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EFFECT OF SCARIFICATION METHOD ON THE GERMINATION AND SEEDLING GROWTH OF FLAMBOYANT: *DELONIX REGIA*

***Mohammad, M. and Abdulrahman, A.**

Department of Biological Sciences Federal University Dutse, Jigawa.

* Correspondence Author maryammohammad35@yahoo.com.

ABSTRACT

Effect of scarification method on the germination and seedling growth of flamboyant (*Delonixregia*) was investigated. The experiment was conducted at botanical garden Federal University Dutse, Jigawa State (Latitude 11.00^0N to $13.00N^0$ and longitude 8.00^0E to 10.5^0E). Flamboyant (*Delonixregia*) seed were collected from Kundila garden in Kano State. The experimental design used was completely randomized block design. There were 15 replications per treatment. The experiment consists of three treatments; acid treatment by soaking the seed in 75% H_2s04 for 2hours, mechanical treatment of the hard seed coat using sand paper and treatment of the seed with hot water for 10minute. Data was collected on seedling emergence, seedling height and germination rate and analyzed using analysis of variance at 5% significance level. There were significance differences between the treatments. The highest germination rate of 100% was observed in mechanically scarified seeds while the control recorded the lowest germination rate of 20%.In seedling emergence, the highest emergence 66.6% was induced by hot water treatment and the least were the untreated seed which recorded 20%. In seedling height the highest result was obtained with mechanical treatment and the least were the control plants. Mechanical scarification significantly inducedhigh and quick germination more than any of the treatments. Therefore selection of Mechanical Scarification method would be a wiser choice as it is more effective in breaking the Seed Dormancy of *Delonixregia*.Results of this research may serve as useful information in the production and improvement of *Delonixregia* species, as knowledge on seed germination requirements is a critical factor in seedlings production.

Keywords: *Cowpea, Benzyl Amino Purine, Nitrogen, Kanannado, Fertilizer*

INTRODUCTION

Delonixregia (Poinciana regia) a member of the family *Fabaceae* is a tree of 10-18m height. The generic name, '*Delonix*', is derived from a Greek word meaning 'clear talon' in allusion to the conspicuously clawed petals.Royal poinciana (*Delonixregia*) belong to the family Fabaceae and originated in Madagascar, Africa. The specific name, '*regia*, is from the Latin word 'regis'. Most of its common names are derived from its large, flame-red flowers (Borthwick and Robbins, 2011). It is also called the Peacock flower and the Flamboyant. *Delonixregia*is planted as a shade tree in dairy farms, tea plantation and compounds (Bonner, 2009). The tree yields thick mucilage of water-soluble gum in yellowish or reddish-brown warty tears; the seeds contain gum that may find use in textile and food industries (Willan, 2010). *Delonixregia*is propagated from seeds that have a hard, woody testa and take a long time to germinate. They may lie for 2-3 years in the soil without germinating (Delouche, 2000).

Seed dormancy could be considered simply as a block to the completion of germination of an intact viable seed under favorable condition (Girase*et al.*, 2006). A dormant seed does not have the capacity to germinate in a specified period of time under any combination of normal physical environmental factors that are otherwise favorable for its germination, i.e., after the seed become non-dormant (Baskin and Baskin, 2004). A completely non dormant seed has the capacity to germinate over the widest range of normal physical environmental factors possible for the genotype.

Any treatment that destroys or reduces seed coat impermeability is commonly known as scarification (Bonner, 2009). The efficiency of treatments varies greatly with the degree and kind of seed dormancy. Scrificationis a technique for overcoming the effect of an impermeable seed-coat. Mechanical scarification can be done by rubbing seeds between two pieces of sandpaper Girase *et al* (2006) or using a file, a pin, or a knife to rupture the seed coat. Seed may also be mixed with coarse sand and shaken vigorously in a jar (Girase *et al.*, 2006). Even a vise can be used to squeeze seeds along the suture until they crack open. Large seeds like those of the Poinciana Seed (*Delonixragia*) are easily scarified with a knife; the hot water treatment is easier for small seeds.

Many seeds fail to germinate after processing and placement in favorable growing conditions, and such seeds are said to be

dormant. Many seeds can also spend a complete season without germinating (Levitt, 1972). However, those seeds can be manipulated to facilitate germination during short period of time through ~~s~~carification to break the dormancy in those seeds. This procedure makes the propagation of this plant easy as it paves the way to easy and fast manifest.

Scarification methods associated with dormancy have been studied experimentally in so many seeds of tropical trees such as *Melanoxylon* seeds, *Acacia mangium* seeds, *Meliavolkensii* seeds *Tamarindus indica* seeds etc by several workers including Baskin & Baskin 1998, Msanga 1998, Nikolaeva 2007, Martin 2013, Albrecht 1993 and several other workers but not much work has been done on *Delonix regia* seeds and hence their selection for this research. The current research will give a better understanding of the type of dormancy associated with *Delonix regia* seeds and also the best scarification method to be employed to break its dormancy.

The aim and objective of this research is to evaluate the effect of scarification method on the germination and seedling growth of flamboyant [(*Delonix regia*)*]* while the objectives include:-to assess the effect of scarification on seed germination and seedling growth of *Delonixregia*, to determine the best scarification method for breaking ~~s~~eed dormancy and also to determine the Germination Rate of seeds.

MATERIALS AND METHODS

Study site

All experiments were carried out in the Biology Laboratory and Botanical Garden in the Department of Biological Science Federal University Dutse

Seed source

Delonixregia seeds were collected from Kundila Garden, Maiduguri Road, Kano State. The pods were plucked from the tree, using knife the dried matured seeds were removed from the pod. The seeds were placed in a plastic container and stored in a cool dry place at room temperature before the commencement of the experiment. About 120 seeds were collected in all.

Soil analysis

Analysis of the soil used for this experiment was carried out before planting. The parameters determined were as follows: PH, electrical conductivity, sodium, potassium, calcium, magnesium, total nitrogen, phosphorous, ~~%~~ percentage sand, silt and clay.The instruments used for each of the parameters are stated as follows: PH by using glass electrode PH meter, electrical conductivity by atomic spectroscopy, Sodium, Potassium~~by~~ using flame photometer, Calcium, Magnesium by simple titration, total Nitrogen by kjeldahl instrument, Phosphorous using colorimetre, and percentage sand, silt and clay ~~by~~using Hydrometer.

Description of the procedure for the analysis and instrumentation of each of the parameter is given below:

The pH was determined using the method of Schofield and Taylor (1955).

Determination of Electrical Conductivity

Electrical Conductivity Procedure: This was carried out using the method described by Richard, (1954).

Determination of Calcium (Ca), Magnesium (Mg), Sodium (Na) and Potassium was carried out according to the method of Golkin *et al*.(1960).The sample was then analyzed and the result was recorded at concentration of cations in original sample in meq/100g.

Determination of sand, silt and clay

This was done based on the method of Clark (1962).

Planting

Polythene bags (25x20) cm were used for the experiment. The bags were perforated at the lower end to allow free drainage of water, and then filled with soil mixture and placed in a sunken bed. Later they were labeled and placed in completely randomized block design. All seeds were treated and sown directly in the prepaid soil. The seeds were watered daily by infiltration. There were 15 replications for each treatment. The planting was done on 2/7/2018. 120 seeds were used for the experiment

EXPERIMENTAL TREATMENTS

Scarification Treatment

The treatment involves Seed coat scarification at micropyle end. Mechanical seed coat scarification were carried out by rubbing the seeds between two pieces of sandpaper and also by using knife to rupture the seed coat. Non-scarified seeds were considered as control (Gupta *et al.*, 2001).

Acid Treatment

Concentrated sulfuric acid was used for the experiment. The procedure involved soaking the seeds in the concentrated sulfuric acid (75%) for 2hours in a glass container and stirred occasionally with a glass rod according to the method of Bonner *et al.* (1974)

Hot Water Treatment

Hot boiling water was used as a treatment to soften the hard coated seed of *Poinciana* (Delonixregia).The treatment includes soaking of the seeds in boiling water (100°C) for 15 minutes and seeds were subsequently soaked in cool water immediately after the treatment with the hot water. The untreated seeds were used as Control (Bonner *et al.* 1974).

DATA COLLECTION

Germination Rate (%)

Germination rate was obtained by counting the number of germinated seeds and divided by the number of sowed seeds multiply by one hundred (100). Justice (1972)

Seedling Emergence (%)

This was also obtained by counting the number of emerged seedlings and divided by the number of sowed seeds and multiply by one hundred (100) **Justice (1972)**

Shoot Height

Five seedlings from each treatment were selected at random to measure the shoot height (cm) with a meter rule. Justice (1972)

STATISTICAL ANALYSIS

The data collected was subjected to Analysis of Variance (ANOVA) and significant differences were further treated to a least significance difference test at p= 0.05

RESULTS AND DISCUSSION

Table 1: Mean germination percentage rate (%) as affected by the different treatments.

Treatment	Germination percentage rate (%)
Mechanical treatment	100
Hot water	86
H_2So4	70
Control	20
Mean	69
LSD (0.05%)	30.14

Table 2: Mean seedling emergence (%) as affected by the different treatments.

Treatment	Seedling emergence (%)
Mechanical treatment	60
Hot water	66.6
H_2So4	46
Control	20
Mean	45.65
LSD (0.05%)	22.41

Table 3: Mean seedling height (cm) as affected by various treatments at different weeks after planting.

Treatments	2 weeks	4 weeks
Control	8.25	12.5
Mechanical Treatment	14.25	19.5
Hot Water Treatment	13.5	18.9
H_2So4	10.7	16
Mean	11.7	16.23
LSD (0.05%)	1.32	1.32

Germination percentage rate

All the seeds (viable) which have overcome dormancy either naturally or artificially will readily germinate under suitable environmental conditions necessary for seed germination i.e., water, oxygen, and some cases light. In most cases these seeds germinate if placed on moist substrate. The germination percentage of *Delonixragia* treated with different artificial methods of breaking seeds dormancy were obtained from the data collected. This study revealed significant differences ($p < 0.01$) between treatments. Because scarification of the seed coupled with acid and boiling water treatments improved germination of this species, we can infer that dormancy of their seeds is physical and is related to the hard coat of the seeds. The seed coat is a physical barrier against growth of the embryo or radicule, which also inhibits absorption of water and gas-exchange.

The result on germination percentage rate for the *Delonixragia* Seeds is presented in Table 1.

Results revealed highly significant difference between the different treatments on germination rate. The highest germination rate, 100% was observed in mechanically scarified seeds followed by those treated with hot water, 86% and those treated with sulphuric acid which had germination rate, 70%. The untreated seeds (control) recorded 20% germination which was the lowest.

Delouche (2000) reported that the most important cause of seed dormancy in *Fabaceae* is the impermeability of hard seed coat to water. Similar results were obtained by Gupta *et al.* (2001)

with *Psoraleacorilifolia* and by Ghadiri and Torshiz (2000) with *Glycyrrhizaglabra L.* This support the report by Hartmann and Kester (1995) that manual scarification is effective in breaking physical, mechanical and chemical dormancies of seeds.

The results showed decrease in number of days to germination in treated seeds. Souza and Silva (1998) reported that mechanical scarification promoted the best germination rates and seedling emergence. The decrease in number of days to germination may be due to increasing permeability of the seed coat to water through puncturing the hard seed coat. This result agrees with those of Mayer and Poljakoff-Mayber (1989) who reported that the most hard-coated seeds become permeable to water when the seed coat is broken or punctured by mechanical abrasion or chemical treatment. Muhammad and Amusa (2003) reported a similar result of 98% germination when tamarind ('Jabbe')seeds were treated with 50% sulphuric acid for 60minutes.Wang *et al.* (2007) pointed out that most pre-treatment significantly reduce hard seed content and improve germination percentage and rate of growth.

Seedling emergence

In seedling emergence, the results revealed highly significant differences between different pre germination treatments on seedling emergence. The highest emergence of 66.6% was induced by hot water treatment, followed by those seeds treated with mechanical treatment (60%), and then sulphuric acid (H_2so4) treatment with 46%. The least were the untreated seed which recorded 20%. Nikolaeva (1989) reported that hot water treatment of *P. pinnata* for 15 minutes, improved seedling emergence.Also it was found that for *Acacia nilotica*and *Tamarindus indica*, pouring 80 °C water over the seeds in a container, followed by a soaking for 24 hours, was found to be effective (Albrecht, 1993). Pouring 100°C water over the seeds of *Adansoniadigitata*, *Calliandracalothyrus*, and *Sesbaniasesban*, with continued soaking as the water cooled off for 24 hours, was reported effective in breaking seed coat dormancy and seedling emergence (Albrecht, 1993). Pasiecznik *et al*. (1998) also, reported that treated seeds of *Prosopis* species with boiling water increased seedling emergence. The decrease in the number of days to germination in treated seeds may be due to cracking and rupture of the outer surface of testa by boiling water and then increasing the permeability of seed coat to water. This result supports what has been reported by Kannan, *et al* (2001) that changes in seed coat structure during dormancy breaking by heating at$100^0{}_C$showed the rupturing of the testa near the hilum. The decrease in the number of days to germination is related to the duration of soaking i-e the longer soaking duration the less number of days to germination. Levitt (1972) reported that seeds which do not swell during boiling can survive boiling in water for several hours.This also corresponds to the finding on "Effect of some seed pre-treatment on emergence of *Acacia senegal and Tamarindusindica*" by Saikou *et al*. (2000).

Seedling height

Growth in a plant is the outcome of cell division, enlargement of the new cells and their differentiation into different types of tissues. These process of growth are accompanied by a permanent change in size (usually increase in the growing parts such as the shoot).

The simpler rather crude method of measurement of growth (direct method) was used during the data collection, in which the length of growing part (shoot) was measured just with the help of centimeter ruler daily after the seedling emergence.

Analysis of variance showed that there was significant difference in the different treatments on shoot height at different weeks after planting (Table 3). The seedling height increased with increase in number of weeks after planting with significant difference. Those seeds that received mechanical treatment had significantly ($P\leq 0.05$) greater seedling height at 2 weeks (14.25 cm) and at 4 weeks (19.5 cm), followed by those seeds treated with hot water at 2 weeks (13.5 cm) and at 4 weeks (18.9cm). This was followed by sulphuric acid treated seeds that had seedling height of 10.7 cm and 16 cm at 2 weeks and 4 weeks respectively. The least were the control with 8.25 cm and 12.5 cm seedling height at 2 weeks and 4 weeks respectively. A similar result was obtained by Awodola (1994) with his experiment with the seeds of *Tamarindus indica* where the plant height was significantly enhanced by the mechanical treatment.A similar result was also obtained by Muhammad and Amusa (2003) with their work ontamarind. The results of seedling height in *Delonixregia* are supported by similar studies by (Masamba, 2010; Rungu, 2006; Teketay, 2011; Bonner, 2000; Phartyal*et al*., 2005). Results of the boiling water treatment for *Delonixregia*are similar to those of earlier studies as well (Lima, 2008; Teketay, 2011; Pasiecznik *et al*., 2001; Pearman *et al.*, 2002; Baskin *et al*., 2004; Bamel *et al*., 2007; Cook 2008). Compared with the previous studies on this species, it was seen that seeds need scarification treatment.

CONCLUSION

The germination rate, seedling growth, the seedling height were higher with mechanical scarification and hot water treatment. However, this response was not equal to all treatments.

RECOMMENDATIONS

- Hot water treatment is recommended as it is cheap, safe and efficient while mechanical scarification is suitable for hard large seeds.
- There is need to apply Scarification methods when dealing with Dormant Seed (like *Delonixregia* seeds) in order to speed up germination, seedling emergence and growth, because from the result obtained one can infer that dormancy of seeds of *Delonixregia* was probably associated with the seeds coat, since the treatment that induced germination were those that can effect disruption of the hard seed coat.
- Selection of Mechanical Scarification method over any other method will be a wiser choice as it is more

effective in breaking the Seed Dormancy of matured seeds of *Delonixregia.*

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