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KARYOMORPHOLOGICAL STUDIES IN *SATYRIUM SWARTZ*. (ORCHIDACEAE)

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Abstract

Satyrium swartz., *an orchidoideae taxa of orchidaceae, attains a position with two species in India. The present paper deal with the karyomorphological studies of* S.nepalense D.Don *for the first time from the area. It reveal the somatic numbers to be 2n=82,123 and 164 which confirms the previous reports also.*

Introduction

The genus *Satyrium swartz*., (Sub.Fam. orchidoideae) has 115 species, which are distributed in South Africa, Mascarene island , India, Tibet and china (Airy Shaw ,1973)two species, namely *Satyrium ciliatum* and *S. nepalense* are found in north west Himalaya, of which one could be collected. Cytological information in the genus is meager and based on chromosomes counts. (Kamemoto and Tanaka, 1984; Vij et al.; 1986).The present investigation briefly reports the chromosome number and karyotype details in *Satyrium nepalenseD.Don.*

Material and Methods

Material for the present investigation was collected from shivalik ranges of Western Himalaya and maintained in the Orchidarium of Botany Department KLDAV College Roorkee, during 1990-94.The sources of the material of the investigation is given in table1. Cytological studies were accomplished in the pollen mother cells and actively growing root tips following Garg and Jorapur (1987), Garg and Kumar (1989),Vij et al., (1990),Uma (1993)and Rani et al.,(1995).The karyotypes were analyzed in mitotic complement at metaphase. The chromosome numbers were counted and their morphology was determined following Levan et.al.,(1964)and Tanaka (1980).For comparative study, the large (above 5µm),medium(2-5µm)and small(below 2µm)chromosome have been abbreviated as L. M. and S respectively. In describing the karyotype, the value of the form percent (F %), Total form percent (TF %) and relative chromosome size(S %) are calculated, as also earlier employed by shekhar and Vij (1986)

Based on F% value, the chromosomes are designated as median (45.1-50.5), sub-median (30.1-45.0) and sub-terminal (0.1-30.0)and are abbreviated as m, sm and st respectively.TF% is utilized to estimate over all position of centromere in the chromosomal complement. For describing the karyotypes, the terms symmetrical asymmetrical are used after stebbin (1950). A karyotype consisting of essentially identical size chromosomes with median or sub-median centromere , are termed as symmetrical while the karyotypes with many sub-terminal and /or with discordant size chromosomes are taken as asymmetrical.

Observations

The normal somatic numbers is *Satyrium nepalense* from different localities of Chakrata are found to be 2n=82, 123 and 164(figs.1-6) however, 2n=164 from Mussoorie (fig7-8). In normal case of 2n=82, the chromosomes fall in two categories medium and short ranging from 3.094-1.326µm in length and are matched into medium and 21 short pairs (fig.9). Of the medium pairs, the centromere has been observed as median in 9 passes median and sub-median in 11 however, of the short pairs and 12^{th} sub-median centromere (fig.9) .The total chromosome length (TCL) of complement is measured as 86.109µm.TF%andS% values are calculated as 43.84 and 42.85 respectively (Table-1). The karyotype is symmetrical (fig. 9) and represented as follow:K:2n=2x=82=18M(m) +22M(sm)+18S(m)+24S(sm).

In triploid number (2n=123), chromosomes (fig.3-4) are between 2.652-0.663µm in length. These are distinguished into 61 pairs, while ones are observed without homologue, which is small in size and median constriction. Of the 61 pairs, 6 are medium (3 median+2 submedian+1 sub terminal) and 55 small (22 median+32 submedian+1 sub terminal) in size (fig.10). TLC of the complement has been measured as 97.682 µm .TF% and S% values are calculated as 43.77 and 25.00 respectively (Table-1). The karyotype is symmetrical (fig.10) and represented follows. K:2n=3x=123=6M(m)+4M(sm)+2M(st)+45S(m*)+6 4S(sm)+2S(st).

In case of tetraploid number (2n=164) (fig.5-6), the chromosome measure between 2.652-1.326µm in length are comprise of medium (11) and short (71) sized pairs. The medium pairs are distinguished as 7 median and 4 sub median, while of the 71 small pairs, 46 are median and 25 sub median (fig.11) with a TCL of 114.534µm.The TF% and S% values are calculated as 46.78 and 50.00 respectively (Table-1). The karyotype is symmetrical (fig.11) and represent as follows.
K:2n =4x=164=14M(m)+8M(sm)+92S(m)+50S(sm).

In case of tetraploid (2n=164)which has been collected from mussoorie (fig.7-8).The chromosomes are measured between 2.431-1.105µm is length and comprise of medium(13)and short (69) pairs.The medium pairs are distinguished as 7 median and 6 sub median .However , of the short pairs, 45 are median and 24 sub median (fig.12). The TCL of the complement is measured as 144.092µm.TF%and S% values are calculated as 44.69 and 45.45 respectively

(Table-1). The karyotype is symmetrical (fig.12) and represented as follows K: 2n=4x=164=14M (m)+12M(sm)+90S(m)+48S(sm).

Regular meiosis has been observed in latter stages and shows iso-bilateral and "T", shaped tetrads with pollen mitosis and octant stages have been confronted (figs.13-15)

Discussion

The gametophytic number (n=82) and somatic chromosome numbers (2n=82,123 and 164) in *Satyrium nepalense represent the only cytologically documented species of Satyrium. Orchids reveal a great deal of inter and intra-complement diversity of chromosome size. But the relative size of the chromosome are more or less uniform in S. nepalense.*

The chromosomes fall into two categories of medium and small in all the complements studied here (Table.1). The largest (3.090µm) and smallest (0.663µm) chromosome are observed in the complement with 2n=82 and 2n=123 respectively (Table.1). The karyotypes are uniformly symmetrical.

Chromosome number and basic number

Occurrence of cytotype related through polyploidy 2n =82 ,123 and 164 (Table.2) indicates cytological complexity of this species. Mehra and vij 1972b) suggested x=41 the basic number of this genus. One the above bases somatic chromosomes counts as 2n=82,123and 164 in this species of present investigation represent diploid, triploid and tetraploid levels respectively. Detailed chromosomes behavior at meiosis could not be attempted due to paucity of material. However, frequent occurrence of multi valets in triploid and tetraploid as studied by Kashyap and Mehra(1983b) possibly hints at the involvement of identical genomes in their constitution.

Polyploidy

The occurrence of polyploidy cell with 2n=123 and 164 with karyotypes of different localities of the present study, significantly show that there were no morphological expression of the polyploidy number .However ,the species showing polyploidy number occupied disturbed niches.

Satyrium nepalense shows normal number as 2n=82 and cytotype with 2n=123 and 164 have also been observed in this investigation (Table.1).The occurrence of these number confirms the earlier reports of the chromosome number for this spices (Table.2). The presence of chromosome numbers 2n=123 and 164 needs further discussion. It is possible that the plant with 2n=82 by polyploidization produced 2n=164 for achieving acclimatization.At the time of meiosis this /these plants may face unequal distribution of chromosomes .One of the possible number may be 2n=41 and 123. BY chance if these cells are chosen for study showing mitosis, will be

considered as aneusomic cells. If these aneusomic cells enter into tuber formation and tuber develops a plant next year, the plant will have 2n=123 uniformaly.

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Table 1.Source And Cytodata Of Investigated Taxa (*Satyrium nepalenese)*

Taxa	source & Altitude (m)	Chromosome		TCL(µm)	TF%	S%	Karyotype
		Number (2n)	Size range (µm)				
Satyrium nepalenese D.Don	Chakrata (Dehra Dun) 2100	82	3.094-1.326	86.19	43.84	42.85	8M(m)+22M(sm)+18S(m)+24S(sm)
	Chakrata (Dehra Dun) 2100	123	2.652-0.663	97.682	43.77	25.00	6M(m)+4M(sm)+2M(st)+45S(m')+ 64S(sm)+2S(st)
	Chakrata (Dehra Dun) 2100	164	2.652-1.326	144.534	46.78	50.00	14M(m)+8M(sm)+92S(m)+50S(sm)
	Mussoorie (1850)	164	2.431-1.105	144.092	44.69	45.45	14M(m)+12M(sm)+90S(m)+48S(sm)

Table-2 : Chromosome numbers in *Satyrium nepalense*

Taxon	Phytogeographic region of investigation	Chromosome numbers		Author(s)
		n	2n	
Satyrium nepalense D.Don.	North West Himalaya		82	Mehra &Pal,1961; Rani,1993
		82		Vij&Gupta,1975
			123	Vij et al.,1976b, 1983; Rani, 1993
			164	Mehra &Kashyap,1979; Kashyap&Mehra, 1983b; Rani,1993
	North East Himalaya	41	82	Mehra &Vij,1972b
	North East India	41		Mehra &Sehgal,1980; Shekar,1984
	Penninsular India		82	Jorapur,1980
		41		Swamy,1944

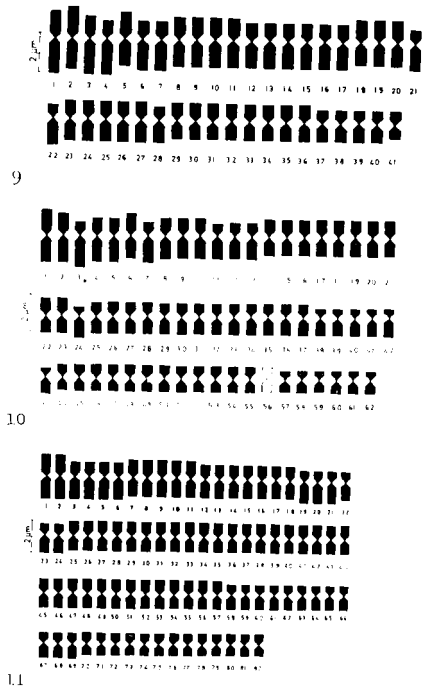

Fig. 1-8: Photomicrographs and Camera Lucida drawings of chromosomes in *Satyrium nepalense* : 1-2, 2n=82; 3-4,2n=123; 5-6,2n=164(Chakrata); 7-8,2n=164(Mussoorie)

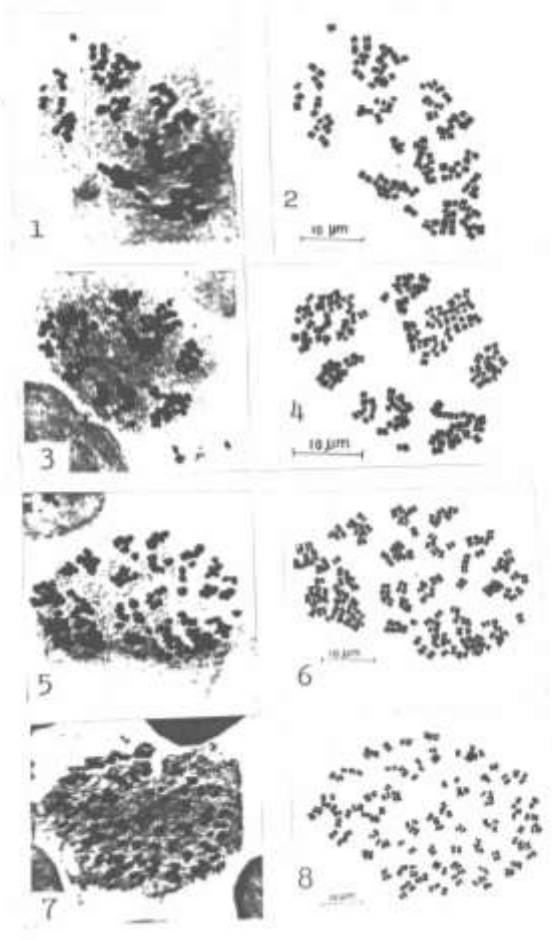

Fig. 9-12: Idiograms in *Satyrium nepalense*: (Chakrata) 9, 2n=82; 10,2n=123; 11,2n=164 ;(Mussoorie)2n=164.

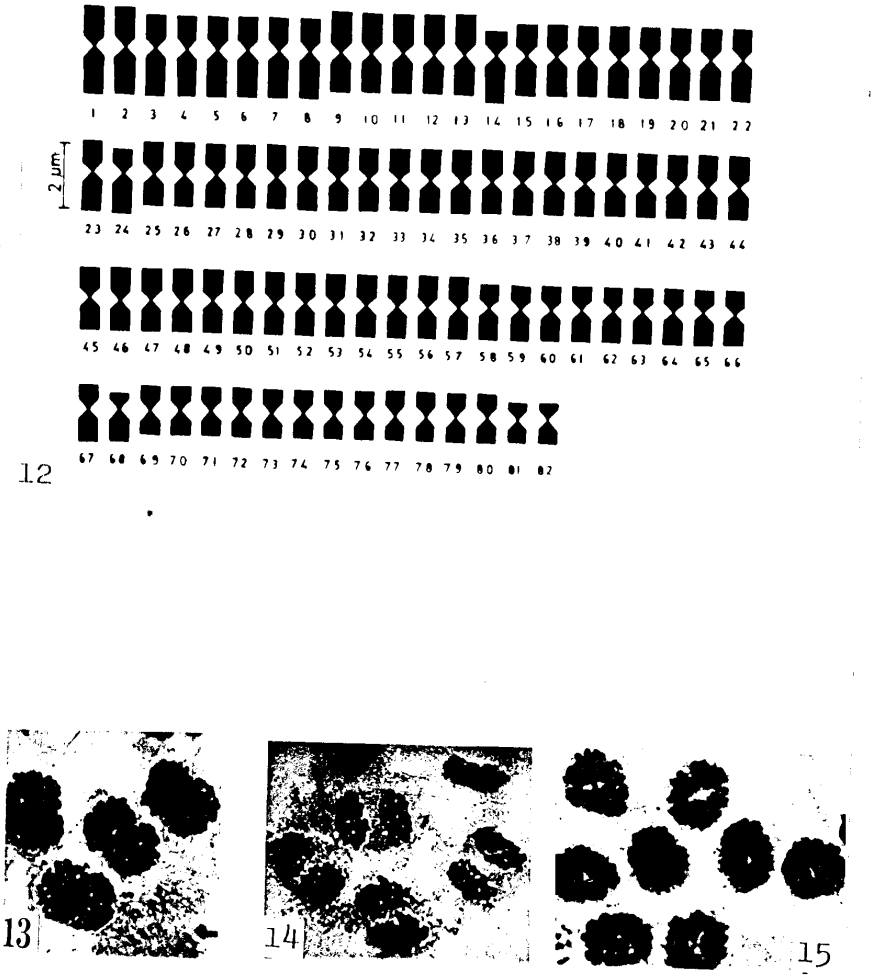

Fig. 13-15: Meiosis in *Satyrium nepalense* 13, Anaphase; 14, Telophase; 15, Octant.