

GERMINATION PERFORMANCE OF MOLAVE (*Vitex parviflora*) SEEDS UNDER FOUR PRE-GERMINATION TREATMENTS

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Molave (*Vitex parviflora*) is one of the high premium species which been considered excellent material for house floor, railroad ties, carpenter plane, house parts, picture frames, native agricultural equipment, wood joints, house doors, wood jalousies, high grade furniture, window frames boats, interior finish, window sills, beams, footing of posts, siding, joists, rafters, stairs, risers, ship-building (cutwater, steam posts, keels, ribs, crotches, rudders, futtocks), wagon making (axles, wheels, rim yokes); bridges, docks, saltwater piles, pillars, plows, rice mortars, sugar mills, paving blocks, hemp pressers, sculpture and carving, wooden tools, plane stocks, toys, novelties, pinion, planks, firewood, pestles, slippers, wedges, undersills, wharfs, sheating and wooden type and wood cut engraving, wooden tool parts, and for high grade construction where both strength and durability are required. The wood and bark of molave have also curative effects on wounds and poisonous bites.

The nationwide forest inventory reveals that the valuable premium hardwood species (one of which is molave) are fast diminishing. Molave, like other hardwood species, is fast disappearing due to the rampant cutting by local wood sellers.

Since the molave is very useful and conventionally important, management schemes, reproduction methods and protection should be given due concern. Due to the fast rate of forest destruction in our country, efforts should be pooled to arrive at sound management and silvicultural practices that would, in the long run, regenerate and perpetuate the molave tree.

It has been a common observation that molave trees do not have regenerations. Consequently, natural regeneration as a natural means for perpetuating the genetic resources of molave may not be possible unless something is done about its reproduction.

Therefore, a knowledge of the methods and techniques of germinating molave seeds is the basic first step in the successful reproduction and multiplication of this species.

It is a fact that due to the high demand for molave wood in the Philippines, molave timber is decreasing at a very fast rate every year, hence, there is a great danger that in the near future, the country will run out of precious molave wood supply. Besides, molave is a slow grower. It is unable to regenerate naturally and it has a short viability period.

Objectivity of the Study

The objectives of the study are :

1. To find out what seed treatment would give the highest germination percentage; and
2. To find out whether the differences in germination percentage as affected by the different treatments are statistically significant.

Seed Dormancy

Seed dormancy has been defined as the condition of a seed when it fails to germinate (Salisbury and Ross, 1969). Seed dormancy was categorized by Hartmann and Kester (1975) as follows :

1. Seeds where regulation occurs in the non-living external seed covering but the embryo itself is quiescent.
 - a. Hard seed covering impermeable to moisture (seed coat dormancy)
 - b. Hard seed covering resistant to embryo expansion
 - c. Seed covering contains chemical inhibitors
2. Seeds with morphologically underdeveloped (rudimentary) embryo
3. Seeds with interval (endogenous) dormancy
 - a. Physiologically shallow dormancy
 - b. Physiologically intermediate dormancy
 - c. Physiologically deep dormancy
 - d. Combined or double dormancy

It was discovered that dormancy is imposed by the presence of a seed coat; if this is removed, the seed germinates (Bidwell, 1979). Seed coats can also cause dormancy depriving the seed of water and gasses. Mechanically restricting the growth of the embryo can also cause dormancy (Devlin, 1975). Hard seed coats may affect other physiological properties of the seed besides its permeability of water. They may have a purely mechanical strait jacket effect upon the swelling and developing of the seed or embryo (Borner and Gatson, 1952).

The germination of hard-coated leguminous seeds under desert conditons may sometimes be accomplished by scarification caused by the mechanical abrasion of the seed against the sand. Thus, it has been noted that the seeds produced by such leguminous plants as the desert smoke-tree (*Dalea spinosa*) which grows in the ordinary dry washes of the Southern California desert do not germinate until they are carried away for some distance by an occasional torrential rain. In the course of this travel, the seeds are abraded against sand rock, and the normally impermeable seed coats are ruptured (Borner and Gatson, 1952).

The break in the dormancy of seeds depends on the balance between growth inhibitors and growth promoters. Among the numerous plant-produced inhibitors, some are localized in the fruit wall or seed coat and associated covering (Esau, 1977).

Promotion of Seed Germination

Gherardi and Valio (1976) found that the percentage of germination of naked papaya seeds soaked in gibberellic acid increased with gibberellic acid concentration from 10 to 100 ppm. Copeland (1976) also reported that hydrogen peroxide (H_2O_2) has a stimulating effect on the germination and subsequent seedling vigor in a number of species including conifers, legumes, tomatoes and barley. Similarly, KNO_3 and thiocerea (Toole, 1938) also promote germination.

Other laboratory procedures in promoting germination may include treatment with boiling water, burning with an electric

needle, clipping the seed apex with a sharp razor blade, piercing the embryo with a sharp needle, exposing the seeds to fluctuating temperatures and mechanical impaction (Copeland, 1976).

The seed germination of various local tree species has been established through (a) soaking either in plain tap water or water at 50°C for an extended period for kupang (*Parkia javanica* Merr.) by Clemente (1948); for ipil-ipil (*Leucaena leucocephala* Lam. de Witt.) by Racelis and Bagañoyos (1977); and Supa (*Sindora supa* Merr.) by Salvador (1951); ipil (*Intsia bijuga* Kuntze) by Azurin (1947) and Romero (1961); and (b) stratification for teak (*Tectona grandis* L.) by Fabia (1946) and Rosario (1959).

Materials used were :

- 525 molave seeds
- 15 size 8 clay pots
- sulfuric acid
- hard stone
- graduated cylinder (1 liter)
- fine sand
- shovel
- fine steel screen
- 2 boxes tooth pick
- garden hose
- distilled water (1 liter)
- scratch paper
- matches
- tap water

Place and Date of the Study

The study was conducted at the screen house of the University of the Philippines at Los Baños, College of Forestry in February 1980.

Experimental Design

A completely randomized design (CRD) with three replications was used. There were 35 seeds assigned to every treatment.

These 35 seeds were sown in one size-8 clay pot filled with sterilized sand with a pH adjusted to 5.9. Every treatment was replicated three times, which means that there were three clay pots for every treatment. Since there were five treatments including the control, 15 pots were used for the entire experiment. These pots were tagged properly according to treatment and replication, arranged side by side at random. There was a total of 525 seeds for the whole experiment.

Preparation of the Medium

Coarse sand gathered from Pampanga was screened using a fine steel screen mounted on a wooden frame in order to separate the fine sand particles which was used as growing medium. To remove its organic matter content, the sand was washed with tap water on a cemented container about 5 inches deep with an area of about 5 square meters. Holes at both ends of the container were made to facilitate drainage.

The sand was flooded with tap water using a garden hose connected to the faucet. Using the hands, the sand was shoveled and squeezed to hasten the separation of clay particles from the sand grains. After about 30 minutes, the water flooding the sand was drained and replaced with clear water from the faucet repeating the same procedure of separating clay particles from the sand 5 times until the sand was very clear. The sand pH was adjusted to 5.9 by soaking it in sulfuric acid (0.33 normal) for one night. The water mixed with the sulfuric acid flooding the sand was drained well.

Fifteen (15) size-8 clay pots were filled with this treated sand. The holes of the clay pots were plugged with cotton to prevent sand erosion. Each pot was marked with a plastic marker according to treatment and replicate.

Seed Collection

Molave seeds were collected from the College of Forestry

campus, University of the Philippines at Los Baños. The collection was done by picking up from the ground some recently fallen ripe molave fruit. With the hands, the seeds were extracted from the fruit by removing the pericarps and were subsequently washed with tap water. Then the seeds were air dried in the room.

Treatments

Molave seeds were treated with the following:

1. *Sulfuric acid treatment*

105 seeds were soaked in a 0.5% sulfuric acid for 5 minutes and then divided into 3 groups, each group representing 1 replicate.

2. *Hot water treatment*

Seeds were soaked in hot water (98-100°C) for 15 minutes, and then, divided into three groups, each group representing one replicate.

3. *Cracking*

105 seeds were slightly cracked by slightly pounding each seed with a stone, and then, these seeds were divided into 3 groups, each representing 1 replicate.

4. *Burning*

105 seeds were placed in an aluminum tray. Crumpled scratch paper was placed over these seeds and burned. The flame was kept burning for 5 minutes then water was poured over the flame to cool the seeds. These burned seeds were divided into 3 groups, each group representing 1 replicate.

5. *Control*

105 seeds with no treatment employed were divided into 3 groups, each group representing 1 replicate.

These treated seeds were sown into the pots filled with sterilized soil. Thirty-five (35) seeds, representing one replicate of each treatment were sown at a depth of 1 centimeter. The pots were placed under a plastic roofing in the screen house of the U.P. College of Forestry. Watering with tap water was done every day.

Data Collection

The number of seeds that germinated during the first day was recorded. Each germinated seed was marked with a toothpick punched into the soil beside it. This was done to determine the number of germinations per day. After nine days, it was observed that no more seeds were germinating, so the observation was ended. The number of germination per replicate for every treatment was computed and an analysis of variance for a completely randomized design was done to determine the significant differences among treatments. A comparison of treatment means was also determined using the Duncan's Multiple Range Test (Table 1).

Results

Table 1 shows the means of the number of seeds that germinated in each treatment, the percentage of germination per treatment, the comparison of treatment means and the analysis of variance.

Figure 1 shows the trend of germination of seeds as affected by the different treatments.

The data in Table 1 show that the control gave the highest germination (46%) followed by sulfuric acid (43%), hot water (13%), cracking (11%), and burning (5.8 %). The difference in germination capacity was significant at 1% level.

Table 1. Percent germination of molave seeds as affected by different pre-germination treatments and ANOVA.

Treatments	Replicates			Total	Means	(%)	Statistical significance
	1	2	3				
H ₂ SO ₄	13	20	13	46	15.33	43	a
Hot water	5	6	3	14	4.66	13	b
Cracking	2	7	3	12	4.00	11	b
Burning	1	2	3	6	2.00	5.8	b
Control	26	10	12	48	16.00	46	a

Note: Means with the same letters are not significantly different from each other as tested using the Duncan's Multiple Range Test for comparison of means

Analysis of variance (ANOVA) in Completely Randomized Design (CRD).

Source of Variation	d.f.	SS	MS	F
Treatment	4	540.27	135.060	6.581**
Error	10	205.33	20.523	
Total	14	745.60		

** Significant at 1% level

It was remarkable to note that among the different treatments used, the control had the highest germination percentage (46%). Although this germination capacity did not significantly differ from the germination percentage (43%) of the seeds treated with sulfuric acid (0.5%), the result suggests that the germination of molave seeds does not require any treatment besides plain water and sand. However, removing the fleshy covering of molave seeds is necessary since it was found out by Dr. Mercedes Garcia that their fleshy covering inhibits its germination. It was also found out by Dr. Garcia that removing the pericarp of a green molave

fruit was enough to enhance its germination. She also discovered that the germination capacity of a green molave fruit is the same as that of a ripe one.

The seeds treated with cracking, burning, and hot water showed an inferior germination capacity. These treatments were believed to have destroyed the embryo of the seeds. The impact of the stone used in cracking by pounding the molave seeds may have cracked and destroyed their embryo.

Burning may have destroyed the embryo of most seeds. Exposing the seeds to fire for 5 minutes must have totally cooked most seeds, thus, destroying some enzymes within the seeds. Hence, a very poor germination capacity was observed.

The hot water treatment for 5 minutes must have destroyed the embryo of most seeds, thus, a poor germination capacity was observed.

Conclusions and Recommendations

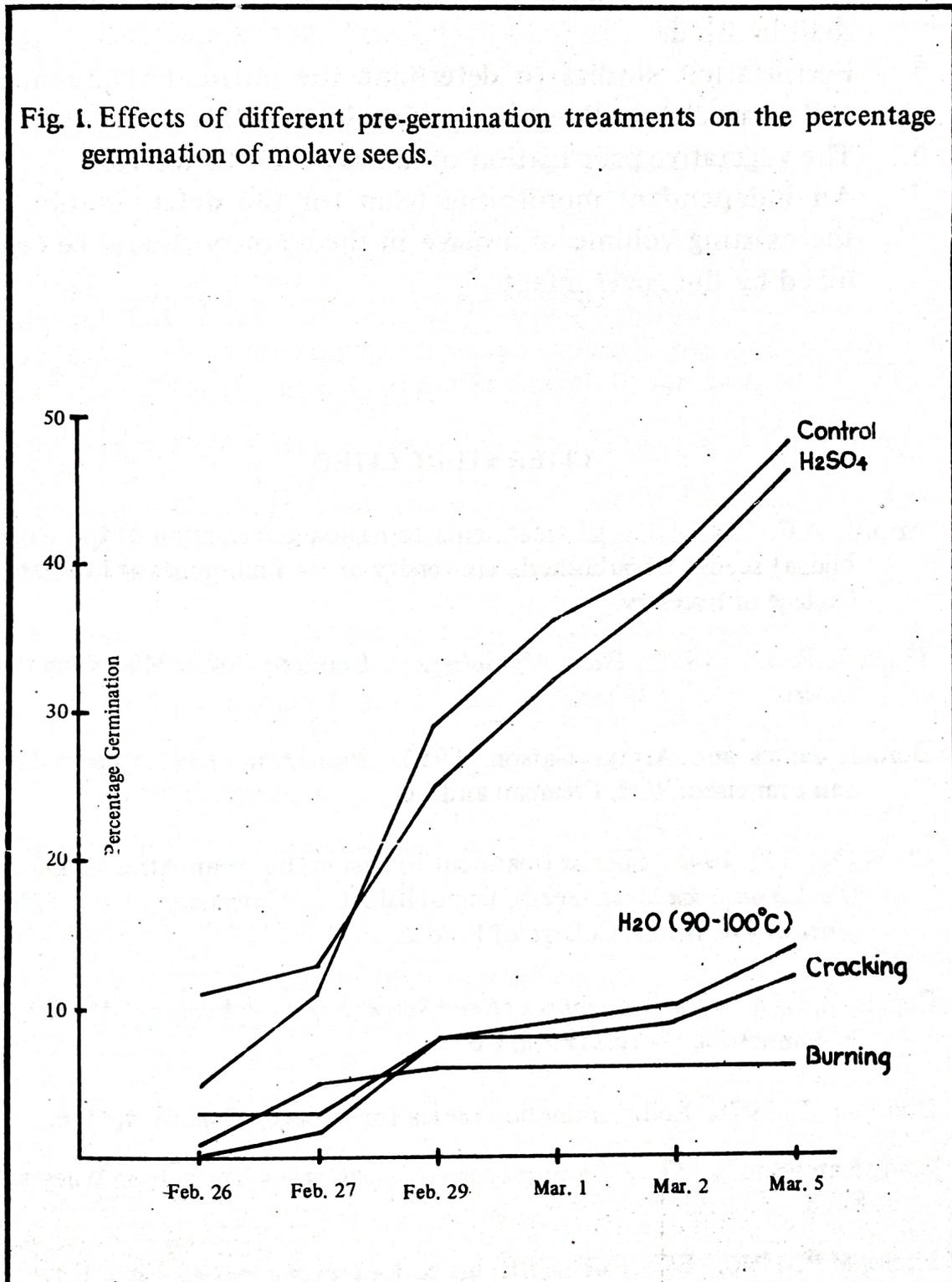
From the results of the study, the following conclusions were made :

1. Molave seeds do not need pre-germination treatment.
2. The removal of the fleshy coating of molave seeds is enough to hasten their germination.
3. Sulfuric acid at 0.5% concentration is just enough to break the dormancy of molave seeds though it may not be necessary to use sulfuric acid to hasten their germination.
4. The hot water treatment, cracking and burning definitely destroy molave seeds, thus, reducing their capacity to germinate.

It is recommended that :

1. Other pre-germination treatments that would possibly increase the germination to more than 46 percent shall be tested in both green and ripe molave fruit.
2. Studies on the storage of molave seeds shall be tried.

Fig. 1. Effects of different pre-germination treatments on the percentage germination of molave seeds.



3. Conservation measures to preserve the genetic resource of molave shall be adopted.
4. Enhancing natural regeneration in the natural stand by cleaning and cultivating the soil under the crown of molave trees shall be tried.
5. Fertilization studies to determine the nutrient requirement and to accelerate the growth of molave shall be tried.
6. The vegetative propagation of molave shall be tested.
7. An independent monitoring team for the determination of the existing volume of molave in the country should be organized by the government.

LITERATURE CITED

- Azurin, A.C. 1947. Special treatments to hasten germination of ipil (*Intsia bijuga*) seeds. Unpublished. University of the Philippines at Los Banos, College of Forestry.
- Bidwell, R.G.S. 1979. *Plant Physiology*. London: Collier Macmillan Publishers.
- Borner, James and Arthur Gatson. 1952. *Principles of Plant Physiology*. San Francisco: W.H. Freeman and Co.
- Clemente, G.M. 1948. Special treatment to hasten the germination of kupang (*Parkia javanica* Merr.) seeds. Unpublished. University of the Philippines at Los Banos, College of Forestry.
- Copeland, L.O. 1976. *Principles of Seed Science and Technology*. Minneapolis, Minnesota. Burgess Publ. Co.
- Domingo, L. 1978. Soil germination media for molave. *Canopy* 4(6): 6.
- Esau, Katherine. 1977. *Anatomy of Seed Plants*. New York. John Wiley and Sons.
- Fabia, M.P. 1946. Effect of stratifying teak (*Tectona grandis* Linn. F.) seeds with sawdust on germination. Unpublished. University of the Philippines at Los Banos, College of Forestry.

- Garcia, Mercedes Umali. 1980. "Effect of Pericarp Removal on the Germination of Molave (*Vitex parviflora*) Seeds." *Sylvatrop*. Forest Research Institute, Laguna.
- Gherardi, E. and I.F.M. Valio. 1976. Occurrence of promoting and inhibiting substances in the arils of *Carica papaya* L. *Journal of Horticultural Science*. 51:1-14.
- Hartman, Hudson T. and Dale E. Kester. 1975. *Plant Propagation Principles and Practices*. New Jersey. Prentice-Hall Inc.
- Kramer, Paul S. and Theofore Kozlowski. 1960. *Physiology of Trees*. New York, McGraw-Hill Book Co.
- Racelis, E.A. & A.P. Bagaloyos. 1977. Germination of *Leucaena leucocephala* seeds under varying temperature and length of soaking in water. *Sylvatrop*, Philippines. Forest Research Institute, Laguna.
- Reyes, L.S. 1938. *Philippine Woods*. Bureau of Printing, Manila.
- Romero, U.M. 1961. Hastening germination of ipil (*Intsia bijuga* Kuntze) seeds by tap water treatment. Unpublished. University of the Philippines at Los Banos, College of Forestry.
- Rosario, E.A. 1959. Hastening the germination of teak (*Tectona grandis*, Linn.) seeds by stratification method. Unpublished. University of the Philippines at Los Banos, College of Forestry.
- Salisbury, Frank and Cleon Ross. 1969. *Plant Physiology*. California. Wadsworth Publishing Co.
- Salva dor, P.B. 1951. Special treatments to hasten germination of supa (*Sindora supa* Merr.) seeds. Unpublished. University of the Philippines at Los Banos, College of Forestry.
- Toole, V.K. 1938. Germination requirements of the seeds of some introduced and native range grasses. Proceedings of the AOSA.