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.

REFERENCES

Kawanishi, C.Y., Splittstoesser, C.M., Tashiro, H. & K. H. Steinkraus. 1974. Ataenius spretulus, a potentially important turf pest, and its associated milky disease bacterium. Environ. Entomol. 3: 177-180.

Niemczyk, H.D., & D.M. Dunbar. 1976. Field observations, chemical control, and contact toxicity experiments on Ataenius spretulus, a grub pest of turfgrass. J. Econ. Entomol. 69: 345-348.

Niemczyk, H.D. & G.S. Wegner. 1982. Life history and control of the black turfgrass ataenius (Coleoptera: Scarabaeidae), pp. 113-117. *In* Niemczyk, H.D. , and B.G. Joyner (eds.), Advances in turfgrass entomology.

Hammer Graphics, Piqua, Ohio. 150 pp.
Sears, M.K. 1979. Damage to golf course fairways by Aphodius granarius (L.) (Coleoptera: Scarabaeidae). Proc. Entomol. Soc. Ontario. 109: 48.
Splittstoesser, C.M. & H. Tashiro. 1977. Three milky disease bacilli from a scarabaeid, Ataenius spretulus. J. Invertebrate Pathol. 30: 436-438.
Tashiro, H. 1987. Turfgrass insects of the United States and Canada. Cornell University Press. Ithaca, New York. 391 pp.
Weaver, J.E. & J.D. Haeker. 1978. Bionomical observations and control of Ataenius spretulus in West Virginia. West Virginia Univ. Agric. Forest Exp. Sta. Current Rep. No. 72. 16 pp.
Wegner, G.S. & H.D. Niemczyk. 1981. Bionomics and phenology of Ataenius spretelus. Ann. Entomol. Soc. Amer. 74: 374-384.

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

Table 4. European chafer larvae test: Blythefield Golf Course, 1993

Company	Treatment		Rate	n	Grubs per plot
				5	0.0 a
Rohm & Haas	XF89005	preventative	4.0 lb AI/acre		
Miles	Merit 75 WP	preventative	0.3 lb AI/acre	5	0.0 a
Rohm & Haas	0345	preventative	1.0 lb AI/acre	5	0.0 a
Rohm & Haas	XF89005	preventative	2.0 lb AI/acre	5	0.2 ab
Miles	Merit .62G	preventative	.3 lb AI/acre	5	0.2 ab
Miles	Dylox 6.2 G	curative	6 lb AI/acre	5	0.2 ab
Miles	Dylox 80 SP	curative	8 lb AI/acre	5	0.2 ab
Rohm & Haas	0345	preventative	2.0 lb AI/acre	5	0.4 abc
Miles	Dylox 80 SP	curative	6 lb AI/acre	4	0.5 abcd
Miles	Oftanol 5G	preventative	2 lb AI/acre	5	0.6 abcd
Miles	Dylox 6.2 G	curative	8 lb AI/acre	5	0.8 abcd
Rohm & Haas	0345	preventative	0.5 lb AI/acre	5	1.0 abcd
Rohm & Haas	0345	curative	1.0 lb AI/acre	5	1.0 abcd
Rohm & Haas	0345	preventative	0.25 lb AI/acre	5	1.0 abcd
Rohm & Haas	0345	curative	2.0 lb AI/acre	5	1.0 abcd
Lesco	Mainstay 2G	curative	4.6 lbs/1000 ft^2	5	1.8 abcd
Lesco	Mainstay 2G	curative	2.3 lbs/1000 ft^2	5	1.6 bcd
Rohm & Haas	XF89005	preventative	1.0 lb AI/acre	5	2.0 cd
Biosys	Nematode 25	curative	2 billion/acre	5	2.8 d
Biosys	Nematode 326	curative	0.5 billion/acre	5	2.6 d
Control				5	2.4 d