

Ministry of Environmental
Conservation and Forestry
Forest Department
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**The Effect of Different Pretreatments on the
Germination of *Aleurites montana* (Lour.) Wils. and
Aleurites moluccana (L.) Willd.**

By

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တန်းဆီ *Aleurites montana* (Lour.) Wils. နှင့် *Aleurites moluccana* (L.) Willd. တို့၏
အညှောက်ပေါက်ခြင်းအား ပြုပြင်မှုပေးနည်းအမျိုးမျိုးဖြင့် စမ်းသပ်လေ့လာခြင်း

သိန်းကြည်၊ သုတေသနအရာရှိ
တင်တင်မူ၊ သုတေသနလက်ထောက်(၂)
သစ်တောသုတေသနဌာန

စာတမ်းအကျဉ်း

သစ်စေ့များအား ပြုပြင်မှုပေးရခြင်းမှာ သစ်စေ့မှ အညှောက်ပေါက်သေချာစေရန်နှင့် အညှောက်ပေါက်ရာတွင် လျင်မြန်ညီညာစေရန် ဖြစ်ပါသည်။ တန်းဆီမျိုးစိတ်များသည် အညှောက်ပေါက်ရာတွင် စတင်ပေါက်ရန်အချိန်ကြာပြီး ပေါက်နှုန်းနည်းပါး၍ မှန်မှန်ပေါက်လေ့မရှိပါ။ သို့ဖြစ်ပါ၍ ပြုပြင်မှုပေးနည်း (၄)မျိုး (၂၀% ဟိုက်ဒြိုဂျင်ပါအောက်ဆိုဒ် (H_2O_2) တွင် ၁ နာရီစိမ်ခြင်း၊ နေလှန်း ၂ ရက်နှင့် ရေစိမ် ၁ ရက်ပြုလုပ်ခြင်း၊ အစေ့ခွံအားကွဲအက်စေပြီး ရေတစ်ညစိမ်ခြင်းနှင့် အပူချိန် ၈၀ ဒီဂရီစင်တီဂရိတ် ရှိ ရေတွင် ၁ မိနစ်စိမ်ခြင်း)အားဖြင့် တန်းဆီမျိုးစိတ် (၂)မျိုး၏အစေ့များအား အညှောက်ပေါက်စေပြီး အညှောက်ပေါက်မှုများအား သုံးသပ်ဖော်ထုတ်ခဲ့ပါသည်။

တန်းဆီမျိုးစိတ် *Aleurites moluccana* (L.) Willd. တွင် အစေ့ခွံကွဲအက်စေပြီး ရေတစ်ညစိမ်သည့် ပြုပြင်မှုပေးနည်းသာလျှင် အကောင်းဆုံးဖြစ်ပြီး အညှောက်ပေါက်နှုန်းမှာ ၆၇% ဖြစ်ပါသည်။ တန်းဆီမျိုးစိတ် *Aleurites montana* (Lour.) Wils. မှာ အစေ့ခွံအက်ကွဲစေပြီး ရေတစ်ညစိမ်သည့် ပြုပြင်မှုပေးနည်းတွင် ၉၈%၊ နေ(၂)ရက်လှန်းနှင့် ရေ(၁)ရက်စိမ်တွင် ၉၂%၊ အပူချိန် ၈၀ ဒီဂရီစင်တီဂရိတ်ရှိရေတွင် ၁ မိနစ်စိမ်ခြင်းတွင် ၈၃%နှင့် ၂၀%ဟိုက်ဒြိုဂျင်ပါအောက်ဆိုဒ်(H_2O_2) တွင်(၁)နာရီစိမ်ခြင်းသည် ၇၅% ဖြစ်ပြီး၊ ပြုပြင်မှု ပေးခြင်းမရှိခြင်း (no pretreatment) သည်ပင်လျှင် အညှောက်ပေါက်ရာခိုင်နှုန်း ၆၄% ဖြစ်ကြောင်း တွေ့ရှိရပါသည်။

The Effect of Different Pretreatments on the Germination of *Aleurites montana* (Lour.)
Wils. and *Aleurites moluccana* (L.) Willd.

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Abstract

The purpose of pretreatment is to ensure both that seeds will germinate, and that germination is fast and uniform. Pretreatment methods have been developed and described for many species. However dormancy still causes problems of low germination rates for several species. Seed germination of *Aleurites* spp. is slow, erratic and low. In this paper 4 different methods of pretreatment (ie. Soaking in 20% Hydrogen peroxide (H₂O₂) for 1 hour, Drying in the sun for two days & soaking in water for one day, Cracking hard seedcoat & soaking in water overnight, and soaking in 80°C water for one minute), were given and germinations were assessed.

A. moluccana gave the best germination (67%) when pretreated only with cracking hard seedcoat & soaking in water overnight. *A. montana* was found to improve in germination when pretreated with cracking hard seedcoat & soaking in water overnight (98%), drying in the sun for two days & soaking in water for one day (92%), soaking in 80°C water for one minute (83%), and soaking in 20% Hydrogen peroxide (H₂O₂) for 1 hour (75%) respectively. Even control (no pretreatment) also gave satisfactory germination percent(64%).

Key words: *Aleurites montana*, *Aleurites moluccana*, pretreatment, germination, dormancy

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1. Introduction

The genus **Aleurites**, belongs to the family **EUPHORBIACEAE**, is a small genus of five or six species. Trees of this genus are distributed in the tropical and sub-tropical regions of eastern Asia, Malaysia, the Pacific, and south America. They are deciduous or evergreen, small, medium or large-sized trees, 7-25 m in height with spreading crown and handsome flowers.

The tree species are cultivated for their seeds which yield valuable quick drying oil called Tung oil or Chinese Wood oil. This Tung oil is utilized in the manufacture of lacquers, varnishes, paints, linoleum, oilcloth, resins and artificial leathers. And also products of Tung oil are used to coat containers for food, beverages, and medicines. So Tung oil, sometime called Chinese Wood oil is obtained from the seeds of some of *Aleurites* spp. as they are called tung trees or tung oil trees. Because of their usefulness and beauty, tung trees are grown in homegardens throughout the Pacific and elsewhere in the tropics.

There are five different *Aleurites* spp.: *Aleurites fordii* Hemsl, *A. montana* (Lour.) Wils., *A. cordata* (Thunb.) R.Br., *A. moluccana* (L.) Willd. and *A. trisperma*. Three species, *A. fordii*, *A. montana* and *A. moluccana* naturally occurred and planted in Myanmar. *A. fordii* and *A. montana* were especially occurred in Northern Shan State while *A. moluccana* only in Southern Shan State.

The pilot tung tree plantations in Myanmar were first established in 1923 by the Forest Department of Northern Shan State. Nowadays the total areas of tung tree plantations in Myanmar especially in Northern Shan State is approximately 12,250 acres (4961.25 ha) during the year of 2000-2001.

Aleurites spp. can be propagated from seeds or vegetatively. Seeds can be direct-seeded in containers or pregerminated in seed beds. When seeds are pregerminated in a bed, it is best to transplant the seeds just as they begin to germinate when the seed cracks open. Pregerminated seeds can either be planted in nursery containers or direct-sown in the field.

Seeds of *Aleurites* spp. tolerate desiccation to at least 3% moisture content (Merrill, 1947; Webster, 1948) They can be store dry at low temperatures. (Sharpe & Merrill, 1942; Large et al., 1947). Thus despite reports that they are short-lived and many growers prefer to store the seeds moist in cool conditions. (Large et al., 1947). Seeds of *Aleurites* spp. show orthodox, not recalcitrant in seed storage behaviour. Germination of seed is slow, erratic and low. Therefore this one is problematic for growers. (Eakle & Garcia, 1977; Li, 1943; Merrill et al., 1941; Sharpe & Merrill, 1942; Shear & Crane, 1943). The seed coat is reported to be the cause of delayed germination. (Eakle & Garcia, 1977; Shear & Crane, 1943; Webster, 1948). So they show seed coat dormancy.

The period required for germination can be considerable. For example, there may be a 60 day delay before the first seeds to germinate begin to emerge through the soil surface for *A. fordii*, and a 75 day delay for *A. moluccana*. (Merrill et al., 1941; Eakle & Garcia, 1977).

The seed of *A. moluccana* can take up to 3-4 months to germinate. (WWW.traditionaltree.org). For *A. montana* seeds may take from 2 to 3 months to germinate. (Internet : file:///F:/Aleurites % 20 montana.htm)

Seeds of over 50% of the forest tree species exhibit dormancy to a varying degree. The nature of seed dormancy also varies greatly among species. The dormancy can be broken by various treatments. Germination process stimulates the uptake of oxygen in dormant seeds.

The term " dormancy " refers to a condition in a viable seed which prevents it from germinating when supplied with the factors normally considered adequate for germination – suitable temperature, moisture and gaseous environment. A viable seed is defined as one which can germinate under favorable conditions, providing any dormancy that may be present is removed (Roberts, 1972).

Seeds of many tree species germinate readily when subjected to favorable conditions of moisture and temperature. As mentioned above, many other species possess some degree of seed dormancy. Where dormancy is strong, some form of seed pretreatment is essential in artificial regeneration in order to obtain a reasonably high germination rate in a short time.

Where dormancy is slight, the effect of pretreatment may be marginal. Pretreatment to terminate dormancy and speed up germination is thus one important type of pretreatment.

So it is need to investigate the degree of seedcoat dormancy of Aleurites species. In this paper, it was described the different pretreatment methods of only two species, *A. montana* and *A. moluccana*.

2. Objectives

- to investigate the correct pretreatment method for *A. montana* and *A. moluccana*.
- to determine the effects of seedcoat dormancy on germination.
- to study the germination percent and to be germinate within short period.

3. Materials and Methods

3.1 Seed collection and processing

The fresh and mature fruits of *A. moluccana* and *A. montana* were collected on the ground on 18 September and 4 October 2007, respectively, from Heho along the Taungyi-Heho road side, Southern Shan State and Plantation (2001), Natma Compartment (19), Thipaw Township of the Northern Shan State.

Fruits of both species were transported in about 3 days to the Seed Laboratory by express post (*A. moluccana* arrived at the laboratory on 21st September, an *A. montana* on 7 October). The fruits were spread on the bamboo

sieves under the shade for two days. After that the seeds of both species were extracted from the fruits and washed with water thoroughly to be clean any pulp on the seeds.

3.2 Pretreatments

Different pretreatment methods were carried out for seeds of *A. moluccana* and *A. montana* as follows:

Pretreatment 1 - Control (no pretreatment)

Pretreatment 2 - Soaking the seeds in 20% Hydrogen peroxide (H₂O₂) for 1 hour (20% H₂O₂ = mixture of 1000 cc of distilled water and 200 cc of H₂O₂)

Pretreatment 3 – Drying the seeds in the sun for two days and soaking in water for one day

Pretreatment 4 – Cracking the seed coat (shell) and soaking in water overnight

Pretreatment 5 – Soaking in water at 80° C for one minute; seed volume: water volume=1:10

Randomly selected 100 seeds each were used in this study. Four replicates of 25 pretreated seeds each were sown in the germination beds containing pure sand under the nursery shed. Lines 4 cm deep and 6 cm apart were drawn on the sand in the germination bed. The pretreated seeds were then sown in these lines 1 cm apart, and covered with 1 cm of sand. These were watered twice a day. The testing period did not exceed 60 days. Germinated seeds as completely developed seedlings were counted and recorded daily.

Germination was expressed both as germination percent and germination value. Method of calculation of “germination value” which expresses both the speed and totality of germination was developed by Czabator (1962). According to this method, germination value (GV) is expressed as

$$GV = PV \times MDG$$

Where PV = Peak value and

MDG = mean daily germination

Peak value which is the measure of the vigor of the seed is expressed in terms of highest germination percent in relation to elapse of time from the start of the test. This is determined by successively dividing the cumulative germination percent by the number of days until a quotient giving the highest value (ie PV) is obtained.

Mean daily germination is the average number of seeds germinated per day of the actual test period to the date of last measurement. It is calculated by dividing the total germination percent on the closing day by the total number of days.

4. Results

During the test unpretreated (Control) seed started germination within 30-32 days for *A. moluccana* and 18-20 days for *A. montana* after sowing. It was also found that the first germination of all pretreated seed generally takes place within 18-22 days for *A. moluccana*, 12-16 days for *A. montana* and continued for the next 30-35 days.

The effect of pretreatments on seeds of the *A. moluccana* and *A. montana* tested was as given in the following Table , Figure 1 and 2.

Table Effect of Seed Pretreatment on the Germination of Seeds of the two species tested

Sr. No.	Species	T1 control		T2		T3		T4		T5	
		Ger. %	GV	Ger. %	GV	Ger. %	GV	Ger. %	GV	Ger. %	GV
1	<i>A. moluccana</i>	16	0.07	17	0.10	18	0.10	67	2.27	60	1.94
2	<i>A. montana</i>	64	2.81	75	3.29	92	4.21	98	6.03	83	3.34

T 1 - Control (no pretreatment)

T 2 - Soaking the seeds in 20% Hydrogen peroxide (H₂O₂) for 1 hour

(20% H₂O₂ = mixture of 1000 cc of distilled water and 200 cc of H₂O₂)

T3 – Drying the seeds in the sun for two days and soaking in water for one day

T 4 – Cracking the seedcoat (shell) and soaking in water overnight

T 5 – Soaking in water at 80° C for one minute; seed volume : water volume=1:10

A. moluccana : - This table shows clearly that seeds of *A. moluccana* can not be germinated easily without pretreatments. Without pretreatment only 16% germination resulted indicating that pretreatment is essential for moluccana seeds. Out of the four pretreatments applied Pretreatment 4 was the best (67%),and was followed by T5,T 3,T2 and control. The germination percent increased from 16% (without pretreatment) to 60% and 67% (with pretreatment) respectively. Similarly GV also increased from 0.07 (without pretreatment) to 1.94 and 2.27 (with pretreatment) respectively. Pretreatment 2 and 3 were slightly better 1% and 2% than control.



Germination of *A. moluccana* seed

A. montana : - As mentioned in Table seeds of *A. montana* germinated relatively easily using a number of pretreatments. Out of the four pretreatments applied Pretreatment 4 was the best and was followed by Pretreatment 3, 5, 2 and 1 (Control). The germination percent also increased from 64% (without pretreatment) to 75%, 83%, 92% and 98% (with pretreatment) respectively. GV also increased from the normal 2.81 to 3.29, 3.34, 4.21 and 6.03(with pretreatment) respectively.



Germination of *A. montana* seed

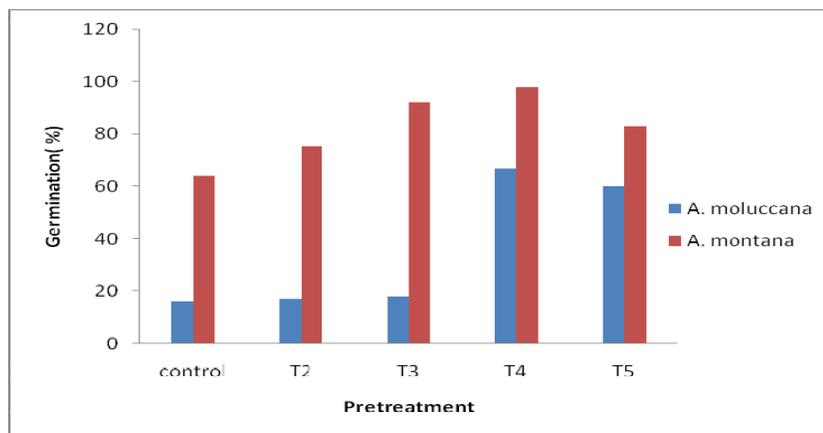


Fig1. Effect of seed pretreatments on the germination percent of two species

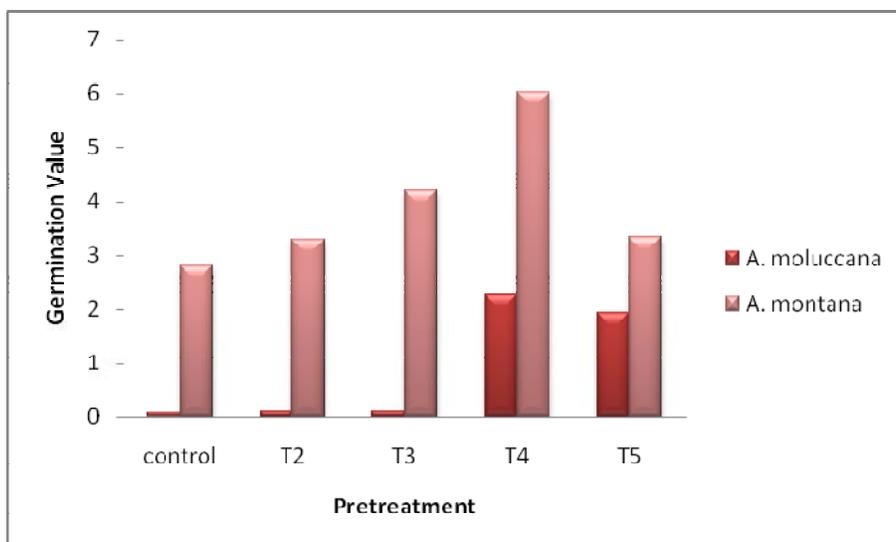


Fig 2. Effect of seed pretreatments on the germination value of two species

5. Discussion

With the increase in the plantation programme and consequently the need to know more about seed, it is hoped that this paper could be of some use to the Forest Department.

According to Willan (1985), germination consists of three overlapping processes: - (i) Absorption of water mainly by imbibitions, causing a swelling of the seed and eventual splitting of the seedcoat (ii) Enzymatic activity and increased respiration and assimilation rates and (iii) Cell enlargement and divisions resulting in emergence of radical and plumule.

All the pretreatment methods applied in this experiment facilitated better absorption of water by imbibitions. The species of *A. montana* tested responded very well to the methods applied except the species of *A. moluccana*. If comparison with seedcoats of two species, seeds of *A. moluccana* are very hard-shelled and more thicker and harder than that of *A. montana*.

6. Conclusion

Results of this study suggest that seeds of *A. moluccana* and *A. montana* exhibit physical dormancy (seedcoat dormancy). This kind of dormancy was very strong in *A. moluccana* and slight in *A. montana*. Unpretreatment (Control) seed of *A. moluccana* took 30-32 days and *A. montana* took 18-20 days to germinate.

Before sowing, seeds of two species should be cracked and soaked in water overnight. For *A. montana*, pretreatment 3 also gave satisfactory result ie. 92%.

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