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KARYOMORPHOLOGY OF FIVE TAXA OF ZEPHYRANTHES HERB. FROM SOUTH INDIA

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INTRODUCTION

Zephyranthes Herb., a genus of about 65 species of bulbous flowering plants which are natives of warmer part of America and of West Indies belongs to the family Amaryllidaceae (Hutchinson, 1973, Judd *et al*., 1999). Many of them are valued as ornamentals with relatively small flowers and short life cycle (Lorenzi and Souza 1999). The leaves are narrowly strap shaped and few in number, flowers solitary and are usually borne on a pedicel of variable length. Cytology of over 50 species have been investigated (Darlington and Wylie 1955, Fedorov 1969 and Goldblatt 1981, 1984, 1985 and 1988), which are taxonomically complex and cytologically variable group. However, the quest for size and colour of flower has led to indiscriminate use of hybrids and wild species in breeding and the evolution of cultivars warrants their screening. This has prompted the present authors to take up this study. Present study deals with detailed karyotype analysis of five taxa.

MATERIALS AND METHODS

Plant specimens were collected from different localities of South Indian states of Kerala and Tamil Nadu. For cytological analysis, young root tips were pre-treated in 0.002 M aqueous solution of 8-hydroxyl-quinoline for 3 hrs at 4^0 C and then fixed in Carnoy's fluid for 24 hrs and stored in the refrigerator. The roots were first washed twice for 5 min in distilled water, hydrolyzed for 20 min in 5N HCl and then squashed. The chromosomes were stained in 2% aceto carmine. Photomicrographs were taken from temporary preparations. Karyomorphological analysis was made following Stebbins (1958) and Levan *et al* (1964). Chromosomes were arranged in three groups according to the relative position of the centromere (metacentric-m, centromeric index-Ci= 50 to 37.5, submetacentric-sm, Ci= 37.5 to 25 and subtelocentric-st, Ci=25 to 12.5 based on arm ratio and centromeric index (Stebbins, 1958).Cells were photographed with Olympus photomicroscope. After species identification, voucher material was deposited at Herbarium of University of Kerala, Botany Department.

RESULTS AND DISCUSSION

The karyotype details of the five taxa studied are given in (Table 1) and idiograms in (Fig. 2). *Z.grandiflora* revealed 2n=48, *Z. longifolia* 2n= 46, *Z. candida* 2n=25 and *Z. rosea* 2n=24, while the four accessions of *Z. mesochola* showed 2n=36, 19, 18 and 16 chromosomes each respectively (Fig. 1).

The presently studied five taxa of *Zephyranthes* from South India are all based on x=6. The karyotype of all the species are graded with five of them belonging to the 2B category and three of them to 3B category. *Z. candida*, a tetraploid based on x=6 was less specialized with mostly m-type and sm-type of chromosomes. Chromosome number 5 in *Z. candida* was heteromorphic with only one of the members of homologue possessing the satellite while in chromosome number 7 both members possessed satellite. *Z. rosea* is a tetraploid on x=6 and showed more asymmetry with 2- st, 16- sm, and 6-m type of chromosomes. The chromosome 3 possessed satellite. The hexaploid *Z. longifolia* was less specialized with mostly m-type and sm-type of chromosomes. *Z. grandiflora* representing the octaploid based on x=6, revealed a graded karyotype which belonged to the category 2B with m- and sm- type of chromosomes. Of the four taxa of *Z. mesochola*, variability in chromosome number were evident, there was little karyomorphological change with the different taxa having median, submedian and subterminal constrictions. It is apparent that apart from the superficial similarity in chromosome morphology of the different species in having long, medium as well as short chromosome with either median, submedian and subterminal constrictions, they differ from each other in their chromosome complement, total amount of chromatin matter, average chromosome length as well as TF%. On the whole, the karyomorphological situation in the genus *Zephyranthes* reveal that structural alterations of chromosomes to be less operative. However, chromosome numerical data holds the genus to constitute a complex with an array of chromosome numbers ranging from 10 to 200 with 12, 18, 22, 24, 26, 28, 40-50, 54, 58-61, 66-69, 72, 73, 93, 100, 120 and 200 of which most frequent number being 2n=48 (Inariyama 1937, Coe 1954, Yokouchi 1963, Flory and Smith, 1980a and Davina, 2001). Also 2n=24 and 36 (Kapoor and Tandon 1963), 2n=38 (Nagao and Takusagawa 1932), 2n=40 (Tandon and Meenakshi, 1965) have been reported. Some authors considered x=6 to be the basic number for the genus (Inariyama 1937, Sato 1938, Sharma and Ghosh 1954, Flagg 1960 and Raina and Khoshoo 1971). Darlington and Wylie (1955) suggested three basic numbers of x=6, 7 and 9 for this genus. However x=6 seems to be deep rooted basic constitution of the entire tribe Zephyrantheae. Sato (1938) has opined that x=6 condition may have originated from x=11 by fusion of translocation or by loss of one pair of chromosome from a 7-chromosomal ancestor.

Chromosome number variability in 32 individuals of *Z. sylvatica* populatopn from Northeast Brazil was investigated by Felix *et al*. (2008). They identified three cytotypes-2n= 12 (one metacentric, four submetacentric and one acrocentric pairs) in 24 individuals; 2n=12+1B in five and three individuals with 2n=18, a triploid cytotype. Here all diploid individuals showed chromosomes with polymorphism in pair one and two. But in triploids the polymorphism was observed in all chromosome triplets with two homomorphic

chromosomes and a higher or lower heteromorphic chromosome. All species showed karyotypes formed by a set of metacentric to submetacentric chromosomes and a smaller number of acrocentric chromosomes, with gradual reduction in size and chromosome morphology. Different species had distinct karyotypic formula and sometimes they coincided concerning ploidy level (Felix *et al*., 2011).

In this context it is pertinent to note that all the varying nuclei show their chromosome complement as multiples of six and this irregularity has been explained on the basis of endomitotic replication (Sharma and Ghosh 1956). Thus the polyploid species of *Zephyranthes* occur in a regular series in multiples of x=6 ranging from 2x to 16x showing a great role of polyploid evolution on this number in this group.

The chromosome in this family is large and it is apparent that considerable amount of segmental interchange coupled with aneuploidy and polyploidy, due probably to prolific vegetative multiplication have enabled these forms to multiply. Further evolution as it is evident must have been through aneuploidy in both directions at different ploidy levels giving rise to taxa with a variety of chromosome constitutions. Of the five taxa presently studied all of them are based on x=6, one of each with 2n=48 (*Z. grandiflora*), 2n=36 (*Z. mesochola)*, 2n=24 (*Z. rosea)* and the rest are aneuploids with 16, 19, 25 and *Z. longifolia* with 2n=46 respectively. The overall chromosome situation appears to be suggestive that this genus is an evolutionarily dynamic one and that chromosomal numerical variation, both polyploidy and aneuploidy, have contributed significantly more than structural rearrangement in the rapid evolution of this genus.

LITERATURE CITED

Coe G E. (1954). Chromosome numbers and morphology in *Habranthus* and *Zephyranthes*. Bull. Torrey Bot. Club **81** pp. 141-148.

Darlington C D and Wylie A D (1955). Chromosome Atlas of Flowering Plants. (George Allen and Unwin:London).

Davina JR. (2001) Estudios citogeneticos en algunos generous argentines de Amaryllidaceae. Tese de doutorado, Universidade Nacional de Cordoba, Cordoba.

Fedorov A (1969). Chromosome number of flowering plants, Komarov Botanical Institute, Leningrad.

Felix WJP, Dutilh JHA, Melo NF, Almeida A, Felix LP (2008) Intrapopulational chromosome number variation in *Zephyranthes sylvatica* Baker (Amaryllidaceae" Hippeastreae) from northeast Brazil. *Rev. Bras. Bot.* **32**: 371-375.

Felix WJP, Felix LP, Melo NF, Oliveira MBM, Dutilh JHA and Carvalho R (2011). Karyotype variability in species if the genus *Zephyranthes* Herb. (Amaryllidaceae-Hippeastreae). Plant Syst. Evol. 294: 263-271.

Flagg R O. (1960). The *Zephyranthes clintiae omples* 1. Initial report on the somatic chromosomes. Plant Life. **16** pp. 86-91.

Flory WS and Smith, G. L. (1980a) High chromosome number in several Zephyrantheae taxa. Plant Life 36: 63-72.

Goldblatt P. (1981). Index to Plant Chromosome Numbers. 1975-1978, Monogr. Syst. Bot. Missouri Bot Gard. **6** pp. 1-553.

Goldblatt P. (1984). Index to Plant Chromosome Numbers. 1979-1981, Monogr. Syst. Bot. Missouri Bot Gard. **8** pp. 1-427

Goldblatt P. (1985). Index to Plant Chromosome Numbers. 1982-1983, Monogr. Syst. Bot. Missouri Bot Gard. **13** pp. 1-224.

Goldblatt P.(1988). Index to Plant Chromosome Numbers. 1984-1985, Monogr. Syst. Bot. Missouri Bot Gard. **23** pp. 1-264.

Hutchinson J. (1973). The Families of Flowering Plants. 3rd ed., (Clarendon Press, Oxford).

Inariyama S. (1937). Karyotype Studies in Amaryllidaceae. 1. Sci. Rep. Tokyo Bumika Daiguku Ser. **52**. pp- 95-113.

Judd, W. S. , Campbell, C. S., Kellogg, E. A., and Stevens, P. F. (1999) Plant systematic: a Phylogenetic approach. Sinauer Associates, Massachusetts.

Kapoor B M and Tandon S L. (1963). Contribution to the cytology of endosperm in some Angiosperms IV. *Zephyranthes grandiflora* Lindl., Genetica **34** pp 102-112.

Levan A, Fredga K and Sandberg A A. (1964). Nomenclature for centromeric position on chromosomes. Hereditas **52**. pp 201-220.

Lorenzi H and Souza HM (1999) Planta ornamentais no Brasil: arbustivas, herbaceas e trepadeiras. Instituto Plantarum, Sao Paulo.

Nagao S and Takusagawa H. (1932). Uber die chromosome einiger Amaryllidaceen.Bot. Mag. (Tokyo) **46**. pp 473-478.

Raina S N and Khoshoo T N. (1971). Cytogenetics of tropical bulbous ornamentals VI. Chromoomal polymorphism in cultivated *Zephyranthes*. Caryologia. **24**. pp. 217-227.

Sato D. (1938). Karyotype alterations and phylogeny IV. Karyotypes in Amaryllidaceae with special reference to SAT-chromosome. Cytologia 9. pp. 203-242.

Sharma A K and Ghosh C. (1954). Further investigation on the cytology of the family Amaryllidaceae and its bearing on the interpretation of its phylogeny. Genet. Iber. **6** pp 71-100.

Stebbins G L. (1958). Longevity, habitat and release of genetic variability in higher plants. Cold Spring Harb. Symp.Biol. **23** pp 365-378.

Tandon S L and Meenakshi M. (1965). Cytotaxonomic studies on some Zephyranthes species. Indian J. Hort. **22(2)** 190-200.

Yokouchi Y. (1963). Chromosome studies on *Zephyranthes* 1. Karyotypes of Z. candida, Kromosomo **55-56** pp 1811-1817.

Fig. 1 (A-H) - Somatic chromosome of *Zephyranthes* (x900).

A. *Z. mesochola*, accession IV (2n=36), B. *Z. mesochola*, accession II (2n-2=16), C. *Z. mesochola*, accession III (2n=18), D. *Z. mesochola*, accession I (2n+1=19), E. *Z.*

grandiflora (2n=48), F. *Z. rosea* (2n=24), G. *Z. longifolia* (2n-2=46), H. *Z. candida* (2n+1=25).

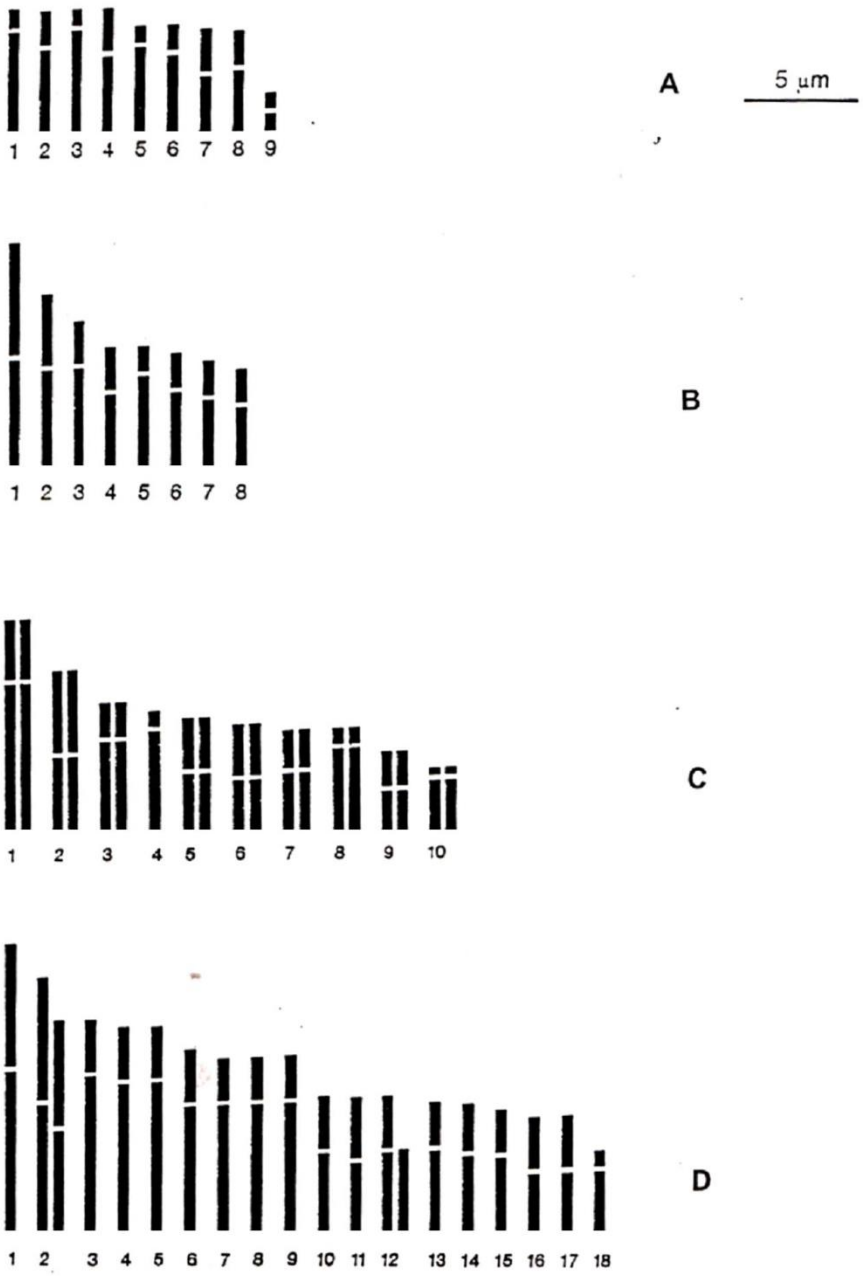

Fig. 2. (A-H) - Idiograms of the haploid complements of *Zephyranthes*.

A. *Z. mesochola*, accession III, B. *Z. mesochola*, accession II, C. *Z. mesochola*, accession I, D. *Z. mesochola*, accession IV..

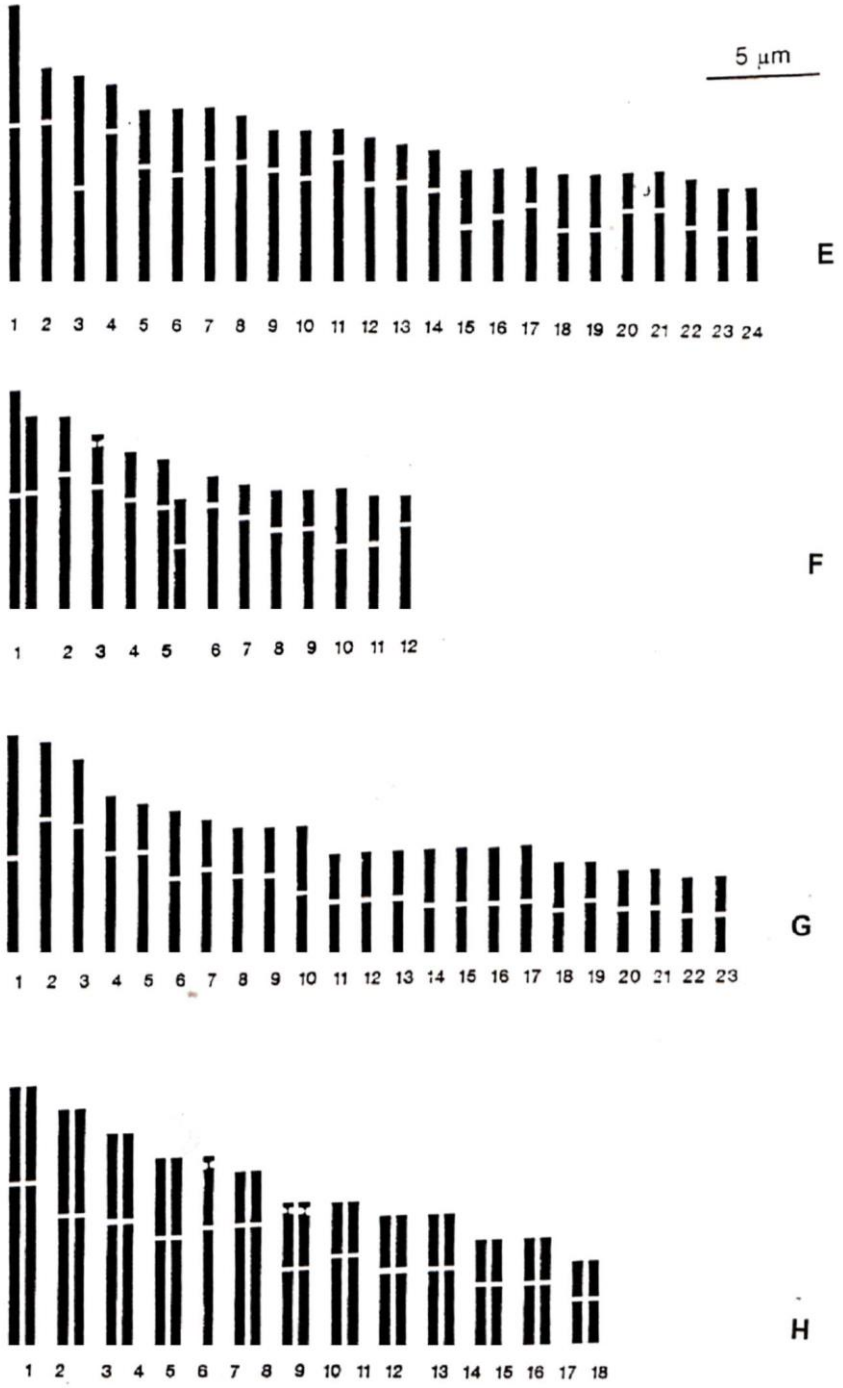

Fig. 2. (A-H) - Idiograms of the haploid complements of *Zephyranthes*.

E. *Z. grandiflora*, F. *Z. rosea*, G. *Z. longifolia*, H. *Z. candida*.

TABLE 1. KARYOMORPHOLOGICAL DATA ON EIGHT TAXA OF *ZEPHYRANTHES* FROM SOUTH INDIA

Taxon	Karyotype formula	TCL (μm)	ACL (μm)	TF%	Karyotype category (STEBBINS 1958)
Z candida	2n = 25: 2 Bsm + 2 Bm + 2 Cm + 5 Dsm + 2 Em + 2 Fsm + 4 Fm + 6 Gm	237.73	9.50	37.21	2B
Z rosea	2n = 24: 1 Cm + 3 Dsm + 5 Esm + 1 Fm + 2 Fst + 6 Fsm + 4 Fm + 2 Gsm	191.01	7.95	31.38	3B
Z longifolia	2n = 46: 2 Cm + 4 Csm + 2 Em + 6 Esm + 6 Fm + 4 Fsm + 18 Gm + 4 Hm	323.02	7.02	40.80	2B
Z grandiflora	2n = 48: 2 Am + 2 Cst + 2Cm + 6 Dsm + 2 Dst + 6 Esm + 4 Est + 6 Fsm + 6 Fm + 8 Gm + 4 Gsm	410.42	8.55	32.76	3B
Z mesochloa accession I	2n = 19: 2 Csm + 2 Em + 2 Esm + 1 Fst + 4 Fm + 4 Gm + 2 Gst + 2 Hst	136.82	7.20	33.07	2B
Z mesochloa accession II	2n = 16: 2 Cm + 2 Dm + 2 Esm + 6 Fsm + 2 Fst + 2 Gsm	127.42	7.96	36.25	2B
Z mesochloa accession III	2n = 18: 2 Fm + 6 Fsm + 6 Fst + 2 Gm + 2 Hm	109.28	6.07	28.98	3B
Z mesochloa accession IV	2n = 36: 2 Am + 1 Bm + 1 Cm + 6 Cst + 2 Dsm + 6 Dst + 2 Em + 7 Fm + 6 Fsm + 3 Gst	352.58	9.79	33.01	2B

TCL – Total chromosome length of diploid complement; ACL – Average chromosome length; TF% - (Total short arm length x 100) / (Total long arm length x Total short arm length).