



# Effect of Pre-sowing treatments on Seed Germination of *Syzygium cumini* (L.) Skeels

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Seed germination studies were performed in *Syzygium cumini* (L.) Skeels. (Myrtaceae). Seed viability, seed germination in response to various pre-sowing treatments and polyembryony were studied. Seeds stored at low temperature showed 100 % viability for about 4 months. Acid (H<sub>2</sub>SO<sub>4</sub>) scarification for 10 min duration results in better germination percentage both in diffused light and dark conditions. Production of multiple shoots was observed. Polyembryony in this native multipurpose tree can be utilized in plant breeding techniques and in turn used for various reclamation programmes.

## INTRODUCTION

*Syzygium cumini* is a multipurpose large, evergreen native tree species distributed in south and Southeast Asia from Pakistan to Australia, growing up to 30m tall. It is commonly known as 'naaval' in Tamil and Black plum, Indian black berry, Java Plum in English. It is found throughout India, from sea level to an altitude of 1,800m, usually along streams and often gregarious in Sal (*Shorea robusta*) and evergreen forests. It grows well in sandy soils, riverbeds and clayey loam soils, poorly drained soil too (Ramachandra & Kamakshi, 2005). It is cultivated as an avenue tree. This tree is a fast growing tree with good coppicing capacity, suitable for degraded wastelands (Singh, 1982). This tree is a pollutant tolerant tree (Jacob, 2002; Ahmad, 2003; Satya *et al.*, 2005). It has been valued in Ayurveda and Unani systems of medication for possessing variety of therapeutic properties (Kirtikar & Basu, 1975). The seeds have hypoglycemic (Chopra *et al.*, 1958), antibacterial (Bhuiyan *et al.*, 1996), anti-HIV (Kusumoto *et al.*, 1995) and antidiarrheal effects (Indira & Mohan, 1993). Seed extracts possessing significant CNS activity due to the presence of saponins (Kumar *et al.*, 2007). Leaf extracts are used for treatment of skin wounds (Oliveira *et al.*, 2007). The bark, the fruit, the seeds as well as the leaves are utilized in the treatment of insulin dependant diabetes mellitus (IDDM) (Schossler *et al.*, 2004).

With the threats of global warming and increasing desertification, there is an urgent need to develop conservation strategies for dryland plants, thereby ensuring the preservation of their diversity. Whilst the *ex situ* conservation of seeds is an effective means of achieving this goal, little information is available on the seed germination, desiccation tolerance and storage performance (potential) of *S. cumini*. The present study was carried out with the main objective to test the effect of

various pre-sowing treatments on seed germination of *S. cumini*.

## MATERIAL AND METHODS

The material for this present study was taken from the trees of *S. cumini* growing at Madras Christian College Campus (MCCC), which supports one of the stands of Tropical Dry Evergreen Forest (TDEF) vegetation. The geographical area is located at 12° 55' N and 80° 7' E and climate is Tropical Wet Moderate Bioclimate. The average minimum temperature ranges between 20° C and 22° C during November - December and maximum ranges from 40° C to 42° C during May - June. The average rainfall is c. 130 cm. Maximum rainfall is during October - November due to the activity of the northeast monsoon. The meteorological data were obtained from the nearby Indian Air Force (IAF) Station, Tambaram.

Several individuals of *S. cumini* were observed and their ripe fruits were collected and de-pulped in running water. Shade-dried seeds were stored in airtight plastic containers kept in different storage conditions such as diffused light (DL), darkness (D) as well as in low temperature (cold) conditions. Stored seeds were used for germination and viability tests. Viability of seeds was determined by TTC test using tetrazolium salt as a reagent (Schmidt, 2002).

Seeds were first surface sterilized for 1 min by immersing in 0.1% HgCl<sub>2</sub>, washed thoroughly with water, and then sown separately in Petri plates lined with 3-layered filter papers. Various pre-sowing treatments (Table 2) were given to the healthy seed lots. Untreated seeds taken as control were planted on moist filter paper in a Petri plate after surface sterilization. Treated seed lots were exposed to different environmental conditions such as continuous light (CL), diffused light (DL) and total darkness.

**Table 1 : Changes in Viability of *Syzygium cumini* seeds in Response to Different Storage Conditions**

Storage Condition	After No. of Days Storage (Days)	No. of Viable Seed out of 10	Viability in %
Dark	10	8	80
DL		8	80
Cold		10	100
Dark	23	4	40
DL		6	60
Cold		10	100
Dark	45	9	90
DL		10	100
Cold		9	90
Dark	59	9	90
DL		7	70
Cold		7	70
Dark	114	6	60
DL		-	-
Cold		0	0

## RESULTS AND DISCUSSION

Table 1 depicts the changes in viability of *S. cumini* seeds in response to different storage conditions. Seeds stored at low temperature in the refrigerator showed higher percentage of viability up to 45 days of storage. Further storage resulted in loss of viability. Seeds stored in all three conditions permitted prolonged viability for a maximum of three months *i.e.*, about 90 days. Seeds stored at low temperature maintained 100% viability for 127 days of storage. Dark and DL showed significant decrease in viability after 100 days of storage. At low temperature seeds showed decline in viability after 150 days of storage. *S. cumini* seeds are recalcitrant because of their high moisture content of 23-37% (Schmidt, 2002). Hence, *S. cumini* seeds require good ventilation because recalcitrant seeds respire actively (Murty & Singh, 2009). Seeds of *S. cumini* must be maintained at high moisture contents, below which viability lost is about 40%.

Table 2 shows the effect of various pre-sowing treatments on the germination of seeds. Acid ( $H_2SO_4$ ) scarification for 5 minutes duration resulted in 80 % germination in DL and 60 % in dark conditions whereas acid scarification for 10 min resulted in 70 % germination in both DL and Dark conditions. 20 min duration acid scarification promoted germination in DL up to 90 % whereas in dark only 20 % germination was observed. Increased duration of acid scarification resulted in negative impact in seed germination may because of damage to the embryo due to prolonged exposure. DL condition generally promoted germination than darkness.

The effect of acid scarification was also tested in a variety of germination media. Exposure for 5 minutes to 50 %  $H_2SO_4$  and sown in saw dust promoted germination in darkness up to 90 % while 10 min exposure resulted in 80 % germination

in DL (Table 2). In addition, seeds of *S. cumini* have also been tested for their germination capacity in forest as well as red soil taken in Petri plates. Seeds sown in forest soil showed 90 % and 70 % germination in CL and DL conditions respectively but it was slightly less (60 %) in dark condition. Red soil with CL showed 80 % germination response while in other conditions it was less. Therefore, acid scarification, irrespective of medium employed for germination, promotes germination significantly for higher percentages by causing the softening of seed coat. All other treatments are lesser % of germination when compared to acid ( $H_2SO_4$ ) scarification treatment. Light quality also doesn't have much effect on seed germination of *S. cumini* (Table 2).

*S. cumini* seeds produced twin seedlings and they were independent, having separate tap roots. The seedlings grew as healthy as normal seedlings. The twin seedling is due to the presence of twin embryos in the seed. Polyembryony is a phenomenon of occurrence of more than one embryo in the embryo sac (Good, 1956; Davis, 1966) or a seed resulting in development of more than one seedling from it (Maheshwari, 1950). Earlier, polyembryony was reported in many native species and even in *S. cumini* (Kader *et al.*, 2000). So, the present work confirms that *S. cumini* do have polyembryony which has much application in plant breeding (Maheshwari & Sachar, 1963).

## ACKNOWLEDGEMENT

We are grateful to Dr. C. Livingstone, Head (Retd.), Department of Botany, Madras Christian College for necessary departmental facilities, encouragement and critically going through the manuscript. We are also grateful to Dr. P. Dayanandan, Head (Retd.), Department of Botany, Madras Christian College for freely giving tetrazolium salt to perform viability test.

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**Table 2 : Effect of pre-sowing treatments on the seed germination (%) of *Syzygium cumini* (CL = continuous light; DL = diffused light); \*seeds showed no sign of germination; - seeds showed no life (blackened)**

Treatment	Control		5 min		10 min		20 min		30 min		40 min		60 min		90 min	
Acid Scarification (50% H <sub>2</sub> SO <sub>4</sub> )	DL 10	Dark -	DL 80	Dark 60	DL 70	Dark 70	DL 90	Dark 20	DL 40	Dark -	DL 70	Dark 10	DL -	Dark -	DL -	Dark -
Acid scarification (50 % H <sub>2</sub> SO <sub>4</sub> ) sown in saw dust	Control		5 min		10 min											
	DL 70	Dark 75	DL 55	Dark 90	DL 80	Dark 60										
Various media	Control			Forest soil			Red soil									
	DL 90	CL 80	Dark 100	DL 70	CL 90	Dark 60	DL 60	CL 80	Dark 70							
Leaching (Presoaking)	Control		6 hrs		12 hrs		24 hrs		48 hrs							
	DL 10	Dark 30	DL 10	Dark 20	DL -	Dark -	DL -	Dark -	DL 10	Dark 20						
Dry heat followed by presoaking (6 hrs)	Control		6 hrs		12 hrs		24 hrs		36 hrs		48 hrs					
	DL -	Dark -	DL -	Dark -	DL -	Dark -	DL -	Dark -	DL -	Dark -	DL -	Dark -				
Hot water scarification	Control		50°C/5 min		50°C/10 min		60°C/5 min		60°C/10 min							
	DL -	Dark *	DL -	Dark *	DL -	Dark *	DL -	Dark *	DL -	Dark *						
Acid scarification Alcohol : HCl 3:1	Control		15 min		30 min		60 min									
	DL -	Dark *	DL -	Dark *	DL -	Dark *	DL -	Dark *								
Presoaked 48 hrs - Mechanical scarification	Control		Sown in H <sub>2</sub> O		Sown in 0.2% KNO <sub>3</sub>		Presoaked in 0.2% KNO <sub>3</sub> - 24 hrs		Presoaked in 0.2% KNO <sub>3</sub> - 48 hrs							
	DL 10	Dark *	DL 0	Dark *	DL 0	Dark *	DL 0	Dark *	DL 0	Dark *	DL 0	Dark *				
Light quality	DL -	Dark -	Red 40	Far red 10												

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(Received on 1 Dec., 2010, Accepted on 1 March, 2011)