



Topic : Polyploidy breeding in *Urgenia indica* - To study the effect of colchicines treatment on morphological character of *Urgenia indica*

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INTRODUCTION

The genus *Urginea* is a bulbous perennial herb having wide distribution throughout the world (Desai, 1999). The species of *Urgenia indica* is wide spread in the Old world tropics & subtropical areas, Africa, Southern India (Thiselton-Dyer, 1898). *Urgenia indica* (Indian squill or true squill) is commonly wide spread through India. It is having tunicated bulb & is commonly called 'Kolkanda', 'Rankanda' or 'Jangali Piyaz' etc. (Deb and Dasgupta, 1974).

The bulbous of *Urgenia indica* are rounded, conical or pear shaped and about the size of an onion. They are whitish in colour and tunicate, the fleshy scales completely enveloping one another.

Bulb of *Urgenia indica* is used as medicine (www.usphormouit.com). Vinegar of *Urginea*, Oxymel of *Urginea*, Compound *Urginea* are prepared from *Urginea* (www.emedicine.com). Bulb powder is mucilaginous in nature and many times used extensively to check skin diseases. The powder has good adhesive properties and its 3 % solution in water can be used as a paper paste. (Desai, 1999).

Mutation is one of the means for inducing variability. (Chandrashekrana and Parthasarathy, 1975). Induction of polyploidy is one of the means to induce variability. Colchicines is chemical agent widely used to induce polyploidy.

Colchicine treatment is accepted as source of induction of polyploidy during last many years by breeders such as banana (Baziran and Ariffin, 2002), Grapes (Heinz and Mee, 1970), Alocasia (Thao et al, 2003), Rhododendron (Eeckhout et al, 2002), Cyclamen (Takamura and Miyajima, 1996) Ichizaka and Vemastu, 1994).

An attempt is done to study the induction of polyploidy in *Urgenia indica*. The research effort further

extended to study the effect of colchicines on morphology of *Urgenia indica*.

Induction of polyploidy may affect the morphology of *Urgenia indica*. It may help in improvement in germination rate, growth rate and increase in size of bulb of *Urgenia indica*. The polyploidy mutant with positive morphological changes can be used to develop new improved variety.

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MATERIALS AND METHODS

Dormant *Urginea indica* bulbs were collected from sea shore sand natural habitat. Thoroughly washed bulbs were kept in aquaculture and sand culture. In aquaculture, water is used as control and 0.25 % colchicines aqueous solution is used as mutagen. In sand culture, bulb are grown in sand (acid washed and aqua washed) with water as control

and 0.25 % colchicines aqueous solution as mutagen. Control and treatment is in two replicas (each replica with 5-15 bulbs). The dose of Colchicine is fixed randomly.

Control and Colchicine treated bulbs were studied for the parameters as germination percentage, rate of growth in terms of root length, number of roots per bulb, plant height and chlorophyll content. The chlorophyll estimated was followed by

Arnon (1949). Statistical tool called 't' test (Gossette, 1908) was applied to test the significance of the Colchicines treatment on morphological, growth parameter. Following formulae are used to obtain test of significance

$$t = \frac{X_1 - X_2}{SE_D}$$

Here, X_1 = mean of control

X_2 = mean of Colchicine treatment

SE_D = standard Error of difference between two means.

To obtain SED, SE of each mean is calculated with the help of following formula –

$$S.E = \frac{6}{N} \sqrt{\frac{1}{N_1} + \frac{1}{N_2}}$$

To obtain the following '6', the following formula is used –

$$6 = \sqrt{\frac{X_1^2 + X_2^2}{N_1 + N_2 - 2}}$$

Calculated 't' compared with table 't' value at (N-2 d.f, 0.01 level) for finding the significance of Colchicine treatment over control.

The germination percentage and rate of growth in terms of root length and number of roots per bulb were studied on 15th day after germination of control and treated bulbs. The plant height and total chlorophyll content were determined on 45 days.

There were two replicas of five bulbs each of control and colchicines treated bulbs for aquaculture. There were two replicas of ten bulbs each of control and colchicines treated bulbs for sand culture while two replicas of 15 bulbs for study of plant height and chlorophyll content in sand culture up to 45 days.

RESULTS AND DISCUSSION

Photograph I shows germinating bulbs of control and colchicines treatment of *Urgenia indica* after 15 days. The photograph shows bulbs growth in aquaculture and in sand culture, along with germination and root growth.

Photograph II depicts germinating bulbs of control and colchicines treatment of *Urgenia indica* after 45 days. The photograph reveals height of bulbs in sand culture along with chlorophyll content.

Germination percentage and rate of growth in terms of length of roots and number of roots per bulb in

control and colchicines treated *Urgenia indica* is shown in Table I.

Table I - Effect of Colchicines chemical on germination and growth on *Urgenia indica*.

Treatment	Germination in Percentage		Rate of Growth			
	Aqua Culture	Sand Culture	Av. length of root in cm		Av. no. of roots per bulb	
			Aqua Culture	Sand Culture	Aqua Culture	Sand Culture
Control	98.3±0.22	96.7±0.16	6.81 ±0.50	6.7 ± 1.4	10 ± 0.52	8.9 ± 0.48
Colchicine	80.2 ±0.28	76.5 ± 1.2	5.2 ± 0.83	4.7 ±1.03	6.3 ± 0.49	5.6 ± 0.73

Table 2 Test of significance for Colchicine treatment in *Urgenia indica*.

Morphological growth parameter	Calculated 't' value	Table 't' value	Inference
Germination in aquaculture	6.733	4.541 (3d.f. at 0.01 level)	Significant
Germination in sand culture	3.148	2.896 (8d.f. at 0.01 level)	Significant
Root length in aquaculture	5.192	4.541 (3d.f. at 0.01 level)	Significant
Root length in sand culture	4.105	2.896 (8d.f. at 0.01 level)	Significant
Root number in aquaculture	4.936	4.541 (3d.f. at 0.01 level)	Significant
Root number in sand culture	3.248	2.896 (8d.f. at 0.01 level)	Significant

Table 3 Effect of Colchicine treatment on morphological characters of *Urgenia indica*.

Treatment	Plant height after 45 days of germination in sand culture (cm)	Chlorophyll content (mg/100g fresh leaves)
Control	38.8 ±1.64	88.00
Colchicine	39.2 ± 0.95	87.80

Table 4 Test of significance for Colchicine treatment on morphological characters of *Urgenia indica*.

Morphological growth parameter	Calculated 't' value	Table 't' value	Inference
Plant height after 45 days of germination	1.461	2.650 (13d.f. at 0.01 level)	Non significant
Chlorophyll content	2.032	2.650 (13d.f. at 0.01 level)	Non significant

Table -2 shows the result of test of significance of Colchicine treatment on germination, root length and number of roots of *Urgenia indica* bulbs.

From the Table -1, it is clear that germination is less in Colchicine treated bulbs. The Colchicines treated aquaculture and sand culture shows about same effect.

From Table 2- shows the effect of Colchicines

treatment on germination, root length and number of roots is significant. It means due to Colchicine treatment there is considerable decrease in germination, root length, number of roots over the control. Escandon et.al.(2003) also found that *Bacopa monnieri* plant showed significant differences in size and colour both in leaves and flowers in colchicine treated plants compared to untreated controls. Escandon et.al. (2005) with *Scoparia montevidensis*,

Observed under in vitro conditions between the control and the colchicine treated plants that treated plants grew less compared to the controls. In this investigation also the treated bulbs of *Urgenia indica* shows less growth as compared to the controls.

From Table 3-, it is clear that plant height after 45 days of germination is 38.8 cm in control while 39.2 cm in colchicine treated plants. The chlorophyll contents are 88.0 mg and 87.80 mg per 100 gm fresh leaves in control and Colchicine treated plants respectively. The effect of Colchicine seems to be nil on plant height as well as chlorophyll content in *Urgenia indica*.

Table 4 further confirms the results by statistical application of significance. Test of significance shows that there is no significant effect of Colchicine treatment on plant height and chlorophyll content. Ghosh (1949) observed that plants grown from Colchicine treated seeds and seedlings shown increased height over that of control.

In present research, the effect of Colchicine on plant height of *Urgenia indica* is neither positive nor negative. There is no significant effect on height in treated bulbs with compared to control.

According to Thao (2003), Jaskani et.al. (2005) and Mensah et.al. (2007), Colchicine treatment influences chlorophyll content. Almiri et.al.(2010) observed there is significant relation between Colchicine treatment and Chlorophyll content. In present studies, there is no any significant change in chlorophyll content in Colchicine treated bulbs over control.

The results and discussion suggested that in *Urgenia indica* that aquaculture and sand culture of

Colchicine treated bulbs shows no difference in result. Colchicine treated bulbs shows decrease in germination, root length and root number parameters. Colchicine treated bulbs shows no effect on plant height and chlorophyll content. According to Andrea et.al (2006), there is relationship between dose of Colchicine and effect in plant is very important. He further found that Colchicine treatment to be effective only if affecting spindle function. The present investigation also agrees with Andrea et.al (2006). Further investigations also are necessary to discover the biological dose of Colchicine to induce mutation in *Urgenia indica*.

Trial and error is the best method. The best concentrations of Colchicine to detect by number of experiments.

REFERENCES

- ✎ Andrea, B.; Schiff, S. and Mori, B. 2006. Effect of Colchicine in *Cichorium intybus* L. *Caryologia*. 59 (3) : 284-290.
- ✎ Amiri, S. ; Kazemitabaar, S.K. ; Ranjbar, G. and Azadbakht, M. 2010. The effect of trifluralin and Colchicine treatments on morphological characteristics of jimsonweed. *Trakia Journal of Sciences*. 8(4): 47 - 61.
- ✎ Arnon, D. I. 1949. Copper enzyme in isolated chloroplast. Polyphenol oxidase in *Beta vulgaris*. *Plant Physiol*. 24: 1-15.
- ✎ Baziran, N and Arifin, S. 2003. The progress and potentials of mutation induction in vegetatively propagated plants in Malaysia. Malaysian Institute for Nuclear Technology Research (MINT). Available from internet: <http://www.fnca.ip/english/fnca/main.html>.
- ✎ Chandrasekharan, S.N and Parathasarathy, S. V. 1975. Cytogenetics and plant breeding. P. Varadachary and Co. 3rd edition. pp 152
- ✎ Deb, D. B and Dasgupta, S. 1974. Revision of the genus *Urginea*. *Bull. Bot. Survey India*. 16 (1-19) :

116 124.

- ✎ **Desai , N. S . 1999 .** Cytogenetical studies in Indian *Urginea* species . Ph.D thesis submitted to Shivaji University , Kolhapur . pp . 41 .
- ✎ **Eeckaut , T . ; Samsyn , G . and Van E . 2002 .** In Vitro polyploidy induction in *Rhododendron simsii* hybrids . *Acta Horticulturae* . **572** : 43 49 .
- ✎ **Escandon , A.S . ; Ferrari , P . ; Facciuto , G . ; Soto , S . ; Hagiwara , J. C and Acevedo , A .** Combinacion de tecnicas in vitro y ex vitro para la micropropagacion de Santa Rita (Hibr) . Una arbustiva de relevancia ornamental . *Revista de investigaciones Agropecuaria* **32** : 111 122 .
- ✎ **Escandon , A. S . ; Miyajima , L . ; Alderete , M . ; Hagiwara , J. C ; Facciuto , G . ; Mata , D . and Soto , S . 2005 .** In vitro Colchicine treatment to obtain a new cultivar of *Scoparia montevidensis* . *Electronic Journal of Biotechnology* (online) . **8** (2)
- ✎ **Ghosh , B. N. 1949 .** Physiological studies on the effect of Colchicine on rice . *Jour . Ind . Bot . Soc .* **27** : 119 130 .
- ✎ **Gosset W.S . 1908 .** Probable error of correlation coefficient . *Biometrika* **6** (3) 302-310 .
- ✎ **Heinz , D.J. and Mee , G. W. P . 1970 .** Colchicine induced polyploids from cell suspension cultures of sugarcane crop . *Science* . **10** (6) : 696 699 .
- ✎ **Ishizaka , H . and Uematsu , J . 1994 .** Amphidiploids between *Cyclamen persicum* and *C . hederifolium* induced through Colchicine treatment of ovules in vitro . *Breeding Science* . **44** (2) : 161 166 .
- ✎ **Jaskani , M .J . , Kwonl , S.W . and Kim , D . 2005 .** Comparative study on vegetative , reproductive and quantitative traits of seven diploid and tetraploid watermelon lines . *Euphytica* . **145** : 259 268 .
- ✎ **Kerr , A . 2001 .** Tetraploidy conversions : An easy and effective method of Colchicine method . [http : /](http://members.tripods.com/-h_syriacus/tetraploidy.html)
- members.tripods.com/-h_syriacus/tetraploidy.html .
- ✎ **Liu , G . ; Liu , Z . and Bao , M , 2007 .** Colchicine induced chromosome doubling in *Plantus acertifolia* and its effect on plant morphology . *Euphytica* . **157** : 145 - 154 .
- ✎ **Mensoh , J.K. ; Obadoni , B.O . ; Akomeah , P.A . ; Ikhajiajbe , B . and Ajibolu , J . 2007 .** The effects of sodium ozide and Colchicine treatments on morphological and yield traits of *sesame* seed . *African Journal of Biotechnology* **6** (5) : 534 538 .
- ✎ **Raufe , S . ; Khan , I.P. and Khan , F.A . 2006 .** Colchicine induced Tetraploidy and changes in morphology of Diploids . *Biol . Journ .* **30** . 93 100 .
- ✎ **Takamura , T . and Miyajima , I . 1996 .** Colchicine induced Tetraploids in yellow flowered cyclamens and their characteristics . *Scientia Horticulture* . **65** (4) : 305 -412 . flowered cyclamens and their characteristics . *Scientia Horticulture* . **65** (4) : 305 -412 .
- ✎ **Thao , N.T.P . ; Ureshino , K Miyajima , I . ; Ozaki , Y . and Okubo , H . 2003 .** Induction of tetraploids in ornamental *Alocasia* through Colchicine and oryzalin treatments . *Plant cell Tissue and organ culture* . **72** (1) : 19 25 .
- ✎ **Thiselton Dyer W . T . (Ed) 1898 .** Flora of tropical Africa . **8** : 424 426 . Reeve and Co.London .
- ✎ www.emedicine.com . Medicinal applications of *Urgenia indica* .
- ✎ www.usphormouit.com . Medicinal applications of *Urgenia indica* .
- ✎ flowered cyclamens and their characteristics . *Scientia Horticulture* . **65** (4) : 305 -412 .