# Effectiveness of Different Pre-Treatments on Seed Germination and Seedling Vigour of *Tetrapleura tetraptera*

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*Abstract*
*Despite its socio-economic importance, the cultivation of Tetrapleura tetraptera is not popular owing to the difficulty in seed germination. As a step in its domestication process, investigations were undertaken on germination requirements to determine the effectiveness of different pre-treatments media on seed germination and seedling vigour of Tetrapleura tetraptera. The seeds were extracted and subjected to the following treatments:100% concentrated tetraoxosulphate vi acid, 50% concentrated tetraoxosulphate vi acid, 100% concentrated hydrochloric acid, 50% concentrated hydrochloric acid, Hot water treatment, Cold water treatment, Sandpaper treatment, and a control experiment (untreated seed). Results showed that mean percentage germination was higher on the seeds treated with 100% $H_2S0_4$ than on other pre- treatments. While untreated seeds and those soaked in cold water irrespective of the duration of treatment failed to germinate. Soaking seeds in either 100% concentrated HCl or 100% concentrated $H_2SO_4$ for 5 seconds were the most effective treatments in breaking dormancy, with 78 % and 89 % mean germination recorded respectively. Thus for the production of Tetrapleura tetraptera fruit, $H_2SO_4$ and HCl can be used to promote germination of its seeds.*

## INTRODUCTION

*Tetrapleura tetraptera* (Schumach. and Thonn) is one of the molluscicidal medicinal plants and lesser-known multipurpose tropical tree in Nigeria (Aladesanmi, 2007). The economic and medicinal uses of *T. tetraptera* are many. The fruits are used locally in Nigeria in flavouring, in creams, and in soaps. However, trees exhibit seed dormancy in order to survive unfavorable condition (Carvalho and Nakagawa, 2000). *T. traptera* have a hard coated seeds just like other tropical and leguminous trees, therefore resulting in delay germination. In an ideal condition, germination of the seeds often takes a much longer period compared to the common arable crops (Aref*et al.,* 2011). In view of this, there is a need to enhance the rate of seed germination using pre-treatment.

The significance of subjecting tree seeds to pre-treatment in order to obtain optimum germination, healthy and vigorous seedling has been highlighted by the different researchers (Doran *et al.,* 1983; Tietema *et al.,* 1992; Sahoo, 2007; Olajide*et al.,* 2014; Omokhua *et al.,* 2015; Thangjam and Sahoo, 2017).The germination of hard-coated seeds has been trigger using different pretreatment, among which are acid treatment, hot water, scarification, cold water, nicking, sandpaper etc. According to Rawat (2009), all these pretreatments have been found to enhance seed germination and seedling growth of trees.

These studies also confirmed that trees species respond differently to different media, which mean they have a distinctive preference for some (Bahuguna *et al.,* 1987). Like many other tropical trees, the *T. tetraptera* also have hard-coated seeds which prevent seed germination and thus there is the need to investigate the most appropriate method to break its dormancy. However, scanty information exists on the effectiveness of different pre-treatments media on seed germination and seedling



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vigour of *T. tetraptera*. Therefore, this study aimed to examine the effects of pre-treatment on germination of *T. tetraptera* seeds as well as its seedling vigor.

**MATERIALS AND METHODS**

The experiment was conducted between July to October 2012 under the screen house of the Department of Crop, Soil, and Pest Management, The Federal University of Technology, Akure.

The planting materials (seeds of *T. tetraptera)* were obtained from Oja-oba market in Akure, Ondo state. The seeds were authenticated in the department after which the infected and diseased seeds were discarded. Selected healthy seeds were air dried and keep at room temperature (28±2°C). Seeds with above average weight were selected and bulked. The sample representative taken from the bulked seeds were used for the experiment. The initial soil test conducted on the soil indicated that the soil is slightly acidic (5.64), with organic carbon of 1.26%. The selected seeds were subjected to different pre-treatments viz; 100% concentrated tetraoxosulphatevi acid, 50% concentrated tetraoxosulphate vi acid, 100% concentrated hydrochloric acid, 50% concentrated hydrochloric acid, Hot water treatment, Cold water treatment, Sandpaper treatment, and control; where no treatment was applied.

**Pre-nursery/pre-planting procedures:** 100% of $H_2SO_4$ was prepared by measuring 100ml of $H_2SO_4$in a conical flask. The 50% of $H_2SO_4$ was prepared by measuring 50ml of distilled water and 50ml of Conc. $H_2SO_4$ in a conical flask in the laboratory. A similar procedure was used in measuring 100% and 50% of HCl. Seeds of *T. tetraptera* were soaked in the prepared media for 5 seconds, removed, and rinsed in distilled water before they were sowed according to Tietema (1992).

For the hot-water treatment, ten seeds were dipped into hot water at 100°c for five minute. They were left to cool on the laboratory bench under room temperature and sowed afterwards Onyekwelu(1990). The cold water treatment was setup by soaking ten seeds of *T. tetraptera* in cold water for 48 hours, after which they were sowed (Onyekwelu, 1990).

For the sand-paper treatment, the seeds were rubbed between two rough surfaces of sandpaper for three minutes before planting (Onyekelu,1990). In the case of the control experiment, the ten seeds were sowed without applying any of the pre-sowing treatment.

**Nursery procedure:** Germination were monitored daily and recorded. The first germination was observed five days after planting, while the last germination was observed after six after. Two weeks after germination, the number of plant stands per treatment were thinned to three plant stands. Potting of healthy and vigorous seedlings began a week after thinning. Three (3) seeds of *T. tetraptera* were planted per pot to give a total of 72 seedlings. Potting of healthy and vigorous seedlings was done using a well-perforated polythene bag filled with farrowed forest top-soil. The weed control was done manually (hand-pulling) as at when due and watering was done daily.

Experimental Design: the experiment was laid out in Complete Randomised Design (CRD) and replicated three times

**Data Collection and Analysis:** Germination count was determined by visual observation and this was done on a three days interval, to note if there was a sign of soil bulging up or opening.

Percentage germination was determined after seedling emergence using the formula:

X/Y x 100



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Where X= germinated seeds for each treatment,
Y= total number of seeds planted for each treatment**.**
The following growth parameters were collected: plant height, stem girth, number of leaves, and number of branches. Data collected were subjected to analysis of variance (ANOVA) using SPSS version 17 and means separated using Duncan Multiple Range Test (DMRT).

**RESULTS**

The % germination of *T. tetraptera is* presented in Table 1, the result revealed that seed germination was influenced significantly by various pretreatments. Furthermore, the result showed that 100% of $H_2SO_4$ had the highest and maximum seed germination percentage (89), followed by seed exposure to 50% $H_2SO_4$ (78). The following treatments had equal % germination (67): 100% HCl, % 50 HCl and sandpaper. The cold water treatment and control had 56% while the hot water treatment had the least percentage germination rate of 45. However, the seed treated with 100% $H_2SO_4$showed significantly ($P<0.05$) higher germination compared to control while other pretreatments also showed significantly ($P<0.05$) higher germination.
The result presented in Table 3showed the correlation for the growth parameters. Plant height of *T. tetraptera* had a positive and highly significant correlation with number of branches, The number of branches had a positive and significant correlation with number of leaves. The correlation between plant height and number of branches had the highest positive and significant correlation (0.97), followed by number of branches and plant height (0.82). However no negative correlation between the parameters.

**DISCUSSION**

The differences in germination attributes for the treated and untreated seeds might be due to altered physiology of embryos and liberating enzymes so that processes occur more rapidly after sowing the seeds. The application of conc. $H_2SO_4$ at 100% treatment gave the highest germination. The absolute concentration (100%) of $H_2SO_4$ and HCl gave the best performance among the pre-treatments. A similar study conducted by Alaba *et al*. (2006) on *T. tetraptera* revealed that subjection of the seeds to absolute sulphuric acid, heat treatment at 100 C and mechanical scarification using sandpaper for 7 minutes resulted in 90%, 16%,and 80% germination, respectively.
Results from the study have clearly demonstrated that application of pre-sowing treatments proved beneficial as it markedly improved growth parameters of *T. tetraptera* compared to the control. It showed that the application of 100% $H_2SO_4$ in breaking the dormancy of seeds of *T. tetraptera* followed by 100%HCl, 50% $H_2SO_4$ and 50% HCl were effective in improving most of the parameters (plant height, number of leaves and number of branches) studied. Cold water treatment was not significantly different from control (untreated).
Although the control also performed well which means that the seeds of *T. tetraptera* are capable of germinating naturally without any pre-sowing treatments. But the exposure of the seed to 100% $H_2SO_4$ and HCl, reflect the need or importance of pre-sowing treatment in the breaking of dormancy of hard coat seed and the seedling vigour of the seeds of *T. tetraptera,*

**CONCLUSION**

The seed dormancy in *T. tetraptera* is mainly due to the hard seed coat, which affects the seed germination. The results obtained in this study emphasized the



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necessity of treating *T. tetraptera* seeds before sowing, in order to enhance its growth. Applying pre-sowing treatments to break the seed dormancy of *Tetrapleuratetraptera*using 100% $H_2SO_4$, 100% HCl, and sandpaper treatment proved effective compared with hot and cold water treatment which had no significant difference from the control.The pre-germination treatment of *T. tetraptera* seeds by using 100% $H_2SO_4$, 100% HClenhanced germination of theseeds, heightand number of leaves of seedlings. Thus for the production of *T. tetraptera* $H_2SO_4$ can be used to promote germination of its seeds. But for the benefit of the average peasant gardener who may not have access to 100% $H_2SO_4$, and 100% HCl, soaking tne seeds of *T. tetraptera* in hot water for five minutes is highly recommended.

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**Table 1: Effect of different pretreatments on Seed germination of*Tetrapleura tetraptera***

| Treatments | %Germination |
|---|---|
| 100% $H_2SO_4$ | 89a |
| 50% $H_2SO_4$ | 67c |
| 100% HCl | 78b |
| 50% HCl | 67c |
| Hot-Water | 64c |
| Cold-Water | 56d |
| Sand Paper | 67c |
| Control | 45e |

**Table 2: Effect of different pretreatments on growth parameters of *Tetrapleura tetraptera***

| Treatments | Seedling height (cm) | Number of leaves | Girth (cm) |
|---|---|---|---|
| 100% $H_2SO_4$ | 38.30a | 23.67a | 0.49a |
| 50% $H_2SO_4$ | 28.43c | 20.00d | 0.49a |
| 100% HCl | 34.67b | 22.00b | 0.49a |
| 50% HCl | 28.43c | 20.67e | 0.48a |
| Hot-Water | 26.87c | 17.67c | 0.49a |
| Cold-Water | 16.97e | 12.00e | 0.48a |
| Sand Paper | 20.17d | 15.67e | 0.48a |
| Control | 15.30e | 11.67e | 0.47a |



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**Table 3: Correlation for growth parameters across the 8 treatments**

| | Plant height | Number of leaves | Number of branches |
|---|---|---|---|
| Plant height | 1 | 0.97** | 0.82** |
| Number of leaves | | 1 | 0.77* |
| Number of branches | | | 1 |

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).



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