

Cytological Studies in *Datura metel*

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Abstract : Mitotic and Meiotic studies in one population of *Datura metel* were carried out in detail from Gaya town. Mitosis showed asymmetrical nature of karyotype while meiosis indicated anomalies like multivalent, univalents at metaphase-I and chromosomal bridge at anaphase-I. On the basis of cytological analysis, it was inferred that *Datura metel* possesses general purpose genotype.

(Key words : *Datura metel* mitosis and meiosis, general purpose genotype)

Introduction

Mitotic and Meiotic studies in one population of *Datura metel* were carried out in detail from Gaya town. Mitosis showed asymmetrical nature of karyotype while meiosis indicated anomalies like multivalents, univalents at metaphase-I and chromosomal bridge at anaphase-I. On the basis of cytological analysis, it was inferred that *Datura metel* possesses general purpose genotype.

Introduction

Datura metel Linn, is a member of family Solanaceae. It is a shrub like perennial herb and is commonly known as angel's trumpet. It grows as a weed in Gaya town and all the other areas of the state of Bihar. Regarding *Datura metel*, Baker's¹ (1965) quotation can be cited, "Weeds possessing diverse genetic system and tolerating wide environmental, climatic adaptive situations are found to contain general purpose genotype". In this context, the present cytological investigation on *Datura metel* from a population of Gaya town has been carried.

Experimental

Materials & Methods:

Materials for mitosis and meiosis have been collected from a population (*Dm1209*) of *Datura metel* growing in Gaya College campus, Gaya. Mitotic studies were made from young and growing root tips which were obtained from germinating seeds of the studied plant. Root tips were pre-treated with paradichlorobenzene for three hours and fixed in 1:3 aceto-alcohol. Fixed root tips were stained in 2 % acetocarmine. Total form value was calculated by the formula given by Huziwara²(1962). Meiotic studies were done from anther squash preparation. The materials were fixed in 1:3 aceto-alcohol and stained in 2% acetocarmine. Mitotic & meiotic slides were made permanent according to the method given by Celarier³(1956). Photomicrographs were taken from temporary as well as permanent slides.

Observations: Mitosis *Dm1209*

For the detail karyotypic studies, chromosomes have been classified on the basis of their length as follows: -

Type of Length of chromosomes

- A. 4.00/ μ and above
- B. 3.50/ μ to 3.99 μ
- C. 3.00/ μ to 3.49 μ
- D. 2.50/ μ to 2.99 μ
- E. 2.00/ μ to 2.49 μ
- F. Less than 2.0 μ

Somatic chromosome number in the population was found to be $2n=24$ (figure-1). The chromosome length varied from 1.80 μ to 2.80 μ . Nine pairs of chromosomes were found to be sub-medium while two pairs of chromosomes were median and one pair was terminal. The chromosome

Table -1 Details of somatic chromosomes of *Datura metel* (Dm 1209)

S. No. of Chromosome pairs	Chromosome types	Position of the constrictions		Length of component portion in $\frac{1}{4}$		Total Length in $\frac{1}{4}$	T. F. %
		Primary	Secondary	Long Arm	Shorty Arm		
1	D	SM	SC	1.90	0.90	2.80	39.03
2	E	SM		1.30	1.00	2.30	
3	D	SM		1.80	1.00	2.80	
4	E	SM		1.60	0.80	2.40	
5	F	SM		1.10	0.80	1.90	
6	E	SM		1.06	0.94	2.00	
7	D	SM		1.60	1.00	2.60	
8	E	SM		1.30	1.10	2.40	
9	F	M		0.90	0.90	1.80	
10	E	T		1.80	0.20	2.00	
11	F	M		0.92	0.88	1.80	
12	E	SM		1.06	0.94	2.00	

Total Chromatin length is 53.60 μ

The karyotype formula for this locality is:

1(DSM^c)+2(DSM)+5(ESM)+1(ET)+1(FSM)+2(FM).

Table -2

Nature and frequency of chromosome association at metaphase-I of population *Dm* 1209

Chromosome association						Frequency of PMCs	Populations
VI	V	IV	III	II	I		Population: <i>Dm</i> 1209.
0	0	0	0	12	0	28	
0	1	0	1	7	2	12	
1	0	0	0	8	2	5	
0	0	0	1	10	1	3	
0	0	1	0	10	0	2	

Table -3

Chromosome pairing and chiasma frequency at metaphase-I of Population: *Dm* 1209.

Population	No. of PMCs studied	No. of Bivalents per PMCs				Total	Chiasmata per PMC		Terminalized chiasmata		% Chiasmata per Chromosome	Term. Co eff
		Ring		Rod			Rang	Mean	Rang	Mean		
		Rang	Mean	Range	Mean							
Dm 1209.	50	8-11	10	1-4	2	12	16-21	18.33	14-20	16.67	0.76	0.90

Table-4
Pollen analysis of population of *Datura metel* studied from Gaya town.

Populations	No. of Pollen Studied	No. of Normal Pollen	No. of sterile Pollen	Percentage of sterile pollen
Dm1209	1000	890	110	11

pairs have been represented into idiogram (figure-2) and chromosomes measurements are summarised in Table-1. Meiosis The gametic number of species was found to be $n = 12$. Meiotic division was highly non-synchronised. At diplotene stage, a few pollen mother cells were found to contain three or four chromosomes associated with nucleolus. In most of the pollen mother cells at diakinesis and metaphase-I stages, twelve bivalents were recorded (Fig.3). Metaphase-I stages were marked by a number of important anomalies. The anomalies recorded were clumping of chromosomes (Fig-4), precocious separation of

chromosomes, univalents and multivalents. Details of chromosomal association and chiasma frequency have been summarised in Tables 2 & 3 respectively. Anaphase-I was marked by equal distribution of chromosome at two poles in most of the pollen mother cells (Fig-5). The abnormalities recorded at this stage were chromosomal laggards, chromosomal bridges (Fig-6,) both simple and inversion, unequal distribution of chromosome and clumping of chromosome at two poles. Due to the presence of anomalies, formation of dyads, triads and pentads were also reported. Pollen sterility was calculated to be about 11 % (Table-4).

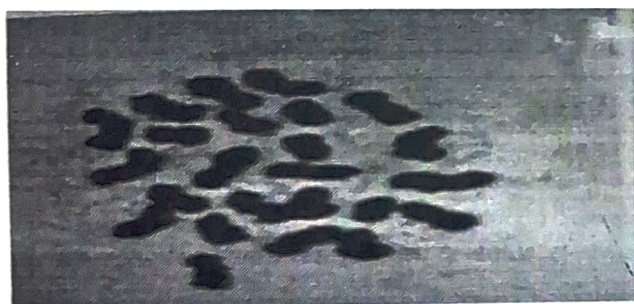


Fig-01

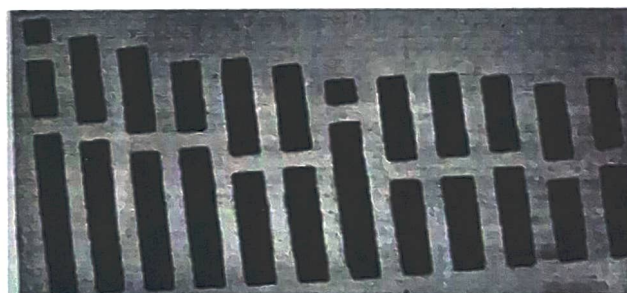
Fig - 02 1 μ 

Fig-03



Fig - 04

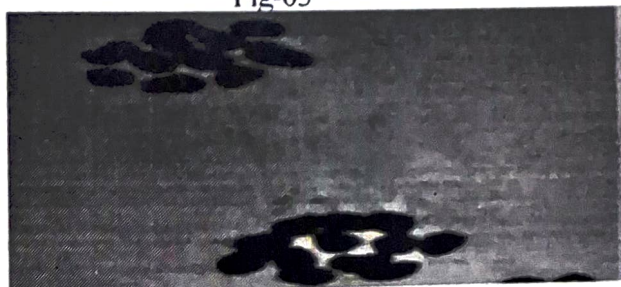


Fig-05



Fig - 06

Fig-01 Somatic Chromosomes at metaphase showing twenty-four chromosomes 1350x.

Fig-02 Ideogram of somatic chromosomes.

Fig-03 PMC at Metaphase-I clumped bivalents 1350x.

Fig-04 PMC at Metaphase-I showing clumping of chromosomes 1350x.

Fig-05 PMC at anaphase-I showing 12:12 chromosomes at both poles 1350x.

Fig-06 PMC at anaphase-I showing chromosomal bridge 1350x.

Results and Discussion

The detailed mitotic studies of the population Dm1209 showed minimum number of sub-median of chromosomes. It was nine pair while median was only two pair and one pair were terminal chromosome. No sub-terminal chromosome was reported. Chromosomes on average, were smaller in sizes which shows advance nature of species. Total form value was 39.03 % which indicated asymmetrical nature of Karyotype. Similar finding has been reported by Trivedi & Sinha⁴ (1986), Jose et al.⁵ (2011), Singh⁶ (2010) and Kumari⁷ (2012). Meiotic studies showed anomalies ranging from clumping of chromosomes and presence of univalent and multivalent at metaphase-I, chromosomal bridge,

chromosomal laggard at anaphase-I. Half chiasma per chromosome was 0.76 while pollen sterility was reported to be 11 %. According to Garber³ (1958) chiasma formation is controlled by gene & half chiasma per chromosome can be used as a cytotaxonomical tool in drawing phylogenetical conclusion in the species. The studied weed was growing luxuriantly in the area of collection even though it showed some important mitotic and meiotic anomalies. So, on the basis of cytological evaluation it can be very well argued that *Datura metel* possesses general purpose genotype which is a typical characteristic of a weed (Kumari-2012)⁷.

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