BREAKING SEED COAT DORMANCY OF *Terminalia mantaly* H. Perrier SEEDS

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ABSTRACT
Terminalia mantaly is a popular amenity tree that is commonly used to beautify the environment and provide shade. The seeds exhibit seed coat dormancy especially when it is allowed to dry before sowing thereby hindering rapid and synchronous germination. To break the seed coat dormancy, the seeds were subjected to biological treatment using termites as the biological agent. Viable seeds of Terminalia mantaly were subjected to 4 treatments, namely: Termite digestion for 5 days (T1), 7 days (T2), 9 days (T3), 12 days (T4) and control (undigested seeds) (T5). Fifty (50) seeds were collected from each treatment and sown in germination trays that were filled with sterilized river sharp sands. The experiment was arranged in a completely randomized design (CRD) and replicated 4 times. The germination trays were watered twice daily (morning and evening) while the experiment lasted. The results show that the duration (days) of termite digestion significantly affects germination percentage and germination speed. Seeds that were digested for 7 days (T2) recorded the highest germination percentage (82.5%), while the lowest germination percentage (13.75±4.79) was recorded by undigested seeds (control). Seeds digested for 5 days (T1) had a faster germination speed (7.15±0.09), while the control had the lowest (0.51±0.05). Termites' digestion successfully breaks seed coat dormancy of Terminalia mantaly, however, for a high germination rate, digestion for 7 days is recommended.

Keywords: *Terminalia mantaly, Madagascar almond, seed coat dormancy, germination percentage, termites.*

INTRODUCTION

Germination is the most critical stage of seed-bearing plants (Foley and Fennimore 1998). Seeds germinate after being subjected to favourable environmental factors such as water, light, temperature and oxygen. However, when seeds failed to germinate after being subjected to these favourable environmental conditions, they are regarded as dormant (Baskin and Baskin, 2000). Many seeds plants exhibit some form of dormancy, according to Baskin and Baskin (2000), except for tropical rainforest and tropical semi-evergreen forest plants, most seed plants are dormant at maturity. Several pretreatment methods such as chemical, mechanical, biological, hormone, water etc have been used to break dormancy in seeds. These methods performed one or more of the following: stimulate embryo metabolism, increase the permeability of seeds to water and oxygen and/or reduce the mechanical resistance to the growth of the embryo (Kozlowski and Pallardy 1997).

The use of biological agents in breaking seed dormancy is not popular possibly because of the challenge faced in controlling the processes. However, this method is successful in breaking dormancy in some plant seeds. For example, seeds coat dormancy of *Acacia senegal* and *ceratonia siligua* were broken after passing through the digestive tract of goats (Goor and Barney 1976). Termite digestion has been reported to successfully break the seed coat dormancy of *Tectonia grandis* (Bryndum 1966; Sompherm 1975) and *Pterocarpus angolensis* (Groome *et al*., 1957). However, Vijayalakshmi and Renganayaki (2011) observed no significant difference between seeds of *Pterocarpus santalinus* sown without treatments (Control) and those sown after being subjected to termite digestion. The lack of significant effects between termites' digestion and undigested seeds of *Pterocarpus santalinus* seeds could be due to the high phenol content in the seeds which could inhibit termites' activities as opined by Vijayalakshmi and Renganayaki (2011).

Terminalia mantaly formerly known as *Terminalia radii is* commonly called Madagascar almond in English and it is from the family of Combretaceae. The tree is native to Madagascar, but it is now distributed in Djibouti, Eritrea, Ethiopia, Kenya, Senegal, Somalia, Tanzania, and Uganda (Orwa *et al*., 2009). In Nigeria, it is commonly called a "satellite tree" because of its crown shape and branching pattern which are in layers. It is one of the popular amenity tree species in Nigeria, it is found adorning streets and beautifying houses in many towns and cities in Nigeria. It has received wide acceptability because of its fast growth rate and beauty. *Terminalia mantaly* trees provide shade and improve the micro-climatic condition.

Freshly collected seeds of *Terminalia mantaly* germinate easily when sown; however, after storage its exhibit seed coat dormancy. This could largely be attributed to the drying of the seeds during storage thereby resulting in a hard seed coat which prevents water permeability. The duration of time it takes for the seeds to germinate when sown poses a serious challenge for its propagation sexually. Breaking the dormancy of *Terminalia mantaly* seeds will reduce the time, resources and effort used thereby promoting rapid and synchronous germination which is vital for raising seedlings in the nursery. However, there is scanty information about breaking seeds coat dormancy of the species. Although Kiamba (2011) reported enhanced germination of *Terminalia mantaly* seeds when subjected to nipping in comparison to other treatments (boiled seeds, nipped seeds, cold water soaking and sulphuric acid scarification), experience is required to be able to carry out nipping.

In this study, we explored the possibility of breaking seeds coat dormancy of *Terminalia mantaly* using biological methods. Termites were used as biological agents. This method is safe, cheap and environmentally friendly in comparison to the use of chemicals.

Figure 1. Plantation of *Terminalia mantaly* at University of Ibadan

MATERIAL AND METHODS

Experimental site

The study was carried out at the Seedlings Nursery of the Department of Forestry and Wildlife Management, Federal University Gashua, Yobe State, Nigeria. Gashua town is located between Latitude 12°51'.723"- 12°54'.723" N and longitude 11°00'.024" - 11°03'.475" E. The climate is divided into wet (June – September) and dry seasons (end of September – May). Average annual rainfall ranged between 500 to 1000 mm. The minimum temperature ranged from 23 to 28°C, while the maximum temperature ranges from 38 to 40°C (Wakawa and Suleiman 2022).

Experimental design and treatments

Matured and healthy seeds of *Terminalia mantaly* were collected beneath mother trees within the town of Gashua, Yobe State, Nigeria. The seeds were subjected to a viability test to ascertain their viability. The seeds were then divided into 5 batches of 500 seeds each, representing five treatments, namely: Termite digestion for 5 days (T1), 7 days (T2), 9 days (T3), 12 days (T4) and control (undigested seeds). Each batch of seeds was placed on a sheet of paper; this was done to stimulate easy initiation of the seeds by termite. The seeds were then placed on a termite mould located within the Federal University Gashua, Yobe State, Nigeria and allowed to stay for 5 days (T1), 7 days (T2), 9 days (T3) and 12 days (T4). The seeds were collected after being subjected to the various treatment methods and washed to remove soil particles. Fifty (50) seeds were then randomly selected from each batch and sown in a germination tray filled with sterilized river sharp sand, this was replicated 4 times. The last batch of seed was sown without termite digestion to serve as a control (T5). The experiment was arranged in a completely randomized design (CRD). The germination trays were watered twice daily (Morning and Evening) while the experiment lasted. The seeds were considered to have germinated when the plumule emerges. The experiment was terminated after germination, this was after two weeks for all the treatment. The experiment lasted for 5 weeks.

a. Termite mound b. **seeds of Terminalia during termites initiation**

Figure 2. Termite mould and seeds of Terminalia during initiation

Germination characteristics assessed

Germination percentage (GP %): GP was calculated using the formulae described below:

$$GP = \frac{Number\ of\ germinated\ seeds}{Total\ number\ of\ seeds\ sown} \times 100$$

Germination speed (GS): Maguire's (1962) equation was used to calculate GS as shown below:

$$GS = \frac{No. of\ seeds\ germinated}{Days\ of\ first\ count} + - - + \frac{No. of\ seeds\ germinated}{days\ of\ final\ count}$$

Data analysis

Germination percentage data were transformed using arcsine before being subjected to analysis of variances (ANOVA). STATISTICA version 12 package was used for the analysis of variance (P ≤0.05). Fisher’s least significant difference (LSD) was used to separate means.

a. *Terminalia mantaly* seeds **b. Seedlings of *Terminalia mantaly* after germination**

Figure 3. Seeds and seedlings of *Terminalia mantaly* after germination

RESULTS AND DISCUSSION

Germination percentage

A significant difference in germination percentage was observed among treatments. Digestion of *Terminalia mantaly* seeds by termites for 7 days gave the highest germination percentage (82.5), while termite digestion for 5 days recorded 71.25 germination percentages (Table 1). This implies that termite digestion for 5 and 7 days significantly enhanced the germination percentage of *Terminalia mantaly*. The least germination percentage (13.75±4.79) was recorded by seeds sown without termite digestion (control). Our result was in agreement with that of Omokhua and Alex (2015) who observed a significant improvement in mean germination of *Tectona grandi*s seeds after termites' digestion. However, Vijayalakshmi and Renganayaki (2011) result contradicts our findings, they reported a lack of significant difference among seeds of *Pterocarpus santalinus* digested by termites and those sown without termite digestion. This contradiction may be attributed to the differences in species. Various species exhibit a different form of dormancy as such their behaviour would be expected to vary. The presence of chemical substances such as phenols in large quantity could also hinder the effects of termites on the seeds as opined by Vijayalakshmi and Renganayaki (2011) Germination percentage reduces as the days increase as can be seen from the results (Table 1). Seeds digested for 9 days recorded 43.75%, while those digested for 12 days had 15% germination. This is probably due to the damage of endosperm by the termites because of prolonged exposure. Seeds sown without termite digestion (control) had the least germination percentage. The poor germination rate recorded by undigested seeds could be an indication of dormancy thereby confirming our earlier assumption on the dormancy status of the seed.

Table 1. Germination percentage of *Terminalia mantaly* seeds subjected to termite's scarification

Treatments	GP (%)
Termites' scarification for 5 days	71.25±19.74[a]
Termites' scarification for 7 days	82.5±14.43[a]
Termites' scarification for 9 days	43.75±17.5[b]
Termites' scarification for 12 days	15±4.08[c]

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Means carrying the same alphabet did not differ significantly p≤ 0.05 (values presented are Mean± Standard deviation)

Germination speed

The duration of termite digestion of *Terminalia mantaly* seeds significantly affected the germination speed of *Terminalia mantaly*. *Terminalia mantaly* seeds digested for 5 days germinated faster and differed significantly from all the other treatments (Table 2). This implies that digestion of *Terminalia mantaly* seeds by termites for 5 days would lead to faster germination. *Terminalia mantaly* seeds digested for 7 days had a germination speed of 3.58±0.16 and did not differ significantly with seeds digested for 9 days which recorded a germination speed of 3.44±0.06 (Table 2). Germination speed is used in combination with germination percentage to assess seedling vigour after treatments (Wakawa and Akinyele, 2017) and give us an indication of how well the seeds will perform under field conditions (Schmidt, 2000). Therefore, seeds of Terminalia mantaly digested by termites' for 5 days which had the highest germination speed would be expected to be of high vigour and do well when transplanted to the field.

Table 2. Germination speed of *Terminalia mantaly* seeds subjected to termite's scarification

Treatments	GS
Termites' scarification for 5 days	7.15±0.09[a]
Termites' scarification for 7 days	3.58±0.16[b]
Termites' scarification for 9 days	3.44±0.06[b]
Termites' scarification for 12 days	1.44±0.02[c]
No scarification (Control)	0.51±0.05[d]

Note: GS = Germination speed
Means carrying the same alphabet did not differ significantly p≤ 0.05 (values presented are Mean± Standard deviation)

CONCLUSION AND RECOMMENDATION

Termite digestion successfully breaks the seed coat dormancy of *Terminalia mantaly* in this study. Termite digestion for 7 days gave the optimum germination percentage (82.5±14.43), while Termite digestion for 5 days resulted in the fastest germination rate (7.15±0.09). Termite digestion of *Terminalia mantaly* seeds for 5 or 7 days is recommended. Scientists should consider exploring the same method in breaking the seed coat dormancy of other species of trees. However, constant monitoring is required when using termites to break seat coat dormancy. This is because prolonged exposure can damage the endosperm, hence, affect germination as evidenced from this study.

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