Effects of Chemical and Mechanical Scarification Treatments on Germination Rate of *Monotheca buxifolia* (Flac) Seeds

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ABSTRACT

Monotheca buxifolia (flac) is economically important plant. Seeds of *Monothesa buxifolia* were subjected to 17 different treatments in order to reduce dormancy. After scarification, scarification coupled with hot water treatment, application of kinitine after scarification and application of IAA after scarification gave 76%, 88%, 72% and 76% respectively shows higher percentage of germination in all treatments. Scarification coupled with hot water and kinitine, scarification coupled with hot water and IAA, hot water coupled with H_2SO_4 and kinitine, and scarification coupled with H_2SO_4 and kinitine gave same result which is 60% for all. Other treatments gave moderate results. The results show that reduction in germination is due to hard seat testa and inactive plants germination hormones.

Keyword; IAA, scarification, dormancy, hormones, Sapotaceae

Introduction

Monotheca buxifolia is evergreen small tree having broad leaves belonging to the family Sapotaceae. Distribution of this specie is mainly in the mountains of Northern Pakistan and Afghanistan. In Pakistan it is commonly found in Zhob, Gorakh Hills, Loralai, Kohat,Drosh Chitral,Attock District and , Kala Chitta Hills and Darra adam khel NWFP [1] and [2]. This is a common tree of Darra adam khel [3] and [4]. Inspite of other species, *Monotheca buxifolia* is the most preferred species in hilly areas.

The specie is mainly used as a fuel, fodder, small timber. *Monotheca buxifolia* is economically valuable for local mountain inhabitant [5]. Local inhibitant sold delicious gurguri which is the local name of the fruit of *Monotheca buxifolia*. Ethno botanically or medicinally fruit is digestive, laxative, and used in urinary tract diseases

[6].This specie is endangered and special care is needed. The fruit of this specie is mainly purgative, vermifuge and refrigerant [2].

Material and Methods

Monotheca buxifolia seeds were collected from District lower Dir Hindukash Range of pakistan. The study area District Dir Lower (DDL) lies in sub tropical dry temperate areas of Pakistan [7].With the help of running water the seeds of *Monotheca buxifolia* were separated from the fruit and then dried and store at temperature 8-10° C. At four different temperatures i.e. 10, 20, 25 and 35° C the germination studies were carried out to find out the suitable germination temperature to germinate *Monotheca buxifolia* seeds. The best suitable temperature for seed germination of *Monotheca buxifolia* were observe 25° C. the germination of seeds were carried out in sterilized Petri dishes. The double fold filter paper soaked with water and used in a sterilized petridishes for germination. five replicates were used for each experiment with 5 seeds. Experiments were carried out at 25° C. The Experiment was observed for 15 days .The filter paper throughout in experiment was kept moist. The germinated seeds were removed after counting. Different experiments were performing for germination of seed described as following:

Germination at different Temperature: The seeds were germinated on different temperature i.e 15° C, 20° C, 25° C and 30° C. The first seed germinated on 25° C after 20 days. So the further experiments were carried out at 25° C.

Effect of hot water: The unscarified seeds were soaked for 12 hours in water at room temperature and then immersed in a hot water for 5 mints. And then keep for 24 hours in cold water before germination.

Effect of hot water and plant hormones: The unscarified seed were soaked for 12 hours in water at room temperature and then immersed in a hot water for 5 mints. and then kept for 24 hours in cold water. Before germination they were treated with kinitine.

Effect of Mechanical scarification: The scarification of seeds was done within sand papers folds. The scarification carried out till seeds testa was ruptured at least 1-2 points. The scarified seeds were kept after scarification in cold water for at 24 hours before germination.

Effects of scarification and plant hormones: Seeds were scarified through sand paper and then immersed in cold water for 24 hours. Before set for germination these were treated with kinitine and IAA.

Effect of hot water and scarification: Seeds were scarified within folds of sand paper and then immersed in a hot water for 5 mints. Then these hot treated seeds were kept in cold water for 24 hours before to set for germination.

Effect of scarification, hot water and plant hormones: The seeds were scarified within folds of sand paper and then immersed in a hot water for 5 mint and kept in cold water for 12 hours before set for germination treated with kinitine and IAA.

Effects of sulfuric cid: Seeds were kept in water for 24 hours then these seeds were treated with sulfuric acid for 20 mints before set for germination.

Effect of hot water and sulfuric acid: Seeds were immersed in hot water for 5 mints and then kept in cold water for 24 hours and treated with concentrated sulfuric acid for 20 mints before set for germination.

Effect of sulfuric acid and plant hormones: Seeds were kept in cold water for 24 hours and then treated with concentrated sulfuric acid for 20 mints and before set for germination treated with Kinitine and IAA.

Effect of Hot water, sulfuric acid and plant hormones: Seeds were immersed in hot water for 5 mints and then kept in cold water for 24 hours. Hot treated seeds were treated with concentrated sulfuric acid for 20 mints and then treated with Kinitine and IAA before set for germination.

Effect of Scarification and sulfuric acid: Seeds were scarified within folds of sand paper and then treated with concentrated sulfuric acid for 20 mints before set for germination.

Effect of scarification, Acid and plant hormones: Seed were scarified within fold of sand paper and then kept in cold water for 24 hours and then treated with concentrated sulfuric acid for 20 mints. Before set for germination these seeds were treated with Kinitine and IAA.

Control: Seeds were set for germination without any treatment.

1) Germination index (GI)

Total germination (Final germination percentage)

$$(Gr)= [Nr/N\times100]$$

(%age of Germinated Seeds on specific day divide by total number of seeds used in experiments)

2) Speed of germination (SG) [8] and [9]

$$S= (N_1\times1)+(N_2-N_1)\times1/2+(N_3-N_2)\times1/3+\ldots\ldots\ldots N_n-N_{n-1})\times1/n$$

(N1, N2, N3...Nn are the number of germinated seeds on Day 1,Day 2, Day 3….Day n)

3) Coefficient of the rate of germination (CRG) [10]

$$CRG = \underline{[N_1+N_2+N_3+\ldots\ldots\ldots\ldots N_n]}$$

$$(N_1\times T_1)+(N_2\times T_2)+(N_3\times T_3)+\ldots\ldots(N_n\times T_n)$$

4) Germination index (GI) [11]

$$G_I=\Sigma\ (G_t/T_t)$$

5) Energy of Germination (EG) [12]

EG= Percentage of germinated seeds on 7th days after sowing relative to the number of seed tested

6) Speed of Emergence (SE) [12]

SE= No. of seedling emerged 7 days after sowing/ No. of seedling emerged after 15 days×100

Results and Discussion

Seed of *Monotheca buxifolia* kept at various temperatures i.e. 15, 20 and 30° C given no significant result except 25° C for 25 days. The first seed germinated after 25 days at 25° C Therefore all the rest of experiments were carried out at 25° C. The present study show that temprature variation was not effected on seed germination. Seed germination study on different plants i.e *Datura fastuosa* and *Datura innoxia* [13] and *Withania Somnifera* [14] revealed possible dormancy causes and poor germination such as inhibitors to germinate seeds, hard seed coat and testa, small quantity of food.

Seed were subjected to various experimental treatments to overcome seed dormancy. The pre-sowing treatments involve in earlier germination and growth of seedlings [15]. Untreated seed show no result. In experiment 1st the untreated seed gave no results. Hot water and water percolation treatments show 8% result after seven days and 16% result after 15 days (Table 01). It show that seed testa and seed coat were softened by hot water and percolation and become rupture to germinate, these two treatment was not so good. The second treatment show better

result as compared to first one which was 08 % after 7 days and 24% after 15 days (Table 01). This result shows deficiency of germinated hormones and hard seed coat which was softened by hot water treatment and application of kinitine. The hot water treated seeds were treated by application of plant growth hormone IAA show better result 8 % after 7 days and 32 % after 15 days (Table 01). Mechanical scarification on seeds show best result 40% after 7 days and 76 % after 15 days which show that inhibition is mainly due to hard seed coat. Mechanical scarification enhanced germination (Table 01).

This result is different from the results of Al-yahyai & Harith Al-nabhani [16] achieved when he worked on seed germination of *monotheca buxifolia* that the scarification reduced germination of seeds. Hussain & ilahi [14] achieved the similar results of germination on seeds of *Withania somnifera* after rupturing of hard seed coat and testa by mechanical scarification. The seed after treatment with hot water and scarification gives best result 48 % after 7 days and 88 % germination after 15 days (Table 01). This result suggested that some seeds need hot water treatment before germination in order to softened hard seed coat. The mechanical scarification ruptures seed coat easily after hot water treatment. Hot water treatments combined with mechanical scarification show best results as compared to other treatments.

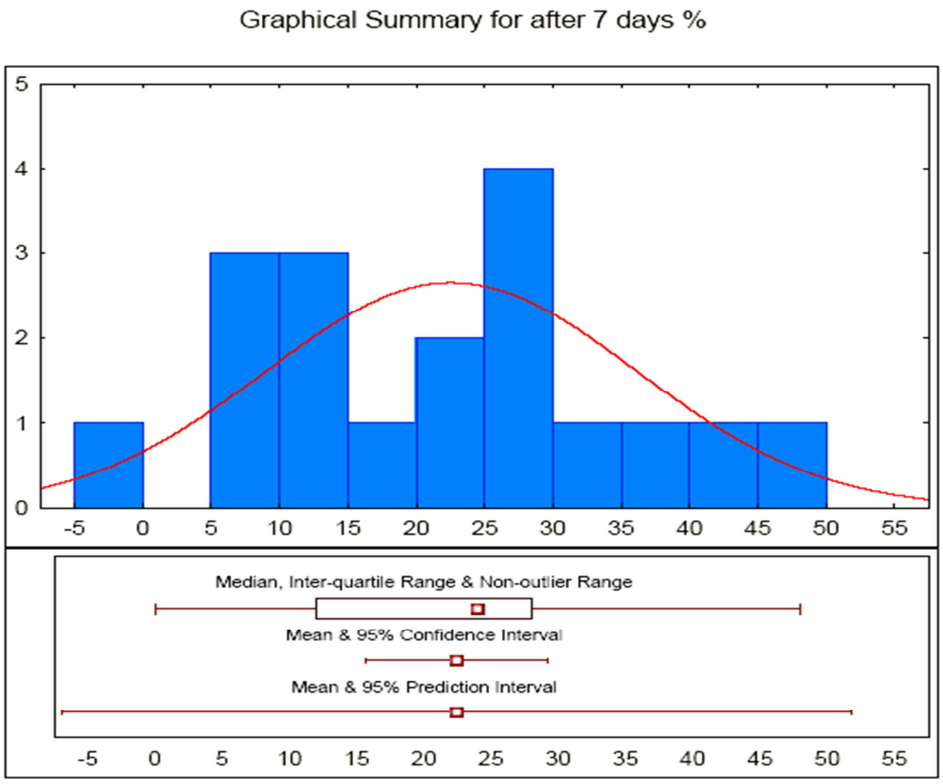
In some seeds Hormones is needed to start germination (Table 01) scarification are combine with plant hormone kinitine in order to promote germination. Seed germinated 44 % after 7 days and 72 % after 15 days. Rate of germination and seedlings growth increase by rubbing seeds with sand paper [17] and [18].

The scarified seeds were treated by IAA gave 76% result after 15 days and 32 % after 7 days (Table 01). This result shows that hormones has also some enhancing capability of germination and promote seed germination. The Seeds were scarified after hot treatment and then subjected to kinitine gives 20 % germination after 7 days and 60 % after 15 days (Table 01). The seeds were treated by IAA after scarification and hot water treatment gave almost same result as in kinitine application which was 28% after

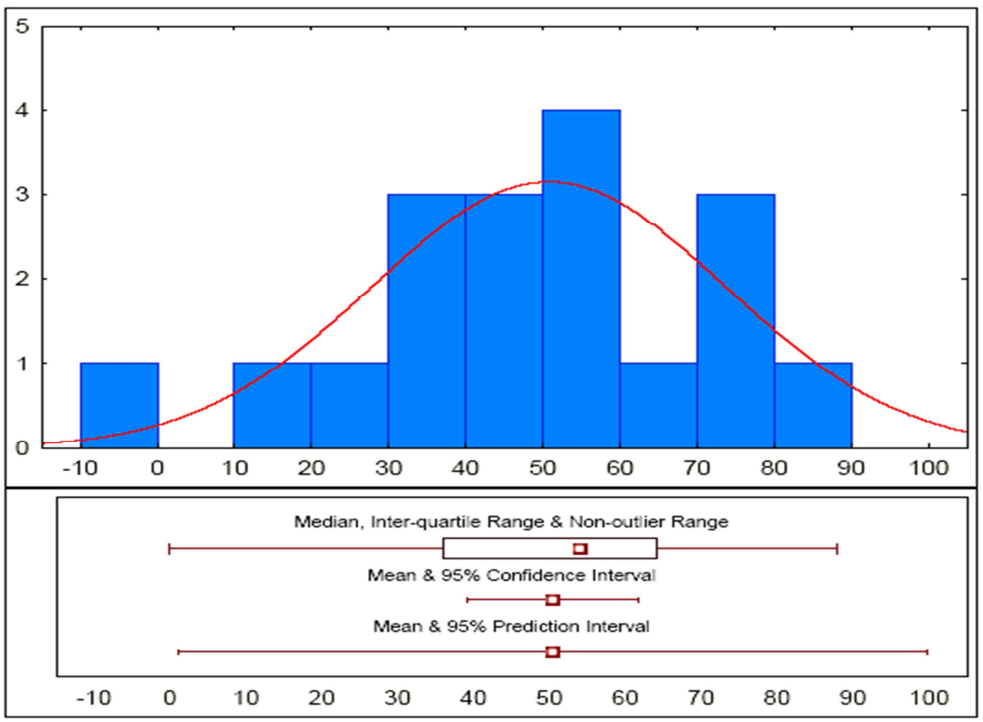
Table 01. Effect of various Chemical and Mechanical Scarification treatments on the germination rate of *Monotheca buxifolia* seeds.

S. No	Treatment	GI	CRG	SG	SE	EG (%age)	%age after 07 days	%age after 15 days
1	Control	0.93	6.66	01	01	00	00	04
2	Hot water	7.5	8.84*	9.512	50**	08	08	16
3	Hot water + K	9.13	8.80*	10.57	40*	08	08	24
4	Hot water +IAA	12.93*	7.7	14.508*	25	08	08	32*
5	Sand paper Scarification	36.26***	8.6	44.81***	52.6**	40***	40***	76***
6	Hot water + Sand paper scarification	36***	9.0*	46.536***	63.15***	48***	48***	88***
7	Sand paper Scarification + K	35.93***	8.9*	45.47***	61.1***	44***	44***	72***
8	Sand paper Scarification +IAA	33.4***	8.5	41.09***	47.36**	32**	32**	76***
9	Sand paper Scarification+ Hot water + K	27.13***	8.1	31.66***	66.6***	20	20	60***
10	Sand paper Scarification +Hot water +IAA	27.33***	8.7*	34.30***	53.3**	28*	28*	60***
11	H_2SO_4	22.2**	7.8	25.03**	27.27	12	12	48**
12	Sulfuric Acid +Hot water	22.4**	8.6	27.66**	22.22	24	24	48**
13	H_2SO_4 + K	16.4*	8.1	19.22*	30	12	12	40*
14	H_2SO_4+Hot water + K	25.86**	9.7*	31.58***	46.6**	28*	28*	60***
15	Hot water +H_2SO_4+IAA	29.49***	8.5	36.38***	43.75*	28*	28*	64***
16	Sand paper Scarification+H_2SO_4	14.4*	7.8	16.43*	33.33	12	12	36*
17	Scarification+H_2SO_4+ K	26.86**	8.6	33.39**	46.6*	28*	28*	60***
18	Sand paper Scarification+H_2SO4+IAA	21.8**	8.8*	29.46**	50**	24	24	48**

Significance=P<0.05
*=Low significant; **=Significant; ***= highly significant
Key words:
H_2SO_4= Sulfuric acid; IAA= Indole acetic acid; K= Kinitine; GI= Germination index; CRG= Co-efficient of rate of germination; SG= Speed of emergence; EG; Energy of germination;

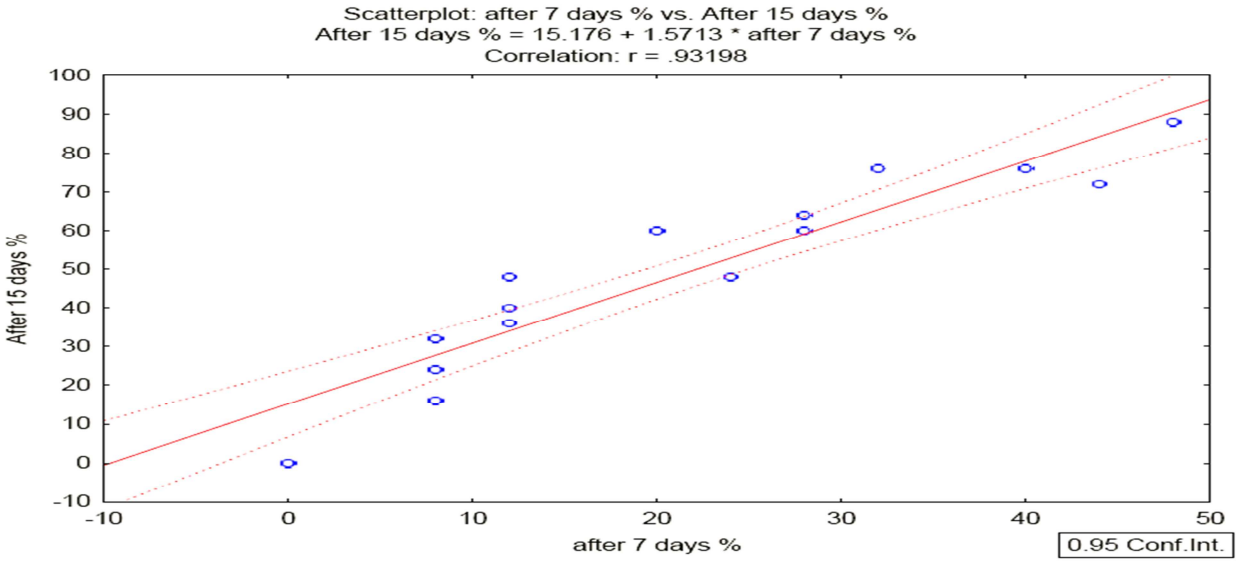


Shapiro-Wilk p:	0.448
Mean:	22.44
Std.Dev.:	13.52
Variance:	183
Std.Err.Mean	3.187
Skewness:	0.265
Valid N:	18.00
Minimum:	0
Lower Quartile	12.00
Median:	24.00
Upper Quartile	28.00
Maximum:	48.00
95% Confidence for Std Dev	
Lower	10.15
Upper	20.27
95% Confidence for Mean	
Lower	15.72
Upper	29.17
95% Prediction for Observation	
Lower	-6.867
Upper	51.76



Shapiro-Wilk p:	0.774
Mean:	50.44
Std.Dev.:	22.80
Variance:	520
Std.Err.Mean	5.374
Skewness:	-0.535
Valid N:	18.00
Minimum:	0
Lower Quartile	36.00
Median:	54.00
Upper Quartile	64.00
Maximum:	88.00
95% Confidence for Std Dev	
Lower	17.11
Upper	34.18
95% Confidence for Mean	
Lower	39.11
Upper	61.78
95% Prediction for Observation	
Lower	1.025
Upper	99.86

7 days and 60 % after 15 days (Table 01). Seeds when treated with sulfuric acid give 12 % germination after 7 days and 48 % after 15 days (Table.01). These results were almost same as seeds were treated only with sulfuric acid. The germination was 24 %after 7 days and 48 %after 15 days (Table 01) the seed were treated with sulfuric acid and then kinitine was not give the good result as 12 % after 7 days and 40 % germination after 15 days (Table 01). the seeds were treated with hot water in order to softened the seed testa and the subjected to sulfuric acid combine with application of plant hormone kinitine gives slightly better result as 28% after 7 days and 60 % germination after 15 days (Table 01). IAA was applied on seed after passing on treatments with hot water and sulfuric acid gave better result 28 % after 7 days and 64 % after 15 days (Table 01).



Seeds were treated with sulfuric acid after scarification was not given the good result as 12 % after 7 days and 36 % germination after 15 days (Table.01). The seed were treated with kinitine after treated with hot water treatment and sulfuric acid gives slightly good result 28 % after 7 days and 60 % germination result after 15 days (Table.01). The seeds were treated with IAA after treatments of hot water and sulfuric acid gave 28% result after 7 days and 48% germination result. This result shows that plant hormones deficiency may be the cause of seed dormancy (Table 01)). These results are same as results of Muhammad ibrar and Farrukh hussain [19] who achieved that reduced germination is due to hard impermeable testa. Germination index were

taken after 15 days show variable results. Highest germination index were shown by scarification, scarification + Hot water treatments, sacrification + kinitine and scarification + IAA which is 36.26, 36, 35.93 and 33.4 respectively (Table 01). Other germination index values such as scarification+ hot water treatments+ kinitine, Scarifiction+ Hot water IAA, Hot water+H_2SO_4+IAA, H_2SO_4, Hot water +H_2SO_4+ Kinitine, Hot water +H_2SO_4+ IAA, scarification + H_2SO_4+Kinitine and scarification + H_2SO_4 +IAA show moderate results like 27.13, 27.33, 22.2, 22.4, 25.86, 29.49, 26.86 and 21.8 respectively (Table.01). Other germination index value were lower such as values of Hot ware, Hot water + Kinitine, Hot water +IAA, H_2SO_4 +Kinitine, Scarification +H_2SO_4 and control show lower germination such as 7.5, 9.13, 12.93, 16.414.6 and lowest for control which is 0.93 respectively. Highest coefficient of rate of germination after 15 days are 9.7 which is the treatment result of seeds treated with hot water and H_2 SO_4 and then treated with kinitine. Control treatment co-efficient of germination show lowest value 6.66. Similarly speed of germination was observed to be highest in hot water +scarification treatment which was 46.53. Some other treatment shows also good speed of germination such as scarification, scarification +Kinitine, scarification +IAA have value for this parameter was 44.81, 45.47, and 41.09 respectively. Other treatment show moderate to lower effectiveness in speed of emergence and the lowest speed was observing in control i.e. 01 (Table 01). Speed of Emergence is also useful parameter in order to study the emergence property of seed after treatments. The highest value observe in Scarification+ Hot water+ Kinitine, Hot water +scarification and scarification +kinitine plant hormones seed treatments which was 66.6, 63.15 and 61.1 respectively (Table. 1). Other speed of emergence value was moderate to Average. Energy of Germination was also observed in upper 18 treatments after 7 days. The highest values are mainly observe in Hot water +Scarification, Scarification +kinitine and scarification method which was 48, 44 and 40.Other values are average to below average. And the control treatments show lowest result such as 00.The results suggested that seeds of *Monotheca buxifolia* seed dormancy should be effectively break down by using sand paper for scarification as well as sulfuric acid show significant results in seedlings emergence.

Conclusion

It is concluded from the results that different techniques such as scarification, acid treatment, use of hormones etc for reduction of dormancy of hard seeds show significant results as compared to untreated Seeds.

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