TURFGRASS

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Annual bluegrass weevil

(previously known as the "Hyperodes" weevil)
Listronotus maculicollis Dietz

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Introduction

The annual bluegrass weevil (ABW) is a burgeoning pest of turfgrass in the northeastern United States. This native beetle is most prevalent and injurious in low-cut, high maintenance turf such as golf course greens, tees and fairways. The insect was first reported damaging turfgrass in Connecticut as early as 1931. Until the last 20 years or so, damage had been concentrated in the metropolitan New York area. Severe infestations, however, are now experienced across the Northeast and into the Mid-Atlantic, including north to Maine and Quebec, west to Pennsylvania and Ontario, and south to Maryland. It has also been identified within the last two years from Delaware, West Virginia and Virginia.

ABW larvae and adults feed primarily on annual bluegrass (*Poa annua L.*), a major component of many golf course playing surfaces. Annual bluegrass is often considered a weed by golf course superintendents since it is an aggressive invader of newly seeded stands of creeping bentgrass (*Agrostis palustris H.*). When annual bluegrass becomes the dominant grass species in fairways and putting greens, however, superintendents resort to managing it, rather than eliminating it. ABW has also been reported to feed on creeping bentgrass and perennial ryegrass (*Lolium perenne L.*). In areas where annual bluegrass is prevalent, high populations of weevils will cause substantial areas of dead turf that affect both the visual and functional quality of golf course turf.

Life stages

In the field, ABW adults are relatively active walkers. Viewed up close they have long snouts that are a hallmark of the weevils. They measure 3-4 mm (~1/8 in.) long, about the same size as black turfgrass ataenius, or about half the size of bluegrass billbugs, another common turfgrass weevil. In addition to overall size, ABW adults can be differentiated from billbugs because their antennae arise from the tip of the snout, rather than the base, and the hind margin of the eye is convex rather than concave. Newly emerged adults, known as "callows" or "tenerals," are chestnut to brown in color, making the young adults distinguishable from mature adults that are dark grey to black. Adults feed on grass blades, carving out notches on the edges, but cause insignificant damage.

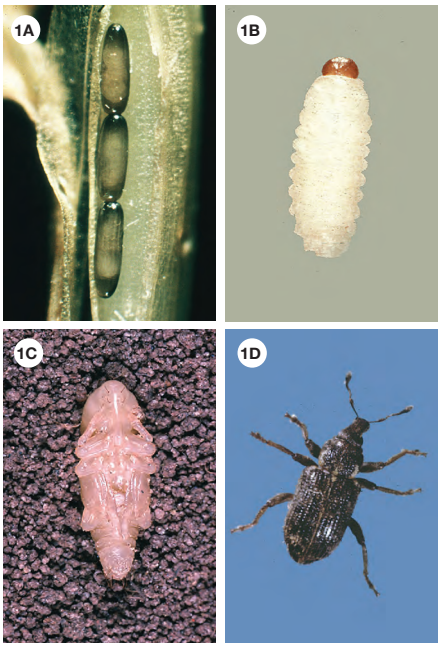

Fig. 1. ABW life stages: egg (A), larva (B), pupa (C) and adult (D). Photos by NYSAES Photography.

During oviposition, females chew holes in the outer leaf sheath and insert eggs between the sheath and the stem. Eggs are oval in shape, measure 0.25 x 0.8 mm (1/100 x 3/100 in.) and hatch in 4-5 days. The young larvae live as stem borers, chewing and consuming tissue within the relative protection of the stem and filling it up with sawdust-like frass. When they outgrow the stem, older larvae will drop down to the soil surface where they shape crude burrows and forage out to chew on surface roots and crowns.

Larvae are legless with bodies that are straight to slightly curved. Therefore they are easily distinguished from white grubs, which have six legs and a "C"-shape. Their bodies are creamy white in color with a well-defined brown head capsule. Larvae pass through five instars ranging in size from 1 mm (1/25 in.) long for first instars to 4.5 mm (1/6 in.) long for fifth instars. Small larvae are the size of *P. annua* seeds while large larvae are the size, shape and color of rice grains except with brown heads.

The mature fifth instar transforms to a prepupa within the top 1 cm of the soil. This stage is active, lasts 2-5 days and builds the cell in which the inactive pupa will reside. After 3-9 days, the pupa transforms to the callow adult, which will stay in the pupal cell for 3-8 days before abandoning it for a life on the surface. The prepupa, including the head capsule, is creamy white. The pupa resembles the adult, but remains creamy white until it darkens with maturation and takes on the brown coloration of the new adult.

Life cycle

ABW adults overwinter in protected areas away from the short-mown turf where the insect feeds and develops during the warm season. They tend to settle into the litter and soil surface along defined tree lines, but also in other areas such as tall rough, patches of weeds and edges of hedgerows.

In early spring, warming temperatures prompt an exodus from overwintering sites and a reinvasion of areas of short-mown *P. annua*. During warm periods from late March to May, it is common to see the small dark adults ambling over the peripheries of fairways, tees and greens. These reinvading adults lay eggs of the spring (first) generation. Depending on the climate, ABW will complete a summer (second) and occasionally fall (third) generation. Two generations may be typical in Upstate NY, three Downstate. By late fall, adults have made their way back to the protection of overwintering sites. Overwintering adults are rarely ever found on the fairways, tees or greens.

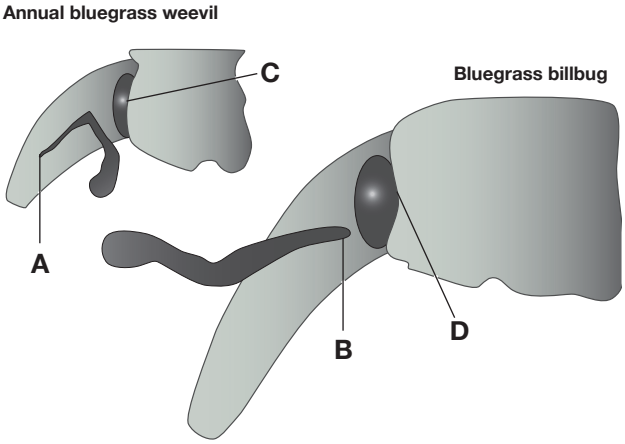

Fig. 2. Key characters for differentiating adults of ABW and billbug: antennae arise from tip (A) or base (B) of snout, posterior margin of eye convex (C) or concave (D). Illustration by D. Peck.

Damage

ABW has an affinity for close-cut *P. annua*. Nevertheless, it will feed on perennial ryegrass and creeping bentgrass in those same close-cut habitats. As such, home lawns, athletic fields, and turf habitats other than golf courses and tennis courts are not affected, even though ABW and *P. annua* might be present.

Most impact is attributed to the larvae feeding on and killing stems. A single individual can injure up to 20 stems. Stems are weakened and broken due to the boring activities of the young larvae. Older larvae reside at the soil or thatch surface where they feed on the crowns. ABW injury is generally expressed as growing areas of yellow and brown patches usually first noticed around the collar and perimeter of the greens, tees or fairways. Unlike white-grub injury, the soil and root zone remain firm and not spongy. Early ABW damage has anthracnose-like symptoms and is frequently confused with this disease.

ABW damage can be superficially similar to the injury caused by some other pests and diseases. Therefore, be sure to use the "tug-test" as part of your diagnosis. A light tug on affected grass will pull up stems if they have been weakened by the activity of larvae. It may also reveal the frass, or excrement, left behind after their feeding.

Fig. 3. Damage due to severe ABW infestation on a golf course fairway (A), tee box (B) and putting green (C). Photos by M. Diaz.

Monitoring

Before an informed decision about any chemical application can be made, scouting must be conducted to gather information on which life stages are present, where infestations are located, and whether those populations are large enough to warrant intervention. Unfortunately, ABW is challenging to monitor due to its small size. In the spring, mower baskets can be monitored for adults because they are picked up along with clippings. This can be a useful way to stay abreast of when adults are appearing in the spring, and, with more careful monitoring, on which areas of the course they are most prevalent. Some areas of the course may always harbor ABW so it is a good idea to monitor consistently those historically affected areas from year to year.

A more site-specific approach to monitor adults is to pour a soapy disclosing solution on the turf surface (1-2 tablespoons of lemon-scented dish detergent mixed in 2 gallons water). This irritant forces adults to emerge from the thatch and ascend to the surface where they can be counted. Shallow soil core sampling or simply digging around at the soil surface / thatch interface will reveal older larvae and pupae. If more detailed information is desired, larvae of all sizes (even stem boring stages) will float to the surface when an infested core is submerged and agitated in a saturated salt solution. This is a good way to confirm that your adult controls were adequate; if too many larvae are found, the application may have been poorly timed to suppress adults and another application against adults of the developing population may be necessary.

Damage thresholds are considered to be 30-80 larvae/sq. ft for the spring generation. Given summer heat stress, thresholds drop to 20-40 larvae/sq. ft for the summer generation. Nevertheless, field experience indicates that action may have to be taken at thresholds as low as 5-10 larvae/sq. ft in order to avoid injury and minimize the threat of the subsequent generation. While a limited number of products are registered in NY and labeled for larvae, their efficacy is far inferior to products that target adults. Therefore, when larval thresholds are surpassed, withhold applications and monitor those areas to track development as the population matures from small to large larvae and to pupae. If sampling reveals a preponderance of pupae, delay an application for one week to effectively target the adults.

Management

Traditionally, golf course superintendents have targeted early spring adult populations that represent overwintering insects returning to the short mowed turf. A preventive insecticide application is then made to suppress adult populations before the insects begin to lay eggs. The timing of spring applications can be based on a plant phenological indicator. The most widely used is the period that occurs between Forsythia V. full bloom, and dogwood, *Cornus florida L.*, full bract. It is better to make the spring application a little late than a little early so aim for the time when Forsythia is in full bloom and has already acquired many new leaves (i.e. “half gold/half green”).

Choose a relatively insoluble insecticide that stays in the thatch where adults are active. Synthetic pyrethroids (Bifenthrin, Cyfluthrin, lambda-Cyhalothrin, Deltamethrin) are the best options. Water in the application lightly to move the material off the leaves. Widespread fairway applications are usually not necessary. It should be sufficient to limit applications to periphery sprays along historically susceptible greens, collars, tees and fairway perimeters. If this control fails, second generation adults can be targeted again around July 4.

Given these recommendations, the best-case scenario is one well-timed perimeter spray targeting spring adults. Nevertheless, some courses end up making 3-5 applications in a season. One problem is asynchrony in population development, that is, when all life stages do not occur simultaneously. This makes it difficult or impossible to interpret timing of the generation and to decide when to apply controls. Other limitations are the lack of efficacious products labeled for larvae, and the overwhelming reliance on one class of insecticides (pyrethroids). Further complicating a successful control program is recent evidence supporting the idea that resistance to pyrethroids has emerged in some ABW populations in the Northeast, and that this may be linked to control failures. Control failures may be due to a significant proportion of the population in unsusceptible life stages, namely eggs and pupae that are unaffected by insecticides. Asynchrony could be related to climate and other environmental factors if, for instance, it led to a broad versus narrow window of adult emergence from overwintering sites and their reappearance on the golf course. Barring that, failure of a well-timed pyrethroid application could be due to resistance. Researchers in the Northeast are working to determine how widespread pyrethroid resistance is, while they are simultaneously pursuing new control alternatives.

There are currently no non-chemical alternatives that can be recommended for ABW control. Overwintering adults are sometimes very abundant in white pine litter, leading some golf courses to remove pine litter or even remove stands of white pine trees. Tree removal is not recommended, however, because these sites are not actually preferred locations for overwintering. Weevils will overwinter elsewhere.

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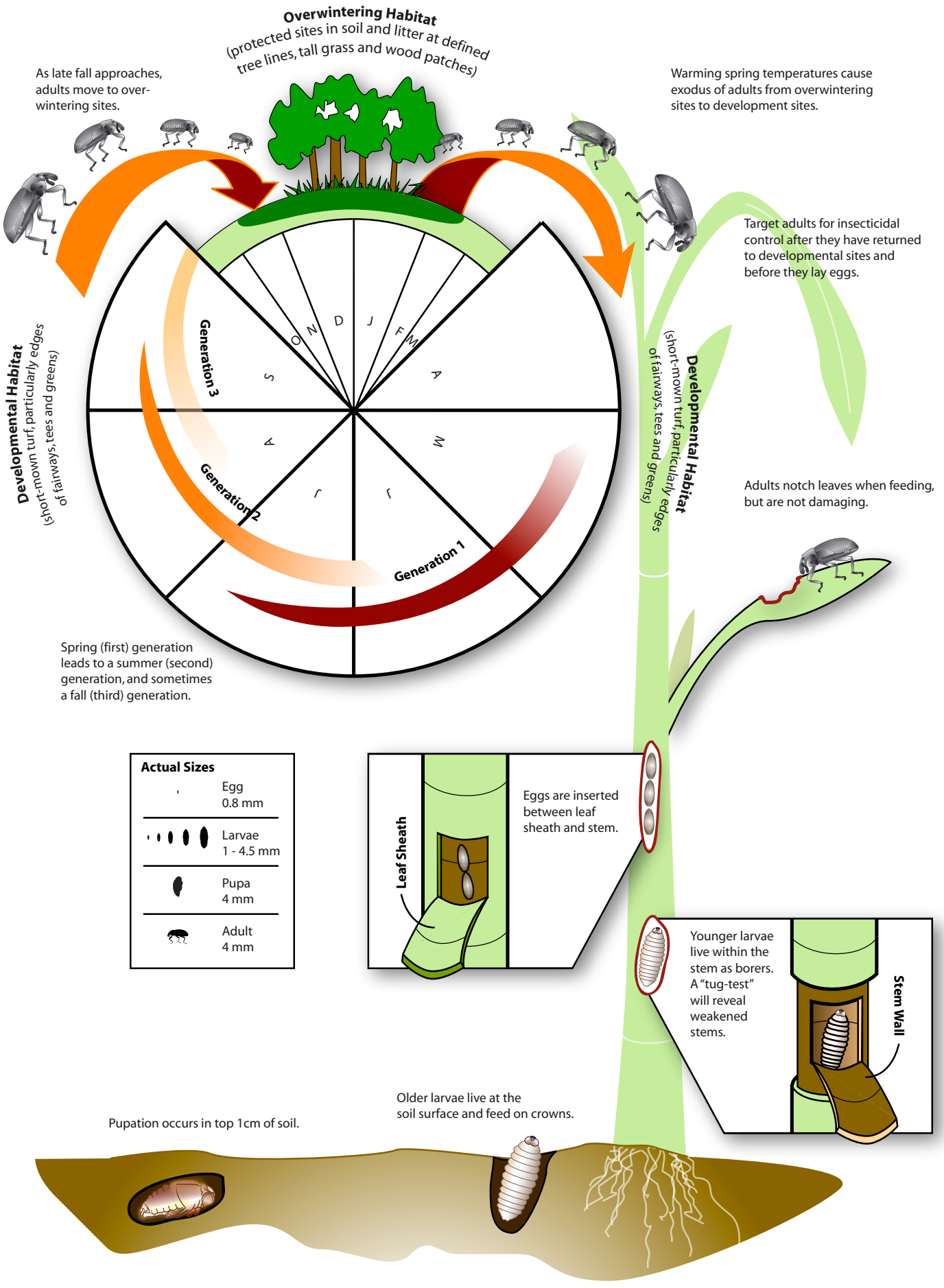

Fig. 4. Life stages (to scale) and life cycle diagram. Illustration by C. Cooley and D. Boyce.