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CYTOLOGY

MEIOTIC STUDIES IN THREE POPULATIONS OF *Lindenbergia urticaefolia* FROM DHANBAD TOWN

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Key words : *Lindenbergia urticaefolia,* Meiosis, Pollen mother cells, chiasma frequency.

Three populations of *Lindenbergia urticaefolia,* belonging to the family Scrophulariaceae, were randomly selected for meiotic study. The populations from Dhanbad are Lu 0313, Lu' 0313 and Lu" 0313. Meiotic study was done in a large number of pollen mother cells and the gametic number was found to be n = 15. The division was found to be highly non-synchronised. Pollen mother cells at different stages of division from prophase to tetrad stage were observed to be present in the same anther. However, many chromosomal anomalies like clumping of chromosomes, univalents and multivalents at metaphase I, chromosomal bridges, laggards and unequal separation of chromosomes during anaphase- I have also been observed. Variation in chiasma frequency was found to be quite pronounced in different populations. Meiotic behaviour of all the populations has been found more or less similar but in terms of chiasma frequency, these populations differ considerably.

INTRODUCTION

Cytological studies include the study of variations, evolution and genetic structure of the population. Population is a reproductive community which shares common gene pool through sexual reproduction and cross fertilization. So, populations are the general base of genetic system in plants. The genetic system comprises of all the intrinsic genetic processes that affect genetic recombination in a population or species (Norden & Kirkman, 2004; Jeyachardran, 2012). The major components of the genetic system are the chromosomal organization and their behaviour during Meiosis (Kumari, 2013). Keeping these points in consideration, meiotic studies have been carried out in three different populations of the weed *Lindenbergia urticaefolia* of the family Scrophulariaceae. Three populations from Dhanbad were studied meiotically and observed chromosomal anomalies have been interpreted.

MATERIALS AND METHODS

Three different populations of *Lindenbergia urticaefolia* from different ecological conditions of Dhanbad town were studied from meiotic point of view. The three populations selected from Dhanbad town were Lu 0313, Lu' 0313 and Lu" 0313. For meiotic studies, buds were fixed in 1:3 aceto-alcohol and squashed in 2% acetocarmine. The slides were made permanent according to the method of Celarier (1956) and mounted in euparol.

OBSERVATIONS

Population: Lu 0313

The population was growing on a very old wall at Bank More in Dhanbad town. The population has large number of plants and growth of plants was luxuriant. Flower buds from this population were collected in the morning around 9 a.m. for studying meiotic division.

Fifteen bivalents were found arranged on the equator at metaphase-I. In a few pollen mother cells, clumping of chromosomes were observed as abnormality. However, transmigration was also found as an important anomaly (Fig. 1). In transmigration, entire chromatin materials were found to migrate from one cell to another (Fig. 2). Details of chromosomal association and chiasma frequency have been described in Tables - 1 & 2 respectively.

At anaphase-I, both the poles consisted of equal number of chromosomes. However, some pollen mother cells at this stage and at later stage exhibited abnormality in the form of triad and pentad formations. Pollen sterility was found to be twenty three percent (Table- 3).

Population: Lu' 0313

For meiotic study, flower buds were collected from this population. Population comprising eight plants were studied from old wall in Hirapur area of Dhanbad. This population was exposed indirectly to sunlight as well as dust.

Meiotic studies confirmed the haploid number of chromosomes as n =15. The division was non-synchronized. Abnormalities were also recorded at different stages of division, mostly at metaphase-I. Multivalents (Fig. 3), univalents and clumping of chromosomes (Fig. 4) were observed as common anomalies. A few pollen mother cells showed the presence of some degenerated chromosomes arranged in a ring like structure at the equator of the pollen mother cells. Details of chiasma frequency and chromosomal association have been summarised in Tables- 1 & 2 respectively.

At anaphase-I, equal number of chromosomes were observed on the poles. A few pollen mother cells showed chromosomal laggards (Fig. 5). Pollen sterility was calculated to be nineteen percent (Table-3).

Population: Lu" 0313

This population was found to be growing on the old wall of the residential area of Bekerbandh area of Dhanbad. Population was exposed to sunlight after midday.

Meiotic studies were done in a large number of pollen mother cells and in this case also, the gametic number was confirmed as n =15 (Fig. 6). Univalents and multivalents

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(Fig. 7) and clumping of chromosomes (Fig. 8) at metaphase-I were recorded as anomalies. Among multivalents, quadrivalents were important. Transmigration of chromatin material was found to be of common occurrence. Details of chromosomal association and chiasma frequency have been summarized in Tables - 1 & 2 respectively.

At anaphase I & II, clumping of chromosomes was found besides normal division. In most of the pollen mother cells, equal number of chromosomes were observed on both the poles. Triad and pentad formation in some of the pollen mother cells were also noticed. Pollen grains were found to be of variable size (Fig. 9). Pollen sterility was found to be sixteen percent (Table 3).

RESULTS & DISCUSSION

In all the three populations of the species the chromosome number was found to be n=15. Abnormalities were also recorded which include clumping of chromosomes, univalents and multivalents formation at metaphase-I, chromosomal bridge, laggard and unequal segregation of chromosomes at anaphase-I besides multipolarity at anaphase- II. In some populations, transmigration was also recorded. Half chiasma per chromosome was found to vary from 0.83 to 0.88 (Table- 2). The data on half chiasma per chromosome indicates slight deviations. Meiotic study of the populations provide the potentialities for genetic recombination and this gives an information regarding the relationship between crossing over and chiasma frequency (Darlington, 1963; Dulger & Ugurlu, 2005). The trends marked in the three populations have been toward greater reproductive efficiency with a reduction in the recombination index (Sharma *et al*., 2000; Bano, 2002).

TABLE- 1

Nature and frequency of chromosomal association at metaphase-I of different populations of *Lindenbergia urticaefolia.*

Populations	Frequency of PMCs	Chromosome Association					
		VI	V	IV	III	II	I
Lu 0313	25	0	0	0	0	15	0
	6	0	0	2	1	11	1
	5	1	0	0	1	10	1
	4	0	1	2	1	7	0
	10	0	0	1	0	13	0
Lu′ 0313	28	0	0	0	0	15	0
	2	1	0	1	0	10	0
	8	0	1	2	1	8	0
	4	0	0	2	0	10	2
	8	1	1	0	0	9	1
Lu″ 0313	37	0	0	0	0	15	0
	5	0	1	2	0	11	1
	2	1	1	0	1	8	0
	3	0	1	2	1	10	0
	3	0	1	0	0	12	1

TABLE - 2

Chromosome pairing and chiasma frequency at metaphase-I of different populations of *Lindenbergia urticaefolia*

Populations	No. of PMCs Studied	No. of bivalents per PMC				Total	Chiasmata per PMC		Terminalisation Chiasmata		½ chiasma per chromosome	Term Coeff
		Ring		Rod								
		Range	Mean	Range	Mean		Range	Mean	Range	Mean		
Dhanbad												
Lu 0313	50	10-14	12.0	3-4	3.5	15	25-28	26.5	24-27	25.5	0.88	0.96
Lu′0313	50	8-12	10.5	3-7	4.5	15	24-26	25.0	22-24	23.0	0.83	0.92
Lu″0313	50	9-11	10.0	4-6	5	15	26-27	26.5	24-26	25.0	0.88	0.94

TABLE - 3

Pollen analysis of different populations of *Lindenbergia urticaefolia*

Populations	No. of Pollen Studied	No. of Normal Pollen	No. of Sterile Pollen	Percentage of sterile Pollen
Lu 0313	1000	770	230	23
Lu′0313	1000	810	190	19
Lu″0313	1000	840	160	16

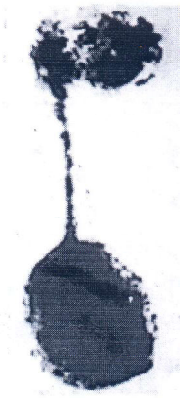

Fig. 1: PMC showing transmigration of chromatin

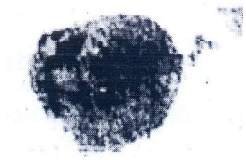

Fig.2 : PMC showing entire chromatin materials migrating from one cell to another.

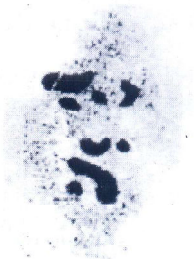

Fig.3 : PMC at metaphase-I showing multivalents.

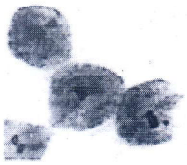

Fig.4 : PMC at metaphase-I showing clumping of chromosomes

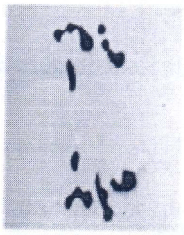

Fig.5 : PMC at anaphase-I showing chromosomal laggard.

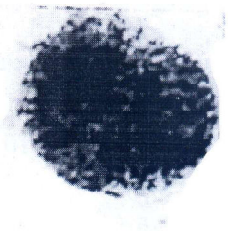

Fig.6 : PMC at metaphase-I showing multivalents

Fig.7 : PMC at metaphase-I showing fifteen bivalents.

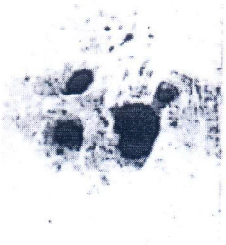

Fig.8 : PMC at metaphase-I showing clumping of chromosomes.

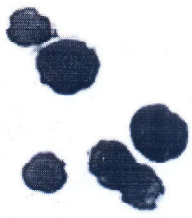

Fig.9 : Pollen grains of variable size

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