

Germination Studies in *Lycium shawii* Roem. And Schult.

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Abstract: Usage of aesthetically appealing native plants in urban landscape projects can support its conservation by contributing to genetic diversity and their sustainability in that region. *Lycium shawii* is a thorny perennial shrub with an ability to tolerate extreme climatic conditions prevalent in Kuwait. In this germination study, effects of dry heat (50°C) and/or various concentrations (500, 750 and 1000 ppm) of gibberellic acid (GA₃) on seed germination of *Lycium shawii* were assessed in an effort to standardize the techniques for mass propagation. Seeds that were exposed to dry heat (50°C) for 20 days followed by 500 ppm GA₃ resulted in 94.67% germination. Alternatively, pre-treating the seeds with 750 ppm (93%) and 1000 ppm(91%) GA₃ was also effective in enhancing the germination, compared to the control (55%).

Key words: Urban landscape % Germination study % Genetic diversity % Mass propagation % Conservation % *Lycium shawii*

INTRODUCTION

Kuwait's native vegetation is of enormous scientific value as it represents a transition between semi-desert and desert vegetation and it is highly tolerant to the harsh environmental conditions of Kuwait such as extreme temperatures, drought and salinity. Several native desert plants are being threatened and are facing danger of extinction due to anthropogenic causes [1]. Restoration and re-vegetation programs are necessary to reverse the negative trends of ecosystem degradation and to conserve the biodiversity of these important ecosystems. In addition to their contribution to the integrity of the environment, native plants are invaluable sources of useful genes for genetic improvement of crop plants [2]. The native vegetation of Kuwait includes scant perennial woody shrubs, herbs and spring ephemerals [1]. Many native plants have potential for use as animal fodder and sand protector from erosion and in phytoremediation and ornamental landscaping. Shrubs in specific are significant for desert rangeland vegetation and have the potential for urban landscape utilization [3]. 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 [1]. *Lycium shawii* was selected for this study due to its ability to tolerate extreme adverse conditions in addition to its possible potential use in urban landscaping.

Lycium shawii (Awsaj) is a thorny perennial shrub that belongs to the Solanaceae family. It grows along sandy stone ridges. It has purple, sometimes white, trumpet – like flowers and sharp thorns. The leaves are elliptical and congested in closed clusters [4]. The flowers are produced during March to April in its natural environment and throughout the year in irrigated soil. The fruits are globular, many seeded, red to orange berries which are edible and somewhat sweet. It provides honey for wild bees and food and shelter for wild birds and animals [1]. In Tanzania the roots of *Lycium shawii* are boiled and the decoction is used to treat sores in the mouth, coughs, backache and administered internally to cure tick fever in livestock. Leaves are used to treat constipation and stomach ache. The salty leaves are much liked by livestock [5].

Although tissue culture techniques for propagation of *Lycium shawii* were developed it is of ultimate necessity to enhance and standardize 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. During 1996-98, studies were conducted at Kuwait Institute for Scientific Research (KISR) to germinate seeds of 14 desert plants [6]. Results indicated a wide variation in germination and seedling establishment. Though various studies have been performed at KISR on native plant propagation; the techniques used were not

standardized for mass propagation and utilization. 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

Seed Source: Seeds used in this study were obtained from the seed bank of Kuwait Institute for Scientific Research (KISR) in November 2007. These seeds were collected from Sulaibiya (Kuwait) in April, 2007. Prior to their use in the experiment, seed viability was determined using Triphenyl Tetrazolium Chloride (TTC) Test [7]. In this test, viable embryos are stained pink due to the reduction of 2, 3, 5- TTC by respirative activity in the cell. For this, 100 seeds (four replicates of 25 seeds each) were soaked in distilled water overnight, excised to expose the embryos, placed in a petri dish, soaked in 0.1% TTC solution, covered the petri dish with aluminum foil and left for 24 hours at room temperature (25°C). Following the treatment, seeds were washed thoroughly with distilled water to remove excess stain and examined under the microscope.

Germination Studies: 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 (GA₃) for 24 hours. Treatments included exposure to dry heat at 50°C for 10 or 20 days and/ or pre-sowing soaking in GA₃ solution (0, 500, 750 or 1,000 ppm) for 24 hours. There were twelve 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 GA₃ treatment. The total germination was calculated when no more seeds germinated. Pre-treated seeds were sown in agricultural

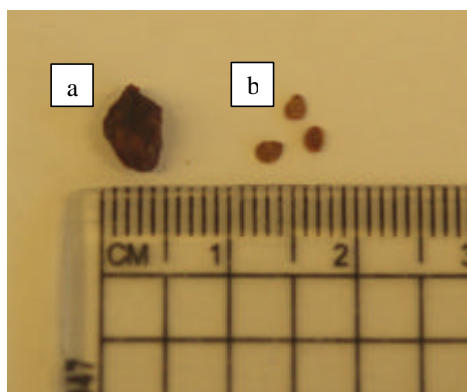


Plate 1: *Lycium shawii* (a) fruit; (b) seeds.

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 Duncan's Multiple Range Test to ascertain the significant differences among treatments [8,9].

RESULTS AND DISCUSSION

Viability of seeds used in these studies was found to be 100%. The highest germination (94.67%) occurred when the seeds were exposed to dry heat for 20 days followed by treatment with 500 ppm GA₃ for 24 hrs (Table 1). Pre-treatment with 750 ppm and 1000 ppm of GA₃ also resulted in 93% and 91% germination, respectively. Fifty five percent of the untreated seeds germinated. When the seeds were exposed to extended duration of heat (20 days) marginal increase in seed germination (68.67%) was observed, compared to control. While germination percentage of seeds that were exposed to dry heat (50°C) for 10 days increased when treated with 750 ppm GA₃ (74%), a negative effect on germination was observed, when the same was treated with 1000 ppm GA₃ (54%). The improvement in germination by dry heat and GA₃ was significant at P#0.001 level compared to control.

Table 1: Effect of Dry Heat (50°C) Exposure and GA³ on Germination of *Lycium shawii* Seeds

		Germination (%) ⁱ			

		GA ₃ Treatment (ppm)			

		0	500	750	1000
Heat Treatment		-----			
24 h		-----			
RT		55.33 a ⁱⁱ ± 4.29	89.00 d ± 4.00	93.00 d ± 3.00	91.00 d ± 2.92
50°C 10 Days		56.00 a ± 4.88	59.33 ab ± 3.40	74.00 c ± 6.53	54.67 a ± 4.03
50°C 20 Days		68.67 bc ± 6.38	94.67 d ± 1.70	90.00 d ± 1.05	90.00 d ± 2.58

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 0.001

The findings of this study are essential as this is the first attempt to standardize the propagation techniques of *Lycium shawii* and to promote its usage in urban landscape and re-vegetation projects, as indigenous plant species have evolved and adapted to the local harsh climatic conditions over the years and they are more likely to function adequately under the local climate as opposed to exotic plants.

CONCLUSIONS

Utilization of native plants in urban landscaping can potentially support its conservation by contributing to genetic diversity and safeguarding endangered native species from extinction thus promoting their sustainability in that region. This is the initial step for the commercial production of these plants in Kuwait's nurseries. Mass propagation of native plants like *Lycium shawii*, can be standardized for further commercial use. Exposure to dry heat (50°C) for 20 days followed by 500 ppm GA₃ or pre treating the seeds with 750 or 1000 ppm GA₃ alone were capable of increasing the germination percentage effectively.

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