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Karyotype analysis of a wild medicinal plant *Urginea indica* Kunth

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Abstract : The planet earth is endowed with a variety of living creatures including floras and faunas. All the faunas are dependent upon floras for their nutritional requirements in one or the other way. Plants provide food and are used for medicinal purposes by human beings. Plants have been used for medicinal uses since time immemorial. Most of the local people and tribal of India are still dependent on medicinal plant resources for treatment of various ailments. Identification and utility of these plant resources not only help to keep them healthy but also fulfill their nutritional needs.

Urginea indica Kunth. is one such wild plant of family Liliaceae called as Van piyaz having high therapeutic value. It is an uncultivated bulbous herb and is distributed in Mediterranean region, Asia and Africa. In India, nine species of *Urginea* are seen commonly. It is commonly called Van piyaz. It is used chiefly as a powerful expectorant in the treatment of cough, especially in chronic bronchitis and asthma. The alcoholic extract of the bulbs possesses anticancer activity. They are used to cure dropsy, rheumatism, skin troubles and are used to remove warts and corns. *Urginea indica* is the medicinal plant with considerable morphological variations, although the chemical properties of the different varieties show minor variations. This species have been extensively studied cytologically, but the taxonomic identity of each of the species of *Urginea* needs reconsideration on the basis of cytology. The present investigation, therefore, deals with the detailed karyotype analysis of the two varieties of *Urginea indica* Kunth. collected from Ranchi, Jharkhand. The karyotype of *Urginea indica* under investigation was highly asymmetrical with $2n=20$ chromosomes. The chromosome size ranged from very long to very short.

The cytological characters of the two varieties of *Urginea indica* will be used to characterize the karyotype of plants and define the taxonomic difference between them.

Keywords: Karyotype, *Urginea indica*, medicinal plant.

INTRODUCTION

Plants have been used as medicines for curing various ailments since time immemorial. They play an important role in human health care. Mostly the local people of India are still dependent upon plant resources for treatment of various ailments. They use a number of wild plants which are commonly available in and around their habitat and also cultivate such plants in their agricultural fields. Unfortunately, use of such medicinal plant is restricted to particular communities due to unawareness. These wild

plants are significant for having some active constituents for further pharmaceutical analysis.

Urginea indica Kunth. (Liliaceae) is also an economically important wild plant having high therapeutic potential. It has high free radical scavenging activity. It refers to an uncultivated species growing in the wild and used worldwide as cardiac drug. This species was introduced in Australia and North America, where it became invasive species¹. It is commonly called as Indian squill or van piyaz. It is largely used as an expectorant, cardiac stimulant, in treating rheumatism, dropsy, endema, gout, asthma, and as an anticancer agent. It is chiefly used in chronic bronchitis².

The bulbs of squill are employed as a DE obstructant in indigenous medicine. Externally they are used to remove

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warts and corns and to relieve burning sensation in the soles of feet.

The genus, *Urginea* as a whole is well characterized on the basis of morphology and chromosome structure. Chromosome study is a veritable tool in the understanding of genetic relationship and evolutionary development in the species of the same genus. The number, size and shape of chromosomes are used to characterize the karyotypes of plants and define the taxonomic differences between them.

Although this genus has been extensively studied cytologically by many authors, *Urginea indica* were not subjected to any of mitotic studies in Ranchi, Jharkhand. Therefore, the present investigation deals with the detailed karyotype analysis of the two varieties of *Urginea indica* collected from Ranchi, Jharkhand, to gain insight into their cytogenetic structure and evolutionary relationships.

MATERIALS AND METHODS

The two varieties of *Urginea indica* Kunth. were collected from Ranchi, Jharkhand and brought into cultivation. Root tips (1-2cm long) were collected and pretreated with saturated solution of Para dichlorobenzene for 4-5 hours before fixing them in fixative solution (1:3 acetic alcohol) for 24 hours. They were then hydrolyzed in 1 N HCl for 10 minutes, stained with 2% acetocarmine and slides were prepared by squash techniques.

Well spread metaphase plates were selected and lengths of long arm (LA) and short arm (SA) were measured for karyotype analysis.

The two varieties of *Urginea indica* Kunth. were distinguished on the basis of color of bulbs:

1. *Urginea indica* Kunth. White bulb variety, V_1
2. *Urginea indica* Kunth. Brown bulb variety, V_2

Types of chromosomes were identified and classified according to Abraham and Prasad (1983)³. The total form percent (TF%) i.e. the average degree of symmetry over the whole karyotype was calculated according to Huziwara (1962)⁴.

RESULT AND DISCUSSION

Both the varieties of *Urginea indica* Kunth. under study were diploid, showing $2n=20$ and $n=10$ chromosomes. Normal mitotic divisions were observed in all the examined cells. Neither secondary constrictions nor the satellites were observed. Karyotype analysis including chromosome number, arm ratio, total complement length, relative length, form per cent, total chromatin index and karyotype formula for both the varieties are depicted in Table 1. Total form percentage, gradient index, symmetry index and disparity index were also calculated (Table 2). Karyotypic differences were observed between the two varieties of *Urginea indica* Kunth. with regard to chromosomal morphology and chromosomal length. Chromosomes of *U. indica* Kunth. White bulb variety (V_1) falls in two groups: nearly median and sub median (-), while that of *U. indica* Kunth. Brown bulb variety (V_2), falls in three groups: nearly median, nearly sub median (-) and nearly sub median (+). Chromosome lengths of the two varieties also varied. The karyotype formulae of both the varieties of *Urginea indica* revealed that both of them had asymmetric karyotype and the taxa with asymmetric karyotype tends to have low total form percentage (Huziwara, 1962), as in the two varieties of *U. indica* under study.

The study of karyotype is of great importance in modern taxonomy, as chromosome is a stable and definite species character. Jones and Smith (1967) contented that the study of karyotype is particularly rewarding in such families as the Liliaceae, where large chromosomes and frequent bimodality in size within complements, makes possible the determination of the progress of chromosome change and its consequences⁵.

Therefore, karyotypic investigation would not only indicate principal features of evolution within the species but may also lead to exploitation of certain distinct genotypes for commercial purposes⁶.

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Table1: Cytotaxonomical data of two varieties of *Urginea indica* kunth.

| variety | Chromosome number | Arm length | | Chromosome length (μ) | Arm ratio | R. L. (μ) | F% | TCI | Classification |
|----------------|-------------------|--------------------|---------------------|-----------------------------|-----------|-----------------|-------|-------|----------------|
| | | Long arm (μ) | Short arm (μ) | | | | | | |
| V ₁ | 1 | 6.00 | 3.48 | 9.48 | 1.82 | 100 | 36.70 | 15.01 | nsm(-) |
| | 2 | 5.40 | 3.36 | 8.76 | 1.59 | 92.40 | 38.35 | 13.87 | nm |
| | 3 | 4.80 | 2.88 | 7.68 | 1.73 | 81.01 | 37.50 | 12.16 | nsm(-) |
| | 4 | 4.32 | 3.12 | 7.44 | 1.43 | 78.48 | 41.93 | 11.78 | nm |
| | 5 | 3.72 | 3.12 | 6.84 | 1.21 | 72.15 | 45.61 | 10.83 | nm |
| | 6 | 3.60 | 2.52 | 6.12 | 1.44 | 64.55 | 41.17 | 9.69 | nm |
| | 7 | 3.36 | 2.16 | 5.52 | 1.60 | 58.22 | 39.13 | 8.74 | nm |
| | 8 | 3.00 | 1.56 | 4.56 | 2.35 | 48.10 | 39.39 | 7.22 | nsm(-) |
| | 9 | 2.40 | 1.56 | 3.96 | 1.80 | 41.77 | 39.39 | 6.27 | nsm(-) |
| | 10 | 1.80 | 0.96 | 2.76 | 1.90 | 29.11 | 34.78 | 4.37 | nsm(-) |
| V ₂ | 1 | 4.16 | 2.08 | 6.24 | 3.04 | 100 | 33.33 | 15.67 | nsm(+) |
| | 2 | 3.88 | 1.95 | 5.85 | 2.60 | 93.75 | 33.33 | 14.69 | nsm(-) |
| | 3 | 3.64 | 1.69 | 5.33 | 2.35 | 85.41 | 31.70 | 13.38 | nsm(-) |
| | 4 | 2.86 | 1.75 | 4.61 | 1.70 | 73.87 | 37.96 | 11.57 | nsm(-) |
| | 5 | 2.64 | 1.56 | 4.20 | 1.75 | 67.30 | 37.14 | 10.54 | nsm(-) |
| | 6 | 2.58 | 0.91 | 3.49 | 3.13 | 55.92 | 26.07 | 8.76 | nsm(+) |
| | 7 | 2.22 | 1.04 | 3.26 | 2.50 | 52.27 | 31.88 | 8.19 | nsm(-) |
| | 8 | 1.94 | 0.91 | 2.86 | 2.40 | 45.89 | 31.77 | 7.19 | nsm(-) |
| | 9 | 1.56 | 0.78 | 2.34 | 2.20 | 37.50 | 33.33 | 5.87 | nsm(-) |
| | 10 | 1.04 | 0.61 | 1.65 | 1.74 | 26.53 | 37.19 | 4.15 | nm |

Table2: Data related to karyotype of two varieties of *Urginea indica* kunth.

| Varieties | TF% | GI | SI | DI |
|----------------|-------|-------|-------|-------|
| V ₁ | 39.16 | 29.11 | 64.37 | 54.90 |
| V ₂ | 33.36 | 26.53 | 50.07 | 33.26 |

Karyotype formulae:

V₁: 5nm+5nsm(-)

V₂: 1nm+7nsm(-)+2nsm(+)

V₁=V₂=2n=2x=20

V₁: *Urginea indica* Kunth. White bulb variety

V₂: *Urginea indica* Kunth. Brown bulb variety

R.L. Relative Length

F% form per cent

T.C.I. Total chromatin index

nm: nearly median

nsm: nearly sub median

TF% Total form per cent

GI: Gradient Index

SI: Symmetry Index

DI: Disparity Index

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