

## Alternative Control Tactics for Black Cutworms in Turf

**B**lack cutworms *Agrotis ipsilon* (Hufnagel) (BCW) are economically important pests of highly maintained turfgrass—both sod production and landscape turf—throughout the United States.

We evaluated alternative control agents (entomopathogenic nematodes, inorganic sulfur, insect growth regulators, and fungal pathogens) against black cutworm larvae using test products incorporated into standard artificial diets and more natural arenas using turfgrass as the cutworm food source and application target site. A secondary objective of this project was to develop a rapid and reliable assay system that would be easily replicated and allow activity measurements for cutworm fitness (larval and pupal weights) beyond simple mortality data.

Artificial diet bioassays involved the presentation of control agents in standard BCW wheat germ diet with weekly evaluation of larval mortality and development until pupation. Three insect growth regulators, slow release inorganic sulfur, the commercially-produced entomogenous nematode Hb Oswego, the fungal pathogen commercial formulation of *Beauveria bassiana* (Botani Gard), and the fungal pathogen, *Metarhizium anisopliae* were all evaluated against mid-instar cutworms at multiple rates. Insect mortality and weight in the various treatments were evaluated seven and twenty-eight days post treatment.

Our artificial diet results suggest that insect growth regulator products that tend to be quite selective in targeting pest species, are quite active at 7 days post treatment against black cutworm larvae at the labeled or anticipated field rates. Assays indicate a reasonable dose-dependent activity with increased mortality directly correlated with higher rate of product. Cumulative cutworm mortality and pupal weights at twenty-eight days appear to follow the trends described above for the insect growth regulators and inorganic sulfur treatments.

Entomopathogenic nematode treatment (Hb) showed excellent results in our diet assay indicating that the black cutworm is highly susceptible to the nematode species even at relatively low rates. However, because these nema-

todes must actively search for prey in turf, and they must survive possibly harsh environmental condition in the field these results do not translate into an expectation for comparable results in the field. The commercial fungal pathogen, Botani Gard did not produce cumulative mortality nor pupal weights that were significantly different than the untreated checks. Finally, *Metarhizium* grown in rice grains and placed on top of the diet cause high levels of mortality. This fungal isolate has also proven to be active against scarab grubs in laboratory and greenhouse bioassays.

Results obtained through the addition of test compounds to artificial diet, although easily replicated and useful for comparing levels of activity within a group of products or doses of an individual compound, may not reliably mirror field activity. Through a process of trial and error requiring several rounds of test bioassays our lab developed a protocol that provided low check mortality and reasonable reproducibility if assays were conducted sequentially through time, and provided a treatment substrate (grass clippings) that are the natural target against black cutworm products. Three insect growth regulators, inorganic sulfur, Hb nematodes, and the fungal pathogen Botani Gard were tested at a single rate.

Assessing larval mortality one day post treatment appears to provide little predictability on the ultimate activity of a product. Relatively few cutworm larvae died over the first 24 hours of this bioassay. Mortality at six days was uniformly high in the insect growth regulator treatments and relatively low in the sulfur and fungal pathogen treatments. These data are similar to the mortality levels observed in the artificial diet assays. The entomopathogenic nematode treatment showed highly variable activity. It should be noted that highly variable results are often observed in field and greenhouse bioassays using entomopathogenic nematodes

The mean larval weight of black cutworms one day post treatment was lower in most treatments than in the untreated controls. Larvae were observed down in the soil of these treat-

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## Clippings

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since the 1940's through the research efforts of Dr. Gambrell, Dr. Tashiro, and myself," said Villani. The Station continues to be one of a small handful of institutions working on both fundamental and applied aspects of turf entomology.

"This is a national meeting and one of the most useful ones I go to," said Robert L. Crocker, associate professor at Texas A&M. Crocker's current project taping the sounds made underground by white grubs is a potential means of monitoring their numbers. "This meeting is a chance for us all to talk about environmental concerns, pesticides and alternatives to pesticides, to exchange new information on the ecology and biology of pest species, discuss new pests of turf, and talk about the effect of government regulations," he said.

During the meeting, the group also took the opportunity to celebrate the release of the second edition of *Turfgrass Insects of the United States and Canada*. Retired Cornell professor, Haruo Tashiro, who is considered the dean of American turfgrass entomologists, is the sole author of the first edition. Drs. Vittum, Villani and Tashiro are the authors of the second edition. A dinner was held in Dr. Tashiro's honor during the conference.

Seven topics were addressed during informative panel discussions over three days. In the discussion on biocontrol, moderators Jennifer Grant (NYIPM/Cornell), Albrecht Koppenhofer (Rutgers University), and Parwinder Grewal (Ohio State University) took a look at the practical use of biological control agents for controlling turfgrass pests. The use of biological insecticides, predators, and parasitoids for in-

sect control in turf was also discussed.

In a panel discussion on the transition of IPM from research to implementation, moderator Fred Baxendale (Univ. of Nebraska), Rich Cowles (Conn. Agric. Exp. Sta.), and Gary Couch (NYIPM/Cornell) discussed moving IPM from the classroom to the field to the end user, integrating biocontrol and traditional approaches in a realistic IPM program, and the status of action thresholds and sampling in IPM programs.

In University/Industry/Government/Professional Relationships, moderator Rick Brandenburg (North Carolina State Univ.), Dan Potter (Univ. of Kentucky), and Chris Becker (American Cyanamid) talked about how funding shapes the message, whether roles, goals and responsibilities were clear, and how these relationships affect graduate education now and in the future.

Moderators Chris Williamson (Univ. of Wisconsin), and Wendy Gelerntner (Pace Consulting, San Diego CA) talked about advances in black cutworm management, from traditional and emerging control tactics to action thresholds and laboratory bioassays.

Pheromones and their use as attractants, arrestants and repellants was the focus of the session moderated by Paul Robbins (NYSAES/Cornell), Mike Klein (USDA/ARS.), and Robert Crocker (Texas A&M).

Emerging Environmental Issues, such as the impact of FQPA on turf insect pest management, selective vs. broad spectrum insecticides, homeowner use of products and local laws were addressed in a session moderated by Amy Suggars (TruGreen Chemlawn), David Cox (Novartis), and Gwen Stahnke (Washington State Univ.).

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ments rather than feeding on the grass blades as observed in larvae feeding in untreated check replicates. Small cutworm larvae consume relatively large amounts of grass and grow rapidly during this period of their development. This weight disadvantage evaporates at the six day post treatment evaluation in the sulfur treatments (there is virtually 100% mortality in the growth regulator treatments). No weight loss was observed in the entomopathogenic nematode or fungal pathogen treatment at either evaluation.

Research conducted in this project has provided better understanding of the activity of products not currently under FQPA review against an important turfgrass pest. Additionally funding has allowed for the development of a novel and reliable screening assay that will but used to evaluate additional IPM compatible products in the future. Funding for this project was provided by the NYS Turfgrass Association and the NYS Community IPM Program.

Michael G. Villani

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