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Germination Studies in *Nitraria retusa* (Forssk.) Asch

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Abstract: Highly unpredictable environment, water scarcity, saline soils and extreme aridity are major challenges faced by the urban landscape projects in Kuwait. Native plants are highly adapted to the local environmental and climatic conditions and their utilization in urban landscape projects will conserve natural plant diversity and impart a natural appeal to the landscape. *Nitraria retusa* (Forssk.) Asch. is one of the leading shrubs in the steppes, deserts and saline soils. In this study, efforts were made to standardize the techniques for mass propagation of *Nitraria retusa*. Results indicated that exposure of *Nitraria retusa* seeds to dry heat (50°C) for 20 days followed by treatment with 750 ppm, 500 ppm and 1000 ppm GA_3 was effective in enhancing the germination with 94, 91 and 90%, respectively compared to the control (79%).

Key words: Urban landscape · Native plants · Mass propagation · Dry heat exposure · *Nitraria retusa*

INTRODUCTION

Desert plants are under tremendous pressure and are subjected to large fluctuations over time due to highly unpredictable environment with respect to water availability, a relatively short growth period and extreme aridity [1]. Deserts are generally regarded as fragile ecosystems that are highly vulnerable to anthropogenic disruption [2]. Arid and semi-arid regions are jeopardized by land degradation with serious consequences for the natural vegetation, plant biodiversity and sustainable use of the natural environment [3]. Native plants are the part of the desert ecosystem that has been damaged by overgrazing, cutting down the woody plants for fuel, abuse of off-road vehicles, urbanization, mining, pollution and activities of the Gulf War. The native plant communities are crucial constituents of our ecosystems.

Utilizing native plants in the urban landscape promotes their sustainability in that region. Although introduced ornamental plants are necessary in urban and sub-urban landscape for diversity, they rely on high levels of nutrients and water. The climate of Kuwait is characterized by extremely hot summer, with daytime temperature exceeding 50°C and winter, cooler and at times wet, with temperature sometimes falling below 4°C [4]. The mean annual rainfall is 113mm [2]. Native soil in Kuwait is mostly sandy in texture with high infiltration rate and is calcareous in nature [2]. Utilization of native plants in urban landscape projects, on the other hand, would conserve natural plant diversity and impart a fully natural appeal to the landscape. They are also easy to establish and less expensive than the exotic species in terms of water and nutrient requirement. Shrubs, in particular, are significant and have good potential for urban landscape application [5]. The vegetation of Kuwait consists of perennial shrubs and ephemerals [6]. Many native plants have potential for use as animal fodder and sand protector from erosion and in phyto-remediation and ornamental landscaping. Such perennial native plant genotypes need to be preserved and propagated on a large scale for the rehabilitation and restoration of Kuwait's desert ecosystem [7]. *Nitraria retusa* was selected for this study due to its ability to tolerate extreme adverse conditions in addition to its possible potential use in urban landscaping.

Nitraria retusa (Forssk.) Asch. (Plate 1) is one of the native perennial species that belong to the botanical family Zygophyllaceae. It grows along the shallow sand hummocks on saline ground near the coastal areas. It is a thorny shrub with fleshy, grayish, heart-shaped leaves [7]. It is a salt-tolerant and drought-resistant species which produces fleshy red fruits [2]. The fruits (Plate 1) are tasty and a refreshing juice may be extract from them. Many wildlife forms feed on the fruits and leaves of this plant. The natural propagation of this species is through seeds. This species is under severe pressure from grazing

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Table 1: Effect of Dry Heat (50°C) Exposure and GA3 on Germination of Nitraria retusa (Forssk.) Asch. Seeds

	Germination (%) [i]			
	GA_3 Treatment (ppm)			
	0	500	750	1000
Heat Treatment	24 h			
RT	79.00±2.19 bc [ii](55)[iii]	83.00±5.01 bc(49)	77.00±6.71 bc(49)	85.00±5.47bc(18)
50°C 10 Days	86.00±5.54 bc(49)	63.00±7.14 ab(55)	73.00±9.74 bc(49)	70.00±11.56bc(49)
50°C 20 Days	45.33±11.16a(30)	91.33±1.79c(30)	94.00±2.73c(30)	90.00±3.76c(30)

[i] Seeds with 2 mm or longer radicle or shoot are considered as germinated.

[ii] The means followed by the same letter are not statistically different at $p \leq 0.01$

[iii] Duration in days to attain the final germination.

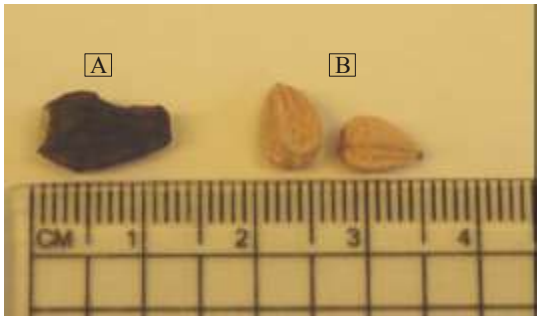

Plate 1: *Nitraria retusa* (a) fruit; (b) seeds

animals and harsh climatic conditions. Tissue culture technology for the mass propagation and conservation of this species has been developed [7]. Although tissue culture propagation is a convenient method of propagation; it is of ultimate necessity to develop and enhance seed and vegetative propagation techniques to ensure their adoption by the agricultural sector in Kuwait, including local agricultural nurseries, as they depend heavily on unskilled labors. Literature study indicated that there are no previously published reports on mass propagation of this species. Hence, this study investigates the possibility of mass propagation via seeds.

MATERIALS AND METHODS

Seeds: Seeds used in this study were obtained from seed bank of Kuwait Instititute for Scientific Research (KISR) in November 2007. These seeds were collected from Kuwait desert in 2006. Viability was determined using Triphenyl Tetrazolium Chloride Test as recommended by the International Seed Testing Association [8]. Seeds were soaked in distilled water overnight and they were excised to expose the embryo and were then soaked in 0.1% 2,3,5-TTC solution in Petri dishes, covered with aluminum foil and kept for 24 hours at room temperature (25°C). These seeds were washed thoroughly with distilled water to remove excess stain and were then examined under the microscope. A total of 100 seeds (four replicates of 25 seeds each) were used for the test.

Germination Studies: The experiments were carried out in the Plant Physiology Laboratory at Kuwait Institute for Scientific Research (KISR).

The experiment was conducted during 18.05.08 to 29.09.08. Seeds stored at room temperature were kept in an oven at 50°C for 10 days or 20 days and treated with various concentrations of gibberellic acid (GA_3) for 24 hours. Treatments included exposure to dry heat at 50°C for 10 or 20 days and/ or pre-sowing soaking in GA_3 solution (0, 500, 750 or 1,000 ppm) for 24 hours. There were nine treatments, which were replicated thrice in a completely randomized design. Each replication contained 20 seeds. The control seeds were not subjected to either heat or GA_3 treatment. The total germination was calculated when no more seeds germinated. Pre-treated seeds were sown in agricultural soil medium in Petri dishes and maintained in laboratory conditions at 25°C. The data were analyzed using R analysis procedure of Analysis of Variance (ANOVA) and Dunkan's Multiple Range Test to ascertain the significant differences among treatments [9, 10].

RESULTS AND DISCUSSION

Viability of seeds used in this study was found to be 100%. The highest germination of (Table 1) 94% was obtained in 30 days from seeds that were exposed to dry heat (50°C) for twenty days followed by treatment with 750 ppm GA_3 for 24 hours. The next best treatment

(91.33%) combination was twenty days dry heat exposure with 500 ppm GA_3 from the same period. Untreated seeds required 55 days to obtain 79% of germination. Whereas seeds treated with 1000 ppm GA_3 (without heat treatment) resulted in 85% germination in just 18 days. Extended period (20 days) of dry heat exposure alone resulted in drastic reduction in germination (45%). In contrast, dry heat exposure for ten days, marginally enhanced the germination (86%) when compared to control seeds. The improvement in germination by pre-treatment was significant at $P \leq 0.01$ level.

To propagate *Nitraria retusa* in a short period of time, treatment with 1000 ppm GA_3 is effective. Whereas to attain highest germination, twenty days heat treatment with 750 ppm GA_3 was found to be comparatively successful. The findings of this study are essential as this is the first attempt to standardize the propagation techniques of *Nitraria retusa* and to promote its usage in urban landscape projects. It is also important as desert rehabilitation and biodiversity conservation is crucial to prevent the extinction of valuable native plants in Kuwait [2, 11].

CONCLUSIONS

Utilizing native desert plants like *Nitraria retusa* in urban landscaping can be very rewarding in terms of ease in establishment, aesthetic value and cost.They easily adapt to the harsh environmental conditions in the desert. It's of optimum necessity to standardize the propagation techniques of indigenous plants, to promote their usage in urban landscape projects and its conservation. Exposure of seeds to dry heat (50°C) for 20 days followed by treatment with 750 ppm GA_3 was effective in enhancing the germination in *Nitraria retusa*.

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REFERENCES

1. Omar, S.A.S. and N.R. Bhat, 2008. Alteration of the *Rhanterium epapposum* plant community in Kuwait and restoration measures. Intl. J. Environ. Studies, 65(1): 139-155.
2. Omar, S.A.S., Y. Al-Mutawa and S. Zaman, 2007. Vegetation of Kuwait, Kuwait: Kuwait Institute for Scientific Res., pp: 32-159.
3. Brown, 2003. G. Brown, Factors Maintaining Plant Diversity In Degraded Areas of Northern Kuwait. J. Arid Environ., 54: 183-194.
4. FAO., 2004. AQUASTAT- FAO's Information System on Water and Agriculture. http://www.fao.org/ag/agl/aglw/aquastat/countries/kuwait. 15/11/06.
5. Abo El-Nil, M., L. Al-Sabah, H. Al-Menaie, S. Bastaki and S. Zaman, 1993. Mass propagation of stress tolerant desert plants by tissue culture. Phase l/ Biotechnology Department, Aridland Agric. Dep. Food Resources Division. KISR 4300, pp: 83-86.
6. Halwagy, R. and M. Halwagy, 1974. Ecological studies on the desert of Kuwait II. The vegetation. J. the University of Kuwait, 1: 87-95.
7. Sudhersan, C., M. AboEl-Nil and J. Hussain, 2003. Tissue culture technology for the conservation and propagation of certain native plants. J. Arid Environ., 54: 133-147.
8. International Seed Testing Association (ISTA), 1999. International Rules for Seed testing. Seed Sci. Technol., 27: 333.
9. Little, T.M. and F.J. Hills, 1978. Agricultural Experimentation Design and Analysis. (U.S.A: John Wiley & Sons Inc), pp: 63-65.
10. Crawley. M.J., 2005. Statistics- An Introduction using R. England: John Wiley ans Sons Ltd., pp: 155-185.
11. Suleiman, M.K., N.R. Bhat and R. Bellen, 2004. Various attempts in greening the State of Kuwait. Archives of Agronomy and Soil Sci., 50: 353-360.