

Final Project Report to the NYS IPM Program, Community IPM 2000 – 2001

Title: Impact of Scarab Grub Management Tactics on Non-Target Soil Fauna

Project Leader(s):

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Type of grant:

Pheromones; biorationals; microbials; conventional pesticides

Project location(s):

Application: throughout the Northeast. Research site: Crittenden Farm, NYSAES, Geneva.

Abstract:

Turf stands developed at NYSAES, Geneva, NY were treated with both “fast tracked” chemicals as well as biological insecticides in 2000 and 2001. This field test will demonstrate the effects of these pest management applications on nontarget soil fauna in turfgrass. A several year study of this issue is important because effects on nontarget soil fauna may be cumulative.

Background and justification:

Accelerating urbanization of the U.S. population has resulted in increasingly larger areas of green space being utilized for recreation both communally in the form of parks, golf courses and natural areas and personally in the form of home lawns. The average town of 170,000 people in the U.S. has 1,338 acres of turf in parks, cemeteries and factories, school and churchyards as well as about 3,500 acres around single-family dwellings. All of these areas require decision-making strategies to maintain them for their intended uses. Although much research has been conducted on efficacy of various control tactics for the target species, comparatively little research has been conducted on the effects of these control tactics on non-target organisms. Knowledge about the effects of these strategies on non-target soil organisms will provide

extremely useful information to area IPM educators in that it will yield a benevolence index of treatment effects on soil dwelling beneficials and non-target organisms. This information can be communicated to IPM stakeholders to aid in choosing environmentally friendly yet efficacious control tactics. This may prove to be particularly important and useful information for homeowners whose use of lawn care products is regulated mainly by their desire to use them or not and whose advice comes mainly from the companies selling the products they wish the homeowners to purchase for use.

Objectives:

- Compare the effects of three standard chemical insecticides, a biological control agent and elemental sulphur, a plant nutrient, on nontarget beneficial organisms in turfgrass with attention given to the effect of these pest management systems on microfauna (new 2001) versus macrofauna (existing 2000) populations. For example, reductions in soil predators may increase secondary pest pressures while the disruption of decomposer communities (e.g. oribatid mites, springtails) may increase thatch and organic matter in soil.
- Compare repeated yearly applications since effects on nontarget species may be cumulative. These effects may be direct by affecting numbers of nontarget organisms as well as indirect in that reduced numbers of detritivores may increase thatch and unincorporated organic matter.
- Develop and improve of current turf stands for future collaborative use and educational demonstrations.
- Generate specific information on the effect of pest management options on beneficial organisms in turfgrass that can be used in educational materials such as brochures and fact sheets on turfgrass IPM.

Procedures:

1. Turfgrass plots, 10 x 10 meters, were established at the New York State Agricultural Experiment Station in Geneva, NY in 2000. Six treatments were applied in 2000 and reapplied in 2001 (in the same locations and at the same rates): Dylox - the organophosphate insecticide trichlorfon (as the “traditional” chemical control), Merit - imidacloprid, Mach2 - the insect growth regulator halofenozide, Heteromask - the entomopathogenic nematode *Heterorhabditis bacteriophora*, SulFer95 - a high analysis granular dispersible elemental sulfur fertilizer, and Control - an untreated control. Plots were replicated four times for a total of 24 test plots. Buffer zones of 10 x 10 meters separated test plots on all sides.
2. In 2001, plots were overseeded and fertilized to yield a higher density grass stand.
3. Plots were sampled monthly from July-October. The treatments Merit, Mach2 and SulFer (first application) were applied just after the first sampling date in July, while treatments Dylox, Heteromask and SulFer (second application) were applied just after the second sampling date in August.
4. Macrofauna were sampled using pitfall traps and ant baits. As in 2000, five pitfall traps (6 in. diameter, 4 in. tall, screened bases to allow water infiltration) were set and sampled 24 hr later in each plot. The abundance of different taxonomic groups of arthropods was quantified. Ant baits were 1 ml plastic microcentrifuge tubes with bait (tuna or “gummy” candy) pushed into the soil to their rim. Eight tuna and two candy baits were set per plot and

sampled for ants after 24 hours. Ant activity was measured as the presence of ants in the traps.

5. Microfauna were sampled in 2001 from 5 soil cores in each plot. Cores (4 in. deep) were dug with a 4-in. diameter cup cutter, transported to the lab in plastic bags, and extracted under modified Tullgren funnels. After 48 hr the captured microarthropods were separated from other fallen debris through flotation and decantation in saturated salt solution. The abundance of different classes of soil organisms was determined from counts made under a microscope.
6. Decomposition rates were also measured using litterbags. Bags contained 1.5 g of dry grass litter and were of two mesh sizes to compare decomposition rates due to microbes, and due to the combined effect of microbes and microarthropods. On 5 July four bags of each type were buried just under the turfgrass in each plot. One bag of each mesh size were removed on each of the insect sampling dates and frozen until future analysis of mineral ash and biomass loss.
7. Entomopathogenic nematode activity was assessed on each insect sampling date by using wax moth larvae, *Galleria mellonella*, as an indicator organism. Two *Galleria* were held 7 days in each of five 1-oz cups with soil collected from the soil cores in each plot.

Results and discussion:

Over the sampling period a total of 3791 arthropods were captured in the pitfall traps. Of these 730, 1444, 1038, 579 individuals were captured in the July, August, September and October sampling dates, respectively. In order of greatest to lowest abundance, the major taxa evaluated included sowbugs (897), daddy-longlegs (854), crickets (481), spiders (438), pillbugs (169), ground beetles (116), ants (106), leafhoppers (24), leaf beetles (11) and weevils (9). Treatment differences in abundance and diversity have not yet been tested statistically. Figures that express abundance across treatments and months do not reveal any obvious evidence for treatment effects (Fig. 1)

Over the sampling period 37.3% of baits were positive for ant activity, 35.9% in tuna baits and 43.0% in sweet traps. Overall activity declined with season, with 62.1, 31.4, 42.5 and 17.9% activity in the July, August, September and October sampling dates, respectively (Fig. 1).

Extraction and enumeration techniques were developed for managing the microarthropods associated with the soil samples. The three major challenges were extracting microarthropods and other soil organisms from the soil sample, separating them from other contaminants in the extracted sample, and counting the vast number of organisms captured. To overcome these challenges standardized protocols were established for (a) extracting organisms from individual soil samples in modified Tullgren funnels that used light and humidity gradients to force them into vials of alcohol, (b) separating organisms from the organic and mineral materials associated with them by floating and decanting using a saturated salt solution, and (c) plating specimens onto counting trays to systematically quantify and classify each individual. Because the analysis of each subsample required 1-3 hours, only specimens from the first sampling date have been completed thus far.

On the July sampling date 64,806 individuals were collected, counted and classified. There was a mean of 540 (range 56-1146) individuals per cup cut, or an extraction rate of approximately 68,761 individuals/m² of turf and associated topsoil. In order of greatest to lowest

abundance, the major taxa present mites (77.7% of total individuals), springtails (14.0%), ants (2.7%), fly larvae (2.3) and nematodes (1.3). Other taxa collected (2.0%) included millipedes; sowbugs and pillbugs; earthworms; snails; spiders; immature Coleoptera, Lepidoptera and Homoptera; thrips; and rove beetles. If treatment effects are found, certain of these broad taxonomic groups could be classified further to describe the effect in more detail. Springtails, for example, are a diverse group that had at least four families represented in the July sample; classification to family, genus or species would help explore any treatment effects in higher resolution.

Results from the decomposition rate and nematode activity studies have not yet been analyzed.

Analysis of specimens and statistical testing of treatment effects will continue through June 2002. The results will measure specific direct and indirect effects of common lawn-care products on the abundance, diversity and function of nontarget predators and decomposers in the soil and turfgrass community. This study is intended as a multiple-year experiment to gauge the cumulative effects of treatments. Other anticipated results of a long-term study include (a) establishment of improved protocols for monitoring and assessing the soil arthropod community in turfgrass, (b) identification of potential indicator species that should be targeted in future studies due to their susceptibility to specific treatments, (c) strengthened understanding of the soil arthropod community and undesirable effects of common lawn care practices for communication to stakeholders, and (d) improvement of the experimental turfgrass stands for future use in research and demonstration projects.

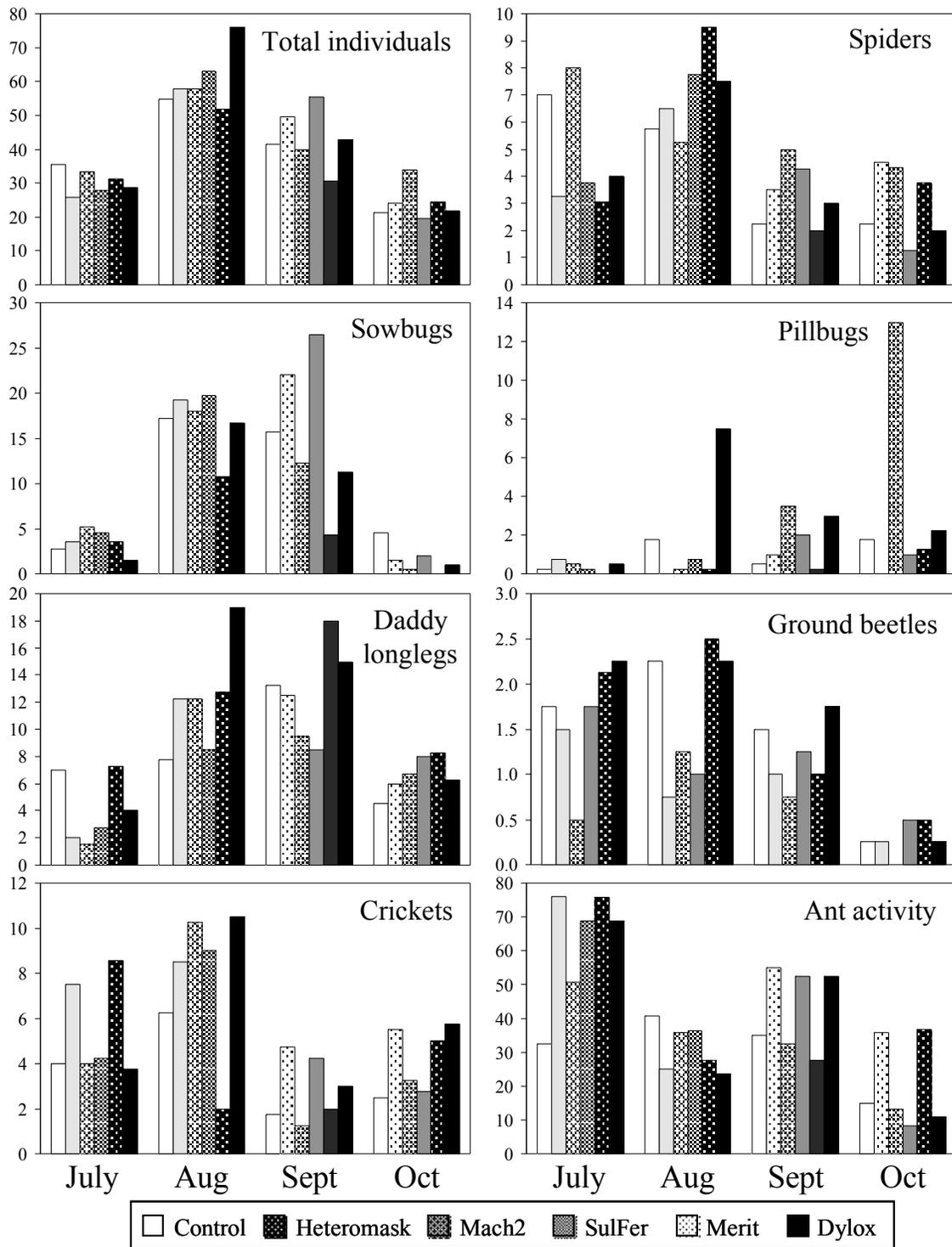


Figure 1. Relationship between sampling date, treatment and abundance (total individuals) of major organisms captured in pitfall traps, or ant activity (% traps with ant presence) in baited traps in an experimental lawn plot, Geneva, NY.

