

## SPATIAL DISTRIBUTION OF *ATAENIUS SPRETULUS*, *APHODIUS GRANARIUS* AND PREDACEOUS INSECTS ACROSS GOLF COURSE FAIRWAYS AND ROUGHS

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### Introduction

The black turfgrass ataenius, *Ataenius spretulus* (Haldeman), was first reported to damage golf course greens in Minnesota in 1932 (Hoffman 1935). Over the next 35 years *A. spretulus* was apparently not a widespread problem because there were no publications addressing it as a turf pest (Tashiro 1987). After 1970, *A. spretulus* is reported as a sporadic pest in most of the midwest and northeast United States and Ontario, occasionally causing extensive damage to fairways where it may build-up to larval densities of over 300 per 0.1 m<sup>2</sup> (Cartwright 1974, Kawanishi et al. 1974, Niemczyk and Dunbar 1976, Weaver and Hacker 1978, Wegner and Niemczyk 1979, Wegner and Niemczyk 1981, Vittum 1995). *A. spretulus* completes at least two generations per year in regions south of central Ohio, and one generation per year, sometimes followed by a partial second generation in areas north of Ohio (Wegner and Niemczyk 1981, Vittum 1995, Smitley 1994). *Aphodius granarius* (L.), a native of Europe, is widely distributed in the United States, but has only recently been known to damage golf course fairways and greens in Colorado, Michigan and Ontario (Jerath 1960, Sears 1979, Tashiro 1987, Smitley 1994). *A. granarius* was believed to have two generations per year, based on spring and fall peaks of adult activity in Ontario and Ohio (Sears 1979, Tashiro 1987). However, only one generation of larvae was observed in New Jersey and Michigan (Wilson 1932, Smitley 1994). In Michigan, a golf course may have damage from *A. granarius* larvae in June and again from *A. spretulus* larvae in late July (Smitley 1994).

Little is known about the distribution of *Ataenius* and *Aphodius* larvae on golf courses other than accounts of damage to tees, greens, aprons, and fairways (Niemczyk and Dunbar 1976, Tashiro 1987, Vittum 1995). Previous investigations of the natural enemies of *A. spretulus* and *A. granarius* appear to be limited to milky disease, *Bacillus popilliae* Dutky (Kawanishi et al. 1974, Splittstoesser and Tashiro 1977, Tashiro 1987). The importance of predators of *A. spretulus* and *A. granarius* has not been studied.

### Research Summary 1992-1997

#### Spatial Distribution Experiments

In 1992 and 1993 *Ataenius spretulus* and *Aphodius granarius* (Coleoptera: Scarabaeidae) larvae were 3 to 17-fold more abundant in golf course fairways than in the adjacent irrigated rough. From 1994 to 1996 glass vials were used as pitfall traps to map the distribution and abundance of adult *A. spretulus*, *A. granarius*, and the most abundant species of surface-dwelling insects. Replicated lines of pitfall traps ran 11 m into the fairway and 11 m into the rough. A total of 112 pitfall traps were changed weekly from early May to early July. In 1995, 341 *A. granarius*, 1,131 *A. spretulus*, 4,703 formicidae, 2,693 carabidae, 2,304 staphylinidae, and 579 histeridae were captured in pitfall traps. Similar numbers of insects were trapped at Cattails Golf Course in 1996. *A. spretulus* adults were 4-fold more abundant in the fairway while the numbers of *A. granarius* adults captured in the fairway and rough were similar. In 1995 and 1996 the numbers of predatory insects captured in pitfall traps declined sharply when crossing from the rough into the fairway. Staphylinids were 6-fold more abundant in the irrigated rough compared with the fairway. We found a strong inverse relationship ( $R^2 = 0.38$ ,  $F = 37.8$ ) between the distribution of *A. spretulus* adults and predators caught in pitfall traps; and a weaker inverse relationship between surface predators and *A. spretulus* larvae. The density of *A. spretulus* adults explained 12 and 47% of the variation in larval density in 1995 and 1996, respectively. At the Cattails Golf Course, our 1996 research site, no insecticides and only a few fungicides applications have been made in the 7-years it has been open, the rough and fairway are irrigated in the same way and have the same grass type: perennial ryegrass, *Lolium perenne* (L). The high density of *A. spretulus* and the relatively low density of surface predators in golf course fairways appears to be caused by mowing practices and the resulting changes in the turf habitat.

### Mowing Height and Daconil Experiments

In the last two years we have found *ataenius* and *aphodius* grubs to be much more abundant in fairways than in the adjacent irrigated rough. We conducted two experiments at The Cattails to learn more about why this is happening.

In the first experiment 16 plots were defined in the fairway and 16 in the irrigated rough. Half of the plots were sprayed once every two weeks with Daconil. At the end of this test we found an average of 31.3 *ataenius* larvae per plot in the fairway and only 7.5 larvae per plot in the rough. Daconil had no effect on the number of *ataenius* larvae that we found. We collected all the grubs that we found and dissected them to determine how many were infected with the naturally occurring milky spore disease. We found that 20% of the grubs in the fairway were infected compared with 51% of the grubs in the rough. Clearly, milky spore disease is much more active in the rough. Daconil did not have any effect on the proportion of larvae infected with milky spore disease, and it did not effect the number of predators found. After this test we do not believe the use of Daconil is causing the build-up of grubs in the fairway.

In a second experiment, the line between the fairway and rough was altered from the previous year by mowing a gentle curve back and forth across the old border. This created plots that were fairway in 95 and rough in 96, rough in 95 and fairway in 96, rough both years, and fairway both years. The new mowing arrangement was started in April, 1996. The plots were sampled for grubs in the middle of July when *ataenius* grubs were most abundant. The distribution of grubs followed the line of the old fairway. Regardless of how the turf was mowed or fertilized in 1996, grubs were most abundant in plots that were fairway in 1995. The average number of grubs found in plots where the old fairway was located, was 21, compared with 7 grubs per plots where the old rough was located. It did not make much difference whether the plots were maintained as fairway or rough in 1996. In 1997, the most grubs were found in the new fairway, regardless of the mowing height two years earlier. Therefore, after two years, *ataenius* grubs were again most abundant in the new fairway.

### Summary

It now appears that *ataenius* grubs are more abundant in golf course fairways because of the mowing practices and the changes in the turf habitat caused by frequent mowing at a short height. The fairway turf habitat does not support nearly as many predators as the rough, and the incidence of milky spore disease in grubs in the fairway is 25%, compared with 50% in the rough.

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