INFLUENCES OF SEED WEIGHTS AND CONCENTRATIONS OF SULPHURIC ACID ON THE GERMINATION OF AFRICAN LOCUST BEAN (*Parkia biglobosa* JACQ BENTH) SEEDS

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ABSTRACT
There is dearth of quantitative information on the effect of seed weights and concentrations of acid on the germination of Parkia biglobosa seeds. Towards enhancing quality of planting stock and germination potential, this experiment was conducted. The experiment adopted a 3x4 factorial arranged in a completely randomized design with twelve treatments replicated five times to assess the effects of seed weights (0.57, 0.63 and 0.70g) and concentrations of sulphuric acid (0, 30, 60 and 90%) on the germination of Parkia biglobosa seeds. Six hundred (600) seeds stored in room temperature (27°C) for three month were used. Fifty (50) seeds each of different weights (0.57, 0.63 and 0.70g) were soaked in different concentration of sulphuric acid (0, 30, 60 and 90%) for 30 minutes and planted in 4cm depth of sterilized river sand. A 200ml of water per each pot was applied at two days' interval. Data collected were subjected to analysis of variance (ANOVA) using SAS 2003. Comparison of significant means was accomplished using Fishers Least Significant Difference (LSD) at 5% level of significance. Seed weights and concentrations of sulphuric acid significantly (P<0.05) enhanced the germination of P.biglobosa seeds. A significant germination percentage value of 100% was recorded from 0.70g seeds soaked in 90% concentration of sulphuric acid. Soaking of 0.7g P.biglobosa seeds in 90% concentration of sulphuric acid enhances its germination for mass production of planting stock for cultivation.

***Key words**: Seed weight, Concentrations of sulphuric acid, Soaking, Germination, Indigenous tree species*

INTRODUCTION

The world leaders agree that incessant existence of many societies and their livelihoods depends on the sustainability of the biodiversity of their forests for availability of more goods and services (Oboho *et al.,* 2015). However, Oboho *et al.* (2015) stated that deforestation is threatening the survival and health of natural forests, with consequences effect of man losing forests and associated benefits. Lapido (2010) reported that the deforestation rate in Nigeria at about 3.5%, meaning a loss of 350,000 to 400,000 hectares of forest land per year. The increase in world population and demand for forests and forest resources in Nigeria lead to deforestation and forest degradation that threaten forest productivity and sustainability (Okunomo, 2010).

The genetic erosion of indigenous forest tree species is affecting some of species that are necessary for survival of present generation as *Chrysophyllum albidum* and *Parkia biglobosa*. The *Parkia biglobosa* occurs in a diversity of agro ecological zones, ranging from tropical forest with high rainfall to arid zones, from the lower Sudan savanna Southwards to the derived savanna and lowland forest where mean annual rainfall may be less than 400mm (Gbadamosi *et al*., 2005). It is an important multipurpose tree of West African Savannah land and common species of the parkland agroforestry system (Sacande and Clethero, 2007). Okunlola *et al.* (2011) stated that the tree has capacity to withstand drought conditions, because of its deep taproot system and an ability to restrict transpiration. The different parts of the tree are used for food, fodder, soil enrichment and sources of rural economics of West African countries (Gbadamosi, 2002; Okunlola *et al.,* 2011; Alex *et al.,* 2022). Joshi and Joshi (2009) stated that more attention have been given to *Parkia* biglobosa in recent years due to an increasing recognition of its contribution to fulfil basic needs of people, household economics, food security and conservation of natural resources. Sacande and Clethero (2007) stated that the roots, barks, leaves, stems, flowers, fruits and seeds of Parkia biglobosa are all used medicinally to treat a range of ailments including diarrhea, ulcers, pneumonia, burns, coughs, jaundice etc.

The yellow pulp surrounding the seeds contains 60% sugar when ripe and is edible in many forms and also the seeds are made into condiments, used as flavouring and additives to soups and stews (Sacande and Clethero, 2007; Okunlola *et al*., 2011; Sale, 2015). The seeds contain 54% fat and 30% protein in addition to vitamins and minerals such as calcium, potassium and phosphorus (Aliero, 2004; Sacande and Clethero, 2007). Locust bean seeds are rich in proteins (30-40%), contain significant amounts of carbohydrates (10-15%), fats (15-20%), minerals (4%) and vitamins mainly from Group B (Diawara and Diasso, 2004). Okunlola *et al.* (2011) mentioned that the trees are used as wind breaker and shade provider, while its branches are cut for firewood, pods and roots are used as sponges as well as strings for musical instruments. The use of *Parkia biglobosa* pod powder delayed the emergence of *Striga hermonthica* in maize (Ibrahim *et al.,* 2011). Sale (2015) reported that its fruit pods are used to produce an insecticide powder for treating crops.

In spite of enormous potentials of *P.biglobosa*, its propagation has been limited due to dormancy of its seeds. Owing to poor seed germination, there is rapid depletion of the natural population of the *P.biglobosa* tree. In an attempt to meet population demand of this species, dormancy associated with its seeds needs to be broken. The methods of breaking dormancy as well as appropriate selection of quality seed weight that promise quality planting stock are worth investigating. Various investigators have reported the efficacy of acid in breaking dormancy of forest tree seeds (Aliero 2004; Ajiboye *et al.*, 2009; Emerhi and Nwiisuator, 2010; Al-Menaie *et al.*, 2010; Okunlola *et al.*, 2011; Amusa, 2011). One needs to take into consideration the concentration of acid and appropriate seed weight in successful propagation of forest tree seeds. Adelani *et al.* (2018a) stated that out of all the challenges that are confronting the production of quality planting stock, the poor selection of the seed weight in seed lot appears to be critical. Selection of appropriate seed weight from seed lot of high physiological quality should be meticulously done to guarantee future planting stock as well as growth, development and high productivity (Adelani *et al.*, 2018a). Successful selection of quality seed weight requires appropriate concentration of acid for pre-sowing treatment to ensure seedlings of high vigour. Little information is available on the effect of seed weights and concentrations of sulphuric acid in breaking the dormancy of *P.biglobosa*. In this light, this experiment was conducted to assess the effects of seed weights and concentrations of sulphuric acid on the germination of *P.biglobosa* seeds.

MATERIALS AND METHOD

The research was conducted in the screen house of Federal College of Forestry Mechanization, Afaka, Kaduna State during wet season of 2015. The College is located in the Northern Guinea Savannah ecological zones of Nigeria. It is situated in Igabi Local Government Area of Kaduna State, Nigeria. It lies between Latitude 10 º 35' and 10 º 34' and Longitude 7 º 21' and 7 º 20' (Adelani, 2015). The mean annual rainfall is approximately 1000mm. The vegetation is open woodland with tall broad leave trees (Otegbeye *et al.*, 2001).

Experimental Procedure

The seeds were sourced from Afaka Forest, Kaduna State. The seeds were extracted from fruits and air dried for thirty minutes. Six hundred seeds were extracted from fruits. The viability of the randomly selected seed samples were assessed using cutting method (Schmidt, 2000). The sowing media (river sand), which was collected from the floor of College dam was made to pass through 2mm sieve and then sterilized at 160ºC for 24hours. The polythene pots used was 20x10x10cm in dimension and filled with the sterilized river sand and arranged in the screen house.

Influences of seed weights and concentrations of sulphuric acid on the germination of *Parkia biglobosa* seeds

A 3x4 factorial arrangement in a completely randomized design with twelve treatments replicated five times to assess the effects of seed weights (0.57, 0.63 and 0.70g) and concentrations of sulphuric acid (0, 30, 60 and 90%) on the germination of *Parkia biglobosa* seeds was adopted. A number of six hundred (600) seeds stored in room temperature (27ºC) for three month were used for the experiment. The seeds were washed and air dried for 30 minutes. The three seed weights of the samples of the seeds sorted out by sizes were determined by weighing the seeds on Mettler Top loading Weighing Balance (Model Mettler PM 11-K). Based on the method of Adelani *et al.* (2018b), the seeds were classified into 0.57, 0.63 and 0.70g. The seed weights (0.57, 0.63 and 0.70g) were soaked in different concentrations of sulphuric acid for 30 minutes. Ten (10) seeds represented a replicate. Five replicates were planted in 4cm depth of sterilized river sand. A 200ml of water per each pot was applied at two days interval. Seeds that were not soaked in concentration of acid served as control. A seed was considered to have germinated when the radicle was able to break open the seed coat and at the sight of plumule emergence. Noting of successful germinated seeds was as described by Hossain *et al.* (2005). Final germination count was taken when no further germination took place for several days. Germination count was converted to germination percentage.

Data analysis

Germination percentage was computed as expressed below:

$$\text{Germination \%} = \frac{Total\ seed\ germinated}{Total\ seed\ sown} \times 100$$

The data obtained were subjected to one-way analysis of variance (ANOVA). Comparison of means was carried out using Fischer's Least Significant Difference (LSD) at 5% level of significance**.**

RESULTS

Highest germination percentage value of 78% was recorded from 0.70g seeds soaked in acid. The least value of 66% was recorded from 0.66g seeds soaked in acid. An increase germination percentage was recorded with increasing seed weights. The germination percentage of seeds increased with increasing concentration of acid. Germination percentage value of 94% was recorded from seeds soaked in 90% concentration of sulphuric acid. The least value of 5% was recorded from seeds not soaked in concentration of acid (control) (Table 1).

Table 1: Influences of seed weights and concentrations of acid on the germination of *Parkia biglobosa* seeds

Seed weights(g)	Means Per. Germ (%)	Conc. of sulp acid (%)	Mean Per. Germ (%)
0.57	66.00[b]	0	5.00[d]
0.63	76.00[ab]	30	40.00[c]
0.70	78.00[a]	60	62.00[b]
-	-	90	94.00[a]
SE±	1.31	SE	1.31

Means on the same column having different superscripts are significantly different (P<0.05)

Key: Per.Germ=Percentage Germination, Conc. of sulp. acid= Concentration of sulphuric acid

A significant germination percentage value of 100% was recorded from 0.70g seeds soaked in 90% concentration of sulphuric acid. The least value of 10% was recorded from seeds not soaked in concentration of sulphuric acid (control). An increase germination percentage was recorded with increasing concentration of acid.

Table 2: Interactive influence of seed weights and concentrations of sulphuric acid on the germination of *Parkia biglobosa* seeds

Seed weights (g)	Concentrations of sulphuric acid			
	0	30	60	90
0.57	10.00[a]	60.00[a]	75.00[a]	80.00[c]
0.63	10.00a	40.00[b]	60.00[b]	90.00[a]
0.70	12.00a	16.00[c]	44.00[c]	100.00[a]
SE±	1.15	1.15	1.15	1.15

Means on the same column having different superscripts are significantly different (P<0.05)

DISCUSSION

The highest germination percentage recorded for highest seed weight. Similar observation had been reported by Adelani *et al.* (2018a, b) who reported highest germination percentage for 1.8g *C.albidum* seeds compared to other lower weights. Large-size of *Dialium guineense* seeds showed higher germination of 80%, while small size seeds had 60% (van Molken *et al.*, 2005; Ajiboye and Agboola, 2011). Contrary to afore mentioned reports, Ajiboye and Agboola (2009) reported highest germination of 100% in *Parkia biglobosa* with small seeds after sulphuric acid scarification.

The increased germination percentage of seeds with increasing concentration of acid could be ascribed to the ability of higher concentration of sulphuric acid to degrade the seed coat for imbibition better than lower concentration without damaging the embryo. Similar observation has been made by Aliero (2004) who adduced the ability of 98% concentrated sulphuric acid to enhance *Parkia biglobosa* seed germination better than lower concentration as 90%, 70% and 50% respectively, to its degradation of seed coat faster than others. Highest germination percentage was recorded for *Adansonia digitata* seeds soaked in 98% concentration of sulphuric acid (Falemara *et al.*, 2013; Falemara et al., 2014). Oyebamiji *et al.* (2019) reported highest germination percentage for *Parkia biglobosa* seeds soaked in 98% concentration of sulphuric acid for 4minutes

Various species respond to concentrations of acid differently. Sikiratu (2014) reported highest germination percentages for *Acacia senegal* soaked in 50% concentration of sulphuric acid (89%) and in 50% concentration of hydrochloric acid (65%) respectively for 15 minutes. Highest germination percentages were recorded for *Acacia auriculiformis* seeds (94.17%) (Adelani and Joseph, 2014) and *Tamarindus indica* (93.33%) (Adelani *et al.*, 2014) treated in 98% concentration of sulphuric acid at different times respectively.

Rajesh (2021) reported germination perentange of 70% for *Abrus precatorius* seeds soaked in 80 % concentration of sulphuric acid for 2minutes and 50% HCL concentration for 30 minutes in 21 days period of experiment. Immersing of Albizia lebbeck seeds in 37% concentration HCl acid for 30 and 45minutes gave germination percentage values of 35.56% and 46.67% respectively as compared to control treatment with 15.56% (Hivi and Othman, 2019). Wakawa and Akinyele (2016) stated that Tetrapleura tetraptera seeds treated with concentrated H_2SO_4 at 98% concentration recorded the highest cumulative percentage germination (61%) and mean of germination speed (15.25). Acid treatment of *Piliostigma reticulatum* recorded highest germination percentage of 76 when seeds were soaked in 98% of HCL acid for 90 minutes (Aduradola, 2004). Ehiagbanare and Onyibe (2007) reported

that *Tetracarpidium conophorum* seeds treated for 5minutes with 98% concentrated sulphuric acid had the highest percentage germination of 66%.

The highest germination percentage value of 80% was recorded when *Parkia biglobosa* seeds were soaked in 98% sulphuric acid for 60 minutes (Isah, 2012). The reason for this could be partly adduced to the fact that 98% sulphuric acid was able to scarify seed coats through decreasing the inhibitory effect of seed coats and softening of the seed coat that accelerated water uptake and resulted in earlier and faster germination (Isah, 2012). Various investigators had reported improved seed germination response following chemical scarification pretreatments (Pendly, 2001; Olvera-carrillo *et al.,* 2003; Ajiboye *et al.,* 2009).

Highest germination percentage of 0.7g seeds soaked in the 90% concentration of acid could be attributed to compatibility of highest seed weight with highest concentration of acid.

CONCLUSION

Successful enhancement of seed germination is a pre-requisite for plantation establishment as well as conservation of diverse indigenous economic tree species. Appropriate selection of quality plant stock of priority species which start right from choosing appropriate seed weight needs to be embraced. Investigation conducted into selection of appropriate seed weight and concentration of sulphuric acid, revealed that for maximum germination percentage, 0.7g seeds need to be soaked in 90% concentration of sulphuric acid. The soaking of 0.7g *P.biglobosa* seeds in 90% concentration of sulphuric acid enhances its germination.

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