ENTOMOLOGY RESEARCH REPORT 2000

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I. Investigating the causes of outbreaks of white grubs on golf course fairways (Breanna Simmons and Young-Ki Jo).

We have been using the black turfgrass ataenius, *Ataenius spretulus*, to investigate why white grubs are so abundant in golf course fairways. The factors causing outbreaks of ataenius may also cause problems with Japanese beetle grubs and other insects in golf course fairways. From our research we have developed the following model:

> ***Turf mowed at rough height supports a greater abundance and diversity of small arthropods that in turn support more predatory insects. The abundance of predators (spiders, rove beetles, ground beetles and ants) in the rough keep Ataenius, Aphodius and other turf insect pests under control, while the relative scarcity of predators in the fairway allows turf pests to escape with little affect from predation.***

Previous research supporting this model is outlined in the 1999 Entomology Research Report in the 70th Annual Michigan Turfgrass Conference Proceedings (Vol. 29). In 1999 and 2000 we added some new pieces to help solve the puzzle of why more turf pests are found in fairways than roughs. Breanna Simmons found some important differences between soil arthropod communities in the fairway and rough at Groesbeck Golf Course in Lansing. Soil cores were pulled once per week and placed in a Berlese Funnel to extract small arthropods. Springtails were more than twice as abundant in the rough (3,078) compared with the fairway (1,364), and soil mites were more than 3-fold more abundant in the rough (3,636) compared with the fairway (1,156). These results support our model that predators are more abundant in the rough because the small arthropods that they eat are more abundant in the rough. Breanna also found more Japanese beetle larvae in the fairway compared with the rough. No insecticides had been used on this fairway or rough for five years. At the Hancock Turf Research Center, Young-Ki Jo worked-out experimental methods for studying the relative rate of predation in the fairway and rough. He placed *Ataenius* larvae in cup-cutter soil cores. The cores were sealed around the sides with burlap. After one week, about 70% of the larvae were recovered from soil cores in the fairway compared with 50% in the rough, suggesting a higher rate of predation in the rough. Young-Ki also devised a laboratory experiment with turf cores to determine if the *Ataenius* beetles preferred moist or dry turf. Clearly, the beetles preferred the moist turf. Finally, *Ataenius* larvae or eggs were confined in small cages with individual adult beetles of the most common species of rove beetles or ground beetles found in turf. Small rove beetles ate *Ataenius* eggs and larger rove beetles and ground beetles ate the *Ataenius* larvae. Rove beetle larvae also ate *Ataenius* larvae.

We now have solid support for our model of how outbreaks of white grubs occur on golf course fairways. This model will also help explain outbreaks of black cutworms, Japanese beetle and other insect pests on golf course fairways.

II. Biological Control of Japanese Beetle in Michigan and the North Central United States: From Project GREEEN (David Cappaert).

In this project we plan to reduce the pest status of Japanese beetle in Michigan, and ultimately in the North Central United States by collecting pathogens and parasites from areas of the Northeastern United States where Japanese beetle populations are dwindling and introducing them to Michigan where they have not yet been found. A summary of our work in 1999 can be found in the 70th Annual Michigan Turfgrass Conference Proceedings (Vol. 29).

Progress in 2000:

- Introduction of 500 *Tiphia vernalis* (a wasp parasite of Japanese beetle grubs) adults.
- Introduction of 2,000 Istocheta eggs on live Japanese beetle adults.
- *Ovavesicula* was recovered from one of five introduction sites in 2000.
- Initial work has begun in collaboration with Dr. Richard Clopton to describe the Japanese beetle Eugregarine pathogen as a new species.
- The parasitic wasp, *Tiphia vernalis,* was introduced at three locations in 2000.
- Two entomopathogenic nematodes and the milky disease bacterial pathogen were applied at five sites to evaluate their persistence and long-term impact on Japanese beetle larvae.
- At one of the five study sites, the nematode pathogens continued to infect a high proportion of Japanese beetle larvae, even 12 months after application, causing a decrease in the grub density to levels about ⅓ of that in untreated areas.

Results of our research after two years suggest that the Eugregarine and *Ovavesicula* pathogens combined with the *Tiphia vernalis* and *Istocheta sp.* parasites found in Connecticut and Massachusetts may help keep populations of Japanese beetle under control. Of these four natural enemies, only the Eugregarine was found in most Michigan locations, although it was not as abundant or widespread in Michigan as in Connecticut. The other three were completely absent in Michigan except one location where *Ovavesicula* was found. By following the incidence of these pathogens and parasites closely over the next three years in introduction and control sites, we should be able to determine which pathogens and parasites have the greatest impact on Japanese beetle in Michigan. Once pathogens and parasites become established at a research site, that site can be used as a pathogen or parasite nursery to collect and transport them to other locations in Michigan and the North Central United States.