

## Chromosome counts in two species of *Curcuma* Linnaeus (Zingiberaceae) from North-East India

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### Abstract

The somatic chromosome number of two species of *Curcuma* from Northeast India has been investigated. Chromosome counts were carried out in root tip cells by squash preparation. All the root tip cells analyzed show the chromosome number of  $2n = 63$  in both the species viz. *C. longa* and *C. caesia*. Probable triploid nature of both the species has been indicated.

**Key words:** *Curcuma caesia*, *Curcuma longa*, Chromosome number, Polyploidy

### INTRODUCTION

The genus *Curcuma* Linnaeus of Zingiberaceae comprises of about 100 species (Velayudhan *et al.* 1999) including some most useful and popular ones viz. *C. longa* (Sasikumar 2005). The origin and spread of the genus favoured its Indo–Malayan origin and centre of diversity theory (Harlan 1975). The genus *Curcuma* Linnaeus contains many taxa of economic, medicinal, ornamental and cultural importance (Velayudhan *et al.* 2012).

Chromosome numbers and genome size of plant species provide authentic information which is useful in systematic, evolution and conservation of plants (Bennett & Leitch 2005; Guerra 2008), especially in taxa with smaller chromosomes like *Curcuma* (Skornickova *et al.* 2007). A quick perusal of published literature reveals that somatic chromosome numbers have been investigated in various species of *Curcuma* and polyploidy has been implicated in the diversification and evolution of the species (Suigura 1931; Raghavan & Venkat 1943; Chakravorti 1948; Sato 1948; Ramachandran 1961; Prana 1977; Apavatjirut *et al.* 1996; Das *et al.* 1999; Joseph *et al.* 1999; Ardiyani 2002; Sirisawad *et al.* 2003; Islam 2004; Skornickova *et al.* 2007; Nair & Sasikumar 2009). However, there are no detailed cytogenetical reports about *Curcuma* species growing in wild and/or cultivated in northeast India. Therefore, the present investigations have been undertaken to determine the somatic chromosome number in two species belonging to the genus *Curcuma* viz. *C. caesia* Roxburgh and *C. longa* Linnaeus which are medicinally important species of the region.

### MATERIAL AND METHODS

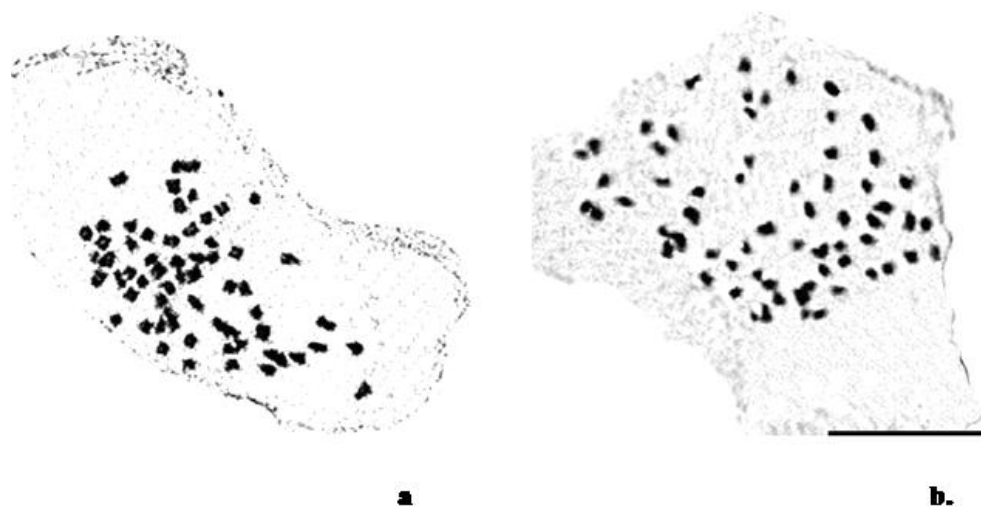
The rhizomes of *C. caesia* (IISR 700) and *C. longa* (IISR Pratibha) used in the present investigation were obtained from Indian Institute of Spices Research, Kozhikode, Kerala. The plants were grown and maintained in poly-house conditions at the Department of

Biotechnology and Bioinformatics, North-Eastern Hill University, Shillong. Actively growing root tip of 1 – 2 cm long were excised from field grown plants and were pretreated with saturated para-dichlorobenzene (HiMedia) for 3 hours at room temperature. The root tips after pretreatment were fixed in freshly prepared 1 : 3 acetic alcohol for a minimum period of 24 hrs and thereafter stored in 70 % ethanol till those are squashed. Root tips were hydrolysed in 1N HCl for 8 minutes at 60° C and stained in leucobasic-fuschin (HiMedia) for 45 minutes at room temperature. The stained root tips were then thoroughly washed with distilled water and finally squashed in 1 % acetocarmine (Shamurailatpam *et al.* 2012).

Photomicrographs of the metaphase plates were taken from temporary preparations using Leica DFC 310FX microscope. At least 5 well spread metaphase plates were used for the study. The voucher slides for future verification have been stored at Plant Biotechnology Laboratory, Department of Biotechnology and Bioinformatics, North-Eastern Hill University, Shillong.

### RESULTS AND DISCUSSION

In the present study, the somatic chromosome numbers of *C. caesia* and *C. longa* were determined to be  $2n = 63$  (Figs. 1 a & b). Karyological investigation of *Curcuma* species is rather challenging and errors may easily be introduced due to relatively high number but smaller chromosomes (Ramachandran 1961; Apavatjrut 1996; Joseph *et al.* 1999; Sirisawad *et al.* 2003). Different chromosome counts for the same species have also been reported in some cases. However, in present investigations the occurrence of  $2n = 63$  has been clearly recorded with the help of neat, clean and unambiguous preparations in *C. longa* and *C. caesia* with no evidence of numerical variations, whatsoever. The occurrence of  $2n = 63$  as somatic chromosome number is in agreement with the findings of Ramachandran (1961),



**Fig. 1.** Mitotic complements in *Curcuma* spp. **a.** *C. caesia* ( $2n = 63$ ); **b.** *C. longa* ( $2n = 63$ ). Scale bar = 10  $\mu$ m.

Joseph *et al.* (1999) and Islam (2004). However, the somatic chromosome number in *C. caesia* has also been reported to be  $2n = 22$  (Das *et al.* 1999) which is quite unrelated chromosome count and thus our observations are at variance with the report of Das *et al.* (1999). On contrary,  $2n = 22, 48, 62, 64$  and  $93$  have been reported by different workers for *C. longa* (Raghavan & Venkatasubban 1943; Ramachandran 1961; Sharma & Bhattachrya

1959; Sato 1960; Scornickova *et al.* 2007). The present authors opine that these unrelated chromosome numbers might be due to ambiguity in cytological preparations and/or technical difficulties in obtaining quality preparations. There has been continued disparity and controversy concerning the basic chromosome number of the genus *Curcuma* (Scornickova *et al.* 2007). Three basic numbers of  $x = 7, 16, 21$  have been proposed for the genus *Curcuma* by various cytogeneticists (Raghavan & Venkatasubban 1943; Ramachandran 1961; Sharma & Bhattacharya 1959; Sato 1960; Scornickova *et al.* 2007). However, our study indicates that the basic chromosome number could be  $x = 21$  in conformity with the reports of Ramachandran (1961), Prana (1978), Ardhiyani (2002) and Islam (2004) which is a widely accepted basic chromosome number. Therefore, based on our study, *C. caesia* and *C. longa* could be regarded as possible triploid ( $3x$ ) species. Chromosome counts provide indispensable information on genetic discontinuities within and among the species and they contribute to our understanding of phylogenetic relationships at all taxonomic levels (Semple *et al.* 1989). However, it is untenable to depend only on chromosome counts to resolve the basic chromosome number in *Curcuma*. Therefore, further cytogenetical investigations related to meiotic analysis should be carried to ascertain the basic chromosome number in *Curcuma* and determine the type of polyploidy ( $3x$ ) which is recorded here in *C. caesia* and *C. longa*.

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