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MEIOTIC STUDIES IN TWO POPULATIONS OF *Solanum sisymbrifolium* Lam.

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Key words : *Solanum sisymbrifolium,* Meiosis, B-chromosomes, Ring and Rod bivalents.

Meiotic studies were carried out in two populations of *Solanum sisymbrifolium* Lam. collected from two different places of Gaya town. The gametic number in both the populations was recorded as n = 12. Meiotic anomalies were observed in metaphase-I and anaphase-I stages. These anomalies comprised of clumping of chromosomes, multivalents, univalents and translocation chains and rings at metaphase I stage and chromosomal laggards, bridges and unequal separation of chromosomes at anaphase I stage. One interesting finding was noticed from Ss'-0812 population where 1 to 3 B-chromosomes were observed both at diakinesis and metaphase I stage. Pollen sterility was recorded to be 12% in Ss-0812 and 18% in Ss'-0812 populations respectively. Apparently due to less number of B-chromosomes reported in the species, there might not have been any adverse impact on it. Variation in the number of ring and rod bivalents have also been observed in both the populations. The findings are indicative of the fact that populations with more number of rod bivalents are yet to establish themselves in the ecological niche of the particular habitat.

INTRODUCTION

Solanum sisymbrifolium, commonly known as sticky nightshade, belongs to the family Solanaceae. It occurs as a weed in the wasteland areas and along railways tracks in Gaya town. It is often found in small populations comprising 4 to 5 plants and grows along with some other weeds like *Eclipata alba, Euphorbia hirta* and *Parthenium hysterophorus*. In the present investigation two different populations of *Solanum sisymbrifolium* collected from diverse places have been studied meiotically in detail to understand their genetic variations. As it is known that meiotic studies provide significant information regarding phylogenetic attributes, critical examination of chromosome behaviour at meiosis may bring about clear cut and definite picture of chromosome homology (Darlington, 1963 and Sinha, 2014). With these considerations as guiding principles, the present investigation has been undertaken.

MATERIAL AND METHODS

Buds of *Solanum sisymbrifolium* Lam. were collected from two different populations of Gaya town as shown in Table-1.

TABLE-1

***Solanum sisymbrifolium* Lam.**	**Polulations**	**Locality**	**Period of collection**
	Ss0812	Along railway track, gaya	10 Aug 2012
	Ss'0812	Gaya College Campus, Gaya	12 Aug 2012

Meiotic studies were carried out from anther squash preparations. The time for obtaining suitable buds varied from 10.30 a.m. to 11.00 a.m. Fixtation of flower buds and staining were done in 1 : 3 aceto-alcohol and in 2% acetocarmine respectively. The slides were made permanent according to the method of Celarier (1956).

OBSERVATIONS

Population- Ss0812 : The populations consisted of nine plants growing along the railway track. Another weed *Parthenium hysterophorus* was found growing mixed with this weed.

Meiosis : Meiotic studies revealed the chromosome number as n = 12. Meiosis was highly non-synchronized. At diakinesis and metaphase I stages, twelve bivalents were noticed (fig-1). Anomalies at metaphase I were prominent. Clumping of chromosomes, precocious separation of chromosomes and univalent and multivalent formation (fig-2) were found in some of the pollen mother cells. In a few pollen mother cells, translocation chains and rings were also recorded (fig-3 &4). Details of chromosomal association and chiasma frequency have been given in Table-2 and 3 respectively.

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TABLE-2

Nature and Frequency of chromosome association at metaphase I

Populations	Chrmosomal association						Frequency of PMCs
	VI	V	IV	III	II	I	
Ss-0812					12		24
					10	4	12
			2		8		8
	1				9		2
			1	1	7	3	4
Ss'-0812					12		20
			3		5	2	10
	1			2	7	1	6
		1	2	0	5	1	6
	1		1		7		8

TABLE- 3

Chromosome pairing and chiasma frequency at metaphase I

Population	No. of PMCs studied	No of bivalents per PMC				Total	Chiasmata per PMC		Terminalised Chiasmata		1/2 Chiasma per chromosome	Terminalization coefficient
		Ring		Rod								
		Range	Mean	Range	Mean		Range	Mean	Range	Mean		
Ss-0812	50	7-10	8.5	2-5	3.5	12	19-22	20.5	18-22	20	0.85	0.975
Ss'-0812	50	6-8	7.0	4-6	5.0	12	18-20	19.0	17-20	18.5	0.79	0.970

At anaphase-I, 12 : 12 chromosomes were recorded in most of the pollen mother cells. However, abnormalities like clumping of chromosomes, chromosomal laggards (fig-5), chromosomal bridges (fig.-6) and unequal separation of chromosomes were also noticed in about 15% of the pollen mother cells studied. Later stages were more or less normal except the formation of tripolarity (fig.-7) and multipolarity in some of the pollen mother cells. Pollen sterility was found to be about 12% (Table -4).

TABLE-4

Pollen analysis

Populations	No. of Pollen studied	No. of Normal pollen	No. of Sterile pollen	% of sterile pollen
Ss-0812	1000	879	121	12% aproox.
Ss'-0812	1000	818	182	18% aproox.

Population : Ss'0812

This was a very small population consisting of only three plants and the plants were growing in the campus of Gaya College, Gaya along with other weeds like *Eclipta alba* and *Euphorbia hirta*.

Meiosis : Here also the gametic number was confirmed as n = 12. Twelve bivalents were reported from diakinesis and metaphase I stages.

The characteristic feature of this population was the presence of B-chromosomes ranging from one to three at diakinesis and metaphase I stages.

The diakinetic plates showed twelve bivalents and one to three B-chromosomes (fig-8 & 9). These chromosomes were small in size, well stained and stood apart as dark bodies.

The extra chromosomes were also recorded at metaphase-I stage confirming the presence of B-chromosomes (Fig. 10, 11 & 12).

These chromosomes did not pair among themselves or with any other chromosomes at any stage. About sixty percent of the pollen mother cells at metaphase I showed the presence of B-chromosomes. Details of chromosomal association and chiasma frequency have been given in Table-2 and 3 respectively.

At anaphase-I,12 : 12 chromosomes were recorded from most of the pollen mother cells. Some anomalies like clumping of chromosomes and unequal separation of chromosomes were also noticed. Pollen sterility was calculated to be 18 per cent approximately (Table-4).

DISCUSSION

Meiotic studies were carried out in two populations of *Solanum sisymbrifolium* growing in two different ecological conditions. The study revealed the gametic number as n = 12. Meiosis was highly non-synchronized and the anomalies recorded included multivalents, univalents, clumping of chromosomes, precocious separation of chromosomes and translocation chains and rings at metaphase I stage. Half chiasma per chromosome varied from 0.79 to 0.85 in two populations (Table-3). At anaphase I chromosomal laggards, chromosomal bridges, clumping of chromosomes and unequal separation of chromosomes were reported. Pollen strelity was 12% in Ss0812 and 18% in Ss'0812. Interestingly, the presence of B-chromosome was noticed in one population of Ss'0812. One to three extra chromosomes were observed both at diakinesis and metphase I stage. These chromosomes did not pair among themselves, though other chromosomes paired regularly to form bivalents. B-chromosomes are not of frequent occurrence in the family Solanaceae and only a few reports are available. Lesley and Lesley (1929) reported B chromosomes in *Lycopersicum esculentum*, Blakeslee (1931) in *Datura stramonium*, Rai(1959) in *Solanum melongena*, Zutshi and kaul (1974) in *Solanum ottoris*, Dnyansagar and Pingle (1979) in *Solanam viarum* and Sinha (1982) in *Solanum sisymbrifolium*. It is interesting to note that in spite of the presence of B-chromosome, there is regular pairing of normal chromosomes in the studied species. This goes to suggest that the presence of B-chromosomes does not affect the pairing capability of the bivalents both at diakinesis and metaphase I stages. Further, ambiguity exists about whether the meiotic irregularities are due to the presence of B-chromosomes or

are inherent in the genetic make up of the species. Similar reports have been observed by Nazeer *et al.* (1980) in *Linaria spp*.

Battaglia (1964), Fedorov (1974), Jones (1975) and Gill (1981) have given exhaustive information on the behaviour of B-chromosomes and according to them their genetic effects are phenotypically undetectable when present in low numbers. The physiological effects of B-chromosomes may be neutral or stimulatory when present in low numbers and adverse when present in high number for the species concerned. In the present investigation the number of B-chromosomes was 1 to 3, i.e., it was low and therefore, it may be concluded that physiological effects of B-chromosomes on *Solanum sisymbrifolium* may have been neutralized.

The half chiasma per chromosome has been found to vary considerably in the two populations and there is variation in the number of ring and rod bivalents. The population (Ss0812) with more number of ring trivalent is supposed to have established itself at the particular habitat while population (Ss'0812) with more number of rod bivalents is supposed to be in the process of stabilizing itself in the habitat.

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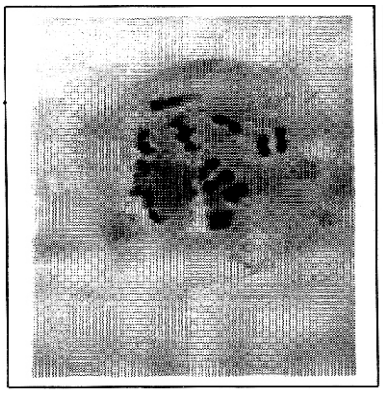
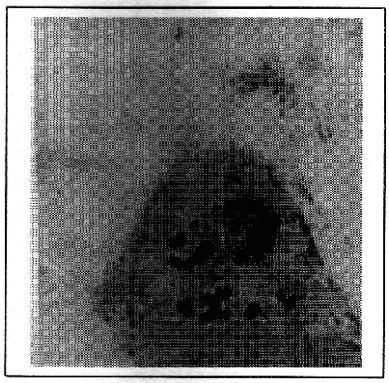
Population Ss´-0812, n = 12



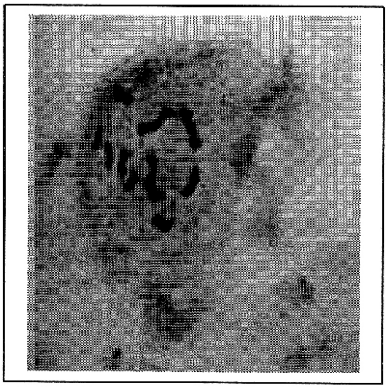
1

Fig-1 PMC at metaphase-I showing 12 bivalents



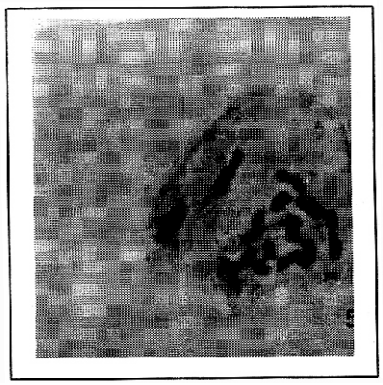
2

Fig-2 PMC at metaphase-I showing multivalents



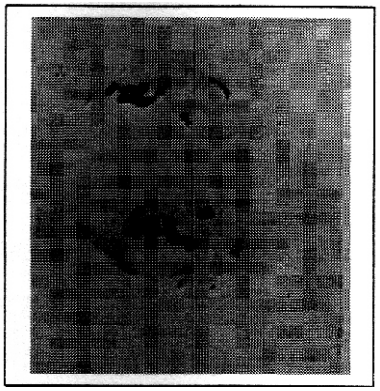
3

Fig-3 PMC at methaphase-I showing translocation chain



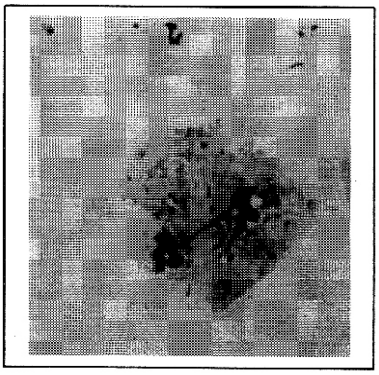
4

Fig-4 PMC at metahphase-I showing translocation



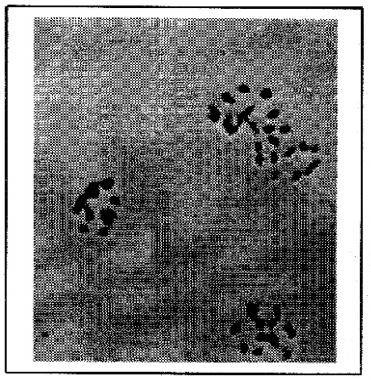
5

Fig-5 PMC at anaphase-I showing chromosomal leggard



6

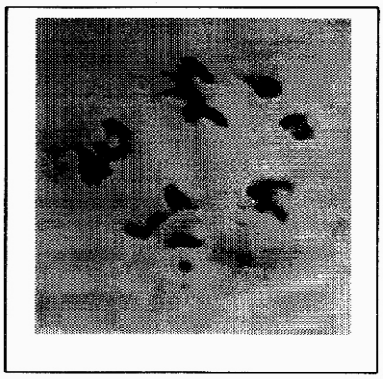
Fig-6 PMC at anaphse-I showing simple chromosomal bridge



7

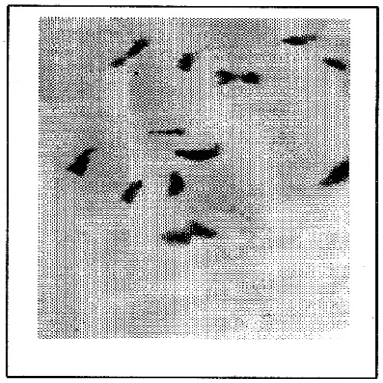
Fig-7 PMC at anaphase II showing tripolarity condition

Population Ss-0812, n = 12



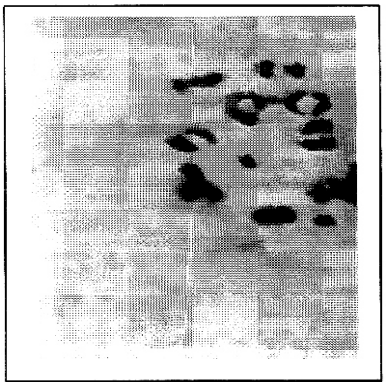
8

Fig-8 PMC at diakinesis showing clustered bivalents and two B-chromosomes



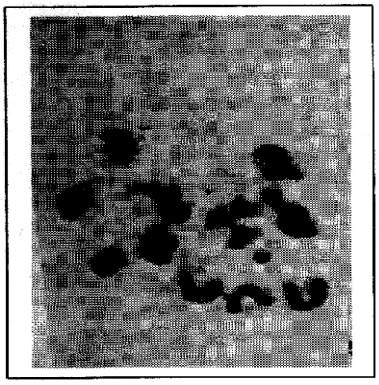
9

Fig-9 PMC at late diakinesis showing bivalents, quadrivalent and two B-chromosomes



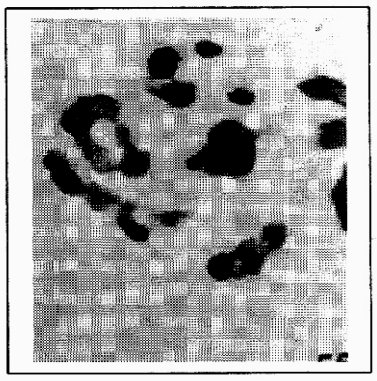
10

Fig-10 PMC at metaphase-I showing multivalent in addition to two B-chromosomes



11

Fig-11 PMC at metaphase-I showing one B-chromosomes



12

Fig-12 PMC at methaphase-I showing different configuration of multivalents and two B-chromosomes