Biological Control of Japanese Beetle in Michigan and the North Central United States: A GREEEN Project

David Smitley and David Cappaert
Department of Entomology

Cooperators: W. C. Kaufman APHIS PPQ Niles Biocontrol Lab,Michigan Department of Agriculture, Catherine Mannion (Tennessee State University), John Tanner (USDA APHIS Otis AFB, MA), Leah Bauer (MSU, USDA Forest Service), H. Y. Choo (Gyeon Gsang, South Korea).

Introduction: Japanese beetle (*Popillia japonica* Newman) is a costly pest for the nursery, landscape and turf industries in Michigan. It is damaging to nursery growers because a federal quarantine prevents shipment of nursery stock from infested states to non-infested states unless it is certified as free of Japanese beetle. For landscapers and arborists, adult Japanese beetles may be the most serious tree and shrub pest in southern Michigan, frequently defoliating lindens, sycamores, Japanese maple, birch, chestnut, horsechestnut, black walnut, sassafras, hibiscus, crabapple, ornamental cherries, roses, mountain ash, pussy willow, American elm, and Virginia creeper. In some areas, insecticide applications must be repeated frequently to maintain foliage on infested plants. Japanese beetle larvae are also the most damaging pests of golf courses in Michigan. Adults are attracted to moist turf where they prefer to lay their eggs. The larvae feed on turf roots, sometimes causing extensive damage. Costly insecticides are applied to prevent turf injury. Recreational turf, industrial turf, home lawns and sod farms also may be damaged from Japanese beetle larvae.

Project Goal: Reduce the pest status of Japanese beetle in Michigan, and ultimately in the North Central United States through introduction of natural enemies.

Objective 1: Introduce *Tiphia vernalis* , a wasp parasite of Japanese beetle larvae, into Michigan, monitor its spread, and determine impact on local populations of Japanese beetle. *Tiphia vernalis* is already established in several eastern states, including Tennessee, where it is believed to be helpful in limiting populations of Japanese beetle. *Tiphia vernalis* is not known to be established in Michigan at this time. The adult female *Tiphia vernalis* wasp crawls into the soil to find Japanese beetle larvae and deposits one egg on each grub. The *Tiphia* egg hatches into a larva that feeds externally on the Japanese beetle grub until it is nearly as large as the grub is, at which time the grub dies.

Objective 2: Introduce *Istocheta sp.* , a fly parasite of adult Japanese beetles, into Michigan, monitor its spread, and determine its impact on local Japanese beetle populations. *Istocheta* was introduced into several eastern states from Japan. It is now well established in those states. It has not yet been introduced into Michigan. The Istocheta fly lays its egg on the back of the adult Japanese beetle. The fly larva tunnels into the Japanese beetle soon after it hatches, where it feeds inside of the Japanese beetle causing death in 1-2 weeks.

Objective 3: Introduce *Ovavesicula,* a microsporidian pathogen of Japanese beetle, to Michigan, monitor its spread, and determine its impact on local Japanese beetle populations. *Ovavesicula* was found in 25-75% of the Japanese beetles collected in Connecticut. It is believed to substantially reduce the fecundity of females. *Ovavesicula* has not yet been reported from Michigan.

Objective 4: Collect adults and larvae of *Popillia uchidai* Niijimi in Korea to find parasites and pathogens for introduction into the United States. These two species are so closely related to *Popillia japonica* that they are difficult to distinguish. Previous collections of parasites have been from Japan. Collecting in Korea will be increase the probability of finding parasites that will successfully establish in Michigan and the north central states because Korea has a climate similar to Michigan.

Results as of August 11, 1999

1. Study sites identified. Over 50 potential sites were sampled for Japanese beetle grubs this spring. Sites were sampled where Japanese beetle was reported to be abundant in previous years. At each location 30 to 100 golf course cup-cutter samples were taken. Grubs were counted and the most heavily infested areas were identified (on golf courses only rough was sampled). At about half of these sites Japanese beetle grubs were absent or very difficult to find. Sites with the most grubs were selected and paired geographically, so that one site of each pair will be an introduction site and the other a control site. Golf courses tended to support the highest number of grubs. The following sites have been identified:

County	Location	Peak grubs (per sq ft)
Macomb	Cracklewood	5.4
Macomb	Pine Valley	8.0
Oakland	Rochester Hills	3.1
Oakland	Pine Lake	2.3
Kalamazoo	Eastern Hills	3.1
Kalamazoo	Kalamazoo C.C.	1.6
Calhoun	Medalist	5.2
Calhoun	Binder Park	3.2
Wayne	Willow Golf Course	4.0
Monroe	Police Station	2.7
Oakland	Bloomfield Hills C.C.	7.3
Oakland	Orchard Lake C.C.	6.5

2. The parasitic wasp: *Tiphia vernalis.* *Tiphia vernalis* has not been found at any location in Michigan so far and thus remains a good candidate for introduction. Adult wasps will be collected next spring and introduced at half of the research sites.

The parasitic fly: *Istocheta.* Over an average of 1,000 beetles were examined from each location and no *Istocheta* eggs were found on adult Japanese beetles. Approximately 400 adult beetles infested with Istocheta were collected in Massachusetts and shipped to Michigan for introduction as eggs on live adult Japanese beetles. The *Istocheta* were introduced at 3 locations. More *Istocheta* will be introduced next year.

3. The pathogen: *Ovavesicula.* *Ovavesicula* was not found in larvae collected This spring from any of our research sites. However, *Ovavesicula* was found in at least one location in adult Japanese beetles. *Ovavesicula* will be introduced at half of the research sites, unless it is already present. If it is still rare and localized in Michigan we will attempt to determine if locations with *Ovavesicula* tend to have lower populations of Japanese beetle than locations without it.

4. Korea: the search continues. Dr. Choo has found *Popillia* grubs infected with milky disease in Korea. He will be sending slides with a film of spores to Dr. Mike Klein in Ohio for evaluation of virulence. If virulent isolates are found, they could be introduced quickly, because *Bacillus popilliae* is already present here.