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CYTOLOGICAL STUDIES IN *Solanum surattense* BURM F.

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Key words : *Mitosis, Meiosis, Solanum surattense, Heterozygosity.*

Mitotic and meiotic studies have been carried out in *Solanum surattenese* Burm F. Somatic chromosomes have been found to vary from 2.2425 μ to 4.00 μ in length. Total form value indicates slight asymmetrical nature of karyotype. During meiosis, abnormalities reported are univalent, multivalent, clumping of chromosomes at metaphase I, chromosomal bridges, laggards at anaphase I and tripolarity and multipolarity at anaphase II. Pollen sterility is sixteen per cent. Meiotic anomalies and pollen sterility suggest a high level of heterozygosity in the population of *Solanum surattenese*.

INTRODUCTION

Solanum surattenese Burm F. belongs to the family Solanaceae and is found as a weed. Weeds are undesirable, injurious, unsightly and troublesome plants which interfere with cultivated crops and affect human affairs. They can potentially thrive under adverse agroclimatic conditions. It is mentioned that weeds possess general purpose genotype (Baker, 1965). In this context, cytological studies in the weed, *Solanum surattenese* would be notably interesting. In the present investigation, detailed mitotic and meiotic studies have been done to explore the chromosomal behaviour of this weed as it is an established fact that chromosomal organization and their cytological behaviour are the major components of any genetic system.

MATERIAL AND METHODS

The material for the present study is *Solanum surattenese* Burm F. of the family Solanaceae. Mitotic studies were made from young and growing root tips and meiotic studies from anther squash preparation. For meiotic studies, buds were collected from a population consisting of seven plants growing in the campus of Gaya College, Gaya. Staining was done in 2% acetocarmine. Slides were made permanent according to the method of Celarier (1956).

OBSERVATIONS

Cytological observations are given under the headings mitosis and meiosis as follows :

Mitosis

Somatic chromosome number in *Solanum surattenese* was found to be *2n =24* (fig.-1). The chromosomal length varied from 2.425 μ to 4.00 μ. From an analysis of the detailed karyotype, it was found that five pairs of chromosomes were sub-median while six pairs were median and one pair was of sub-terminal type. The chromosome pairs have been represented in the idiogram (Fig. - 2). The detailed chromosome measurements are summarized in Table - 1.

Meiosis

The gametic number was found to be n = 12 (Fig. -3). Meiotic division was found to be highly non-synchronised. The abnormally dividing pollen mother cells were also noticed at different stages of division.

The bivalents were intermingled and not easily countable at diplotene stage. At diakinesis and metaphase I stages, univalent was recorded in large number (Fig. -4), besides this clumping of chromosomes were of frequent occurrence at metaphase I stage. Multivalent formation was also noticed in few pollen mother cells, (Fig. 5). The nature and frequency of chromosome association and details of chiasma frequency have been summarized in Tables -2 & 3 respectively. Apart from the regular distribution of chromosomes at anaphase I, some of the pollen mother cells showed unequal segregation of chromosomes, chromosomal laggards and simple chromosomal bridges of various types (Figs. 6 & 7). Clumping of chromosomes at this stage was also of frequent occurrence.

At anaphase II, multipolar and tripolar conditions (Fig. -8) were reported in some of the pollen mother cells. All these abnormalities resulted in the formation of micronuclei at the quartet stage. Pollen sterility was calculated to be sixteen per cent (Table - 4).

DISCUSSION

Mitotic studies revealed that the total chromatin length of the somatic chromosomes of the plants is 76.65 μ. The smallest chromosome pair was of 2.425 μ in length while the largest chromosome pair measured 4.0 μ in length. Six median, five sub-median and one sub-terminal chromosome pairs were reported. Total form value was calculated to be 43.25 per cent (Table-1).

The total form value indicates slight asymmetrical nature of the karyotype. According to Sinha (1982), asymmetry pertains to wider variations in the length of chromosome pairs which is evident in the present investigation. Meiotic studies showed a number of anomalies like clumping of chromosomes, univalent and multivalent formation at metaphase I, simple chromosomal bridges and chromosomal laggards at anaphase I and tripolarity at anaphase II. Pollen sterility was sixteen per cent. The presence of univalent may be attributed either to failure of chromosome pairing during meiosis (Sharma, 1985) or due to high temperature (Frankel, 1975). The latter condition is more logical as Gaya is one of the hottest places in the country. Varying frequency of multivalents recorded in the present study indicates that their formation is the result of non-disjunction of the chromosomes due to the formation of interstitial and intercalary chiasmata. Chromosomal bridges might have occurred due to the failure of terminalisation of

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the chiasmata or due to clumping of chromosomes. The latter reason is more convincing as it is of very common occurrence in the studied plant. Pollen sterility may be due to male sterility gene (Gottschalk & Kaul, 1974) or environmental factors (Whyte, 1975).

The pattern of meiosis, kinds of meiotic anomalies and pollen sterility suggest that a high level of heterozygosity prevails in the population of *Solanum surattense*.

TABLE - 1

Somatic chromosomes of *Solanum surattense*

Sl. No. of Chromosome pairs	Chromosome type	Position of the constrictions		Length of the component portions in μ		Total length in μ	T.F. %
		Primary	Secondary	Long arm	Short arm		
1	A	M		2.075	1.925	4.0	
2	B	M		2.0	1.925	3.925	
3	B	M		2.0	1.925	3.925	
4	B	M		1.90	1.825	3.725	
5	C	SM		2.05	1.275	3.325	
6	C	SM		1.875	1.35	3.225	43.25
7	C	SM		1.875	1.175	3.05	
8	D	SM		1.85	1.05	2.90	
9	D	M		1.375	1.325	2.70	
10	D	M		1.325	1.25	2.575	
11	D	SM		1.55	1.0	2.55	
12	E	ST		1.875	0.55	2.425	

Total chromatin length is 76.65 μ.

The karyotype formula for this locality is :

1 (AM) + 3 (BM) + 3 (CSM) + 2 (DM) + 2 (DSM) + 1 (EST).

TABLE - 2

Nature and frquency of chromosome association at metaphase I of *Solanum surattense*.

Chromosome association						Frequency
VI	V	IV	III	II	I	of PMC
0	0	0	0	12	0	32
0	0	1	1	7	3	6
1	0	1	0	6	2	6
0	1	1	0	5	5	6

TABLE - 3

Chromosome pairing and chiasma frequency at metaphase I of *Solanum surattense*

No. of PMCs studied	No. of Bivalents per PMC				Total	Chiasmata per PMC		Terminalised chiasmata		½Chiasma per chromosome	Term. Coeff.
	Ring		Rod			Range	Mean	Range	Mean		
	Range	Mean	Range	Mean							
50	6-8	7.0	4-6	5.0	12	18-20	19.0	17-20	18.5	0.79	0.97

TABLE - 4

Pollen analysis of *Solanum surattense*

No. of Pollen studied	No. of normal pollen	No. of sterile pollen	Percentage of sterile pollen
930	781	149	16

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Fig.1-8 : Cytological studies in *S. suranttense*

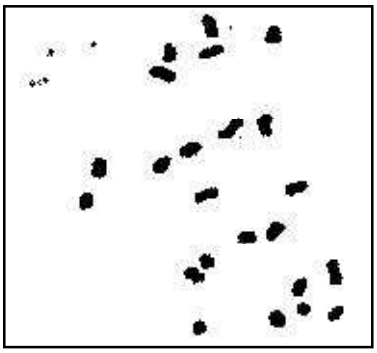

Fig.1

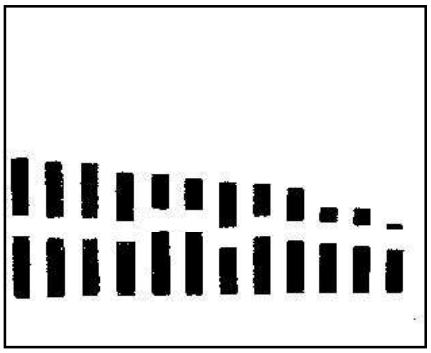

Fig. 2

Fig. 3

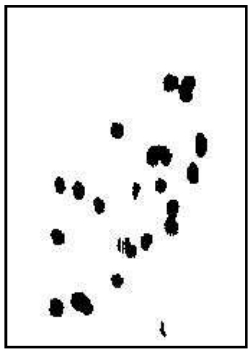

Fig. 4

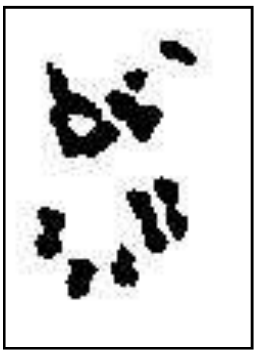

Fig. 5

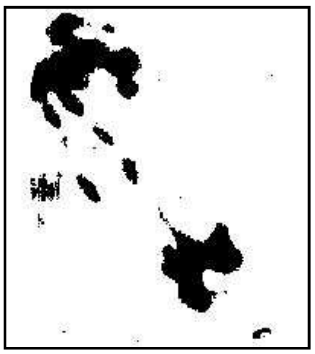

Fig. 6

Fig. 7

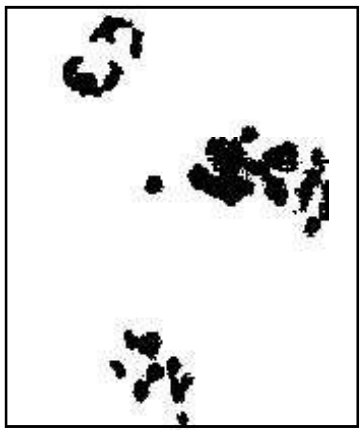

Fig. 8

Fig.1 : Mitotic plate showing somatic chromosome number (2n=24)

Fig.2 : Chromosome pairs in the idiogram

Fig.3 : Gametic chromosome number (n=12)

Fig.4 : Univalents at Diakinesis

Fig.5 : Multivalents in pollen mother cell

Fig.6&7 : Unequal segregation of chromosomes, laggards and simple chromosomal bridges.

Fig. 8 : Tripolar condition at Anaphase-II