

Diversity in Aneuploids of *Urginea indica* Kunth. Hyacinthaceae

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Abstract: *Urginea indica* is a morphologically variable species and differs both in vegetative and reproductive morphology. It is a perennial bulbous geophyte with fibrous roots. Five aneuploid accessions of *U. indica* were collected from different parts of Karnataka under standardized conditions and measured traits related to morphology, growth and phenology. The trait measurements revealed substantial phenotypic variations among the accessions. The morphometric studies were based on twenty parameters. The results obtained have shown that vegetative characters deviated significantly and also showed differences in ecological preferences. Differences were observed in reproductive characters. Variation in flowering and blooming time played a role in isolation of these accessions. The objective of the present study was to assess the diversity of *U. indica* in these five accessions. These morphological variations would be worth in recognizing them as a separate sub specific taxon.

Keywords: *Urginea indica*, morphometrics, accessions, aneuploids, vegetative characters

1. Introduction

Urginea is derived from the name Ben Urgin, a native ancient Arab tribe of Annaba (Bellakhdar, 1997). It is a perennial bulbous geophyte of family Hyacinthaceae now placed in Asparagaceae. It is abundantly found throughout the plains of India, frequently cultivated in the sandy soils of the sea shore in the deccan peninsula for its bulbs which are used in medicine. The hysteranthous geophytes are characterized by possessing perennial storage organs, a distinct flowering stem, onset of flowering proceeding leaf development in winter, seed dispersal immediately after flowering (Dafni *et.al.*, 1981). *U. indica* (Roxb) Kunth is native to India, Africa, and Mediterranean regions.(Gentry *et.al* 1987, Bruneton 1996, Bellakhdar 1997). A taxonomic revision of the genus have been made by Deb & Dasgupta (1977, 1981, 1983) and have recognized five species. Shiva kameshwari and Muniyamma(2004) revealed the presence of diploids, triploids, tetraploids, pentaploids and aneuploids in *U. indica*. The five species of Indian *Urginea* are grouped into two complexes, *U.indica* complex and *U.wightii* complex on the basis of their pollen morphology, karyotype, and hybridization behavior. These two groups were found to be evolving separately (Neetin Desai *et.al* 2012).

A perusal of the literature shows that different versions exist about the chromosome number and morphology of the species No critical work on morpho taxonomical studies has been carried out in the accessions of this species (Dixit and Yadav 1989). Although *U. indica* has been investigated for various parameters it has been found quite ignored in recording the accessions of the species throughout India. The findings in the present study has added significant information to existing data and hence proposing that the accessions of *Urginea* distributed throughout India has enormous variations In the present investigation, morphometric studies were assessed in 5 aneuploid accessions of *U. indica* (Roxb) Kunth.

The purpose of our study was to investigate the significant morphological differences that existed between the 5 accessions of *Urginea indica* (Roxb) Kunth. For resolving taxonomic misunderstandings morphological characters have the most important role in plant systematics, palynological, and anatomical characters can also be used to support the morphological characters. Ploidy plays an important role in delimiting the taxa.

2. Materials and Methods

In the present investigation 5 accessions of *U. indica* were collected from Basavanahalli, Ranganathittu, KRS Island, Karighatta and Biligiriranganahills, identified, and maintained in the germplasm at Department of Botany, Bangalore University, Bangalore. GPS data for all the 5 accessions were recorded (Table - 1) and Fig 1 (A – J).

Morphometrical studies of 5 accessions of *U. indica* were assessed based on 20 parameters like length of the bulb, leaf, flowering phenology that included length of the inflorescence, counting the number of flowers, length of perianth, androecium and gynoecium of the accessions periodically throughout the flowering period (March to May) and blooming time of the flowers. Morpho taxonomical characters were scored in 12 plants for each accession and 20 parameters were recorded for each accession for four consecutive years (Table 2).

Morphological parameters like time of leaf fall, renewal, length of the leaf, width of the leaf, number of leaves, length of the root, height of the plant, diameter of the bulb, phenological events like flowering and fruiting period were recorded. Leaf measurements were made using Image J software. Mature leaves were taken into consideration for measurements. Height of the plant included the total length of the bulb including inflorescence.

3. Results and Discussion

U. indica is an ideal material for the study of phenotypic plasticity and have shown considerable variations within the accessions. The present study provides statistical support for the recognition of 5 aneuploid accessions in *U. indica*. The common features observed in these accessions were the length of inflorescence, racemose type of inflorescence, presence of spurred bract, lax type of arrangement of flowers, reflexed perianth segments during blooming, yellow colored anthers, time of reproductive phase and the reticulate ornamentation on the pollen walls.

The accessions were collected from different habitats like crop fields, foot hills, river island, indicating the diversity and variations in the habitat. Variations were also observed in the number of leaves in each accession, size, length of vegetative parts and reproductive parts.

General morphological characters of *U. indica* under study are tabulated in Table 2 and are represented in Figs 1 (A – J). The morphological variations in these accessions of *U. indica* have been discussed taking 15 countable and 5 uncountable parameters into consideration. The morphometric data have been represented in Table 2 and graph (1 & 2).

In aneuploid group of *U. indica* accessions, the highest and least have been highlighted with respect to each parameter in Table 2. The assessment of morphological parameters among all the accessions gives a clear picture of variations within them and is also represented in the graphs. Among 5 aneuploid accessions of *U. indica* Karighatta (accession number 826, 755 MSL) reported highest quantitative value with respect to the parameters and the least has been reported in accession collected from K.R.S. Island (accession number 804, 747 MSL). All these results indicate genomic plasticity or instability.

The morphological traits showed a pronounced variation among accessions. Similar studies were reported by Yadav and Dixit (1990) in *Urginea* species. It is interesting to note that the flowering and blooming time varies in different accessions of *U. indica* which might have played an important role in speciation and evolution of different species (Shiva kameshwari 2010).

On the basis of blooming characters Waisel (1972) grouped coastal plants into two groups as night flowering and day flowering. Similar studies were made by Neetin Desai et.al 2012 in Indian *Drimia* species. In *U. indica* complex that includes diploids, triploids, tetraploids, pentaploids the accessions bloom at different times, like morning, afternoon evening and in night. This peculiarity attracted many scientists. This indicates that each accession in *U. indica* complex are reproductively isolated which do not allow gene flow between them. Aneuploids form night blooming group. Thus reproductive isolation through differences in time of blooming of flowers seems to be one of the important factor in separating the accessions of *U. indica*.

The 20 parameters used in assessing the accessions revealed substantial phenotypic variations among the accessions of *U. indica* complex. The results obtained have shown that

vegetative characters deviated significantly than reproductive characters, and also showed differences in ecological preferences.

According to Yadav & Dixit (1990) there is considerable degree of genetic and modificational plasticity which has prevented a satisfactory systematic differentiation at lower taxonomic level in *U. indica* species. Present studies indicate that there is satisfactory systematic differentiation based on the comparative morphometric and genotypic studies observed in aneuploid accessions of *U. indica*. The phenotype variation may be due to the chromosome compliments including the total length and genome size among the same ploidy levels and these variations support the systematic differentiation of *U. indica* accessions and a clear sub specific taxon rank can be given to few accessions like Karighatta (accession number 826) among aneuploids.

These morphological differences would be worthy in recognizing each accession as a separate sub specific taxon. It is revealed from the tables and graphs that morphometric parameters differ between accessions.

Since the accessions vary in their morphology it can be proposed as Morphotypes and Ecotypes due to prevailing ecological conditions in their natural localities. Morphological traits were useful for assessing the diversity and relationships in Indian Urgenoid *Drimia* species. The characters like length of the inflorescence, arrangement and number of flowers, and the ornamentation of the pollen wall can be used to delimit the accessions of *Urginea* and has proved in the present investigation. Further research in this area will be of great importance in accurately classifying this diverse group of geophytic plants.

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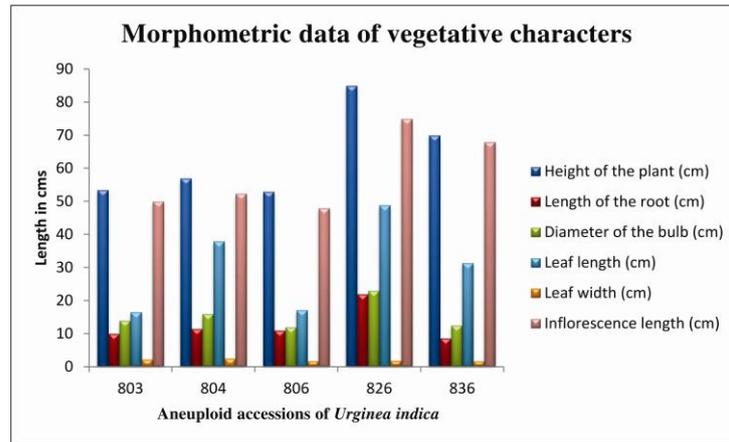
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Table 1: Distribution of *U. indica* (Roxb) Kunth. (GPS Data) for 5 accessions collected from 5 different localities of Karnataka

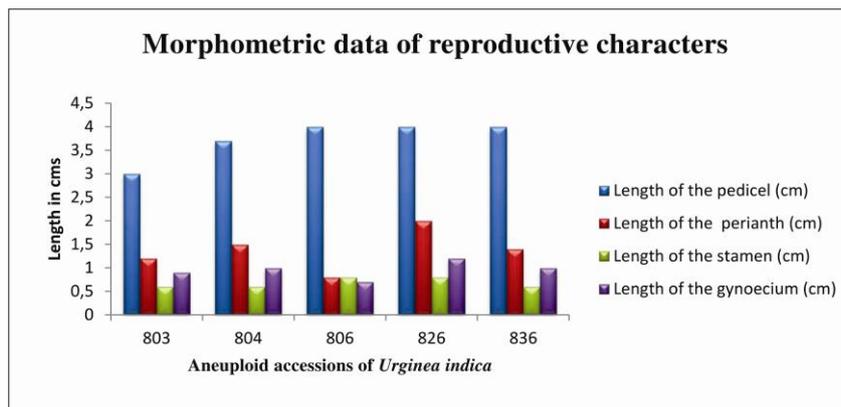
Sl no	Name of the accession	Accession number	GPS		
			Latitude	Longitude	Altitude (MSL) (m)
1	<i>Urginea indica</i> (Basavanahalli)	803	12.32431	76.586388	781
2	<i>Urginea indica</i> (Ranganthittu)	804	12.42502	76.653544	686
3	<i>Urginea indica</i> (KRS Island)	806	12.45709	76.496792	747
4	<i>Urginea indica</i> (Karighatta)	826	12.42473	76.719493	755
5	<i>Urginea indica</i> (Biligirirangana hills)	836	11.98790	77.157144	1182

Table 2: Comparative account of morphometric data of 5 accessions of *U. indica* (Aneuploids). **Highest** , **Least**

Sl No	Parameters	Accession number 803	Accession number 804	Accession number 806	Accession number 826	Accession number 836
1.	Habitat	Crop fields	River Island	River Island	Rocky area	Foot Hills.
1.	Height of the Plant (cm)	53.5	57	53	85	70
2.	Length of the Root (cm)	10	11.5	11	22	8.6
3.	Diameter of the Bulb (cm)	14	16	12	23	12.5
4.	Number of Leaves per Plant	5	10	3	8	7
5.	Leaf length (cm)	16.56 + 0.1	37.99 + 1.01	17.19 + 0.3	48.92 + 0.5	31.37 + 3.2
6.	Leaf width (cm)	2.23 + 0.05	2.52 + 0.1	1.7 + 0.06	1.82 + 0.1	1.69 + 0.06
8.	Inflorescence Length (cm)	50	52.4	48	75	68
9.	Number of Flowers per plant	12	6	5	11	10
10.	Blooming Time	Night	Night	Night	Night	Night
11.	Length of the Pedicel (cm)	3	3.7	4	4	4
12.	Length of the Perianth (cm)	1.2	1.5	0.8	2	1.4
13.	Length of the Stamen (cm)	0.6	0.6	0.8	0.8	0.6
14.	Length of the Gynoecium (cm)	0.9	1	0.7	1.2	1
15.	Length of the Fruit (cm)	1.2	1	0.8	1	1.2
16.	Inflorescence /Leaves	Hysteranthous	Hysteranthous	Hysteranthous	Hysteranthous	Hysteranthous
17.	Vegetative Phase	June - February	May - December	June -December	June-November	June - January
18.	Reproductive Phase	March - April	March - May	May - June	March - April	March - April
19.	Chromosome Number	32	34	38	34	36
20.	Ploidy	Aneuploid	Aneuploid	Aneuploid	Aneuploid	Aneuploid



Graph 1: Comparison of Morphometric data showing variations in aneuploid accessions of *U.indica*.



Graph 2: Comparison of Morphometric data showing variations in aneuploid accessions of *U.indica*.

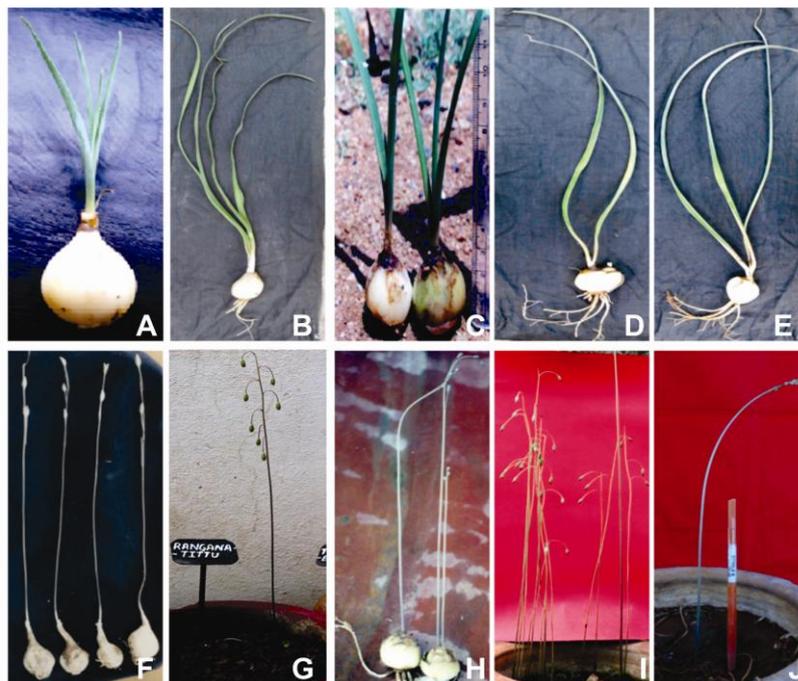


Fig 1: A - Vegetative phase of accession number 803. B - Vegetative phase of accession number 804. C - Vegetative phase of accession number 806. D - Vegetative phase of accession number 826. E - Vegetative phase of accession number 836. F - Reproductive phase of accession number 803. G - Reproductive phase of accession number 804. H - Reproductive phase of accession number 806. I - Reproductive phase of accession number 826. J - Reproductive phase of accession number 836.