SUSCEPTIBILITY OF BERMUDAGRASS CULTIVARS TO *EOREUMA LOFTINI* (LEPIDOPTERA: PYRALIDAE) IN SUBTROPICAL MEXICO

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ABSTRACT

Susceptibility of eight bermudagrasses (Tifton 68, Tifton 78, Tifton 85, Gigante, Brazos, Cruza 1, Callie, and NK 37) to the Mexican rice borer, *Eoreuma loftini* (Dyar) was evaluated monthly during 1994 in northern Tamaulipas, northeastern Mexico. Damage by *E. loftini* occurred year around, peaking in April and December. Borer attack was reduced substantially after mowing the pastures to 3-5 cm height. Susceptibility of the cultivars to borer damage was influenced by stolon width, an important characteristic for *E. loftini* tunneling. This relationship between stolon width and borer damage was explained closely (R^2 = 0.86) by the curvilinear model $y = (1.2 + 0.1757\, x^3)^2$, where y = borer damage and x = stolon diameter. The widest stemmed bermudagrass, and hence the most susceptible to *E. loftini*, was Tifton 68. Tunneling behavior of *E. loftini*, as affected by stem width of host plants, is discussed.

Key Words: Mexican rice borer, host plant resistance, seasonality, tunneling behavior.

RESUMEN

Se evaluó mensualmente durante 1994 la susceptibilidad de ocho cultivares de zacate bermuda (Tifton 68, Tifton 78, Tifton 85, Gigante, Brazos, Cruza 1, Callie y NK 37) al ataque del barrenador del tallo *Eoreuma loftini* (Dyar) en el norte de Tamaulipas, México. Los daños de *E. loftini* ocurrieron durante todo el año, aunque la mayor incidencia se presentó en Abril y Diciembre. El ataque del barrenador se redujo substancialmente después de cosechar los pastos a una altura de 3-5 cm sobre el nivel del suelo. La susceptibilidad de los cultivares al daño del barrenador resultó asociada con el grosor de los estolones, una característica importante en los hábitos de daño de *E. loftini*. Dicha relación entre el grosor del tallo y el daño del barrenador fue explicada (R^2 = 0.86) por el modelo $y = (1.2 + 0.175\, x^3)^2$, donde y = daño del barrenador y x = diámetro del estolón. El cultivar Tifton 68 resultó tener los estolones más gruesos, y por lo tanto fue el más susceptible al daño de *E. loftini*. Se discute el comportamiento de daño de *E. loftini* en relación al grosor de los tallos de las plantas hospederas.

The Mexican rice borer, *Eoreuma loftini* (Dyar), is an important pest of sugarcane, *Saccharum officinarum* L., field corn, *Zea mays* L., grain sorghum, *Sorghum bicolor* (L.) Moench, and forage grasses in Mexico and southern Texas (Browning & Hussey 1987, Rodriguez-del-Bosque et al. 1988, Youm et al. 1988, Meagher et al. 1994). In addition, a number of wild grasses serve as hosts to *E. loftini* (Osborn & Phillips 1946, Browning & Hussey 1987). Although earlier reports acknowledge the distribution of *E. loftini* in southern California and southern Arizona (Dyar 1917, Osborn & Phillips 1946), there is no recent evidence on the pest status of this species in those areas. Feeding by *E. loftini* on leaves and stems causes varied damage, including tunneling near the plant growing point during the early growth stages, and a symptom called

"dead heart", which appears as a dead or necrotic center whorl on green shoots (Browning et al. 1989).

Management of *E. loftini* in sugarcane has focused on several tactics, including biological control (Smith et al. 1987), insecticidal suppression (Meagher et al. 1994), male mating disruption technique (Shaver & Brown 1993), and host plant resistance (Pfannenstiel & Meagher 1991). A major concern, particularly in Texas where *E. loftini* was first detected in 1980, is the potential of this insect pest to expand its geographical range via transportation of infested plant material such as pasture grasses (Browning & Hussey 1987). In northern Tamaulipas, a subtropical agricultural region south of the Texas border, the main agronomic crops are corn and sorghum planted over approximately one million hectares (30% irrigated; 70% dryland). However, recent reductions in international grain prices and the increasing production costs for corn and sorghum are forcing many producers to consider production alternatives, such as forage grasses for feeding livestock. Several cultivars of bermudagrass, *Cynodon* spp., are being evaluated in northern Tamaulipas for their establishment characteristics, dry matter yield of forage, nutritional quality, and cattle performance (Palomo & Mendez 1993, 1994). The objective of this investigation was to detect possible differences in susceptibility of eight bermudagrass cultivars to *E. loftini*.

MATERIALS AND METHODS

This study was conducted in the Campo Experimental Rio Bravo (Rio Bravo Experiment Station), near Rio Bravo, Tamaulipas. In April 1992, eight bermudagrass cultivars (Tifton 68, Tifton 78, Tifton 85, Gigante, Brazos, Cruza 1, Callie, and NK 37) were established in 3x4 m plots arranged in a randomized complete block design with four replications. Plots were evaluated for *E. loftini* damage during the first week of each month during 1994 by counting and removing at ground level stolons exhibiting dead heart symptoms. Excised stolons were transported to the laboratory and examined for evidence of *E. loftini* tunneling or living larvae. A proportion (25-50%) of the collected larvae was reared on artificial diet (Martinez et al. 1986) in the laboratory for completion of development to corroborate the borer species by examining genitalia of emergent moths (Bleszynski 1969). Stolons exhibiting dead heart symptoms caused by factors other than *E. loftini* (<5%) were omitted from the evaluations. The diam of 10 undamaged stolons per plot was measured (about 5 cm above ground level) at each sampling date. During 1994, plots were mowed to a height of 3-5 cm during the second week of January, April, May, July, and September. After mowing, plots were fertilized with urea (46 kg N/ha) and irrigated (10 cm). No insecticide was applied during the study.

Dead heart data were subjected to analysis of variance as a factorial design (A, cultivars; B, months), and means separated by Tukey's studentized range test ($p = 0.05$) (PROC ANOVA, SAS Institute 1988). Average dead hearts (over 12-mo) of each cultivar (y) were fit to the curvilinear model $y = (a + bx^3)^2$, where a and b are constants and x the average (12-mo) stolon diam.

RESULTS AND DISCUSSION

The only stalk borer attacking bermudagrass throughout the study was *E. loftini*. The analysis of variance indicated damage was significantly different ($p < 0.05$) among bermudagrass cultivars (A), and months (B), with no A×B interaction. Incidence of *E. loftini* occurred throughout the year, with the greatest damage occurring in April and December (Fig. 1). Mowing the pastures substantially reduced *E. loftini*
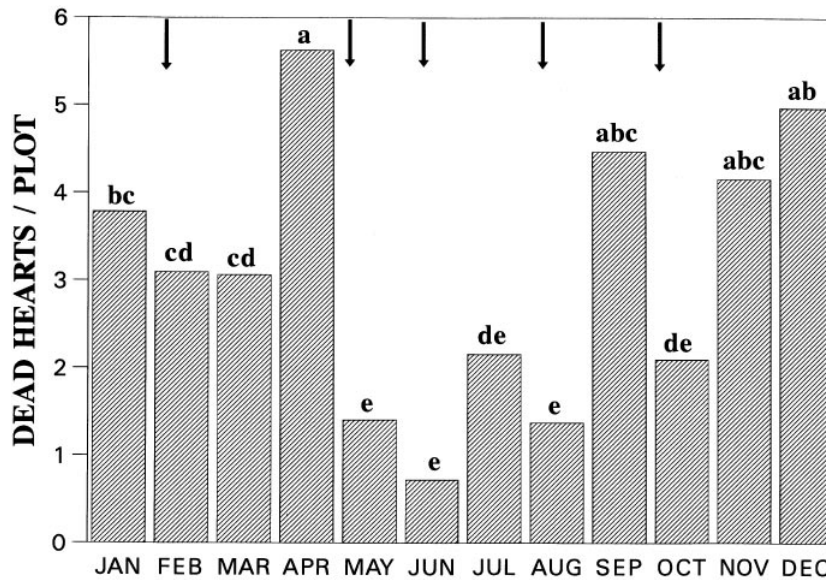
Figure 1. Seasonal damage by *E. loftini* to bermudagrass (average of eight culti-vars and four replications in plots of 3×4 m) in northern Tamaulipas, Mexico. Arrows indicate mowing practices. Means (bars) with the same letter are not significantly dif-ferent ($p < 0.05$; Tukey's studentized range test).

attack, a result similar to the findings by Browning & Hussey (1987). Overall, the oc-currence of dead hearts was 51% lower in those months when mowing was practiced during the previous month (Fig. 1). The practice of periodically harvesting the grasses removed or killed the larvae and prevented a continued recruitment of *E. loftini* lar-vae throughout the period of study. The maximum incidence of dead hearts (22 per plot) observed in Tifton 68 in April represented only about 0.2% of the total stolons in the plot, a proportion that probably did not affect either forage yield or quality. How-ever, these damage figures are much lower than those observed in larger semicom-mercial plots planted with Tifton 68 in Rio Bravo in previous years (L.A.R.B., unpublished data) and in south Texas, where an average of 38% of the Tifton 68 sto-lons exhibited *E. loftini* damage (Browning & Hussey 1987). One possible explanation of the higher damage in Texas is that counts of damaged stolons included not only dead hearts, but also other symptoms such as entry holes and discoloration at the area of attack. Although dead hearts may represent a reasonable and practical pa-rameter for measuring stolon attack by borers, this method likely underestimates the actual damage and yield loss. In addition, in the study by Browning & Hussey (1987), mowing was less frequent than in our study, and borers were probably removed less frequently, allowing more borer attack and/or pest population buildup.

The most susceptible cultivar throughout the study was consistently Tifton 68 (Ta-ble 1). Average dead hearts (12-mo) observed in Tifton 68 were 3.4 times greater than the average of the remaining seven cultivars. In April, when *E. loftini* incidence peaked, Tifton 68 had 6.6 times more dead hearts than the average for the other grasses. A closer look at the data showed that borer damage was positively associated with stolon diam (Table 1). This relation was explained ($R^2 = 0.8632$, $df = 5$, $p < 0.01$)

TABLE 1. AVERAGE NUMBERS OF DEAD HEARTS CAUSED BY *E. LOFTINI* AND AVERAGE STOLON DIAM OF EIGHT BERMUDAGRASS CULTIVARS IN NORTHERN TAMAULIPAS, MEXICO.

Cultivar	Dead Hearts (Mean±SEM)[1]	Stolon Diam (mm) (Mean±SEM)[1]
Tifton 68	7.96±1.47a	2.09±0.07a
Tifton 78	3.71±0.60b	1.26±0.05b
Brazos	3.31±0.59bc	1.29±0.03b
Cruza 1	2.38±0.47bc	1.32±0.05b
Tifton 85	2.33±0.49bc	1.42±0.04b
Gigante	2.25±0.41bc	0.89±0.03cd
NK 37	1.58±0.33bc	0.84±0.06d
Callie	0.98±0.25c	1.17±0.06bc

[1]Means within a column followed by the same letter are not significantly different ($p < 0.05$; Tukey's studentized range test). Mean values averaged over 12 months and 4 replications in 3×4 m plots.
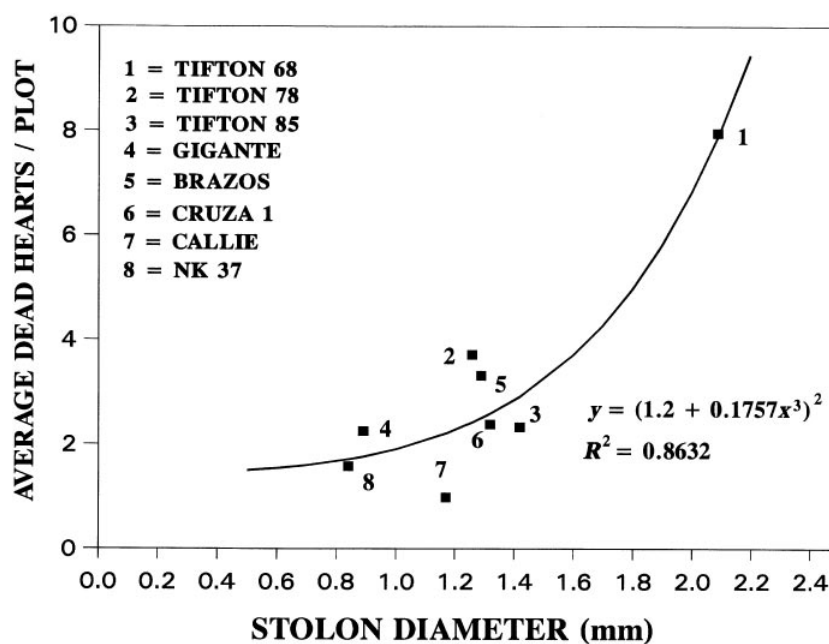

Figure 2. Relation of dead hearts caused by *E. loftini* to stolon diam of eight bermudagrass cultivars (average of 12 months and four replications in plots of 3×4 m) in northern Tamaulipas, Mexico.

by the curvilinear model $y = (1.2 + 0.1757\ x^3)^2$, where y = dead hearts per plot, and x = stolon width (mm) (Fig. 2). This partially explained the greater susceptibility of Tifton 68, the cultivar with the greatest stolon diam. The possible influence of stolon diam in bermudagrass susceptibility to *E. loftini* was also suggested by Browning & Hussey (1987), although data were not conclusive because only two cultivars were evaluated. They also suggested that grasses must provide a certain minimum width in order to afford sufficient space for tunneling by *E. loftini*.

Stalk width may have implications in the tunneling behavior of *E. loftini* within the stem of susceptible grasses. Stalk or stolon tunneling in small-stemmed host plants such as bermudagrass, johnsongrass, *Sorghum halepense* (L.) Pers., rice, *Oryza sativa* L., and wheat, *Triticum aestivum* L., is longitudinal, usually causing dead hearts or heads, a result of larval feeding near the growing point (Browning et al. 1989). In contrast, larval tunneling in larger stemmed hosts like corn, sugarcane, and sorghum can be vertical, horizontal, or diagonal within the stem (Van Zwaluwenburg 1926, Rodriguez-del-Bosque et al. 1988, Browning et al. 1989). In these larger-stemmed hosts, stalk width may not be an important mechanism for differential susceptibility within cultivars as shown for forage sorghums (Browning & Hussey 1987), probably because space for tunneling is not a limiting factor.

In summary, *E. loftini* damaged bermudagrass throughout most of the year in northern Tamaulipas, although forage harvesting at regular intervals reduced the pest incidence. Bermudagrass cultivars with smaller stolon width may preclude *E. loftini* damage by not providing sufficient space for larval tunneling. In contrast, Tifton 68, the cultivar with the largest stolon, sustained the most damage of all bermudagrasses tested.

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