



Influence of Seed Age and Mechanical Treatments on Seed Germination in *Calophyllum inophyllum* Linn.

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ABSTRACT

Calophyllum inophyllum Linn., is one of the multipurpose tree species of coastal area and commercially used as Tree Borne Oil seeds (TBOs). In the study, fresh and one year stored seeds were examined for germination pattern by using some mechanical treatments. One year stored seeds did not germinate in control, whereas fresh seeds resulted in 40% germination in control. De-coated seed fetched the germination improvement up to 88.3% in fresh seeds and 20% in one year old seeds. Seed thickness and seed length showed significant positive association with seed germination. The study revealed that it is better to use fresh seeds followed by de-coating of seeds to achieve higher germination in *C. inophyllum*.

Key words:

Calophyllum inophyllum, Germination, Seed traits, Seed age, Tree Borne Oil seeds

INTRODUCTION

Calophyllum inophyllum Linn. is one of the littoral tree species of the tropics and is occurring above the high-tide mark along seacoasts and commonly seen on the sandy beaches of seashore (Anon 2007). In India, it is distributed along the Western and Eastern Coasts of Kerala, Karnataka, Maharashtra, Tamil Nadu, Andhra Pradesh and Orissa. In Maharashtra state, it is distributed scatterly along the Konkan coast from Thane to Sindhudurg districts (Shinde 2010).

It is considered as one of the Multipurpose tree species where trees are used in avenue planting, wood is largely used in boatbuilding and construction of houses, especially in the Coastal region, Kernel yield about 50 to 73% bluish yellow to dark green viscous oil, popularly called *Domba oil*, *Tamanu oil* used as preservative for ships and boats. Oil obtained

from kernel can also be used in conventional diesel engines in its pure form or as a blend with mineral oil (Grace et al. 1996; Ramanadane et al. 2007; Agarwal 2007; Venkanna and Reddy 2009). Therefore, now a day, seeds are used as alternative source for bio-fuel. Apart from these properties, the oil is also employed as a remedy for rheumatism, ulcers and skin diseases. The plant has got other medicinal properties like anti-HIV and anti-cancer (Dharmaratne et al. 2002).

The annual demand of seeds of this species is about 20,000 tons (Mandal 2004). The present demand is partially fulfilled by seed collection from natural habitat. Therefore, it is essential to establish captive plantations of this species in large scale, especially along the coastal line. This not only fulfils the requirement of quality seeds, but also improves the coastal heritage. In the present study, seed germination

trial was undertaken to understand the effect of fresh and one year stored seeds on germination with some mechanical treatments to enhance it.

MATERIALS AND METHODS

Experiment was carried out in the College of Forestry, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Ratnagiri district of Maharashtra during 2009-10. Seeds were collected from nearby population of *Calophyllum inophyllum* located in Harne coast of Dapoli (Longitude = 73° 06' 04 N, Latitude = 17° 48' 13 E and Altitude = 7m MSL). In the trial, fresh seeds and one year old seeds were used to study the germination pattern along with few mechanical treatments (Photo 1). Details of treatments imposed in the experiment are given below:

Treatment details

T₁ = Fresh seeds (Control-1)

T₂ = Mechanical scarification* of fresh seeds

T₃ = De-coated fresh seeds

T₄ = One year old seeds (Control-2)

T₅ = Mechanical scarification* of one year old seeds
T₆ = De-coated one year old seeds

*cracking of seed-coat by hammer

Total six treatments with three replications of 100 seeds each were sown on nursery bed following Randomized Block Design (RBD) under the mist chamber. Daily germination count was recorded up to six months from the date of sowing. Germination data was statistically analyzed using statistical package. To understand the association of various seed traits with germination, a simple correlation analysis was done.

RESULTS AND DISCUSSION

The fruit is green and turns to yellowish when it matures and starts wrinkling after over maturation. Each fruit contains single large seed enclosing hard coat. Seed lots collected from natural population were subjected to seed processing and healthy seeds were used in germination experiment. It was observed that collection of fresh mature fruits is better for easy depulping; however, in dried fruits, depulping is

too difficult get the seed germination.

In the study, collected seed lot was examined for status of seed health. It is recorded that the percentage of healthy seeds in a seed lot was 65.0. However, remaining 30.6% and 4.4% seed lot represents the rotten and aborted seeds, respectively (Photo 2).

Seed physical parameters such as seed length, thickness and weight were recorded from collected seed lot. Seed length varied from 24.46 to 29.95 mm and seed thickness varied from 16.51 to 24.46 mm, whereas seed weight ranged between 4.94 g and 12.88 g in the collected seed lot (Table 1).

An experiment on germination showed that freshly collected seeds resulted in 40 per cent germination (T₁); however, one year stored seeds didn't germinate at all (T₄; Table 2). In case of fresh seeds, de-coated seeds (T₃) showed significantly higher germination of 88.3 per cent, followed by mechanically scarified seeds (T₂; 57.3%) as against control (T₁; 40%). Interestingly, in one year stored seeds, de-coated seed (T₆) fetched the germination improvement up to 20% as compared to control (T₄; 0.0%). However, mechanically scarified old seeds (T₅) resulted in 1.3% germination (Table 2).

The cumulative germination of fresh and old seeds exposed to different seed treatments is shown in figure 1. Result showed that seed germination started after 19 days from the date of sowing and maximum germination achieved in 41 days after sowing. Peak day of germination was 26th and 28th days, respectively in T₃ and T₂. The overall result showed that there is physical kind of seed dormancy in this species (Gunaga et al. 2011) and it may need some sort of mechanical treatments to break down the dormancy. That is why, in this study, maximum germination was achieved in decoated seeds. Further, one year old decoated seeds also showed germination up to 20.0% in this species. This low germination may be due to loss of seed viability during storage. Friday and Okano (2006) recorded the influence of seed coat, where average time required for germination was 22 days for seeds with fully shelled, 38 days for



Photo 1: Different seed treatments (a. Control, b. Mechanically scarified seed and c. de-coated seeds) used in the study



Photo 2: Healthy (a), rotten (b) and aborted (c) seeds recorded in seed lot

slurry with 79.4 % germination as against control (62.4%). Therefore, it is suggested to use fresh seeds followed by seed de-coating treatment to achieve better germination in *C. inophyllum*.

In the study, positive association between seed thickness and seed length was recorded; however, seed weight showed positive association with only seed thickness (Table 3). Considering seed germination, it was positively associated with seed thickness and length (Table 3). It is indicated that bigger size seeds produce maximum germination than smaller ones. Study conducted by Gunaga (2011) reported that bigger size seeds produced quick, uniform and more germination as well as more seedling

vigour and biomass as compared to small to medium size seeds. Similar observation was also recorded in different tree species like *Pongamia pinnata* (Manonmani et al. 1996), *Artocarpus heterophyllus* (Mandal et al. 1997) and *Vateria indica* (Gunaga et al. 2007). The present study revealed that it is better to conduct seed grading before seed sowing in forest nursery to obtain quality seedlings in large quantity.

It is concluded that freshly collected seeds imposed to de-coating treatment resulted in 88.3 % germination in *C. inophyllum*. One year stored seeds did not germinate in control treatment. However, de-coated old seeds achieved the germination up to 20%.

Table 1: Seed traits recorded from collected seed lot of *C. inophyllum*

Seed trait/ Range (N= 1200 seeds)	Seed weight (g)	Seed length (mm)	Seed thickness (mm)
Minimum	4.94	24.46	16.51
Maximum	12.88	29.95	24.46
Mean	7.24	26.51	22.25

Table 2: Seed Age and mechanical treatments on seed germination in *C. inophyllum*

Treatments	Germination (%)	
T1 Fresh seeds (Control-1)	40.0	(39.19 ^c)
T2 Fresh break open seeds	57.3	(49.22 ^b)
T3 De - coated fresh seeds	88.3	(73.11 ^a)
T4 One year old seeds (Control-2)	0.0	(0.0 ^e)
T5 One year old break open seeds	1.3	(4.92 ^e)
T6 de - coated one year old seeds	20.0	(25.63 ^d)
Mean	34.5	(32.01)
SEm		2.39
CV (%)		18.29
CD @5%		8.82

Figures in the parenthesis are arc-sine transformed values

Table 3: Association between seed characters and germination in *Calophyllum inophyllum*

Parameters	Seed weight	Seed thickness	Seed length
Seed thickness	NS	-	
Seed length	0.698*	0.501*	-
Germination	NS	0.399*	0.319**

* Significant at 1 % P; ** Significant at 5% P; NS indicating Non-significant

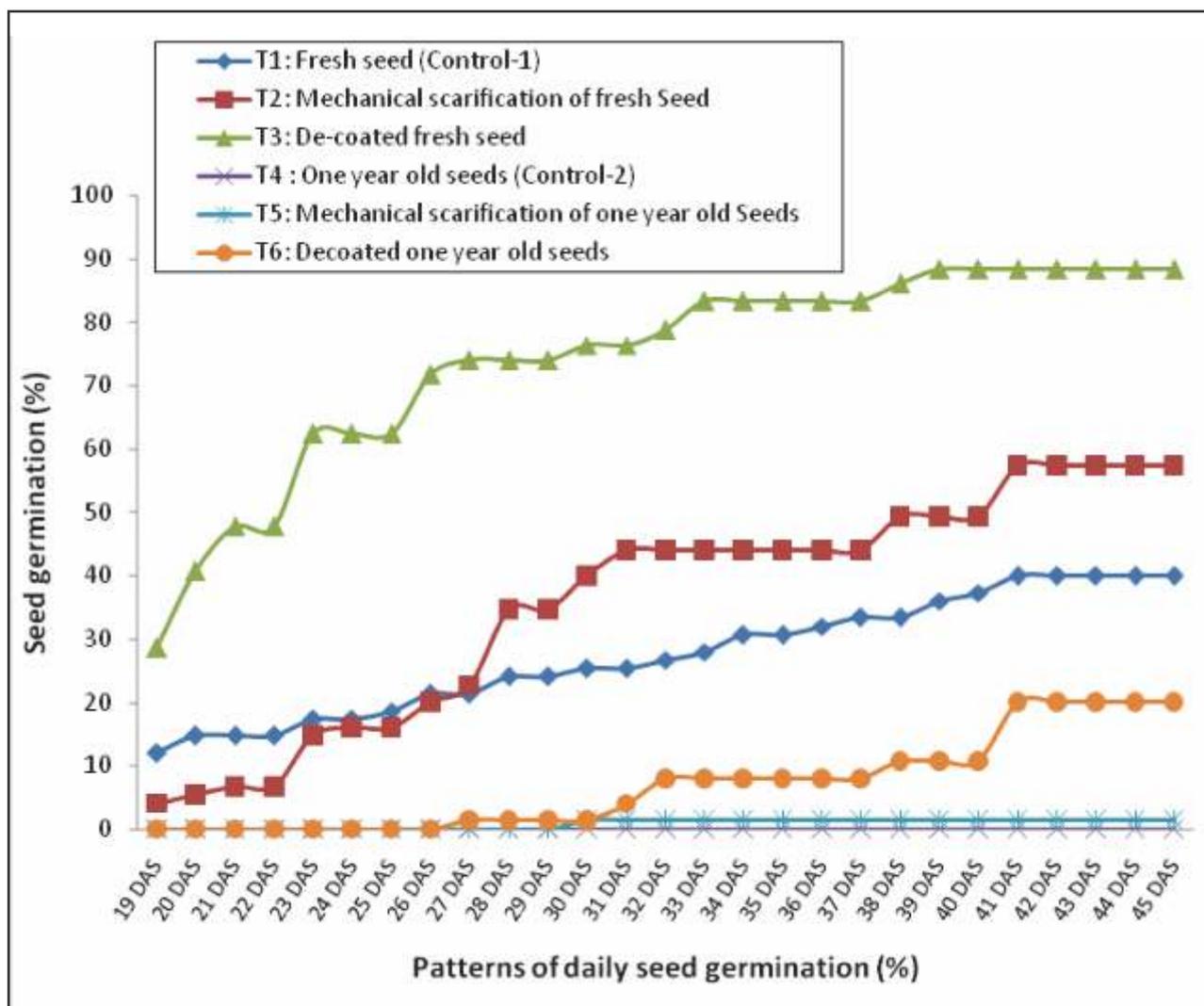


Fig. 1: Daily seed germination in seed lots exposed to different seed treatments in *C. inophyllum*

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