Sustainable White Grub Management with Steinernema scarabaei*: a New Highly White Grub-pathogenic and -specific Nematode*

Albrecht M. Koppenhöfer
Rutgers University

Objectives:

1. To improve predictability of *S. scarabaei* applications by determining the effect of soil moisture and soil type on the nematode's infectivity and persistence.
2. To determine the control potential of *S. scarabaei* against white grubs, especially with respect to low application rates and long-term control.

Start Date: 2003
Project Duration: three years
Total Funding: $29,208

Presently available entomopathogenic nematode species provide only limited control of most of the important white grub species. Our overall objective is to develop the recently discovered nematode *Steinernema scarabaei* as a novel biocontrol agent for white grub management.

In laboratory and greenhouse experiments, *S. scarabaei* efficacy against grubs tended to be the highest in loamy sand, did not differ significantly among sandy loam, loam, silt loam, and clay loam, and tended to be the lowest in an acidic sand (pH 3.9) and a potting mix (69% OM). *S. scarabaei* infectivity varied with soil moisture [ranging from saturated to very dry (-1 to -3,000 kPa water potential)], being the highest at -10 and -100 kPa, lower at -1 and -1,000 kPa, and the lowest at -3,000 kPa. The effect was stronger in heavier soils. Ongoing studies indicate that *S. scarabaei* can persist very long in all the above substrate types and soil moisture levels.

Microplots (4' x 4'), enclosed by garden edging material, were seeded with oriental beetle 3rd instars (10 per ft^2) and treated with *S. scarabaei*. Grub and nematode populations were determined periodically by going through cup cutter cores and baiting soil samples with wax moth larvae, respectively.

In the first experiment (Fig. 1), all *S. scarabaei* rates [0.125, 0.4, or 1 billion per acre (b/a); standard nematode rate is 1 to 2 b/a] provided 100% grub control at 31 DAT. This high efficacy was achieved through additional grub infections caused by the *S. scarabaei* progeny emerged from the grubs killed by the applied nematodes. This is supported by an increase in *S. scarabaei* densities in the soil samples between 0 and 31 DAT. *S. scarabaei* density did not decline during winter but declined between April and August because no more oriental beetle larvae were left for nematode reproduction in spring. However, *S. scarabaei* survival was high enough to provide 69 to 94% grub control 13 months after application.

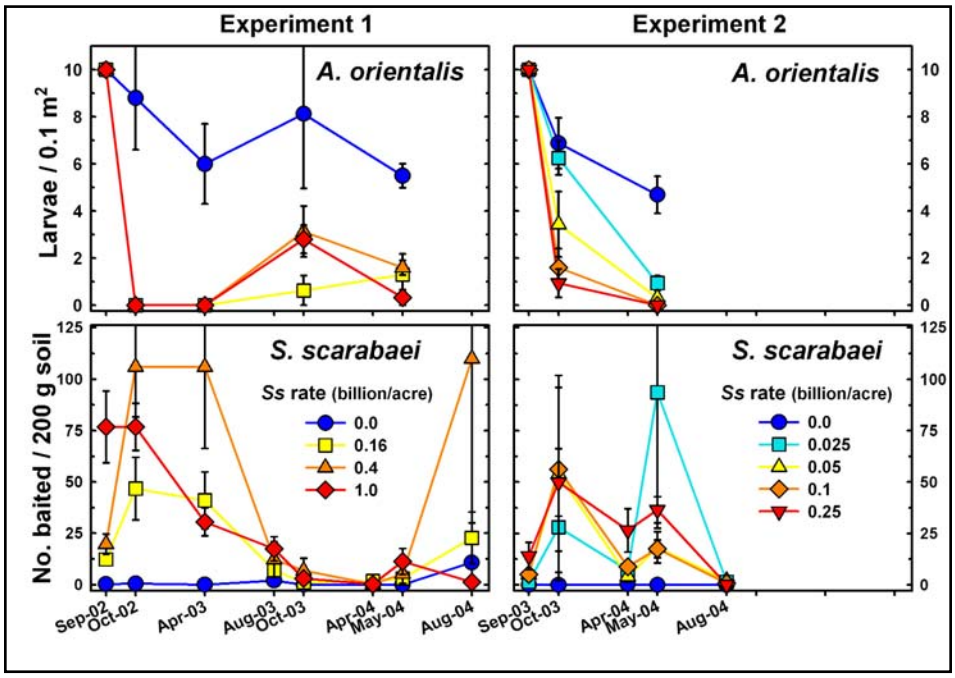

Figure 1*. Population densities (± SE) of oriental beetle larvae (top graphs) and* S. scarabaei *(bottom graphs) in two experiments (left vs. right graphs) after application of different* S. scarabaei *rates to 16 ft^2 microplots seeded with 160 3rd-instar oriental beetle.*

In the second experiment (Fig. 1), *S. scarabaei* provided 50, 77, and 86% control at 0.05, 0.1, and 0.25 b/a, respectively, but no control at 0.025 b/a. *S. scarabaei* survived at sufficient numbers through the winter to increase grub control rates to 89, 96, 100, and 100% at 0.025, 0.05, 0.1, and 0.25 b/a, respectively. The additional grub kill in spring resulted in increased *S. scarabaei* densities in spring, but by August the numbers had decreased to low levels.

We will continue sampling grub and nematode populations in these experiments, and we recently initiated a third experiment.

Summary Points

- *S. scarabaei* is highly effective as a curative white grub control.
- Due to multiplication in infected grubs, even very low *S. scarabaei* rates can provide very high control rates within one month.
- The best long-term effect of *S. scarabaei* is expected with low rates that allow some grubs to survive until spring allowing *S. scarabaei* an additional reproduction round before summer.
- *S. scarabaei* is highly effective in a range of typical turf soil types, but is probably most effective in lighter soils.