



Effect of seasons on seed germination of *Terminalia tomentosa* wight & arn

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Abstract

Survival and development of a plant depends upon successful seed germination. The effect of seasons or seasonal influence on germination and survivability percentage of *Terminalia tomentosa* were studied. In the initial trials, no germination was recorded with depulped (removal of exocarp) dried seeds through mechanical scarification. Before heaped on sand bed, the healthy dried seeds were soaked in water for 24-48 hrs. Maximum germination phase (imbibition period) seed germination percentage during summer and survivability percentage of saplings were recorded high in rainy season. No germination was recorded in winter. During the study period, less than 50% of seed germination was noticed.

Keywords: germination, seasons, survivability, *Terminalia tomentosa*

Introduction

Terminalia tomentosa is commonly called as 'Asan' and is native to southern and southeast Asia. *T. tomentosa* is a medium-sized to fairly long deciduous tree. It is ovoid, longitudinally thin and horizontally veined with 5 broad wings having 3.5 to 6.5 cm length not exceeding beyond the fruit apex. The fruits are collected by lopping. The fruits ripen from February-April and they turn brown when they ripe and best time for the collection is when the tree becomes leafless. The fruit of *T. tomentosa* is botanically a drupe; which are winged and papery with straight marks (e-flora of India, 2021) [1]. Due to diverse nature, the over exploitation of these trees by the pharmaceutical, leather and timber industries throughout hills causes their destruction. However, species of *Terminalia* have not been included in any afforestation programme because of the problems associated with its poor germination due to hard seededness and low germination (Negi *et al.*, 1995) [6].

Materials and Methods

Germination studies of *Terminalia tomentosa* wight & arn.

Terminalia tomentosa is conventionally propagated through seeds. These seeds have low viability and due to hard seed coat, exhibit poor germination. The viability of the seeds and percentage of seed germination was checked periodically for every season during summer (March-June), Rainy (July-October) and winter (November-February) seasons. To study the seed germination, raising seedlings on sand bed was evaluated. The seeds were used from the natural stands of scattered trees of Tirumala hills, Seshachalam forests, Eastern Ghats.

Source and collection of Seed

Highly mature fruits/drupes of *T. tomentosa* were amassed from Seshachalam forests of Eastern Ghats of Tirumala hills, Chittoor district of Andhra Pradesh during the months April-May every year for four years. After segregating healthy fruits, these were stored at room temperature for the experimental work.

Raising of saplings on sand bed

Seed germination study was conducted to determine the germination of the seeds. Before sowing, seeds were heaped tightly in gunny bags and immersed in tap water for 24-48 hours. Subsequently these seeds were placed on wet sand bed precisely sheathed with wet gunny bag on it.

Pattern of seed germination on sand bed

The seeds were assessed periodically by counting germinated seeds. The germination data was recorded from the date of sowing and continued till the germination ceased. These were watered twice a day, in the late morning and early evening. Germination percentage was summed up diurnally to attain cumulative germination percentage. Germinated seeds were counted until no further germination was recorded for three consecutive days.

Seedling survivability pattern in nursery bags

Each germinated seedling was sown in black polythene bags filled with farmyard manure, soil and sand in 1:3:1 ratio, as recommended for growing tree seedlings of *T. tomentosa* (Central Silk Board).

Germination phase (imbibition period), seed germination (%) and survivability (%)

The imbibition period (number of days from sowing to commencement of germination) was recorded. Seed germination percentage was recorded daily from the commencement of germination and continued for 3 weeks till the termination of germination. The data on total number of seedlings survived after 4 weeks was recorded. Germination percentage and survival percentage in nursery bags was calculated by recording data at the end of growing season.

$$\text{Germination percentage (GP)} = \frac{\text{Number of seeds germinated}}{\text{Total number of seeds sown}} \times 100$$

$$\text{Survivability percentage (SP)} = \frac{\text{Number of seedlings survived}}{\text{Total number of seedlings planted}} \times 100$$

Effect of seasonal influence on percentage of seed germination and survivability of seedlings

To ascertain the effect of seasons on seed germination percentage and survivability of seedlings in nursery, seeds of bigger size were collected during April-May from Seshachalam forests, Tirumala hills. Healthy seeds were sorted out and from these 100 seeds were taken for each sowing period on sand bed in all the three seasons viz. summer (March-June), rainy (July-Oct) and winter (November-February) to assess the viability and germination percentage. The germinated seedlings were planted in nursery bags, composited with mixture of FYM, soil and sand.

Results and Discussion

Germination studies of *Terminalia tomentosa* wight & arn.

Seed is one of the incredible products of the nature which encloses within itself a promise of life. The year wise percentage of seed germination and survivability of saplings in nursery bags of *T. tomentosa* is presented in Table 1.

Raising of saplings on sand bed

No germination was recorded in the initial trials where dried seeds of this species were depulped (removal of exocarp) through mechanical scarification using scissors and heaped on sand bed. Then dried seeds were soaked in water for 24 h, then depulped and overlaid on sand bed to enhance the germination phase (results not shown). However, no major change in germination was observed.

Pattern of seed germination on sand bed

In the final study, seeds were not depulped, rather the dried seeds were initially tied in gunny bags and were soaked in water for 24 h. Then these were taken out and heaped as single layer on sand bed and then covered with wet gunny bag which resulted in better seed germination percentage.

Seedling survivability pattern in nursery bags

In the early trials, without farmyard manure, sand and soil in different ratios was mixed (results not shown). Later, FYM was added along with sand and soil, enhanced the survivability percentage.

Germination phase (Imbibition period), seed germination (%) and survivability (%)

In the present study, less than 50 % of seed germination percentage was observed. Highest seed germination (43.33) was observed in 2017 and lowest percentage (34.00) in 2016. The saplings survivability percentage (5.66) was recorded high in 2014 and minimum (3.66) was in 2015.

Mewded *et al.*, (2018) studies stated that fruits soaked in water improves permeability of the pericarp thus increasing the moisture and oxygen uptake. Hossain *et al.*, (2005) [2] have also reported effective results in *Terminalia chebula* with respect to faster and higher germination percentage, seedling growth and biomass production when seeds/fruits were soaked in cold-water for 48 h rather than with control (without depulping and soaking) and other treatments.

According to the literature cited, the tropical trees show wide heterogeneity in terms of seed size (Vozzo, 2002; Khan, 2004 and Panna and Sundriyal, 2013) [10, 5, 8] and seed-size dependent seedling growth (Khan and Shankar, 2004; Sundriyal and Sundriyal, 2005) [5, 9]. Information on

the germination performance with respect to these parameters would be of immense use to understand species distribution and management of forest stands (Khan *et al.*, 2002) [4]. Moreover, germination phase, frequency of germination and survivability percentage is also variable. The other reasons for poor germination could be probably due to rotten seeds or infection by fungal pathogens Okeyo *et al.*, (2020) [7].

Effect of seasonal influence on percentage of seed germination and survivability of saplings

Germination of seeds and survivability of saplings during all the three seasons were observed and results are presented in Table 2.

The mean germination phase varied from 8.67 to 13.92 days. Seed germination (germination phase) started 8 days after sowing and continued for 2 weeks. Different seasons significantly affected the germination phase. Less germination period (8 days) during summer and highest germination period (14 days) during rainy seasons were observed. Seed germination percentage varied from 23.25 to 37.25. Highest seed germination percentage (37.25) was noticed during summer which was significantly high and lowest (23.25) was observed in winter. Survivability percentage ranged from 4.00 to 6.08. It is Significantly higher (6.08) in winter and lowest (4.0) in summer.

The timing of seed collection is a significant outcome for the study of seed germination (Negi and Todaria, 1995) [6]. Survival and development of a plant depends upon successful seed germination. In the present study, less than 50 % of seed germination percentage was observed. It was comparatively high during summer and number of days (germination phase) for germination were also less. During rainy season, number of days (germination phase) were increased significantly and produced least germination percentage. Chauhan *et al.*, (2002) evaluated germination behavior of *Terminalia* species in which *T. tomentosa* germination percentage was recorded maximum at high temperatures and taken minimum at median germination time (days). Germination was noticed till October (rainy season) and no germination was recorded during winter season. According to literature cited, seed viability of *T. tomentosa* is limited for about 4-5 months. Since mature fruits/seeds are available only during March to May, survivability of seedlings is significantly poor in both the seasons but comparatively more during rainy season. Wolks *et al.*, (2018) stated that seeds from drylands record higher germination at warm compared to cold temperatures.



Fig 1: Mature fruit/dupe/seeds of *Terminalia tomentosa*

Conclusion

Seed germination is highly variable, may be due to external environmental factors and due to internal factors like many seeds are often devoid of seed kernels and often seed kernels are either malformed or infected with various parasites. The results of the study showed that strong seasonal influence effects the percentage of seed germination of *T. tomentosa*. It shows faster and minimum

germination phase and maximum seed germination during summer and highest survivability percentage of saplings during rainy.

Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.



a. Germination of seeds after 10 days of sowing
 b. Germination of seeds after 28 days of sowing
 c. Saplings in nursery bags

Fig 2: Seed germination of *Terminalia tomentosa* wight & arn. on sand bed

Table 1: Percentage of seed germination and survivability of saplings of *Terminalia tomentosa* Wight & Arn.

S. No	Year	Seed germination (%)	Survivability of saplings (%)
1	2014	38.66	5.66
2	2015	35.33	3.66
3	2016	34.00	4.33
4	2017	43.33	4.66

Table 2: Seasonal influence on percentage of seed germination and survivability of seedlings

S. No	Seasons	Germination phase (days)	Seed germination (%)	Survivability of saplings (%)
1	Summer (Mar-Jun)	8.67 ± 0.88	37.25 ± 5.33	4.00 ± 0.95
2	Rainy (Jul-Oct)	13.92 ± 1.16	23.25 ± 4.86	6.08 ± 1.83
3	Winter (Nov-Feb)	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00

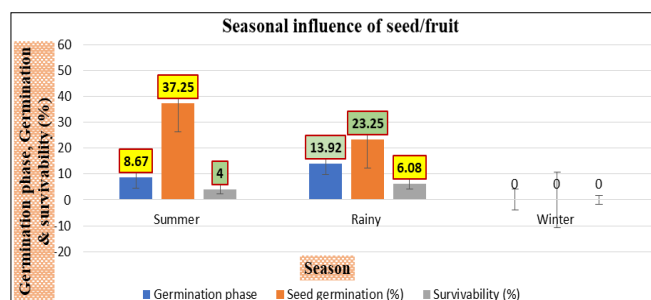


Fig 3: Seasonal influence on percentage of seed germination and survivability of seedlings

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