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Karyomorphology of three taxa of *Haemanthus multiflorus* martyn. from south India

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Abstract
Karyotype of three taxa of *Haemanthus multiflorus* collected from different localities of South Indian States of Kerala and Tamil Nadu were studied. The study confirmed the report of 2n=18 in the species. The taxa maintained its distinct karyotype architecture (3C) which is highly specialized among members of Amaryllidaceae.

Keywords: amaryllidaceae, *haemanthus*, cytology, karyomorphology, karyotype, heteromorphisity

Introduction

Haemanthus L. (family Amaryllidaceae) is a fairly large genus of over seventy species (Willis, 1973) [14] comprising of bulbous plants which are chiefly distributed in Tropical and South Africa of which one species *H. multiflorus* Martyn. is being domesticated in South India. This genus is popularly known as blood or globe lily (Bailey, 1850). Cytology of over 20 species has been reported (Fedorov 1969, Goldblatt 1981, 1984, 1988) [3, 4, 5]. Invariably most of them recorded the diploid complement of 2n=18 or 16 chromosomes. The karyotype study of the taxa from three different localities of South India were carried out to confirm its chromosome constitution in the light of reported occurrence of 2n=18 or 16 chromosomes. In addition karyomorphologically South Indian species received meagre attention.

Materials and Methods

Plant specimens were collected from different localities of South Indian states of Kerala and Tamil Nadu. Root tips were allowed a prefixation treatment in 0.002 M aqueous solution of 8-hydroxy-quinoline for 3 hrs. at about 4ºC. The chromosomes were stained in 2% acetocarmine. Photomicrographs were taken from temporary preparations. Karyomorphological analysis was made following Stebbins (1958) [13] and Levan *et al*., (1984).

Results and Discussion

Accession I

Root tip cells at metaphase revealed the diploid complement of 2n=18 chromosomes (Fig. 1). The size of the chromosomes ranged from 6 µm to 25 µm. ACL was 12.05 µm, TCL 217.01 µm and TF% 26.26.

The karyotype (Fig. 4) was found to be a heterogeneous one falling in the category 3C consisting of 5-m, 5-sm, 6-st and 2-t type of chromosomes. The chromosomes '1' was heteromorphic with the long arm of one of the members shorter than the other.

Accession II

Accession II showed the diploid complement of 2n=18 chromosomes at the somatic metaphase (Fig. 2). The size of the chromosomes ranged from 6.5 µm to 25 µm. ACL was 12.75 µm, TCL 229.5 µm and TF% 22.44.

The karyotype (Fig.5) fell in the category 3C comprising of '1-m', '7-sm', '8-st', and '2-t' types of chromosomes. Chromosomes '3' and '7' exhibited size heteromorphism between its members with long arm of chromosomes '3' varying in length with its homologue, while the short arm of chromosome number '7' varied in its length with the corresponding homologue. Karyomorphological details evince the preponderance of structural heteromorphism between members of homologues either in terms of size or orientation of centromere or both.

Accession III

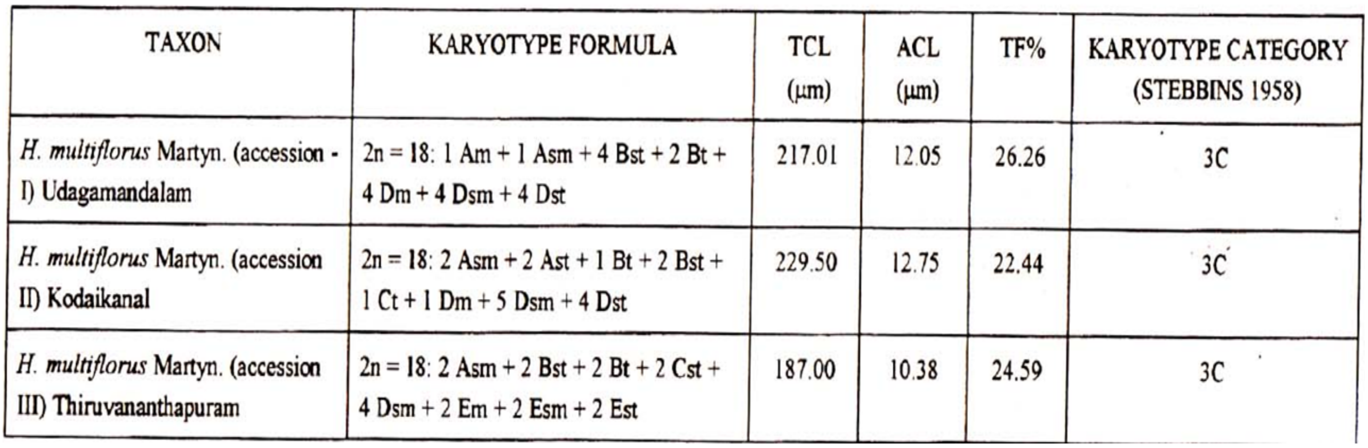
Root tip cells of Accession III at metaphase revealed the diploid complement of 2n=18 chromosomes (Fig. 3). The size of the chromosomes ranged from 4 µm to 20 µm. ACL was 10.38 µm, TCL 187 µm and TF% 24.59.

The karyotype (Fig. 6) fell in the category 3C comprising of ' 1' pair of 'm', 4 pairs of 'sm', 3 pairs of 'st' and a pair of 't' type of chromosomes. The chromosome number '3' was heteromorphic with the long arm of one of the homologue being shorter than the other.

Karyomorpho logical details of all three accessions are summarised in Table 1 and idiograms (Fig. 4-6).

The cytological details of over 20 species of the genus *Haemanthus* records their chromosome numbers as 2n=18 and 16, of which 16 occurs with more regularity. The genus *Haemanthus* revealed the presence of 16 to 18 chromosomes in the somatic cells of different species. *Haemanthus* is characterised by bimodal karyotype which is typical of this genus and alien to other members of Amaryllidaceae. The genus has been supposed to be associated with the basic number of x=8 and x=9. Sato (1938) [11] based on karyomorphology of species with 2n=16 and 2n=18 concluded x=9 to be the derived condition from x=8 either by fragmentation of medium sized chromosomes or by duplication of a short chromosome. The currently studied 3 taxa are all diploids based on x=9. Their karyo morpho logical features mark its distinctness in the family Amaryllidaceae with the karyotype being dominated by chromosomes with a shift in centromere position towards the terminal region, resulting in ‘sm’, ‘st’ and‘t’ types of chromosomes. This together with appreciable intrakaryotypic size variations have made it highly specialised and asymmetrical one falling in the category (3C). Another pertinent feature was the high incidence of heteromorphism between members of the homologue in different taxa. In *H. kalbreyeri,* Patwary and Zaman (2014) [9] found karyotypic heteromorphicity among 2n=18 chromosomes; one long pair had a distinct difference in size. This incidence of heteromorphic chromosomes is generally regarded as the proof of existence of structural hybridity in the taxa. But with sexual reproduction being a distant possibility, the basis of structural hybrid is ambiguous. Sharma and Bal (1956) [12] suggested that it might be caused by chromosome duplication or deletion. Karyotypic heteromorphicity could also results from various types of chromosomal re-arrangements, some of which might readily be detected during meiosis. The importance of meiotic data to understand the exact nature and behaviour of chromosomes has also been mentioned by other workers (Khoshoo and Raina (1968) [6], Raina and Khoshoo (1971) [10]. However Lakshmi (1980) [7] recorded abnormal behaviour of meiotic chromosomes including non-synchronization and non-orientation of chromosomes on the metaphase plate and irregular anaphase segregation, formation of inversion and disjunction bridges *etc*. apparently reasons the high incidence of structural heteromorphism between homologous members resulting in intrakaryotypic variations.

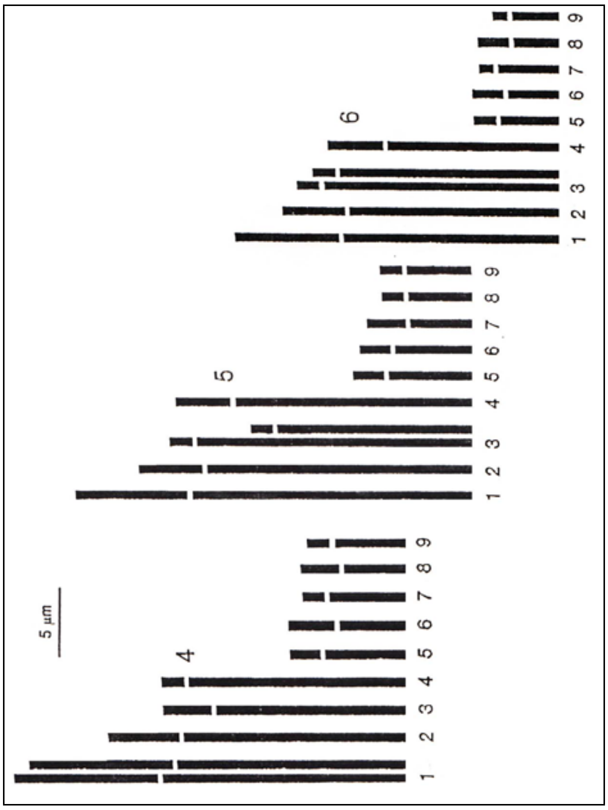
Table 1: Karyomorphological data on three taxa of H. multiflorus from South India



TAXON	KARYOTYPE FORMULA	TCL (µm)	ACL (µm)	TF%	KARYOTYPE CATEGORY (STEBBINS 1958)
H. multiflorus Martyn. (accession - I) Udagamandalam	2n = 18: 1 Am + 1 Asm + 4 Bst + 2 Bt + 4 Dm + 4 Dsm + 4 Dst	217.01	12.05	26.26	3C
H. multiflorus Martyn. (accession II) Kodaikanal	2n = 18: 2 Asm + 2 Ast + 1 Bt + 2 Bst + 1 Ct + 1 Dm + 5 Dsm + 4 Dst	229.50	12.75	22.44	3C
H. multiflorus Martyn. (accession III) Thiruvananthapuram	2n = 18: 2 Asm + 2 Bst + 2 Bt + 2 Cst + 4 Dsm + 2 Em + 2 Esm + 2 Est	187.00	10.38	24.59	3C

TCL - Total chromosome length of diploid complement; ACL - Average chromosome ength; TF% - (Total short arm length x 100)1 (Total long arm length x Total short arm length).

Fig 1-3: Somatic chromosomes of *Haemanthus multiflorus* (x1000). 1. H. multiflorus, accession I (2n=18), 2. Accession II (2n=18), 3. Accession III (2n=18).



Figs 4-6: Idiograms of the haploid complements of the three accessions of *H. multiflorus* 4. Accession I, 5. Accession II, 6. Accession III

Conclusion

The genus *Haemanthus* revealed the presence of 16 to 18 chromosomes in the somatic cells of different species and is characterised by bimodal karyotype which is typical of this genus and alien to other members of Amaryllidaceae. The genus is associated with the basic number of x=8 and x=9. This together with appreciable intrakaryotypic size variations have made it highly specialised and asymmetrical one falling in the category (3C). The high incidence of heteromorphism between members of the homologue in different taxa results from various types of chromosomal re-arrangements.

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