UPDATE ON EAB BIOCONTROL: RELEASE AND RECOVERY OF *SPATHIUS AGRILI* AND DISCOVERY OF NEW POTENTIAL BIOCONTROL AGENTS IN ASIA

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ABSTRACT

Spathius agrili is a gregarious, idiobiont parasitoid that was discovered attacking the emerald ash borer (EAB) in Tianjin City, China. Parasitism rates ranged from 30 to 90 percent on velvet ash, which is native to the southwestern United States. *Spathius agrili* females find their hosts by listening for the sound of feeding larvae. They insert their ovipositor through the bark, paralyze the EAB larva, and deposit up to 20 eggs. The parasitoid larvae develop outside the EAB larva, spin cocoons, and emerging adults chew through the bark to emerge. This parasitoid can develop through three generations per year compared to one for the EAB host. *Spathius agrili* is well synchronized with the occurrence of its favored host stage, late instar larvae. Adult *S. agrili* emerge 1 ½ to 2 months after emergence of EAB adults, allowing time for EAB to develop to the appropriate stage.

Rearing *S. agrili* presents a challenge because the larvae must be hidden and feeding or they will not be attacked. We solved this problem by drilling a chamber in the outside of an ash stick, inserting an EAB larva, and wrapping the stick with floral tape. Host specificity testing discovered that *S. agrili* attacked significantly more EAB than nontarget hosts in no-choice tests. In olfactometer tests, *S. agrili* was attracted to ash and to a lesser extent willow and Chinese prickly ash, but not to any other plants tested. In the laboratory, *S. agrili* lays significantly more eggs when the chamber is filled with ash foliage to stimulate oviposition. These and other data were submitted for public comment, and in July of 2007 a permit was issued for field release of *S. agrili*.

More than 300 female parasitoids were released at three sites in Michigan starting in August 2007. In March 2008, four trees were cut at the release location at all three sites. One-half of each tree was peeled and the other half was placed in paper tubes to collect emerging parasitoids. We found that 18 percent of the EAB at the Oakland, MI, site were parasitized by a gregarious braconid, which upon adult emergence was determined to be *S. agrili*. From this we can conclude that *S. agrili* was able to reproduce and overwinter in southern Michigan. In September 2008 we cut down 10 trees at each of 30, 60, 90, and 120 m from the release point to determine if *S. agrili* had continued to reproduce at that site. Half of each tree was peeled and half were put in emergence tubes. Unfortunately, we saw no sign of *S. agrili*—not even old galleries from 2007.

In 2008, 300 female *S. agrili* were released at seven sites in Michigan and Ohio. Establishment and impact evaluation protocols were standardized with U.S. Forest Service and Agricultural Research Service scientists so that comparisons can be made among the three parasitoid species being released. Four trees were cut at each release site in December 2008; it is too early to determine if *S. agrili* will emerge. A rearing facility dedicated to rearing EAB parasitoids is up and running in Brighton, MI. The goal is to rear large numbers of parasitoids in this facility for release in 2009 and beyond.

Foreign exploration is continuing with an emphasis on finding natural enemies that attack EAB in colder climates and where the host is found at low population density. In China, trees were girdled at 10 locations where EAB is present but rare. In addition to *Tetrastichus planipennis*, two insects were found associated with EAB overwintering galleries. One is probably a clerid beetle, and we are rearing the other species to the adult stage for positive identification. In Korea, several new species were discovered: *Teneroides maculicollis* (Cleridae), *Tetrastichus telon* (Eulophidae), and an unidentified *Spathius* that is not *S. agrili*. In Russia, cooperators recovered *Spathius depressithorax* and an as yet unidentified *Tetrastichus*. The goal for 2009 is to start colonies of many of these insects and study their biology and host interactions to evaluate them for release.