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EFFECT OF PRE-GERMINATION TREATMENT ON GERMINATION OF *Zizyphus mauritiana* and *Zizyphus spina-christi* SEEDS IN A SEMI ARID ENVIRONMENT OF SOKOTO-NIGERIA

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ABSTRACT

Effect of three seed treatment methods (mechanical seed scarification, sulphuric acid and hot water) were investigated on germination of *Zizyphus mauritiana* and *Zizyphus spina-christi.* Floatation method was used to separate viable seeds form non-viable ones. Mechanical scarification was carried out at three seed sites, (2mm from microphyle, 2mm from distal end and around the circumference) for the two species. In sulphuric acid treatment, 98% concentration was used at three varying periods of immersion (10 minutes, 30 minutes and 60 minutes) for both species. Similarly hot water (100^0C) treatment was carried out at three varying immersion time (15, 30 and 45 minutes). Untreated seeds were also used as control in each case. Seeds which were mechanically scarified around the circumference had higher germination percentage of 76.7%, and 73.3% for *Z. mauritiana* and *Z. spina-christi* respectively. In both species, poor germination percentage was obtained from mechanical scarification at 2 mm from the distal end in the two species with 46.7% and 43.3% for *Z. mauritiana* and *Z. spina-christi* respectively. A higher germination percentage was recorded from seeds immersed for 10 and 30 minutes with 80% each for *Z. mauritiana* and 60% and 66.7% from seed immersed at 10 and 30 minutes respectively for *Z. spina-christi* . There was no germination in seeds treated with hot water in the two species. Thus, hot water treatment was found incompatible with the species. Interestingly untreated seeds (control), showed good germination response. However, it inferred from this study that, mechanical scarification and concentrated sulphuric acid treatments are some the factors that significantly influence germination percentage in seeds of *Z. mauritiana* and *Z. spina-christi*

Keyword: Germination; *Zizyphus mauritiana*; *Zizyphus spina-christi*

INTRODUCTION

The genus *Zizyphus* (ber, jujube) belongs to the buckhorn family (Rhamnaceae). It is a genus of about 100 species of deciduous or evergreen trees and shrubs distributed in the tropical and subtropical regions of the world (Johnson, 1962). Species such as *Z.*

mauritiana and *Z. jujube* occur on nearly every continent, where as other species, like *Z. nummularia, Z. spina-christi* and *Z. mucronata,* are endemic species (restricted in their distribution to distinct areas) *Zizyphus* species can grow either as trees and shrubs (*Z. mauritiana, Z.rotundifolia, Z.jujuba, Z. mucronata*) or exclusively small shrubs or bushes (*Z. nummularia,Z.lotus, Z. spina-christi, Z. obtusifolia*). In Australia, this species grow in wide variety of soil types, including cracking clays, solodic soils and deep alluvias in the tropical and sub-tropical where the average annual rainfall is in the range 470-1200mm. In the drier parts of this range, it grows best in riparian zones. (Grice, 2002).

It forms impenetrable thickets which seriously hamper livestock management and reduces pasture production and accessibility (Land protection, 2001). It also likely have significant environmental effects on tropical and sub-tropical woodlands and savannah (Grice, 2002).

Z. mauritiana lam and *Z. spina- Christi* (*L*) *Desf* belongs to the family Rhamnaceae. These tree species are among the indigenous tree species found commonly in the savannah. They both are important fruit species which are used as food. They are also multipurpose tree species which are used as fodder, firewood, shade, posts, furniture, building materials etc. The fruit can be prepared for consumption in many ways. The drupes are eaten fresh, pickled, dried or made into confectioneries, and juice can be made into a refreshing drink (Khoshoo and Subrahmanyam, 1985).

Beside the fruits, nearly every part of these species can be utilized. The leaves and twigs of *Z. mauritiana* and *Z. spina-christi* can be used as high nutritional fodder for livestock. Due to their high protein content per dry weight, they are an important nitrogen source for the animals. They are also good desertification control (Anonymous, 2001).

Z. mauritiana Lam. and *Z. spina-christi* also have very nutritious fruit and usually eaten fresh. The fruits are applied on cuts and ulcers. They are also used to treat pulmonary ailments and fever to promote the healing of fresh wounds and dysentery (Adzu et al., 2001). The seeds are sedatives and are taken somewhere with buttermilk to halt nausea, vomiting and abdominal pains associated with pregnancy (Kaaria, 1998).

Propagation is by seeds which should be stratified 6 months prior to seeding. The *Z. spina-chriti* is distributed over Sahara and Sahel, from Senegal to the Sudan and Arabia. While *Z. mauritiana* distribution is widely distributed in semi-arid Africa and in the Mediterranean region, Sahel and Sudan Savana (Maydell, 1986).

MATERIALS AND METHODS

Study Area

The study was conducted in the Agric physical laboratory of the Usmanu Danfodiyo University, Sokoto. The main campus lies between latitude 13^{o}06'- 13^{o} 08'N, longitude 5^{o}11'- 5^{o}12' E (SERC, 2014). . The main campus lies between latitude 13^{o}06'- 13^{o} 08'N, longitude 5^{o}11'- 5^{o}12' E and an altitude 351.0 m above sea level. It has about 70-125 days of rainy season (SERC, 2014). Annual rainfall is not only variable and unreliable, but a mere fraction of the potential evapo-transpiration.

Temperatures are variable during the dry and rainy season. The minimum temperature is 10- 23^{o} C and the maximum temperature is between 33^{o}C- 45^{o} C. Annual average temperature has a minimum of 22.90^{o} C and a maximum of 35.98^{o} C. Relative humidity is between 52% - 56% (SERC, 2014).

Sokoto state has a maximum temperature of 41^{o}C and minimum of 10^{o}C in April and January respectively. It is characterized by alternating rainy and dry seasons. The mean annual rainfall is 700 mm per annum. Rainfall is short and erratic, falling between the months of June and September. With an altitude of 350 m above sea level (SERC, 2014). Sokoto has two main seasons; the dry season which last from October to May/June, and the rainy season that last from June to September/October. The harmattan season stretches from November to March, which is dry and dust laden wind (SERC, 2014).

Experimental Procedure

The seeds used in this experiment were obtained from Sokoto market, Sokoto State. Floatation method was used to separate viable from non-viable seeds. The non-viable seeds were discarded and those that are viable were used for various pre-germination treatments to induce germination. The treatments were acid treatment, mechanical scarification and hot water.

Experiment 1: Effect of mechanical scarification on germination percentage of *Z. mauritiana* and *Z. spina-christi:*

The experiment was conducted to determine the effect of mechanical seed scarification on the germination percentage of *Z. mauritiana* and *Z. spina-christi*. The seeds of these species were scarified at (a) 2 mm from the microphyle (b) 2 mm from distal end and (c) around the seed circumference by filing method. The scarified seeds were placed on wet filter paper in petri-dishes and observed for germination. The experimental design used was completely randomized design with three replications. Untreated seeds were also used as control.

Experiment 2: Effects of sulphuric acid concentration on varying periods of immersion on germination percentage of *Z. mauritiana* and *Z. spina-christi:*

The seeds of these species were soaked in sulphuric acid concentration (98%) and the varying periods of immersion were 10, 30 and 60 minutes. The treated seeds were then washed under running water and rinsed with distilled water, after which the seeds were sown between filter papers placed in petri-dishes to test for germination. Completely randomized design with three replications was used for the experiment. Untreated seeds were also used as control.

Experiment 3: Effect of hot water treatment on varying immersion periods on germination percentage of *Z. mauritiana* and *Z. spina-christi:*

The seeds of these species were immersed in hot water (100^{0}C) and the varying periods of immersion are 15, 30 and 45 minutes. The treated seeds were placed on wet filter papers in petri- dishes to test for germination. The experimental design used was completely randomized design with replications. Untreated seeds were also used as control.

Data Collection and Analysis

Germination count was done on daily basis. The experiment continued for a period of 21 days.

Analysis of variance (ANOVA) was used to test for significant difference, and the values obtained were further subjected to mean comparison using the Least Significant Difference (LSD) test.

RESULTS AND DISCUSSION

Mechanical Scarification

The mechanical scarification affected germination percentage in seeds of *Z. mauritiana* and the result is shown in Table 1. The highest germination percentage of 76.7% was achieved in seeds which were scarified around the circumference followed by the seeds scarified from the microphyle (63.3%). Untreated seeds (control) were also found to be doing well with germination percentage of (56.7%). Lowest germination percentage was obtained in the seeds which were scarified at 2mm from distal end (46.7%). This is in agreement with the findings of Aduradola and Shinkafi (1999) that scarification around the circumference gave highest germination percentage in *Tamarindus indica* seeds.

From the results it shows that seeds scarified at 2mm from microphyle were not significantly different to the three other treatments. Also, there was significant difference in seeds scarified around the circumference and those scarified at 2mm from distal end as well as the control.

The effect of mechanical scarification on seeds of *Z. spina-christi* was studied and the results were also presented in Table 1. Seeds which were scarified around the circumference had higher germination percentage (73.3%) than those from two other scarification sites (2mm from distal end and 2mm from microphyle). This is followed by the seeds which were scarified at 2mm from microphyle. As in the case of the later species, the lowest germination percentage was 43.3% in seeds which were scarified at 2mm from the distal end. The highest germination percentage of 76.7% was recorded from seeds which were used as control (untreated seeds). This is in agreement with the earlier findings of Iyamabo (1967) and Duguma *et al*. (1988) that mechanical scarification is an efficient way of improving seed coat permeability in *Pterocarpus angolensis* and *Leucocepala* seeds. Interestingly, there was no significant difference among the three treatments and the control.

Table 1: Effect of mechanical scarification on germination percentage in seeds of *Z. mauritiana* and *Z.Spina-christi*

Scarification site	Germination percentage	
	Z. mauritiana	*Z. spina- christi*
2mm from microphyle	63.3^{ab}	66.7^{ns}
2mm from distal end	46.7^{b}	43.3^{ns}
Around circumference	76.7^{a}	73.3^{ns}
control	56.7^{b}	76.7^{ns}
Mean	60.9	65
LSD (0.05)	17.19	45.48

Means with the same letter(s) are not significantly different ($Pr \geq 0.05$). ns- Not significant

Sulphuric Acid Treatment

From the results in Table 2, highest germination percentage of 80% was obtained in seeds soaked for 10 and 30 minutes. While germination percentage of 56.7% was recorded for both seeds soaked for 60 minutes and the untreated seeds (control). This is in contrast with the findings of Duguma *et al.,* (1998) that germination percentage increase with longer

treatment time in *Leucaenia Leucocepala* seeds. The result also shows that, there was significant difference between seeds immersed for 10 and 30 minutes and seeds immersed for 60 minutes together with the untreated seeds (control).

From the experiment, it was clear that the untreated seeds (control) gave the highest germination percentage of 76.6%. Seeds immersed for 30 minutes had higher germination percentage of (66.7%) than those with the other varying periods of immersion (10 and 60 minutes). Germination percentage of seeds soaked for 10 minutes was 60% and the lowest germination percentage was 50% from seeds soaked for 60 minutes. Thus, the longer the immersion period, the lower the germination percentage. Interestingly, there was no significant difference among the three treatments and also, between the control and all the three treatments.

Table 2: Effect of varying periods of immersion in 98% sulphuric acid concentration on germination percentage in seeds of Z. *mauritiana Z. spina-christi*

Treatment time	Germination percentage	
	Z. mauritiana	*Z. spina-christ*
10	80.0[a]	60.0[ns]
30	80.0[a]	66.7[ns]
60	56.7[b]	50.0
control	56.7[b]	76.7
Mean	68.4	63.4
LSD(0.05)	20.34	27.72

Means with the same letter(s) are not significantly different ($Pr \geq 0.05$). ns- Not significant

As with the different immersion periods (15, 30 and 45) in all the two species, there was no germination. This might be as a result of the intensity of the water temperature which might have probably killed the seed.

CONCLUSION

Conclusively, seeds of *Z. mauritiana* and *Z. spina-christi* have short dormancy under suitable environmental conditions. Since, even the untreated seeds (control) have good germination response (56.7% and 75.7%) in *Z. mauritiana* and *Z. spina-christi* respectively. However, it is inferred from this study that, mechanical scarification and concentrated sulphuric acid treatments are some of the factors that significantly influence germination percentage in seeds of *Z. mauritiana* and *Z. spina-christi*. Similarly, Seeds mechanically scarified around the circumference gave higher germination percentage of 76.7% and 73.3% in *Z. mauritiana* and *Z. spina-christi* respectively, than those scarified elsewhere. Also, seeds immersed for 10 and 30 minutes in sulphuric acid gave higher percentage over those immersed for 60 minutes in all the two species. None of the seeds germinate under hot water treatment in both species. This indicates that hot water treatment is not ideal for seeds of *Z. mauritiana* and *Z. spina-christi*.

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