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EFFECT OF PRE-SOWING TREATMENTS ON SEED GERMINATION IN *IMPATIENS TALBOTII* - AN ENDEMIC AND ENDANGERED EPHEMERAL OF THE WESTERN GHATS

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ABSTRACT The present investigation was carried out in College of Forestry Sirsi during 2015-16. *Impatiens talbotii* Hook. is a rare and endangered ephemeral restricted to Northern part of Central Western Ghats, specifically Uttara Kannada and parts of Shimoga District of Karnataka. Because of seed dormancy there is no germination of seeds in off season. This however, hinders the conservation strategy of the species. Thus, efforts were made in this study to break the seed dormancy and improve the germination of seeds for boosting conservation as well for domestication of rare plants in large scale. The highest germination of 93 per cent was observed in combined treatment of scarification and GA3 @ 100ppm for 6 hours soaking followed by 89 per cent germination was observed in seeds treated with GA3 @ 100ppm for 6 hour alone over the other subjected pre- sowing treatments. Similarly germination rate and peak value were observed high in seed treated with combined treatment of scarification and GA3. Seed treated with the same treatment produced comparatively high quality seedlings with the vigour of 4232. There was no germination observed in control. The study suggested the scarification and GA3 treatments were best to break the dormancy of seeds.

KEYWORDS : Endangered, Pre- sowing Germination, Conservation, Pre- sowing

INTRODUCTION

Balsmainacea plants are ephemerals which produce beautiful ornamental flowers with an important role in the ecosystem as nectar producing plants for several butterflies, bees, moths *etc*. The genus *Impatiens*, commonly known as balsams, belongs to the family Balsaminaceae. It is one of the largest groups among flowering plants comprising more than 1000 species in the world and in India the genus is represented by more than 209 species of which 148 are endemic (Vivekananthan *et al*. 1997). Of the total species about 106 species in peninsular India, of which 103 spp. are endemic and confined to Western Ghats. Considering its high endemism, restricted to narrow habitats and also severe threat for its survival, many *Impatienses* of Western Ghats has been categorized for their threat status as per IUCN Red List Categories. About 51 per cent of the total species in Western Ghats are categorized as threatened, about 7 species are possibly extinct, 40 species fall under the category of critically endangered, about 33 endangered and 16 are under vulnerable status (Bhaskar, 2006).

Impatiens talbotii is a typical endemic balsam plant distributed in a narrow belt of Western Ghats and reported only from Uttara Kannada and Shimoga districts of Karnataka along the Central Western Ghats. As per the Red Data Book of Indian plants, it is a rare endemic species (Jyosna and Janarthanam, 2011) and endangered according to IUCN threat status. Plant appears in the month of mid June and flowers during July to September. The growth ceases during October and thereafter it terminates its life cycle.

Many wild seeds have natural mechanism which ensures that a seed will only germinate under specific environmental conditions at particular time of year. Seed dormancy is one specific challenge which deals with the germination of wild plant species. To overcome seed dormancy, seeds have to be subjected to different pre-sowing seed treatments. In this regard, study the seed dormancy and germination, the species *Impatiens talbotii* has been chosen. Lack of knowledge of seed biology and seed handling techniques and other important aspects includes population dynamics; reproductive ability and their fitness of organisms are hard to conserve them from extinction. The main intention of this attempt is to understand the effects of pre-sowing treatments in breaking of seed dormancy. Eventually it would help in conserving the rare and endangered ephemeral.

MATERIAL AND METHODS

To assess the nature of dormancy and to work out pre-sowing treatments to improve seed germination and its quality, matured uniform sized healthy seeds were subjected into following ten different pre-sowing seed treatments. Since the species is very sensitive to ecological site; the pre treated seeds were sown on sand media to avoid the contamination. Freshly collected seeds were used in all the treatments. (T_1) Seeds were sown without subjecting to any treatment (T_1). Seeds were soaked in 100ppm GA3 solution for 6 hours before sowing (T_2). The outer coat of the seed was removed manually by sand paper rubbing and soaked in 100ppm GA3 for 6 hours before sowing (T_3). In T_4 seeds were soaked in 1% KNO_3 solution for overnight before sowing. The seed coat was removed manually by sand paper rubbing considered as T_5. In treatment 6 (T_6) outer coat of seed was removed manually by sand paper rubbing and then scarified seeds were soaked in water for overnight before sowing. Seeds were dipped in boiling water for less than a minute (T_6). Seeds were soaked in water for all the night hours (12) and kept for drying in all the day hours (12), the same procedure was repeated for 5 days before sowing was used as treatment T_9. For treatment 9 and 10 seeds were dipped in Conc. H_2SO_4 for less than a minute and soaked in 50 ppm Ethrel solution for 6 hours before sowing. All the treatments were timed in such a way that all treatment would end at the same time just before seed sowing. After imposing all the treatments, seeds were sown in acid washed sand substrata under laboratory condition. The plates were watered regularly on daily basis. Complete Randomized Design (CRD) was adopted in present experiment with three replications. Seed germination and seedling quality parameters were recorded and calculated (Anon., 1996).

RESULTS AND DISCUSSION

Seed germination is emergence and development from the seed embryo of those essential structures which are indicative of the ability to produce a normal plant under favorable conditions Dormancy may withhold or delay the sequencing process involved in the germination, seed dormancy can bring certain changes in physiological, bio-chemical process alternation in promoters to inhibiter ratio, catalyze enzyme activities, moisture content of seed, water absorption capacity of the seed, and also total amino acid content of the seed. Which leads in arresting growth of the embryo, application of suitable dormancy breaking treatments is very much essential in order to improve the planting value of the seed. The environmental conditions which are necessary for germination are essentially water, oxygen and adequate temperatures for metabolism and growth after imbibition. Once imbibition has been achieved, activation of metabolism in a very short time provides ATP, which is used in numerous, energy requiring reactions and processes at the cellular level (Mayer *et al*., 1997). Influence of different pre sowing treatments on germination attributes were assessed. The results obtained were presented and tabulated in Table 1. Significant difference was observed in germination per cent of *Impatiens talbotii*. Among all the subjected treatments highest germination of 93 per cent was observed in T_3 followed by T_2 (89 %) and T_6 (63 %). The least germination of 16 per cent was observed in T_4 followed by T_{10} (17%) and T_9 (21%) germination. There was no germination observed in T_1 - control (Fig. 1). All the treatments results enhanced germination over the control. In conformity, pre-sowing

seed treatment at 25°C temperature for 6 days with GA_3 at 500ppm for 24 hours significantly increased the germination in *Solanum incanum* (Joshua, 1978). Seeds of an endangered herb *Brachycome mulleri* treated with GA_3 resulted in higher germination of 90% at conc. of 1000mg/l. (Manfred *et al,* 2003). Rate of germination was significantly varied among the pre-sowing treatments during experimentation of *Impatiens talbotii*. Higher germination rate of 8.56 was observed in T_3 followed by T_2 (6.99) and T_6 (3.29). The low germination rate of 0.75 was observed in T_9 followed by T_{10}(0.87) and T_4(1.21). This high rate of germination may be due to the inducing the hormonal activity within the seed (Dey and Choudhari, 1982). The low rate of germination was found in seeds treated with Conc. H_2SO_4 for a minute; this may be due to the acid burning of storage tissues. This difference in pre treated seeds may be due to the altered physiological activity of embryos and liberating enzymes. It may mobilize storage reserves for seed germination, which helped to enhance the germination (Renuka, 1992). Similarly, there was significant differences were observed in peak value of germination. Highest peak value of 0.23 was observed in T_3 followed by $T_2$and T_5. The low peak value of 0.05 was observed in T_9 followed by T_{10} and T_8. The pre-sowing treatments initiated early germination and reduced period of germination by facilitating enhanced imbibitions of water into cotyledons and hastened the biochemical reactions; intern increased the peak value. Thus, the liberation of enzyme rapidly increases the whole system that is already in motion, so that when the seeds are sown, developmental processes go on rapidly. It leads to higher germination with reduced germination period.

Influence of different pre-sowing treatments on seedling quality attributes was assessed. The obtained results were tabulated in Table 2. Significant difference was observed in shoot length, root length, seedling length and seedling vigor of *Impatiens talbotii*. Shoot length exhibited significant differences among the different pre-sowing treatments (Plate 1). Among the treatments, highest shoot length of 32.04 cm was observed in T_3 followed by T_6 (27.87 cm) and T_2 (27.69 cm). The minimum shoot length of 20.69 cm was observed in T_9, followed by $T_8$and T_{10}; which are on par with each other, showed value of 24.60 cm. Higher root length of 13.24 cm was observed in T_3 followed by T_2 (11.97 cm) and T_5 (11.96 cm), which are on par with each other. The lower root length of 9.41 cm was observed in T_9 followed by T_8 (10.41cm). Highest seedling length of 45.29 cm was observed in T_3 followed by T_2 (39.66 cm); and T_6(39.66 cm); which are on par with each other. The minimum seedling length of 35.07 cm was observed in T_8 followed by T_9 (10.41cm). Among all the subjected treatments highest seedling vigor of 4232 was observed in T_3 followed by T_2 (3511); and T_6 (2479), The lowest seedling vigor of 586 was observed in T_4 followed by T_{10}(588). Positive relationship between the germination percentage and seedling vigour was observed (Fig. 2). Scarified seeds treated with GA3 produced high quality seedling, this is may be due the stimulating of seed germination in early stages by gibberlic acid and further trigger transitions from meristem to shoot growth, juvenile to adult leaf stage (Gupta and Chakrabarthy, 2013).

CONCLUSION:

In this experiment different chemical, mechanical, physical and hormonal pre sowing treatments were tried to know the germination parameters. Different treatments exhibit significant differences in per cent germination. Among all the treatments, the maximum germination percentage of 93.33 % and 88.69 % was found in T_3 (scarification + GA_3) and T_2 (GA_3 @ 100ppm) respectively than the other treatments.

Table 1: Influence of pre sowing treatment on germination percent, rate of germination and peak value in *Impatiens talbotii*

Treatments	Germination %	Germination rate	Peak value
T1: Control	0 (0.00)	0.00	0.00
T2: GA3 @ 100 ppm for 6 hour soaking	89 (70.33)	6.99	0.21
T3: Scarification + T_2	93 (75.04)	8.56	0.23
T4 : KNO3 @ 1 %	16 (23.58)	1.21	0.06
T5: Scarification	41 (40.01)	1.35	0.11
T6: Scarification + soaking	63 (52.34)	3.29	0.09
T7 : Boiling Water treatment for a min.	43 (41.17)	1.69	0.07
T8: Alternate wetting and Drying	31 (33.63)	1.20	0.06
T9: Acid treatment (Conc. H2SO4) for a min.	21 (27.04)	0.75	0.05
T10: Ethrel @ 50 ppm	17 (24.09)	0.87	0.06
SEm ±	2.22	0.30	0.02
CD @	6.59	0.90	0.07

***figures in parentheses indicate arc sine values**

Table.2 Influence of pre-sowing treatments on seedling quality in *I. talbotii*

Treatment	Shoot length	Root length	Seedling length	Seedling vigor
T1: Control	0.00	0.00	0.00	0.00
T2: GA3 @ 100 ppm for 6 hour soaking	27.69	11.97	39.66	3511
T3: Scarification + T2	32.04	13.24	45.29	4232
T4 : KNO3 @ 1 %	25.68	10.93	36.61	586
T5: Scarification	26.48	11.96	38.43	1589
T6: Scarification + soaking	27.87	11.74	39.61	2479
T7 : Boiling Water treatment for a min.	24.89	10.67	35.56	1542
T8: Alternate wetting and Drying	24.66	10.41	35.07	1081
T9: Acid treatment (Conc. H2SO4) for a min.	20.69	9.41	30.10	621
T10: Ethrel @ 50 ppm	24.69	10.74	35.43	588
SEm ±	0.54	0.45	0.91	108.53
CD @ 1 %	1.61	1.34	2.69	322.42

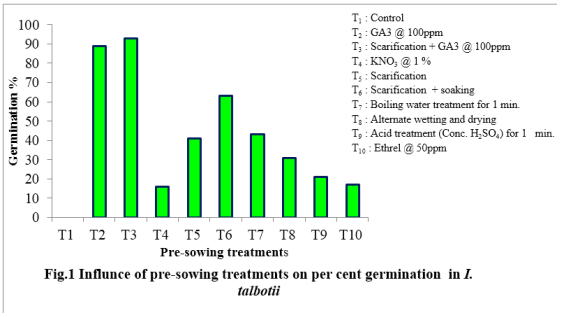

Fig.1 Influnce of pre-sowing treatments on per cent germination in *I. talbotii*

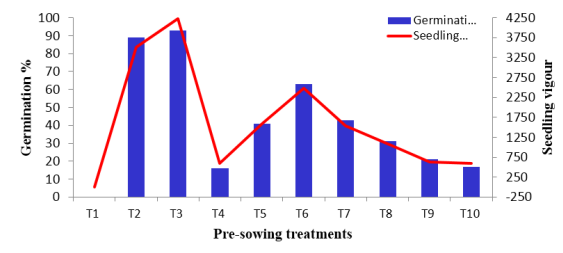

Fig.2 Relationship between germination percentage and seedling vigour in *I. talbotii*

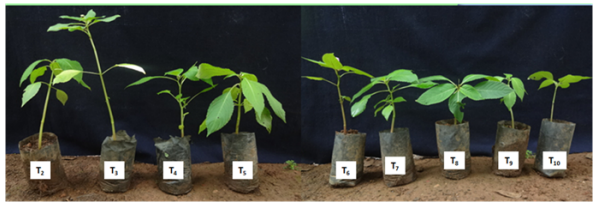

Plate 1: Influence of pre-sowing treatments on seedling height in *I. talbotii*

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