

ANOPLOPHORA GLABRIPENNIS (MOTSCHULSKY):

FIELD BEHAVIOR AND NATURAL ENEMIES IN CHINA

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ABSTRACT

Development of management strategies for control of *A. glabripennis*, including eradication, biological control, bait trees, breeding and improved silvicultural practices, all require a fundamental understanding of its biology, behavior and ecology. *A. glabripennis* has been studied for at least the past four decades in China, during which time much has been published on its biology and its control, primarily with insecticides. While in-depth investigations of its host plant range are limited, some progress has been made in the areas of bait trees, host plant resistance and breeding, particularly within *Populus* species. However, very little is known about *A. glabripennis* behavior, ecology and host-plant interactions (i.e. preference). In regard to the natural enemies of *A. glabripennis*, only a few species have been identified. Furthermore, no systematic exploration for their natural enemies has been conducted, and investigations of their fundamental biology, behavior, ecology and efficacy are lacking. Therefore, in an effort to take a proactive approach towards the development of biological control of *A. glabripennis*, as well as to provide basic information on *A. glabripennis* which is essential for the other management strategies, investigations of its behavior and natural enemies in China were collectively undertaken during 1998.

Behavioral investigations of *A. glabripennis* were initiated in Hebei, Gansu and Ningxia Provinces of China. While such studies are needed at several ecological levels, i.e. within-tree, among tree and among infestation, as well as in different habitats (i.e. windrows, plantations, forests), emphasis was placed on the within-tree behavior of male and female adult beetles. The primary behaviors under consideration were adult feeding, courtship and mating, and oviposition. While the data collected to date are both descriptive and quantitative, they are preliminary in nature, and therefore require further replication. However, these studies will be expanded to include larval feeding behavior and adult emergence, both of which may play key roles in natural enemy efficacy (i.e. search behavior and ecological synchronicity). Investigations of *A.*

glabripennis dispersal among trees, also initiated in 1998, will be intensified. As such, the temporal and spatial aspects of tree colonization are being elucidated.

The natural enemies of *Anoplophora* in China and Japan reported to date are within the Eulophidae (egg parasitoid), Colydiidae (larval parasitoid) and Braconidae (larval parasitoid). Additionally, the natural enemies of other cerambycids in China and Japan are within the Encyrtidae (egg parasitoid), Bethyidae (larval parasitoid) and Ichneumonidae (larval parasitoid). However, given both the limited number of known natural enemies of *Anoplophora*, and the lack of detailed knowledge on these few known species, investigations of natural enemies for biological control of *A. glabripennis*, as well as other *Anoplophora* species, will include identified natural enemies of other cerambycid species which are native to Asia and the U.S. However, as efforts will focus on those species with the greatest probability of providing biological control of *Anoplophora*, selection of these natural enemies will be prioritized according to the relatedness of the respective cerambycid hosts to *Anoplophora* at three levels: (1) phylogenetic relatedness; (2) ecological relatedness; and (3) behavioral relatedness. Certain aspects of each of these likely play a major role in determining the potential efficacy of a given natural enemy to control *A. glabripennis*, as well as other *Anoplophora* species. The specific objectives of this research will be: (1) to explore, collect, identify and characterize natural enemies and other biological control agents of *Anoplophora* species and other similar cerambycid species in China and the U.S., respectively, including investigations of host-parasitoid/predator relationships, host specificity, host-finding cues, dispersal behavior, and bioecological studies; (2) to determine the potential non-target impacts of the promising natural enemies; (3) to develop mass rearing methodology for the most promising natural enemies; and (4) to release and evaluate the most promising natural enemies, including investigations of both inoculative releases and the classical biological control approach.

In closing, as little or nothing is known about the biology, behavior and ecology of *A. glabripennis* within the U.S., reciprocal investigations to those discussed above for China are sorely needed.