

Original Research Article

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## Effect of Seed Storage and Seed Treatments on Seedling Growth of *Garcinia gummi-gutta* (L.) Roxb. in Ponnampet, Western Ghat

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### ABSTRACT

#### Keywords

*Garcinia gummi-gutta*,  
Growth, Seedling,  
Seed storage, Seed  
treatment

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The experiment was conducted to examine the effect of seed storage and seed treatments on seedling growth of *Garcinia gummi-gutta* at College of forestry, Ponnampet in split plot design in that seed storage selected as main plot and seed treatment as sub plot. In the present study seed stored up to 0, 30, 60, 90 days respectively with the eight different seed treatments. In each treatment 30 seeds were used per replication. The study indicated that seed stored up to 60 days has significant effect on growth. Results indicates that seed treated with mechanical scarification of seed coat showed best growth while seed treated with hydrogen peroxide and hot water treatment showed less growth. The overall result concluded that seed stored up to 60 days and seed treated with mechanical scarification of seed coat found best for the seedling growth of *Garcinia gummi-gutta*.

### Introduction

Genus *Garcinia* belongs to the family Clusiaceae (Guttiferae). It is composed of approximately 400-600 species, including dioecious evergreen trees growing in the tropical parts of the world (Steentolft, 1988; Richards, 1990). *Garcinia gummi-gutta* (L.) Roxb. is a moderate sized tree with round canopy, drooping branches (Shringeshwara *et al.*, 2000) and the trees have a dark, smooth

bark with an average thickness of 5.3 mm (Hegde *et al.*, 1998). These trees grow up to an average height of 18 m and attain diameter of up to 70 cm. *Garcinia gummi-gutta* trees are dioecious, with a male to female sex ratio of 1:1. Trees of both the sexes usually commence flower production when they are about 14 cm in diameter. Male and female trees produce flowers from early February to April. Fruits ripen from June to August. Fruit is an indehiscent berry, pulp juicy and weigh about

80 g (Saldanha, 1984). The English name of the tree is Malabar Gamboge. In Kannada it is known as Simai Hunase, and Uppage (Saldanha, 1984). The scientific name of the species is derived from a botanist Garcinia who described it in 1547 (Subhas, 1996). *Garcinia gummi-gutta* is also known as *Garcinia cambogia*, probably got its name from the gum tree gummi-gutta or gamboges used as pigment in miniature paintings and water colors (Bhandari, 1998).

*Garcinia gummi-gutta*, is a common medicinal plant, has been used historically to treat respiratory infections such as sore throat and cough. The phyto-chemical constituents include bi-flavinoid, xanthone and benzophenones and principle acid in the fruit and rind is Hydroxycitric Acid (HCA) (Jayaprakash and Sakariah, 1998). The acid has been found to suppress fatty acid synthesis, lipogenesis, and food intake and to promote glycogenesis, while inducing weight loss (Jena *et al.*, 2002). The sun dried rind of the fruit is astringent, antiseptic and purgative. Due to its commercial importance several farmers of the Western Ghats have shown interest in bringing the species under cultivation (Vasudeva *et al.*, 2003).

Owing to these important properties the demand for the fruit has increased, which in turn has led to the unscientific and reckless exploitation. In rural areas of the Western Ghats, people harvest the fruits even when they are green and there are also instances of severe loping of branches for easy collection of fruits. As a result, the species has already been declared as “threatened” as per the IUCN guidelines (Ravi Kumar and Ved, 2000; Ramesh *et al.*, 1997).

## Materials and Methods

The present study was conducted at college of forestry, Ponnampet, Kodagu district, Karnataka. Fruits were collected from healthy

and high yielding mother plants from nearby estates in Ponnampet, Kodagu during month of July. Seeds were extracted from the fruit of *Garcinia gummi-gutta* and wash thoroughly to remove pulp. The experiment was conducted in split plot design with four replications in that seed storage selected as main plot and seed treatment as sub plot. In the present study seed stored up to 0, 30, 60, 90 days respectively with the eight different seed treatments. In each treatment 30 seeds were used per replication. Observation on growth recorded after 180 day of sowing for each storage period. The data collected was subjected to analysis of variance (adjusted for covariate) based on Split plot design using the GENSTAT software (Genstat 5 Release 3.2) after angular transformation of per cent values and square root transformation of count. The covariates considered for the analysis of covariance is Air temperature.

## Treatment details

### Main plot- storage

- M<sub>1</sub>: Sowing of fresh seeds.
- M<sub>2</sub>: Sowing after 30 days storage.
- M<sub>3</sub>: Sowing after 60 days storage.
- M<sub>4</sub>: Sowing after 90 days storage.

### Sub plot - Seed treatments

- S<sub>1</sub> Control (soaking in water)
- S<sub>2</sub> Mechanical damaging of seed coat
- S<sub>3</sub> Acid scarification for 3 minute
- S<sub>4</sub> Treatment of kernel with 50 ppm GA<sub>3</sub> after removal of seed coat
- S<sub>5</sub> Cow dung slurry treatment for 48 hours
- S<sub>6</sub> Hot water treatment for 30 minutes
- S<sub>7</sub> H<sub>2</sub>O<sub>2</sub> (30%) treatment for 30 minutes
- S<sub>8</sub> Fresh cow urine treatment for 24 hour

## Observations recorded

Root and shoot length (cm): Root and shoot length of seedlings was taken by the help of scale after 180 days of sowing, the seedlings

were carefully uprooted with least disturbance to the root from the soil. Root portion was washed to remove the soil. Shoot length was measured from collar region to the top most nodal region. The root length was measured from collar region to the tip of the longest root. For each treatment one seedling was taken.

Collar diameter (cm): Collar diameter of seedling was taken by using digital calliper.

Average Number of leaves: Leaves were counted after 180 days of sowing.

Root and shoot biomass (g/plant): Dry weight of root and shoot were taken by harvesting one plant from each of the replication for storage and seed treatment by keeping in hot air oven at 70° C for 72 hours.

## Results and Discussion

### Effect of storage on seedling growth

The study revealed that the effect of seed storage on seed germination showed significant differences for growth parameters except root length. Out of the different storage period tried, seed stored up to 60 days after collection recorded the higher collar diameter, average number of leaves, root length and shoot length while the shoot weight and root weight were found maximum in seed stored up to 90 days after collection of seed. The minimum growth parameter were observed in fresh seeds except collar diameter which is found minimum in seed stored up to 90 days (Table 1).

**Table.1** Effect of seed storage on seedling growth parameters

Storage	Collar diameter (mm)	Average number of leaves per plant	Root length (cm)	Shoot length (cm)	Root weight (g)	Shoot weight (g)
M <sub>1</sub>	2.06 <sup>b</sup>	8.80 <sup>a</sup> (2.97)*	13.92	11.67 <sup>a</sup>	0.61 <sup>a</sup>	0.93 <sup>a</sup>
M <sub>2</sub>	2.21 <sup>c</sup>	10.73 <sup>b</sup> (3.28)	15.15	12.60 <sup>b</sup>	0.71 <sup>b</sup>	1.06 <sup>ab</sup>
M <sub>3</sub>	2.25 <sup>c</sup>	11.92 <sup>c</sup> (3.45)	15.71	13.44 <sup>b</sup>	0.75 <sup>c</sup>	1.12 <sup>b</sup>
M <sub>4</sub>	1.84 <sup>a</sup>	9.01 <sup>a</sup> (3.01)	14.69	12.71 <sup>b</sup>	1.15 <sup>d</sup>	1.53 <sup>c</sup>
<b>Mean</b>	2.09	10.08 (3.18)	14.86	12.60	0.80	0.60
<b>SEm±</b>	0.04	0.09	0.47	0.27	0.03	0.13
<b>LSD(0.05)</b>	0.15	0.30	NS	0.92	0.09	0.17

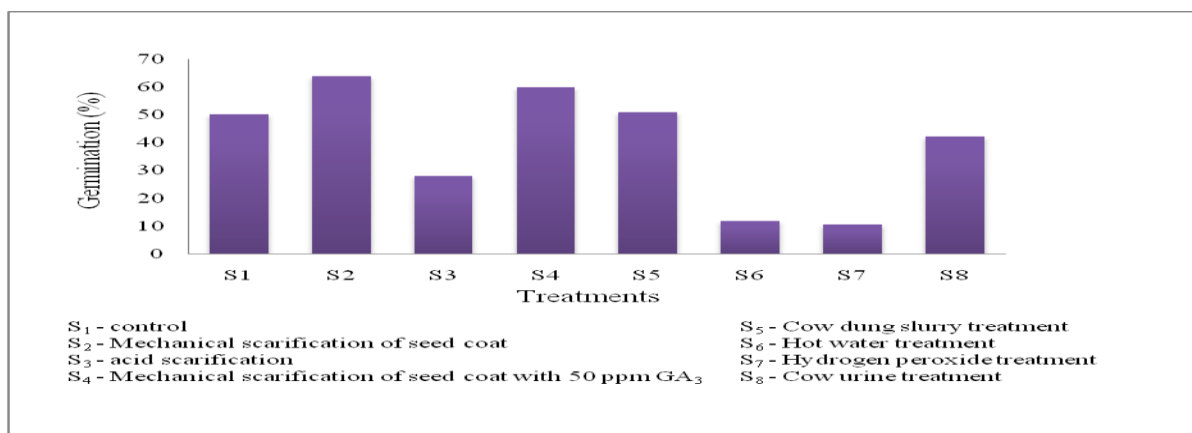
\*Values in Parentheses are square root transformed; LSD- Least Significant Difference NS- Non Significant, Figure with similar letters as superscript do not differ significantly

**Table.2** Effect of seed treatments on seedling growth parameters

Treatments	Collar diameter (mm)	Average number of leaves per plant	Root length (cm)	Shoot length (cm)	Root weight (g)	Shoot weight (g)
S <sub>1</sub>	2.38 <sup>c</sup>	12.55 <sup>d</sup> (3.54)*	16.62 <sup>b</sup>	13.21 <sup>c</sup>	0.74 <sup>c</sup>	1.34 <sup>b</sup>
S <sub>2</sub>	2.63 <sup>c</sup>	13.68 <sup>e</sup> (3.70)	17.37 <sup>bc</sup>	15.58 <sup>d</sup>	1.23 <sup>e</sup>	1.77 <sup>c</sup>
S <sub>3</sub>	1.66 <sup>b</sup>	8.68 <sup>b</sup> (2.95)	10.25 <sup>a</sup>	10.71 <sup>b</sup>	0.57 <sup>bc</sup>	0.59 <sup>a</sup>
S <sub>4</sub>	2.53 <sup>c</sup>	12.04 <sup>c</sup> (3.47)	19.33 <sup>c</sup>	17.37 <sup>d</sup>	1.22 <sup>e</sup>	1.70 <sup>c</sup>
S <sub>5</sub>	2.41 <sup>c</sup>	12.22 <sup>c</sup> (3.50)	18.62 <sup>bc</sup>	13.63 <sup>c</sup>	0.93 <sup>d</sup>	1.53 <sup>bc</sup>
S <sub>6</sub>	1.29 <sup>a</sup>	5.16 <sup>a</sup> (2.27)	8.92 <sup>a</sup>	8.54 <sup>a</sup>	0.40 <sup>ab</sup>	0.40 <sup>a</sup>
S <sub>7</sub>	1.42 <sup>ab</sup>	4.89 <sup>a</sup> (2.21)	10.58 <sup>a</sup>	8.46 <sup>a</sup>	0.36 <sup>a</sup>	0.31 <sup>a</sup>
S <sub>8</sub>	2.40 <sup>c</sup>	12.17 <sup>c</sup> (3.49)	17.21 <sup>b</sup>	13.33 <sup>c</sup>	0.97 <sup>d</sup>	1.60 <sup>bc</sup>
Mean	2.09	10.8(2.19)	14.86	12.60	0.80	1.16
SEm±	0.10	0.10	0.73	0.65	0.06	0.12
LSD(0.05)	0.29	0.29	2.07	1.84	0.18	0.34

\*Values in Parentheses are square root transformed; LSD- Least Significant Difference, Figure with similar letters as superscript do not differ significantly

**Fig.1** Effect of different treatments on germination per cent



**Plate.1** Influence of seed treatments on seedling growth in fresh seeds

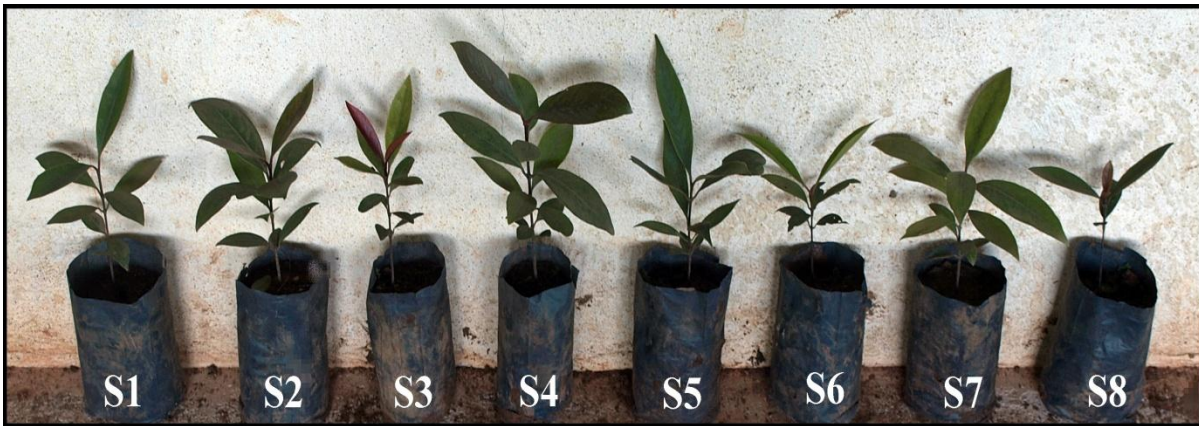




**Plate 2:** Influence of seed treatments on seedling growth in seed stored for 30 days



**Plate 3:** Influence of seed treatments on seedling growth in seed stored for 60 days



**Plate 4:** Influence of seed treatments on seedling growth in seed stored for 90 days



### Effect of seed treatment on seedling growth

The effect of different seed treatment on growth of seedling showed significant variation for all the growth parameter. Seed treated with mechanical scarification of seed coat showed maximum collar diameter, average number of leaves, root weight, shoot weight while root length and shoot length were found maximum in seed treated with GA<sub>3</sub>. The minimum collar diameter and root length were observed in hot water treatment while other growth parameters were lowest in seed treated with hydrogen peroxide (Table 2).

The maximum collar diameter, average number of leaves, root length and shoot length were recorded in seed stored up to 60 days it could be due to the presence of favourable growth condition manifested by environment. Ologundudu *et al.*, (2013) conducted study on effect of light on *Delonix regia*, *Abelmoschus esculentus*, *Amaranthus cruentus*, *Celosia argentea* and *Corchorus olitorius*. They revealed that the light condition affect development and germination of seedlings. The result is in line with Silveira *et al.*, (2014) study concluded that seed storage for short periods does not reduce seedling growth and survival of *Mimosa foliolosa*.

Root weight and shoot weight were found maximum in seed stored up to 90 days it could be due to the to the enhanced root length, shoot length, collar diameter and number of leaves per plant. These parameters have led to increase overall photosynthesis rate within the plant and resulted in higher biomass production. Maximum values for collar diameter, average number of leaves, root weight and shoot weight were recorded in seed treated with mechanical scarification of seed coat it could be due to the mechanical damaging of seed coat; it was an efficient

method for breaking seed coat dormancy. It improved seed imbibitions and germination (Botsheleng *et al.*, 2014), so the water, oxygen and soil nutrient is available and the growth of seedling was fast. Root length and shoot length were found maximum in seed treated with GA<sub>3</sub> could be due to the combine effect of scarification of seed coat and GA<sub>3</sub>. Mechanical Scarification of seed removes the impermeable seat coat and GA<sub>3</sub> helps in intermodal and sub-apical elongation and root growth.

Gurung *et al.*, (2014) studied the effect chemicals and growth regulators on germination, vigour and growth of passion fruit. They concluded that application of GA<sub>3</sub> might have boosted growth by increasing cell multiplication and cell elongation resulting in better plant growth. The result is in line with Chandrashekara (1996) where the study has revealed that seedling vigour, seedling growth and dry matter were high in seed soaked in GA<sub>3</sub> for 24 hours.

The study has concluded that seed storage and seed treatment had great impact on seedling growth. The overall results indicated that seed stored up to 60 days and treated with mechanical scarification of seed coat treatment best for the growth of seedling of *Garcinia gummi-gutta*.

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