Biological and Biorational Management Options for the Annual Bluegrass Weevil on Golf Courses

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Objectives:

1. Conduct surveys for entomopathogenic nematodes in annual bluegrass weevil (ABW) infested areas and adult ABW hibernation sites on golf courses.
2. Determine the virulence to annual bluegrass weevil of entomopathogenic nematodes, *Bacillus thuringiensis* (Bt) strains, and several biorational compounds.
3. Determine the field efficacy of promising entomopathogenic nematodes, *Bacillus thuringiensis*, and several biorational compounds.

Start Date: 2006
Project Duration: three years
Total Funding: $69,532

The annual bluegrass weevil (ABW), *Listronotus maculicollis*, formerly 'Hyperodes weevil', is a serious and expanding pest of close-cut annual bluegrass on golf courses through much of the Northeast. Adult ABW emerge from overwintering sites in leaf litter and tall rough in early April and migrate to short-mowed turfgrasses (greens, tees, fairways) to feed and mate. Females lay eggs into the grass stems from late April through May.

The young larvae feed internally on the plant, ultimately tunneling through the crown and destroying the turfgrass plant. Later instars feed externally on crowns and roots which leads to the most extensive turf loss typically around early to mid-June. Damage caused by the 2nd and 3rd generations is usually less severe and more localized as peak larval densities decrease in successive generations.

In laboratory experiments, various nematodes species/strains were tested against field-collected adult ABW. Only the commercial and field isolates of *S. carpocapsae* (both 58%) and *H. bacteriophora* (51 and 63%, respectively) provided moderate control, whereas commercial strains of *H. megidis*, *S. feltiae*, and *S. kraussei* were ineffective (26-38%). Since control rates were limited even under ideal laboratory conditions and with high nematodes rates (250 per adult), control of ABW adults does not appear to be feasible in spring or in their hibernation sites in fall when low temperatures limit nematode activity.

Figure 1. Pupa infected by H. bacteriophora *(dorsal view).*

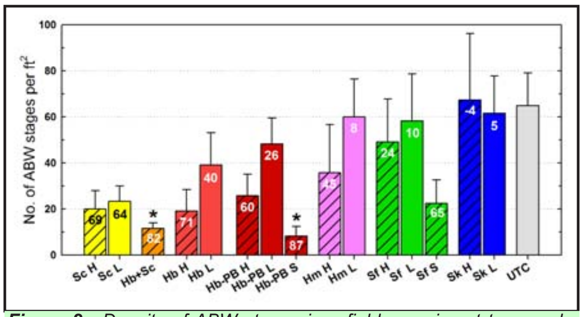

Figure 2. Density of ABW stages in a field experiment two weeks after application of the nematodes S. carpocapsae *(Sc),* H. bacteriophora *(Hb),* H. megidis *(Hm),* S. feltiae *(Sf), and* S. kraussei *(Sk). All nematodes were commercial strains except for one field isolated (Hb PB). Rates are H = 1 billion per acre, L = 0.5 billion per acre, S = 1 billion split into two weekly rates of 500 million. Hb+Sc = 0.5 billion per species. Figure inside bars are percent reduction compared to untreated control (UTC). * indicates significant reduction compared to UTC.*

Virulence of nematodes to ABW larvae was assessed in field infested turf cores in the laboratory. Cores were taken from infested fairways weekly to coincide with peak in 4th and 5th instars during the 2006 and 2007 seasons. Fourth-instar control ranged from 65 to 100% in 2006 and reached 97% (*S. feltiae*) and 100% (*S. carpocapsae* field isolate) in 2007. Fifth-instar control could not be observed in 2006 (larval densities too low), but was upwards of 90% with *S. feltiae* in 2007.

Density of ABW stages in the field trials also varied between years. In 2006, control ranged between 62-92 %, but due to low densities, only *S. feltiae* and the endemic *H. bacteriophora* significantly reduced ABW densities. In 2007, 16 treatments were tested against very high densities in the field (Figure 2). Control ranged between 0 and 87%. High variability in the data made detection of significant differences difficult. No single nematode species applied once provided significant control, whether applied at 0.5 or 1.0 billion nematodes per acre.

However, combining doses within species for analysis showed significant control by *S. carpocapsae*. A combination of *S. carpocapsae* and *H. bacteriophora*, each at 0.5 billion/acre, provided significant control (82%). Two treatments with 0.5 billion/acre applied one week apart resulted in significant control for the endemic *H. bacteriophora* (87%), but not for *S. feltiae* (65%). Neither the species combination nor the split applications provided control that was significantly different from the high rate of the respective species applied once.

A third field season will be required to determine the best neamatode species for control of ABW larvae.

Summary Points

- Entomopathogenic nematodes can be important natural mortality factors of ABW larvae.
- Control of adult ABW with nematodes does not appear feasible due to the low nematode susceptibility of adult ABW and the low temperatures occurring during potential application periods.
- Entomopathogenic nematodes can provide significant control of ABW larvae under field conditions. Rates and timing of nematode application appear to be critical factors in the ability of nematodes to suppress ABW below damaging thresholds.