

## CYTOLOGICAL STUDIES OF *THEVETIA PERUVIANA* L. AND *CATHARANTHUS ROSEUS* L.

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Three varieties of *Thevetia peruviana* L. and *Catharanthus roseus* have been studied for chromosome number, chromosomal associations, chiasma frequencies, size of tetrads and pollen grains and pollen viability. In all the four plant types, the chromosome number remains more or less same ( $2n=16-22$ ). Both bivalents and univalent have been observed in three varieties of *T. peruviana*, specially ring association. But in *C. roseus*, rod association is in higher frequency. Linear type of tetrads have not been found in three varieties of *T. peruviana* but interestingly it is observed in *C. roseus*. The shape of viable pollen grains is quite similar in all four plant types.

**Key words:** *Thevetia peruviana*, *Catharanthus roseus*, chromosome number, chromosomal association, chiasma frequencies.

Apocynaceae (Dogbane) family of about 300 genera and 1300 sp. (Lawrence 1964) is a very important medicinal plant family. The genus *Thevetia* and *Catharanthus* are two important members of this family. Almost all members of genus *Thevetia* are evergreen shrubs, in which eight spp. are widely cultivated and only one species found in India i.e. *T. peruviana* (Bhattacharya 2005). Whereas *C. roseus* is round herb and native of Madagascar (Edward 1999). All three varieties of *T. peruviana* prefers fertile, well drained soil and grown as an ornamental (Bailey 1951). It blooms repeatedly. *C. roseus* is a perennial herb and mainly grown in arid coastal location for its medicinal uses. This genus contains more than 70 alkaloids. Specific alkaloids have anti-cancerous effect and have ability to reduce blood pressure. This species mostly used in curing of diabetes, malaria, Hodgkin's disease and leukaemia (Ferrerres *et al.* 2008). Different species of genus *Thevetia* also have medicinal properties like skin diseases, leukoderma, wounds, piles, itching, fever, bronchitis cures (Elle horn and Braceloux 1988). Both genus are used in medicinal application. Very little attention has been paid towards cytological analysis of these plants. Many cytological characteristics namely chromosome number, chromosomal associations, chiasma frequency and size of tetrads of microspores, size and viability of pollen grains are studied in above

said plant species.

### MATERIALS AND METHODS

Phenological studies of both plant indicate that the blooming is throughout the year. Flower buds of different sizes were collected from the selected plants species during their flowering seasons, at the relative temperature and humidity, appropriate size of bud was taken. They were fixed in Carnoy's fluid I for 24 hrs, and then transferred to 70% alcohol for storage. Their anthers were put on the slide and stained in 1% acetocarmine solution. A cover slip was placed over the solution.

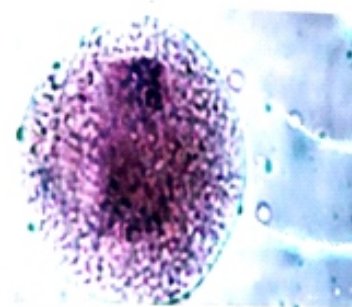
After pressing and heating different pollen mother cell (PMC's) were seen with different meiotic stages. Microphotography was done from temporary prepared slides at different magnifications ( $\times 100-450 \mu\text{m}$ ).

### RESULT AND DISCUSSION

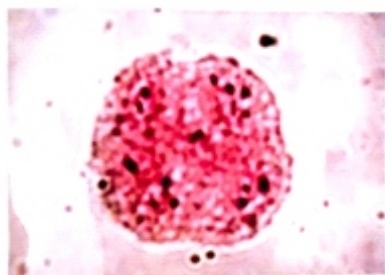
Observations about cytological characters have been presented in Table 1, Figures (1-2). Normal meiotic division was observed in all the selected species. Orange, yellow and white varieties of *T. peruviana* and *C. roseus* were studied for their chromosome number, chromosomal association, chiasma frequency. The chromosome number of three varieties of



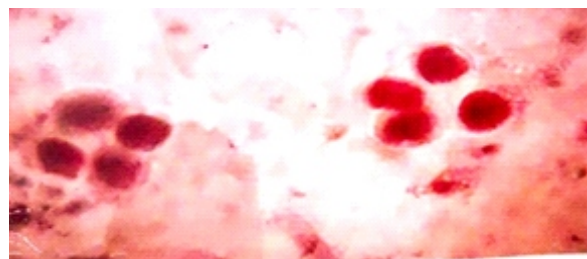
**A:** PMC showing 10II at MI showing ring and rod bivalents(x450)



**B:** With MII(x450)

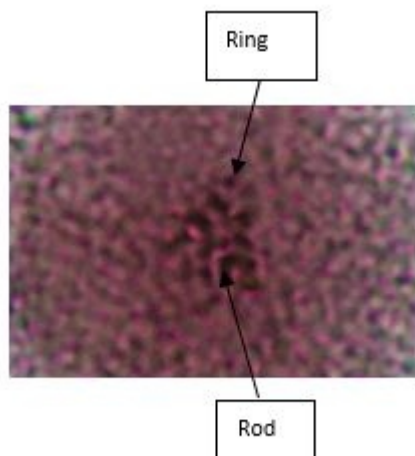


**C:** PMC showing late A II(x450)

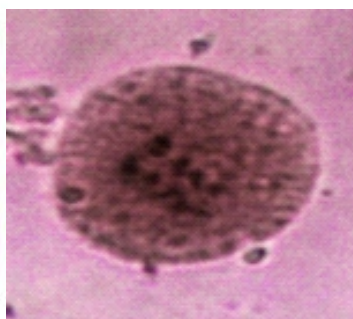


**D:** Rhomboidal and isobilateral tetrads

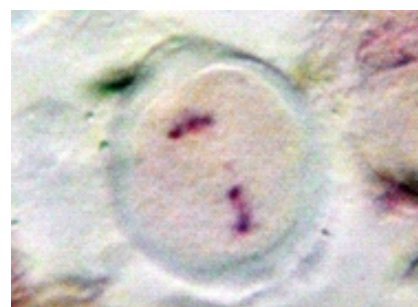
**Figure 1 (A-D):** Pollen Mother Cells in different stages of growth of *Thevetia peruviana*



**A:** PMC showing 10II at MI showing ring and rod bivalents(x450)



**B:** PMC showing A I(x450)



**C:** PMC showing MII(x450)

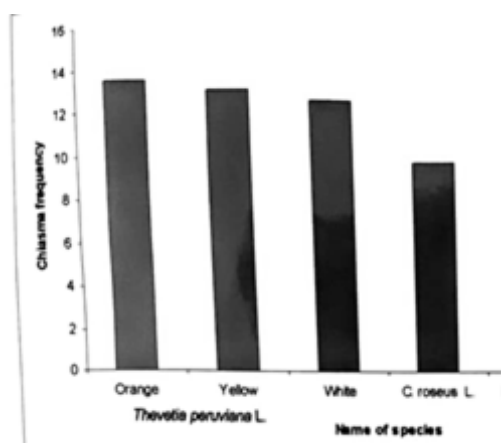
**Figure 2 (A-C):** Pollen Mother Cells in different stages of growth of *Catharanthus roseus*.

*Thevetia* were  $2n=20$ . However chromosome number differ in *C. roseus*  $2n=16$ . Both bivalents (ring and roads) and univalent have been observed in all above said plant types. General ring association occur in three varieties of *T. peruviana*. Rod association were observed in higher frequency in *C. roseus*. Chiasma frequency per chromosome is quite

low in *C. roseus* and it remains least affected in all the three varieties of *T. peruviana*. Laan and Arends(1985) also arrived at similar conclusion from their cytological studies in many genera of family Apocynaceae. They observed basic number of  $X=6,8,9,10,11,12,16,20,21$  and  $23$ . Out of these  $X=11$  is primitive occurring in 60% of genera

**Table 1:** Data on chromosomal characteristics of three varieties of *Thevetia peruviana* L. , *Catharanthus roseus* L.

S.No.	Character  Plant spp.	Chromosome  number	Chromosome association		Univalent  (range/average)	Chiasma frequency/  Chromosome  (range/average)
			Bivalent{range/average}			
			Ring	Rod		
1.	<i>Thevetia peruviana</i> L.					
	Var.orange	2n=20	2-6/3.8±0.413	3-6/4.1±0.452	2-4/2.8±0.302	11-15/13.5±0.554
	Var.yellow	2n=20	3-6/4.1-±0.432	3-6/4.2±0.465	2-4/2.7±0.301	12-15/13.1±0.536
	Var.white	2n=20	3-6/4.4±0.480	2-5/4.0±0.421	2-3/2.2±0.298	11-14/12.6±0.525
2.	<i>Catharanthus roseus</i> L.	2n=16	2-4/2.8±0.310	3-5/4.2±0.462	0.4/2.0±0.271	8-11/9.8±0.513

**Figure 3:** Data on chiasma frequency of chromosome in three varieties of *T. peruviana* and *C. roseus*

investigated by them. Santhosh and Omnakumari (1997) studied karyomorphology of two varieties of *T. peruviana*, yellow and white. They observed some differences in chromosome category and chromosome length; in contrast we have not observed any differences in chromosomal character in three varieties (orange, yellow and white) of *T. peruviana*. Sasikumar and Abraham 1993, and Mendiolo *et al.* 2005, Rani and Kumar 2011 observed 2n=16 as chromosome number in *C. roseus*. Our cytological studies also confirm their findings.

Roy Thapadar (2014) had studied cytotaxonomic work in Apocynaceae family. Goven *et al.* (2019) have been reported

contribution the chromosome number and phylogeny of Turkish Vincetoxicum Wolf of Apocynaceae. Two floral types of *Catharanthus roseus* L. viz. pink and white were studied through differential staining with orcein, CMA and DAPI for cytogenetical characterization and to assist towards updating their taxonomical status and evaluating chromosomal diversity between them (Datta *et al.* 2020).

## CONCLUSION

All the plant types are diploid in nature. Meiosis was quite normal in them. Univalent as well as bivalents are commonly distributed in selected plant types. There is no marked variation among the plants different localities of Jaipur. Therefore, it is inferred that above said plant types are almost ecologically well established locally.

The chromosomal data providing an important basis for future studies like cytogenetic mapping, genomics, TIA genetics and breeding programmes related to these important medicinal species.

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