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Selection of Insecticides Applied at Different Timings for Control of Billbug Species on Zoysiagrass Fairways

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Objectives: The overall objective is to evaluate insecticides for efficacy and appropriate application timing for the control of billbug damage on zoysiagrass fairways.

Billbug (*Sphenophorus* spp.), especially hunting billbug (*S. venatus vestitus* Chittenden), is an emerging problem in Missouri and the surrounding states in recent years that left untreated, causes severe damages to zoysiagrass (*Zoysia japonica* Steud.), a dominant grass species for golf course fairways in this region. Billbugs are small weevils with adults ranging 7-8 mm long (< 0.3 inches), and larvae are legless. The females lay eggs in the grass stems and once hatched, the larvae feed inside of the stem before they grow larger and then burrow down to the soil to feed on roots and crowns (Fig 1), sometimes as deep as 15 cm (6 inches) below the surface. The larvae are believed responsible for the major damages of the turf, although evidence shows that adult feeding leads to severe turf quality reductions as well. Presence of billbug easily goes undetected due to their smaller size, hiding/feeding site, and the adults' nocturnal nature. Without pitfall traps, damages caused by billbugs are often misdiagnosed as winter-kill, drought, white grubs or other stresses.

Field plots, established on a zoysiagrass fairway where billbug damages have been previously documented, were treated with insecticides included bifenthrin (Talstar®), deltamethrin (DeltaGard®), lambda-cyhalothrin (Scimitar®), and imidacloprid (Merit®) for control of adults, and clothianidin (Arena®) and thiamethoxam (Meridian®) for control of larvae, and chlorantraniliprole (Acelepryn®) for controlling both stages. Insecticides, alone or in combination, were applied in split-plot as single (May 5, 2016), or sequential (June 2, 2016) at the highest label suggested rates arranged in a RCBD with four replications. The whole-plot measured 5 × 10 ft with 10 ft boarder, and the sub-plot measuring 5 × 5 ft. Pitfall traps (total 128) were installed at the center of each sub-plot (Fig 2) and monitored each week. Weekly evaluations included turf quality and normalized difference vegetation index (NDVI), and billbugs counts to the species. All data were subjected to ANOVA using Proc Mixed in SAS 9.4.

In 2016, analysis of weekly turf quality evaluation revealed no significant interactions, and insecticide main effect revealed a similar trend compared to 2015 where all treated plots maintained the same or greater overall turf quality compared to the untreated control (Fig 3). Among treatments, no clear trend was found between application of pyrethroids, or neonicotinoids, or combinations of the two chemicals in turf quality responses. The top three treatments that resulted in greater overall turf qualities, however, all contained a pyrethroid which targets on adult billbugs. When data from both 2015 and 2016 were combined (data not shown), it appeared that treatments contained deltamethrin + thiamethoxam or bifenthrin alone resulted in greater turf quality consistently.

In 2016, hunting billbug population increased approximately 8 times compared to the population trapped in 2015. The total hunting billbugs trapped per pitfall trap over the growing season of 2016 were up to 42, compared to a maximal of 5 in the year of 2015. When weekly hunting billbug counts per trap was plotted over time (Fig 4), it clearly showed a peak adult activity in fall starting from late July to early September. Spring insecticide application in this study might have suppressed the spring adult peak, as evidence from other experiments where insecticides were withdrawn. However, the second peak in fall likely indicates hunting billbugs have two generations per year in our region, compared to bluegrass billbugs which appear to be one generation per year. This result also indicates that application in spring might not be sufficient to control the fall hunting billbug generation in our region.

When analyzed by each week, insecticide treatment effect in hunting billbug counts were only effective on May 23, July 29, and August 10, 2016 (Fig 5). Plots maintained relatively greater turf quality did not appear to show reductions in billbugs counts. Since adult billbug crawls over a significant distance, it is likely that the billbugs trapped in a particular pitfall trap could be from distant plots. Additionally, plots that showed a relatively lower turf quality, such as control and plots received imidacloprid + Meridian, also showed a relatively reduced number of billbug counts.

Summary:

- Hunting billbugs in Missouri likely have 2 generations per year with the second adult activity peak in August;
- Insecticide treatment containing pyrethroid, such as deltamethrin+ thiamethoxam and bifenthrin alone, appeared to provide better turf quality over the two-year period;
- Future research will focus on determination of optimal insecticide application timing likely involves fall applications targeting on adults.

Fig 1. Billbug larvae feeding at the thatch/soil interface (left) and the affected zoysiagrass shoots which can be easily pulled off from the ground (right). Photograph was taken on Oct 26, 2016.

Fig 2. Field plots established on a ‘Meyer’ zoysiagrass (*Z. japonica*) fairway at a local Golf Course, Columbia, Missouri. The pitfall traps were established in the center of each sub-plot and remained underground year round.

Fig 3. Turf quality (1-9) influenced by insecticide main effect in 2016. There were no interactions between insecticide and application timing, or between insecticide and evaluation timing; hence data were pooled over a 17-week period. Bars labeled with the same letters were not significantly different based on Fishers' Protected LSD at 0.05 level.

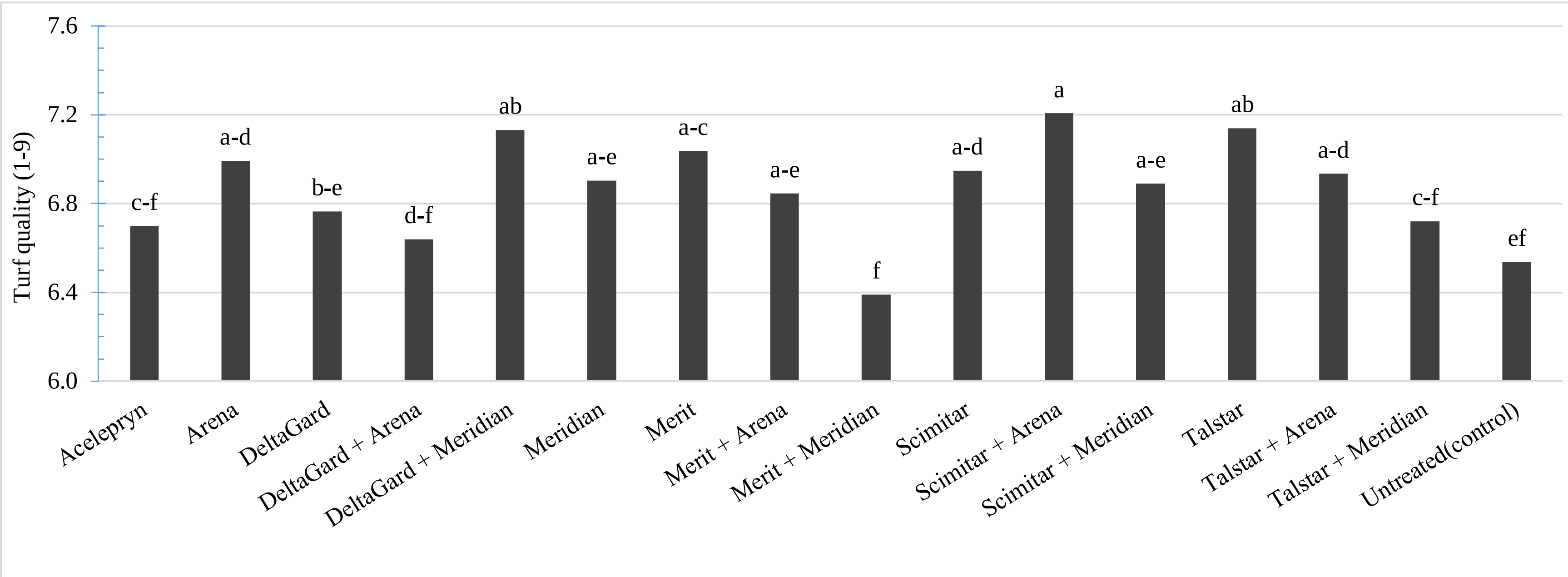

Fig 4. Average hunting billbug counts per pitfall trap fluctuated over the growing season in 2016. No significant interaction of weekly counts by other factors were found; hence hunting billbug count at each week were pooled across all treatments.

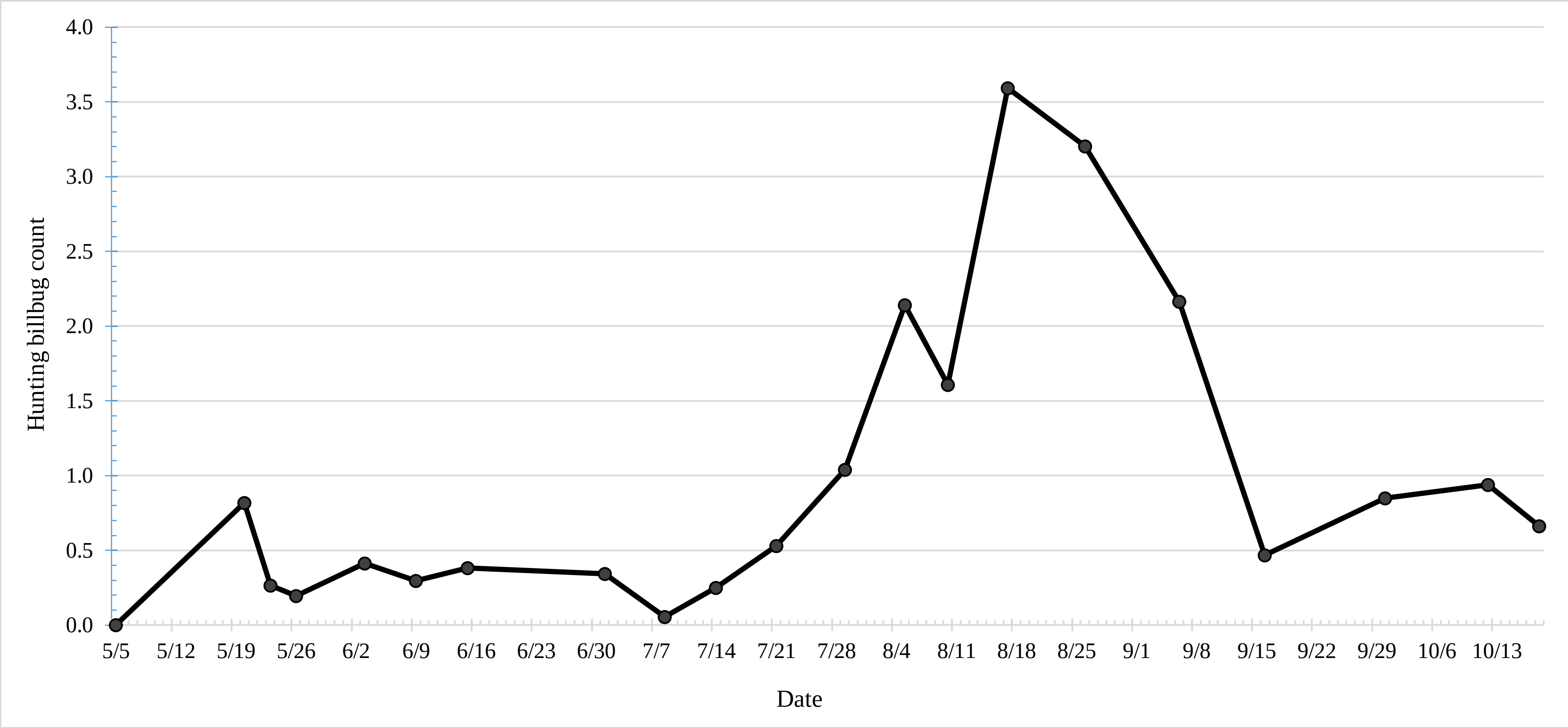

Fig 5. Treatment effect on hunting billbug counts evaluated on May 23, July 29, and August 10, 2016, which corresponded to 7, 12 and 14 weeks after the initial treatment application, respectively. Number of application did not influence hunting billbugs; hence insecticide main effect were presented at each evaluation time. Bars at each evaluation timing labeled with the same letters were not significantly different based on Fishers' Protected LSD at 0.05 level.