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Morphometric studies in *Urginea indica* (Roxb) Kunth. Hyacinthaceae

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ABSTRACT

Urginea indica is a morphologically variable species and differs both in vegetative and floral characters. 7 diploid accessions of Urginea indica were collected from different parts of India 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 two characters. The results obtained have shown that vegetative characters deviated significantly and also showed differences in ecological preferences. Minor differences were observed in reproductive characters. Variation in flowering and blooming time also played a role in isolation of these accessions. These morphological differences would be worth in recognizing them as a separate sub specific taxon.

Key words: *Urginea indica, Morphometrics, accessions, vegetative characters.*

INTRODUCTION

The use of continuous morphological characters in taxonomy is traditionally contingent on the existence of discrete diagnostic characters. The purpose of our study was to investigate the significant morphological differences that existed between the 7 diploid accessions of *Urginea indica* (Roxb) Kunth. *Urginea indica* (Roxb) Kunth is a perennial bulbous geophyte native to India, Africa, and Mediterranean regions[1,2,7]. A taxonomic revision of the genus have been made by Deb & Dasgupta[3,4,5] and have recognized five species. Shiva kameshwari and Muniyamma[9] revealed the presence of diploids, triploids, tertaploids, pentaploids and aneuploids in *Urginea indica.* 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[6]. In the present investigation, morphometric studies of the taxa under investigation were assessed in 7 diploid 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.

MATERIALS AND METHODS

In the present study 7 accessions of *Urginea indica* were collected, identified, and maintained in the germplasm at Department of Botany, Bangalore University, Bangalore. GPS data for all the 7 accesssions were recorded (Table - 1).

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Morphometrical studies of 7 accessions of *Urginea indica* were assessed based on 22 parameters like flowering phenology that included length of the inflorescence, counting the number of flowers, length of the perianth, androecium and gynoecium of the accessions periodically throughout the flowering period (March to May), blooming time of the flowers, type of pollen wall ornamentation, was also assessed. Morpho taxonomical characters were scored in 12 plants for each accession and 22 parameters were recorded for each accession for four consecutive years (Table 2).

Phenology

Phenological events (time of leaf fall, renewal, length, width, area, perimeter of leaf, number of leaves, length of the root, height of the plant, diameter of the bulb, 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.

RESULTS AND DISCUSSION

Urginea 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 7 accessions in *Urginea 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 open fields, crop fields, foot hills, river island, indicating the diversity and variations in the habitat. Variations were also observed in the area, number of leaves in each accession, size, length of vegetative parts and reproductive parts.

General morphological characters of *Urginea indica* under study are tabulated in Table 2 and are represented in Figs 1 (A – C). 7 accessions of *Urginea indica* under investigations are diploids showing 2n = 20 chromosomes. The morphological variations in these accessions of *U. indica* have been discussed taking 12 countable and 10 uncountable parameters into consideration. The morphometric data have been represented in Table 2 and fig (A - C), and graph (1 &2). Among diploid accessions of *Urginea indica* ,it was found that there is no correlations in the parameters indicating, phenotypic variations are independent of genotypic variations.

In diploid group of *Urginea 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 1, & 2. Among 7 diploid accessions, Kashmir accession representing highest altitude 2910 MSL exhibited highest quantitative values and is prominent while the least have been noticed in Kushalanagar (accession number 801) with an altitude of 843 MSL. This indicates that the taxa are known for phenotypic and genotypic plasticity.

The morphological traits showed a pronounced variation among accessions. Similar studies were reported by Yadav and Dixit[11] in *Urginea.*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[10].

In *U. indica* complex 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. Accessions that bloomed during night were unable to set seeds even after artificial pollination. Thus reproductive isolation through differences in time of blooming of flowers seems to be one of the important factors in separating the accessions of *Urginea indica.*

On the basis of blooming characters Waisel[12] grouped coastal plants into two groups as night flowering and day flowering. Similar studies were made by Neetin Desai *et al*[8]., in Indian *Drimia* species.

Pollen grains vary in different species of *Urginea.* The pollen grains with fine coarse reticulate ornamentation are common in *U. indica* species and in family Hyacinthaceae. This has been proved in the present study in *U. indica* complex.

According to Neetin Desai *et al*[8]., Indian *Drimia (Urginea)* species cannot be distinguished on the basis of their pollen morphology as they have more similarity than differences. In the present investigation reticulate ornamentation was observed in *U. indica* complex and perforated ornamentation in *U. wightii* complex.

The 22 parmeters 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[6] there is considerable degree of genetic and modificational plasticity which has prevented a satisfactory systematic differentiation at lower taxonomic level in *Urginea indica* species. Present studies indicate that there is satisfactory systematic differentiation based on the comparative morphometric and genotypic studies observed in diploid accessions of *Urginea indica*. The genotypes of these accessions are constant and are an independent variable, while the phenotype characters vary which is a dependent variable on genotype. 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 *Urginea indica* accessions and a clear sub specific taxon rank can be given to few accessions like Kashmir among diploids.

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. 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 this investigation. This study differentiated all the accessions of *Urginea indica*, identified in diploids considering 22 morphological traits and can be used for further characterization of *Urginea* accessions.

Table 1: Distribution of *Urginea indica* (Roxb) Kunth.

S.No.	Locality	Accession Number	Latitude	Longitude	Altitude(MSL) (m)
1.	Kushal Nagar (Karnataka)	801	12.460228	75.90839	843
2.	Shivamogga (Karnataka)	802	13.92993	75.568101	588
3.	Tiruchendur (Tamil nadu)	819	8.496308	78.125085	11
4.	RamanagaraAnkanahalli, (Karnataka)	835	12.832309	77.257757	808
5.	Sitampundi Namakkal (Tamil nadu)	846	11.237435	77.9074761	166
6.	Kanakapura (Karnataka)	849	12.546244	77.19882	639
7.	Gulmargh (Kashmir)	852	34.041603	74.370477	2910

(**GPS Data)** for 7 accessions collected from various localities of India with details of Latitude, Longitude and Altitude.

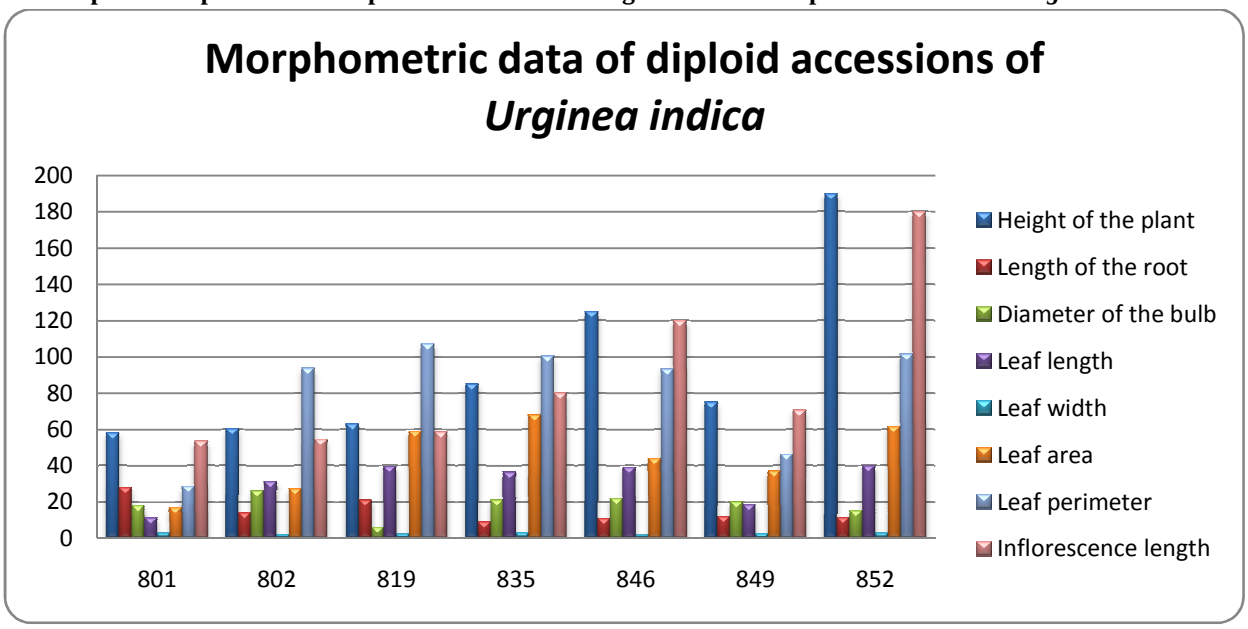
Table 2: Comparative account of morphometric data of *Urginea indica* accessions (Diploid).

S.No.	Parameters	Accession number 801	Accession number 802	Accession number 819	Accession number 835	Accession number 846	Accession number 849	Accession number 852
1.	Height of the plant (cm)	58	60.5	63	85	125	75	190
2.	Length of the root (cm)	28	14	21	9	11	12	11.5
3.	Diameter of the bulb(cm)	18	26	6	21	22	20	15.3
4.	Number of leaves per plant	14	9	8	7	9	9	12
5.	Leaf length (cm)	11.27	31.21	39.71	36.32	39.17	18.57	39.94
6.	Leaf width (cm)	2.81	1.99	2.31	2.96	1.85	2.59	2.93
7.	Leaf area ($cm^{2)}$	16.97	27.27	58.96	68.04	43.89	37.03	61.66

8.	Leaf perimeter (cm)	28.61	93.76	107.18	100.47	93.25	46.35	101.40
9.	Inflorescence length (cm)	53.5	54.5	58.5	80	120	70.6	180
10.	Type of inflorescence	Racemose & lax	Racemos e& lax	Racemose & lax	Racemose & lax	Racemose & lax	Racemose & lax	Racemos e&lax
11.	Number of flowers per plant	22	9	22	16	15	8	10
12.	Blooming time	Night	Day, Forenoon	Night	Evening	Night	Evening	Night
13.	Length of the pedicel (cm)	3	1.5	2	2	4.3	2	6.2
14.	Length of the flower (perianth) (cm)	1.5	0.7	1.2	2.9	1.2	0.7	1.3
15.	Length of the stamen (cm)	0.7	0.5	0.6	0.5	0.7	0.6	0.8
16.	Length of the gynoecium (cm)	0.9	0.7	0.9	0.7	0.8	0.8	1.2
17.	Length of the fruit (cm)	1.3	0.7	0.8	No Fruit setting	1.3	No fruit setting	1.5
18.	Inflorescence/ Leaves	Hysteranth ous	Hysteran thous	Hysteranth ous	Hysteranth ous	Hysteranth ous	Hysteranth ous	Hysterant hous
19.	Vegetative phase	June - October	June - January	June - March	June - February	June - February	June - July	April - October
20.	Reproductive phase	March - April	March - April	March - April	March - April	March - April	March - April	March - April
21.	Chromosome number	20	20	20	20	20	20	20
22.	Ploidy	Diploid	Diploid	Diploid	Diploid	Diploid	Diploid	Diploid

HighestLeast

Graph1: Comparison of Morphometric data showing variations in diploid accessions of *Urginea indica*



Graph 2: Comparison of Morphometric data showing variations in diploid accessions of *Urginea indica*

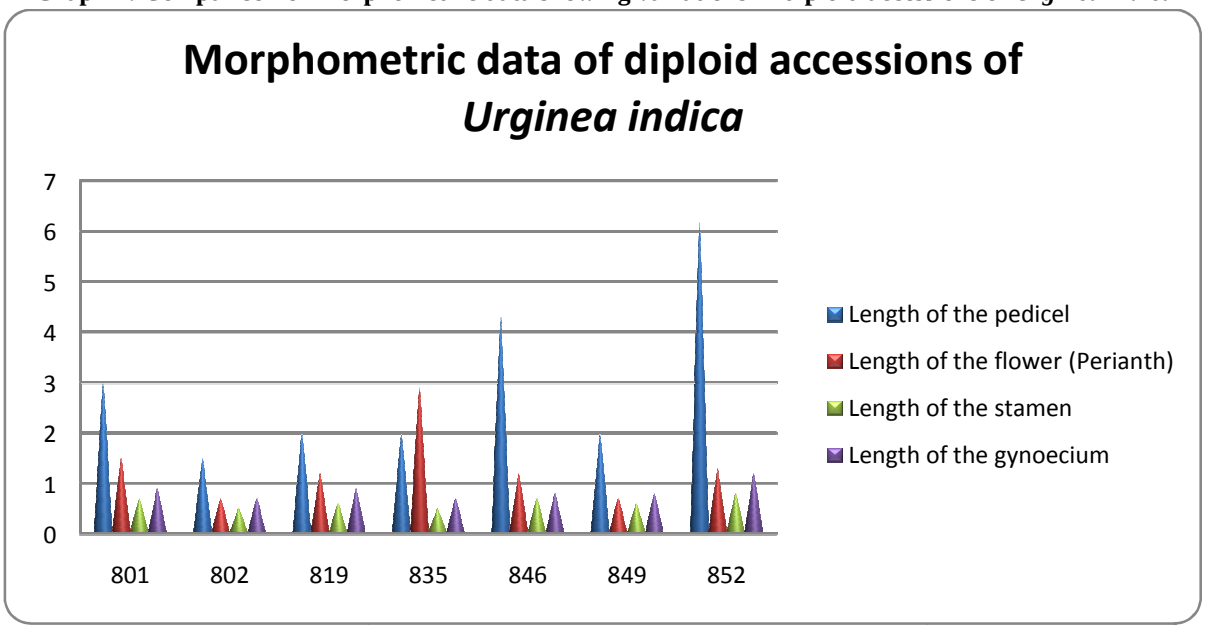


Fig 1. A – C.

A. Vegetative phase of diploid accession of *Urginea indica*. **B.** Reproductive phase of diploid accession of *Urgineaindica.* **C.** Single Flower of diploid accession of *Urginea indica*
(Accession number 801 - Kushalanagara)

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