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 directly into the stem of the turfgrass plant from late April through May in New Jersey.

The young larvae are initially stem borers, feeding 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 (Figure 1). Damage caused by the 2nd and 3rd generations is usually less severe and more localized as peak larval densities tend to be lower than in the 1st generation. In previous project years we found that entomopathogenic nematodes (EPNs) naturally occurring in golf course fairways not treated for ABW control can cause up to 50% generational ABW mortality. Additionally, EPNs have provided high levels of larval control (65-100%) when applied to field-infested turf cores in the laboratory.

Figure 1. *First generation larval feeding damage to an edge of a fairway (June 23, 2008).*

We examined the efficacy of commercial EPN products against 1st generation ABW immature stages in field trials in 2008. Products based on *Steinernema feltiae*, *S. carpocapsae*, and *Heterorhabditis bacteriophora* were chosen for closer examination in field trials since they have provided at least 70% control in past field trials (Figure 2). Since lower control levels in 2007 than in 2006 were believed to be linked to high ABW larval populations in the treated areas, we included higher EPN rates [0.5, 1.0, and 2 billion infective juveniles (IJs) per acre] in the 2008 trials. However, despite lower larval densities, the higher EPN rates did not provide greater or even equivalent control than in 2007. Only the high rate of *S. carpocaposae* provided statistically significant control (86%).

In the 2007 trials, treatments consisting of combinations of species and applications split into half doses applied in consecutive weeks provided higher levels of control than the 1 billion IJs per acre rate alone. In 2008, the three combinations of two species treatments failed to improve upon the levels of control observed at the full rate (1 billion IJs/acre) of either of the species applied alone. Similarly, splitting applications into two consecutive half-rate treatments (0.5 billion IJs/acre) did not provide better control than the full or half rate applied once. The inconsistent control of ABW by EPNs could be due to numerous abiotic (e.g., weather, soil type) and biotic (e.g., EPN formulation, persistence, ABW density) factors. Another year of field trials will be conducted to solve some of the inconsistencies in control of ABW with EPNs.

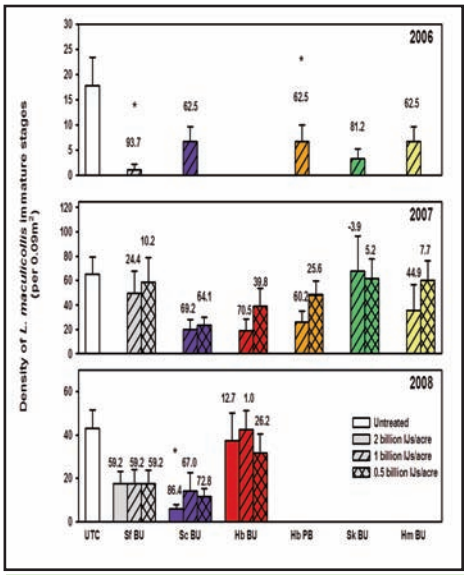

Figure 2. *Density of ABW stages (average ± SE) in a field experiment 2 weeks after application of the nematodes* S. carpocapsae *(Sc),* H. bacteriophora *(Hb),* H. megidis *(Hm),* S. feltiae *(Sf), and* S. kraussei *(Sk) for field trials conducted in 2006, 2007, and 2008. Nematodes were commercial strains (BU = Becker Underwood) except for one field isolated (Hb PB). Figures above bars are percent reduction compared to untreated control (UTC). Asterisces (*) indicate significant mean separation from the UTC (P < 0.05).*

Summary Points

- Entomopathogenic nematodes can provide significant control of ABW larvae under laboratory conditions. However, in field trials, control was inconsistent between years.
- The level of suppression achieved in the field is likely affected by factors such EPN concentration, ABW larval densities, and timing of application.
- An additional field season should help clarify the effects of application timing and concentration, and ABW density on the ability of EPNs to suppress ABW below damaging thresholds.