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Karyomorphology of *Bambusa balcooa* Roxb. – A new report from Tripura, India

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Abstract: The karyotype of *Bambusa balcooa* Roxb. is investigated. The species has chromosome number 2n = 72 with the karyotype formula 2Asm + 42Bnm + 28Csm. The karyotype is slightly asymmetric with 21 metacentric and 15 sub-metacentric pairs of chromosomes. The chromosome count and constancy of the karyotype recorded in the present study justify a new cytotypic record of *B. balcooa* growing wild in this part of North east India.

Keywords: *Bambusa balcooa* Roxb., karyotype, chromosome number, Tripura.

INTRODUCTION

Bamboo is the most unique, versatile, multipurpose grass of the family Poaceae with high economic and environmental value. Northeast India represents one of the major resources in India (Trivedi and Tripathi, 1984; Tewari, 1992). *Bambusa balcooa* Roxb. is widely distributed in this region. The species is the tallest, strongest, highly durable and utilized in structural and pulping purpose (Dutta and Borthakur, 2009). The young shoots are consumed by the tribal and local peoples of the State (Chakraborti and Sinha, 2009). The species is commonly known as *Barak* in Tripura, *Bhaluka* in Assam, *Wamnah*, *Beru* in Meghalaya, *Oti* in Nagaland, *Balukabans* in West Bengal and *Borobans* in North Bengal.

In spite of high multipurpose economic value, no attempt has so far been made to carry out cytological analysis of the species growing in this part of North East. The present paper reports and describes new chromosome number and karyotype of *B. balcooa*.

MATERIALS AND METHODS

Mitotic chromosome studies were carried out following standard aceto–orcein squashing

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technique (Sharma and Sharma, 1980) with slight modification. Young whitish roots arising from lower-most nodal portion of the *B. balcooa* culm was selected as source material for the present cytological study. Root tips from healthy roots were collected at 10.35 am and thoroughly washed with water. The tips measuring 6–8 mm were cut and each root tip was longitudinally split into two halves. All the root tips were pretreated with saturated para–Dichlorobenzene (pDB) solution for 5 h at 12°C and subsequently fixed in 1:3 acetic–ethanol mixture for overnight. Then root tips were treated with 45 per cent acetic acid for 30 min, followed by warm hydrolysis of the sample in 1 (N) HCl for 30 min. After thorough washing with distilled water for several times root tips were again treated with 45 per cent acetic acid for 10 min followed by staining with 2 per cent aceto-orcein (N) HCl (9:1) mixture solution for overnight. On the next day root tips were squashed in 45 per cent acetic acid and temporary slides were prepared for observation. At least 100 metaphase plates were scanned and 5 well spread metaphase cells were randomly selected and drawn for different chromosome measurements with the aid of drawing prism under oil immersion objective (×2260) of compound microscope. photomicrographs were taken with Sony DSC – W55 Cyber Shot camera and suitably enlarged. In preparing the karyotype, measurements of long arm, short arm, total chromosome length and centromeric index were used. Total forma percentage (TF%) of chromosomal complements was also calculated (Levan *et al.*, 1964).

RESULTS AND DISCUSSION

The somatic chromosome number of *B. balcooa* was found to be constant with 72 chromosomes, in all the metaphase cell scanned (Figs. 1A and 1B). The chromosomes are small sized ranging from 0.94 ± 0.01μm to 1.66 ± 0.06 μm with a pair of chromosome having secondary constriction (Table 1). The secondary constriction is associated with the short arm of the chromosome complement. The chromosomes are quite homogeneous in size with an average chromosome length of 1.31 ± 0.04 μm. The total chromosome length of the complements is 47.06 μm and the total forma percentage (TF%) is 38.95. There are 21 pairs of nearly median (nm) and 15 pairs of sub median (sm) chromosomes in which one pair had secondary constriction. On the basis of primary constriction and size of chromosomal complements, the chromosomes are classified into three morphological types:

Type A: Chromosomes with a mean size of 1.55 ± 0.11μm having sub-median (sm) primary constriction and with sub – terminal (st) secondary constriction.

Type B: Chromosomes with a size range of 0.94 ± 0.01μm to 1.66 ± 0.06 μm and bears nearly median (nm) primary constriction

Type C: Chromosomes ranging from 1.05 ± 0.01 μm to 1.55 ± 0.00 μm and with sub median (sm) primary constriction.

The karyotype formula of the present species is 2Asm + 42Bnm + 28Csm

Table 1. Karyotype and measurements of somatic metaphase chromosomes of *B. balcooa*

No. of chromo-some comple-ments	Total length of chromosome (μm) *Mean ± SD	Length of short arm (μm) *Mean ± SD	F% *Mean ± SD	Natureof primary constri-ction	Chromo-some types	Remark
2	1.55 ± 0.66	0.44 ± 0.05	33.08 ± 0.09	smst	A	Chromosome
2	1.66 ± 0.06	0.66 ± 0.04	39.76 ± 0.11	nm	B	with
6	1.55 ± 0.03	0.66 ± 0.02	42.58 ± 0.09	nm		secondary
2	1.49 ± 0.00	0.66 ± 0.00	44.30 ± 0.00	nm		constriction
2	1.44 ± 0.01	0.66 ± 0.00	45.83 ± 0.02	nm		
8	1.33 ± 0.02	0.66 ± 0.01	49.62 ± 0.03	nm		
2	1.33 ± 0.02	0.65 ± 0.03	48.87 ± 0.07	nm		
2	1.33 ± 0.06	0.61 ± 0.04	45.86 ± 0.10	nm		
2	1.33 ± 0.02	0.55 ± 0.01	41.35 ± 0.05	nm		
2	1.22 ± 0.07	0.55 ± 0.03	45.08 ± 0.12	nm		
6	1.11 ± 0.05	0.44 ± 0.02	39.64 ± 0.06	nm		
4	1.05 ± 0.02	0.44 ± 0.01	41.90 ± 0.04	nm		
2	1.00 ± 0.00	0.44 ± 0.00	44.00 ± 0.00	nm		
2	0.94 ± 0.01	0.44 ± 0.02	46.81 ± 0.04	nm		
2	1.55 ± 0.00	0.55 ± 0.00	35.48 ± 0.00	sm	C	
4	1.55 ± 0.05	0.44 ± 0.02	28.39 ± 0.09	sm		
8	1.33 ± 0.01	0.44 ± 0.01	33.08 ± 0.02	sm		
4	1.27 ± 0.02	0.44 ± 0.01	34.65 ± 0.05	sm		
2	1.26 ± 0.00	0.44 ± 0.00	34.92 ± 0.00	sm		
4	1.22 ± 0.06	0.44 ± 0.02	34.43 ± 0.07	sm		
2	1.11 ± 0.02	0.22 ± 0.01	19.82 ± 0.06	sm		
2	1.05 ± 0.01	0.22 ± 0.00	20.95 ± 0.03	sm		

*Mean of 5 metaphase plates

Mitotic chromosome studies of *B. balcooa* clearly reveals a diploid chromosome number 2n = 72, which is a new record of the species in this region. Somatic chromosome number in different species of *Bambusa* has been reported to vary from 48 to 72 (Seethalakshmi *et al.*, 1998) with the basic chromosome number x = 12. Present finding on *B. balcooa* did not corroborates with the earlier record of chromosome number 2n = 70 (Seethalakshmi *et al.*, 1998). However, variation in somatic chromosome number within the species was also reported in *B. bamboos, B. multiplex* and *B. polymorpha,* etc. (Seethalakshmi *et al.*, 1998). The present findings on somatic chromosome number 2n = 72 of *B. balcooa* indicated the presence of ploidy level in the species.

The somatic chromosomes of *B. balcooa* show relative size reduction in each group or type of chromosomes. The TF per cent and the chromosome arm symmetry index value indicate the symmetry of chromosomes to a certain extent. According to the degree of asymmetry the karyotype of *B. balcooa* belongs to the category 2A (Stebbins,

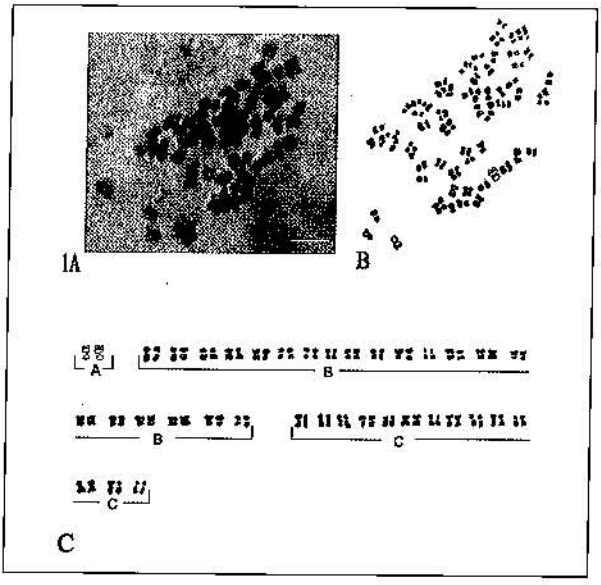

Figure 1A. Somatic metaphase plate of *B. balcooa* (2n = 72) [Bar: 4.78ìm]. **1B.** Camera lucida drawing of the same (magnification × 2260). **1C.** Karyogram of the species.

1971) (Table 2). Thus, the accumulation of relative size differences between the chromosomes of the complement suggests its karyotype to be considered as slightly asymmetric.

Therefore, the present cytological observation on *B. balcooa* reveals somatic chromosome number 2n = 72 with the characteristic karyotype formula 2Asm + 42Bnm + 28Csm. This is a report of a new cytotype of the species. The chromosome count and constancy recorded in the present study could be utilized to measure the cytological as well as karyomorphological variability among the ecotypic populations of the taxon.

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Table 2. Stebbins categorization of the karyotype of *B. balcooa*

	Proportion of the chromosome with arm ratio <2:1			
Ratio Largest /Smallest	0.00	0.01 – 0.50	0.51 – 0.90	1.00
	1A	2A	3A	4A
		B. balcooa		
< 2 : 1		2A		

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