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BIOLOGICAL CONTROL OF ATAENIUS AND APHODIUS ON GOLF COURSES

Ataenius spretulus may be the most widespread grub on golf courses in the United States (Niemczyk & Dunbar 1976, Tashiro 1987). Ataenius has been found in 41 states and is known to damage turf in at least 23 states (Tashiro 1987). A few Ataenius beetles or grubs can be found on almost every golf course, prompting cautious superintendents to apply insecticides. However, damage to fairways is unlikely unless the density of Ataenius exceeds 100 grubs per square foot (Niemczyk & Dunbar 1976, Weaver & Hacker 1978, Tashiro 1986). In Michigan, superintendents consistently list Ataenius as one of their most serious pest problems. In 1992 the Michigan Turfgrass Foundation funded an investigation of Ataenius with the objective of reducing the use of insecticides on golf courses. Research on Ataenius in 1991 and 1992 uncovered key pieces to the Ataenius puzzle. The outlook is promising: Ataenius and Aphodius may be managed almost entirely by scouting and avoiding the use of certain pesticides. More research is needed to determine which pesticides are causing problems. This report will outline what we have learned about Ataenius and Aphodius so far, and what needs to be done to develop a realistic management plan that minimizes the use of insecticides.

Ataenius spretulus, a small black scarab beetle native to North America, was first reported to damage fairway turf in Minnesota in 1927 (Tashiro 1987). Although Ataenius was present throughout the century it was rarely reported as a turf pest until after 1970 (Weaver & Hacker 1978). The dramatic increase in the number of golf courses reporting damage from Ataenius after 1970 has been attributed to the development of resistance to chlordane, dieldrin, and perhaps other insecticides (Niemczyk & Dunbar 1976, Niemczyk & Wegner 1982). Investigations in Ohio and West Virginia indicate that Ataenius beetles in those states undergo two generations per year, with grubs causing the most damage in June and August. In northern New York, Ontario, Michigan, and other parts of the country north of Ohio, Ataenius may have only one generation per year. In some locations Aphodius granarius, another small scarab grub about the same size as Ataenius, has been found along with Ataenius grubs (Tashiro 1987). At one golf course in Ontario where turf damage was extensive, 97% of the grubs were identified as Aphodius granarius (Sears 1979). Overall, Ataenius spretulus has been reported to injure turf far more often than Aphodius granarius, although many superintendents probably do not realize that they have Aphodius. The number of Ataenius grubs necessary to injure turf (the damage threshold) is controversial. In most cases damage to fairway turf has been associated with counts of over 100 grubs per square foot, or 10 grubs per cup-cutter. However, Tashiro (1987) found little or no damage on fairways with 10 grubs per cup-cutter, and suggested that densities of 25 per cup-cutter are more likely to cause damage. A consistent thread running through the literature is the presence of milky spore disease, caused by Bacillus popillae. The strain of B. popillae causing milky spore disease in Ataenius and Aphodius grubs is different from the strain of B. popillae that infects Japanese beetle. The strain infecting Ataenius and Aphodius occurs naturally in the soil and does not infect Japanese beetle, European chafer or masked chafer (Splittstoesser & Tashiro 1977). The milky spore bacteria are ubiquitous in golf course soils, always causing some infection and death of Ataenius grubs (Kawanishi et al. 1974). In some cases more than 79% of the Ataenius grubs were found to be infected with B. popillae (Wegner & Niemczyk 1981).

Our initial objective was to determine why Ataenius was so abundant on golf courses and yet relatively rare on home lawns. Three golf courses in the Detroit area; Oakland Hills, Franklin Hills, and Orchard Lake, were selected for the study because of a history of Ataenius problems. Fifty cup-cutter samples were collected from each golf course once per week from June through August. At Oakland Hills, Aphodius was the most abundant grub (Figure 1). The number of grubs peaked in late June, and some damage was observed in hot-spots. Ataenius grubs began to appear about the time that Aphodius grubs pupated into adult beetles. Similar data was collected at the other two golf courses (Figures 2 and 3). In both years Ataenius went through one generation with grub activity peaking in late June, followed by one generation of Aphodius peaking in late July. In 1993 all the grubs were brought back to laboratory and dissected to determine the incidence of milky spore disease. In some cases more than 75% of the grubs were infected with B. popillae. At all locations far more grubs were found in the fairway compared to the adjacent irrigated rough (Table 1). One explanation for this could be the different species of grass in the fairway and rough. However at Orchard Lake, the grass composition was very similar in the fairway and rough, yet grubs were far more abundant in the fairway. Another explanation could be related to the increased pesticide use on fairways compared with roughs. Many Ataenius and Aphodius grubs were infected with B. popillae (Table 2). Bacillus popillae is capable of maintaining grub populations at low levels. However, it is also sensitive to pesticides. It is likely that fungicides and insecticides used on fairways are suppressing the milky spore disease bacteria.

Of the three golf courses where our research plots were located, the highest incidence of milky spore disease was at Oakland Hills, where no fungicides were used on the research plots, and the lowest incidence of disease was at Orchard Lake where the most fungicides were used (Table 2).

What is needed at this time is more information on how fungicides and insecticides used on golf courses affect the development of milky spore disease in Ataenius and Aphodius grubs. We plan to investigate the effect of fungicides on milky spore disease in 1994.

CHINCH BUG AND EUROPEAN CHAFER TESTS

Chinch bugs were difficult to find in the Lansing area in 1993, probably because of frequent rain and the fungal pathogen, Beauveria. A lawn heavily infested with chinch bugs was found in Okemos, Michigan. Of the three products tested this year, only Dursban Turf 4E provided good control of chinch bugs.

Sevin 3.5G and Sevin 80WP did not work well against chinch bug in our 1993 test. These results are different from our 1992 test where Sevin worked very well.

Several new products were tested for efficacy against European chafer. Rohm and Haas has two new products, RHXF89005 and RH0345, that worked well against European chafer, and look promising as future products for grub control in turf. The new Miles, Inc. product, Merit, also worked well for control of European chafer. Miles may receive a federal label for Merit in 1994. There is little doubt that Merit will be an excellent product for turf grub control. Unfortunately, to be effective Merit must be applied in July or early August, before grubs can be counted. Merit will be a good product to use in places where a grub problem is almost certain, but not a good choice for turf that is usually scouted first before a management decision is made. Dylox was also effective in our test; the 80SP and 6.2G formulations worked as well as Merit. Mainstay and the two insect parasitic nematode treatments did not reduce the number of European chafer grubs in our test plots.

Adding the results of our 1993 test to those of previous years, the most consistent products for European chafer control have been Dylox, Merit, Mocap and Oftanol.

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Table 1. Number of Ataenius and Aphodius grubs found in samples from the fairway and adjacent irrigated rough at three golf courses in 1993.

Location	Species	Number of grubs: Fairway	Number of grubs: Adjacent irrigated rough
Franklin Hills	*Aphodius granarius*	0	0
	Ataenius spretulus	85	5
Oakland Hills	*Aphodius granarius*	155	44
	Ataenius spretulus	19	5
Orchard Lake	*Aphodius granarius*	49	0
	Ataenius spretulus	83	5

Table 2. Proportion of Ataenius and Aphodius infected with Bacillus popillae

Location	Insect	Number of fungicide sprays on research plots	Percent infection
Franklin Hills	Ataenius	3	45
Oakland Hills	Aphodius	0	56
Orchard Lake	Ataenius	6	26
Orchard Lake	Aphodius	6	18

Table 3. Chinch bug test: Ingham, Co., Michigan, 1993

Company	Treatment	Rate AI/acre	Chinch bugs per plot: 23 Jul (2 min)	Chinch bugs per plot: 30 Jul 6 min)
DowElanco	Dursban Turf 4E	1.0 lb	3.33 a	5.17 a
Rhone Poulenc	Sevin 3.5G	8.0 lb	3.67 a	15.17 b
Rhone Poulenc	EXP60720A 80 WG	0.025 lb	3.50 a	24.50 b
Rhone Poulenc	Sevin 80 WP	6.0 lb	3.00 a	18.00 b
Rhone Poulenc	EXP60720A 80 WG	0.05 lb	3.50 a	15.50 b
Control			5.50 a	21.83 b

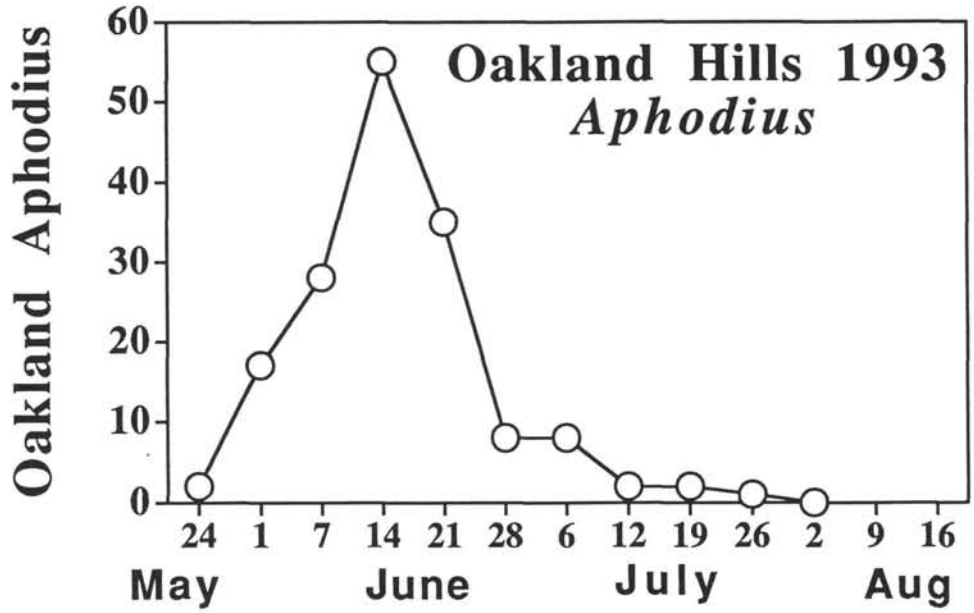

Figure 1. Number of Aphodius grubs per sample at Oakland Hills at weekly intervals in 1993.

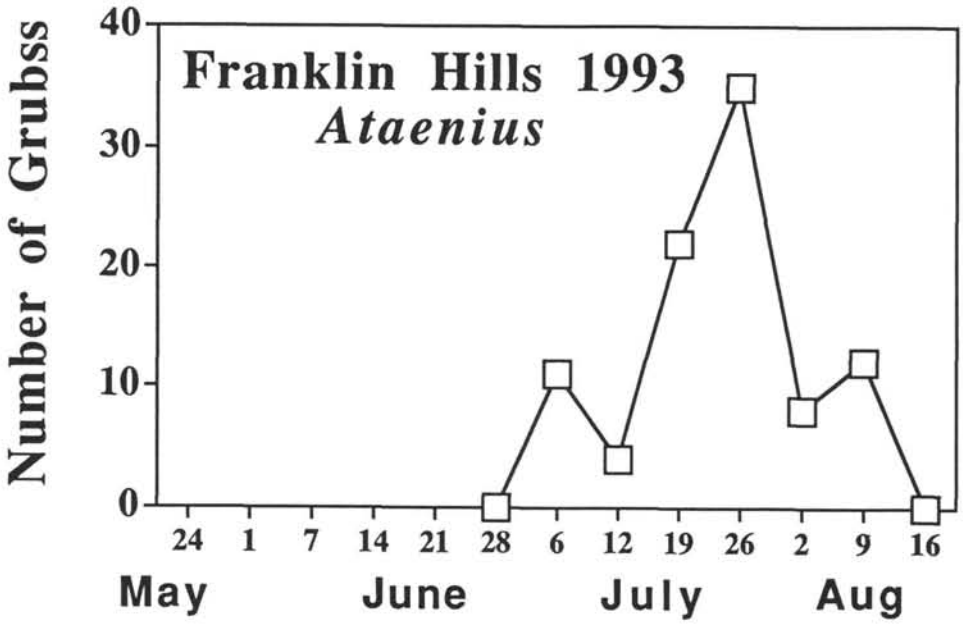

Figure 2. Number of Ataenius grubs per sample at Franklin Hills in 1993.

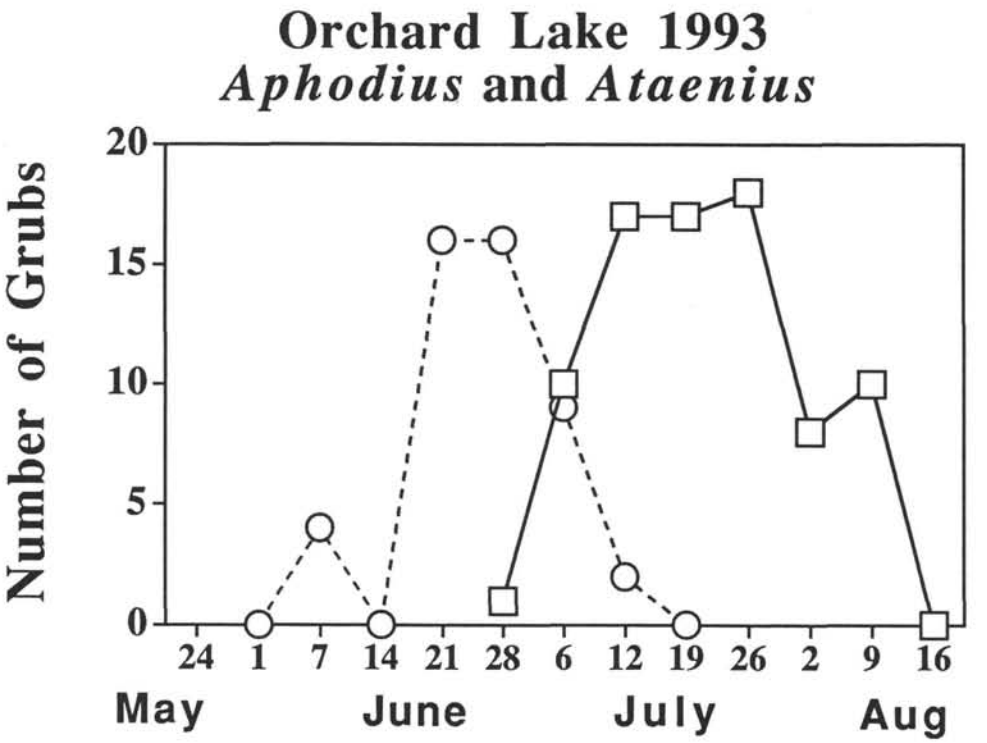

Figure 3. Number of Aphodius ( ) and Ataneius ( ) grubs per sample at Orchard Lake in 1993.