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EFFECT OF PRE-TREATMENTS ON SEED GERMINATION OF *PARKIA BIGLOBOSA (BENTH)*

[*1]Amonum, J.I., [1]Nyam, R. T. and [2]Gbande, S.

[1]Department of Forest Production and Products, University of Agriculture, Makurdi.
[2]Department of Forestry Technology Akperan Orshi College of Agriculture
Yandev, Gboko Benue State.

***Correspondent email**: *jamonng@yahoo.com;* Phone: +234 (0)7030559666

ABSTRACT

There has been emphasis on the use of indigenous tree species to check land degradation but these have not yielded the desired result, due to poor regeneration and slow growth rate of most indigenous trees. Parkia biglobosa (Jacq) Benth is being endangered as a result of over-exploitation coupled with the adverse effect of increasing human activities on its habitats and lack of its stand plantations (presently not being cultivated). This study was conducted at nursery section in University of Agriculture Makurdi. This study was carried out to investigate the most effective pre-sowing treatments to break seed dormancy and to stimulate seed germination. Matured seeds of P. biglobosa were collected from farmers at Mbalagh council ward of Makurdi area of Benue, Nigeria. The seeds were dried at room temperature and tested for viability by floatation. The seeds were subjected to four (4) different pre-treatments, namely: physical scarification treatment (treatment A); sulphuric acid for 20 minutes (treatment B); hot water treatment for 15 minutes (treatment C); cold water Treatment for 24 hours (treatment D) and untreated seeds which served as control. The result shows that dormancy was effectively broken by physical scarification which improved the germination percentage to 72%; sulphuric acid for 20 minutes had 61% germination, treatment with hot water for 15 minutes had germination percentage of 49% while treatment with cold water for 24 hours had percentage of 32% and untreated seeds (control) had 21% germination. Based on this study, physical scarification is recommended as the best treatment to break dormancy in P. biglobosa (Jacq) Benth seed.

Keywords: Seed, Dormancy, Germination, Treatment, Indigenous species *P. biglobosa.*

INTRODUCTION

Parkia biglobosa (Jacq) Benth is commonly known as Dorowa (Hausa), Africa locust beans (English). Iyere (Yoruba), Nere (Bambara), Nune (Tiv) has been known to been native of Africa.It is an economic multipurpose tree of West Africa and is an important tree of the most common species of the parkland agro-forestry system (Sacande and Clethero, 2007). The tree has the capacity to withstand drought because of its deep tap root system and an ability to restrict transpiration (Okunlola *et al.,*2011). More attention have been given to economic important species of tree plants especially *P. biglobosa* in recent years for a sustainable use and integrated management due to an increasing recognition of its contribution to fulfill basic needs of people, household economics, food security and conservation of natural resources (Joshi and Joshi, 2009). *P. biglobosa(Jacq) Benth*is a common species in agro-forestry. It plays vital role to food security, supply of timber, firewood, fodder, drugs, and dyes as well as restoration of fertility (Okunlla *et al.,* 2011).

*P. biglobosa*tree only grown by natural regeneration in the wild. The leaves, fruits, nuts and oils of the tree obtained from the wild have been used as food for humans, livestock and wildlife in many parts of the country.Latiff*et al.*, (2002) reported that forest resources directly contributed up to 180% of the livelihood of the people in the country living in extreme poverty.

The species provides food, income and employment to the people (Tee and Popoola, 2007; Tee andVerinumbe, 2007; Tella*et al*., 2008). This species provides protein, starch, vitamins and essential materials to human diet. It also, provides income and employment opportunities to rural and urban households (Tee *et al*. 2009).

The root, bark, leaves, stem, flowers, fruits and seeds of the tree species are all used for medicinal purpose to treat a range of ailments including diarrhea, ulcers, pneumonia, burns, coughs, jaundice etc. (Sacande and Clethero, 2007). The leaves are rich in nitrogen and used as manure. The yellow pulp surrounding the seed is edible in many forms and the seeds are made into condiments (iru), used extensively as flavouring and additives to soups and stews. (Okunlola *et al.,*2011). The pulp also contains simple sugars (Alabi*et al*. 2005). The sweet yellow pulp contains 60% sugar when ripe and the seeds contain 30% protein as well as vitamins and minerals (Sacande and Clethero, 2007). The fruit pods are used to produce an insecticide powder for treating crops.

According to Okunlola *et al.* (2011), *P. biglobosa* seed possesses an exogenous dormancy in which the hard seed coat prevents its germination. As a result of this problem, there is rapid depletion of the natural population of the tree and losing their genetic hereditary. The seed coat dormancy in *Pakia biglobosa* seed prevents the species from fast and uniform germination at the nursery stage. Seed dormancy is from impermeability of the seed coats to water, immaturity of the embrayo, low permeability of the seed coats to gases, mechanical resistance of the seed coats to embryo growth. This problem can be controlled by plantation establishment of this indigenous species; also, by successful production of healthy and vigorous seedlings at the nursery stage and ensuring viable seeds. This study aims at solving this problem of breaking dormancy using five (5) different methods of pre-treatment of *Pakia biglobosa(Jacq) Benth*-seeds.

MATERIALS AND METHODS

The Study Area

The experiment was carried out at Forestry Department nursery, located at south-core, University of Agriculture Makurdi. University of Agriculture Makurdi lies between latitude 7° 21' and 8° N and longitude 8° 21' and 9° E in Benue State (in the southern guinea savanna ecological zone). The climate of the area is tropical sub-humid with high temperatures and high humidity. The average maximum and minimum daily temperature of 35°C and 21°C in wet season, and 37°C and 16°C in dry season. Benue state has boundaries to the south with Enugu and Cross River states, to the east with Taraba state, north with Nasarawa state and west with Kogi state. The climate is characterized by distinct rainy and dry seasons. The mean annual rainfall value is between 1200mm to 1500mm. The vegetation of the area has been described as Southern guinea savanna (UAM Physical Planning Manual, 1989). The major occupations of the people include: farming, civil service, trading and hunting; and the major tribes found in the area are *Tivs*, *Idoma* and *Igede.*

Experimental Design and Data Collection

P. biglobosa(Jacq) Benth seeds for the experiment were collected from the wild mature trees growing at Mbalagh council ward of Makurdi Local Government Area. The seeds were selected after a viability test by the floating method (Okunlola *et al.,*2011). Five specimen representing four (4) different treatments and a control were adopted and examined. These includes:-Treatment A: physical scarification; Treatment B: soaking in 50% dilute tetraoxoSulphate (iv) acid; Treatment C: soaked in cold water; Treatment D: soaked Hot water and Treatment E: untreated seeds (control).

Treatment 1*:*

*P. biglobosa Benth*seeds were held with a rice, one seed at a time and a filer (sandpaper) was used to scrap the test a so that some part of the hard coat was removed living the healthy radical.

Treatment 2
The seeds were placed in an empty beaker, 50% diluted sulphuric acid was poured into the beaker. The seeds were fully immersed and left in the acid for 20 minutes after which they were removed and washed promptly and thoroughly in cool water for 3 to 5 minutes. This was to remove all traces of acid from the seed and then spread to dry.

Treatment 3
The Seeds were soaked in a beaker containing cold water and left for 24 hours.

Treatment 4
The Seeds were soaked in a beaker containing boiled water for 15minutes before it was removed.

Treatment 0
The Seeds were not given any pre-treatment before planting (control for the experiment).

After given pre-treatments to the seeds, the seeds were sown for germination and growth rate assessment. Sown seeds were watered daily using watering can. The treatment were laid out in a Complete Block Randomized Design (RCBD) with hundred (100) seeds per each treatment. Each germination box contained a mixture of topsoil, river sand and cow-dung in the ratio of 4:1:1.

Data Collection
The experiment was conducted for 7 weeks. Seedling parameters of interest include: number of germinated seeds and leaflets number. All germinated seedlings from each treatment were used for the assessment. Germination percentage was determined and subjected to Analysis of Variance (ANOVA) and chi-square test (2 x k).The number of germinated seeds for each treatment were counted and recorded daily throughout the period of germination. These assessments represented the germination rates for the four pretreatments on the seeds of *P. biglobosa.* The germination percentage was calculated using the formulary below.

$$\text{Germination \%} = \frac{\text{Number of germinated seed}}{\text{Number of seeds sown}} \times 10$$

RESULTS AND DISCUSSION
Table 1 shows the results on germination rate and percentage on different pre-treatment methods, this showed variation among the pre-treatment methods. Hundred (100) seeds were sown for each pre-treatment method. The untreated seeds (control) having a total of twenty one (49) seeds had 21% germination while physical scarification was observed to have 72% germination. Treatment with sulphuric acid (H_2SO_4) for 20 minutes had 61% germination, treatment with cold water (H_20O) for 24 hour and treatment with hot water (H_2O) for 15 minutes recorded a germination of 32% and 49% germination respectively.

Treatment A (T_1) germinated better than all the pre-treatments under observation. This result agree with Okunlola *et al.* (2011), who stated that germination must have occurred as a result of the partial exposure of the cotyledons of the seeds which permits the process of hydrolysis whereby hormones such as auxins and ethylene which could increase nucleic acid metabolism and protein synthesis are released.

According to the result shows on Table 1, it can be observed that *P. biglobosa* seeds dormancy may be associating with the seeds coat. The pre-treatment that induced germination were those that could penetrate the seed coat (T_1, T_2 and T_4) while pre-treatments (T_0 and T_3) that could not effectively penetrate the seeds coat were observed to germinated poorly.

Table 1: Germination rate and percentage of *Parkia biglobosa* seed at various pre-treatments

Treatment	No. of seed sown	No. seed germinated	Seed germinated (%)
T_o	100	49	21.0
T_1	100	72	72.0
T_2	100	61	61.0
T_3	100	31	31.0
T_4	100	49	49.0

T_o = untreated seed (control); T_1 = Physical scarification; T_2 = treatment with 50% dilute H_2So_4 for 20 minutes; T_3 = treatment with cold water for 24 hour; T_4 = treatment with Hot H_20 for 15 minutes.

The emergency rate (ER) and emergency rate index (ER1) were also determined with untreated seeds having the highest of 224.43 ER, 10.67 ER1 and treatment seeds by physical scarification with the lowest with 79.58 ER and 1.11 ER1 (Table 2). The mean daily germination of all pre-treatment was obtained with untreated seeds, physical scarification, treatment with sulphuric acids for 20 minutes, treatment with cold water for 24 hours and treatment with hot water for 15 minutes having 0.70, 7.20, 5.08, and 4.08 respectively. This implies that scarification using physical method had better germination since they had low ER and ER1.

Table 2: Indices of *Parkia biglobosa* seed germination with different Pre-treatment methods.

Seed	**T_o**	**T_1**	**T_2**	**T_3**	**T_4**
ER	224.43	79.58	135.80	158.03	128.65
ER 1	10.69	1.11	2.23	4.94	2.46
Germination %	21	72	61	32	49

ER = Emergency rate; ER1 = Emergency rate index.

In all the pre-treatment methods, untreated seeds and the seed treated with cold water for 24 hours did not improve germination, they recorded considerably low germination compared to the other treatments. This may have been due to the nature of the impermeable coats restricting water and air exchange, suffocation of the embryo or probably the accumulation of endogenous inhibitors.

According to Sabongari, (2001); Okunlola *et al.* (2011), the seeds of *P. biglobosa* treated with hot watershowed the least performance in germination percentage as a result of its effect on the seed coat that must have ruptured or damaged the seeds embryo. When their results were compared with this study, pre-treatment with hot water did better than untreated seeds and seeds treated with cold water for 24 hours.

Table 3 shows the comparison of the germination interval with respect to the first day of planting to the last day of emergence with determination of the early and late germination. The experiment examined whether the pre-treatment has effect on the viability of *Parkia biglobosa* seeds; the time taken for seeds from the various pre-treatment to germinate were observed. The result showed different germination interval, with untreated seed germinating on the fourteen day and ending it germination on the thirtieth day with germination interval of sixteen days. Physical scarification having it first germination on the fourth day and it last germination on fourteenth day with the germination interval of ten days. Seeds treated with sulphuric acid (H_2So_4) for twenty minutes started it germination on the seventh day, it last germination was observed on the nineteenth day with a germination interval of twelve days. Seeds treated with cold water (H_20) for twenty four hour and hot water (H_20) for fifteen minutes started germinating on the six and six day respectively; and it last emergence on the twenty first and eighteenth day, respectively with it germination interval as fifteen and twelve days respectively (Table 3).In comparison of early, late and germination interval of the various pre-treatment methods Fisher's exact test was used with Fisher's exact test value as 2.37 and p-value of 0.97 which shown no significant different.

Table 3. Comparison of early and late germination interval of different pre-treatment methods.

Seed germination	**T_o**	**T_1**	**T_2**	**T_3**	**T_4**
Early emergence	14	4	7	6	6
Late emergence	30	14	19	21	18
Germination interval	16	10	12	15	12
Mean daily Germination	0.70	7.20	5.08	2.13	4.08

Fisher's exact test = 2.37,P = 0.97

The viability of seeds of *Parkia biglobosa* depends on the effectives of different pre-treatment which were capable of breaking seed dormancy and promoting germination. The result of the viability of *P. biglobosa* with respect to different pre-treatment methods is shows in Table 4. Chi-square value was obtained to be 69.29 while P = 0.0001 with level of significance at 0.05 which shows highly significant different. From the result of this study, physical scarification produced the best pre-treatment method for the germination of *P. biglobosa* seeds sown in the nursery.

Table 4: *P. biglobosa* seed viability at different pre-treatment methods.

Treatment	**T_o**	**T_1**	**T_2**	**T_3**	**T_4**
No of seed Sown	100	100	100	100	100
Germinated seeds	21	72	61	32	49
Non germinated seed	79	28	39	68	51

Chi square test = 69.29; P = 0.0001

The total number of leaves produced from the germinated seeds based on weeks were presented in Table 5. The highest number of leaves was recorded on the seedlings from seeds scarified while cold water and untreated seeds had the lowest numbers of leaves. The pre-treatment method by physical scarification had the number of leaves to be 137 leaves, pre-treatment with sulphuric acid for 20 minutes produced 108 leaves, cold water pre-treatment for 24 hours produced 50 leaves, while pre-treatment with hot water for 15 minutes produced 83 leaves and untreated seeds produced 18 leaves, this was based on the numbers of the seedling produced.

Table 5: Number of leaves of germinated seeds of *P. biglobosa* in four weeks.

Number of leave/week	**T_o**	**T_1**	**T_2**	**T_3**	**T_4**
Week 1	0	90	12	10	20
Week 2	2	194	184	94	166
Week 3	16	122	131	80	37
Week 4	54	140	105	15	107
Mean value	18	137	108	50	83

The variations observed among the seedling growth variables(germination and numbers of leaves) could be as a result of the effect of the pre-treatments given to the seeds. Seedlings with the highest plant number of leaves may be as a result of the early germination by the seedlings induced by the method of dormancy breakage (Table 5).This variable (numbers of leaves) is very useful in the promotion of rapid production of vigorous seedlings for nursery establishment or species for plantation establishment; because leaves are the part where photosynthesis takes place on a plant. Based on the result of this experiment, seedlings from seeds that were physically scarified with filer/sandpaper had performed best in comparison with time of germination and highest mean values for seedling leaves numbers.

CONCLUSION AND RECOMMENDATION

Based on the result of this experiment, physical scarification andsulphuric acid for 20 minutes pre-treatment methods did better; the two methods have the ability to enhance fast germination and growth of *P. biglobosa* seeds. It is recommended that for high germination percentage of *P. biglobosa* seeds at a shorter period of time, the seeds should be physically scarified using a filer, sandpaper or knife as a pre-treatment method. This is to enhance and encourage raising of *P. biglobosa* seedlings for plantation establishment and to ensure sustainable management of the tree species in the guinea ecological zone of Nigeria for prevention of endangering andextinction of the tree species.

REFERENCES

Alabi, D.A. Akinsulire O.R and Sanyaolu, M.A. (2005): qualitative determination of and Innovation, 19:230-237. Chemical and nutritional composition of P*arkia biglobosa* (Jacq) Benth;*African Journal of Biotechnology* 4 (8): 812-815.

Joshi, A.R and Joshi, K. (2009): Plant Diversity and Ethno botanical notes on the tree Species of Syabru village, Langtang National Park, Nepal Ethno botanical leaflets: 651-654. Keay R.W.J., (1989): Trees of Nigeria, Oxford University Press, New York.

Latif, A., Z. K Shinwari and S. Begum, (2002): Potentials and Market status Mushrooms as Non-timber Forest production in Pakistan. Ethno-botany project. WWWF-P, Peshawar, Pakistan.

Sacande, M. and Clethero, C, (2007): P*arkia biglobosa* (Jacq) G. Don Millenmum seed Bank project Kew. Seed leaflet: 124.

Tee N.T. and L. Popoola, (2007): The role of *Borassuesaethiopum* (Mart) on livelihood sustainability, the North-eastern Nigeria Experience; *Discovery and Innovation*, 19:230-237.

Tee N.T. and I. Verinumbe, (2007): Utility dynamic and prioritization of Brassusaethiopum (Mart) in Northeastern Nigeria. *Agricultural Research Policies*, 3:87-93.

Okunlola, A. I.; Adebayo, R. A. and Orimogunje, A. D. (2011): Methods of Braking Seed Dormancy on Germination and Early Seedling Growth of African Locust Bean (*Parkia biglobosa*) (JACQ.) Benth; *Journal of Horticulture and Forestry;* Vol. 3(1); pp. 1- 6