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STUDIES ON CHROMOSOME VARIATION IN *VANDA* SPECIES OF ORCHIDACEAE

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ABSTRACT

Chromosome analyses on different species of Orchidaceae namely, *Vanda alpine* Lindl, *Vanda amesiana* Reichb.f. *Vanda coerulea* Griff, *Vanda coerulescence* Griff, *Vanda cristata* Lindl, *Vanda densiflora* Lindl and *Vanda hookeriana* Reichb. f.. Deviant report as against the previous records of chromosome numbers have been made in *Vanda alpine* Lindl, *Vanda amesiana* Reichb.f. *Vanda coerulea* Griff, *Vanda coerulescence* Griff, *Vanda cristata* Lindl, *Vanda densiflora* Lindl and *Vanda hookeriana* Reichb.f.a. In all other species studied the present report of chromosome numbers are in correlation with those of earlier reports. The first record of chromosome number has been made in 2 species namely *Vanda coerulescence* Griff 2n-42, *Vanda cristata* Lindl 2n–40 and *Vanda densiflora* Lindl 2n-42. Most of the species of *Vanda alpine* Lindl 2n-38, *Vanda amesiana* Reichb.f. 2n–38, *Vanda hookeriana* Reichb.f. 2n–38 and *Vanda coerulea* Griff 2n–42. *Vanda cristata* 2n–40, *Vanda densiflora* 2n-42. Chromosome should have been originated by aneuploidy. The study of karyotype analyses shows that each and every species has a distinct karyotype. Therefore, karyotype alternations of chromosomes may have also play important role in speciation along with aneuploidy.

Keywords **:** Chromosome, aneuploidy, euploidy and orchids

Introduction

The Orchids are a group of extremely interesting plants which outnumber all the other plant groups in the plant Kingdom. Numbering about 20,000 species, they exhibit pollination related floral complexities, produce a large number of microscopic and poorly organized seeds and require a fungal endophyte for their germination and growth in nature. The morphological, physiological and genetic peculiarities inherent in this group of plants have stimulated research to such a degree that Orchidology today is one of the most popular and dynamic branches of botany. Some of the orchids are medicinally important while certain others are used for the extraction of various chemical compounds. Previous cytogenetical studies of this family are fragmentary, as for as Tamil Nadu taxa are concerned. Orchids are valuable ornamental species mainly for their cut flower and multivarious forms of growth habits.

Materials and Methods

The plants for the present investigation were collected from Kolli hills. The species were identified and checked with the help of the Botanical Survey of India, Coimbatore and National Orchidarium and Experimental Garden, Southern Circle at Yercaud of Tamil Nadu, India. The Particulars regarding the species collected, wild or cultivated and the place of collection are furnished in the following table (Table 1).

The root tips were collected and thoroughly washed in distilled water and they were pretreated in 0.002 M hydroxyquinoline at 4^{o}C for 3 hours. Then the root tips were thoroughly washed and fixed in 1:3 acetic alcohol for 3 hours and following from iron alum haematoxylin squash schedule described (Marimuthu and Subnramaniam, 1960). Squashes were made with 1 or 2 root tips per slide and sealed. Ten plates were considered for the karyotyphic analysis in each species in the present investigation. The measurement of chromosomes were made with ocular micrometer, the scale of which had been calibrated from stage micrometer.

Results and Discussion

The particulars regarding the species studied, 2n chromosome number, the previous chromosome reports, authors and year are furnished in the Table 2. The chromosome numbers of the orchids are generally medium sized (Fig. 8). Based on the length, the chromosomes are classified into long, medium and short sized. Under each of these groups the following of chromosomes have been recognized.

Type S = Chromosome with a sub-median or median primary and secondary construction and satellite on the long arm or short arm.

Type J = Chromosome with a sub-median construction.

Type V = Chromosome with a median construction

Type I = Chromosome with a sub-terminal construction

1. Long chromosomes (more than 5.0 µm)
2. Medium sized chromosomes (3.0 to 4.9 µm)
3. Short chromosomes (0.1 to 2.9 µm)

More than 5 µm size chromosomes are

1. Sub median primary construction and sub terminal construction
2. Chromosome with sub-median centromear and sub terminal secondary construction.
3. Chromosome with median primary construction and sub terminal secondary construction.

Medium (3.0 to 4.9 µm) size chromosomes are

1. Chromosome with median primary construction and sub terminal secondary construction.
2. Chromosome with median construction.

Short (0.1 to 2.9 µm) size chromosomes are

1. Chromosome with sub-median construction.
2. Chromosome with median construction.

Cytological studies on the family Orchidaceae received much attention during the past two decades. Mitotic studies have been made in various species of Orchidaceae by eminent cytologists from various parts of the world and these studies have attracted the attention of taxonomists and biosystematics uniformly.

Vatsala (1964) described the cytology and evolution of Orchidaceae with special references to orchids of South India. Jorapur and Hedge (1974) described the chromosome morphology of *Bulbophylllum neilgherrense*. Jorapur and Kulkarni (1980) reported detailed karyological studies in a few members of Orchidaceae. The somatic chromosome numbers of varies species of *Vanda* were reported by Harmsen (1943), Sulabha, Pathak (1982), SulabhaPathak and Jorapur (1983). In recent years Mehra and Viji (1972) reported the diploid chromosome numbers of H. plantaginea (2n=126). In 1882, cytoembrological works have been made in Epidendreae and Vander by Divakar (1987). Jorapur and Kulkarni (1979) reported the diploid chromosome numbers of the species of Eria. Stenar (1937) reported the diploid chromosome number of the species of Malaxis Kamemoto and Randolph (1949), Kamemoto (1950) and Blumenschein (1960) reported the somatic chromosome numbers of the species of *Epidendrum.*

Histogram has been drawn with the help of the absolute chromosome lengths of the various species studied. The genus Helleborus contains a primitive complement having large isobranchial chromosomes in low number. Davis and Heywood (1963) have fully discussed the cytotaxonomical aspects.

Deviant number of chromosome has been observed in the species namely *Vanda cristata*as against the previous reports of chromosome numbers. The *Habenaria viridiflora* there are 2n = 22 chromosomes as observed in the present investigation but the earlier reports show 2n = 44 chromosomes (Jorapur and Kulkarani, 1980) and 2n = 84 chromosomes (Foja Singh, 1983). The members of the Tamilnadu Orchidaceae studied show variation of somatic chromosome numbers from 2n = 10 to 410.

The species having 2n=20 chromosomes namely, *Vanda densiflora* and *Vanda cristata*are diploids as revealed by the present investigation. In the same way the species having 30 somatic chromosomes namely *Vanda coerulescence* 2n-42, *Vanda cristata* 2n–40 and *Vanda densiflora* 2n-42. may be considered as triploids. Similarly the species having 40 somatic chromosomes namely Coelogyneovalis, Eriareticosa and Spathoglottisplicata may be considered as tetraploids. The diploid, triploid and tetraploid species are examples for euploids, when we consider n = 10 chromosomes as primary basic chromosome number of this family. Therefore *Vanda coerulescence* 2n-42, *Vanda cristata* 2n–40 and *Vanda densiflora* 2n–42 all these species may be considered as aneuploids.

The chromosome analyses of different species of Orchidaceae indicate that mostly asymmetrical karyotypes of chromosome have been observed. Therefore, it is concluded that along with aneuploidy and euploidy, karyotype alterations of chromosome also play important role in evolution.

Conclusion

The present investigation first record of chromosome number have been made in species namely. *Vanda cristata* 2n – 40 and *Vanda densiflora* The largest chromosome are found in *Vanda densiflora* 2n-42 (40.6µm) and the smallest chromosomes observed in *Vanda densiflora* (13.6 µm) in all other species are chromosome size having large, medium and small sized. Therefore, it is concluded that along with aneuploidy and euploidy, karyotype alterations of chromosome also play important role in evolution.

Table 1: Place of collection and species

Sl.No.	Name of the taxa	Epiphyte or terrestrial	Wilds (or) cultivated	Place collection
1.	*Vanda alpine* Lindl	Epiphyte	Wild	Kolli hills
2.	*Vanda amesianab* Reichb.f. .	Epiphyte	Wild	Kolli hills
3.	*Vanda coerulea* Griff	Epiphyte	Wild	Kolli hills
4.	*Vanda coerulescence* Griff	Epiphyte	Wild	Kolli hills
5.	*Vanda cristata* Lindl	Epiphyte	Wild	Kolli hills
6.	*Vanda densiflora* Lindl	Epiphyte	Wild	Kolli hills
7.	*Vanda hookeriana* Reichb.f. .	Epiphyte	Wild	Kolli hills

Table 2: Chromosome number of the species investigated

S.No.	Name of the taxa	Present study	Previous report
1.	*Vanda alpine* Lindl	2n = 38	2 n = 38 Foja Singh (1981) 2n = 38 Santhan (1991)
2.	*Vanda amesiana* Reich b.f..	2n = 38	2n = 40 Vatsala (1964) 2n = 42 Jorapur and Kulkarni (1980) 2n = 42 Santhan (1991)
3.	*Vanda coerulea* Griff	2n =38	n = 25 Mehra and Sehgal 2n = 60 Abraham and Vatsala (1981) 2n = 54 Vijayakumar (1986) n = 28, 2n = 56 Santhan (1991)
4.	*Vanda coerulescence* Griff	2n = 42	No previous report
5.	*Vanda cristata* Lindl	2n = 40	No previous report
6.	*Vanda densiflora* Lindl	2n = 42	No previous report
7.	*Vanda hookeriana* Reichb.f. .	2n = 42	n = 21 Vatsala (1964) 2n = 42 Jorapur and Garg (1980) n = 21Abraham and (1981) 2n = 42 Foja Singh (1983)

Table 3: Summarized karyomorphological features

S. No.	Name of the taxa	2n	S	J	V	I	Total chromosome length in µm	Absolute chromosome length in µm	Average chromosome length µm
1.	*Vanda alpine* Lindl	38	6	8	14	38	17.9	11.45	0.66
2.	*Vanda amesiana* Reich b.f. .	38	12	14	12	38	38.5	18.79	0.88
3.	*Vanda coerulea* Griff	38	12	16	10	38	27.7	16.80	1.00
4.	*Vanda hookeriana* Reich b.f.	42	12	14	16	42	31.0	15.06	0.06
5.	*Vanda coerulescence* Griff	42	21	14	8	42	16.5	7.70	0.80
6.	*Vanda cristata* Lindl	40	22	-	18	40	14.6	6.6	0.78
7.	*Vanda densiflora* Lindl	42	20	16	4	40	26.2	12.8	0.46

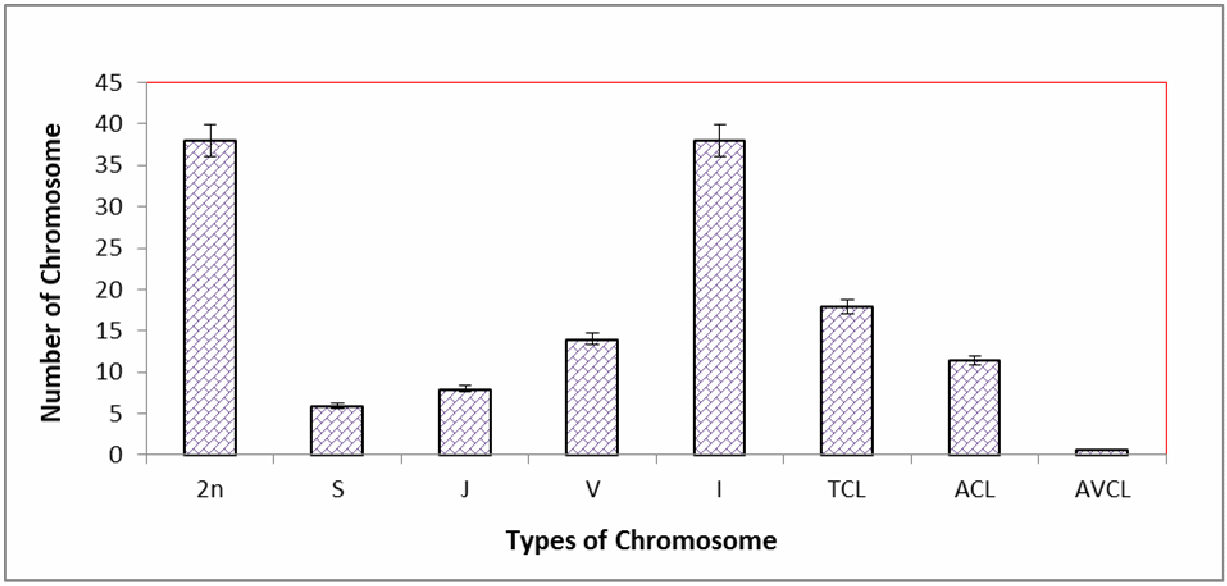

Fig. 1 : Number of chromosome in *Vanda alpine* Lindl on Kolli hills

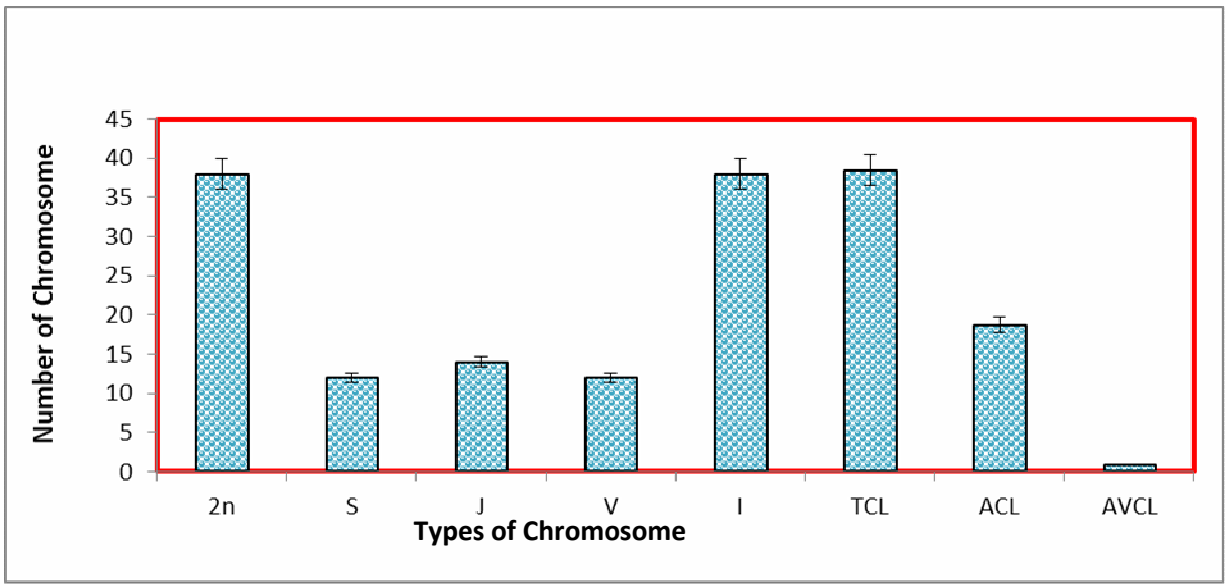

Fig. 2 : Number of chromosome in *Vanda amesiana* Reich *b.f.* on Kolli hills

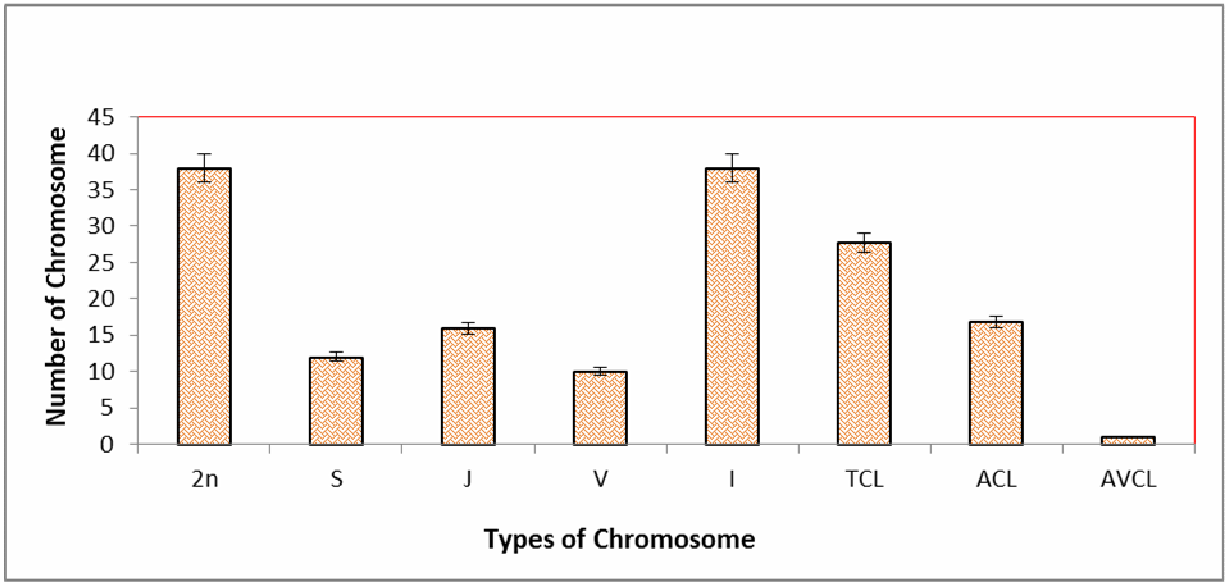

Fig. 3 : Number of chromosome in *Vanda coerulea Griff* on Kolli hills

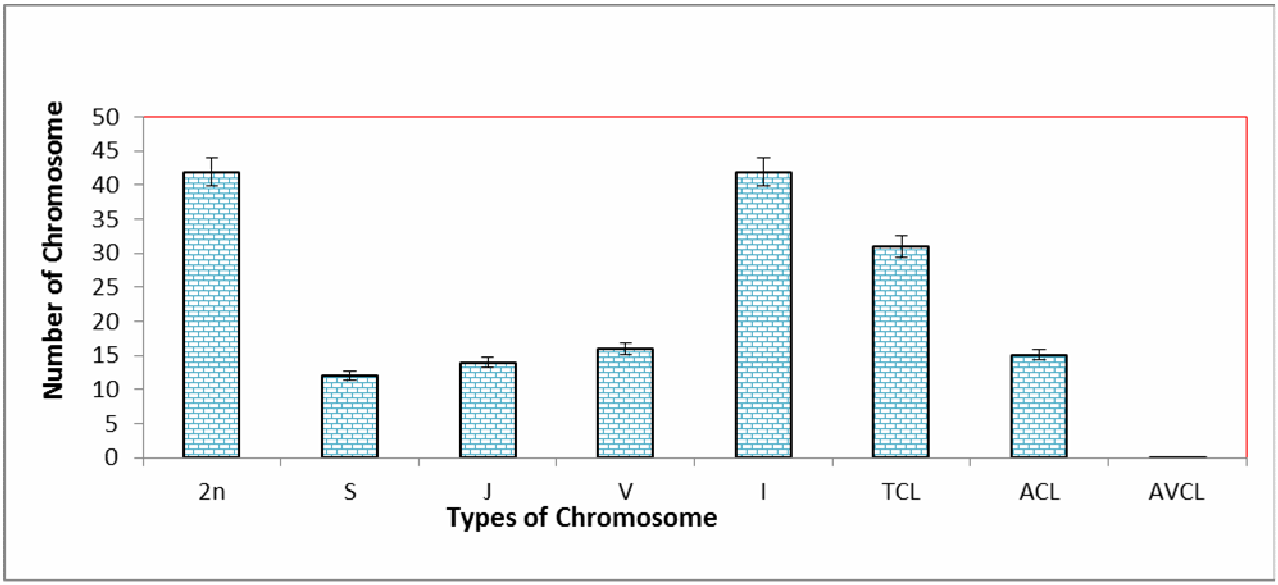

Fig. 4 : Number of chromosome in *Vanda hookeriana Reich b.f.* on Kolli hills

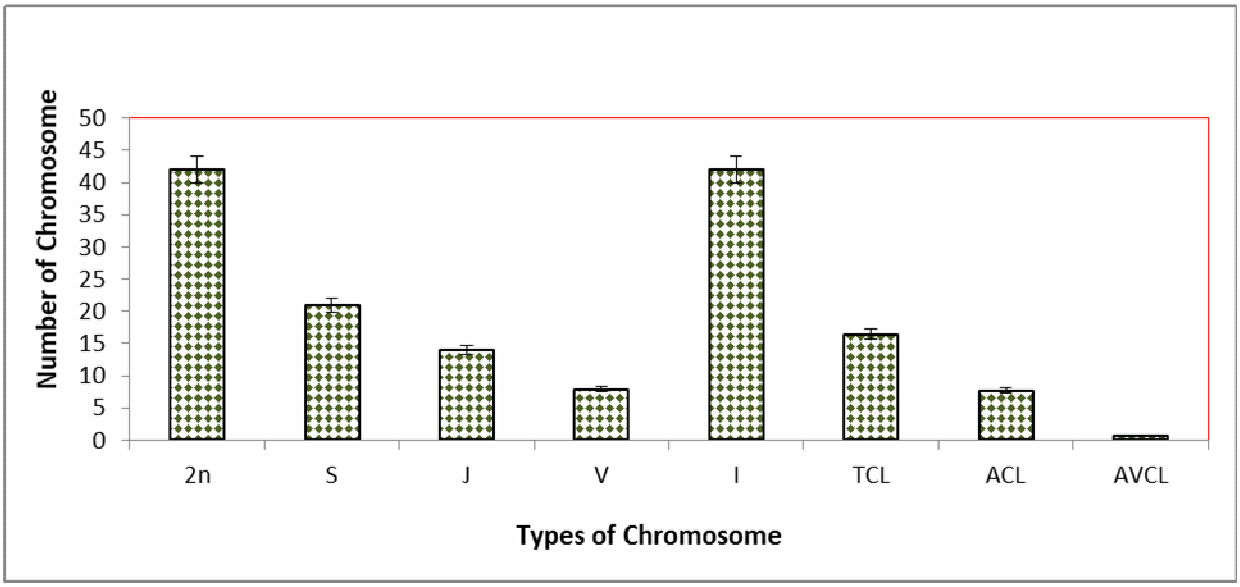

Fig. 5 : Number of chromosome in *Vanda coerulescence Griff.* On Kolli hills

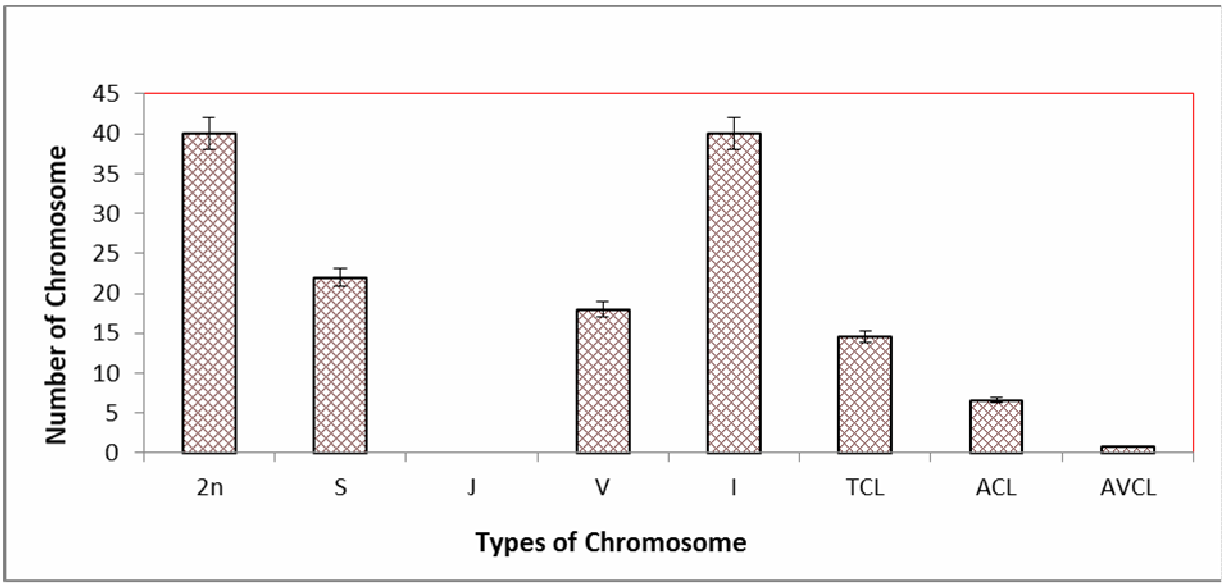

Fig. 6 : Number of chromosome in *Vanda cristata Lindl* on Kolli hills

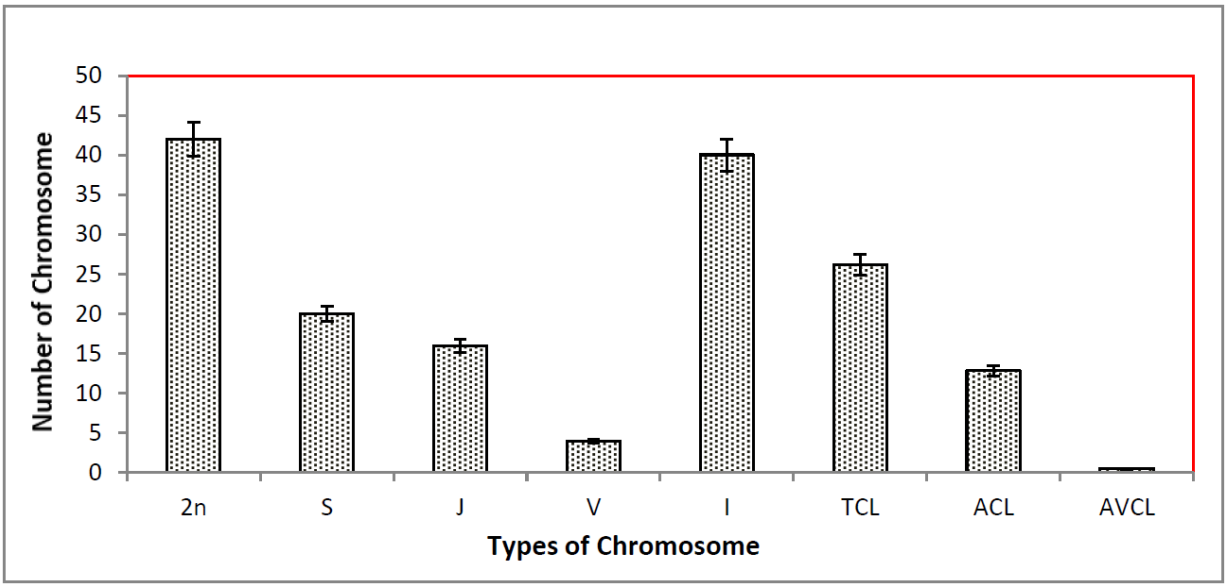

Fig. 7 : Number of chromosome in *Vanda densiflora Lindl* on Kolli hills.

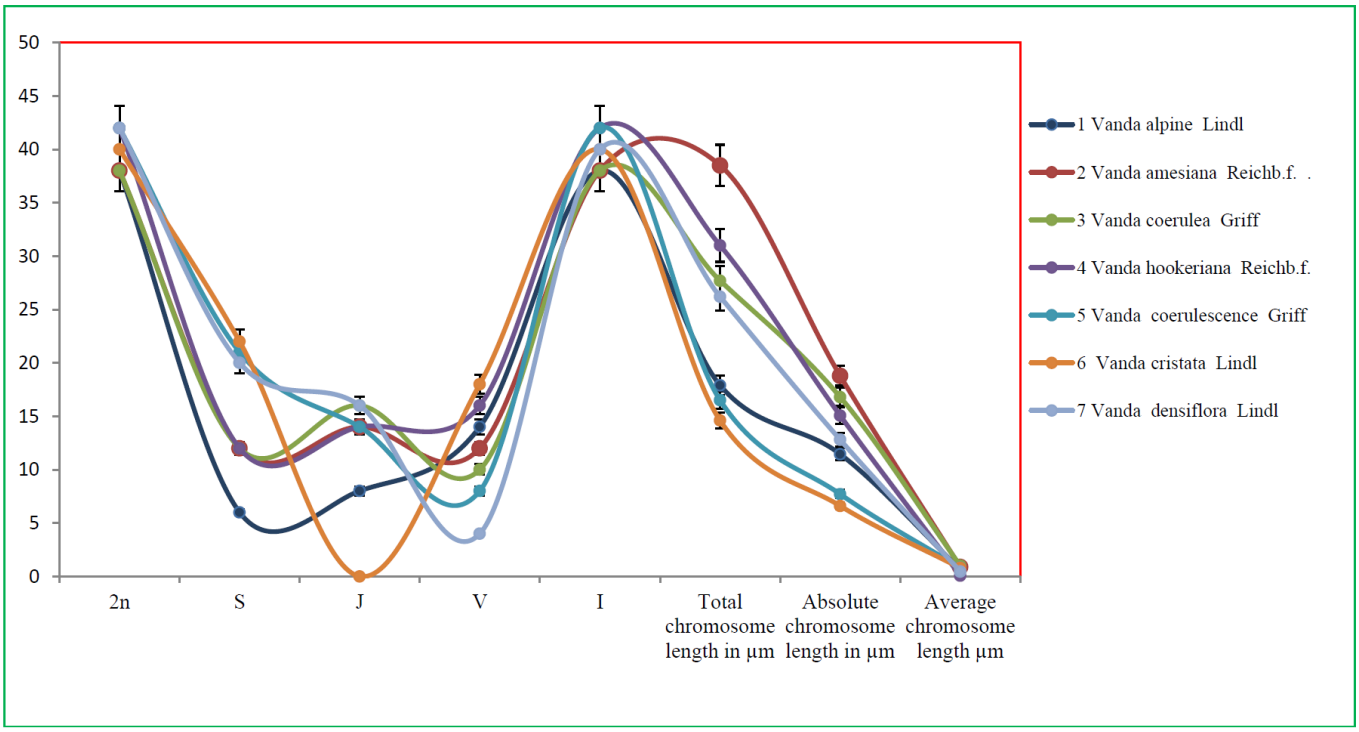

Fig. 8 : Number of taxa and number of chromosome on Kolli hills

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