ELUCIDATING THE BIOLOGY OF THE BLUEGRASS AND DENVER BILLBUGS IN NE OREGON

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Billbugs *(Sphenophorus* spp.) constitute an important threat to turf grass in the United States. A review of the literature indicates that there are at least eight species of this genus that attack turf grass in the United States (Johnson-Cicalese et al. 1990). However, because of few taxonomic or life history field studies, three species of *Sphenophorus* that may cause serious injury to turf grasses grown for seed in northeastern Oregon have been overlooked: the bluegrass billbug (*Sphenophorus parvulus* Gyllenhal), the Denver or Rocky Mountain billbug (*S. cicatristriatus* Fahraeus) and the northeastern Oregon billbug (*S. sayi* Gyllenhal). Previously, S. *parvulus* was the only billbug thought to damage turf grass in the area. Thus, the objective of this study was to examine the biology and seasonal distribution of billbugs commonly found in Kentucky bluegrass seed production fields located in the Grande Ronde Valley (GRV) region of northeastern Oregon.

Materials and Methods

Billbug Collection

In the fall 2008, larvae and adult billbug specimens were collected (n=300) from an infested Kentucky bluegrass seed production field in the GRV. All adult specimens were positively identified as the Denver billbug (*S. cicatristriatus*) due to the relative size of punctures located on the 5^{th} sternite (Johnson-Cicalese et al. 1990) as viewed under a standard dissecting microscope. A sub-sample was sent to OSU campus for a confirmation of species identification.

Biology Studies

First instar billbug larvae were reared in plastic Solo cups (4 cm diameter X 4 cm height) containing sterilized soil and a small grass seedling (2 leaf seedling; one tiller). Seedling growth was maintained on an every other day watering schedule. No fertilizer was added. If seedlings grew too large for the cups or senesced due to insect feeding damage, a new seedling was transplanted into the cup. Four trays with 30 Solo cups per tray were set up and infested with one larvae per cup (n = 120). Visual evaluations were made on an every other day schedule beginning October 10 and ending when each larva entered the pupal stage.

In addition, daily observations were made to record the number of days elapsed between instar stages. The change to the next instar was noted by the presence of cast exuvia (cephalic capsule) found within each cup. Once adults emerged, one male and one female were paired (n = 20) within 30 ml plastic cups for 48 h to facilitate mating. Gender was determined by examining the last abdominal sclerite with a dissecting microscope. After 48 h, females were then isolated in 15 X 15 X 10 cm plastic cups to determine number of eggs produced by each female, viability of eggs (% eclosion), survival rate from larva to adult, and adult longevity. The oviposition substrate for this procedure was a small grass seed plant (as described above) and sterilized soil. This component of the study was conducted within a controlled environment located at the OSU-HAREC Entomology Laboratory in Hermiston, Oregon. The temperature regime was a constant 21 ± 2^{o} C (69.8^{o}F -73.4^{o}F) and a photoperiod of 14:10 (L:D). A summary of the Denver billbug *S. cicatristriatus* life stage observations from the laboratory study is presented in Table 1.

Results and Discussion

The study was laborious and time consuming since billbugs were fed a natural diet consisting of small grass seedlings which had to be replaced at least every two weeks. Initial experimentation with a commercially available sod webworm diet was unsuitable (and expensive) due to high larvae and adult mortality rates. Observations made during the study indicate that larvae fed on the base of the tillers and crown tissues thus causing rapid desiccation of the plant. Only 35% of the larvae survived before pupation. A small percentage of larvae pupated and a small percentage of adults emerged (Table 1). Based on a small sample size of adults, there were a greater number of males than females (2:1). This data may indicate either that males are more active than females, or simply that there are more males than females. Average egg incubation for the Denver billbug was 7.6 days (after second generation) and average pupation was 26.8 days (first generation). Our results are consistent with other studies on billbug biology (Smith 1913, Niemczyk and Cobb 1986, Satterthwait 1919).

In the field, observations suggest that Denver billbug larvae emerge from eggs deposited during May-June, pupate and emerge as new adults before winter in north eastern Oregon (Figure 1); however, field observations also suggest a second generation may also occur from Denver billbugs overwintering as larvae in the soil/sod complex (Figure 1). We have not quantified the percentage of larvae that actually pupate resulting in new adults emerging prior to winter. Another common billbug specie in the area, the bluegrass billbug (*S. parvulus*), is reported to have one generation per year in the field (Figure 2). As the weather warms up in the spring, overwintering bluegrass billbug adults begin moving from protected locations in early to mid-May into turf areas or to Kentucky bluegrass seed production fields where females begin ovipositing on actively growing grasses. Adult female bluegrass billbugs perish once the oviposition stage is complete and males “migrate” to other fields looking for potential females or an overwintering place. Field men observed adults in the field just for a short period of time. The development of molecular marker techniques to

distinguish between **the larvae** of three different species of billbug is still underway; therefore, it is presumed the billbug population within fields can have more than one predominant species.

Billbugs probably cause more damage to turf in the U.S. than we are aware of since feeding damage can easily be overlooked, or mistaken for drought or disease damage. With the recent awareness of a species complex in Oregon, it is still uncertain the differences among the species related to their biology and ecology. Future research should gear toward surveys of billbug species present on grasses, to gain a better understanding of billbugs' life cycles in the field, potential species interactions and especially population dynamics to better target control methods. Several insecticides have been evaluated for billbug control and efforts have resulted in a special use permit for Brigade® (active ingredient bifenthrin) on the Western orchard grass billbug only in western Oregon (Note: bifenthrin is currently in the IR-4 program). A succession of insecticides beginning with the chlorinated hydrocarbons (Aldrin, Dieldrin), followed by diazinon 14G and most recently Lorsban 4E, have been the most cost effective means of controlling billbugs in orchardgrass grown for seed. The application is timed so that most of the overwintered beetles are in the field and actively feeding but before females begin to deposit eggs (early May). Clorpyrifos is the only currently registered insecticide for billbug control in northeastern Oregon; however, it has not provided consistent control due to the critical need for adequate rainfall and/or irrigation to move the insecticide into the crown and soil where the pests reside.

References Cited

Johnson-Cicalese, J.M., G.W. Wolfe, and C.R. Funk. 1990. Biology, distribution and taxonomy of billbug turf pests (Coleoptera: Curculionidae). Environ. Entomol. 19(4): 1037-1046.

Niemczyk, H.D. and P. Cobb. 1986. Turf insect control. Weeds Trees Turf May: 26, 30-34, 38.

Satterthwait, A.F. 1919. How to control billbugs destructive to cereal and forage crops. Farmers' Bulletin 1003, USDA, Washington, D.C.

Smith, R.I. 1913. Biological record of little grass billbug. N.C. Agric. Exp. Stn. Annu. Rep. 1911-12 35:136-140.

Table 1. Life cycle for the Denver billbug, *Sphenophorus cicatristriatus*, in a laboratory study, Hermiston, OR 2009.

	Egg (2^{nd} generation)	1^{st} instar larva (n=120)	last instar larva (n=42)	Pupa (n=4)	Adult
Duration (days)	7.6	ND*	26.8	26.8	ND
% Survivorship	-	35	15	100	100

*ND Not Determined

Figure 1. Phenology of the Denver billbug, *Sphenophorus cicatristriatus*, in the Grande Ronde Valley of northeastern Oregon (credits. D.L. Walenta; C.R. McNeal, B. Quebbeman).

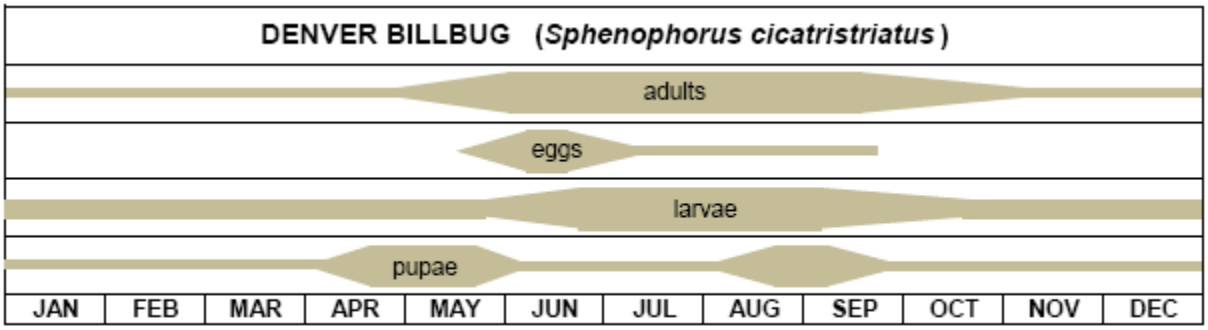

Figure 2. Phenology of the Bluegrass billbug, *Sphenophorus parvulus*, in the Grande Ronde Valley of northeastern Oregon (credits. D.L. Walenta; C.R. McNeal, B. Quebbeman).