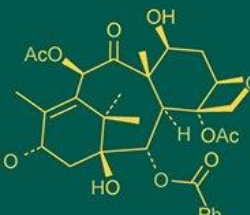
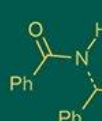


## International Journal of Advanced Biochemistry Research



ISSN Print: 2617-4693  
ISSN Online: 2617-4707  
NAAS Rating (2026): 5.29  
IJABR 2026; SP-10(8): 2222-2226  
[www.biochemjournal.com](http://www.biochemjournal.com)  
Received: 18-05-2026  
Accepted: 22-06-2026

**Animesh Kanawjia**  
Research Scholar, College of Forestry, Sam Higginbottom Institute of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India

**Sameer Daniel**  
College of Forestry, Sam Higginbottom Institute of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India

**Antony J Raj**  
College of Forestry, Sam Higginbottom Institute of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India

**Afaq Majid Wani**  
College of Forestry, Sam Higginbottom Institute of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India

**Dr. Ritu Prakash Dubey**  
Professor & Head, Department of Food Nutrition and Public Health, NAI, SHUATS-Prayagraj, Uttar Pradesh, India

**Corresponding Author:**  
**Animesh Kanawjia**  
Research Scholar, College of Forestry, Sam Higginbottom Institute of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India

## Effect of Different Storage Containers on Germination Parameters in *Diospyros melanoxylon* R

**Animesh Kanawjia, Sameer Daniel, Antony J Raj, Afaq Majid Wani and Ritu Prakash Dubey**

DOI: <https://www.doi.org/10.33545/26174693.2026.v10.i8Sy.9731>

### Abstract

An experiment was conducted to evaluate the effect of different storage containers on germination parameters of *Diospyros melanoxylon* L. (Tendu) seeds under laboratory conditions over a period of 12 months. Seeds were stored in nine different containers: open tray (T<sub>0</sub>), air-tight plastic jar (T<sub>1</sub>), earthen pot (T<sub>2</sub>), gunny bag (T<sub>3</sub>), paper bag (T<sub>4</sub>), cotton bag (T<sub>5</sub>), polythene bag (T<sub>6</sub>), glass jar (T<sub>7</sub>) and tin container (T<sub>8</sub>). Germination percentage, germination value, germination energy and germination speed were recorded at 2, 6 and 12 months of storage during two consecutive years and pooled data were analysed. Significant differences were observed among the treatments for all parameters. After 12 months of storage, the highest germination percentage was recorded in glass jar (88.58%) followed by air-tight plastic jar (87.20%) and tin container (87.65%), while the lowest was observed in open tray (28.48%). Similar trends were recorded for germination value, energy and speed. The results clearly indicated that enclosed containers such as glass jar, air-tight plastic jar and tin container were most effective in maintaining seed viability and vigour of *D. melanoxylon* for up to one year, whereas open storage lead to rapid deterioration. These findings provide practical recommendations for safe seed storage of this economically important species.

**Keywords:** *Diospyros*, seed storage, germination, storage containers

### Introduction

Forest is a dense growth of trees, together with other plants, covering a large area of land. It represents an ecosystem a community of plants and animals interacting with one another and with the physical environment. The forests of the world are classified into three general types or formations, which are primarily expressions of the climate in which the vegetation grows. In addition, the forest provides shelter for wildlife, recreation and aesthetic renewal for people, and irreplaceable supplies of oxygen and soil nutrients. Deforestation, particularly in the tropical rain forests, has become a major environmental concern, as it can destabilize the earth's temperature, humidity, and carbon dioxide levels (Anonymous, 1998) [1].

*Diospyros melanoxylon* Roxb., commonly known as tendu or kendu and belonging to the family Ebenaceae, is a medium-sized tree or shrub that may attain a height of up to 25 m and a girth of 1.9 m. The bark is pelican in colour and exfoliates in rectangular scales. The primary root is long, thick and fleshy at first, later becoming woody and greyish, often swollen in the upper part near ground level. Leaves are opposite or alternate, coriaceous, up to 35 cm long, tomentose on both sides when young and becoming glabrous above when fully grown. Male flowers are mauve, mostly three-flowered, while female flowers are also mauve, mostly extra-axillary or sometimes solitary, generally two and opposite each other, and larger than the male flowers (Luna and Chamoli, 2006) [18]. Fruits are olive green, ovoid, 3-4 cm across and contain 1 to 8 seeds. The pulp is yellow, soft and sweet. Seeds are compressed, oblong, shiny and often banded. The tree may be deciduous or evergreen depending on its habitat. In dry localities it remains leafless for a short period during the hot weather and regains its leaves in May-June, whereas in moist localities it is evergreen. Flowers appear from April to June on new shoots and the fruit ripens after one year. The edible fruits are largely eaten and disseminated by fruit bats, birds and hornbills. The tree produces good seed in alternate years (Anonymous, 1998) [1].

*Diospyros melanoxylon* is an important multipurpose tree species native to the Indian subcontinent. The leaves of this species are extensively used in the manufacture of beedi (country cigarette), providing livelihood to millions of tribal and rural people in central and

eastern India. In addition, the fruits are edible and the wood is valued for timber and fuel (Khamngamang *et al.*, 2017). Despite its economic and ecological importance, natural regeneration of *D. melanoxylon* is often poor due to irregular seed production, short seed viability under ambient conditions and lack of standardized storage practices (Imchen *et al.*, 2015)<sup>[13]</sup>. Seed storage is a critical component of any successful nursery or plantation programme. The type of container used for storing seeds significantly influences moisture content, gaseous exchange, temperature fluctuations and pest infestation, all of which affect seed longevity and germination potential. Hermetic containers that restrict moisture and oxygen exchange have been reported to prolong viability of many orthodox seeds, whereas permeable containers often lead to faster deterioration under fluctuating environmental conditions (Chitra *et al.*, 2010; Hossain *et al.*, 2005)<sup>[6, 12]</sup>. Although limited studies have examined the seed biology of *D. melanoxylon*, systematic information on the comparative performance of different storage containers on its germination attributes over extended periods is scarce. Therefore, the present investigation was undertaken to assess the effect of various storage containers on germination percentage, germination value, germination energy and germination speed of *D. melanoxylon* seeds stored for 2, 6 and 12 months under laboratory conditions.

## Materials and Methods

The present study was carried out in the laboratory and nursery of the College of Forestry, Sam Higginbottom Institute of Agriculture, Technology and Sciences, Naini, Allahabad. The experimental site is situated between 28°52' N latitude and 81° E longitude at an altitude of 98 m above mean sea level. The climate of the region is generally tropical, characterized by hot summers with a maximum temperature of 48 °C during May-June and cold winters with a minimum temperature of 1°C. The average annual rainfall ranges from 850 mm to 1000 mm, most of which is received during the monsoon season. Ripe fruits of *Diospyros melanoxylon* were collected from healthy, superior, medium-sized trees growing at different locations in Uttar Pradesh. The collection sites lie between 23°45' to 23°35' N latitude and 82°78' to 83°27' E longitude. The seeds were extracted by depulping the fruits through maceration followed by thorough washing under running tap water. The cleaned seed lot was then divided into different small samples for the subsequent experiments. The experiment was laid out in a completely randomized design

(CRD) with nine treatments and three replications. The treatments consisted of storage of seeds in an open tray (T<sub>0</sub>), air-tight plastic jar (T<sub>1</sub>), earthen pot (T<sub>2</sub>), gunny bag (T<sub>3</sub>), paper bag (T<sub>4</sub>), cotton bag (T<sub>5</sub>), polythene bag (T<sub>6</sub>), glass jar (T<sub>7</sub>) and tin container (T<sub>8</sub>). Equal quantities of seeds were placed in each container and stored under ambient laboratory conditions. The experiment was repeated for two consecutive years. Germination tests were conducted at 2, 6 and 12 months after storage. Seeds were placed in sterilized petri dishes or germination trays lined with moist filter paper and maintained at optimum temperature. The parameters recorded included germination percentage, calculated as the proportion of seeds that produced normal seedlings; germination value, computed following standard formulae that combine the speed and completeness of germination; germination energy, expressed as the percentage of seeds germinated by a specified early period of the test; and germination speed, representing the rate of germination expressed as the sum of germinated seeds divided by the number of days. Analysis of variance (ANOVA) was performed and treatment means were compared using critical difference (CD) at the 5% level of significance.

## Results and Discussion

### Germination percentage

Significant differences were observed among storage containers for germination percentage at all storage periods (Table 1). At 2 months of storage, the highest pooled germination was recorded in air-tight plastic jar (94.77%) which was statistically at par with glass jar (94.31%) and tin container (94.21%). The lowest germination was observed in open tray (82.14%). After 6 months, glass jar maintained the highest germination (93.34%) followed by tin container (92.12%) and air-tight plastic jar (91.69%), while open tray declined sharply to 55.48%. At 12 months of storage, glass jar recorded the maximum germination percentage (88.58%), closely followed by tin container (87.65%) and air-tight plastic jar (87.20%). Open tray showed the poorest performance (28.48%). Intermediate containers such as polythene bag (78.84%), earthen pot (59.74%), paper bag (52.06%), cotton bag (50.91%) and gunny bag (48.79%) showed progressive decline with increasing storage duration. Overall mean germination decreased from 89.47% at 2 months to 64.70% at 12 months, indicating gradual loss of viability with time, the magnitude of which was strongly influenced by the type of container.

**Table 1:** Effect of different storage containers on germination percentage (%) in *Diospyros melanoxylon* under laboratory condition

| Treatment      | Treatment Details     | 2 months storage |          |        | 6 months storage |          |        | 12 months storage |          |        |
|----------------|-----------------------|------------------|----------|--------|------------------|----------|--------|-------------------|----------|--------|
|                |                       | 1st Year         | 2nd Year | Pooled | 1st Year         | 2nd Year | Pooled | 1st Year          | 2nd Year | Pooled |
| T <sub>0</sub> | Open Tray             | 83.20            | 81.07    | 82.14  | 55.59            | 55.37    | 55.48  | 29.25             | 27.72    | 28.48  |
| T <sub>1</sub> | Air Tight Plastic Jar | 95.22            | 94.32    | 94.77  | 92.79            | 90.59    | 91.69  | 88.70             | 85.70    | 87.20  |
| T <sub>2</sub> | Earthen Pot           | 90.05            | 87.67    | 88.86  | 75.22            | 74.18    | 74.70  | 60.09             | 59.39    | 59.74  |
| T <sub>3</sub> | Gunny Bag             | 86.64            | 85.56    | 86.10  | 67.57            | 68.28    | 67.92  | 49.19             | 48.40    | 48.79  |
| T <sub>4</sub> | Paper Bag             | 86.94            | 86.71    | 86.82  | 72.25            | 70.78    | 71.51  | 53.31             | 50.81    | 52.06  |
| T <sub>5</sub> | Cotton Bag            | 86.80            | 85.54    | 86.17  | 69.54            | 69.14    | 69.34  | 51.30             | 50.52    | 50.91  |
| T <sub>6</sub> | Polythene Bag         | 92.46            | 91.20    | 91.83  | 86.75            | 85.40    | 86.08  | 79.37             | 78.31    | 78.84  |
| T <sub>7</sub> | Glass Jar             | 95.17            | 93.45    | 94.31  | 92.86            | 93.82    | 93.34  | 89.54             | 87.62    | 88.58  |
| T <sub>8</sub> | Tin Container         | 94.67            | 93.75    | 94.21  | 92.62            | 91.62    | 92.12  | 87.95             | 87.34    | 87.65  |
| Mean           |                       | 90.13            | 88.81    | 89.47  | 78.36            | 77.69    | 78.02  | 65.41             | 63.98    | 64.70  |
| F - Test       |                       | S                | S        | S      | S                | S        | S      | S                 | S        | S      |
| S. Ed          |                       | 0.92             | 0.72     | 0.49   | 0.92             | 0.64     | 0.44   | 1.09              | 1.16     | 0.62   |
| CD 0.05        |                       | 1.93             | 1.50     | 0.70   | 1.93             | 1.34     | 0.62   | 2.29              | 2.43     | 0.88   |

### Germination value

Germination value followed a similar pattern (Table 2). At 2 months, glass jar (32.19), air-tight plastic jar (31.98) and tin container (31.89) recorded the highest values, significantly superior to open tray (24.65). After 6 months, glass jar (30.77) and tin container (30.46) continued to perform best,

while open tray dropped to 11.63. At 12 months, glass jar maintained the highest germination value (28.48), followed by tin container (27.88) and air-tight plastic jar (27.61). Open tray recorded the lowest value (3.32). The mean germination value declined from 29.00 at 2 months to 17.06 at 12 months.

**Table 2:** Effect of different storage containers on germination value in *Diospyros melanoxylon* under laboratory condition

| Treatment      | Treatment Details     | 2 months storage |          |        | 6 months storage |          |        | 12 months storage |          |        |
|----------------|-----------------------|------------------|----------|--------|------------------|----------|--------|-------------------|----------|--------|
|                |                       | 1st Year         | 2nd Year | Pooled | 1st Year         | 2nd Year | Pooled | 1st Year          | 2nd Year | Pooled |
| T <sub>0</sub> | Open Tray             | 24.93            | 24.37    | 24.65  | 11.80            | 11.46    | 11.63  | 3.40              | 3.24     | 3.32   |
| T <sub>1</sub> | Air Tight Plastic Jar | 32.23            | 31.73    | 31.98  | 30.16            | 29.83    | 29.99  | 27.96             | 27.26    | 27.61  |
| T <sub>2</sub> | Earthen Pot           | 28.23            | 28.19    | 28.21  | 20.98            | 20.59    | 20.79  | 13.81             | 13.71    | 13.76  |
| T <sub>3</sub> | Gunny Bag             | 26.95            | 26.53    | 26.74  | 17.49            | 17.08    | 17.28  | 9.35              | 8.86     | 9.11   |
| T <sub>4</sub> | Paper Bag             | 28.04            | 27.32    | 27.68  | 19.39            | 18.18    | 18.78  | 10.70             | 10.64    | 10.67  |
| T <sub>5</sub> | Cotton Bag            | 27.83            | 27.06    | 27.45  | 18.06            | 17.91    | 17.98  | 10.01             | 9.49     | 9.75   |
| T <sub>6</sub> | Polythene Bag         | 30.40            | 29.96    | 30.18  | 27.67            | 26.23    | 26.95  | 23.23             | 22.77    | 23.00  |
| T <sub>7</sub> | Glass Jar             | 32.56            | 31.82    | 32.19  | 31.24            | 30.30    | 30.77  | 28.53             | 28.44    | 28.48  |
| T <sub>8</sub> | Tin Container         | 32.06            | 31.73    | 31.89  | 30.72            | 30.19    | 30.46  | 28.13             | 27.63    | 27.88  |
| Mean           |                       | 29.25            | 28.75    | 29.00  | 23.06            | 22.42    | 22.74  | 17.23             | 16.89    | 17.06  |
| F-Test         |                       | S                | S        | S      | S                | S        | S      | S                 | S        | S      |
| S. Ed          |                       | 0.27             | 0.33     | 0.18   | 0.32             | 0.29     | 0.22   | 0.40              | 0.34     | 0.19   |
| CD 0.05        |                       | 0.57             | 0.70     | 0.26   | 0.66             | 0.61     | 0.31   | 0.83              | 0.71     | 0.27   |

### Germination energy

Germination energy was significantly influenced by storage containers (Table 3). At 2 months, glass jar (78.81%), air-tight plastic jar (78.45%) and tin container (78.06%) showed the highest energy. After 6 months, the same three treatments remained superior (76.77%, 75.45% and 76.29%,

respectively). At 12 months, glass jar (72.84%), tin container (72.52%) and air-tight plastic jar (72.22%) continued to exhibit high germination energy, whereas open tray recorded only 22.25%. The progressive reduction in germination energy with prolonged storage was least pronounced in hermetic containers.

**Table 3:** Effect of different storage containers on germination energy in *Diospyros melanoxylon* under laboratory condition

| Treatment      | Treatment Details     | 2 months storage |          |        | 6 months storage |          |        | 12 months storage |          |        |
|----------------|-----------------------|------------------|----------|--------|------------------|----------|--------|-------------------|----------|--------|
|                |                       | 1st Year         | 2nd Year | Pooled | 1st Year         | 2nd Year | Pooled | 1st Year          | 2nd Year | Pooled |
| T <sub>0</sub> | Open Tray             | 67.65            | 65.98    | 66.82  | 45.17            | 44.16    | 44.66  | 22.18             | 22.31    | 22.25  |
| T <sub>1</sub> | Air Tight Plastic Jar | 78.50            | 78.40    | 78.45  | 75.88            | 75.02    | 75.45  | 72.40             | 72.04    | 72.22  |
| T <sub>2</sub> | Earthen Pot           | 73.54            | 72.22    | 72.88  | 61.77            | 61.53    | 61.65  | 49.28             | 48.76    | 49.02  |
| T <sub>3</sub> | Gunny Bag             | 72.02            | 70.52    | 71.27  | 56.04            | 56.69    | 56.36  | 39.17             | 37.90    | 38.54  |
| T <sub>4</sub> | Paper Bag             | 72.68            | 72.43    | 72.55  | 59.45            | 56.29    | 57.87  | 42.39             | 40.23    | 41.31  |
| T <sub>5</sub> | Cotton Bag            | 71.91            | 72.37    | 72.14  | 56.57            | 57.36    | 56.96  | 41.58             | 39.59    | 40.59  |
| T <sub>6</sub> | Polythene Bag         | 74.79            | 75.45    | 75.12  | 71.14            | 71.35    | 71.24  | 65.50             | 64.71    | 65.10  |
| T <sub>7</sub> | Glass Jar             | 79.15            | 78.47    | 78.81  | 76.86            | 76.69    | 76.77  | 73.63             | 72.06    | 72.84  |
| T <sub>8</sub> | Tin Container         | 77.97            | 78.15    | 78.06  | 76.75            | 75.84    | 76.29  | 73.83             | 71.22    | 72.52  |
| Mean           |                       | 74.25            | 73.78    | 74.01  | 64.40            | 63.88    | 64.14  | 53.33             | 52.09    | 52.71  |
| F - Test       |                       | S                | S        | S      | S                | S        | S      | S                 | S        | S      |
| S. Ed          |                       | 1.27             | 0.94     | 0.54   | 1.03             | 0.89     | 0.51   | 0.72              | 1.13     | 0.54   |
| CD 0.05        |                       | 2.67             | 1.97     | 0.77   | 2.17             | 1.86     | 0.72   | 1.51              | 2.37     | 0.77   |

### Germination speed

Germination speed also varied significantly among treatments (Table 4). At 2 months of storage, the highest pooled speed was recorded in glass jar (30.39) and air-tight plastic jar (30.17), while open tray recorded the lowest (26.32). After 6 months, glass jar (29.44), air-tight plastic jar (29.50) and tin container (29.26) maintained superiority. At

12 months, glass jar (28.25), tin container (28.09) and air-tight plastic jar (27.98) again performed best, whereas open tray declined to 9.07. The data confirm that seeds stored in hermetic containers not only retained higher germinability but also germinated more rapidly even after one year of storage.

**Table 4:** Effect of different storage containers on germination speed in *Diospyros melanoxylon* under laboratory condition

| Treatment      | Treatment Details     | 2 months storage |          |        | 6 months storage |          |        | 12 months storage |          |        |
|----------------|-----------------------|------------------|----------|--------|------------------|----------|--------|-------------------|----------|--------|
|                |                       | 1st Year         | 2nd Year | Pooled | 1st Year         | 2nd Year | Pooled | 1st Year          | 2nd Year | Pooled |
| T <sub>0</sub> | Open Tray             | 26.57            | 26.07    | 26.32  | 17.53            | 17.75    | 17.64  | 9.18              | 8.96     | 9.07   |
| T <sub>1</sub> | Air Tight Plastic Jar | 30.19            | 30.15    | 30.17  | 29.77            | 29.23    | 29.50  | 28.14             | 27.82    | 27.98  |
| T <sub>2</sub> | Earthen Pot           | 28.52            | 28.04    | 28.28  | 24.17            | 23.71    | 23.94  | 19.34             | 19.26    | 19.30  |
| T <sub>3</sub> | Gunny Bag             | 27.73            | 27.57    | 27.65  | 22.02            | 21.36    | 21.69  | 15.49             | 15.09    | 15.29  |
| T <sub>4</sub> | Paper Bag             | 27.87            | 28.09    | 27.98  | 23.05            | 22.59    | 22.82  | 16.73             | 16.21    | 16.47  |
| T <sub>5</sub> | Cotton Bag            | 27.91            | 28.05    | 27.98  | 22.58            | 21.80    | 22.19  | 16.15             | 16.17    | 16.16  |
| T <sub>6</sub> | Polythene Bag         | 29.32            | 29.74    | 29.53  | 27.48            | 27.42    | 27.45  | 25.41             | 25.79    | 25.60  |
| T <sub>7</sub> | Glass Jar             | 30.39            | 30.39    | 30.39  | 29.50            | 29.38    | 29.44  | 28.63             | 27.87    | 28.25  |
| T <sub>8</sub> | Tin Container         | 30.73            | 29.47    | 30.10  | 29.40            | 29.12    | 29.26  | 28.38             | 27.80    | 28.09  |
| Mean           |                       | 28.80            | 28.62    | 28.71  | 25.06            | 24.71    | 24.88  | 20.83             | 20.55    | 20.69  |
| F - Test       |                       | S                | S        | S      | S                | S        | S      | S                 | S        | S      |
| S. Ed          |                       | 0.24             | 0.24     | 0.24   | 0.37             | 0.26     | 0.26   | 0.36              | 0.26     | 0.26   |
| CD 0.05        |                       | 0.50             | 0.50     | 0.34   | 0.78             | 0.55     | 0.37   | 0.76              | 0.55     | 0.37   |

## Conclusion

The present study clearly demonstrated that the type of storage container has a profound influence on the retention of seed viability and vigour of *Diospyros melanoxylon*. Among the nine containers evaluated, glass jar, air-tight plastic jar and tin container proved most effective in maintaining high germination percentage, germination value, germination energy and germination speed even after 12 months of storage. These hermetic containers minimized moisture exchange and protected seeds from fluctuating environmental conditions, thereby slowing down the ageing process. In contrast, open tray storage resulted in rapid loss of viability, with germination declining to less than 30% after one year. Permeable containers such as gunny bag, paper bag and cotton bag offered only intermediate protection. It is therefore recommended that seeds of *D. melanoxylon* intended for nursery use or long-term conservation should be stored in glass jars, air-tight plastic jars or tin containers under ambient laboratory conditions. Adoption of these simple and low-cost storage practices can significantly improve seed availability and support large-scale plantation and regeneration programmes of this economically important species.

## Acknowledgements

The authors are grateful to the college of Forestry, SHUATS for providing necessary laboratory facilities to carry out this research work.

## References

- Anonymous. The wealth of India: raw material. Vol. 2B. New Delhi: Publication and Information Directorate, CSIR; 1998. p. 308-310.
- Harish Babu B, Larkin A, Kumar H. Effect of plant growth regulators on rooting behavior of stem cuttings of *Terminalia chebula* (Retz.). Int J Curr Microbiol Appl Sci. 2018;7(8):2475-2482.
- Harish Babu B, Larkin A, Kumar H. Effect of plant growth regulators on rooting behavior of stem cutting of *Terminalia arjuna*. Plant Archives. 2018;18(2):2159-2164.
- Bajpai CK, Yadav MP, Tewari RK. Effect of time and depth of sowing on germination and seedling growth of *Buchnanian lanzan* Spreng. Indian Journal of Agroforestry. 2006;8(1):42-50.
- Chaubey A, Prasad R, Choubey OP, Pant NC. Some aspects of germination studies in *Buchnanian lanzan* Speng seeds. Journal of Tropical Forestry. 1997;13(2):65-73.
- Chitra CR, Anil Kumar C, Binda S. Germination and storage studies on *Orozylum indicum* (L.) Vent seeds. Journal of Non Timber Forest Products. 2010;17(2):179-181.
- Ekameren IJ, Sen S, Kumar H, Marak J. Community status, distribution and behavior of wild primates in Intanki National Park, Nagaland. Journal of Entomology and Zoology Studies. 2018;6(5):796-800.
- Sangma EMT, Kumar H. Effect of different growth regulators and potting media on macro-propagation and morphological appearance of bakul (*Mimusops elengi* L.). Trends in Biosciences. 2015;8(23):6399-6407.
- Handa AK, Anand RK, Ajeet, Chaturvedi OP, Kumar RV, Chauhan R. Effect of water stress on seed germination of *Pongamia pinnata* (Karanj). Bhartiya Krishi Anusandhan Patrica. 2006;21(2):159-162.
- Handa AK, Dar SA, Uma. Response of different growing media on germination and seedling growth of *Albizia amara*. Indian Journal of Agroforestry. 2005;7(2):58-61.
- Helmerix RH, Pfeifer RP. Different varietal responses of winter wheat germination and early growth to control limited moisture conditions. Agronomy Journal. 1954;46:560-562.
- Hossain MA, Arefin MK, Khan BM, Rahman MA. Effect of seed treatment on germination and seedling growth attributes of Horitaki (*Terminalia chebula* Retz) in nursery. Research Journal of Agriculture & Biological Sciences. 2005;1(2):135-141.
- Imchen C, Sen S, Kumar H, Marak J. Effect of different pretreatment method on seed germination of Gulmohar (*Delonix regia*). Trends in Biosciences. 2015;8(19):5105-5110.
- Kajal RS, Singhrot. Vegetative propagation of Ber (*Zizyphus mauritiana* Linn.). IX studies on the effect of sowing depths and dates on seed germination and seedling growth. Haryana Journal of Horticulture Science. 1986;15:156-161.
- Kerishnaveni K, Sekhar I, Rajan PA, Rao G. Influence of seed fortification treatment with inorganic nutrients and growth regulators on seed and seedling quality characteristics in bamboos (*Bambusa bambusa*). Indian Forester. 2010;136(8):1006-1012.
- Pamei K, Larkin A, Kumar H. Effect of different treatments on the germination parameters and seedling quality index of *Tectona grandis* (Teak) under nursery

- condition. International Journal of Chemical Studies. 2017;5(5):2418-2424.
17. Kumar D, Mishra DK. Studies on seed germination in *Capparis deciduas* (Rorsk) Edgew: a tree of hot desert. Indian Forester. 2008;134(4):500-504.
  18. Luna RK, Chamoli N. Effect of root trainers size on quality of seedling production in *A. procera* (Roxb), *E. teriticornis* and *A. catechu* Wild. Annals of Forestry. 2006;14(2):184-193.
  19. Mc Donough WT. Water potential of germinating seeds. Botanical Gazette. 1979;136:106-108.
  20. Mohd Saad, Kumar H, Umrao R. Effect of the different growth regulators on vegetative propagation of Buddha Belly Bamboo. Advances in Life Sciences. 2016;5(4):1310-1314.
  21. Mundhe AD, Shamet GS. Propagation of soapnut (*Sapindus mukorossi*) by cuttings and seeds. Indian Forester. 2011;137(8):1015-1019.
  22. Narkhede SS. Storage behavior of *Simarouba glauca* seed under different temperature and containers. Journal of Non Timber Forest Products. 2010;17(2):183-185.
  23. Palani M, Dasthagis MG, Kumaran K, Jerlin R. Effect of pre sowing treatment on growth attributes of *Albizia lebbecki* (L). Annals of Forestry. 1996;4(1):85-88.
  24. Shukla SK, Solanki KR. Studies on seed germination and plant growth of Chironji (*B. lanzan*). Journal of Tropical Forestry. 2000;16(1):44-49.
  25. Singh S, Bhandari AS, Jharea SK, Kunjam KK, Shukla PK. Influence of root trainer cell volume and seedling density on planting stock of tropical broad leaved trees. Journal of Tropical Forestry. 2005;21(1-2):17-22.
  26. Som Dutt, Verma KS. Effect of pre sowing treatment on germination of sandal (*Santalum album*) under laboratory conditions. Annals of Forestry. 2005;13(2):239-242.
  27. Tewari RK, Bajpai CK. Chironji (*Buchanania lanzan*). In: Saroj PL, Awasthi OP, editors. Advances in arid horticulture. Vol. II. Lucknow: International Book Distributing Company; 2004. p. 93-101.
  28. Troup RS. The silviculture of Indian trees. Vol. I. London: Clarendon Press; 1921. p. 240-243.
  29. Umarani R, Bharathi A, Karivaratharaju TV. Effect of seed size and depth of seed sowing on germination and seedling growth of *Cassurina equisetifolia*. Journal of Tropical Forestry. 1997;10(2):275-276.
  30. Venkatesh A, Umarani R, Vanangamudi K. Standardization of potting mixture for production of quality seedlings of *Casuarina equisetifolia*. Indian Journal of Agroforestry. 2009;11(1):80-82.
  31. Vijay, Umrao R, Kumar H, Bijalwan A. Application of different growth media for production of quality planting stock in *Salix alba* Linn. International Journal of Current Research in Biosciences and Plant Biology. 2016;3(5):107-112.