A Small Insect, but a Large Problem

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Bottom line: Black turfgrass ataenius grubs are difficult to control because of their multiple generations, long infestation threat periods, difficult detection, and sporadic appearance. For better forecasting of the timing and location of infestations, monitoring is essential. Three consecutive days of average air temperatures >65F (when observed after April 15) are a rough indicator that grubs will soon be present in the soil, and that preventive insecticide applications should be made within the next two to four weeks. In locations with long threat periods for infestation, follow up applications may be required in order to protect turf season-long. Cultural practices (avoidance of organic fertilizers, removal of clipping piles, keeping soil organic matter below 4%, addressing areas with excessive moisture and/or black layer) can also help reduce infestations.

The black turfgrass ataenius, *Ataenius spretulus,* should be easy to control. Its small size – the insect never reaches more than ¼" in length – means that the damage one insect can cause is negligible. There are several effective products available for its control (Table 2), and its life cycle, behavior and geographic distribution are fairly well understood. Yet every year, there are golf courses that suffer significant damage from this innocuous pest on cool season greens, tees, fairways and roughs. So what gives? Why is this insect such a headache in so many locations?

Life cycle: the Energizer Bunny strikes again

The black turfgrass ataenius (BTA) belongs to a large group of insects known as **scarab beetles,** the larval, or juvenile stage of which are known as **white grubs**. But the BTA differs in a very important respect from most of its scarab brethren, and that is in its ability to lay eggs and produce damaging grubs over a period of several months. In very northern locations, this period may last up to 3 months. But in the mid and southern parts of the country, infestations can develop starting in April through as late as October or November – a threat period of up to 7 months! Like the Energizer Bunny, these BTA populations keep coming back, and unfortunately, just when they are least expected. While we have some very good, long-lasting products such as Merit (imidacloprid) or Mach 2 (halofenozide), their residual control period is usually three months or less. In years with warm springs and/or warm falls, or in southern locations with warmer overall temperatures, some turf managers have had to resort to multiple insecticide applications in order to protect turf during the time that the BTA is actively reproducing and feeding – what we call **the threat period**

The entire life cycle of the BTA – from the time the first eggs are laid until the next generation of adult beetles are laying more eggs -- can take place in as little as 6 weeks. This means that as long as the weather permits (more on that below), these insects can repeat their life cycle one, two or even three times a year. And each successive life cycle brings more and more damaging grubs into the soil. One entire 6 week life cycle progresses as follows:

Photo courtesy of NY Agricultural Experiment Station

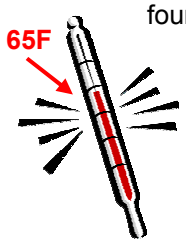
1. White grubs hatch from eggs laid in the soil by adult BTA females. The grubs live for 2-4 weeks in the soil, feeding on turf roots and organic matter. This is the only stage of the BTA that causes damage to turf. The grubs eventually stop feeding and migrate an inch or more down into the soil to form pupae – the stage during which dramatic metamorphosis, from a white grub to an adult beetle takes place.
2. A few weeks after pupation, the **callow or teneral adult,** a light brown and very soft version of the mature BTA beetle emerges from the pupa. This is a short-lived stage of the insect.
3. As the integument, or skin of the teneral adult hardens and darkens, it works its way to the soil surface. The mature black beetles are frequently found walking on the surfaces of greens. This winged form of the BTA then mates, and once mated, the females lay eggs — in clusters of 11 to 12 — in the soil. The eggs usually take a few days to a few weeks to hatch.

Forecasting BTA infestations

As for all other insects, the BTA's activities are closely linked to both air and soil temperatures. Peak BTA reproduction and feeding occur during the late spring and summer months. It is difficult, however, to predict exactly when the insect will first pop out of its winter hibernation (the BTA overwinters as an adult beetle in a quiescent, non-feeding state in the soil), and for how many months it will continue to reproduce and feed. The PACE Turfgrass Research Institute and several university researchers have conducted monitoring and

temperature studies over the past several years, with only moderate success in developing a more accurate forecasting system, but here is what we do know:

- The first BTA eggs of the season are laid at the same time as the full bloom of the Vanhoutte spirea, the horse chestnut and the earliest bloom of the black locust (Wegner and Niemczyk, 1981). The first white grubs should begin appearing about two weeks later. Preventive insecticide applications should therefore be made within 2-4 weeks after these bloom periods occur.
- If these plants are not common in your area, we have found that the use of a **threat temperature** can help in timing management procedures. Three consecutive days of **average** air temperatures greater than 65F, when observed after April 15, will roughly correspond to the plant cues described above. Preventive insecticide applications made 2-4 weeks after reaching the 65F threat temperature should target the first significant group of BTA grubs appearing on the golf course. Using this timing strategy, preventive insecticides should never be applied before May 1. In most years and most locations, applications are made in mid- to late June.



- BTAs will continue to feed and reproduce as long as average air temperatures remain above 65F and/or as long as minimum soil temperatures (at the 6" depth) remain above 60F.

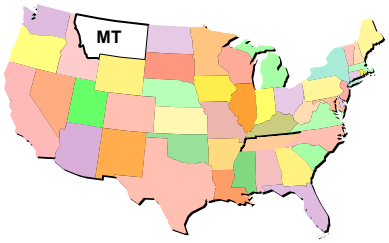
Short season strategy vs. long season strategy

Where the BTA threat period is three months or less, control is relatively straightforward. Preventive products such as imidacloprid or halofenozide are usually applied sometime between June 15 and July 15 (depending on the location), and the turf is protected for the season. The only complicating factor in this short season scenario occurs when other white grubs and/or weevils or billbugs are also threats at the golf course. Under these conditions, timing of preventive insecticide applications must take into account the life cycles of these pests as well, and may result in a slightly earlier or even later application date.

In many parts of the country though, the BTA threat period can extend well beyond three months – at least in some years. Conditions that would lead to this long season scenario include warmer than normal springs, warmer than normal autumns and/or mild winter climates that are typical in many of the southern tier states. Under these conditions, a single preventive application is made sometime between May 15 and June 30 (depending on the location), but the product may not have enough residual activity to protect turf for the entire threat period. Under these conditions, there are several options:

- Make split applications of preventive products such as imidacloprid or halofenozide. The first application is made at the start of the threat period, and the second application approximately 8 weeks later. Our field trials have shown this to be an effective strategy that extends turf protection to 4 months. Be careful to stay within the annual use limits that appear on the product label, however (Table 2). This strategy has the advantage of being almost fool-proof. But it is important to remember that repeated use, year after year, of either imidacloprid or halofenozide should be avoided if at all possible. There is some potential (though fortunately so far not realized) that white grubs can develop resistance to these products if they are used without occasionally rotating to insecticides in other resistance management groups.
- Make a preventive application of imidacloprid or halofenozide at the start of the threat period, and follow up 8 – 10 weeks later with a curative product such as acephate or trichlorfon that targets grubs (Table 2). Though extremely unlikely, it is possible that a second application of the curative product would be required 4 weeks later if monitoring indicated a flurry of late season BTA grub activity. This strategy has resistance management benefits because it rotates two products from different resistance management groups (Table 2).

Geographic distribution, and a small detour



The black turfgrass ataenius is native to the United States (though other closely related ataenius beetles occur around the world) and has been reported from every state in the continental U.S. except Montana, indicating that it is widespread and can tolerate a broad range of climates. However, this is a good time to bring up an interesting point about the hidden pitfalls of interpreting pest distribution reports. As you read the above sentences, did you ask yourself why it was that BTAs have not been found in Montana? Is it because the climate of Montana is harsh enough to inhibit BTA growth? Or because the beetles somehow just never got there? Or simply because the entomologists at Montana State University don't have a research interest in this pest? We don't have the information to answer this question definitively, but there is certainly a good possibility that the last explanation is correct. The point we want to stress with this example is that geographic distribution data for any pest – be it a disease, a weed, a nematode or an insect – is wholly dependent on the existence of someone who cares whether the pest is in a given state or location or not. The bottom line? Even if a pest is not listed in textbooks or magazine articles as occurring in your state, don't automatically assume that the pest doesn't exist there. Send a sample to a diagnostician or extension agent for identification to make sure – and you may end up increasing our collective knowledge about the distribution and behavior of the pest! Conversely, just because an insect is listed as occurring in your area

doesn't mean that it is causing turf damage there. Sometimes the populations are so low, or so restricted that their impact is negligible.

The BTA: a fickle foe

Figure 1. Symptoms of advanced infestations of BTA grubs. Despite the relatively undramatic symptoms (top photo), the slightly yellowed and thinned turf has significant root damage from feeding by BTA grubs (bottom photo). There are at least 5 BTA grubs visible (can you find them all?) in this sample from the thatch/soil interface. Over the next few days, this turf will decline further and eventually die if grubs are not controlled.

We have seen several examples of side-by-side golf courses with similar turf types, with one heavily infested by BTA, and the other BTA-free. While there are some conditions that can promote local ataenius populations (Table 1), we simply don't know enough about this insect to understand where and why it will strike – or how long it will stay. This makes it difficult for superintendents to plan – should preventive insecticides be applied even if BTA grubs have never caused problems on the golf course? Can a year or two of insecticide applications knock BTA populations down to the point that insecticide applications can be skipped the following year? There are no solid answers to these questions, but we can suggest some general rules of thumb:

- If you have recently experienced BTA infestations, it is likely that they will re-appear every year for two or more additional years. Preventive insecticide applications are usually warranted in this situation.
- After several years of insecticide applications, it may be possible to avoid treatment for a year or two on the assumption that populations have been severely reduced by insecticide applications. However, new BTA populations can establish rapidly and unpredictably. For this reason, **do not attempt this strategy unless you are willing to monitor turf weekly (beginning April 15, or when average air temperatures consistently exceed 65F) for early signs of BTA grubs and/or turf damage.** If grubs are detected, then one of the curative treatments that target grubs (Table 2) should be applied immediately.
- If you have never had trouble with BTA, but neighboring courses have, you have a difficult decision before you. It is, of course always safest in the short-term (from the standpoint of avoiding insect damage) to apply a preventive insecticide. However, if you are trying to reduce pesticide inputs, some judgement is called for. In general, if you meet two or more of the risk factors listed below, your are a likely candidate for BTA infestation and damage, and preventive actions are merited. If you meet fewer than two of the risk factors, then it is unlikely (though not impossible) that you will suffer serious damage from BTA grubs.

Table 1. Risk factors for black turfgrass ataenius damage.

- Cool season turf varieties on greens, tees, fairways or roughs
- Nearby courses have experienced BTA damage
- Frequent use of organic fertilizers or compost (the BTA belongs to a dung-loving group of beetles known as the Aphodian dung beetles; though they have adapted well to a life without dung on the golf course, they seem to be especially attracted to areas treated with organic materials that mimic their preferred environment)
- Black layer or poorly drained wet areas are common
- Course is located near a riverbed or wooded area
- Course is near a current or former livestock operation (chickens, horses, cows, etc)
- Piles of decaying turfgrass clippings are common
- Heavy thatch or high soil organic matter (>4%)
- Weekly monitoring for BTA activity is not possible.

It is important to remember, however, that if you deal with infestations from other white grubs (Japanese beetle, chafers, Oriental or Asiatic garden beetle, etc), you must continue to manage for those insects, even if you deem that BTA infestations are not a significant threat.

Table 2. Products registered for use on golf courses for the black turfgrass ataenius.

- **Target** refers to the life stage of the insect that the product is most effective for. Successful control can be achieved by targeting either adults (an indirect method that by controlling the non-damaging adults prevents them from laying eggs and therefore producing more damaging grubs), or grubs (a direct method that targets the damaging stage of the insect with insecticides). While both strategies can result in successful control, targeting of adults is somewhat less reliable, as it requires more monitoring of adult populations, more attention to careful timing of insecticide applications and the possibility of multiple insecticide applications for optimum results.
- **Activity** designations are "C" (curative control) or "P" (preventive control). "P & C" indicates that the product has both preventive and curative activity. "Early C" indicates that the product is effective only when grubs are newly hatched; effectiveness of control will decline as the grubs grow larger.
- **Restricted Use** refers to those pesticides that the EPA has restricted for use to a certified and/or licensed pesticide applicator, or under the supervision of such an applicator. Keep in mind individual states may place additional restrictions on the use of some, or all pesticide products.
- **Signal word:** each pesticide label must display a signal word that indicates the relative toxicity of the active ingredient to humans. The three signal words, in order of increasing toxicity, are **caution, warning** and **danger.**
- **Annual use limit:** An increasing number of products have labeled restrictions on the amount of product that may be used per year per acre. Always check the most recent version of the label for updates to annual use limits.
- **Caterpillars:** Several ataenius-active products may also be active against caterpillar pests such as black cutworm, sod webworm and armyworms. A "Yes" indicates that the product is active against these caterpillars.
- **RM Group**: Insecticides are organized into **Resistance Management Groups** based on mode of action and chemical structure. To avoid development of resistance, rotate applications (from one application to the next, or from one year to the next) among products from different resistance management groups.

Active ingredient	Product names	Target	Activity	Restricted use?	Signal word	Annual use limit	Cater-pillars	RM Group	Comments
acephate	Orthene	Grubs	C	No	Caution	None	Yes	1	
bifentrhin	Talstar	Adults	C	Yes	Caution	None	Yes	3	Longer residual activity than other pyrethroids (cyfluthrin, cyhalothrin, deltamethr in)
carbaryl	Sevin	Adults & Grubs	C	No	Warning	None	Yes	1	Only moderate activity on grubs; must be heavily watered in
chlorpyrifos	Dursban, Pageant	Adult	C	Yes	Danger	None	Yes	1	Labeled for white grubs (larvae), but research indicates mediocre to poor performance
cyfluthrin	Tempo	Adult	C	Only for certain formula-tions	Caution	None	Yes	3	
λ cyhalothrin	Battle, Scimitar	Adult	C	Yes	Caution	0.36 lb AI/A/year	Yes	3	
deltamethrin	Deltagard	Adult	C	No	Caution	None	Yes	3	
halofenozide	Mach 2	Grubs	P and early C	No	Caution	2 lb AI/A/year	Yes	18	May cause discoloration on Tifdwarf Bermuda greens
imidacloprid	Merit	Grubs	P and early C	No	Caution	0.4 lb AI/A/year	Limited	4	
Trichlorfon (dimethyl phosphonate)	Dylox	Grubs	C	No	Warning	None	yes	1	Heavy thatch (1/2 – ¾") may interfere with efficacy

References

Wegner, GS and HD Niemczyk. 1981. Bionomics and phenology of Ataenius spretulus. Annals of the Entomol. Soc. Amer. 74:374-84.