# *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.

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**Project Duration:** three years
**Total Funding**: $69,532

The annual bluegrass weevil (ABW), *Listronotus maculicollis*, formerly 'Hyperodes weevil', is a serious pest of close-cut annual bluegrass on golf courses (greens, tees, fairways) in the Northeast. Young ABW larvae cause limited damage by tunneling the stems, but older larvae can cause severe damage by feeding externally on the crowns, sometimes completely severing the stems from the roots. The most severe ABW damage is caused by the first generation older larvae, usually around late May/early June. Damage from the second generation larvae, during early to mid-July, is usually less severe and more localized.

In a survey in central and northern New Jersey, a total of 103 soil samples were taken from areas with a history of ABW infestations on 11 golf courses. Forty-nine percent of the samples contained ABW stages. Eight percent of the ABW positive samples contained ABW larvae or prepupae infected by entomopathogenic nematodes, most by *Heterorhabditis bacteriophora*, only few by *Steinernema carpocapsae*. From 29% of the spol samples, *S. carpocapsae* and/or *H. bacteriophora* were isolated.

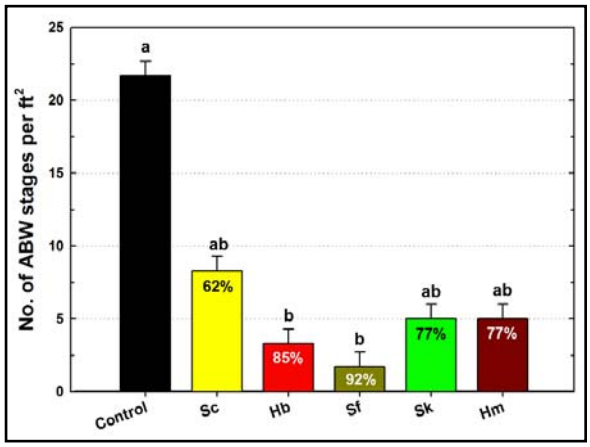
Seasonal dynamics of ABW and entomopathogenic nematodes are being studied on golf course fairways that are not treated with insecticides other than imidacloprid in late spring for white grub control. ABW populations were generally the highest in the first generation in spring, lower in the second generation in summer, and the lowest in the third generation in late summer.

*Annual bluegrass weevil adult*

Populations of *H. bacteriophora* and *S. carpocapsae* showed a clear peak around the time when the first ABW generation were mostly fifth instars and pupae or shortly thereafter. A total of 26% of the ABW stages during the first generation were infected by *S. carpocapsae* or *H. bacteriophora*, mostly fourth and fifth instars but also some third instars and pupae. Similar infection dynamics occurred during the second ABW generation in summer, but nematode densities in the soil were generally low.

In a series of laboratory experiments, commercial strains of *S. carpocapsae*, *H. bacteriophora*, *S. feltiae*, *S. kraussei*, and *H. megidis* and one field isolate each of *S. carpocapsae* and *H. bacteriophora* were tested against field-collected adult ABW. *H. megidis* and the commercial strains of *S. carpocapsae* and *H. bacteriophora* provided similar control as the field isolates, but *S. feltiae* and *S. kraussei* were ineffective. However, even 250 nematodes per adult ABW did not provide more than 56% control in any nematode treatment. Considering that these experiments were conducted under ideal laboratory conditions, control of ABW adults does not appear to be feasible in spring or in their hibernation sites in fall when temperatures are limiting nematode activity.

One field-isolate of *H. bacteriophora* and the commercial stains of *S. carpocapsae*, *S. feltiae*, *S. kraussei*, and *H. megidis* were tested against ABW larvae in cores taken from ABW infested fairway sections under laboratory conditions and in a field trial. In the laboratory, all nematode treatments provided significant control (60-95%) without differences among nematode strains. In the field trial there were no significant differences among nematode strains (62-92% control), but only *H. bacteriophora* and *S. feltiae* provided statistically significant ABW reduction.




*Density of ABW stages in a field experiment two weeks after application of the nematodes* S. carpocapsae *(Sc),* H. bacteriophora *(Hb),* S. feltiae *(Sf),* S. kraussei *(Sk), and* H. megidis *(Hm) at 1 billion per acre each). In parentheses is % reduction compared to untreated control.*

## 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.
- Applications of entomopathogenic nematodes can provide significant control of ABW larvae under field conditions, but additional studies will be necessary to select the best nematode strains.