

Title: Classical Biological Control of Emerald Ash Borer and Asian Longhorned Beetle

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Technical Abstract: The emerald ash borer, *Agrilus planipennis* Fairmaire, and Asian longhorned beetle, *Anoplophora glabripennis* (Motschulsky), are both invasive plant pests recently introduced to North America from the Far East. The emerald ash borer (EAB) is an oligophagous buprestid on *Fraxinus* spp., whereas the Asian longhorned beetle (ALB) is a polyphagous, cerambycid attacking various hardwoods, though it prefers maples, poplars and willows. Classical biological control is indicated for the following reasons: both species arrived in North America without their habitual natural enemies and appear to be minor pests in the Far East, at least in natural settings, where they are known to be attacked by natural enemies. Parasitism of EAB by native parasitoids in MI is too low (<1%) to suppress EAB populations. Limited ALB samples from NY and IL indicate that parasitism by native parasitoids is likewise low. Therefore, studies on natural enemies of both species have been conducted in the Far East. Explorations for natural enemies of EAB have been conducted on a limited basis in Japan, Russia and Mongolia, but more extensively in South Korea, and China. To date, the most promising natural enemies of EAB found are from China and include (1) the solitary parthenogenetic egg parasitoid, *Oobius agrili* (Zhang and Huang) (Hymenoptera: Encyrtidae), (2) the gregarious larval ectoparasitoid, *Spathius agrili* (Yang) (Hymenoptera: Braconidae), and (3) the gregarious larval endoparasitoid, *Tetrastichus* sp. (Hymenoptera: Eulophidae). These species have a number of characteristics that increase the likelihood of success as biological control agents such as female-biased sex ratio and > 1 generation per host generation. Data on the host range of these parasitoids are being

collected. Studies on natural enemies of ALB and its congener, *A. chinensis* (Förster), have been conducted in China. Two species from China, both gregarious larval ectoparasitoids, have been studied in depth; *Sclerodermus guani* Xiao and Wu (Hymenoptera: Bethyridae) and *Dastarcus helophoroides* Fairmaire (Coleoptera: Colydiidae). Both parasitoids can be mass-reared and released in large numbers, but are known to attack other cerambycids. It remains to be seen whether natural enemies with a narrow host range attack ALB in Asia. Field exposures of laboratory reared ALB and *A. chinensis* were made near the latter species; initial point of introduction in Italy. One gregarious egg parasitoid *Aprostocetus anoplophorae* Delvare (Hymenoptera: Eulophidae), very likely originating from eastern Asia, was recovered from *A. chinensis* eggs but not from ALB. Six larval ectoparasitoids, *Spathius erythrocephalus* Wesmäl (Hymenoptera: Braconidae), *Eurytoma melanoneura* Walker (Hymenoptera: Eurytomidae), *Calosota vernalis* Curtis (Hymenoptera: Eupelmidae), *Cleonymus brevis* Boucek and *Trigonoderus princeps* (Westwood) (Hymenoptera: Pteromalidae), and *Sclerodermus* sp. (Hymenoptera: Bethyridae) were recovered from 1st/2nd instars of *A. chinensis*. Five of the latter larval parasitoids (*C. vernalis* excepted) also attacked *A. glabripennis* in the same area. Host range studies to determine if exotic parasitoids of EAB and ALB will attack beetles native to North America are in progress or planned at U.S. laboratories.