EFFECTS OF DIFFERENT SCARIFICATION TREATMENTS ON THE GERMINATION OF *Pseudospondias microcarpa* and *Funtumia africana* SEEDS

BY

Success Esohe OSARUMWENSE (Miss)

LSC18-07132

DEPARTMENT OF PLANT BIOLOGY AND BIOTECHNOLOGY,

FACULTY OF LIFE SCIENCES,

UNIVERSITY OF BENIN,

BENIN CITY.

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A PROJECT REPORT SUBMITTED TO THE DEPARTMENT OF PLANT BIOLOGY AND BIOTECHNOLOGY, FACULTY OF LIFE SCIENCES IN PARTIAL FULFILLMENT OF REQUIREMENTS FOR THE AWARD OF BACHELOR OF SCIENCE (HONOURS) DEGREE (BSc.) IN PLANT BIOLOGY AND BIOTECHNOLOGY.

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CERTIFICATION

This is to certify that this work was carried out by **Success Esohe OSARUMWENSE** (Miss) with matriculation number **LSC1807132** of the Department of Plant Biology and Biotechnology, Faculty of Life Sciences, University of Benin, Benin city, Edo State, Nigeria.

______________________ ______________________

Prof. E. I. AIGBOKHAN **Date**

Project Supervisor

______________________ ______________________

Prof. E. D VWIOKO **Date**

Head of Department

DEDICATION

I dedicate this work to God almighty who made this project a success and also to my parents and friends for their love and encouragement throughout the period of my project.

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The course of this project has been an avenue to learn, grow in wisdom, strength and also to be innovative. All glory is unto God for granting me this opportunity at this phase of my life. I would like to express my sincere gratitude to everyone who has helped me throughout the course of this project. First and foremost, I would like to thank my supervisor, Prof. E. I. Aigbokhan, for his guidance, support, patience and encouragement. His expertise and insights have been invaluable in shaping this project. I would also like to thank my family for their unwavering support, patience, prayer and encouragement throughout the entire process. Their willingness to listen, offer feedback, and provide constructive criticism has been a constant source of inspiration and motivation for me. I appreciate the distinguished academic and non-academic staffs of the Department of Plant Biology and Biotechnology, but to name a few, Prof. B. Ikhajiagbe, Prof. H. O. Shittu and Dr (Mrs.) M. A. Akhere. I also want to appreciate Mr. Edionwe Christopher, i love you. I also appreciate my course mates PHOENIX' 22, my friends, Munachi, Dora, Dorothy, Rume and Desmond, Thank you all so much for the love and support. Sincere gratitude also goes to my God.

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ABSTRACT

Afforestation is habitually used as a resolution to prevent the detrimental effects of deforestation. As a result majority of plants, particularly trees must be subjected to germination and cultivation in nurseries before being transplanted in deforested areas. Scarification is a process that involves weakening or altering the seed coat to break dormancy and enhance germination of seedling growth and development. A study was carried out to investigate the effects of different scarification treatments on the germination of "*Pseudospondias microcarpa* and *Funtumia africana* seeds". Different scarification methods, encompassing hot water, chemical, and dry heat treatment were administered to the seed, with untreated seeds serving as the control reference group. Key germination parameters, namely germination percentage, germination time, and seedling vigor, were documented and subsequently subjected to comparative analysis. Surprisingly, the outcome did not exhibit a significant effect of scarification on the germination of either species. The germination percentage, germination time, and seedling vigor demonstrated similarities between the scarified seeds and the control group. Though the hot water treated for 30 seconds of *Funtumia africana* grew but it took a long time to germinate and the control group grew but died. The absence of response to scarification treatment implies that the induction of seed dormancy breakage or the enhancement of germination might not require scarification within these plant species. Possible interpretations for these inconclusive findings include the natural permeability of the seed coats of *Pseudospondias microcarpa* and *Funtumia africana* which may facilitate the entry of water and gases, without the need of scarification. Moreover, alternative physiological or environmental factors on the seed germination process within these species could overshadow the effects of scarification. This research produced uncertain outcomes concerning the impact of scarification on the germination process of *Pseudospondias microcarpa* and *Funtumia africana* seeds. It is possible that scarification might not be essential for stimulating germination in these particular species.

CHAPTER ONE

INTRODUCTION AND LITERATURE REVIEW

1.0 SEED DORMANCY AND GERMINATION

Seed germination is a crucial process that influences crop yield and quality. (Pham Anh Tuan *et al.,*). The germination process marks the conclusion of seed dispersal, thereby impacting the spatial and temporal aspects of plant growth. Following seed dispersal, germination can be hindered by a phenomenon called seed dormancy. Seeds typically exist in a state that is neither fully dormant nor completely non-dormant. However, seeds with heightened activation of pathways inducing dormancy tend to germinate within increasingly restricted environmental conditions. As a result, assessments of dormancy must always be accompanied by an examination of the environmental circumstances that describe particular phenotypes or behaviors. The simplest form of dormancy can be brought about by the creation of a physical barrier encasing the seed, preventing gas exchange and water passage. Seeds exhibiting this form of "physical dormancy" often require mechanisms like scarification or passage through an animal's digestive tract, along with its associated enzymes, to break down the barrier and enable germination. Alternatively, in seeds with "morphological dormancy," the embryo remains underdeveloped at maturity. A dormant phase ensues as the embryo continues growing after shedding, eventually rupturing the surrounding tissues.

Among the various types of dormancy, the predominant one is "physiological dormancy," which involves a dormancy program initiated by either the embryo or the adjacent endosperm tissues. Physiological dormancy employs hormones that inhibit germination, thereby preventing it from occurring in the absence of specific environmental cues that promote germination. Throughout and following germination, the early growth of seedlings is sustained by the breakdown of stored reserves of protein, oil, or starch that accumulate during seed maturation. These reserves support processes such as cell expansion, chloroplast development, and root growth until photoautotrophic growth can be resumed (Steven Penfield, 2017).

Pre-germination treatment refers to the systematic approach of alleviating seed dormancy using biological, chemical, or mechanical methods, aimed at augmenting the germination process. This method is especially reliable for expediting the germination of challenging seeds, particularly those encased in tough coatings. A key technique within pre-germination treatment is scarification, as highlighted by Oboho (2014).

1.1 SCARIFICATION OF SEEDS

Scarification methods aim to overcome seed dormancy by physically or chemically treating the seed coat to facilitate water uptake, gas exchange, and the initiation of germination. Some seeds have evolved mechanisms that require specific conditions, such as exposure to heat, light, or mechanical stress, to break their dormancy and initiate growth in nature. Mimicking these conditions through scarification techniques can be beneficial for researchers, plant breeders, and growers working with such seeds. In order to promote germination, a seed coat may be scarified by weakening, opening or otherwise modifying it or removing the tough endocarp shell surrounding the seed in the case of drupes (stone fruits). Seed scarification is a pretreatment of seeds that aims to break seed dormancy and accelerate the occurrence of uniform seed germination Novita *et al.* (2021). Scarification is a way to provide a permeable condition of seeds through puncturing, burning, breaking, filling and scratching with knives, needles, sandpaper, and other tools Novita *et al.* (2021). Seed scarification methods have been developed and modified over time to make these more practical and effective. Important methods of seed scarification include heat, freeze-thaw, hot water, mechanical and chemical scarification.

1.2 TYPES OF SCARIFICATION

There are different methods of scarification which includes; mechanical, chemical, hot water and heat scarification. Regardless of the techniques, scarified seeds need to be planted right away to avoid going bad.

1.2.1 Mechanical Scarification: This process entails the physical disruption or abrasion of the seed coat through methods such as using sandpaper or a file for scarification, or using a small knife or scalpel to crack the seed coat. Many researchers have used mechanical scarifies (Carleton *et al*., 1971; Townsend and Mcginnies, 1972; Miklas *et al*., 1987; Dittus and Muir, 2010)

1.2.2 Chemical Scarification: This is a scientific process wherein seeds are treated with chemical agents like concentrated sulphuric acid, hydrogen peroxide or hydrochloric acid for a specific period. These chemicals serve to weaken the seed coats, leading to its breakdown, which enhances the seed's permeability to water and gases (Yushi Ishibashi *et al.,*).

1.2.3 Hot Water Scarification: In this process, seeds are immersed in hot water, usually close to boiling temperature, for a specific duration. The elevated temperature aids in the softening of the seed coat, facilitating germination. Heat scarification can be categorized into different types;

a. Hot water treatment: This approach represents a technique for eradicating or potentially diminishing the presence of pathogens, particularly bacteria ones. The temperature of the water impacts the permeability of the seed shell membrane, influencing the rate of water passage. Organisms capable of withstanding higher water temperatures will experience faster growth in such an environment compared to a colder water basin. Additionally, the application of elevated temperatures removes pathogens. For instance, human pathogens like Escherichia coli and Salmonella spp can be eradicated from seeds by subjecting them to 90ºC for 90 seconds, followed by a 30 second immersion in cold water. This method also exhibits efficacy in eliminating various plant infections, as observed by (Sean Toporek and Brain Hudelson).

b. **Thermal treatment:** Some species' seeds need fire and/or smoke to germinate in some plant communities. Western poison oak is an exception to that rule since it does not require fire scarification and instead has thick seed coverings that delay germination Dayamba *et al.* (2008).

The choice of scarification method depends on the specific plant species and the characteristics of the seed coat. It is important to note that scarification should be performed with caution and expertise, as incorrect or excessive scarification can damage the embryo or decrease seed viability. The purpose of scarification in plant biotechnology is to enhance germination rates, improve seedling establishment, and facilitate the propagation of plant species with dormant or hard-coated seeds.

1.2.4 Heat Scarification: Heat scarification has been one of the most popular methods because it is simple and easy to use. Two main heating devices used in heat scarification include oven and hot water bath Thomas *et al.* (2003). Efficacy of heat scarification varies significantly varies significantly depending on heating devices, treatment times and temperatures.

a. Oven scarification: Using the dry heat in oven seems to be effective on hard seed reduction and germination improvement when appropriate treatment time and temperature time and temperature are used Clarke *et al*. (2005). Various temperatures (below 40°C to over 100°C) and treatment times (1min to 21h) were used in different studies a variable results were reported. Some treatments were more effective than the others.

b. Hot water bath scarification: Unlike the heat scarification using oven, heat scarification with a hot water bath not been shown to be effective on hard seed reduction of many *Medicago species*. (Patane and Gresta 2006) soaked button mediac (M. orbicularis L. Bartal) and milkvetch seeds in a hot water bath with five different temperatures, starting from 60 to 100°C at an interval of 10°C. These treatments had no effect on button medic seeds but had great effect on milkvetch. Hard seed of milkvetch was reduced from 98 in untreated control to 8% when treated at 80°C for 10mins. (Can *et al*., 2009) also reported that hot water bath treatment had no influence on hard seed of button medic even when seeds were heated at 90°C. It has also been reported that hot water bath had little effects on other *Medicago* species such as *M. hispida*, *M. Arabica*, *M. falcate* (Uzun and Aydin, 2004). *M. rotate*, *M. turbinate*, *M. scutellata* (Can *et al*., 2009) and *M. marina L.* (Scippa *et al*., 2011). In contrast, germination of *M. arborea* was increased from 45 in untreated control to 71% when the seed were soaked in a hot water bath at 100 °C for four min (Travlos and Economou, 2006). The positive effect of hot water bath treatment was seen in the legume species common in arid environment (Travlos and Economou, 2006; Travlos *et al*., 2007).

1.3 COMMON USES OF SCARIFICATION

Scarification is used not just in business but also on a small scale since scarified seeds often germinate more frequently and faster than unaffected seeds. For instance, scarification in home gardens can make seeds of plants that are otherwise challenging to produce from seed viable. Water's ability to thaw and freeze, fire and smoke, and chemical interactions in nature are what allow seeds to germinate, although the process can be sped up by applying the various techniques mentioned thus far. The testa must be opened in order to let water and air into the seed. Scarification is frequently employed in horticulture to aid in the controlled and uniform germination of seed batches.

1.4 TAXONOMY AND ECOLOGY OF *Pseudospondias microcarpa*

The *Pseudospondias microcarpa* (Auth) Anacardiaceae commonly known as African grape, Ochol. Locally, it is known as Rimin kuroni (Hausa), Ikanyere, Ekika-aja, Kekere-kuchi (Nude) is a species of flowering plant (tree). It is native to tropical regions of Africa, including countries like Nigeria, Cameroon, Ghana, and Ivory Coast. It is usually a large or medium sized tree up to 18-35m high with a thick canopy, branching low down, trunk strongly buttress. Bole short and crooke. Bark grey, longitudinally fissured; slash pinkish-brown. Leaves alternate, compound imparipinnate, with 4-7 pairs of alternate or sub opposite leaflets; leaflets oblong or elliptic, to 20cm long and 10cm broad, apex acuminate. Inflorescence a large auxiliary panicle of pale-green male, female or hermaphrodite flowers borne on the same inflorescence. The fruits are produced in lax bunches. Each fruit is an ellipsoid drupe, about 2.5cm long, red or bluish black when ripe, and resinous. With thin edible pulp. Occurs in forest areas and fringing forest in savanna. E.g. Ogba Zoo & Nature park, Benin. *Pseudospondias microcarpa* is valued for its edible fruits, timbers, medicinal plants and various traditional uses (Aigbokhan E.I personal communication).

1.4.1 Scientific Classification of *Pseudospondias microcarpa*

Kingdom: Plantae

Division: Angiosperm

Class: Eudicots

Order: Sapindales

Family: Anacardiaceae

Genus: *Pseudospondias*

Species: *Pseudospondias microcarpa* (A.Rich.) Engl.

1.5 MORPHOLOGY OF *Funtumia africana*

Funtumia africana is a tropical tree, typically under 30m tall, characterized by a straight, cylindrical trunk and a narrow tree crown. The bark is brown to dark, thin, and slightly fissured, becoming granular on older trees. When the bark is cut, it releases orange latex abundantly. The leaves are elliptic or ovate, with a round or cuncate base and an acuminate apex, measuring about 20 x 9 cm. They have approximately 8-14 main lateral veins on each side, with wavy leaf margins. Notably, the axils on the main lateral veins do not have pits. The flowers of *Funtumia africana* are yellow-white and emit a pleasant fragrance. They grow in dense cymes, with a corolla tube measuring 6-10 mm and lobes 5-7 mm in length. The fruit is grey-brown and fusiform, featuring an acute or acuminate apex and reaching up to 30 cm in length. The tree produces windborne seeds with a hairy texture. *Funtumia africana* shares morphological similarities and distribution patterns with *F. elastica*. One notable

Mag. X 0.4

PLATE **1:** *Pseudospondias microcarpa* tree showing ripe drupaceous fruits

Photo Credit: Success Osarumwense

Mag. X 1.5

PLATE 2: Ripe *Pseudospondias microcarpa* fruits collected before processing to remove seeds prior to germination.

Photo Credit: Success Osarumwense

PLATE 3: *Funtumia africana* fruit showing divergence intact follicles (in white rectangle) and another, opened showing flutty hairs.

Ptoto Credit:Success Osarumwense

PLATE 4: *Funtumia africana* follicles showing seed within a mass of fluffy hairs after being dispersed by wind.

distinction is that the latex of *F. africana* coagulates into balls when rubbed between the fingers, while *F. africana* does not exhibit this characteristic. The generic epithet, "Funtumia," originates from the local Ghanaian (Akan dialect) name of the plant, and the specific epithet, "africana," refers to its African origin. Funtumia Africana is a glabrous tree, often reaching about 30 feet in height but occasionally growing up to 100 feet. The flowers form in auxiliary clusters, with the corolla being fleshy yellowish- to greenish-white or orange in color. It can be found in various locations, including Okomu Forest Reserve in Benin (Aigbokhan E.I personal communication).

1.5.1 Scientific Classification of *Funtumia africana*

Kingdom: Plantae

Division: Angiosperm

Class: Eudiots

Order: Gentianales

Family: Apocynaceae

Genus: *Funtumia*

Species: *Funtumia africana* (Benth.) Stapf

1.6 LITERATURE REVIEW

Report from literature shows that *Pseudospondias microcarpa* and *Funtumia africana* seeds does not require any treatment before germination if they are planted immediately after harvest.

1.7 AIM OF THE STUDY

In this study, we will be using several scarification test to test the performance of the seed after treatment *Pseudospondias microcarpa* and *Funtumia africana*

1.8 RESEARCH OBJECTIVES

The main objective of this study is to examine the effects of scarification using *Pseudospondias microcarpa* and *Funtumia elastica* seeds.

CHAPTER TWO

MATERIALS AND METHODS

2.0 SEED SOURCES AND SOIL COLLECTIONS:

In this study, the seeds of *Pseudospondias microcarpa* and *Funtumia elastic*a were gathered during their natural dispersal period, specifically between May 6 – May 12th, 2023, at Ogba Zoo. For seed cultivation, soil samples were procured from Capitol at the University of Benin in Benin City, Nigeria. Subsequently, the seeds were extracted from their fruits and subjected to sun drying until the initiation of germination tests.

2.1 SOURCE OF CHEMICAL

The concentrated hydrochloric acid utilized in this experiment was sourced from a chemical laboratory opposite UBTH at Ugbowo, Benin City, Edo State, Nigeria.

2.2 SEED TREATMENT

Hot water scarification

Initially, the water was subjected to gaseous heating until it reached a temperature of 100^{o}C, after which it was gradually cooled down to 80^{o}C. Subsequently, seeds were immersed in the boiled water for durations of 30 seconds, 5, and 15 minutes. The selection of boiling durations was based on the findings of previous studies. Following each immersion time, seeds of different species were planted in distinct polythene bags filled with soil.

Chemical scarification

To implement the acid treatment, concentrated sulphuric acid was appropriately diluted to attain different concentrations. Specifically, the diluted sulphuric acid solutions of (125%, 75%, and 50% were prepared by mixing the acid with water in a 500ml). Seeds of both

Pseudospondias microcarpa and *Funtumia africana* were subjected to soaking in these respective acid solutions for predetermined durations as prescribed, namely 30 seconds, 5 minutes, and 15 minutes. Following the specified soaking times, the treated seeds were subsequently planted into various polythene bags containing soil.

Dry heat

Pretreatment of *Pseudospondias microcarpa* and *Funtumia elastica* seeds involved placing them on a desiccated frying pan positioned over an ignited camping gas for varying duration of 30 seconds, 5, and 15 minutes. Subsequently, the pretreated seeds were planted in different polythene bags containing soil.

2.3 TIME AND LOCATION

This investigation was conducted within the screen house of the Department of Plant Biology and Biotechnology, located at the University of Benin, Nigeria. The study site is positioned at latitude 6.3998^{o} N and longitude 5.6099^{o} E in Edo state, which is situated in the South-south geopolitical zone of Nigeria.

2.4 NUMBER OF SEEDS/KILOGRAM

The seeds of *Pseudospondias microcarpa* and *Funtumia elastic*a were subjected to a counting process, yielding a total of 86 and 218 seeds respectively.

2.5 EXPERIMENTAL DESIGN

The experiments were laid out in a completely randomized design (CRD). The effects of scarification on the germination of *Pseudospondias microcarpa* and *funtumia elastica* seeds were evaluated. Sixty-four (64) bags were used for the study. Each bag was sown with a seed which individually had undergone the four (3) different treatments which were; Hot water treatment, Dry heat, acid treatment and the zero treatment (control). Each treatment had about 8 bags sown with seeds making it 80 seeds in all. These seeds also underwent four (3) time differences pertaining to the treatments; 30 seconds, 5 minutes, and 15 minutes.

In control, there were no (zero) treatments given to the seeds and therefore the time difference was constant. In treatment 1, seeds were soaked in hot water for three (3) different time limits. In treatment 2, seeds were placed for dessicated frying pan positioned over an ignited camping gas for three (3) different time limits. In treatment 3, seeds were soaked in diluted sulphuric acid for three (3) different time limits.

Based on the three treatments, the seeds were planted in soil media and their growth observed for 9 weeks. The data collected included the week of germination, and the height of the plant, girth of the plant, and the leaves of the plant. The results of the study are shown in table 1, table 2, and table 3.

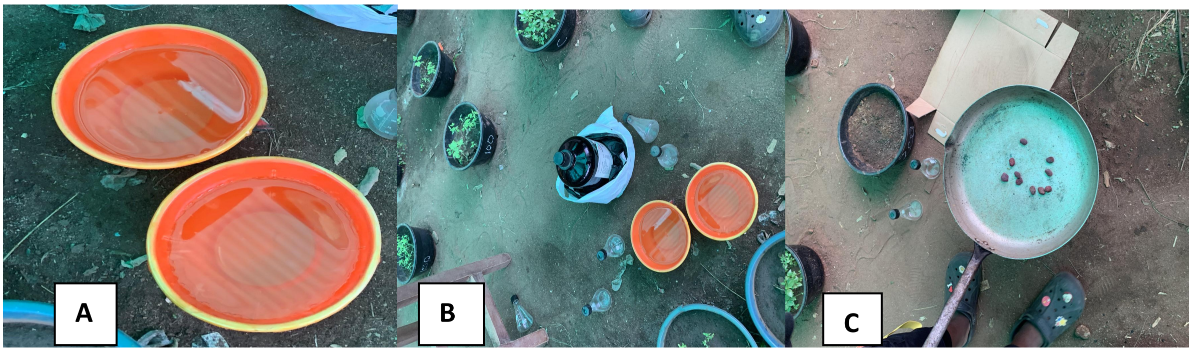

PLATE 5: Methods of scarification

A= Scarification using hot water

B= Scarification using H_2SO_4

C= Scarification by dry heat

PLATE 6: Germination setup of *Funtumia africana* in the screen house.

PLATE 7: Germination setup of *Pseudospondias microcarpa* in the screen house.

CHAPTER THREE

RESULTS

All the treated seeds of *Pseudospondias microcarpa* showed no germination or seedling growth was observed throughout the 9-weeks of study (Table 1, Plate 8).

Table 1: Germination of *Pseudospondias microcarpa*

	CONTROL	HOT WATER	DRY HEAT	ACID
Week 1	0	0	0	0
week 2	0	0	0	0
week 3	0	0	0	0
week 4	0	0	0	0
week 5	0	0	0	0
week 6	0	0	0	0
Week 7	0	0	0	0
Week 8	0	0	0	0
Week 9	0	0	0	0

PLATE 8: Experimental setup showing no germination or seedling development in nursery bags in which harvested seeds of *Pseudospondias microcarpa* were planted.

All the treated seeds of *Funtumia africana* showed no germination or seedling growth in contract to the hot water for (30 seconds) was observed throughout the 9-weeks of study (Table 1, Plate 8).

Table 2: Germination of *Funtumia africana*

	CONTROL	HOT WATER	DRY HEAT	ACID
Week 1	0	0	0	0
week 2	0	0	0	0
week 3	0	0	0	0
week 4	0	0	0	0
week 5	0	0	0	0
week 6	0	0	0	0
Week 7	0	0	0	0
Week 8	0	0	0	0
Week 9	0	0	0	0

Table 3: Seedling development of *Funtumia africana* germinated following very brief (30 seconds) in hot-water treatment.

	HEIGHT	GIRTH	STEM	LEAVES
Week 1	0	0	0	0
week 2	0	0	0	0
week 3	3.5	0.1	3.5	2
week 4	6.0	0.1	6.0	4
week 5	9.6	0.1	9.6	4
week 6	12.7	0.1	12.7	6

PLATE 9: Stages of the leaf growth of *Funtumia africana (*(**A) =** *Funtumia africana* seedling at two-leaf stage after germination and emergence from soil surface, (**B) =** *Funtumia africana* seedling at four-leaf stage after germination and emergence from soil surface; **(C) =** *Funtumia africana* seedling at six-leaf stage after germination and emergence from soil surface.

CHAPTER FOUR

DISCUSSION

Under conditions of this experiment, the various scarification methods which are; hot-water, dry heat and acid treatment led to no successful germination of *Pseudospondias microcarpa* including the control (untreated seed). Several factors could have contributed to the failure of the seeds to germinate successfully even after been pre-treated.

Firstly, *Pseudospondias microcarpa* might not require scarification method to grow or they might require scarification methods that were not used. Secondly, the corrosive nature of acid renders seeds highly permeable to its chemical effects, leading to the ultimately damages of both the embryo and its teguments. Seeds treated with the sulphuric acid failed to undergo germination. This result is identical with the one that Jaouadi *et al.,* (2000) obtained in their study of *Acacia tortilis* exposed to diverse abiotic constraints. Similarly, Vaheji (2005) and Danthu *et al.,* (2003), noted that immersing seeds in concentrate acid solution induce seed swelling, resulting to the tearing of teguments, material abrasion, and delay in germination. Moreover, the environmental conditions provided during the study might not have been optimal for promoting the germination of *Pseudosponias microcarpa*. Elements such as temperature, light intensity, soil composition, and moisture levels can significantly influence seed germination. It is essential to examine these conditions to determine if they were optimal for the species under investigation. Luino., *et al.,* (2016).

In natural settings, employing pre-germinated seeds, as per Gifffard's findings in 1966, proves effectiveness when they encounter rainfall within a 24 to 48-hours after sowing (results not published). Failure to do so results in seeds desiccation leading to the death of the embryo. Untreated seeds exhibited non-uniform germination patterns over time and achieved successful establishment, even enduring brief drought period (Seif el Din. 1979). However, Danthu *et al.,* research suggest that under controlled conditions, the acceleration of seed sprouting can occur through methods such as hot-water treatment, acid scarification, or 12 to 24-hours pre-germination.

The germination response of *Funtumia africana* to the various scarification method which are; hot-water, dry heat and acid treatment yielded no successful result. In contrast to the control (untreatment seeds) which exhibited signs of growth but die after one week of germination and the hot-water treatment for 30 seconds which grew but took 14 days to germinate. Several factors could have contributed to the failure of the seeds to germinate successful even after been pre-treated.

Firstly, *Funtumia africana* might not require scarification method to grow or they might require scarification methods that were not used. Furthermore, maybe the heat treatment could not release the seeds from their physical dormancy due to the limited duration of heat exposure. Baskin and Baskin's work in 1998, as well as the research of Dayamba *et al.* (2008) propose the possibility that the heat treatment, while breaking the physical dormancy of seeds induced a temporary heat-induced physiological dormancy. In line with this, Dayamba *et al.* (2010)*,* findings underscore the adverse effects of heat shock on A. leiocarpus ($P < 0.001$) with no instances of germination observe when subjected to a heat shock of 120 °C. Elements such as temperature, light intensity, soil composition, and moisture levels can significantly influence seed germination. According to Bewley and Black 1994; Slabaugh and Shaw 2008; Tilki ve Guner 2007, temperature and light affect seed germination percentage and germination rate in some species. Seeds treated with sulphuric acid did not germinate. Similarly, Vaheji (2005) and Danthu *et al.,* (2003), noted that immersing seeds in concentrate acid solution induce seed swelling, resulting to the tearing of teguments, material abrasion, and delay in germination.

CONCLUSION

This research was aimed to evaluate how the seeds of *Pseudospondias microcarpa* and *Funtumia elastica* germination might be improved by subjecting them to hot-water, dry heat and concentrated sulphuric acid. Surprisingly, neither boiling nor heat nor concentrated sulphuric acid exhibited a stimulating effect on the germination of the species tested. This lack of influence could potential be attributed to other dormancy-related factors that need to be addressed before applying the various scarification methods. Soaking *Funtumia africana* seeds in hot-water for 30 seconds led to germination compared to other scarification method employed within the study.

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