ATAENIUS AND *APHODIUS* SP. - 1993 FIELD OBSERVATIONS

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Six golf courses in southeast Michigan were sampled weekly from April through mid-October for the various stages of *Ataenius spretulus* and *Aphodius granarius*. Project objectives are to confirm the seasonal habits of these two scarabaeidae beetles; establish Growing Degree Day (GDD) models for their life cycles based on air temperatures and soil temperatures; and compare site specific GDD data to regional GDD data.

The following are principles that support the concept of growing degree days (GDDs). First, development of many plants and cold-blooded organisms depends on the heat in or around the organism. The biological process of interest does not begin until a certain temperature threshold is reached or exceeded. These thresholds, also called base temperatures, usually range between 40°F and 50°F. The temperature threshold for this project was 50°F. The biological process of interest (maturation) continues until the temperature falls below the threshold again. GDDs are a temperature-derived index, calculated from daily temperature data relative to the base temperature. Through the growing season, the accumulation of GDDs is correlated to the state of development of the organism(s) of interest (*Ataenius* and *Aphodius*).

To illustrate the GDD concept, shown below is the **Average Method** of calculating GDDs:

$$\frac{\textit{Maximum Daily Temperature} + \textit{Minimum Daily Temperature}}{2} - \textit{Base Temp} = \textit{GDD}$$

EXAMPLE:

$$\frac{72^{o} + 48^{o}}{2} - 50^{o}\ F = 10\ GDDs$$

Temperature data was collected at three sites with Envirocasters by Neogen corporation. Hourly air temperature and two soil temperature data, at 1" and 2" depths, were collected. The Baskerville-Emin (BE) method of calculating GDD was used to determine site-specific GDDs. Time is added to the BE methodology by weighing all temperatures above the base temperature in a day in proportion to the amount of time the temperature actually exceeded the base temperature.

Comparing the GDD accumulation during 1992 and 1993 with the regional average for SE Michigan in Figure 1, we see that 1992 was cooler than normal with less than 2500 GDD for the season. The 1993 season was slightly warmer than the regional average. In Michigan GDDs typically begin accumulating in March. As the season progresses the GDDs accumulate faster than during the early part of the season. This is because daily temperatures are more consistently above the threshold temperature, thus the slope of the graph increases. This regional GDD data was correlated to the activity of the *Ataenius* and *Aphodius* beetles.

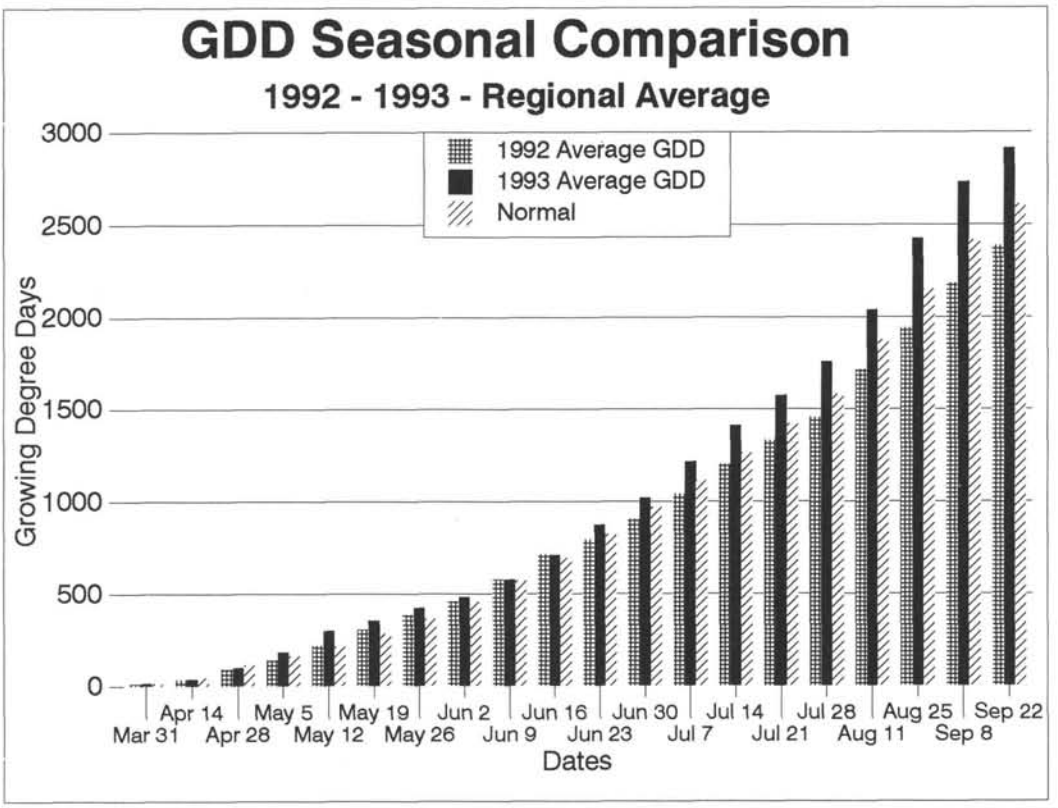

Figure 1. GDD Comparison: 1992 - 1993 - SE Michigan Regional Average

A review of the *Ataenius* and *Aphodius* life cycles reveals that they over-winter as adults, emerge in the spring and lay eggs. The eggs hatch into C-shaped white grubs which develop through three instars. They then pupate and emerge as adults. There is one generation of *Ataenius* and *Aphodius* in Michigan.

Adult (beetle) activity was monitored using yellow sticky cards attached to wooden stakes at 23.5" high. The stakes were placed along fairways, in roughs, along woodlots and native areas, and near greens. Cards were replaced weekly. Trap catches reveal that both beetles are active at the same time in the spring. Peak catches spanned a three week period in May, during a range of 250 to 350 GDDs. As shown in Figure 2, more *Ataenius* beetles were trapped. This could suggest a few things. Aphodius may lay their eggs where they overwinter and may not have a need for flying to egg laying sites in the spring. *Ataenius* beetles may be more active fliers, having a greater potential for dispersing over a larger area. At the six sites, every course had some level of *Ataenius* but only three courses had *Aphodius* grubs. This flight and dispersal activity, or lack of, may help turf managers predict future infestations. Since *Aphodius* may be limited fliers, they may likely appear in or close to the same sites in a succeeding season. Whereas *Ataenius* may be problematic in a location one season and not the next because of their tendency to disperse.

The course with the largest *Aphodius* grub population had the fewest beetle catches. This would suggest monitoring for *Aphodius* using this method is not a reliable prediction of grub-pest pressure. Grubs were sampled by pulling soil cores 4" deep using a cup cutter. The grubs were found at the soil-thatch interface and slightly below this level in the soil. Grubs were collected and taken to the lab for identification and sizing under the magnification of a microscope. To distinguish between the grub species requires looking at the raster patterns on the hind end of the grub. *Aphodius* grubs have a distinctive 'V' pattern and the *Ataenius* rasters are randomly placed and have small hooks on the ends. In the field, grub identification can be deduced by their size and time of season. First, these beetle grubs are much smaller than other common white grubs in Michigan. To distinguish between *Ataenius* and *Aphodius* grubs in the field we can now consider the time of season and the number of GDD that correlates with their peak occurrence.

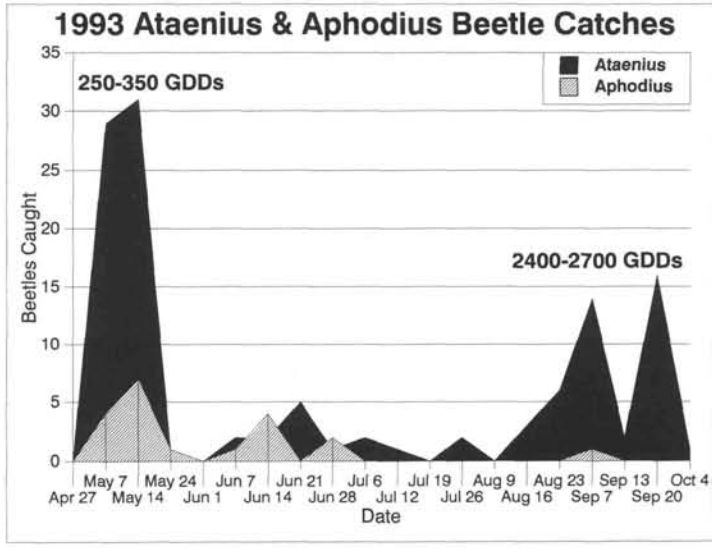

Figure 2. 1993 *Ataenius* and *Aphodius* Beetle (adult) Catches

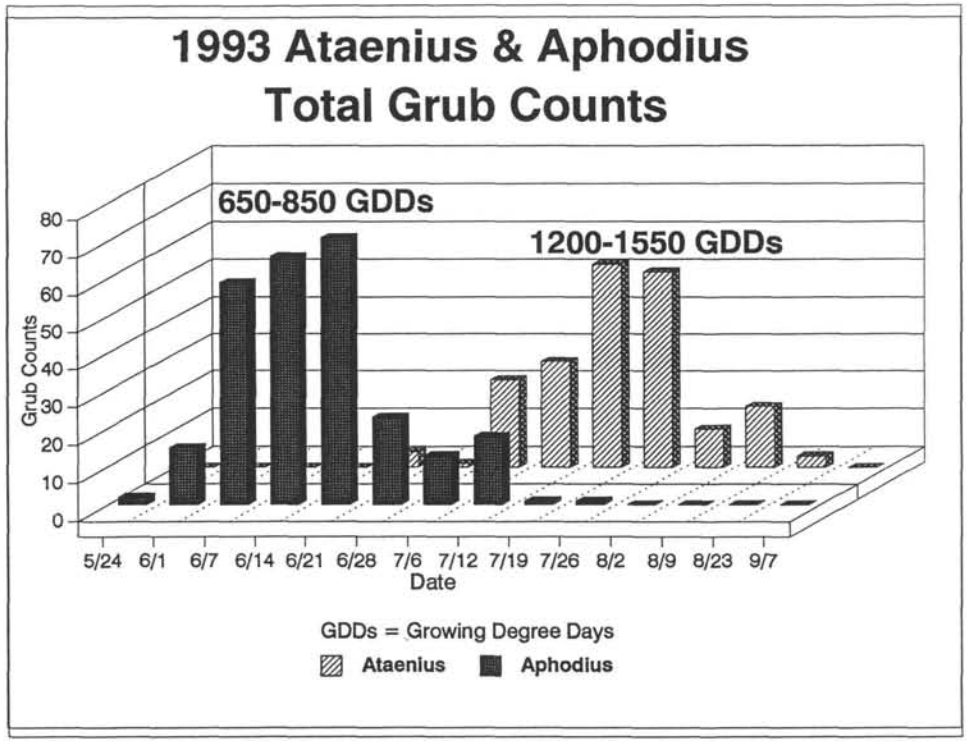

Figure 3. 1993 *Ataenius* and *Aphodius* Total Grub Counts

As illustrated in Figure 3, the *Aphodius* grub population peaked first and developed during the range of 650-850 GDDs, during June. The *Ataenius* grub population developed between 1200-1550 GDDs, peaking during the last week of July. These peaks are narrow, suggesting the time for locating and controlling these grubs is fairly limited. The opportunity to apply a grub control is about two weeks. Knowing the degree day range during which time the grubs can be scouted for and located will be helpful to turfgrass managers. Additional monitoring can be executed at these times and management decisions made based on the findings. Irrigated turf can tolerate approximately 40-50 *Aphodius* grubs per square foot without showing symptoms of injury. The *Ataenius* threshold is still being observed but it appears that irrigated turf can withstand 60-80 grubs per square foot.

Although the six sampling sites were within a 15 mile radius, the presence of beetles, grubs and species varied. It is important for each golf course turf manager to get out and determine the type and level of populations present at their particular site.