

Chromosome number spectrum in parents and progeny populations of sugarcane

SANGEETA SRIVASTAVA¹, A D PATHAK² AND V K SAXENA³

Division of Crop Improvement, Indian Institute of Sugarcane Research, Lucknow – 226002

Sugarcane belonging to the genus *Saccharum* is one of the most important field crops grown in the tropics and sub-tropics. *Saccharum* is a genus with high level of polyploidy, heterozygosity, chromosome mosaicism and variation among morphological and quantitative attributes (Sreenivasan *et al.* 1987). The genus comprises of mainly three cultivated species (*S. officinarum*, *S. barberi* and *S. sinense*) and two wild species (*S. robustum* and *S. spontaneum*). Cultivated sugarcane genotypes (*Saccharum* species hybrids) are aneuploids of complex polyploid interspecific lineage (hybrids of two to three species) with chromosome numbers ranging between $2n = 100 - 130$ and are almost exclusively “back cross derivatives” of a few clones of *Saccharum* species viz. *S. officinarum*, *S. robustum*, *S. barberi* and *S. spontaneum* (Price 1957; Srivastava 2006). Despite their use in breeding programmes, the somatic chromosomal variability and cytogenetic characteristics during meiosis of most of the elite sugarcanes have not been studied widely, although these characteristics are believed to influence the agronomic attributes of the progeny (Burner 1997; Burner and Legendre, 1993). At the Sugarcane Breeding Institute, Coimbatore, work has been done on the conventional cytogenetics of sugarcane species and cultivars, interspecific and intergeneric hybrids and tissue culture regenerants (Sreenivasan *et al.* 1987). Currently the efforts are in progress to study chromosome number variation in wild and cultivated species of *Saccharum* and its hybrids. Inherent chromosomal mosaicism in commercial cane cultivars and its influence on fertility characteristics, nucleolar variations *in vivo* among elite cultivars and chromosomal variations upon selfing of a few genotypes and preferential chromosome pairing of some elite

sugarcane genotypes of subtropical India have been studied by Srivastava (2002), Srivastava and Srivastava (1998). With this in view, the spectrum of chromosome number variability was studied in some sugarcane genotypes being used as parents adapted to subtropical conditions and in their cross populations.

Three sugarcane genotypes ‘CoLk 8102’, ‘BO 91’ and ‘Co 1158’ being used as parents in crossing programmes for subtropical India, and progeny plants from two cross populations

involving them as parents were taken as experimental material. Three replicates of single budded setts of sugarcane genotypes viz. ‘CoLk 8102’, ‘BO 91’ and ‘Co 1158’ and of hundred plants each from the progeny population of CoLk 1158 X BO 91, and BO 91 X CoLk 8102 were planted in tray cultures. The healthy root tips were cut, pretreated with saturated aqueous solution of p-Dichlorobenzene, washed thoroughly in running water and fixed in Carnoy’s 6:3:1 (Alcohol: Chloroform: Acetic Acid) solution for 24-48 h as per Srivastava (1995). The fixed root tips were transferred to 70% alcohol and stored in refrigerator. The root tips were hydrolyzed in 1N HCL at 60°C. The mitotic index and chromosome numbers were determined from the chromosome squash preparations of hydrolyzed root-tips in 45% Acetic Acid. Only clear stained plates were taken into consideration while scoring.

The modal chromosome numbers/cell and their range of variation are given in table 1. In the adapted parents, the chromosome numbers/cell varied from 98-110 in ‘CoLk 8102’, 101-126 in ‘Co 1158’ and 102-115 in ‘BO 91’. The modal chromosome numbers in these genotypes ranged from $2n=108-118$ / cell. The cells having chromosome numbers other than the modal number ranged from 24.29 % (‘CoLk 8102’) to 38.24 % (‘Co 1158’). In the crosses of these adapted parents, the modal chromosome number/ cell in different plants from the progeny population of 92-120 in progeny of CoLk 1158 x BO 91 and 90-112 in BO 91 x CoLk 8102 whereas, the somatic chromosome number variation/cell was 74-124 and 86-114 respectively. Details of range of chromosome number variation/cell in progeny populations of CoLk 1158 x BO 91 and BO 91 x CoLk 8102 are given in Fig.1 and 2. While comparing numerically aberrant cells in parent and progeny population of sugarcane, it was observed that in parents ‘CoLk 8102’, ‘Co 1158’ and ‘BO 91’, the per cent aberrant cells ranged from 24.29 to 38.24, whereas the progeny populations of crosses among these parents displayed a wide and elevated per cent of aberrant cells ranging from 42.25 - 54.00 in CoLk 1158 X BO 91 and 33.33 - 48.60 in BO 91 x CoLk 8102.

It would be of interest to see the influence of selection among these progeny populations during successive clonal generations, on the extent of chromosome number variability and numerical chromosomal aberrations. Further, it is likely that selection for specific traits biases the selection towards one species component of the hybrid genome. A consequence of this is that modern varieties suitable for subtropical regions

¹Principal Scientist, ²Principal Scientist and Head, ³Technical Officer, Division of Crop Improvement, ¹Author for correspondence Email: sangeeta_iisr@yahoo.co.in

Table 1 Modal Chromosomal Number, Chromosome Number Range per Cell and per cent Numerically Aberrant cells in parent and progeny population of sugarcane

Variety	Modal Chromosomal No./ Cell	Chromosome Number Range/ Cell	Numerically Aberrant cells (%)
'CoLk 8102'	108	98-110	24.29
'Co 1158'	118	101-126	38.24
'BO 91'	112	102-115	30.00
CoLk1158 x BO91	92-120	74-124	42.25 – 54.00
BO91 x CoLk 8102	90-112	86-114	33.33 – 48.60

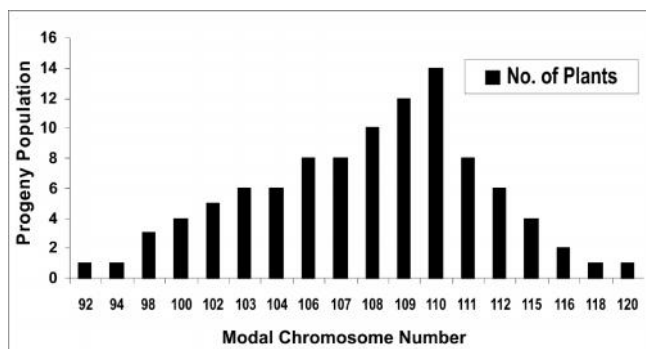


Fig 1 Modal Chromosome number distribution in progeny population of CoLk1158 x BO91

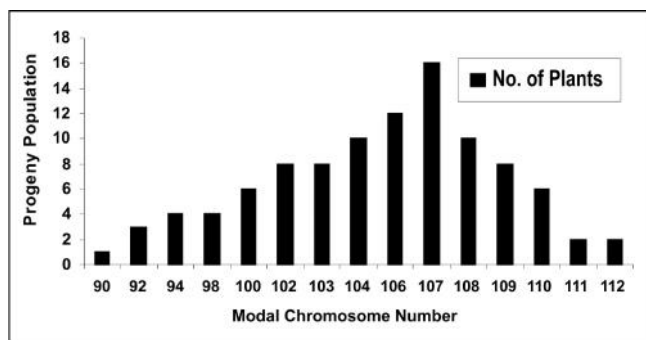


Fig 2 Modal Chromosome number distribution in progeny population of BO91 x CoLk 8102

show more characteristics of the *S. spontaneum* ancestor, such as thinner stalks and a higher stalk population. Use of molecular cytogenetic tools such as FISH and GISH may be explored to

establish the role of *S. spontaneum* / *S. officinarum* chromosomes in determining the adaptability of a particular genotype.

Acknowledgements: The authors are thankful to the Director, Indian Institute of Sugarcane Research, Lucknow, for providing necessary support to carry out this work.

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