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Soil Insect Ecology and Turfgrass Entomology

Program Spotlight

A prime candidate is the annual bluegrass weevil (ABW). The ABW is a burgeoning pest problem in the Northeast and Mid-Atlantic, yet our current "best management practices" are too rudimentary to overcome its increasing pest status.

Two major challenges for the management of turfgrass insect pests are the inherent difficulty of studying subterranean insect behavior and the ever-changing face of the control environment. Pesticide restrictions and phaseouts, for instance, force us to reexamine pest biology in the search for new control opportunities, but efforts are stymied by our unfamiliarity with the soil habitat, and in particular how to access, interpret and manipulate interactions played out below ground.

The Soil Insect Ecology and Turfgrass Entomology lab is launching a new research agenda to begin to overcome some of these challenges and build on the expansive foundation constructed under the leadership of the late Dr. Mike Villani. We are structuring our approach around three points of entry.

Research Agenda

First, we will emphasize the key taxa as identified by stakeholder perception, injury levels, and the economic and environmental costs of current control strategies.

Second, we will address the most strategic research issues, considered as those that most transcend horticultural systems (lawns and golf courses, turfgrass and cranberries, temperate and tropical).

Third, we will focus on areas where our research group has a comparative advantage, such as advanced techniques for the evaluation of control products in the laboratory, radiographic techniques for the study of insect behavior below ground, and a strong collaboration with the chemical ecology lab for the study of insect pheromones. We believe we can have the most positive and rapid impact by addressing research issues at the intersection of these points of entry.

Research Initiatives

We are currently pursuing five initiatives. The first is a study of the specific biology and management of major turfgrass pests. Focused ecological studies are necessary if we are to keep up with the changing face of control opportunities and uncover new management opportunities. A prime candidate is the annual bluegrass weevil (ABW). The ABW is a burgeoning pest problem in the Northeast and Mid-Atlantic, yet our current "best management practices" are too rudimentary to overcome its increasing pest status. Gaps in our understanding of the pest's association with annual bluegrass limits advances in management. Our contribution will be to readdress pest biology, ecology and behavior to identify and exploit new windows for pest management. Rapid advances could be made in collaboration with the applied turfgrass entomology groups at UMass and Penn State, especially as we move from laboratory and greenhouse studies to field trials and ultimately the promotion and adoption of advanced management practices.

A second initiative addresses the orientation, detection and perception of subterranean insect pests to the soil habitat. How is pest be-

Annual bluegrass weevil infestation on a golf course fairway.

havior modified by the soil environment, such as the presence of pathogens, predators, pesticides, competitors, and host plants? Japanese beetle larvae can detect and avoid fungal entomopathogens, but we would like to understand how broad-based this perception is among other white grub species and soil insects in general. This research may open up new opportunities for baits and repellents as control tactics in specific turfgrass and horticultural systems.

A third initiative is on biological-based pest management. There is an increasing demand for more limited use of chemical pesticides in turfgrass systems. Under what circumstances can biological-based pest management be effective? Are these conditions widespread or reproducible? How can we overcome limits to the adoption of these technologies? We hope to more systematically investigate the additive and synergistic effects of combined tactics such as reduced rates of pesticides in tandem with biologicals. Limiting the economic and environmental costs of pesticides may require that we combine tactics into new management approaches, therefore we should evaluate insect susceptibility to control tactics while they are being challenged under different conditions.

A fourth initiative focuses on discovering and exploiting pheromones. In collaboration with the Chemical Ecology research team, we have a highly promising and productive opportunity to isolate and describe compounds from species of economic relevance, study the evolution and ecology of reproductive isolation mechanisms, and advance management applications such as monitoring schemes, mating disruption, and lure and infect systems.

A fifth initiative addresses the effect of control tactics on nontarget microarthropod communities. Although microarthropods are attributed a large role in certain soil processes, such as decomposition, our understanding of this major component of soil fauna is quite limited. In order to gauge the benevolence of pesticides used in lawn care, we are conducting field trials to test their effects on the abundance, diversity and function of nontarget arthropods, particularly those that are "out-of-sight, out-of-mind" without the aid of a microscope. Do these common lawn care products have an effect on nontarget fauna, such as mites and springtails, and is this relevant to soil processes, such as decomposition?

Our probability of success in launching these initiatives will depend on the outcome of exploratory research and funding proposals. The impact of our results, however, will be mediated by the depth of our dialogue with stakeholders and collaborators. We welcome your input.

Daniel C. Peck, Ph.D.

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1) key taxa as identified by stakeholder perception

2) the most strategic research issues, considered as those that most transcend horticultural systems

3) areas where our research group has a comparative advantage