SELECTION OF INTERSPECIFIC HYBRIDS OF *BRACHIARIA* - A TROPICAL FORAGE GRASS

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ABSTRACT

The aim of the breeding program at the National Beef Cattle Research Center (CNPGC) of the Brazilian Corporation for Agricultural Research (EMBRAPA), is to produce vigorous apomictic hybrids with wide edaphic adaptation, good production and nutritive value combined with spittlebug (Homoptera:Cercopidea) resistance. Fifty-six superior hybrids were selected based on visual estimates of vigor, leafiness, tolerance to drought and natural spittlebug infestation in the field. These were characterized for mode of reproduction, spittlebug reaction under controlled conditions and for morphological diversity using nine selected traits. Multivariate analysis classified the population into seven groups where the hybrids were clearly intermediate in plant architecture when compared to parental types. Eight hybrids displayed resistance to spittlebug under controlled conditions and sixteen were found to be susceptible. Twenty seven reproduce sexually and twenty five are apomictic. Their potential as new cultivars will be determined following agronomical evaluation and grazing studies.

KEYWORDS

Apomixis, breeding, morphological characterization, spittlebug resistance.

INTRODUCTION

Species of the genus *Brachiaria* have become the most important component of cultivated tropical pastures for beef cattle in the American tropics. Extensive areas planted to the few available commercial cultivars resulted in the build up spittlebug populations, and in the amplification of specific problems inherent to these cultivars (Valle and Miles, 1994). Small diversity was available for selection until recently (CIAT, 1986), when a large germplasm collection was gathered and evaluated (Grof et al., 1993). Breeding has only recently been accomplished in *Brachiaria*. The genus is characterized by apomictic mode of reproduction and variation in ploidy levels. Artificially induced tetraploids of *B. ruziziensis* were used as female plants in crosses with natural apomictic tetraploids of *B. brizantha* and *B. decumbens* with the objective of generating hybrids with superior agronomical traits (Lapointe and Miles, 1992). The breeding program at CNPGC was initiated in 1988 and has generated vigorous apomictic and sexual hybrids, with apparently good agronomical traits of leafiness, tolerance to drought and spittlebug, profuse flowering and interesting plant architecture. This paper describes the characteristics of 56 interspecific hybrids selected from the breeding program. Good sexual hybrids will be used for further crosses whereas superior apomictic hybrids will be advanced to grazing trials after agronomic evaluation in small plots.

MATERIALS AND METHODS

Sexual, colchicine induced-tetraploid *B. ruziziensis* plants were used as female progenitors in greenhouse crosses with eleven different apomictic pollen parents: two commercial cultivars - *B. brizantha* cv. Marandu (BRA000591), and *B. decumbens* cv. Basilisk (BRA001068) - and nine new selections of *B. brizantha*: BRA002844, BRA003204, BRA003395, BRA003450, BRA003719, BRA003891, BRA003948, BRA004308, BRA004391. The hybridization scheme has been presented previously (Valle et al., 1993). Selection criteria consisted of visual estimation of overall vigor, leafiness, plant architecture and flowering ability in individual spaced plants in the field, spittlebug tolerance under natural infestation, and laboratory identification of the mode of reproduction.

Mode of reproduction was determined by embryological examination of fixed and cleared ovaries (Young et al., 1979). At least 30 ovaries were scored for each hybrid. These were classified as sexual when producing meiotic sacs, and as apomictic when producing aposporous and meiotic. All hybrids displayed varying quantities of sterile and abnormal or aborted sacs.

Morphological characterization of the fifty-six selected hybrids was done using nine traits and ten replicates. Measurements were taken in centimeters. Traits were: plant height excluding inflorescences (PH); plant growth habit (1= erect to 4= prostrate)(GH); leaf width (LW); leaf length (LL); inflorescence length (IL); number of racemes (NR), length of basal raceme (BR); number of spikelets on basal raceme (NS); and length of leaf sheath (LS).

Multivariate statistical analysis was carried out using SAS software (PRINCOMP and CLUSTER) and Ward's minimum variance criterium for the formation of groups.

RESULTS AND DISCUSSION

Varying amounts of sterility and abnormalities are expected among progenies of interspecific hybrids. In this study, 27 hybrids were classified as sexual, 25 as apomictic, and four as sterile plants. For agronomic purposes, all sterile plants will be eliminated from more advanced trials since good seed production is an important trait in future cultivars.

All hybrids were scored visually for vigor, leafiness and tolerance to drought and natural spittlebug infestation in the field. These 56 were selected on the basis of higher overall scores and diversity of morphological type.

Results from the principal component analysis using nine taxonomical variables indicated five as the most discriminant: LL, LS, NS, GH and NR. Figure 1 depicts the dispersal of the hybrids and progenitors according to this analysis.

Average values for the entire population, sexual and apomictic parents and individual clusters, are presented in Table 1. Classification using cluster analysis was arbitrarily truncated at the 7-group level, with semi-partial r^2 value of 0.02. Hybrids, as a whole, were clearly intermediate between progenitors. However, promising hybrids still displayed large morphological diversity.

Apomictic *B. brizantha* pollen parents belong to clusters 5, 6 and 7, characterized by tall, erect plants with long leaves, leaf sheaths and inflorescences, and spikelets in single rows. The sexual *B. ruziziensis* mother clones belong to cluster 2, with prostrate growth habit, numerous racemes and paired spikelets. The *B. decumbens* apomictic parent is intermediate in morphology and was classified in cluster 4.

Forty-one hybrids have already been subjected to artificial infestation with spittlebug under controlled conditions. The evaluation of nymphal survival rates and duration of nymphal period, helped to characterize tolerance and resistance to this insect pest. Eight hybrids have shown resistance and, morphologically, belong to clusters 1 and 2 (small, prostrate plants of stoloniferous growth). Sixteen hybrids have proven to be susceptible. Field evaluation in small plots will then help to determine the potential candidates for future cultivars. One interesting hybrid that was resistant to spittlebug, HB32, has stoloniferous growth, wide, ascending leaves, numerous long racemes, with an average of 39 spikelets on the basal raceme. It is sexual, thus deserving to be incorporated into further crossing blocks, if proven well adapted and productive in agronomical evaluation. Another interesting hybrid is HB36, apomictic, somewhat more prostrate, with shorter but abundant leaves, less prolific in terms of spikelet numbers, but also resistant to spittlebug. This type of hybrid should be multiplied and advanced to grazing trials, again, if proven agronomically superior in the cutting trials.

CONCLUSIONS

The *Brachiaria* breeding program at CNPGC has produced several sexual and apomictic hybrids amenable to selection. The procedures described in this paper allowed selection of 56 vigorous interspecific hybrids of diverse morphological patterns and varying degrees of resistance to spittlebug. Multivariate analysis on morphological data classified progenitors and these hybrids into seven groups using nine discriminant characters. Subsequent agronomical evaluation in small plots will further determine the potential candidates for future grazing trials.

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Table 1
Average values for some morphological traits in the *Brachiaria* progenitors and hybrids.

Traits	Population	R [1]	B	D	CLUSTERS 1	2	3	4	5	6	7
PH (cm)	44.2	48	82	65	32	46	19	59	72	103	134
GH	2.6	4	1	2	3	3	4	2	1	1	1
LL (cm)	29.6	18	53	26	26	27	26	30	55	54	56
LS (cm)	9.8	6	15	11	9	9	9	10	15	14	19
NS	36.8	40	38	30	35	40	38	31	43	30	44
NR	5,4	8	6	5	5	6	5	5	8	5	8
Nº indiv.[2]	72	6	9	1	20	20	13	11	3	2	2

[1]R= *Brachiaria ruziziensis*; B= *Brachiaria brizantha*; D= *Brachiaria decumbens*;
[2]Nº indiv.= Number of individuals considered.
GH : 1 = erect to 4 = prostrate

Figure 1
Dispersal of *Brachiaria* hybrids and progenitors using principal component analysis on morphological data.