KARYOMORPHOLOGY OF SOMATIC CHROMOSOMES IN PEARL MILLET

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Karyotype measurements of an inbred I-55 of pearl millet were recorded. The seven pairs of chromosomes were numbered 1 to 7 according to their descending total length, chromosome 1 being the longest (5.51 μ) and chromosome 7 being the shortest (3.24 μ). The shortest chromosome was the SAT chromosome. Further, the seven chromosomes of the haploid set were classified as median (chromosomes 1, 2, 3 and 5), submedian (chromosomes 4 and 6) and subterminal (chromosome 7).

INTRODUCTION

Varying reports on the karyomorphology of somatic chromosomes of pearl millet [*Pennisetum typhoides* (Burm.) Stapf. and Hubb.] are known (Rangaswamy 1935; Krishnaswamy and Raman 1951; Sharma and De 1956; Pantulu 1960; Krishnaswamy 1962; Al-Fakhry *et al.* 1964; Kumar *et al.* 1965; Gill and Gupta 1966; Burton and Powell 1968; Sree Ramulu and Sree Rangaswamy 1971; Virmani and Gill 1972). The variations have often been attributed to intraspecies genotypic differences. In our cytogenetic work in pearl millet on establishment of interchanges (Singh and Tyagi 1973; Tyagi and Singh 1974) and aneuploids in the inbred I-55, the necessity of characterizing the karyomorphology of that line was felt. The present paper aims to communicate the results of a study on karyotype of the inbred I-55.

MATERIALS AND METHODS

Actively growing root tips from germinated seeds of I-55 were fixed in Carnoy's solution (6 parts ethyl alcohol, 3 parts chloroform and 1 part glacial acetic acid) after pretreating with saturated aqueous solution of alpha-bromonaphthaline at 16°C for three hours. A small quantity of iron acetate was added to the fixative. Root tips were stained and hydrolysed with 9:1 aceto-carmine normal hydrochloric acid mixture for 6 min at 60°C and squashed in aceto-carmine stain.

Fifteen well spread somatic metaphase plates were chosen for the study. The chromosomes were drawn with the aid of a Camera Lucida and photomicrographs were taken from temporary slides. Karyotype measurements viz., lengths of short arm (a) and long arm (b), total length ($a+b$) and centromere position of each chromosome were recorded. The chromosomes were serially numbered in decreasing order of length, the longest being number 1 chromosome. Relative length in

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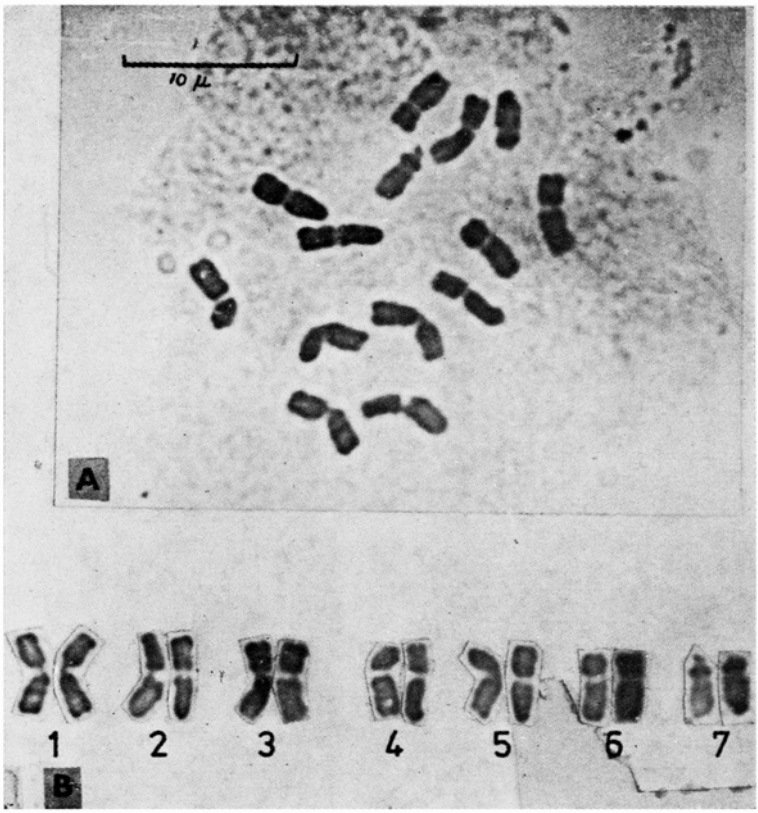

FIGS. 1A and B. Somatic chromosomes of *Pennisetum typhoides*. A, Somatic metaphase with $2n = 14$; B, Somatic chromosome karyotype.

TABLE I

Chromosome length measurements (μ), *relative length, arm ratio and* K *value of haploid set*

Chromosome number	Length of short arm(a)	Length of long arm(b)	Total length ($a+b$)	Relative length in proportion to total genome length (%)	Arm ratio (a/b)	K-value $\left(\frac{a}{a+b} \times 100\right)$
1	2.38	3.13	5.51	17.50	0.76	43.19
2	2.58	2.73	5.31	16.83	0.95	48.58
3	2.19	2.64	4.83	15.31	0.82	45.34
4	1.87	2.62	4.49	14.23	0.71	41.64
5	1.98	2.38	4.36	13.82	0.83	45.41
6	1.50	2.30	3.80	12.04	0.65	39.47
7*	1.07	2.17	3.24	10.27	0.49	33.02

*SAT chromosome

proportion of the length of total genome, arm ratio (a/b) and K percentage $\left(\frac{a}{a+b} \times 100\right)$ were calculated for each chromosome.

Observations

The somatic metaphase chromosomes are shown in Figs. 1A and 1B. The diploid chromosome number was $2n=14$. Short arm length, total length, relative length, arm ratio and K value of the haploid set are presented in Table I. The seven pairs of chromosomes were arranged in sequence in order of their decreasing total length and were assigned Arabic Numerals from 1 to 7 (Fig. 1B). the chromosome 1 being the longest and chromosome 7 being the shortest. The haploid set of somatic complement was measured to be 31.54μ (satellite length was included in the size of the short arm of chromosome 7). Chromosome length varied from 5.51μ for the longest to 3.24μ for the shortest and the arm ratios ranged from 0.49 to 0.95. The ratio of the longest to the shortest chromosome in the complement was 1.7:1, with a difference of 2.27 μ between the longest and shortest chromosomes. Based on relative position of the centromere, as denoted by K percentage, chromosomes 1, 2, 3 and 5 were designated as median (K percentage 43.1 to 50.0), chromosomes 4 and 6 as submedian (K percentage 38.1 to 43.0) and chromosome 7 as subterminal (K percentage below 38.0). Only one of the two 7th chromosomes possessed satellite in the short arm.

Discussion

Individual chromosomes were distinguished on the basis of careful measurements of their total length, arm ratio and K value. As regards the satellited chromosome, the shortest pair was nucleolus organiser, as also reported by others (Krishnaswamy and Raman 1951; Sharma and De 1956; Krishnaswamy 1962; Pantulu 1958, 1960; Burton and Powell 1968; Venkateswarlu and Pantulu 1968; Sree Ramulu and Sree Rangaswamy 1971; Virmani and Gill 1972). Exceptions to this have also been noted (Al-Fakhry *et al.* 1964; Kumar *et al.* 1965; Gill and Gupta 1966; Powell and Burton 1966). In all these studies, however, satellite was located on both the homologues of the SAT chromosome. In the present study, only one chromosome of the 7th pair, the shortest of the complement, displayed satellite and thus was heteromorphic.

Recently Virmani and Gill (1972) reported the Karyotype of pearl millet and their results are in close agreement with the results obtained in the present study. Minor differences in chromosome lengths as recorded in the present study and those reported by Virmani and Gill (1972) may be attributed to the differences in the degree of chromosome condensation in the two studies. The corresponding arm ratios resembled remarkably, suggesting that it will be advisable to compare the karyotype characteristics by the estimates of ratios.

Using K value as a criterion for locating the centromere and classifying the chromosomes, the seven chromosomes of the haploid set were classified as median (chromosomes 1, 2, 3 and 5), submedian (chromosomes 4 and 6) and subterminal (chromosome 7). Based on arm ratios, Virmani and Gill (1972) also classified the

seven chromosomes in the same manner. However, Pantulu (1958) and Venkateswarlu and Pantulu (1968), based on pachytene chromosome measurements, reported that there were two longest and median, two somewhat shorter and median to submedian, two medium-sized and submedian chromosome pairs. Krishnaswamy (1962) and Burton and Powell (1968) classified the seven chromosomes in two groups viz., median and submedian. Kumar *et al.* (1965), studying the interspecific and intergeneric hybrids of *Pennisetum*, reported that among the seven chromosomes of haploid set, two were very long and submedian, two medium, of which one was median and one submedian, and one short subterminal chromosome. The grouping of the haploid set into median or submedian by different workers is somewhat overlapping. This may probably be due to the stage at which the chromosomes were measured and also whether the measurements were taken in the parental species or in the interspecific hybrid background. The pachytene chromosomes may show differential condensation pattern as compared to the somatic metaphase. Similarly, the hybrid background, as studied by Kumar *et al.* (1965), may affect the total length as well as the arm ratio of the parental chromosomes. Such a phenomenon has been reported by Singh (1972) in intersubgeneric hybrids of *Rumex*.

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