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SPHENOPHORUS VENATUS VESTITUS (COLEOPTERA: CURCULIONIDAE) PREFERENCE FOR BERMUDAGRASS CULTIVARS AND ENDOPHYTIC PERENNIAL RYEGRASS OVERSEED

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The hunting billbug, *Sphenophorus venatus vestitus* (Chittenden) (Coleoptera: Curculionidae), is an abundant, widespread, and damaging billbug species in the U.S.A. (Johnson-Cicalese et al. 1990). Its primary hosts are bermudagrass [*Cynodon dactylon* (L.) Pers.] and zoysiagrass (*Zoysia* spp.), but it also infests bahiagrass (*Paspalum notatum* Fluegge), centipedegrass [*Eremochloa ophiuroides* (Munro) Hack], and St. Augustinegrass [*Stenotaphrum secundatum* (Walt.) Kuntze] (Kelsheimer 1956; Oliver 1984). Damage caused by *S. v. vestitus* is often misdiagnosed (Vittum et al. 1999; Niemczyk & Shetlar 2000), resulting in inappropriate pesticide applications.

Although cultivar differences in Kentucky bluegrass (*Poa pratensis* L.) and perennial ryegrass (*Lolium perenne* L.) have been identified for the bluegrass billbug (*S. parvulus* Gyllenhal) (Kindler et al. 1983; Lindgren et al. 1981; Ahmad & Funk 1982, 1983), little is known about warm season turfgrass cultivar resistance to other *Sphenophorus* species (Reinert 2001). In addition, endophytic perennial ryegrass (*Lolium perenne* L. ssp. *perenne*) can reduce *S. parvulus* larval density and feeding damage (Ahmad et al. 1986; Richmond et al. 2000), and endophytic tall fescue (*Festuca arundinacea* Schreb.) can confer resistance against 4 *Sphenophorus* species (Murphy et al. 1993). Thus, we sought to document *S. v. vestitus* adult feeding and oviposition preferences on 4 cultivars of bermudagrass and evaluate the impact of endophytic perennial ryegrass overseeded onto bermudagrass on *S. v. vestitus* feeding potential and reproduction.

Plant Maintenance. Ten plastic pots (8.9 cm diam) of each of 4 cultivars ('Celebration', 'Tifdwarf', 'TifEagle', and 'Tifway') were established from plugs removed from the University of Florida Plant Science Unit in Citra, Florida, grown in Candler sand (Hyperthermic, uncoated Lamellic Quartzipsamment). Grasses established in the pots in a sun emitted greenhouse for 1 mo. Daily greenhouse temperatures ranged from 17-32 °C with a 14:10 h L:D photoperiod, and the average soil temperature was 19.4 °C. Pots were fertilized weekly with a 20-20-20 water-soluble complete nitrogen source (NH_4NO_3) at 0.062 kg N/0.01 m^2 (Scotts-Sierra Horticultural Products Co., Marysville, Ohio), irrigated daily, and trimmed at a 5-cm height before infestation. Thatch had not accumulated within pots when tests began.

Bermudagrass Cultivar Preference. A choice test was conducted in the greenhouse to assess adult *S. v. vestitus* preference for the 4 different bermudagrass cultivars. One pot of each cultivar was randomly positioned in a plastic container (22 × 22 × 10 cm). Turf Builder Seeding Soil (Scotts Co., Marysville, Ohio) was placed between pots. Another bottomless container was positioned upside down and attached to prevent adult escape, but allow light penetration and air flow. Containers were arranged in a randomized complete block design with ten replicates; each container was considered a block (replicate). Pots were irrigated daily, but fertilization and trimming ceased.

Adult *S. v. vestitus* were hand-collected at night with the assistance of a fluorescent head lamp (Princeton Tec, Trenton, New Jersey) on 'Tifway' bermudagrass in Marion County, Florida. Two males and females were randomly selected and released on the soil in the center of each container within 24 h of collection. After 1 mo of billbug confinement, pots were destructively sampled; adult survival, number of larvae, and number of adult feeding notches on plants were recorded.

Overseeding Test. A no-choice greenhouse test assessed the impact of overseeding 2 bermudagrass cultivars with an endophytic perennial ryegrass on *S. v. vestitus* damage potential and oviposition. Cores (10 cm diam) of 'Tifway' and 'TifEagle' bermudagrass were obtained from Citra, Florida, and established into 11.7 cm diam plastic pots with sandy loam for 6 mo. Five pots each of 'Tifway' and 'TifEagle' bermudagrass were overseeded at a rate of 50.5 kg/1,000 m^2 with 'Citation Fore', a perennial ryegrass cultivar with 76% endophyte (Scotts Co., Marysville, Ohio). Five pots of each cultivar were not overseeded (controls). All pots were fertilized with Miracle-Gro® all purpose fertilizer (113.5 g, 20-20-20) weekly, and irrigated daily. After 2 mo of

establishment, 2 adults, a males and a female *S. v. vestitus* (hand-collected from Citra, Florida) were randomly selected and released onto each pot. Pots were encircled 15 cm above the soil surface with a sheet of clear acetate (3M, Austin, Texas) to confine adults and allow near-normal light source and ventilation. After 2 wk of infestation, pots were destructively evaluated to record the adult survival, total number of larvae and adult notches. All data were analyzed using analysis of variance (ANOVA, SAS Institute 2009) with means separation using LSMEANS test ($P < 0.05$). Adult survival (%) was arcsine transformed and number of larvae and notches were logarithmic transformed before analysis (Zar 1999), with non-transformed data presented.

The 4 bermudagrass cultivars significantly varied in the number of larvae ($F = 3.49$; df = 3, 36; $P = 0.0253$) and feeding notches ($F = 18.35$; df = 3, 36; $P < 0.0001$) per pot (Table 1). Infested pots of 'Tifway', 'Tifdwarf,' and 'Celebration' had more *S. v. vestitus* larvae than 'TifEagle'. 'Tifway' had the most notches, followed by 'Celebration' and 'Tifdwarf' and 'TifEagle' had the fewest notches per pot. Adult survival did not differ significantly among cultivars (Table 1).

The 2 overseeded and 2 non-overseeded bermudagrass cultivars varied significantly in adult survival ($F = 5.68$; df = 3, 16; $P = 0.0076$), number of larvae ($F = 11.15$; df = 3, 16; $P = 0.0003$), and feeding notches ($F = 48.98$; df = 3, 16; $P < 0.0001$) per pot (Table 2). Overseeded pots of 'TifEagle' had the lowest adult survival, least damage, and no larvae were recovered (Table 2). Regardless of cultivar, the control pots had significantly more larvae ($F = 20.20$; df = 1, 18; $P = 0.0003$) and feeding notches ($F = 30.87$; df = 1, 18; $P < 0.0001$) than overseeded pots. It is possible that adults avoided feeding and/or ovipositing, or eggs and young larvae died in the overseeded pots. Similarly, overseeding Kentucky bluegrass with endophytic perennial ryegrass can reduce *S. parvulus* larval populations and damage (Richmond et al. 2000), and endophyte-enhanced tall fescue reduces the feeding damage of *S. venatus vestitus* and *S. minimus* (Hart) in the northeastern U.S. (Murphy et al. 1993). This is the first study to document bermudagrass cultivar preference and effect of overseeding with endophyte-enhanced perennial ryegrass on *S. v. vestitus*, for potential use in integrated pest management programs.

Summary

Sphenophorus venatus vestitus responses to 4 bermudagrass cultivars and endophytic perennial ryegrass-overseeded bermudagrass were evaluated in greenhouse tests. 'TifEagle' appeared to be least preferred, compared to 'Tifway', 'Celebration' and 'Tifdwarf'. Pots of 'TifEagle' overseeded with endophytic perennial ryegrass had less adult damage and no larvae, compared to that of 'Tifway.' Using less susceptible cultivars and overseeding with endophytic turfgrasses can minimize billbug populations in warm season turfgrasses.

Key Words: hunting billbug, host preference, endophyte, bermudagrass

Resumen

Se evaluó la respuesta de *Sphenophorus venatus vestitus* a 4 variedades de césped Bermuda con centeno (raigrás) endofítico perenne sembrado por encima en un ensayo de invernadero. La variedad 'TifEagle 'parece ser menos preferida, en comparación con las variedades 'Tifway', 'Celebration' y 'Tifdwarf'. Las macetas de 'TifEagle' sembradas con centeno endofítico perenne por encima tuvieron menos daño hecho por los adultos y no tenían larvas, en comparación con las de 'Tifway. Al utilizar variedades menos susceptibles y sembrar los céspedes endófitos por encima puede minimizar las poblaciones del picudo en céspedes de estación cálida.

Palabras Clave: picudo cazador, preferencia de hospedero, endofitos, césped Bermuda

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Table 1. Mean (±SEM) of *Sphenophorus v. vestitus* adult survival, larvae and feeding notches per pot on 4 bermudagrass cultivars in a greenhouse choice test.

Cultivar	Adult survival (%)	Mean no. larvae/pot[a]	Mean no. notches/pot[b]
Celebration	77.5 ± 5.8 a	0.4 ± 0.2 ab	6.3 ± 0.9 b
Tifdwarf	82.5 ± 6.5 a	0.3 ± 0.2 ab	6.1 ± 2.0 b
TifEagle	75.0 ± 5.3 a	0 c	2.0 ± 0.4 c
Tifway	82.5 ± 5.3 a	0.7 ± 0.2 a	15.7 ± 1.9 a

[a,b] Means followed by the same letter, within each column are not significantly different ($P < 0.05$; LSMEANS test).

TABLE 2. MEAN (±SEM) OF *SPHENOPHORUS V. VESTITUS* ADULT SURVIVAL, LARVAE AND FEEDING NOTCHES PER POT ON 2 BERMUDAGRASS CULTIVARS OVERSEEDED WITH ENDOPHYTIC PERENNIAL RYEGRASS AND 2 NON-OVERSEEDED BERMUDAGRASS CULTIVARS IN A GREENHOUSE NO-CHOICE TEST.

Cultivar	Treatment	Adult survival (%)[a]	Mean no. larvae/pot[b]	Mean no. notches/pot[c]
Tifway	Control	90.0 ± 6.1 a	1.8 ± 0.4 a	31.2 ± 3.3 a
TifEagle	Control	85.0 ± 6.1 ab	0.8 ± 0.4 b	18.4 ± 1.2 b
Tifway	Overseeded	65.0 ± 6.1 bc	0 c	13.2 ± 1.0 c
TifEagle	Overseeded	50.0 ± 11.2 c	0 c	5.6 ± 0.9 d

[a,b,c] Means followed by the same letter, within each column are not significantly different ($P < 0.05$; LS MEANS test).

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