

## CYTOTAXONOMY OF *CHLOROPHYTUM INDICUM* (WILLD.) DRESS

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### ABSTRACT

*Chlorophytum indicum* (Willd.) Dress (Liliaceae) is one of the Western Indian species distributed from Rajasthan in the north to Kanyakumari in the south, chiefly along the Sahyadri hill ranges. Morphologically it closely resembles *C. bharuchae* Ans., Ragh. et Hem. as well as *C. consun* (Thunb.) Jacq. Present cytological studies, however, reveal its probable relationship with the latter alone. This is in confirmation with the earlier observations based on certain anatomical features.

### INTRODUCTION

*Chlorophytum indicum* (Willd.) Dress (= *G. attenuatum* (Wt.) Bak.) is a common Indian species extending from Rajasthan in the north to Kanyakumari in the south. It has been reported from Udai-pur (Agarwal *et al.*, 1971), Canara southwards to Coimbatore (Hooker, 1892; Fischer, 1928), "apparently endemic" in Bombay Presidency (Cooke, 1908), Nandi hills near Mysore (Thirumalachar *et al.*, 1949) and has been collected from Sinhagad near Pune (Personal collections) and Kanyakumari hills (B. S. I. Coimbatore collections). It has also been listed occasionally in European gardens (c.f. Dress, 1961). In spite of this wide occurrence, it has still remained rather imperfectly known in respect of its morphology as well as cytology. Hooker (1892) and Fischer (1928), for instance, described the an-

thers to be longer than papillose filaments. Cooke (1908) did not mention about papillose filaments. Perianth segments are described as either 3-nerved or 3-5 nerved by these authors. Further, even the capsules (or capsule cells ?) are described as 3-4 seeded.

Although there is a solitary report on cytology of this species (Sheriff & Chennaveeraiah, 1975), the authors have noted at least three distinct morphotypes with different chromosome numbers and karyomorphology, suggesting a complex nature of the species.

The present paper, therefore, attempts to provide information on various aspects of this species and attempts to clarify the situation as far as possible.

### MATERIAL AND METHODS

Adequate material of living plants of *G. indicum* was collected from Sinhagad

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near Pune and is grown in the Botanic Garden of Marathwada University, Aurangabad. Enough flowering and fruiting specimens have also been preserved in the departmental herbarium.

Flower buds from wild population as well as cultivated plants were fixed in acetic acid-alcohol (1 : 3) with 2-3 drops of  $\text{FeCl}_3$  as a mordant, for 24 hrs and squashed in aceto-carmin (1%). Root tips, pretreated with 8-hydroxyquinoline (0.002M), were squashed in aceto-orcein (1%).

Letters L (long), M (medium) and S (short) in the karyotype formula represent the relative lengths of chromosomes while the symbols *sm* (submedian) and *st* (subterminal) indicate centromeric position. Symbol *sc* stands for secondary constriction.

### OBSERVATIONS

**Morphology :** *C. indicum* is a small herb 20-40 cm tall, clothed with fibrous sheaths at base. Root fibres cylindric, fleshy without tubers. Leaves linear, 5-30  $\times$  0.6-1.0 cm, slightly narrowed at base and tapering into a fine point at apex, 15 to 20 nerved, shining above, rather glaucous beneath. Scapes about as long as the leaves, erect, naked, scabrid. Racemes simple, 10-15 cm long, 10-20 flowered. Bracts subulate-lanceolate, 3.5-4.0  $\times$  0.5-0.6 cm, 9-nerved; bracteoles 3; no. 1 = 0.7  $\times$  0.3 cm; no. 2 = 0.6  $\times$  0.25 cm; 3 = 0.4  $\times$  0.2 cm; all 2-nerved. Flowers white, ca 25 mm across; pedicels 8-9 mm long, jointed about the middle. Outer perianth segments oblong-lanceolate, 14  $\times$  3-4 mm, acute at apex, 3-nerved; inner ones oblanceolate, 14  $\times$  5 mm, obtuse at apex, 3-5 nerved. Stamens 11-12 mm long; filaments rather longer than the anthers, often smooth. Capsules globose, 6-8 mm in diam., obtusely

3-winged. Seeds 9-10, discoid, black (Fig. 1).

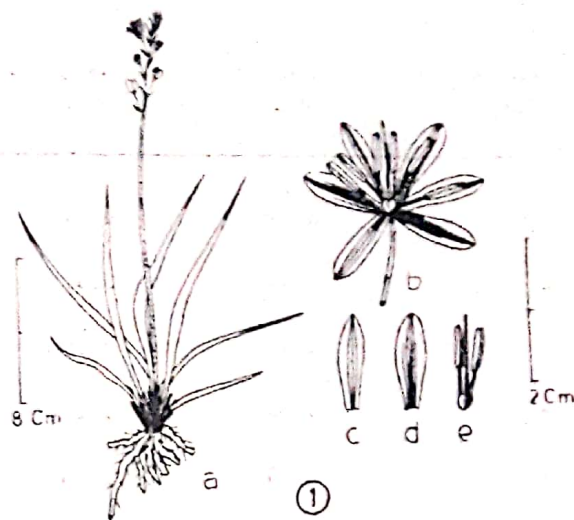


Fig. 1. *Chlorophytum indicum* (Willd.) Dress.  
a) Habit, b) Flower, c) & d) Outer and inner perianth segments, e) Stamens and ovary.

Frequent on slopes of hills. It flowers during June-July in northern parts and during August-September in south India. A fairly large percentage (ca 50-60%) of capsules develop viable seeds.

These features of external morphology closely resemble those of *G. bharuchae* Ans., Ragh. et Hem. as well as *C. comosum* (Thunb.) Jacq.

**Karyomorphology :** Root tip squashes revealed  $2n=28$  chromosomes (Fig. 2) which pertain to the following karyotype formula :

$$6L_{sm} + 8M_{sm} + 2M_{st} + 2M_{sm}^{*c} + 10S_{sm}$$

The karyotype is more or less symmetrical and indicates greater similarity between pairs IV & V; VI & VII; X, XI & XII and XIII & XIV, while pairs I, II, III, VIII and IX are quite dissimilar (Fig. 3). Absolute length of the karyotype is  $\pm 55.8 \mu\text{m}$ . Details of karyomorphology are presented in Table I.



TABLE I

KARYOMORPHOLOGICAL DETAILS IN *CHLOROPHYTUM INDICUM* (WILLD.) DRESS

Chromosome pair No.	Total length ( $\mu\text{m}$ )	Long arm ( $\mu\text{m}$ )	Short arm ( $\mu\text{m}$ )	L/S ratio	Centromere position
1	6.75	4.05	2.70	1.50	Sm
2	5.85	3.60	2.25	1.66	Sm
3	4.50	3.15	1.35	2.33	Sm
4	4.05	2.25	1.80	1.25	Sm
5	4.05	2.25	1.80	1.25	Sm
6	4.05	2.70	1.35	2.00	Sm
7	4.05	2.70	1.35	2.00	Sm
8	4.05	3.15	0.90	3.50	St
9	3.60	2.25	1.35	1.66	Sm(Sc)
10	3.15	1.80	1.35	1.33	Sm
11	3.15	1.80	1.35	1.33	Sm
12	3.15	1.80	1.35	1.33	Sm
13	2.70	1.80	0.90	2.00	Sm
14	2.70	1.80	0.90	2.00	Sm

**Chromosomal behaviour :** Most of the PMCs revealed 14 clear bivalents regularly at diakinesis (Fig. 4) while only a small (10-15%) but significant percentage of meiocytes indicated abnormal chromosomal behaviour. The most common abnormalities observed include, a) multivalent associations (Figs. 5, 6), b) unorientated bivalents at M I (Figs. 7-9), c) laggards (Fig. 10) and chromosome bridges at AI (Figs. 11, 12).

## DISCUSSION

The data available on the chromosome numbers in different species of *Chlorophytum* suggests that *C. indicum* should be considered at the tetraploid level with a basic chromosome number  $\times=7$ , for the genus. Further, the formation of multivalents together with a few bialents, other meiotic abnormalities and greater homology of certain pairs of

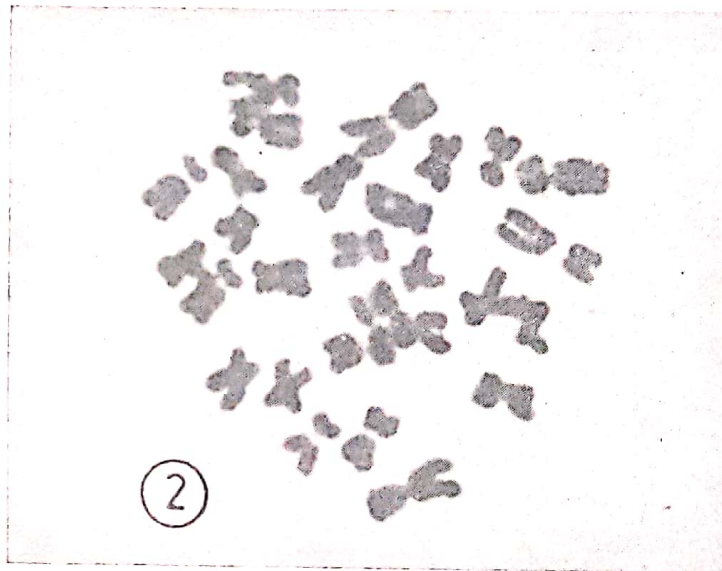


Fig. 2. Somatic metaphase showing 28 chromosomes.  $\times 1875$

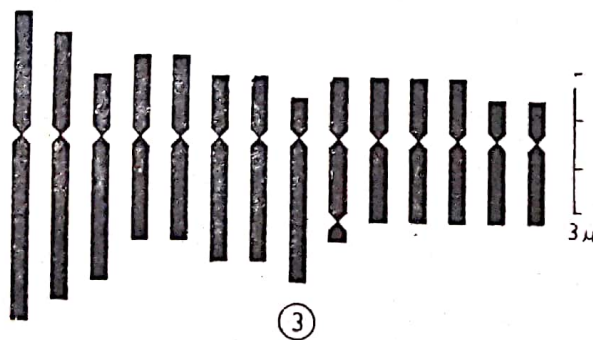
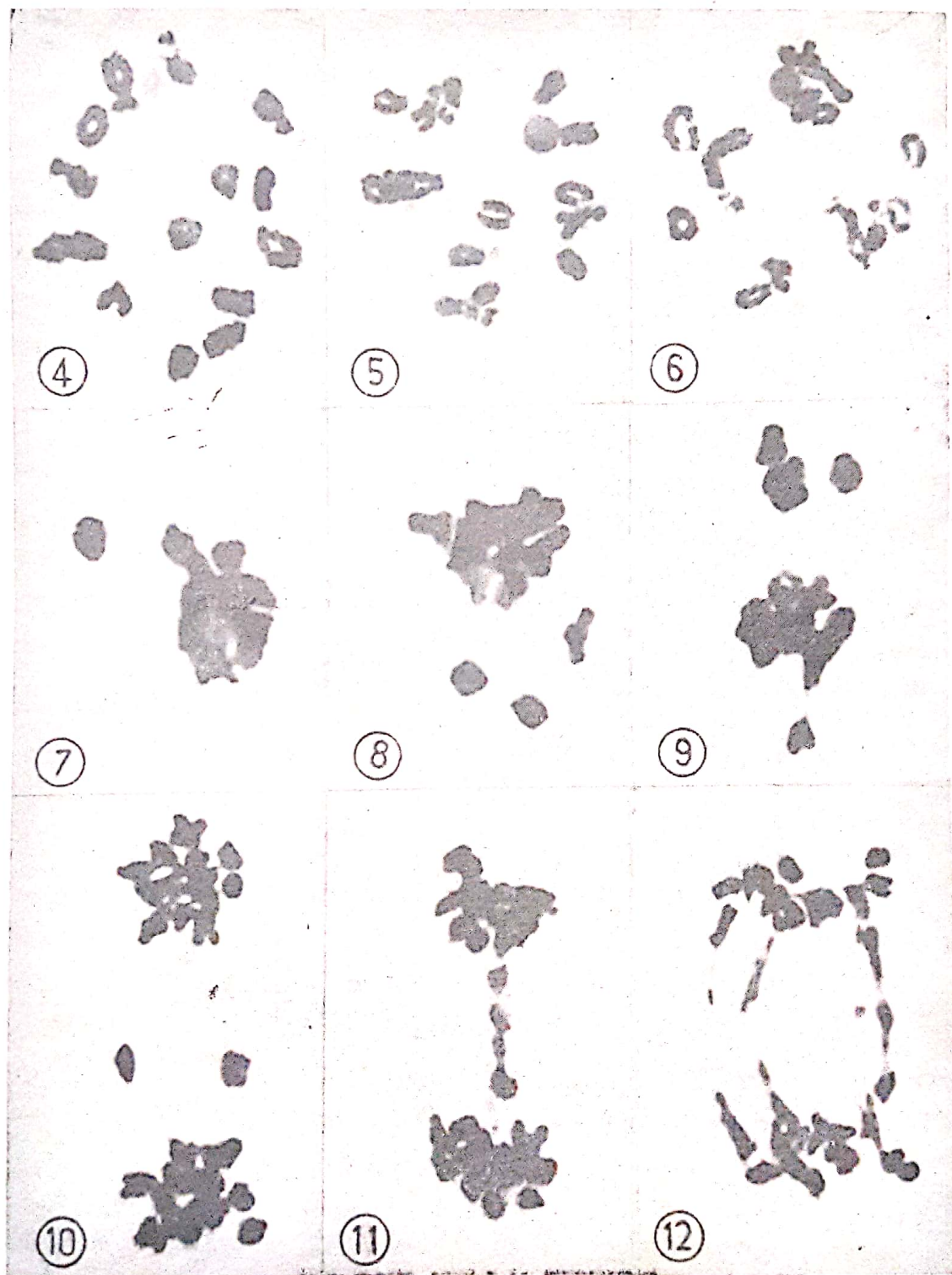


Fig. 3. Idiogram.



Figs. 4 to 12. Meiosis. Fig. 4. 14 bivalents at diakinesis. Fig. 5 & 6. Multivalents and bivalents at diakinesis. Figs. 7 to 9. Unorientated bivalents at M I. Fig. 10 Lagged bivalents at A I. Figs. 11 & 12. Bridges at A I. All  $\times 1800$



chromosomes strongly suggest that *C. indicum* is most probably, a segmental allotetraploid from some closely related unknown ancestors.

Sheriff and Chennaveeraiah (1975) reported a complex nature of this species based on their observations of three different populations. According to these authors, the three populations are not only morphologically distinctive but also have different chromosome numbers and/or karyomorphology. Two of them have  $2n=42$  chromosomes while the third has  $2n=84$  chromosomes and obviously none has  $2n=28$  as observed by the present authors. The species complex reported by these authors, therefore, needs confirmation.

Although there are many similarities in the external morphological features of three distinct species, namely *C. bharuchae*, *C. comosum* and the present species, they do not appear to be closely related to each other. Cytological and anatomical evidence strongly suggests that the present species is closely related to *C. comosum* rather than to *C. bharuchae* (Naik, 1974, 1977, 1980; Naik & Nirgude, 1981a, 1981b).

Incidentally, a note on the nomenclature of this species may not be out of place here. Hooker (1892), while using Baker's combination, *C. attenuatum* based on *Phalangium attenuatum* Wight for this species, considered it conspecific with *Ornithogalum indicum* Willd. If this is accepted then the latter, which has a priority over Wight's name must be considered basionym for the new combination. This was done by Kunth in the genus *Phalangium*, but this genus is now considered invalid. The new combination in *Chlorophytum* was proposed by

Dress which is followed here. The correct nomenclature thus, should be :

*Chlorophytum indicum* (Willd.) Dress in Bailey a(1) : 43. 1961.

*Ornithogalum indicum* Willd. in Schult. & Schult. Syst. Veg. 7 : 535. 1829. *Phalangium indicum* (Willd.) Kunth, Enum. Pl. 4 : 598. 1843. *P. attenuatum* Wt. Icon. Pl. Ind. Or. 6 : 21. t. 2037. 1853.

*Chlorophytum attenuatum* (Wt.) Baker J. Linn. Soc. 15 : 332. 1876.

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