EFFECTS OF PRE-TREATMENT ON SEED GERMINATION OF *Trichilia tessmannii* (Harms) IN NIGERIA

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ABSTRACT

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Trichilia tessmannii is an indigenous fruit tree found in the wild in South east and South south Nigeria. However, inadequate knowledge of its silviculture and threat of extinction due to deforestation from expanding agriculture are major problems of the species. This study was carried out to examine the effect of pre-treatment on germination T. tessmannii seeds. The experiment was set up in a completely randomized design involving three replicates. The treatments were hydrogen peroxide (10minutes) (T1), cold water (24 hours) (T2), hot water (100°C for 5 minutes) (T3), bleach (10 minutes) (T4), methylated spirit (10 minutes) (T5) and control (no treatment) (T6). Sixty seeds were sown per treatment and germination count was recorded for four weeks on emergence, duration and percentage of germination. T1 gave the highest germination percentage (88%), followed by T2 (73%), T4 (65%), T6 (58%), T5 (55%) and T3 (0%). In germination emergence, there were significant differences between the means ($p<0.05$). Seeds of T. tessmannii treated as control were recorded to have the longest mean germination emergence of approximately 14 days. Although the results obtained in this experiment emphasize that T. tessmannii seeds could be germinated without pre-treatment. However, to achieve optimum and uniform germination, it is important that the seeds of T. tessmannii are pre-treated with hydrogen peroxide or soaked in cold water before sowing.

Keywords*: Trichilia tessmannii, pre-treatment, germination, seedling emergence, seedling growth.*

INTRODUCTION

Trichilia tessmannii (Harms) is a tropical fruit tree which belongs to the family of Meliaciae. It is mainly consumed by the rural agrarian communities in South East and South-South regions of Nigeria. It is an evergreen and semi deciduous shrub ranging in mature height from 3 m to 15m (Howard, 1988). It is a forest tree found in the rain forests in lowlands and submontane altitudes, near river banks from Guinea to Southern Nigeria and into Cameroon, Gabon, Zaire and Cabinda (Quartey, 2014). In Nigeria, it is used as a treatment for skin ulcers (Meléndez, 1982). A decoction of the bark is used as a purgative and for treating stomach-aches (Lemmens, 2008). The wood is said to be termite proof and therefore used for house construction, the cooked fruits are eaten in Zaire while the seeds are used by Nigerian women for rattles and tambourines (Quartey, 2014).

Seed dormancy is a temporal failure of mature viable seeds to germinate under environmental condition that would normally favour germination (Ibiang *et al.*, 2012; Fredrick *et al.*, 2016). Within the maliaceae family, it is common to find hard or water-impermeable seeds. The hard seed coats in some tropical species prevent seed germination but foresters rely on seeds that exhibit high rate of germination and vigorous growth after germination, hence dormancy is sometimes regarded as an undesirable trait. Coat imposed dormancy can be eliminated by seed pre-treatment, which include chemical treatment, heat treatment, soaking of seeds which allow imbibition and germination to occur. Pre-treatment such as hydrogen peroxide and sulphuric acid have been used to overcome seed dormancy and improve germination in some forest species (Omokhua and Alex 2015).

In Nigeria, extensive deforestation due to rapid growth in population and expanding agricultural activities has resulted in the decrease in density of most forest tree species including *T. tessmannii*. The species has been insufficiently studied and neglected because it is not cultivated in Nigeria. Hence, there is inadequate information on the silvicultural requirement of the species for regeneration and domestication purposes. However, studies are available on status, ecology, distribution as well as medicinal use of the species (Meléndez, 1982).

An understanding of the germination potential of the species involving pre-treatment will provide some information for its domestication and cultivation in Nigeria. This therefore creates the need for this study. Thus the objective of this investigation was to determine the effects of five pre-treatments on the germination of *T. tessmannii* seeds.

MATERIALS AND METHODS

Experimental site

The study was carried out at the Forestry Nursery in the Department of Forestry and Wildlife Management, Faculty of Agriculture, University of Port Harcourt, Choba, Rivers State which lies at latitude 04°53' 38.3"N and longitude 00.6° 54'38"E.

Fruit collection and seed processing

The fruits of *T. tessmannii* were harvested from five "plus" trees from the Tropical Rainforest in Onne, Eleme Local Government Area, Rivers State. The fruits were processed and extracted by depulping. The seeds were then

mixed thoroughly to obtain a seed lot for the study. The seed lot was subjected to viability test using the floatation method. The seeds that floated were discarded and not used in the study

Experimental design

The experiment was laid out in a completely randomized design involving six (6) pre-treatments with three (3) replicates. The pre-treatments included hydrogen peroxide (10minutes) (T1), cold water (24 hours) (T2), hot water (100°Cfor 5 minutes) (T3), bleach (10 minutes) (T4), methylated spirit (10 minutes) (T5) and control (no treatment) (T6). All the seeds treated with chemicals were rinsed properly with water. The untreated seed lot was used for the control experiment. A total number of three hundred and sixty seed (360) were used. Sixty (60) seeds were used per treatment. The seeds were sown into germination trays filled with sterilized coarse sand. Watering was done daily to maintain adequate moisture content in the soil medium. Germination was taken to have occurred when the plumule emerged from the soil surface. Germination count was taken daily for four weeks until no more germination occurred.

Data collection

Data on germination indices involving germination emergence, germination duration and germination percentage were calculated as shown below:

Germination emergence: when the plumule emerged from the soil surface from the day of sowing.

Germination duration: day to germinate after sowing to end of germination

Germination percentage: $\frac{number\ of\ seeds\ germinated}{number\ of\ seeds\ sown} x \frac{100}{1}$

Statistical analysis

Data collected on germination were statistically analysed using SPSS statistical software (SPSS version 18.0, SPSS Inc.) to explore possible treatment variation. Analysis of variance (ANOVA) in a Completely Randomized Design (CRD) was carried out to test the effect of seed treatments and Duncan's Multiple Range Test (DMRT) at $p \leq 0.05$ level of significance was used for mean separation.

RESULTS

Germination emergence

Highest mean germination and emergence of *T. tessmannii* seeds was observed in T6 (14.33days), followed by T4 (12.67days) while lowest germination inception was observed in T1 (6.33 day), followed by T2 (7.67 days).No germination was observed in T3. Further testing with DMRT indicated that T1 and T2 showed no significant differences and also T4 and T6 showed no significant differences (Table 1).

Germination duration

The results on Table 2 revealed that T4 and T6 exhibited highest germination duration (7.33 days) followed by T5 (6.33 days) and T2 (5.33 days) while T1 exhibited lowest germination duration (4.33 days). There were no significant differences among T6, T5 and T4, between T5 and T2, and between T2 and T1 (Table 1).

Germination percentage

The mean germination Percentage varied from 55% to 88.3%. Germination percentage was highest in T1 (88.3%), followed by T2 (73.3%) and lowest in T5 (55%) followed by T6 (58.3%). However, there was no significance difference among T4, T5 and T6 and betweenT2 and T4 (Table 2).

Table 1: Effects of seed pre-treatment on mean germination parameters of (germination emergence, duration and percentage) of *T. tessmannii* seeds

Treatment	Germination emergence (days)	Germination duration (days)	Germination percentage (%)
Hydrogen peroxide	6.33c	4.33 c	88.33a
Cold water	7.67bc	5.33bc	73.33b
Hot water	0.00d	0.00d	0.00e
Bleach	12.67a	7.33a	65.00bc
Methylated spirit	9.33b	6.00ab	55.00d
Control	14.33a	7.33a	58.33cd

Values in the same column with the same letter do not differ significantly ($p \leq 0.05$)

DISCUSSION

The main aim of seed pretreatment is to enhance fast and even germination (Falemara *et al.*, 2013). There was a significant differences ($p<0.05$) in germination emergence among the various treatments. The significance of early emergence and short duration of germination in silviculture is that it saves time and reduces the cost of production of seedlings in the nursery. There is also effective management of seedlings if seeds germinate at good time and at uniform rate to meet up with field planting season. Among all the treatments used in this study, hydrogen peroxide exhibited lowest germination emergence and duration and highest germination percentage. This finding agrees with earlier studies which reported that acid treatment can enhance the germination of seeds (Diallo *et al.,* 1996; Amusa, 2011; Fredrick *et al.,* 2016).This is also in agreement with studies carried out by

Schopferet *et al.* (2001) who observed the useful role of hydrogen peroxide in the breaking down of seed coat leading to wall loosening during the extension growth of plants cells.

Work carried out by Palma and Kermode (2003) stated that hydrogen peroxide exogenously given to the seed might serve its role in the lipids mobilization by supplying the carbon and energy required for hydrolase synthesis and secretion by aleurone layer cell. Gondim *et al.* (2010) also noted that seeds soaked in 100mm hydrogen peroxide showed increased germination percentage when compared with other treatments. Cold water treatment also exhibited a higher germination when compared with the other treatments. This result concurs to the report of Owonubi *et al.* (2005) that soaking of *Azadirachta indica* seeds for 1, 12 and 24 hours increased the rate of seed germination. Hossain *et al*. (2005) also noted that seeds of Horitaki (*Terminalia chebula*) soaked in cold water increased germination speed, germination percentage, seedling growth and biomass production in comparison to the control treatment. Soaking in cold water is a feature that enhances germination in seeds of tropical trees (Fredrick *et al.,* 2016).

Hot water treatment for 5 minutes destroyed the seeds of *T. Tessmannii* with a germination percentage of 0.00%. This conforms with the report by Amusa (2011) on seeds of *Afzelia Africana* when subjected to hot water pre-treatment which leads to the seed embryo being killed because of prolonged contact with boiled water and Gill *et al.* (2006) who noted that seeds of *Calliandra portoricensis* failed to germinate in hot water. Onyekwelu (1990) and Fredrick *et al.* (2016) also reported that hot water treatment is not effective in breaking dormancy of *Tetraplura tetraptera* and *Faidherbia albidum* seeds respectively. On the contrary, Usman *et al.* (2010) and Missanjo *et al.* (2014) reported that seeds soaked in hot water treatment at 100s°C for 5 minutes did better than the control in *Acacia senegal* and *Acacia polyacantha* seeds respectively while Soliman and Mohamed (2013) noted that soaking seeds of *cassia fistula* in hot water at 100°C for 6 minutes was the best method for breaking dormancy which resulted in an increased germination percentage of 96% and gave high quality of golden shower seedlings. This therefore appears that different species have varying ability to withstand level of temperature which is one of the primary conditions suitable for germination.

Bleach treatment gave a reduced germination emergence and a higher germination percentage when compared with control. Effect of bleach on germination percentage of *T. Tessmannii* conformed with findings of Olatunji *et al.* (2012) for seeds of *Acacia auricuroformis* which displayed higher germination percentage in bleach treatment (10 mins) than control treatment. Methylated spirit exhibited a lower germination emergence and duration than control which indicated that it enhanced germination speed but also had a lower germination percentage than control.

CONCLUSION

The result obtained in this experiment shows that *T. tessmannii* seeds does not exhibit strong dormancy since germination ended within four weeks (one month). However, to enable optimum and uniform germination, it is important that the seeds of *T. tessmannii* are pre-treated with hydrogen peroxide before sowing because it is the best treatment that enhanced germination. This will help to increase seedling availability for reforestation and domestication projects. The cold water treatment exhibited a higher germination than other treatment and is therefore recommended for local farmers, nursery men and foresters who cannot afford the acid (hydrogen peroxide) and also since the use of acid could hazardous if not properly managed.

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