Evaluation of Buffalograss (*Buchloe dactloides* (Nutt.) Engelm.) Genotypes for Chinch Bug (*Blissus occiduus* Barber) Resistance

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ABSTRACT

The western chinch bug, *Blissus occiduus* (Hemiptera: Lygaeidae) is an important insect pest of buffalograss turf. Fifteen diploid, tetraploid and hexaploid genotypes were evaluated for chinch bug resistance under greenhouse conditions using second generation chinch bugs. The buffalograsses 'Prestige'(tetraploid) and '378'(pentaploid) served as resistant and susceptible control, respectively. The experimental design was a completely randomized design with eight replications. Ten adult chinch bugs collected from infested buffalograss turf were introduced on caged single clone buffalograss genotypes at the same growth stage. Plant damage was assessed using a 1-5 visual rating scale at three days interval until 378, the susceptible control reached a mean damage rating of 4.0 or higher. Damage ratings taken at 26 and 29 days after infestation (DAI) were subjected to statistical analysis. Highly significant differences were observed among the genotypes. The mean damage rating at 29 DAI was used to categorize the genotypes for resistance. The test genotypes ranged from moderately resistant to moderately susceptible. Genotypes 'Density', 196, 184, 'Bowie' and 'Legacy' were found to be moderately resistant (damage rating >2, but ≤3), while NE2990 and NE2838 were moderately susceptible (damage rating>3, but ≤4). These results document useful variation to chinch bug feeding among the buffalograss genotypes and imply that polyploidy does not impact the level of chinch bug resistance.

INTRODUCTION

Buffalograss [*Buchloe dactyloides* (Nutt.) Engelmann] is native to the short grass prairies of North America (Wenger 1943), and is used as a turfgrass because of its relative low water and nutrient requirements (Riordan et al. 1996). As public pressure increases for the turfgrass industry to reduce maintenance inputs (Brede, 2000), buffalograss is an excellent option for water conservation, and reduced inputs. Improved turf-type buffalograsses are now being used on home lawns, golf courses, around public establishments, and for erosion control along roadsides (Heng-Moss et al., 2002, Shearman et al., 2005).

The western chinch bug, *Blissus occiduus* Barber (Hemiptera: Lygseidae) has emerged as an insect pest of buffalograss turf in Nebraska (Baxendale et al., 1999). Interest in reducing pesticide inputs for controlling insect pests underscores the need for developing chinch bug-resistant buffalograsses.

Previous evaluation of selected buffalograss germplasm for western chinch bug resistance found that 'Cody', 'Tatanka', 'Bonnie Brae' and 'Prestige' were resistant to *Blissus occiduus* (Heng-Moss et al., 2002). The genetic mechanisms underlying the resistance of these genotypes were categorized as tolerant and/or antixenotic (Heng-Moss et al., 2003). Gulsen et al., (2004) observed a wide range in susceptibility to chinch bugs among 48 buffalograss genotypes evaluated. The genotypes tested ranged from highly resistance to highly susceptible. Genotypes 184, 196, 91-118 and PX3-5-1 were highly resistant while 4A, 188, and 119 were highly susceptible. The findings from these studies indicate that there is a good level of genetic diversity in buffalograss germplasm for chinch bug resistance.

Periodic evaluation of an existing and newly acquired germplasm is important in a breeding program. Therefore, the objective of the present study was to evaluate the status of commercial cultivars and new breeding materials for chinch bug resistance and to select parents for hybridization to generate mapping population for the buffalograss-mapping project.

MATERIALS AND METHODS

Fifteen buffalograss genotypes, including diploids, tetraploids and hexaploids, were studied along with the cultivars Prestige (resistant), and 378 (susceptible) for phenotypic chinch bug resistance. The experiment was conducted in a completely randomized design with eight replications under greenhouse condition in 2006. Stolon cuttings were grown in 3.8 x 21 cm containers filled with a potting mixture of sand-soil-peat-perlite in 2:1:3:3 (v/v) ratios. Fifth instar chinch bugs were collected from infested buffalograss turf on University of Nebraska-Lincoln, East Campus using a modified ECHO Shred 'N Vac. A total of 10 chinch bugs were introduced into each caged single clone buffalograss genotype. Plant damage was assessed using a 1-5 visual rating scale (1=resistant and 5= susceptible). Damage ratings were taken every third day until the mean damaging rating of the *B. occiduus*-susceptible grass (378) reached a 4.0 or higher. Plant injury data taken at 26 and 29 days after infestation (DAI) were subjected to statistical analysis. The number of mature and immature chinch bugs in each container was counted at the end of the experiment. Chinch bug number was considered as a potential covariate to adjust the mean plant injury.

RESULTS AND DISCUSSION

The average plant injury at 26 and 29 days after infestation, the adjusted mean of day 29 and chinch bug count data are presented in Table 2. Differences were observed among the buffalograss genotypes evaluated for chinch bug injury at 26 ($P<0.007$) and 29 ($P<0.0024$) DAI (data not presented). Since the number of chinch bugs counted at the end of the experiment was significantly different among the genotypes, and there was no significant treatment (genotype) by covariate (chinch bug number) interaction (Table 1), the assumption for covariant analysis was fulfilled.

Table 1: Analysis of Covariance Table for buffalograss genotypes evaluated for chinch bug resistance, 2006

Source	df	MS	F-value	Prob. of F
Chinch bug count	1	8.52	9.86	0.0026**
Genotype	14	1.82	2.11	0.0236*
Chinch bug *Genotype	14	0.56	0.65	0.8139NS
Error	83	0.92		

*, ** significant at 0.05 and 0.01 respectively. NS=not significant

The covariate adjusted mean plant injury data are presented in Table 2.
Based on the damage rating for the resistance scale adopted from Heng-Moss et al. (2002), the genotypes ranged from resistant to moderately susceptible. Most of the genotypes were moderately resistant (damage rating >2, but ≤3). Genotypes 196, 184, 'Density', 'Bowie' and 'Legacy' had average ratings of 2.1 to 2.4, while NE 2990 and NE 2838 were moderately susceptible with ratings of 4.0 and 3.9 respectively.
Among the moderately resistant genotypes, 'Legacy' and 184 supported significant numbers of chinch bugs, suggesting the presence of tolerance. Based on covariate analysis 'Density and Bowie' were also moderately resistant to chinch bug. The moderately susceptible genotype, NE 2838, supported the highest mean number of chinch bugs (98) and its injury level was adjusted from 3.9 to 3.2.
There were diploids, tetraploids and hexaploids genotypes that were moderately resistant, and two moderately susceptible genotypes (NE 2990 and NE 2838) were tetraploid and hexaploid, respectively. These results indicate that ploidy level did not impact the level of resistance among the buffalograsses. This finding compares favorably with previous reports that polyploidy level does not impact chinch bug resistance (Heng-Moss et al., 2003; Gulsen et al., 2004).

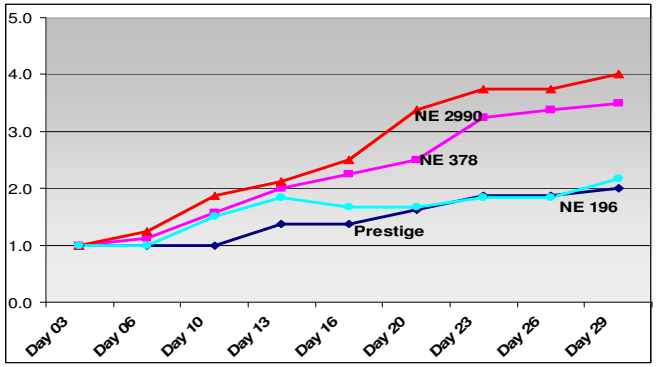

Figure 1: Progress of plant injury for resistant and susceptible type buffalograss genotypes evaluated for chinch bug resistance, 2006

The cultivar used as a resistant check, (i.e., Prestige) maintained its high level of resistance in this study. A resistant and a susceptible genotype along with the checks were graphed to see the progress of injury by chinch bug infestation (Fig.1). For the susceptible genotypes, the progression of damage was fast, whereas the onset of visual damage was delayed in the resistant genotypes. These results document useful variation to chinch bug feeding among the buffalograss genotypes and imply that polyploidy does not impact the level of chinch bug resistance.

Table 2: Gender, ploidy level, and average plant injury at different days after infestation (1-5 scale, 1=resistant and 5=susceptible) for buffalograss genotypes evaluated for chinch bug resistance, 2006

No	Genotypes	Sex	Ploidy Level	Days After Infestation		Corrected Means (Day 29)	Average Chinch Bug Count
				Day 26	Day 29		
1	NE 2781	M	2x	2.1	2.6	3.1ab	30.00
2	184	M	2x	2.3	2.4	2.2b	40.20
3	1-57-19	M	2x	2.9	3.0	3.1ab	29.20
4	Density	F	2x	2.1	2.1	2.4b	13.63
5	NE 2769	F	2x	2.8	2.8	2.8b	61.6
6	NE 2768	F	2x	2.3	2.5	2.5b	43.38
7	Prestige	F	4x	1.9	2.0	2.2b	22.14
8	NE 2990	F	4x	3.8	4.0	3.9a	80.00
9	NE 3016	F	4x	2.6	3.0	2.6b	91.86
10	378	F	5x	3.4	3.5	4.0a	16.57
11	Legacy	F	6x	2.4	2.4	2.2b	45.14
12	Bowie	F	6x	2.3	2.4	2.5b	10.67
13	Cody	F	6x	2.8	3.0	2.9ab	48.25
14	NE 2838	F	6x	3.6	3.9	3.2ab	98.17
15	196	F	6x	1.8	2.2	2.3b	25.17
	G. Mean			2.60	2.78		43.27
	CV (%)			35.99	37.29		123.30
	LSD (0.05)			0.96	1.06		

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