Available online at www.scholarsresearchlibrary.com

Scholars Research Library

Scholars Research Library

Annals of Biological Research, 2011, 2 (5) :400-406
(http://scholarsresearchlibrary.com/archive.html)

Annals of Biological Research
Scholars Research Library
ISSN 0976-1233
CODEN (USA): ABRNBW

The Effect of Different Treatments on Seeds Dormancy Breaking and Germination of Caspian Locust (*Gleditschia caspica*) Tree

Zohre Zoghi[1], Davud Azadfar[2], Yahya Kooch[3*]

[1]*Gorgan University of Agricultural Sciences and Natural Resources, Iran*
[2]*Gorgan University of Agricultural Sciences and Natural Resources, Iran*
[3]*Department of Forestry, Faculty of Natural Resources & Marine Sciences, Tarbiat Modares University, Noor, Mazandaran, IRAN*

ABSTRACT

Caspian Locust (Gleditschia caspica) is a special species in hyrcanian forests. This species has special important with considering of paleology. The conservation of this species is necessary as gene source thus, seedling production and theirs using is essentail in afforestation programming. Current study carried out due to investigation of different treatments for dormancy breaking and germination of Caspian locust seed. For this purpose, mature seeds were collected from Ali Abad Zarin Gol (East North of Iran). Experimental was conducted completely randomized design with eight treatments and three replications. Concentrated Sulphuric Acid in three levels, humidity sand in two levels, seeds soaking in water with two levels and witness treatments were considered.The results show that scarification with Sulphuric Acid treatment with one and half hours time is the best treatment for dormancy breaking of Caspian locust Seed.

Keywords: Caspian locust, Seed dormancy, germination, Sulphuric Acid.

INTRODUCTION

Caspian Locust (*Gleditschia caspica*) is an endemic tree species found in the endangered lowland Hyrcanian forest near the Caspian Sea in Azerbaijan and north western Iran [30]. *Gleditschia* genus has two species in Iran including *Gleditschia caspica* and *Gleditschia triacanthos* (Honey locust). They are similar together. Caspian locust has wide canopy, broadly pinnate leves (one large stem with many small leaflets) with 15-25cm in length and 12 - 20 ellipse form leaflets with 2 - 5cm in length. Its fruits are showy, long, indehiscent and often twisted pods with brownish - grey seed capsules in late summer and autumn [22, 29]. At present this tree is seeing as individual tree or small society in edge of farmland and around of animal husbandry. In spite of, Caspian locust can be increased by its different organs in nature but human activities is due to limitation of distribution this species [3].

One of the most important suvival mechanisms of plants is ability to delay of germination some their seeds after mature. Seed dormancy is a block to the completion of germination of an intact viable seed under favourable conditions that allows seasonal timing of germination for seeds in a population [5, 6, 11, 17, 23, 28]. Dormancy may be strong to weak, and the extent of dormancy present at any particular moment is referred to as the degree of dormancy [22]. If the seed coats are not pre-treated, germination can be erratic and prolonged [12]. In leguminous family many species, have hard and impermeable coats that they are impenetrable to wear and gasses thus they have physically dormancy [9]. Different methods are used to break seed dormancy dependly on the type of plant species and dormancy [2]. Many kind of treatment are using for overcome to physically dormancy such as mechanical scarification, chemical scarification (especially sulphuric acid), cold-wet, hot water, electerasonic waves and stratification [7,19].

In many species, information about seed dormancy is too limited. However applying recognized methods for relative species or copying to natural condition that influence seed dormancy are effective [27, 15]. Some researchers indicated the positive effect concentrated Sulphuric acid (H2SO4) for one until two hours time for scarification of hard coat of honey locust and stratification did not affect seed germination [4,16,24]. In another research, twenty different methods of seedcoat scarification were tested on Honey locust and black locust (*Robinia pseudoacacia* L.) to find an alternative to acid scarification for these species that were found, hot water soaks or heat shock soak treatments yielded satisfactory for larger quantities, though lower, germination [32]. Fordham (1996) in studing on seed germination of some leguminous species, found seed of Honey locust requird relatively long periods of sulphuric acid -two and half hours- pretreatment, seed of *Albizia julibrissin* need two hours time pretreatment with sulphuric acid to effect of rapid general germination.

Aladjadjiyan [2002] introduced microwave electromagnetic treatment of seeds of *Gleditschia triacanthos,* and *Robinia pseudoacacia* cause to an increase of germination and germinating energy. About Caspian locust water with 80º soak, penetrate seed coat or concentrated sulphuric acid treatment cuse to stimulate germination but chilling, lighting and gibberellic acid had no effect on it [3]. In some speices of this family as like *Cercis siliquastrum* is effective scarification with water 80 º and sulphuric acid pretreatment [13] and about *Albizia julibrissin*, sulphuric acid is the best way for scarification [26]. The effects of seed coat color on water uptake, germination, and quantity of seed parts were investigated on honey locust (*Gleditschia triacanthos*). That results showed yellow-coated honey locust seeds had a greater water uptake rate and higher germination (95%) than light or dark brown-coated seeds [10].

Caspian locust is endangered speices and has special important with considering of paleology. The conservation of this species is necessary as gene source thus, seedling production and theirs using is essentail in afforestation programming. But Caspian locut has hard and impenetrable coat and seed dormancy that it is prevent to germination. So, in this study we have investigated the effect of different treatment on removing seed dormancy of caspian locust.

MATERIALS AND METHODS

For this purpose, mature seeds were collected from Ali Abad Zarin Gol (East North of Iran), in autumn 2009. The seeds were separated manually from pods and were numbered. The experiment was conducted a Completely Randomized Design (CRC) with eight treatment and tree replications. 60 seeds were used for each treatment then treatments were tested including moist sand treatment in 3°C temperature (at refrigerator) for 45 days (treatment 1), moist sand treatment (at room temperature, treatment 2) for 45 days (Figure 1), soak treatment at 60°C

temperature water for 2 hours (treatment 3), 3 concentrated sulphuric acid treatment for half (treatment 4), one (treatment 5) and one and half (treatment 6) hours time (they were washed thoroughly with tap water after treatment), soak treatment on water at 3°C temperature (treatment 7) for 48 hours and control (without treatment, treatment 8). Then, treated seeds and control with 3 replications that each other included 20 seeds were planted in a tray filled sterile sand (Figure 2) and kept in a growth room with temperature between 20 - 25°C and trays were watered with tap water according to need. Seed germination was recorded daily. Treated seedlings with H2SO4 and germinated seeds are presented in figures 3 and 4, respectively.

Figure2: Planted seeds with different treatment

Figure 1: H2SO4 treatment

Figure 4: Germinated seeds

Figure 3: Treated seedlings with H2SO4

In current research, measured parameters were germination percentage, germination rate, survival percentage and germination index. Germination rate was calculated according to the Maguire [27] and germination index was calculated according to Scott et al (1992) that their values obtained from follow equations:

1- Germination rate: $GS = \sum_{i=1}^{n} (\frac{n}{t})$

Where *n*: percentage of the seeds that germinate in a specific timed and *t*: the time from culture.

2- Germination index: $GI = \frac{(\sum T_i N_i)}{S}$

Where *Ti:* the days after culture; *N i:*number of seed germinate, in day and *S:* total number of planted seeds.

3- Germination percentage: $GP = \frac{n_i}{N} \times 100$

Where $n_{i:}$ number of germinated seeds and *N* :total number of seeds.

Normality of the variables was checked by Kolmogrov - Smirnov test and Levene test was used to examine the equality of the variances. We used factorial T - test with 2 factors for group comparison multi - range averages we used duncan method. All of analyzes implemented in SPSS 17 software.finaly determined the best treatment for breaking dormancy of Caspian locust.

RESULTS

Results from variance analyze showed that the effect of different treatments on seeds rate germination are significant (P<0.01) (Table 1). Comparison of rate germination means in different treatment by duncan method are observed in table 2. In addition maximum of rate germination in treated seeds was observed at sulphuric acid for one and half hours (Table 2). The considersd treatment had a significant diference (P<0.01) about germination rate index (Table 1). Variation analysis of converted data of germination percentage and survival percentage have been showed in table 1.

In investigation of variation analysis indecated significant differences (P<0.01) between germination percentage and survival percentage. The difference of treatments between germination rates and germination rate indexes are observed in figure 5 and 6 as well and difference of treatments between germination percentage and survival percentage of seeds were presented figure 7 and 8 as well. The highest values of germination percentage and survival percentage obtained sulphuric acid for one and half hours treatment.

Table 1: Variance analyze of germination rate germination, index germination, germination percentage and survival percentage under different treatments

Variable sources	Df	Sum of squares	Mean of squares	F
Germination rate	7	0.040	0.040	24.92**
Error	16	0.004	0.000	
Total	23	0.044		
Germination index	7	2182.753	311.822	11.955**
Error	16	417.340	26.084	
Total	23	2600.093		
Germination percentage	7	3563.500	508.929	21.242**
Error	16	383.333	23.958	
Total	23	3945.833		
Survival percentage	7	2316.667	330.952	45.388**
Error	16	116.667	7.292	
Total	23	2433.334		

Table 2: Comparison means of Germination rate, Germination index, Germination percentage and Survival percentage of Caspian locust under different treatments

Treatments	Mean of Germination rate	Mean of Germination index	Mean of Germination percentage	Mean of Survival percentage
1	0.025cd	9.633c	5.000cd	0.000d
2	0.030c	11.538bc	6.667cd	5.000d
3	0.077b	14.667bc	18.333b	5.000d
4	0.045c	17.083bc	13.333bc	10.000c
5	0.082b	20.733b	21.667b	16.667b
6	0.0125a	30.233a	38.333a	30.000a
7	0.000d	0.000d	0.000d	0.000d
8	0.000d	0.000d	0.000d	0.000d

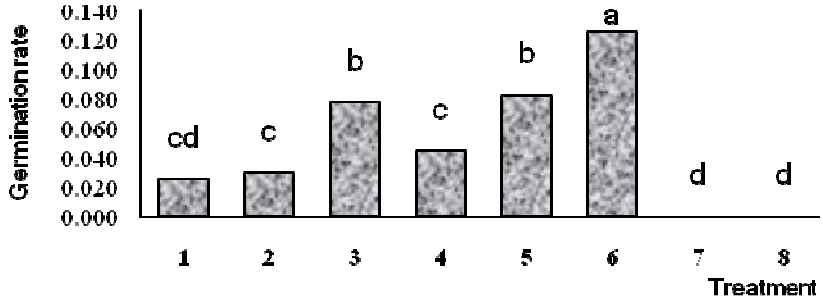

Figure 5: Comparison of germination rate in different treatment

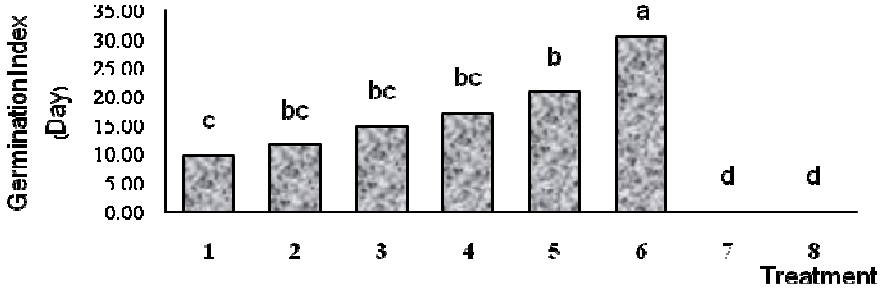

Figure 6: Comparison of germination index in different treatment

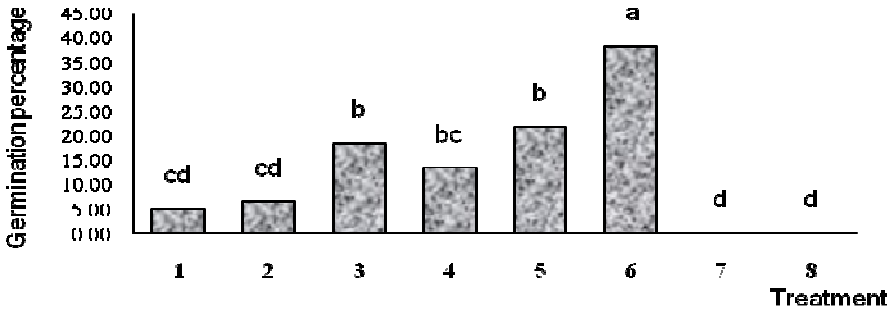

Figure 7: Comparison of germination percentage in different treatment

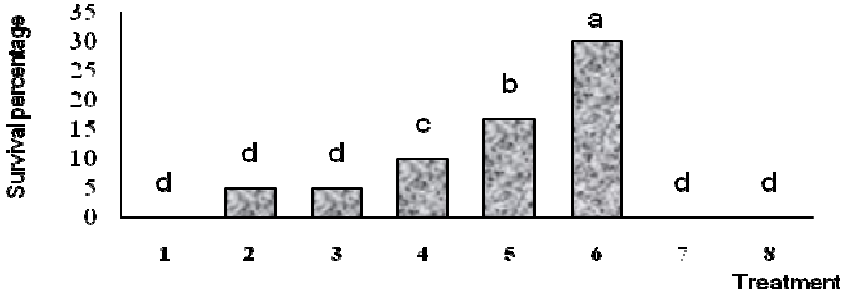

Figure 8: Comparison of survival percentage in different treatment

DISCUSSION AND CONCLUSION

Caspian locust have hard seed coat and physical dormancy as like many leguminous species that need to be overcome before germinatoion can be begin. Research on the dormancy mechanisms

of these legumes indicates that scarification treatments are required for adequate germination [8]. Caspian locust is scarce species of Iranian northen forests which have not done studing about it. According to obtained results, sulphuric acid treatment with one and half hours time, sulphuric acid treatment with one hours time and hot water for 2 hours time treatment had highest values of gemination rate and germination percentage. We are imagining though gemination rate and germination persentage of seeds that treated sulphuric acid with half hours time had egregious difference with control but it had lower effect than sulphuric acid treatment with one and half hours time, sulphuric acid treatment with one hours time had not removed hard coat seeds complately and hot water for 2 hours time treatment has been replaced it. To germinate and grow, seeds must absorb water, we are imagining hot water and sulphuric acid treatment could open away to entrance of gasses and uptake water with decreasing seed resistance. Ovservation of water uptake after treating with sulphuric acid by Genev and Dutt [2008], with using sequential digital images to show seeds germination of Honey locust emphasis this point. Acid scarification is known to be highly effective in improving germination of species with hard seed coats [4, 33]. Some researchers that have been done on Caspian locust [3], Honey locust [32] and other species of leguminous like as *Albizia julibrissin* [26] emphasis the effect of hot water and sulphuric acid.

The germination index is scale of germination time [19], whatever this index is low, the duration of germination time is low. Germination index in sulphuric treatment with one and half hours time had maximum of values, with referring germination percentage and germination rate values, can be found that the trend of seeds germination continuing in all of the germination during. The effect of this scattering and seed germination distribution isn't highlighted opposed to high germination rate and germination rate in this treatment. An understanding of dormancy mechanisms is of ecological and economic importance, indentification and finding of domancy levels need to develop information and experiments to detect the best method for overcome dormancy in special species [21]. Finally, using different treatments to seeds dormancy breaking and germination of Caspian locust tree showed maximum values of germination rate and germination percentage are obsorved in treated seeds with sulphuric acid for one and half hours time and with considering survival percentage of plants, sulphuric acid for one and half hours time scarification is known the best method for breaking seed dormancy of Caspian locust and its germination expedition. With considering to high importance of Caspian locust as genetical bank, we think more seedling production is away for prevention of its overthrow and protection to this gene source.

REFERENCES

[1] Aladjadjiyan A, *Journal of central european agriculture*, **2002**; 3(4): 271-276.
[2] AOSA [Association of Official Seed Analysts], *Journal of Seed_Technology*, **1993**;16(3): 1B113.
[3] Asadi M, M. Sc. thesis, Beheshti University, **1998**; 108p (In Persian).
[4] Babashpour Asl M, Sharivivash R and Rahbari A, *Modern Applied Science*, **2011**; 5 (1): 200-204.
[5] Bagheri R and Asadi F,Collection and conservation of forest tree seeds, Roosta shaghayegh Publications, **2003**; Volume 1, 96p (In Persian).
[6] Bewley J D, *Plant Cell*, **1997**; 9: 1055–1066.
[7] Dehghani Shoraki Y, Seed and seedling of forest trees production, Jahad Keshavarzy Publications, **2005** ; 115p (In Persian).
[8] Deno N C, *American Nurseryman*. **1995**; 182(7):87,89-93.

[9] Ellis R H, T.D. Hong, & E.H. Roberts, Hand book of seed technology for genebanks, *IBPGR*, 2(3).
[10] Ertekin M, and Kirdar E, *African Journal of Agricultural Research*, **2010**; 5(17): 2434-2438.
[11] Finch-Savage W E, and Leubner-Metzger G, *New Phytologist*, **2006**; 171: 501-523.
[12] Fordham J A, *Arnoldia*, **1965**; 25(1): 1-8.
[13] Gebre G H and Keram, N S, *Seed science and technology*, **2004**; 32(1): 255-260 (6).
[14] Genev R L and Dutt, M, *Propagation of Ornamental Plants*, **2008**; 8(1): 13-16.
[15] Hartman, H.T. and Kester, D.E. Davies, F.T. Geneve, R.L. Plant progation principles and practices, Hall international INC, **2002**; 880p.
[16] Heit CE, Acid treatment of honey locust, Notes For Invest, 42 Alban New York Conserv. Dep, **1942**.
[17] Hilhorst H W M, *Seed Science Research*, **1995**; 5: 61–73.
[18] Huxley A, **1992**; The new dictionary of gardening, Mac Millan press **1992** ISIBN, 0-33-47494-5.
[19] Isvand H R, Maddah Arefi H and Tavakkol afshari R, Genetic researches and improvement of rangelands and forest plants in Iran, **2004**; 13 (1): 68-83 (In Persian).
[20] Karimi H, The names of Plant of Iran,Tehran university emission center, **1995**; 412p (In Persian).
[21] Kelly K, Van Staden J M and Bell W E, *Plant Growth Regulation Journa*l, **1992**;11(3):201-209.
[22] Kirmizi S, Guleryuz G, Arslan H, and Sakar S, *TUBİTAK*, **2010**; 34: 225-232.
[23] Li BL, Foley ME, *Trends in Plant Science*, **1997**; 2: 384–389.
[24] Liu N, Khatamian Y H and Fretz T A, *Journal of the American Society for Horticultural Science*, **1981**; 106: 691-694.
[25] Maguire J D, *Crop science*, **1962**; 2:176-177.
[26] Nasiri M, Isvand H R, *Genetic researches and improvement of rangelands and forest plants in Iran*, **2001**; 95 - 111 (In Persian).
[27] Rezaei A, Seed dormancy and pretreatment, Educational booklet of Khazar forest seeds center,**1994**; 55p (In Persian).
[28] Robert L. Geneve, *Hortscience*, **2003**; 38(3): 336-341.
[29] Sabeti H, Forest, trees and shrubs of Iran, Yazd University Publications, **1995**, Volume 4, 750p (In Persian).
[30] Schnabel A and K Krutovskii, *Conservation genetics*, **2004**; 5: 195-204.
[31] Scott S J, Jones R A and Williams W A, *Crop Sci*. **1984**; 24:1192-1199.
[32] Singh D P, Hooda M S and Bonner F T, *New Forests*, **1991**; 5(2): 139-145.
[33] Youssef, A M, *Res. J. Agric. Biol. Sci.*, **2008**; 4(5): 595-603.