

FACTORS INFLUENCING THE SKEWED DISTRIBUTION OF *ATAENIUS* IN GOLF COURSES: MOISTURE AND NATURAL ENEMY PREDATION

Young-Ki Jo and David Smitley
Entomology Department
Michigan State University

Introduction

Turf damage caused by *Ataenius spretulus* grubs has been reported only in fairways rather than in roughs of golf courses. Through previous mowing height experiment conducted by Rothwell and Smitley, the present mowing heights was the deciding factor in the location of natural predators and adult and larval *A. spretulus*. The distribution of *A. spretulus* was high and the activity of grass-inhabiting natural enemies was low in the fairway compared to the rough. For the further study, three factors are hypothesized to explain this uneven distribution of *A. spretulus* on golf courses: the potential preference of *A. spretulus* adults for moisture turf and the *A. spretulus* egg and larval predation by natural enemies.

Moisture Preference Test

A special arena was created in a 4-inch diameter plastic pot. Half of the pot was filled with wet soil and the other half was filled with dry soil. Each soil area contained one fairway and one rough turf plug (1 inch diameter and 3 inches length). 20 adult *A. spretulus* were collected in early July and then released into each turf arena. After seven days, they were recovered to determine where they were inhabiting. Ten replications were done per experiment.

Results showed adult *A. spretulus* preference for wet turf plugs. However, there was no significant difference on the adult choice for low mowing-height fairway and high mowing-height rough turf plugs at the same moisture content (Figure 1).

Egg Predation Test

A small turf arena, fitting into a 2-inch diameter diet cup, was prepared. At its center, ten corn rootworm eggs were implanted. The corn rootworm egg was substituted for *A. spretulus* egg because of the similar size (0.72 mm in length and 0.52 mm in width). An individual natural enemy found in turf was applied to each turf arena. After seven days, eggs were recovered and missing rates were determined. Three dominant ground beetles and two dominant rover beetles were tested.

Some ground beetles and rover beetles predated corn rootworm eggs effectively. These natural predatory enemies were relatively small in size (Table 1).

Larval Predation Test

Four experimental plots were selected in the fairway and rough at Hancock Turf Research Center, where *A. spretulus* was not infected. At each experimental plot, a 4-inch diameter turf core was prepared using a cup cutter. The side of the turf core was covered with burlap. The turf core was put back to the turf ground. Ten *A. spretulus* grubs were released on the turf core. After seven days, the grubs were recovered from the turf core. Grub missing rates were determined. Four replications were done per experiment.

Three consecutive experiments during July showed the trend that more larvae were missed in the rough than in the fairway. At least in one experiment, there was a significant difference on the larval missing in the rough and fairway (Figure 2).

Conclusion

To preserve a high quality of turf, many cultural practices were applied. Such highly managed turf may be susceptible to new pests. *A. spretulus* are among the new grass pests that threaten golf course

turf. Thus, determining the main factors that cause the skewed distribution of *A. spretulus* in golf courses, is important for developing control strategies. The possible cause was the adult's choice for moisturized turf. Additionally, the predation experiment gave us a better understanding about the relationship between *A. spretulus* and predators. The corn rootworm eggs, which have the similar size of *A. spretulus* eggs, were consumed by major ground beetles and rover beetles found in turf. In the rough, more *A. spretulus* grubs were missed by natural predators.

Figure 1. Percent average *A. spretulus* adults found in fairway and rough turf plugs at different moisture levels (19.7 % in wet areas and 8.2 % in dry areas by the gravimetric water content).

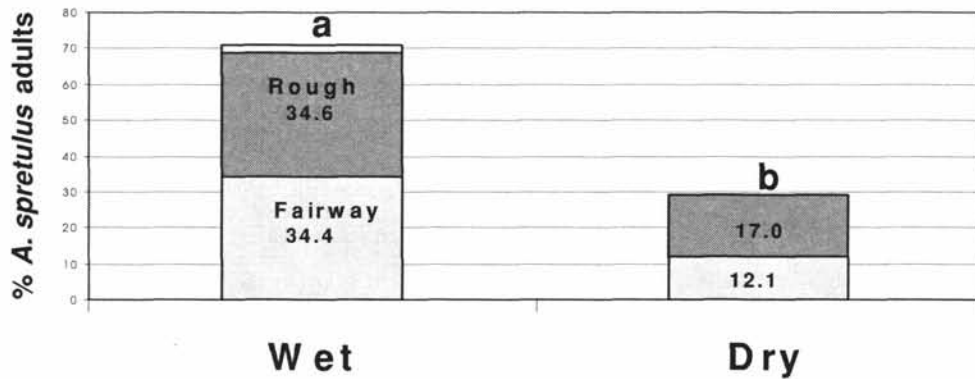


Figure 2. Percent average *A. spretulus* grubs missed in the fairway and rough at Hancock Turf Research Center per week.

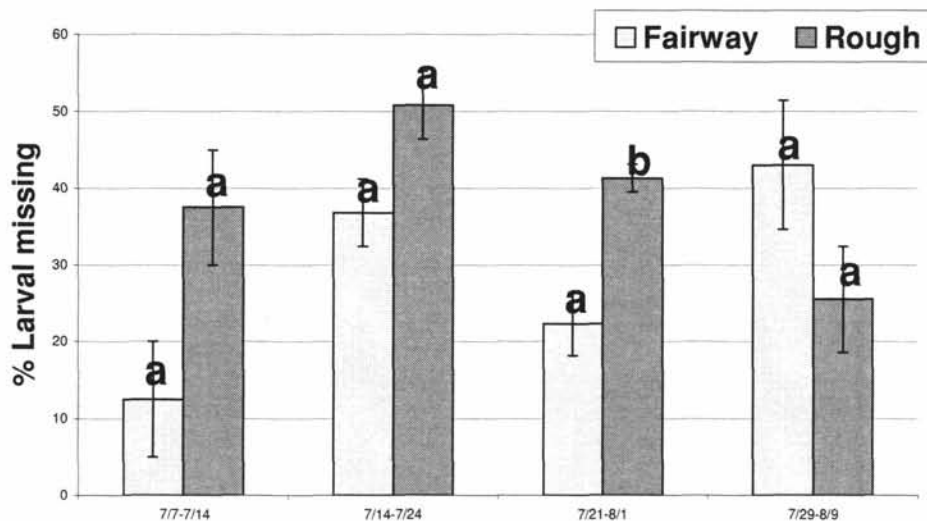


Table 1. Weekly missed corn rootworm eggs (+ SE) consumed by common turf insect predators out of 10 eggs within an experimental turf arena. * Indicates the eggs were missed effectively.

Family	Species	Rep.	Mean eggs ± SE
Carabid	<i>Harpalus pseudophorus</i>	2	3.00 ± 2.00
Carabid	<i>Poecilus chalcites</i>	2	1.50 ± 0.50
Carabid	<i>Stenolophus ochropezus</i>	2	*4.25 ± 0.75
Staphylinid	<i>Philonthus cognatus</i>	2	*4.00 ± 3.00
Staphylinid	<i>Philonthus carbonarius</i>	4	*3.00 ± 0.79
Control	-	6	0.83 ± 0.65

Literature Cited

- Kawanishi, C. Y., C. M. Splittstoesser, H. Tashiro, and K. H. Steinkraus. 1974. *Ataenius spretulus*, a potentially important turf pest, and its associated milky disease bacterium. *Environ. Entomol.* 3:177-181.
- Niemczyk, H. D., and D. M. Dunbar. 1976. Field observations, chemical control, and contact toxicity experiments on *Ataenius spretulus*, a grub pest of turf grass. *J. Econ. Entomol.* 69:345-348.
- Sears, M. K. 1979. Damage to golf course fairways by *Aphodius granarius* (L.) (Coleoptera: Scarabaeidae). *Proc. Entomol. Soc. Ontario.* 109:48.
- Shaw, J. T., R. O. Ellis, and W. H. Luckmann. 1976. Apparatus and procedure for extracting corn rootworm eggs from soil. *Illinois Natural History Survey Biological Note No.96.*
- Smitley, D. R. 1994. Entomology research , pp.27-34. In 64th Annual Michigan Turfgrass Conference Proceedings, January 18-20, 1994, Lansing, Michigan.
- Smitley, D. R., T. W. Davis, and N. L. Rothwell. 1998. Spatial distribution of *Ataenius spretulus*, *Aphodius granarius* (Coleoptera: Scarabaeidae), and predaceous insects across golf course fairways and roughs. *Environ. Entomol.* 27(6).
- Streu, H. T. 1969. Some cumulative effects of pesticides in the turfgrass ecosystem, pp. 53-59. In H. T. Streu & R. T. Bangs [eds.] *Proc. Scotts Turfgrass Research Conference, 19-20 May 1969.* O. M. Scott & Sons, Marysville, OH.
- Tashiro, H. 1987. *Turfgrass insects of the United States and Canada.* Cornell University Press, Ithaca NY and London. 391pp.
- Vittum, P. J. 1995. Black turfgrass ataenius, pp. 35-37. In R. L. Brandenburg and M.G. Villani [eds.], *Handbook of turfgrass insect pests.* Ent. Soc. America, Lanham, Maryland.
- Weaver, J. E., and J. D. Hacker. 1978. Bionomical observations and control of *Ataenius spretulus* in West Virginia. *W.V. Univ. Agric. For. Exp. Stn. Curr. Rep.* 72.16pp.
- Wegner, G. S., and H. D. Niemczyk. 1981. Bionomics and phenology of *Ataenius spretulus*. *Ann. Entomol. Soc. Am.* 74: 374-384.