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Exploring the Potentials of Some Pre-Treatments on Seed Germination of *Monodora myrstica*

[1]Chinwe I. Sanni
[2]Joshua Kayode*
[3]Benson O. Ademiluyi

Author's Affiliation:
[1,2,3]Department of Plant Science and Biotechnology, Ekiti State University, Ado-Ekiti, Nigeria

***Corresponding Author:**
Joshua Kayode,
Department of Plant Science and Biotechnology, Ekiti State University, Ado-Ekiti, Nigeria

E-mail:
joshua.kayode@eksu.edu.ng

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ABSTRACT

Investigation on seed dormancy and germination of *Monodora myrstica* was carried out. Five pre-treatment methods which included the use of chemical, mechanical scarification, vernalization, wet heat and coconut water were examined. The treated and untreated seeds were sown in Petri-dishes and were moistened with distil water. The untreated seeds served as the control. The percentage seed germination (GP) and coefficient of velocity (CoV) of the germinating seedlings from the treated seeds were compared to those of the control. All the pre-treatments used in this study resulted in better GP and CoV. This tends to suggest that *M. myristica* exhibits seed dormancy that the treatments must have broken. Germinations in seeds pre-treated with sulphuric acid were directly proportional to the concentrations of the acid. In the mechanical scarified seeds, treatment with sandpaper had the highest germination. The vernalization pre-treatments revealed that the longer the duration of treatment of the seeds the better their germination. Also in the wet heat pre-treatments, seeds immersed for longer time resulted in better germination. Similarly, germinations in the coconut water pre-treated seeds were directly proportional to the duration of treatments. In all the pre-treatments used in this study, seeds treated with 80% concentration of H_2SO_4 had the highest GP and CoV values. In conclusion, pre-treatment of seeds of *M. myristica* will be advantageous in the efforts to domesticate the species. The use of wet heat method provides a promising method of pre-treating the seeds of this species in the study area.

KEYWORDS: Coefficient of velocity; Germination percentage; *Monodora myrstica;* Pre-treatment

INTRODUCTION

Seed germination has been described as an important physiological process in plants as it enables the transition from metabolically quiescent to an active and growing entity (Donohue *et. al.* 2010), thus it plays critical roles in seedling establishment and environmental adaptation. The seeds are thus the basic means of linkage between parents and progeny (Gupta and Bandopadhyay 2013).

Germination in seed requires viable seeds and appropriate environmental condition. In some cases, even when the above conditions are met, seeds still fail to germinate. Such seeds are said to exhibit dormancy. Aghilian *et al.* (2014) asserted that seed dormancy is a situation whereby a viable seed does not have the capacity to germinate in a specific condition of time under normal physical environmental factors that otherwise is favourable to its germination. Seeds germination failure is attributed to the presence of either exogenous or endogenous factors. While the exogenous seed dormancy that occurs outside the seed embryo could be attributed to physiological factors (Yang *et. al.* 2008), the endogenous seed dormancy that occurs inside the seed embryo could be attributed to

either the presence of the hard seed testa (morphological seed dormancy) or germination inhibitors in the capsule or endosperm (Hilhort 1995).

Recent initiatives have now revealed that seed pre-sowing treatments could improve germination and early seedling growth in plants (Bakht *et. al.* 2011). Various seed pre-treatments have been developed that speed up germination. Hence seed coat treatment have been used to raise the percentage germination in plants that exhibits dormancy and even used to shorten the period required to reach optimum percentage germination in such plants (Wilian 1985). This has led to great improvement in rapid and uniform field emergences which are essential prerequisites to increase yield, improve quality and ultimately improve profit derivable from crops (EL-Refaey *et al.* 2005).

Farahoni *et al* (2011) opined that seed dormancy is more common in wild plants than crop plants. An important wild plant in Akoko division of Ondo State, Nigeria is *Monodora myrstica.* Sanni, *et al.* (2019) asserted that this species is highly valued in the region for its nutritional and medicinal values. Yet Kayode *et al.* (2019) asserted that a gross dearth on investment on this species abounds in the region. Thus the need for the domestication of the species in the study area cannot be over-emphasised. The study being reported here therefore aims to explore the potentials of some pre-treatments on seed germination of *Monodora myrstica.*

MATERIALS AND METHODS

Seed Source

The fruits of *Monodora myristica* were collected from the parent plant from its natural habitat in Akungba- Akoko in Akoko South West Area of Ondo State. The seeds were extracted from the pods and were air-dried under room conditions.

Viability Test

Viability test was carried out on the dried seeds at the laboratory of the Department of Plant Science and Biotechnology, Ekiti State University, Ado-Ekiti, Nigeria, using Tetrazolium Chloride according to ISTA (2004).

Seeds Pre-treatments

The seeds were subjected to the following pre-sowing treatments before germination experiment.

Chemical treatment

90 dried seeds of *Monodora myristica* were selected and divided into three groups, each made up of 30 seeds. One group each was soaked in 20% (Treatment A), 40% (Treatment B) and 80% (Treatment C) sulphuric acid for 1 minute. The seeds were removed and thoroughly rinsed with distilled water after which they were air-dried and used for the experiment.

Mechanical Scarification

90 dried seeds of *Monodora myristica* were selected and divided into three groups, each made up of 30 seeds. One group each was scarified with stone (Treatment D), file (Treatment E) sand paper (Treatment F). These treated seeds were used for the experiment.

Cold treatment (Vernalization)

90 dried seeds of *Monodora myristica* were selected and divided into three groups, each made up of 30 seeds. One group each was chilled inside refrigerator (at $4^{o}C$) and left for 12 (Treatment G), 18 (Treatment H) and 24 hours (Treatment I). These treated seeds were used for the experiment.

Hot water (wet heat)

90 dried seeds of *Monodora myristica* were selected and divided into three groups, each made up of 30 seeds. One group each was placed in socks and immersed in 100mls hot water (at $100^{0}C$) for 5 seconds (Treatment J), 10 seconds (Treatment K) and 15 seconds (Treatment L). The seeds were removed and immersed in cold distilled water and air dried before they were used for the experiments.

Coconut water
90 dried seeds of *Monodora myristica* were selected and divided into three groups, each made up of 30 seeds. One group each was soaked in 100ml coconut water for 30 (Treatment M), 40 (Treatment N) and 50mins (Treatment O). They were later removed and air dried before they were used for the experiment.

Control
Ten untreated seeds of *Monodora myristica* were planted in Petri dishes. This was replicated three times.

Germination Assay
Each petri dish was lined with cotton wool and moistened with 6ml distilled water after which the seeds described above were planted in the dishes (Arowosegbe and Afolayan 2013). Ten (10) seeds were placed in a petri dish. Each treatment was replicated three times.

All the petri dishes were placed on the germination table in the laboratory at room temperature. Germination parameters was determined daily (according to Ajayi and Fakorede 2000) until no further germination occurs.

The percentage germination was determined using the relation;

$$\text{Germination percentage (GP)} = \frac{\text{number of germinated seeds x 100}}{\text{Total number of seeds planted}}$$

Also, Coefficient of velocity was determined according to Kayode (2000) as:

$$\text{CoV} = \frac{A_1 + A_2 + A_3 + \text{---} A_n}{A_1T_1 + A_2T_2 + A_3T_3 + \text{---} A_nT_n}$$

Where;
A is the number of seedlings that germinate on a particular day and T is the number of days involved.

RESULTS

The results of the five different pre-treatments used in this study are presented in Table 1. All the pre-treatments used in this study resulted in better germination % and coefficient of velocity (CoV). While the GP and CoV in the control were 30% and 21 respectively in the control, they were 80% and 62 respectively, 67% and 51 respectively, 47% and 26 respectively in Treatments A, B and C respectively. This tends to suggest that this species, *M. myristica,* exhibits seed dormancy that the treatments must have broken. Also in the pre-treatment with sulphuric acid, GP and CoV tend to be directly related to the concentration of the acid. The higher the concentration of the acid, the higher are the GP and CoV values obtained.

In the mechanical scarified seeds, the GP and CoV values in the treated seeds were higher than that of the control. Treatment F (treatment with sandpaper) have the highest GP and CoV values of 60% and 50 respectively, Treatment E have 40% and 38 values respectively while the least was recorded in Treatment D with GP and CoV values of 33% and 34 respectively. Results obtained from vernalization pre-treatments also possessed higher GP and CoV values than the control. In this pre-treatment, Treatment I had highest GP and CoV values of 47% and 36 respectively. Treatment H had 40% and 29 GP and CoV values respectively while Treatment G had 40% and 27 GP and CoV values respectively. The results revealed that the longer the duration of the seeds in the refrigerator the better the germination.

Results obtained from the wet heat pre-treatments revealed that while the GP and CoV values obtained in Treatments K and L were better than that of the control; the values obtained in Treatment J (i.e. immersion for 5 seconds) were poorer than those obtained in the control experiment. GP and

CoV values of 30% and 21 respectively were obtained in the control while GP and CoV values of 27% and 18 respectively were obtained in Treatment J. The GP and CoV values of treated seeds in this pre-treatment were directly proportional to the length of time of immersion in the hot water.

The results from pre-treatment with coconut water are similar to those of wet heat treatments. The GP and CoV values of seeds soaked for short time of 30 minutes (Treatment M) were poorer than that of the control. Also, the GP and CoV values of seeds soaked in coconut water were directly proportional to the duration of soaking in the coconut water. Seeds soaked in coconut water for 50 minutes (Treatment O) have GP and CoV values of 47% and 34 respectively while seeds soaked for 40 minutes have values of 37% and 26 respectively.

Table 1: Effects of various pre-treatment on germination percentage and coefficient of velocity of treated seeds of

Pre-Treatment	Treatments	Germination Percentage (GP) %	Coefficient of velocity (CoV)
Chemical Scarification	A	80	62
	B	67	51
	C	47	26
Mechanical Scarification	D	33	34
	E	40	38
	F	60	50
Vernalization (cold treatment)	G	40	27
	H	40	29
	I	47	36
Hot water (wet heat)	J	27	18
	K	33	22
	L	43	31
Coconut Water	M	27	17
	N	37	26
	O	47	34
Control		30	21

DISCUSSION

All the pre-treatments used in this study resulted in higher and better GP and CoV than those obtained from the control experiments. The performances of all the pre-treatment methods used revealed that seeds treated with sulphuric acid gave better GP and CoV than the others. Previous studies by Meyer and Potjakoft-Mayber (1989) and Dachung and Verinumbe (2006) revealed that acid treatment of the seed removes the waxy layer of the seed coat by chemical decomposition of the seed coat components. Nadjafi *et al*., (2006) asserted that scarification of seed coat with acid, such as H_2SO_4, eliminates exogenous dormancy. However, a prolonged acid scarification must be avoided as such may damage the embryo of the seeds due to the corrosive effect of acid (Likoswe *et al.* 2008).

The mechanical scarification with sand paper gave second best method of breaking dormancy in this species in this study. Abrasion removes parts of the seed coat making the seed coat to become permeable to water and air. This conformed to the previous studies of Meyer and Poljakoff- Mayber (1989) and Bewley and Black (1997). The vernalization method also resulted in better GP and CoV, though at longer duration. The method is now being used to alleviate endogenous dormancy (Parks and Boyle 2002). This tends to suggest that *M. myristica* is mostly associated with exogenous dormancy. Also in the wet heat treatment, maximum germination was attained when the seeds were treated for longer duration. This is in agreement with the previous assertion of Mackay *et al* (2001) on dormancy in Oil Palm seeds. The effectiveness of coconut water in pre-treatment of this species could be attributed to the fact that it contains a variety of nutrients, including cytokinins, that enhanced growth and development of plants. Studies by Overbeak *et al.,* (Overbeck *et. al.* 1992) and Shakeel

(2010)] have documented the effectiveness of coconut water in the germination of Centrosema and *Cyamopsis tetragonolobust* seeds respectively.

In conclusion, the pre-treatment of seeds of *M. myristica* will be advantageous in the efforts to domesticate the species as more seedlings of the species would be available for cultivation. However the use of acid might be costly, inaccessible and might require expertise. Thus the method might be difficult to apply by the resource-poor and illiterate farmers. Similarly, mechanical scarification by sandpaper might be impracticable especially when large number of seeds is to be worked upon. Difficulties might also be experienced in getting adequate volume of coconut water to be used in pre-treating large number of seeds. The vernalization method may also be a mirage in environment devoid of regular supply of electricity. Thus, the use of wet heat method provides a promising method of pre-treating the seeds of this species in the study area. Proper enlightenment on this is recommended for farmers and other stakeholders in the study area.

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