option in Michigan due to the extensive area infested by EAB, legal issues, and lack of public support. Due to the difficulty in identifying infested trees and the high rate of EAB movement, this invasive buprestid is likely to continue spreading in forests and parks throughout Michigan, resulting in rapid decline and death of the millions of ash trees in this region and beyond. Clearly, methods are needed to manage EAB in North America. To this end, we are studying the efficacy of biopesticides formulated with isolates of *Bacillus thuringiensis* (Bt) and a product formulated with *Beauveria bassiana* var. GHA (Bb). Public acceptance remains high for the use of biopesticides due to good safety records and compatibility with other management strategies, including biological control.

In 2003, we screened EAB adults with four registered Bt biopesticides, each with different Bt strains and host ranges. Mortality was observed for each product, but only at concentrations exceeding the maximum labeled rate. We are now cooperating with other Bt researchers to screen isolates and fractions of Bt for activity against EAB with the long term goal of developing a new Bt-based insecticide targeting EAB.

Beauveria bassiana var. GHA is the active ingredient of the biopesticide, BotaniGard®, registered for control of insect pests of forest and shade trees in 1999. We

are evaluating the potential use of BotaniGard for suppression of EAB populations by homeowners and land managers. The two formulations of this product, BotaniGard ES (petroleum based) and BotaniGard O (vegetable oil) were equally virulent against EAB adults with LC₅₀s of 4.9 and 4.7 spores/cm², respectively; LT₅₀s ranged from 4 to 10 days, depending on spore concentration. Laboratory and greenhouse studies showed that pre-emergent trunk sprays of BotaniGard were a promising method for control of EAB. In spring 2003, we applied BotaniGard to EAB-infested tree trunks prior to beetle emergence at the rate of 2 and 20 qts BotaniGard/acre in a plantation of 20-yr-old ash trees in Ann Arbor. The trunks of treated and control trees were then caged, enclosing some epicormic shoots, and EAB were allowed to complete their life cycle within the cage. After death, EAB were cultured for fungal infection; at 0, 2, and 20 qts/acre, prevalence of *B. bassiana* infection among adults was 0%, 58.5%, and 83.0%, respectively. The maximum-labeled rate for BotaniGard is 17 qts/acre. In Oct 2003, we sprayed EAB-infested ash trees with 14 qts BotaniGard/acre to evaluate the impact on larvae inside infested ash tree trunks. These trees had visible cracks in the bark over EAB galleries, and we presumed BotaniGard may penetrate into the larval galleries via these bark cracks. In the winter, after tree dissection, we determined 10-20% of the larvae were infected with *B. bassiana*; no EAB larvae were infected in the controls. It is possible that higher levels of infection might be achieved if BotaniGard is applied to cracked tree trunks earlier in the fall, prior to EAB entering the sapwood to overwinter. In 2004, we plan to evaluate the application of BotaniGard over larger areas in the field and with foliar treatments.