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Effect of Hydrochloric Acid, Mechanical Scarification, Wet Heat Treatment on Germination of Seed of *Parkia Biglobosa* African Locust Bean (Daurawa) Case Study of Gombe Local Government Area

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ABSTRACT; The effect of different treatments of breaking seed dormancy of Parkia biglobosa seeds were studied in botanical garden of Biological Sciences Department, Gombe State University in May ,2011, the response of different treatments observed showed 100% for wet heat, 90% for scarification (sand paper) and 70% for HCL of 50% concentration while the untreated seed control is 60% germination respectively and the data collected when subjected to analysis of variance showed significant differences between the treatments, the leaves and seedling height performed better than the control(untreated seeds), wet heat, mechanical scarification and 50% hydrochloric acid were found to induce germination of the dormant seeds of Parkia biglobosa These methods could be applied to raise seedlings of plant for field propagation and afforestation programme.

Parkia biglobasa (Jacq. Benth) is popularly known as the African locust been (Osundina (1995). It belongs to the family leguminosae – mimosoidease (MIM). It often grows to a height of 20m. The fruit is a legume, slightly indented between the seed at maturity. The seeds are embedded in yellowish, mealy, sweet testing edible pulp (Hatchisn and Dalziel, 1958: Aliero et al, 2004).

Medium size tree up to 20 -30m. tall, taproot represent lateral roots up to 10-20), spreading from bole, bole usually straight and robust, cylindrical, up to 130cm in diameter, often branching low, bark distinctly longitudinally fissured, often with more or less regular scales between the fissures, thick, ash-grey to greyish-brown, slash fibrous and reddish-brown, excluding an amber gum, crown dense, wide spreading and umbrella shape consisting of heavy branches leaves alternate, bifinnately compound up to 30cm long, petiole 4-12.5cm long, swollen base and an orbicular gland, inflorescence a pendulous heed arrange racemosely, peduncle 10-35cm long turning salmon pink many flowered. Flowers are bisexual male or sterile sessile but pseudopedicilate by the fusion of the bases of calyx, corolla and stamens.

Parkia biglobosa occurs in belt between 5N and 15^0N from Atlantic coast in Senegal to southern Sudan and northern Uganda. The belt is widest West Africa (maximum 800km) and narrows to the east. *Parkia biglobosa* comprises about 30 species and has a pan tropical distribution only 3 species, all belonging to the section *Parkia*, occur in continental Africa, and a fourth one on Madagascar.

African locust bean is protected and planted in agricultural field and waste land in Savannah region. It tolerates a wide variety of climatological condition, the principle constant being a dry season of 5-7 month/year. It may grow in regions with an annual rainfall of 500-800mm in the Sahel, but occurs in region with much higher rainfall as well, e.g. 2200mm in Guinea Bissau

African locust bean is a multipurpose tree that is as highly valued as Shea butter tree, fermented seeds (dawadawa) serve primarily as a condiment for seasoning sources and soups. Roasted seeds are used as a coffee substitute known as coffee, ground seeds are mixed with *Moringa oloifera* leaves to prepare a source and are also used to make doughnuts. It is also important in agriculture, being a good square of nectar and suitable for the placement of hives. It may serve as a decorative avenue tree (Yameogo, 1987).

Parkia is also used in agro forestry because of its ability to fix atmospheric nitrogen in soil and the seeds are reported to retain viability for long time (Leopold and Kreidemann, (1975) however, seedlings of this important plant are rarely seen growing in the wild. The existing trees are ageing and fast disappearing. It

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is therefore imperative to intervene to save this important tree from extinction.

AIM was to elucidate the concept in germination of the seeds of *Parkia biglobosa* treated using different methods of breaking dormancy, with the following objectives
:
To determine the effects of acid (HCL), wet heat treatment, and mechanical scarification on the breaking of dormancy of *Parkia biglobosa* (African locust bean).
To have a check list on different germination rates of *Parkia biglobosa* using different treatments.

MATERIALS AND METHOD

Systematic methodology is the way to success of any research work (project) as it has direct bearing and key relevance on research findings.

This experiment was carried out in the Biological Sciences Department Botanical garden of Gombe State University. The materials used include the following:

Seeds of *Parkia biglobosa*, Hydrochloric acid ,Distilled water, Beakers, Petri dish, Sand paper, Poly pots, Thermometer, Ruler, Measuring cylinder.Viable seeds of *Parkia biglobosa* were subjected to three different methods of breaking seed dormancy:

1. Treatment with hydrochloric acid of 50% concentration for 30 minutes,
2. Mechanical scarification (sand paper)
3. Hot water treatment of 100% for 30 minutes.

Seeds of *Parkia biglobosa* were purchased from three different market, in Gombe metropolis new market, old market, and women market, respectively.

Fig. I Untreated *P. biglobosa* seeds **Fig**. II Wet-Heat Treated Seeds of *Parkia biglobosa*

Sub samples of seeds used in the research that were taken from bulk population of sample, were treated with dilute HCL acid, hot water and mechanical scarification (sand paper) as first, second and third treatments respectively and on different time effect.

About 20 seeds were randomly selected and immersed in 50% HCL concentration in conical flask for 30 minutes. The acid was then decanted and the seeds removed and properly washed with distilled water, they were then sown in poly pots, two seeds per pot.

Dried seeds were taken and were rubbed on a sand paper manually so that the sand paper scratches the seeds epicarp. The seeds were then dusted and sown in poly pot, two seeds per pot.

Effect of wet heat was tested by boiling distilled water at 100^0c the water was allowed to cool for 5 minutes and the water was decanted, the seeds were then sown in poly pots, two seeds per pot.

Twenty (20) untreated seeds were also used as control two seeds were sown per each pot.

Watering and observation was done on daily basis for 21 days.

Undamaged and disease free seeds were selected for sowing, after they have been treated with (3) different treatments. The sowing depth was 2cm deep for all the replicates in each row and the average weight of the seeds were 0.3gm.

The data was subjected to analysis of variance (ANOVA) after observation for a period of 3 weeks (21) days after the date of sowing in order to know the differences between the treatments, mean separation was done using Duncan's Multiple Range Test (DMRT).

The seeds were considered germinated when the tip of the radicle had grown free of the seed coat also the mean height of plant was taken on daily bases after the emergence of seedling, and the average number of leaves was also taken at the interval of two days after seedlings germinate.

RESULTS AND DISCUSSION

All the viable seeds have capacity to germinate if place under suitable condition necessary for germination. While in certain plants such seeds will immediately germinate after harvest. But in others they fail to germinate for sometimes even if placed under such conditions that are ordinarily favourable for germination either due to some internal factors or due to specific requirement for some environment factors. During this period the growth of the seeds remains suspended and they are said to be rest stage or dormant stage.

Sometimes the seeds which are capable of germinating immediately after harvest become dormant if kept in environment in which at least of the factors essential for germination is unfavourable. Advantage of dormancy of seeds, in temperate zones the dormancy of seeds helps the plants to tide over the severe cold which may be injurious for their vegetative and reproductive growth. In tropical region the dormancy of seeds resulting from their impermeable seed coats ensures good chance of survival. Dormancy of seed in many cereals is of utmost importance to mankind. If these seeds would germinate immediately after harvest in the field, they will become useless to man for consumption as food.

Germination percentage is the performance of the seeds germination under different treatment of dormancy in a given period of the experiment.

Germination of mechanically scarified (sand papered) seeds was observed from day 1 – 7 after sowing, there was a continuous increase in number of seeds that germinated every day. Nine out of ten seeds sown in poly pot germinated in just nine days after sowing that was 90% total seeds germination for the scarification (sand paper).

Wet heat treatment that is soaking the seeds in hot water at 100^0c for 30 minutes was effective in breaking the seed dormancy of *Parkia biglobosa*, because it gave the highest germination percentage of 100% in just ten (10) days after sowing.

HCL of 50% concentration gave a germination percentage of 70% in just 20 days. HCL was effective in breaking the dormancy of seeds of *Parkia biglobosa*.

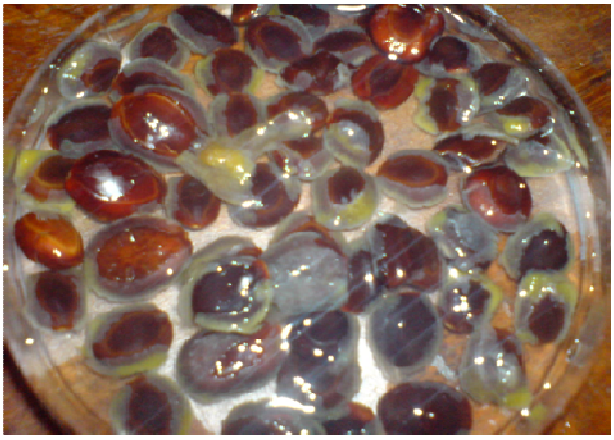

Fig. III Seeds Treated with 50% HCl of *Parkia biglobosa* Fig. IV Seedling of *Parkia biglobosa*

Untreated seeds germinated but took a bit longer time of 18 days after sowing and gave a germination percentage of 60% in 21 days period of the experiment.
The treated seeds performed much better than the untreated (control) seeds in terms of leaves length and number.
Number of leaves

= Total number of leaves
Total number of seed emerged

Plant height and number of leaves were taken on a daily basis it was observed that the treated seeds emerged with high number of leaves more than the control (untreated seeds) and the seedling height for the treatment exceeded the control (untreated seeds).

There was a significant difference observed between seeds treated with different method of breaking dormancy used in this experiment.

Table I Anova Table showing the significant differences observed

	SS	Dff	MS	Fcal	Ftab
Treatment	102.260	3	34.087	5.594	2.96
Error	164.514	27	6.93		
Total	266.774	30			

KEY: α = 0.5 (5%), Coefficient of variation (CV) = 13.7%, DFF=degree of freedom, SS=Sum of Squares, MS= Mean separation, Ftab= F value tabulated and Fcal= F value calculated.

The results were subjected to one way analysis of variance (ANOVA) and the calculated value was greater than the tabulated value and hence there was significant difference between the treatments.

DUNCAN MULTIPLE RANGE TEST
Duncan multiple range test is a multiple pair wise comparism used to determine or estimate the real differences that exist between the treatment, it is used, when there is significant difference between the treatment, to determine the best amongst those treatment.

Table II: Duncan showing homogeneity within the treatments
Duncan multiple table

		Subset for alpha = 0.05	
Cause	N	1	2
3.002.00	7	6.5714	
2.00	9	7.000	
4.00	10	7.000	
1.00	5		11.800
Significance		0.759	1.00

KEY: Subset for alpha = 0.05, N=Number of replicates, 1=Sulphuric acid treatment, 2=Sand paper (mechanical scarification) treatment

, Among the seed dormancy treatments the highest germination percentage was observed for hot water treatment (wet heat) at 100% for 30 minutes which gave the highest germination percentage of 100% in 21 days period of the experiment.

A sudden dip of dry seeds in boiling or hot water may lead to the rapture of the seed coat tissues causing physiological changes and subsequent germination of the embryo.
Agboola and Etejere 1991, Agboola and Adedore 1998, Sabongari 2001, plants that pass through their rest period at low temperature, may have their rest period broken by warm water bath (Leopold and Kreidman 1975).

Germination decreased when seeds were allowed in hot water for a very long period this suggesting that embryo may get destroyed on contact with boiling water for a prolonged period.

In the control seed, water may not be available to the embryo.

Treatment by mechanical scarification (sand paper) was effective in the breaking seed dormancy of *Parkia biglobosa* because germination was observed just two (2) days after sowing it was the first to have germinated among all the treated seeds, resulting in a faster grate of breaking dormancy of *Parkia biglobosa* seed which gave the germination percentage of 90% within the shortest period of time as compared to other treatments.

Seed dormancy resulting from an impermeable seed coat may be overcome by peeling off the coat (Nikoleave 1977).

Germination of seed whose coat where mechanically scarified is therefore not surprising. Where seed coat softens the process of hydrolysis which could commence the release of simple sugars that could be readily utilized in protein synthesis, release of hormones such as auxin and ethylene could increase nucleic acid metabolism and protein synthesis (Irwin 1982 and Jackson 1994).

Treatment with 50% HCL concentration showed effectiveness in breaking dormancy of *Parkia biglobosa*. The seeds soaked in 50% HCL

concentration for 30 minute gave the germination percentage of 70% in 21 days period of experiment.

According to (Levitt 1974) immersion of seed in concentrated acid disrupts the seed coat the fact that 50% HCL concentration gave 70% of germination percentage within 13 day after sowing. This indicates that acid therefore disrupt the seed coat and expose the lumen of the macrosleids cells, permitting imbibitions of water (Nikoleave, 1977) which triggers germination. The untreated seeds (control) also germinated but it took a very long period of 17 days after sowing which gave a germination percentage of 60% and a shorter height of the seedling as compared to those treated with acid, mechanical scarification and wet heat.

When the germination count was taken two days after sowing, the treated seeds with sand paper, wet heat, and 50% HCL concentration performed much better than untreated seed (control) which showed about 60% emergence and with hot water showed 100% emergence. Mechanically scarified was 90% emergence and 50% HCL concentration was 70% emergence respectively.

Plants height and number of leaves were taken on the daily, basis it was observed that the treated seeds emerged with high number of leaves more than the control and since it was fast emerged their seedlings height exceeded the control seedling. And there was significant difference between seeds treated with different method of breaking dormancy in terms of plant height, number of leaves and days of germination.
This showed that the treatments have great effect on *Parkia biglobosa* germination.
Dormancy in seeds of P*arkia* is usually associated with the factors of the protective covering the seeds, the seed coat or enclosed embryo.

Further study of *Parkia biglobosa* should be carried out on how to improve the variety and reduce the number of years in tree growth and seed dormancy inhibition because this plant is a multipurpose plant apart from its medicinal and industrial uses, it also has the ability to fix atmospheric nitrogen in soil and the seeds are reported to retain viability for a very long time.

Appropriate conservation action is important to ensure the perpetuation of this very important species, because seedlings of this plant are rarely seen growing in the wild and the existing trees are ageing and fast disappearing, it is therefore imperative to intervene to save this important and endangered species from extinction.

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