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MEIOTIC STUDIES IN THREE POPULATIONS OF *Parthenium hysterophorus*

Md. Minhaj Alam and Arvind Kumar Sinha*

Key words : *Parthenium hysterophorus,* Meiosis, Translocation chains Multivalents.

Three populations of *Parthenium hysterophorus* L., an obnoxious weed were studied meiotically from three different places of Gaya town. In all the populations, the gametic number was found to be n= 9. Meiotic anomalies consisted of univalents, multivalents, clumping of chromosomes, translocation chains at metaphase-I, laggard formation and chromosomal bridge at anaphase I and disturbed polarity at anaphase II. Micronuclei were seen at the quartet stage. Pollen sterility varied in different populations. Multivalent formation in different populations has been observed as a possible consequence of structural changes in chromosomes which are represented by translocation rings and chain formation in different populations of the weed.

INTRODUCTION

Population has been defined as a reproductive community of sexual and crossfertilizing individuals which share a common gene pool. The natural populations have been found to exhibit drift and selection. In the large population, drift becomes insignificant but in a small population, it becomes significant (Davis and Heywood, 1973; Gupta and Srivastava, 2008).

Parenthenium hyterophorus L., commonly known as carrotgrass, is an obnoxious weed belonging to the family Asteraceae. This weed has allelophatic effects on seed germination of some crop plants (Singh and Chaurasia, 2014). A weed is endowed with a variety of cytological characteristics. Greater knowledge can be accumulated by deducing a relationship between species, races and individuals of the species growing in different environments and by comparative cytological studies. It has been discovered that evolutionary development often involves alteration in the number and structure of chromosomes which constitute the physical basis of genetic system of the species. Therefore much can be known regarding the relation between the individuals of *Parenthenium hyterophorus* by a comparative study of chromosomes.

MATERIAL & METHODS

Meiotic studies were done by anther squash preparation. Fixation of flower bud was done in 1:3 acetoalcohol and staining was done in 2 percent acetocarmine. Slides were made permanent according to the method of Celarier (1956).

OBSERVATION

Three populations of *Parenthenium hyterophorus* namely **Ph 0502**, **Ph'0502** and **Ph"0502** were meiotically studied from three different places of Gaya town.

Ph0502 : This population growing near Kharkhura,Gaya consisted of fifty two plants. The gametic number was found to be n= 9 in this population (Fig. 1). Certain abnormalities were recorded in this population, such as univalents and multivalents at metaphase I, and clumping of chromosomes was also observed. Unequal distribution of chromosomes and laggards were found at anaphase I. Details of chromosomal association and chiasma frequency are given in Tables-1 & 2. Pollen sterility was calculated to be 12.8 percent (Table -3).

P.G. Centre of Botany, M.G. College, Gaya - 823 001
*P.G. Centre of Botany, Gaya College, Gaya - 823 001

Ph'0502 : This population was growing near Manglagouri, Gaya and consisted of thirty two plants. The gametic number in this population was also found to be n = 9. The meiotic behaviourof chromosomes in this population was found to be variable and irregularities of different types were observed in some of the dividing pollen mother cells. The anomalies consisted of quadrivalents, trivalents and univalents (Fig. 2). In some pollen mother cells translocation rings and chains were observed (Fig. 3). Presence of laggards and simple bridges in a few pollen mother cells at anapse I was also noted. Details of chromosomal association and chiasma frequency are summarized in Tables-1 and 2. Pollen sterility was found to be 18.4 percent (Table 3).

Ph"0502 : Plants of this population were found growing in an isolated place in the campus of Medical College, Gaya. This population consisted of forty five plants. The gametic number was found to be n= 9 in this population also. The meiotic abnormalities recorded in dividing pollen mother cells consisted of clumping of chromosomes, univalent, trivalent and quadrivalent formation at metaphase I. In this population also, certain pollen mother cells showed formation of translocation chains and ring. Irregular distribution of chromosomes, formation of laggard (Fig. 4) and chromosomal bridge (Fig. 5) were observed at anaphase I. Details of chromosomal association and chiasma frequency have been summarized in Tables -1 and 2. Pollen sterility in this case was found to be 19.5 percent (Table - 3). Pollen grains of variable size were also noticed (Fig. 6).

DISCUSSION

Different populations of *Parthenium hysterophorus* showed gametic number as n=9. In all the populations, the meiotic division was non-synchronized and anomalies like formation of univalents, multivalents and clumping of chromosomes were observed. at metaphase I. Laggards, unequal separation of chromosomes and chromosomal bridges were found at anaphase I. Micronuclei were seen at the quartet stage. The half chiasma per chromosome was found to be variable and it varied from 0.86 to 0.88 (Table 2) . Pollen sterility varied from 12.8 percent to 19.5 percent (Table 3). The differences in chiasma frequency and half chiasma per chromosome provide

clue to understand the structural heterozygosity. It is quite reasonable to believe that the same variety studied meiotically from two different places favours its own form of individuals and such individuals are adapted to existing condition (Barve and Sangeetha, 2008). The presence of multivalents seems to be a common feature of this weed. Multivalents in the population are indication of real homology among several pairs of chromosomes of different individuals within the population which have common parents. In addition, formation of trivalents instead of quadrivalents may suggest that structural changes in certain pairs of chromosomes have already occurred or are in the process (Gupta and Srivastava, 2008; Singh and Sinha, 2009). Darlington (1973) has suggested that such conditions are indicative of the presence of translocation heterozygote. In the present investigation also, translocation chains and rings were noticed from two populations. The present investigation of the three populations of *Parthenium hysterophorus* reveals that pollen sterility and meiotic irregularities go simultaneously to a great extent. Meiotic irregularities along with infertility are regarded as evidence of hybrid origin of a taxon concerned. All the populations of the species do not seem to behave similarly at least in relation to the production of sterile pollen grains. Irregularity in meiosis is responsible for the production of sterile pollen. The case of pollen sterility has been assigned by Gottschalk and Kaul (1974) as male sterile genes which control the different stages of microsporogenesis.

TABLE - 1 : Nature and Frequency of chromosome association at metaphase I in three difeerent populations of *Parthenium hysterophorus*

Populations	Frequency	Chromosomal Association			
		IV	III	II	I
Ph 0502	30	0	0	9	0
	10	3	0	3	0
	5	1	0	6	2
	5	1	1	4	3
Ph′0502	28	0	0	9	0
	8	1	0	7	0
	7	1	2	4	0
	7	2	1	3	1
Ph″0502	18	3	0	3	0
	12	0	0	9	0
	11	1	0	6	2
	9	0	2	5	2

TABLE-2 : Chromosome pairing and chiasma frequency at metaphase I of different populations of *Parthenium hysterophorus*

Population	No. of PMC studied	No. of Bivalents per PMC				Total	Chiasma per PMC		Terminalised Chiasma		½ Chiasma per chromosome	Term. Coeff.
		Ring		Rod								
		Range	Mean	Range	Mean		Range	Mean	Range	Mean		
Ph 0502	50	4-6	5.0	3-5	4.0	9	15-17	16.0	13-16	14.5	0.88	0.90
Ph′0502	50	2-5	3.5	4-7	5.5	9	15-17	16.0	14-16	15.0	0.88	0.93
Ph″0502	50	3-7	5.0	2-6	4.0	9	14-17	15.5	13-15	14.0	0.86	0.90

TABLE-3 : Pollen analysis of populations of *Parthenium hysterophorus*

Populations	No. of Pollen studied	No. of normal pollen	No. of sterile pollen	Percentage of sterile pollen
Ph 0502	1125	980	145	12.8
Ph′0502	1170	954	216	18.4
Ph″0502	1088	875	213	19.5

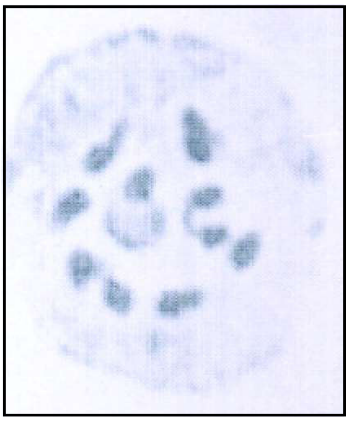

Fig. 1 : PMC at diakinesis showing bivalent

Fig. 2 : PMC at metaphase I showing bivalent and univalents

Fig. 3 : PMC at metaphase I showing translocation chains

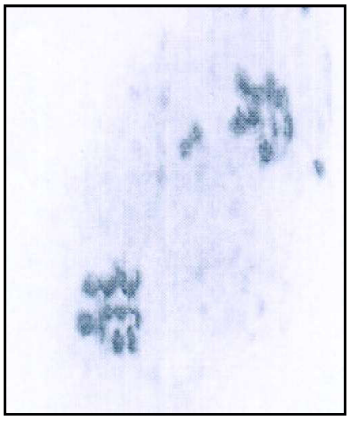

Fig. 4 : PMC at anaphase I showing laggard choromosomes

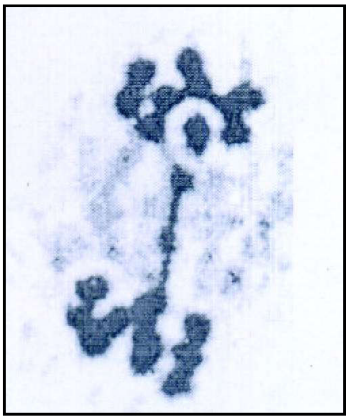

Fig. 5 : PMC at anaphase I showing simple chromosomal bridge

Fig. 6: Pollen grains of variable size

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