GERMINATION BEHAVIOUR OF *CALAMUS FLAGELLUM* SEEDS

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ABSTRACT

Mature seeds of *Calamus flagellum* were utilized to study the germination behaviour in sand and soil under partial shade and complete shade conditions. There was no germination from the clean seeds (seeds after removing pericarp and sarcotesta) after treatments with 50% H_2SO_4 and 50% HNO_3 for five minutes. Germination period was minimum (66 to 100 days) when clean seeds were sown on soil under partial shade conditions after soaking in clean cold water for 24 hours but maximum (125 to 144 days) when intact seeds were sown on sand under complete shade condition. The highest value of mean germination percents (92%) was observed from the clean seeds sown on sand under complete shade condition after soaking in 8% methanol for 24 hours. However, similar results (91%) were obtained from the clean seeds treated with clean cold water or 4% ethanol for 24 hours under same conditions. The lowest value (28%) of mean germination percents was found when intact seeds sown on soil under partial shade. Germination value was found highest (0.78) when clean seeds were sown on soil under partial shade after soaking in clean cold water for 24 hours. On the other hand, lowest germination value (0.0576) was observed from the intact seeds sown on soil under complete shade.

INTRODUCTION

Rattans are mostly trailing or climbing spiny palms with characteristic scaly fruits, classified under the subfamily Calamoidae (Dransfield & Uhl 1986) of the family Arecaceae (Palmae) and one of the most important non timber forest produce from North East India particularly Arunachal Pradesh. World wide, there are about 600 species of rattan belonging to 13 genera (Renuka 1992, Haridasan 1997) and are found only in the tropics largely confined to South East Asia, Africa and America. In India till recently 60 species are recognised (Basu 1992, Renuka 1997) out of which Arunachal Pradesh has 18 species (Thomas et al. 1998).

Calamus flagellum locally known as 'Raidang' is one of the most commercially important rattan species from North East India. This species is harvested for cane, making furniture, handicraft and also has ethnobotanical utility. Due to the heavy extraction of rattans for furniture industry from natural forest, there is an urgent need to cultivate the species having commercial potentiality. This study was initiated to establish proper germination technique for cultivation.

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MATERIALS AND METHODS

Mature seeds of *Calamus flagellum* were collected from the tropical forests of Arunachal Pradesh and were utilized for germination experiments. Seeds were sown at a depth of 3 cm in soil and sand in large trays and kept in partial shade (with overhead shade only) and complete shade under net house (covered all round). Six different treatments were applied and five replica for each treatment were taken before sowing the seeds. Twenty seeds were utilized for each replication. Regular watering was done to provide sufficient moisture for seed germination. Germination period, mean germination percentage and germination value which is an index combining speed and completeness of germination were recorded. The germination value of rattan seeds was calculated as per the method prescribed by Czabator (1962). Germination value is a product of peak value of germination and mean daily germination.

RESULTS AND DISCUSSION

Germination of rattan seeds fits a type of germination known as adjacent ligular (Dransfield 1997). The seed consists of a hard endosperm which has a small and cylindric embryo on one side. During germination, the embryo swells out through a germination pore, pushing out the thin tissue covering the pore (pore cover) and forming a 'plug' of tissue out side the pore which is connected by a narrow stalk to the haustorial cotyledons within the endosperm. The radicle emerged from the centre of the plug about one week after the pore cover had fallen off. Following this an irregular swelling emerged from one side of the plug and from this swelling the shoot emerged out which is a small, bladeless structure. The first leaf which bears a blade is usually the next foliar organ to emerge.

In this study a seed was said to have germinated when the bladeless shoot emerged out from the soil or sand.

The result obtained on germination parameters under various treatments are presented in Table 1. Only 28% to 37% of mean germination were observed in case of intact seeds, while 39 % to 42% were observed if outer scaly pericarp of the seeds were removed. These values are not related to the reported value by Mori *et al.* (1980) where they observed no germination in case of *Calamus manon* seeds. It is possible that the pericarp and sarcotesta may retard germination by the inhibition of gas exchange. Germination period was maximum and germination value was comparatively minimum in both the treatments than other treatments. There was no germination from the seeds when clean seeds were soaked in 50% H_2SO_4 or 50% HNO_3 for five minutes. Perhaps, this concentration of H_2SO_4 or HNO_3 might kill the embryo of the seed. An increased mean germination percent and germination value were observed when pericarp and sarcotesta were removed from the seeds and then soaked in clean cold water for 24 hours. Mean germination percentage (91%) and germination value (0.638) were found good when clean seeds were sown on sand under complete shade after 24 hours water soaking, but germination period (94 to 115 days) was comparatively more than 66 to 100 days when sown on soil under partial shade (exposed to sun for average 2 hrs.) under similar treatments.

Table 1 : Germination of seeds of *Calamus flagellum* under different treatment.

Treatment	Partial shade (with overhead shade)			Complete shade (under net house)		
	Germination period (days)	Mean germination (%)	Germination value	Germination period (days)	Mean germination (%)	Germination value
I. Germination test in soil						
A.	91 to 120	28	0.06	109 to 137	33	0.0576
B.	90 to 113	40	0.12	90 to 125	42	0.1128
C.	66 to 100	66	0.442	32 to 112	74	0.4424
D	-	-	-	-	-	-
E	-	-	-	-	-	-
F	76 to 101	89	0.78	85 to 116	86	0.5495
G	73 to 104	74	0.507	83 to 115	74	0.4224
II. Germination tests in sand.						
A	105 to 125	30	0.06	125 to 144	37	0.065
B	95 to 121	39	0.103	120 to 140	40	0.081
C	87 to 111	75	0.457	94 to 115	91	0.638
D	-	-	-	-	-	-
E	-	-	-	-	-	-
F	85 to 115	84	0.53	97 to 123	92	0.572
G	88 to 117	75	0.413	95 to 121	91	0.575

Treatment used :

A – Intact seeds with sarcotesta and pericarp were soaked in clean cold water for 24 hours.

B – After removal of the outer scaly percarp seeds were soaked in clean cold water for 24 hours.

C – After removal of the pericarp and sarcotesta (Clean seed) by rubbing with sand, seeds were soaked in clean cold water for 24 hours.

D – Clean seeds were soaked in 50% H_2SO_4 for 5 minutes.

E – Clean seeds were soaked in 50% HNO_3 for 5 minutes.

F – Clean seeds were soaked in 8% methanol for 24 hours.

G – Clean seeds were soaked in 0.5 % ethanol for 24 hours.

In terms of germination value, the best result (0.78) was obtained when seeds were sown on soil under partial shade after soaking in 0.8% methanol for 24 hours. However, mean germination percentage was slightly lower (89%) than the highest value (92%) where seeds were sown on sand under complete shade under the same treatment.

It was observed that clean seeds when soaked in 0.8 % methanol for 24 hours was very much effective when sown on soil under partial shade than 0.4 % ethanol treatment. On the other hand, similar results were found when clean seeds were sown on sand under complete shade after soaking in clean cold water, 8% methanol and 4% ethanol. It is possible that at that concentration, methanol may enhance the imbibation process by acting upon cell membrane of the seed. Germination period was found minimum when seeds were sown on soil under partial shade and maximum when sown on sand under complete shade. It was reported that seeds of *Calamus manon* germinated within 1-4 months (Naingallen 1985). The onset of germination of certain *Calamus* species was also reported to take more than four months and the germination percentage varied from 3-80% depending upon the species (Generalao, 1977).

CONCLUSION

The above results amply clarify that cane is better germinated in partial sunlight i.e. in areas where there is chance of getting exposed to sun for at least 2 hrs. This would mean, conventional shade beds with an over head shade above 1.5 meter as given in forest nurseries would enhance seed germination performance better than the modern net houses which considerably reduce sunlight penetration.

It is also significant to note that local traditional practices like removal of seed coat and seed testa along with soaking in cold water for about 24 hours are significant in germination and better nursery management. Other favourable treatments like soaking of seeds in low concentration of alcohol are easy to adopt and cost effective.

Thus, it may be seen that a little care while sowing can greatly enhance seed germination in case of *Calamus flagellum* and success in nursery establishment. This has also a bearing in conservation of canes as the entire group of canes in the present context are being threatened and needs conservation efforts. Our experiments also highlight the possibility of augmenting natural regeneration through slight manipulation of shade in forests by selectively removing some branches of shade plants and allowing penetration of sunlight. The study also points out for taking up further experiments on other aspects of seed germination and nursery technique.

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