

Bluegrass Billbug *Sphenophorus parvulus* Gyllenhal (Insecta: Coleoptera: Curculionidae: Dryophthorinae)¹

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Introduction

The bluegrass billbug, *Sphenophorus parvulus* Gyllenhal, is a weevil that commonly infests cool season turfgrasses, especially Kentucky bluegrass, *Poa pratensis* L. (Figure 1). More than 64 *Sphenophorus* species occur in the United States. Florida contains about 25 of them, including *Sphenophorus apicalis* LeConte, *Sphenophorus cariosus* Oliver, *Sphenophorus inaequalis* Say, *Sphenophorus minimus* Hart, and the hunting billbug, *Sphenophorus venatus vestitus* Chittenden (Peck and Thomas 1998; Woodruff 2001; Huang and Buss 2009). Larval and adult billbugs can be damaging in residential lawns, golf courses, or orchard grasses.



Figure 1. Adult bluegrass billbug, *Sphenophorus parvulus* Gyllenhal, walking on turfgrass.

Credits: David J. Shetlar, Ohio State University

Synonymy

Calendra parvula Gyllenhal 1838 (Vaurie 1954)

Calandra parvulus Gyllenhal 1838 (Schellenberg and Clairville 1789 cited by Kuhn et al. 2013)

Sphenophorus parvulus Gyllenhal 1838 (Vaurie 1951; ICZN 1959)

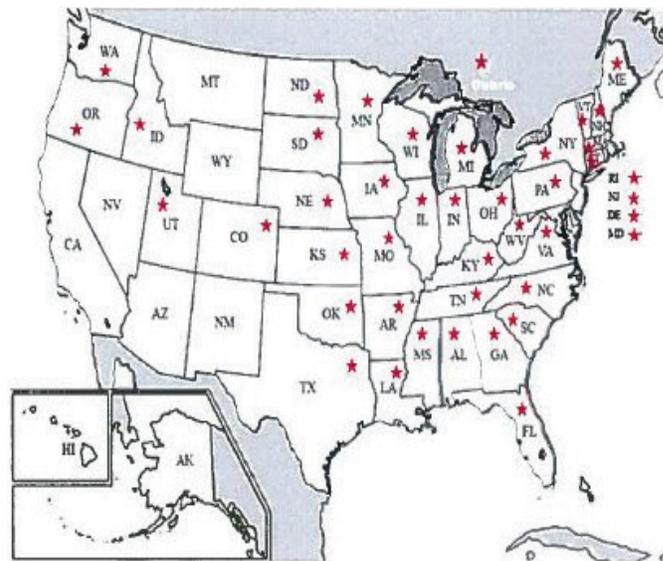


Figure 2. Distribution of bluegrass billbug, *Sphenophorus parvulus* Gyllenhal, in the United States. Red stars show the states where *Sphenophorus parvulus* had been reported.

Credits: Map modified from General Turf and Insects - Stem and Thatch Pests by David J. Shetlar, Ohio State University.

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Distribution

Sphenophorus parvulus is widely distributed within the United States and Canada (Vaurie 1951; Johnson-Cicalese et al. 1990; Watschke et al. 1995). Vaurie (1951) reported the distribution of *Sphenophorus parvulus* to include Arkansas, Colorado, Florida, Georgia, Illinois, Iowa, Kansas, Kentucky, Minnesota, Missouri, New York, and Texas, and also in Ontario, Canada. It has also been reported from Utah and Washington (Tashiro and Personius 1970), and in Nebraska (Kindler and Spomer 1986; Bruner 1890) (Figure 2).

Description

Sphenophorus parvulus eggs are bean-shaped (oblong), and are off-white or cream-colored (Figure 3). Eggs are 1.4 to 1.6 mm long and 0.6 mm wide (Kindler and Spomer 1986).



Figure 3. Egg of the bluegrass billbug, *Sphenophorus parvulus* Gyllenhal.

Credits: David J. Shetlar, Ohio State University

Larvae are soft bodied, legless, off-white in color, and have a distinctly sclerotized (hardened) head capsule (Watschke et al. 1995). The head capsule color varies from yellowish after hatching to dark red or brown when older (Figure 4). Larvae range from 1.2 mm (first instar) to 8 mm in length (fifth instar). The fifth instar becomes a pre-pupa, and actively constructs an earthen cell in which to pupate.

Pupae (Figure 5) are soft and initially off-white in color and then turn rusty brown just before the adult emerges. The pupa has the distinctive snout visible, but the wings

and legs are wrapped around the middle of the body. Pupae range from 5.5 to 10 mm in length (Satterthwait 1931a).



Figure 4. Larva of the bluegrass billbug, *Sphenophorus parvulus* Gyllenhal.

Credits: David J. Shetlar, Ohio State University



Figure 5. Pupa of the bluegrass billbug, *Sphenophorus parvulus* Gyllenhal.

Credits: David J. Shetlar, Ohio State University

Adult *Sphenophorus parvulus* (Figure 1) are distinguished by their typical snouts and for their brown-black color with uniformly small pits in the pronotum. Teneral (newly

emerged) adults look rusty brown in color but darken when sclerotized. Adult body lengths range from 5 to 8 mm; mean length is 7.6 mm for females and 6.9 mm for males. The elytra (wing covers) are characterized by punctate furrows forming striated lines similar to parallel chains (Vaurie 1951; Watschke et al. 1995). The antennae are geniculate (elbowed) and arise from the base of the snout.

Life Cycle and Biology

Sphenophorus parvulus has one to two generations per year in Kentucky, Ohio, West Virginia, and Pennsylvania, but has two or more generations in warmer regions (Figure 6) (Kindler and Spomer 1986). The life cycle of *Sphenophorus parvulus* may be more synchronized in the northern US than in the South due to consistent seasonal changes. The following life cycle is based on studies in Nebraska (Kindler and Spomer 1986). *Sphenophorus parvulus* adults begin emerging from their overwintering sites (beneath dead leaves, under rocks, sticks, and litter, for example) in the spring when the soil temperature (2.5 cm deep) reaches 18 to 20°C.



Figure 6. All developmental stages of the bluegrass billbug, *Sphenophorus parvulus* Gyllenhal.

Credits: David J. Shetlar, Ohio State University

After emergence, adults search for host plants and start feeding. From late April through May, mated females chew holes in the base of grass stems into which they insert one to three eggs. Each female lays about 255 eggs over a three month period, but most egg laying occurs in the first month. Eggs can be found from May to September with a peak oviposition period in May and June in Nebraska (Kindler and Spomer 1986). At 21°C the incubation period for eggs ranges from six to 11 days.

First generation larvae finish development by the end of June and new adults begin to appear in July. These adults often lay eggs that can produce second generation adults in August until early October. Only *Sphenophorus parvulus* adults can overwinter, in contrast to the hunting bill bug, *Sphenophorus venatus vestitus*, which can have multiple life stages overwinter or even remain actively feeding.

Larvae begin feeding inside grass stems immediately after hatching, producing powdery frass that is visible if the stems are cut. Large larvae (third instar) exit from the grass stem to the soil where they feed on roots and rhizomes (Kindler and Spomer 1986). Larval development ranges from 23 to 60 days, depending on temperature (Vaurie 1951; Watschke et al. 1995). Pupae are found in the soil close to the host plant, 2 to 5 cm below the surface. The pupal period ranges from eight to ten days (Satterthwait 1931). Finally, a new generation of adults emerges and the life cycle repeats.

Hosts

Sphenophorus parvulus has become a serious pest of Kentucky bluegrass, *Poa pratensis* L., and *Zea mays* L. This insect also attacks other grasses including perennial ryegrass, *Lolium perenne* L.; tall fescue, *Festuca arundinacea* Schreb; barley, *Hordeum vulgare* L.; wheat, *Triticum aestivum* L; rye, *Secale cereal* L.; Virginia orchardgrass, *Dactylis glomerata* L.; and bentgrass, *Agrostis* spp. (Tashiro and Personius 1970; Johnson-Cicalese 1990).

Economic Importance

According to Haydu et al. (2008), the economic value of the turfgrass and lawn care industries in the United States are significant. In Florida, for example, turfgrass is part of the residential, commercial, and recreational landscape including golf courses. Therefore, any damage caused by pests in turfgrass, lawns, and golf courses will have a negative economic impact.

High populations of *Sphenophorus parvulus* can kill large areas of grass. Residential home lawns, commercial sod fields, and golf courses planted with susceptible turfgrass species are affected by this insect pest. Lawns can provide benefits to the landscape, environment, and homeowners. Benefits of lawns include increasing aesthetics look that increases the economic value of landscape, improvements of recreational areas, but also results in reduction of pollution and prevention of soil erosion. Direct and indirect damage caused by *Sphenophorus parvulus* on lawns and golf courses sometimes necessitate control treatments and lawn replacement, which affect the economy of homeowners and golf courses.

Damage

Both *Sphenophorus parvulus* adults and larvae feed on or in grass stems, causing serious damage. The severity of damage depends on the size of the insect population and the overall health of the infested plants.

Larval stem boring and root feeding reduce or prevent the movement of nutrients in the grass and can cause plant death (Vaurie 1951). In Kentucky bluegrass, association between the number of larvae and live stems was correlated (Kindler et al. 1983). Damage is more common in newly established lawns. Damage symptoms are characterized by wilting and death of small scattered patches in the lawn (Figure 7). Stems affected by *Sphenophorus parvulus* break off easily and are filled with sawdust-like frass (Figure 8). Feeding damage is more evident when soil moisture and soil fertility are low. In addition, secondary damage can occur from the infection of pathogenic bacteria and fungi present in the environment. According to Shetlar (1995), the damage is often confused with white grub or chinch bug damage, or with various grass diseases.



Figure 7. Typical damage in turfgrass caused by the bluegrass billbug, *Sphenophorus parvulus* Gyllenhal.
Credits: David J. Shetlar, Ohio State University



Figure 8. Close view of damage in stems of turfgrass caused by bluegrass billbug, *Sphenophorus parvulus* Gyllenhal.
Credits: David J. Shetlar, Ohio State University

Management

Several tactics that can be used to manage *Sphenophorus parvulus* include cultural practices, use of biological control agents, application of insecticides, and use of resistant turfgrass cultivars as components of an integrated pest management (IPM) program. Insecticides should be

applied after other control tools have been used, if the insect population has increased.

Monitoring: Monitoring is the first strategy to detect pest populations and make control decisions. Pitfall traps (Figure 9) are useful tools for monitoring adult activity. Standard plastic cups (200 ml or larger) can be used to capture and sample surface-dwelling insects including adult billbugs. The container is buried in the ground and soapy-water (approximately 50 to 100 ml) or ethanol (75%) is added to prevent escape. Traps can be checked twice per week or more frequently when there is heavy rain.



Figure 9. Pitfall traps using a standard plastic cup (532 ml capacity) with soapy-water solution used for monitoring bluegrass billbugs, *Sphenophorus parvulus* Gyllenhal.
Credits: Luis F. Aristizábal, University of Florida.

Early detection of overwintered adults in spring is important to establish a control strategy before *Sphenophorus parvulus* reaches a high population density. According to Buss and Unruh (2005), the aesthetic threshold for Florida lawns corresponds to about six billbugs per 0.09 m². In addition, Buckley et al. (2010) estimated that seven to ten billbugs per pitfall trap (using 473 ml cups) every 3 days indicates the need for a preventive insecticide treatment to control the adults.

Cultural Control: Selection of resistant turfgrass cultivars is a cultural practice for long-term control. There are some endophytic fungi associated with some turfgrass cultivars that provide resistance to *Sphenophorus parvulus* attack (Richmond et al. 2000). Fescues and perennial ryegrasses are highly resistant to this insect pest (Brandenburg and Freeman 2012). The level of susceptibility for *Sphenophorus parvulus* differs among Kentucky bluegrass cultivars. According to Ahmad and Funk (1982), Kenblue, Fl 757, F353, and Princenton 104 are cultivars that have shown low damage and low number of larvae per area. In addition, Reveille is a hybrid between Texas bluegrass (*Poa araclmifera* Torr) and Kentucky bluegrass (*Poa pratensis* L.); it is less preferred by *Sphenophorus parvulus* and has higher

tolerance to this pest (Reinert et al. 2006). Populations of other billbugs such as *Sphenophorus venatus vestitus* can be reduced by using less susceptible cultivars and endophytic turfgrasses in warm regions like Florida (Huang and Buss 2013).

Healthy, well-nourished, and watered grasses can be more tolerant to damage and help maintain low populations of *Sphenophorus parvulus*. Larvae emerging from stems to feed on the crowns and roots may drown by irrigation and also be exposed to natural enemies.

Biological Control: Adult and larval ground beetles (Coleoptera: Carabidae) are known predators of billbugs (Bruner 1890). Satterthwait (1931b) reported an egg parasitoid, the wasp *Anaphes (Anaphoidea) (Patasson) calendrae* (Gaham) (Hymenoptera: Mymaridae). This parasitoid was introduced to Hawaii as a biological control agent of sugar cane borer, *Rhabdoscelus obscurus* (Boisduval) (Coleoptera: Curculionidae) in 1928 (Williams 1929) and a second introduction was conducted directly against *Sphenophorus* spp. in 1963, where billbugs had become established. However, evidence of the wasp's success at suppressing billbug numbers or damage is lacking (Beardsley 2000).

The entomopathogenic nematodes *Steinernema carpocapsae* Weiser (Rhabditida: Steinemematidae) and *Heterorhabditis bacteriophora* Poinar (Rhabditida: Heterorhabditidae) have been effective as biological control agents against *Sphenophorus parvulus* larvae and adults, respectively (Watschke et al. 1995, Georgis et al. 2006). *Steinemema carpocapsae* and *Heterorhabditis bacteriophora* showed 78% and 74% control, respectively, against larvae under field conditions in Ohio (Georgis and Poinar 1994).

The entomopathogenic fungus *Beauveria bassiana* (Basidiomycota: Hypocreales: Clavicipitaceae) naturally infects *Sphenophorus parvulus* adults, but its effectiveness is also unknown (Buckley et al. 2010). However, Saliz et al. (2014) reported partial control of billbugs in the field by applying *Beauveria bassiana*. Increasing irrigation on infested turfgrass in the spring could enhance fungal infection (Kuhn et al. 2013).

Chemical Control: An insecticide can be applied when the desired life stage is present, which can only be known by monitoring. Contact insecticides can reduce adult numbers to minimize stem feeding and egg-laying activity (Brandenburg and Freeman 2012). Plant-systemic insecticides are more effective against the stem-boring and root-feeding larvae. All insecticide applications must be conducted according to the product's label.

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