Interspecific Hybrids in Bothriochloa
II. Relationships Between Some American and Australian Species[1]

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The genus *Bothriochloa* O. Kuntze of the tribe Andropogoneae is widely distributed in the Old and New World. The representatives of this genus from North America were studied in some detail by Gould (1951, 1953, 1955, 1956, 1957a, and 1959) and those of the Old World by Celarier and Harlan (1955) and Harlan, *et. al.* (1958). In this paper the relationships between *B. saccharoides* (Swartz) Rydb. var. *longipaniculata* (Gould) Gould from America and both *B. ambigua* S. T. Blake and *B. erianthoides* (F. Muell.) C. E. Hubbard from Australia will be discussed.

Morphological and cytological studies of two collections of *Bothriochloa saccharoides* var. *longipaniculata* from Argentina and Texas, one of *B. ambigua* and three of *B. erianthoides*, the latter two species from Australia, were made at the Oklahoma Agricultural Experiment station, Stillwater. *Bothriochloa saccharoides* var. *longipaniculata* was crossed with *B. ambigua* and with *B. erianthoides*, using the technique described by Richardson (1958). Patterns of morphological variation in the species and their hybrids were studied as suggested by Anderson (1949).

The following characters were found useful in distinguishing between the species and their hybrids: the length of the primary axis and longest raceme, number of inflorescence nodes and racemes, and the frequency of hairs on the inflorescence. These characters are graphically represented in Figure 1. Morphologically the Australian and American species of *Bothriochloa*, which were studied, differ from each other primarily in the number of primary racemes per inflorescence. In the Australian species the raceme number varies from 3-6 while the American species have numerous racemes, ranging from 50 to many in *B. saccharoides* var. *longipaniculata*. Correlated with this increase in raceme number, is an increase in length of the primary axis. Among the three species, *B. erianthoides* can easily be separated from the others by the presence of bilobed lemmas in the fertile florets with the awns arising from the sinus between the lobes; the silky-white long and dense hairs on the callus and the lower half of the glume, covering the sessile spikelets completely; and the joints on the raceme much stouter than the pedicel. Gould (1951, 1953, 1955, and 1957) separates *B. saccharoides* var. *longipaniculata* from the

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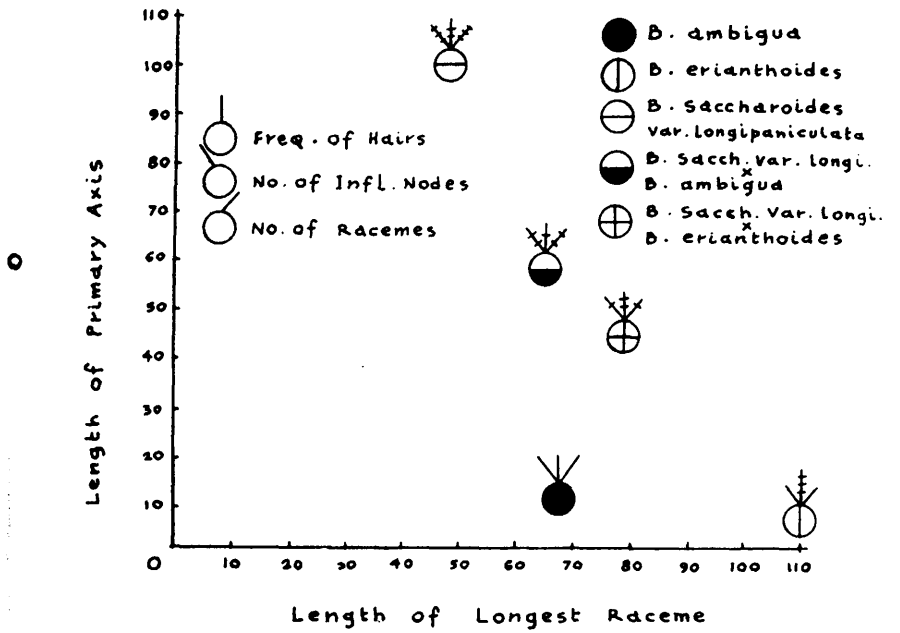

Figure 1. Pictoralized scatter diagram showing some morphological characters in the species and their hybrids.

other New World species on the length of awn (<19 mm.), panicle length (10-20 mm.), sessile spikelet length (<5 mm.) and chromosome number (2n=120). *B. erianthoides* differs also from *B. ambigua* in several respects. *Bothriochloa erianthoides* has erect culms with pubescent nodes, spike-like or spreading racemes, and large sessile spikelets as opposed to decumbent culms with glabrous nodes, inflorescences with subdigitate racemes, narrower, less hairy sessile spikelets in *B. ambigua*. The morphology of the Australian species of *Bothriochloa* is fully discussed by Blake (1944).

In respect of gross morphological characters, *B. saccharoides* var. *longipaniculata* resembles *B. ambigua* more closely than *B. erianthoides*. Relationships between the American species and the species from southeastern Asia has also been assumed by Gould (1953). From Figure 1, it appears that although *B. saccharoides* var. *longipaniculata* resembles *B. ambigua* more closely than *B. erianthoides*, other characters relate the two Australian species more closely.

When *B. saccharoides* var. *longipaniculata* (2n=120) was crossed with *B. ambigua* (2n=60 and with *B. erianthoides* (2n=60) the plants thus obtained (2n=90) had mid-parental values in respect of the morphological characters studied. The results of the cytological studies of these hybrids are shown in Table 1, indicating a closer homology of chromosome between those of *B. saccharoides* var. *longipaniculata* and *B. ambigua* than with those of *B. erianthoides* as suggested by the presence of up to 35

TABLE 1. CHROMOSOME CONFIGURATION IN THE PARENTS AND HYBRIDS AT METAPHASE I.

Name	Ac. No.	2n	Chromosome Range				Av. per cell			
			I	II	III	IV	I	II	III	IV
B. ambigua	5643	60	0	30	0	0	0	30	0	0
B. saccharoides var. *longipaniculata*	3133, 3693	120	0	60	0	0	0	60	0	0
B. erianthoides	4786, 5786 7815	60	0	24-30	0	0-3	—	27.20	0	2.80
Hybrids										
B. saccharoides var. *longipaniculata* X *B. ambigua*	57-X-34-1 57-X-34-2 57-X-34-3	90	20-54	13-35	0	0	49.8	20.2	0	0
B. saccharoides var. *longipaniculata* X *B. erianthoides*	57-X-19-1 57-X-21-1	90	54-76	7-18	0	0	68.8	10.8	0	0

bivalents in hybrids with *B. ambigua* and only up to 18 bivalents in hybrids with *B. erianthoides*. The parental species always have regular chromosome association, indicating that they are allopolyploids. Gould (1953) indicated that *B. saccharoides* var. *longipaniculata* (2n=120) is intermediate between *B. exaristata* (Nash) Henrard (2n=60) and *B. saccharoides* var. *torreyana* (Steud.) Gould (2n=60) and can be assumed to be an allopolyploid derivative of these taxa. Singh and de Wet (in press) have indicated that *B. ambigua* may also be crossed with *B. intermedia* and *B. ischaemum*.

Gross morphological similarities and the homology of the chromosome in the obtained artificial hybrids appear to indicate that *B. saccharoides* var. *longipaniculata* is more closely related to *B. ambigua* than to *B. erianthoides*.

REFERENCES

Anderson, E. 1949. Introgressive Hybridization. New York. John Wiley & Sons, Inc.

Blake, S. T. 1944. Monographic studies in the Australian Andropogoneae I. Univ. of Queensland Papers, Dept. of Biology 2: 1-62.

Celarier, R. P. and J. R. Harlan. 1955. Studies on old world bluestems. Okla. Agr. Expt. Sta. Tech. Bull. T-58: 1-31.

Harlan, J. R., R. P. Celarier, W. L. Richardson, M. H. Brooks, and K. L. Mehra. 1958. Studies on old world bluestems II. Okla. Agr. Expt. Sta. Tech. Bull. T-72: 1-23.

Gould, F. W. 1951. A new species of *Andropogon* from the Edwards Plateau of Texas. Field and Lab. 19: 183-185.

..... 1953. A cytotaxonomic study in the genus *Andropogon*. Am. J. Botan. 40: 297-306.

..... 1955. *Andropogon saccharoides* Swartz var. *longipaniculatus* var. nov. Field and Lab. 23: 17-19.

..... 1956. Chromosome counts and cytotaxonomic notes on grasses of the tribe Andropogoneae. Am. J. Botan. 43: 395-404.

..... 1957a. New North American *Andropogon* of subgenus *Amphilophis* and a key to those species occurring in the United States. Madroño 14: 18-29.

..... 1959. Transfer from *Andropogon* to *Bothriochloa* (Gramineae). Southwestern Naturalist 3: 212.

Richardson, W. L. 1958. A technique of emasculating small grass florets. Ind. J. Genet. and Pl. Br. 18: 69-73.

Singh, A. P., and J. M. J. de Wet. Interspecific hybrids in *Bothriochloa* I. Relationships between *B. ambigua* and *B. ischaemum*. Øyton (in press).