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Meiotic Studies in *Catharanthus roseus* L.G. Don

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ABSTRACT

The present meiotic study was carried out in two varieties of Catharanthus roseus (L.) i.e. Pink flower and white flower. They showed regular formation of 8 bivalents (n=8). The course of meiosis has been found to be normal in both the varieties of C. roseus. The number of bivalents were constant and comparatively small in size. It was found that bivalents were in ring and rod shape in both varieties in late diakinesis and metaphase. In the present work ring bivalents occurred in high frequency and were the outcome of maximum homogeneity of homologous chromosomes. There was negative correlation between bivalents in relation to inter chromosomal distribution of chiasmata. The correlation coefficient was —0.01 in both varieties. The chiasma frequency in pink flower and white flower was recorded as 1.67 and 1.70 respectively and they do not differ very much. The difference in variance ratio of the varieties investigated clearly suggested that there are variation in size, nature and over all Karyotype of bivalents in same pollen mother cell.

Key words: *Catharanthus roseus, Meiosis, Negative correlation.*

INTRODUCTION

Catharanthus roseus (family, Catharanthaceas) is a legendary medicinal plant mostly because of possessing two invaluable anticancerous alkaloids i.e. Vincristine and Vinblastine. This plant plays a considerable role today in herbal and traditional medicine for treatment of various disease. The plant has also high aesthetic value as an evergreen ornamental that yields prolific blooms of splendid colours. Meiotic study envisages whether the plant shows variation or normalcy. It will held us interpret whether after several generations due to inheritance and accumulation of the variable characters, evolution of new species will take place or species under investigation is ness established in the region and the expense and labour devoted to its biochemical assay for the production of quality medicine for the welfare of the human being is worthwhile. Chromosomal study is useful to understand the morphological diversity and genomic variation within the species[1]. Meiotic study is the tool that can support the plant identification. Meiosis is well as Keryotypic asymmetry has played an indispensable role in the evolution of the genetic system and the Chiasma frequency[6]. Therefore, the present study has been conducted to establish chiasma frequency, mean square within and between nuclei, variance ratio and correlation coeffiant among the two varieties of *C. roseus.*

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MATERIAL AND METHODS

For meiotic chromosome counts, young and juvenline buds of different sizes of two varieties of *C. roseus* were collected randomly and fixed in 1:3 acetoalcohol solution supplemented with a pinch of ferric chloride which acted as mordant. The buds were left overnight in acetoalcohol and then transferred to 70% alcohol for further preservation. Staining was done in 2% propionic carmine solution. Microphotographs were taken from temporary metaphase in ORWO 125ASA photofilm. The data were collected from 100 pollen mother cells per plant at diakinetic – metaphase stage. The mean square of Chiasmata between and within nuclei and the analysis of variance was calculated on the principles proposed by Mather[5].

The inter class correlation were carried out by applying the formula.

$$\frac{1+(K-1)}{v} = \frac{\text{sum of squares between nuclei}}{\text{Total sum of Squares}}$$

where,
K= No. of Observation
r = Correlation Co-efficient

RESULTS

Meiosis was studied in one hundred pollen mother cells of two varieties of *Catharanthus roseus* i.e. pink flower and white flowered varieties. Meiosis showed regular formation of 8 bivalents. The number of bivalent was constant and comparatively small in size. Meiotic study revealed that in late diakinesis and metaphase I the bivalents were in ring and rod shape in both the varieties. PMC showed four groups with different peculiarities in cells at metaphase I. Group A contained 7 ring bivalent and 1 rod bivalents where as, Group B had 6 ring bivalents and 2 rod bivalents. Group C showed 5 ring bivalents and 3 rod bivalents while group D exhibited 4 ring and 4 rod bivalents. In group C there was only one bivalent which remained associated with nucleolus. Persistent nucleolus was present only in pink variety while it was absent in white variety. PMC with 6 ring bivalents and 2 rod bivalents were frequently observed in 42% of the cells. The cell with 5 ring and 3 rod bivalents were also observed frequently in 40% of cells, 15% of cells were with 4 ring and 4 rod bivalents and 3% of cells with 7 ring and 1 rod bivalent and were less frequent. The percentage of ring bivalents with two chiasmate view considerably high. It was about 10.68 in pink variety and 11.32 in white variety. The percentage of rod bivalent with one chiasmata was 2.66 and 2.34 in pink and white variety respectively. Mean X^{ta} was recorded 13.34 in Pink variety and it was 13.66 in white variety. Mean square between nuclei was 0.07 which was same in both the varieties. Mean square within nuclei was 11.58 in pink variety and 12.17 in white variety. Variance ratio was 0.006 and 0.005 in pink and white variety respectively. There was a negative correlation. The correlation coefficient was 0.01 in both varieties. The Chiasma frequency in late diakinesis has been presented in the Table. Total Chiasmata was found 1334 in pink variety and 1366 in white variety. Chiasma frequency in diakinetic metaphase was found to be 1.67 and 1.70 in pink and white variety, respectively and they do not differ very much. Terminalization coefficient was 80.06 and 82.86 in pink and white variety respectively. Pollen fertility was found to be normal. The difference in variance ratio of the varieties investigated clearly suggested that there were variation in size, nature, and over all Karyotype of bivalents in same pollen mother cell.

DISCUSSION

The genetic number (n) of two varieties of *Catharanthus roseus* (L.) under investigation were eight. Such findings confirm the earlier reports of Dnyansagar and Sudhakaran[3] and Chauhan and Raghuvanshi[2]. They also reported similar chiasma frequencies in both the varieties of *Catharanthus roseus.* The Univalents, Trivalents, Tetravalents and multivalents were absent in both the varieties of *C. roseus.* There was no non homologous

segment on the chromosomes. The spontaneous micro and macro lesions which occur spontaneously were also absent, indicating that homologous Chromosome fidelity was synchronous with that of Synapsis giving rise to ring bivalents. These observations also confirm the finding of Dnyansagar and Sudhakaran[3]. In the present work ring bivalent occured in higher frequency. The ring bivalents were the outcome of maximum homogeneity of homologous chromosomes. It has been observed that a negative correlation existed between bivalents in relation to inter-chromosomal distribution of Chiasmata. The inter Chromosomal distribution of chiasmasta was determined following Mather[5]. In both the varieties of *C. roseus* a negative co-relation co-efficient existed. Mather[5] concluded on the basis of observation on 27 plant species. A negative correlation means that an increase in the number of Chiasmata in on bivalent or group is followed by decrease in the chiasma number in the other in the same nucleus. The negative correlation indicated that the mean sequare value between nuclei were lower in comparison to that of within nuclei and that there were variations in the number of chiasmata per bivalent even in the same nucleus of species and varieties under considerations. Such findings were reported by Sinha and Acharia[8] in *Lens culinaris* Dnyansagar and Sudhakaran[3] in vinca *rosea* and have suggested that the genetic control of Chiasma distribution and negative correlation are the outcomes of mechanism which controls the chiasma distribution which is influenced by the length, number of chromosomes and physiological condition of the cells. The difference in variance ratio of the varieties investigated clearly suggested that there are variations in size, nature and over all karyotype make up of the bivalents in the same pollen mother cell. Dnyansagar and Sudhakaran[3] reported that in *Vinca rosea* correlation coefficient are not related to the mean chiasma frequency in the plants. The correlation coefficient do not increase or decrease with increase or decrease in the chiasma number of the cells. Similar findings have also been reported by Ronlands[7], Elliot[4], Sinha and Roy[9], Chauhan[1] and Chauhan and Raghuvanshi[3].

Table: Meiotic analysis and Chiasmata frequency in two varieties of *Catharanthus roseus* (L.) G. Don.

	Varieties	No. of Cell observed	No. of Rings	No. of Rods	Mean X^{ta}	½ X^{ta}	Mean square between nuclei	Mean square within nuclei	Variance ratio	Correlation coefficient
Meiotic analysis	PINK	100	1068	266	13.34	0.83	0.07	11.58	0.006	- 0.01
	WHITE	100	1132	234	13.66	0.85	0.07	12.17	0.005	- 0.01

	Varieties	No. of Cell observed	No. of bivalent with Chiasmata in cell studied		Total Chiasmata	Average Chiasmata per nucleus	Chiasmata per bivalent	Terminalization co-efficient
			No. of rings	No. of rods				
Chiasma frequency	PINK	100	1068	266	1334	13.34	1.67	80.06
	WHITE	100	1132	234	1366	13.66	1.70	82.86

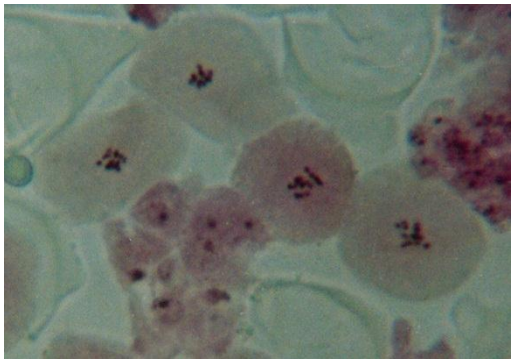

Fig. 1: PMC showing 8 bivalents at Metaphase I in pink variety of *C. roseus*

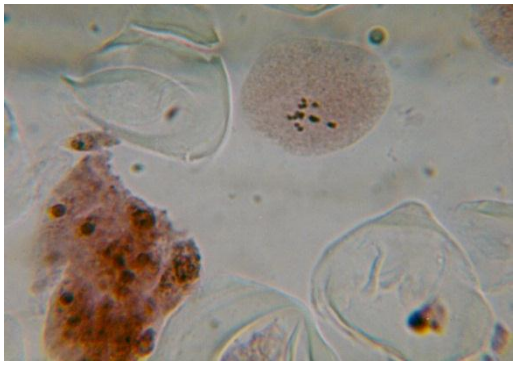

Fig. 2: PMC showing 8 bivalents at Metaphase I in white variety of *C. roseus*

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