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Effect of Various Treatments on Seed Germination Characteristics of Wild Ziziphus (*Ziziphus spina-christi*)

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Abstract: Nowadays, propagation of good Ziziphus cultivars was done by budding or grafting on wild Ziziphus seedlings. Hard endocarp is one of the barriers on seed germination and rootstock production. This study was conducted to evaluate the effect of difference treatments (control, 24 hours soaking in tap water, digested seeds, scarification with sulfuric acid for 30, 60 and 120 minutes, gravel sand and stratification for 1, 3 and 6 weeks) on wild Ziziphus seed germination in completely randomized design with four replications. Treated seeds were sowing in plastic bags containing a mixture of sandy soil and decayed manure. On the basis of results, the highest and lowest germination percentage was observed in 1 and 3 weeks stratification respectively, although germination percentage in treatments of scarification with sulfuric acid was in good range. It can be concluded that that under the condition of this experiment, 3 week stratification (4-5° C) with 78.8 % germination was the best treatments.

Key Words: Ziziphus · Stratification · Scarification · Seed Germination

INTRODUCTION

All species of *Ziziphus* genus have medicinal properties and some species are using in healthy industries for production of herbal anti-scruff shampoo and hair encouraging. Some cultivars also produce big and edible fruits that addition to supply dividend of body requirements, are good source of Ascorbic acid [1]. Propagation of desirable Ziziphus cultivars for harvest of leaf and fruit is via grafting. Grafted Ziziphus tree usually is producing via rootstock production from wild Ziziphus (*Ziziphus spina-christi* L.) and then budding of Indian cultivars (*Z. mauritiana* L.) on it. In this relation, hard endocarp is one of the barriers on seed germination and rootstock production. Scarification by using proper treatments can be increase germination percent and decrease duration of rootstock production time. In nature, seed coat make soft by various factors such as mechanical wear, repeated freezing and melting, soil microorganism attack, passing from digestive system of birds and mammalian and fire [1, 2]. In seed scarification of *Schizolobium amazonicum* by acid treated the seeds by Sulfuric acid for 20, 40 and 60 minutes and sowed immediately or after soaking in water for 24 hours [3]. Highest germination (92%) obtained in Sulfuric acid treatment for 60 min and highest germination velocity in this treatment and soaking in water for 24 hours. Saied *et al*. [4] for increase of *Ziziphus spina-christi* L. seed germination utilized Sulfuric acid 97% for 30, 60 and 120 minutes, very fine emery paper and cracking in seed coat. Basis on results Sulfuric acid for 120 minutes had highest germination percent but had not significant difference to other treatments except to Sulfuric acid for 30 minutes. All treatments except Sulfuric acid for 30 minutes, decrease time duration until germination beginning to 2-4 days and reach to 50% germination to 10-12 days. Nasiri and Eisavand [5] in evaluate the effect of Sulfuric acid on dormancy break and germination of *Albizia julibrissin* and *Ceratonia siliqua* found that in *Albizia julibrissin* with increase of Sulfuric acid concentration, germination percent and velocity increased and highest germination percent observed in application of Sulfuric acid 50%. In experiment on *Ceratonia siliqua* seeds, with increase of Sulfuric acid concentration, germination percent and velocity decreased and highest germination percent obtained in control treatment (without application of

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Sulfuric acid) and lowest in Sulfuric acid 50%. The results of this study showed that Sulfuric acid has various effects on break of seed dormancy in difference species. Nabaei *et al*. [6] in assessment of effective methods in dormancy break and increase of seed germination of *Rheum ribes* found that the seed of this plant has physiologic dormancy because highest germination percent (96%) obtained in integrated treatment of moist chilling for 25 days in 2 °C and GA_3 50 mg/L. Hojati *et al*. [7] in evaluate the effect of Sulfuric acid, GA_3 and temperature on seed germination of *Cycas revolue* observed highest germination percent in stored seeds in 5 °C and treated by 20 mg/L GA_3 for 48 hours and Sulfuric acid for 30 minutes. Sasani *et al*. [8] in assessment of moist chilling, hormonal treatments and storage period on dormancy break and germination of *Bunium persicum* seed found that 10 weeks moist chilling along three years storing period in optimum condition, is able to increase of seed germination. Furthermore hormonal treatments such as Kinetin and GA_3 had significant effect on increase of seed germination. Pivetta *et al*. [9] harvested the fruit of typical palm (*Syagrus schizophylla*) in three stage of maturity and sowed with or without scarification. Basis on results, the seed of full ripening fruits with scarification had highest germination percent. Herranz *et al*. [10] evaluated temperature range from 50 to 150 °C for 1 to 60 minutes in order to seed germination of four Legume species. Results showed that 90 °C for 50-10 minutes, 120 °C for 5-10 minutes and 150 °C for 1 minute were the most effective treatments for increase of germination. Acosta and Rodriquez [11] in study on seed germination of *Lupinus montanus* observed highest germination in Sulfuric acid treatment for 15 minutes in light (100%) and darkness (98%). Hartley *et al*. [12] in study on germination of *Z. rignoni* seed in refuse of two species of Rock Iguanas (*Cyclura* sp) in Dominican republic found that germination velocity of these seeds was more than control. In attentive to hard endocarp of *Ziziphus* seed and need to scarification treatments, our study was performed for access to the treatment with maximum germination value.

Khaleghi *et al*. [13] in evaluate the effects of Sulfuric acid and hot water on germination traits of Tamarind and Acacia seeds found that treated Tamarind seeds by Sulfuric acid 98% for 30 minutes had highest germination percent and velocity. Results of Acacia experiment showed that hot water 90 °C treatment leads to beak of seed dormancy than Sulfuric acid 98% so that recommended hot water treatment for 5 second as the best treatment in viewpoint of germination percent and velocity whereas treated seeds with Sulfuric acid 98% had low germination percent. Hassen *et al*. [14] found that scarification with sandpaper or treatment with sulphuric acid (94%) for 10 or 20 minutes was most effective in breaking seed dormancy and also treatment with boiling water was ineffective in breaking dormancy of *Z. mucronata*. The aim of this study was investigated the effect of various treatments on seed germination of wild ziziphus (*Ziziphus spina-christi*).

MATERIALS AND METHODS

In order to evaluate the effect of various treatments on germination of wild Ziziphus seed, was conducted an experiment in completely randomized design with 10 treatments and 4 replications in Agricultural Researches Station of Minab Hormozgan Iran, during 2009. Treatments was consist control, 24 hours soaking in tap water, digested seeds by sheep, soaking in Sulfuric acid for 30, 60 and 120 minutes, scarification by gravel sand and stratification for 1, 3 and 6 weeks. Digested seed was collected from sheep manure. These seeds had been remained of sheep feeding from shoot and fruit of wild Ziziphus. In Sulfuric acid treatments, after finishing of considered time (30, 60 and 120 minutes) the seeds completely washed and for 30 minutes were put under flowing water. In scarification by gravel sand treatment, the seeds were piled up in a plastic container along angled gravel and had been shaking for 3 hours continuously.

In stratification treatment, the seeds in mixed to sand and water (sand and water mixture three times of seed volume) were put on refrigerator with 4-5°C temperature and then washed. Then treated seeds were sowed in pot and were measured germinated seeds number daily. Thereafter were calculated the traits of day to germination (number of day from sowing until germinate of the first seed), day to 50% germination (number of day from sowing until germinate of half of seeds), germination percent (germinated seed number with regard to 100), germination dispersion (number of day from germinate of first to latest seed), peak value (accumulated germination percent until the day that germinate highest seed number division to day number to reach this stage from experiment beginning), mean daily germination (total germinated seeds division to total days of experiment) and germination value (mean daily germination × peak value) basis on Cruz *et al*. [3]. Finally, obtained data were analyzed by MSTAT-C software and the means compared with Duncan's multiple range tests.

RESULTS AND DISCUSSION

On basis of analysis of variance results, in all evaluated traits the treatments had significant difference together in 1% level. Group comparison of treatments showed that in traits of day to germination beginning and day to 50% germination, there was significant difference between control and other treatments in 5% level. In relation to germination percent, peak value and germination value there was significant difference between control and other treatments in 1% level. In germination dispersion and mean daily germination there was no significant difference between control and other treatments. In all measured traits except day to 50% germination, there was significant difference between acidic and stratification treatments in 1% level (Table 1).

Means comparison showed that the significant influence of various treatments on evaluated traits. The seeds germinated very faster in 3 and 6 weeks stratification treatments than other treatments with significant difference (Fig. 2). The lowest day to 50% germination (11 days) obtained in 3 weeks stratification treatment. The highest germination percent was observed in 1 week stratification treatment (94.7%) and the lowest in 3 weeks stratification treatment (78.7%) (Fig 1). Anyhow germination velocity and other germination traits in 3 weeks stratification treatment was more than other treatments. The highest germination velocity was in Sulfuric acid for 30 minutes whereas the lowest was in 3 weeks stratification treatment. 3 weeks stratification treatment had the highest peak value (4.74), mean daily germination (2.81) and germination value (13.31). Nabaei *et al*. [6] in *Rheum ribes* and Sasani *et al*. [8] in *Bunium persicum* also introduced stratification treatment in viewpoint of germination percent and velocity. Generally, on basis of the results, acidic treatments and scarification by gravel were in the lower level than control treatment (Table 2). On the other hand, findings of Saied *et al*. (2008) [12] on *Ziziphus*, Khaleghi *et al*. [4] on Tamarind, Nasiri and Eisavand [5] on *Albizia julibrissin* and Hojati *et al*. [7] on *Cycas revolute* had been introduced Sulfuric acid as the best treatment. Investigation of Nasiri and Eisavand [5] on *Ceratonia siliqua* showed that acidic treatments have negative influence on germination.

Table 1: Analysis of variance of the effect of treatments on evaluated traits in wild *Ziziphus*

		Evaluated traits						
S.V	df	Day to germination	Day to 50% germination	Germination percent	Germination dispersion	Peak value	Mean daily germination	Germination value
Treatment	9	127.3**	142.6**	118.3**	1.9**	3.77**	0.57**	42.18**
Error	30	1.5	2.7	0.8	53.5	0.04	0.01	0.04
Coefficient of Variation	8.9	7.9	1.0	6.0	7.5	4.3	4.1	
Comparison control to other treatments	*	*	**	ns	**	ns	**	
Comparison acidic to stratification treatments	**	ns	**	**	**	**	**	

ns: not significant, *: significant in 5%,**: significant in 1%.

Table 2: Mean comparison the effect of treatments on evaluated traits of wild Ziziphus

treatments	traits	Day to 50% germination	Germination dispersion	Peak value	Mean daily germination	Germination value
Control	23^{c}	22^{c}	2.00^{ef}	1.84^{cd}	3.68^{d}	
Soaking for 24 hours	21^{cd}	25^{b}	1.78^{fg}	1.72^{de}	3.06^{e}	
digested seed	20^{cd}	23^{bc}	2.08^{ef}	1.83^{cd}	3.81^{d}	
Sulfuric acid (minute)	30	20^{cd}	30^{a}	2.53^{d}	1.57^{ef}	3.97^{d}
	60	20^{cd}	19^{d}	2.93^{c}	1.97^{c}	5.70^{c}
	120	18de	22^{c}	1.92^{f}	1.86^{cd}	3.57^{d}
Stratification (week)	1	27^{b}	22^{c}	2.37^{de}	1.61^{ef}	3.82^{d}
	3	11^{f}	16^{e}	4.74^{a}	2.81^{a}	13.31^{a}
	6	16^{e}	24^{bc}	3.50^{b}	2.14^{b}	7.49^{b}
Scarification by gravel		33^{a}	23^{bc}	1.50^{g}	1.49^{f}	2.24^{f}

Means with same letter in each column have not significant difference in 1% level of DMRT test.

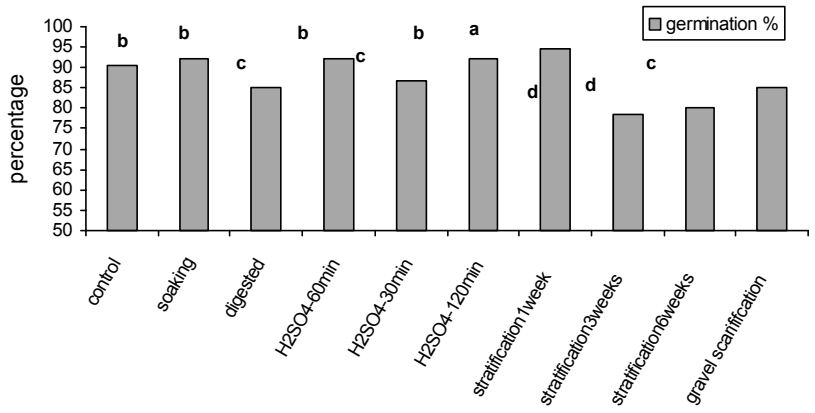

Fig. 1: Comparison the effect of treatments on germination percentage of wild Ziziphus

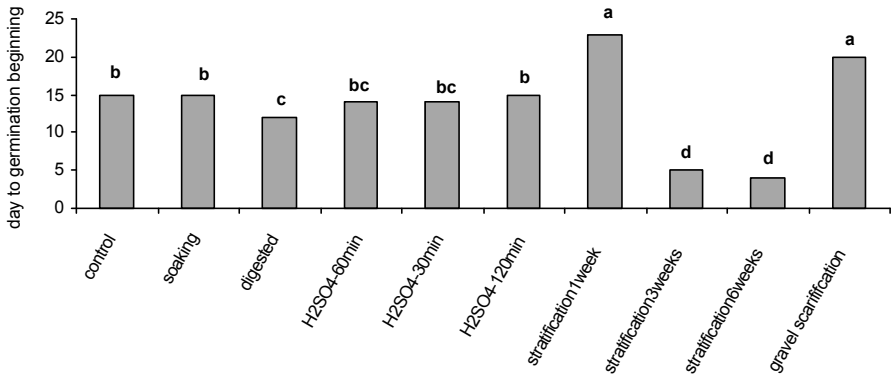

Fig. 2: Comparison the effect of treatments on day to germination beginning of wild Ziziphus

Data obtained in this experiment revealed that used treatments have positive or negative effects on seed germination of wild *Ziziphus*. Acidic treatments and scarification by gravel had bad influence on some evaluated traits. Whereas stratification treatments had been the highest influence on evaluated traits it seems to wild *Ziziphus* seed in addition to hard seed coat dormancy also have been physiologic dormancy but increase of stratification duration will have bad influence. On this basis can be recommending the 3 weeks stratification treatment in wild *Ziziphus* seed for reach to the highest germination velocity, germination value and peak value under this experiment condition.

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