Cytology of *Trichosanthes palmata* Roxb.

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During the course of extensive investigation on the cytology of South Indian Cucurbitaceae, it has been possible to examine male and female plants of *Trichosanthes palmata* Roxb. The only available report on the cytology of this species is that of Rangaswami (1949) who has studied the cytology of male and female plants with 44 chromosomes in root tip cells. Male and female plants of *T. palmata* Roxb. examined in the present study however showed 22 chromosomes in root tip cells. Both mitosis and meiosis in these plants were studied in detail and the results are presented in this paper.

Material and methods

Male and female plants of *T. palmata* were collected from different places in Trivandrum city. Somatic chromosome studies were made from root tips obtained from stem cuttings planted in pots. The roots were fixed in Carnoy's fluid between 11 a.m. and 1 p.m. for 2-4 hours. The haematoxylin squash method (Marimuthu and Subramaniam 1960) was utilized for studying the somatic chromosomes. For meiotic studies, flower buds were fixed between 10 and 11 a.m. in Carnoy's fluid. Acetocarmine smear technique was employed for examining different stages of division in pollen mother cells. Two or three changes of the fixative and addition of a trace of ferric acetate were found to increase the staining of the chromosomes. Photomicrographs were taken from fresh preparations and slides were made permanent in butanol series.

Observations

The plants are extensive climbing perennials with sulcate glabrous stem and palmate deeply lobed and very variable leaves. Male racemes with large bracts are 15-20 flowered. The flowers open between 8 and 9 p.m. The white petals are long fimbriate at the margins. Female plants bear globose fruits which are bright-red when ripe.

Mitotic preparations from the root tip cells of male (Fig. 1) and female (Fig. 2) plants showed twenty-two chromosomes each. Presence of an extra-chromosome was observed in stray cases (Fig. 3). Chromosomes of the male plant varied from $1.75\ \mu$ to $3.75\ \mu$ in length. According to their comparative size, the eleven pairs of chromosomes were classified as one pair of very long

Figs. 1-6. Photomicrographs of somatic and meiotic chromosomes of *Trichosanthes palmata* Roxb. All photographs are reproduced at a magnification of $\times 1,400$. 1, somatic chromosomes in a root tip cell of the male plant showing $2n=22$. 2, somatic chromosomes in a root tip cell of the female plant showing $2n=22$. 3, somatic chromosomes in a root tip cell of the male plant showing $2n=23$. Note the extra chromosome indicated by arrow. 4, diakinesis showing 5 bivalents attached to the single large nucleolus. 5, diakinesis showing 3 nucleoli. 6, metaphase I of meiosis showing 11 bivalents.

chromosomes, 2 pairs of long chromosomes, 2 pairs of medium chromosomes, 2 pairs of short chromosomes and 4 pairs of very short chromosomes (Fig. 7a). Analysis of the female karyotype showed that the size of the chromosomes varied from 1.5μ to 3.25μ in length. According to the comparative size they were also classified as one pair of very long chromosomes, 2 pairs of long chromosomes, 2 pairs of medium chromosomes, 2 pairs of short chromosomes and 4 pairs of very short chromosomes (Fig. 7b).

Fig. 7. Idiograms of the somatic chromosomes of *T. palmata* Roxb. male (a) and female (b) plants.

The longest pair of chromosomes in both male and female plants showed secondary constrictions. All the other chromosomes in both the male and female complements showed median or sub-median constrictions. On comparison, the karyotypes in both male and female plants were found to be similar.

Meiosis was normal and eleven bivalents were observed in dividing pollen mother cells. During prophase, 4-6 bivalents were found associated with the single large nucleolus (Fig. 4). In rare cases 2-3 nucleoli were observed (Fig. 5). Metaphase orientation of the bivalents was regular. In some cells two bivalents showed sticky associations (Fig. 6). Anaphase separation was quite regular. Majority of nuclei in first telophase showed 3 nucleoli per cell; their number varying from 2-6 in other cases. The subsequent stages were normal. The percentage of fertile pollen has been estimated to be 95-97.

Discussion

Out of the 44 species belonging to the genus *Trichosanthes*, 24 species are known to occur in India (Chakravarty 1959). In spite of the prevalence of dioecious habit and the consequent cytological interest regarding the sex chromosome mechanism, only very little work has been done on the cytology

of different members of this genus. From the chromosomal determinations so far made in the genus (Table 1), it is seen that the lowest haploid number

Table 1. Chromosome numbers in the genus *Trichosanthes*

Species	Chromosome number		Authority	Year	Distribution
	n	2n			
<i>*T. anguina</i>	11	22	Mc Kay	1931	Trop. Asia
<i>T. dioica</i>	11	22	Banerji and Das	1937	India
<i>*T. japonica</i>	11	22	Sinotô	1929	Trop. Asia
<i>*T. multiloba</i>		22 (♂ 20+XY)	Kurita	1939	Japan
<i>T. shikokiana</i>		22	"	"	Japan
<i>*T. cucumeroides</i>		44	"	"	Japan
<i>T. palmata</i>	11	22	Present report		India
<i>T. palmata</i>	22	44	Rangaswami	1949	Trop. Asia

* Cited from Darlington and Wylie (1955).

in *Trichosanthes* is $n=11$. The present materials of *T. palmata* appear to be diploids with $2n=22$ and this is the first report of the existence of races $2n=22$ in *T. palmata*. Rangaswami (1949) has reported races of *T. palmata* with $2n=44$. He (Rangaswami 1967) has suggested that these are possibly autoallotetraploid descendants from a putative ancestor of the type of the present day *T. anguina* Linn. But the present finding of the existence of diploid plants with $2n=22$ suggests possible autopolyploid origin for the tetraploid. Observations on a tetraploid *T. palmata* Roxb. (Varghese, unpublished) also support this suggestion.

The family Cucurbitaceae is of considerable cytological interest due to the presence of dioecious members in certain genera. Out of the 24 species of *Trichosanthes* occurring in India, 7 are reported to be dioecious (Chakravarty 1959). Previous studies on the cytology of Cucurbitaceae have shown the existence of sex chromosomes of the XY type in *Coccinia indica* (Kumar and Vishveshwaraiah 1952), *Trichosanthes multiloba* (Kurita 1939) and in *T. palmata* (Rangaswami 1949). Rangaswami (1949) reported that the female plants of *T. palmata* ($2n=44$) studied by him are of the XX type, and the males of the XY type, the X chromosome being the largest of the complement and Y the smallest. Critical examination of a large number of metaphase plates in the diploid plants of *T. palmata*, during the present study, revealed that the chromosome complements of both the male and female plants are similar. No heteromorphic chromosome pair responsible for the dioecious habit in these plants could be detected. The meiotic chromosomes in diakinesis and first metaphase also did not reveal the presence of heteromorphic bivalents of the type reported by Rangaswami (1949) in *T. palmata* and others in *Melandrium* (Warmke 1946) and *Dioscorea tomentosa* (Rama-

chandran (1962). In the absence of sex chromosomes associated with the dioecious habit *T. palmata* resembles *T. dioica* Roxb. which has been investigated by Banerji and Das (1937).

Summary

The cytology of male and female plants of *Trichosanthes palmata* Roxb. has been studied. Both plants showed 22 chromosomes in root tip cells. Meiotic studies on the male plants revealed the presence of 11 bivalents in pollen mother cells. These plants are believed to be diploids on the basic number $x=11$. The present finding of a diploid and earlier report of a tetraploid reveal the existence of intra specific polyploidy in *T. palmata*. Critical examination of karyotypes in the male and female plants did not reveal the presence of morphologically distinct sex chromosomes associated with the dioecious habit.

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