



Seed maturity indices in indian bean tree (*Catalpa bignonioides* Walt.) under temperate conditions of Kashmir Himalayas

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ABSTRACT

Seed maturity indices play a crucial role in determining the optimal time for seed collection and subsequent propagation, thus ensuring successful reproduction and conservation efforts. This study aimed to investigate the maturity indices of Indian Bean Tree (*Catalpa bignonioides* Walt.) under temperate conditions of Kashmir. Collected seeds were assessed for germination percentage, specific gravity, seed weight, and changes in fruit/seed color at 15-day intervals. The results revealed that seeds reached maturity by mid-November, indicated by a change in seed color from green to silver grey. Seeds collected during this period demonstrated the highest specific gravity (0.24), seed weight per 100 seeds (2.32 g), and moisture content (9.69%). Furthermore, seeds collected in mid-November exhibited the maximum germination percentage of 89.40%. *Catalpa bignonioides* seeds are fully mature by mid-November. Therefore, for successful nursery raising of this species, it is recommended to collect seeds during mid-November. These results provide valuable information to foresters and conservationists regarding the optimal time for seed collection and subsequent propagation, contributing to the effective management and conservation of *Catalpa bignonioides* populations.

Key words: *Catalpa bignonioides*, Kashmir, maturity indices, nursery raising, seed germination

The successful establishment of a seedling nursery for any plant species relies on the collection of mature and viable seeds (Kumar *et al.*, 2022). It is crucial to determine the exact stage of seed maturity to avoid gathering immature and non-viable seeds, which can result in significant financial and labor losses (Willians, 1985). Maturity indices, encompassing both physical and chemical characteristics of seeds or fruits, play a vital role in successful seed collection. Hence, it is imperative to identify indicators of maturity specific to individual tree species to ensure timely and abundant collection of healthy and vigorous seeds. Premature collection of seeds leads to the acquisition of immature seeds and subsequent crop loss (Mirgall *et al.*, 2016).

Catalpa bignonioides Walt, belonging to the family Bignoniaceae and the order Lamiales, is a native tree species of the southern United States. Renowned for its vibrant and captivating flowers, this species is widely cultivated as an ornamental tree and holds a prominent place in parks, gardens, and roads across temperate countries (Mir *et al.*, 2014). Aside from its aesthetic value, *Catalpa bignonioides* possesses various medicinal properties, such as its bark being recognized for its antiseptic properties, as an antidote to snake bites, and for its sedative and vermifuge attributes (Ghani and Bana, 2014). The plant is also utilized in traditional medicine for treating whooping cough, while its bark serves as a substitute for Quinin, suitable for stabilizing soil in areas prone to landslide and construction of fence posts and railroad ties (Chiej, 1984; Vines, 1982).

Despite the immense aesthetic and recreational value of *Catalpa bignonioides*, as well as its exotic nature, there is a lack of general information regarding its maturity indices in the Kashmir Valley. Therefore, the present study aims to generate the information regarding the maturity indices of the Indian Bean tree, *Catalpa bignonioides* Walt, under the temperate conditions of the Kashmir Himalayas. Understanding the seed maturity

indices of this species will contribute to improved seed collection practices, enhancing the efficiency and success of seedling nursery establishment and subsequent plantation efforts in the region. By investigating the maturity indices of *Catalpa bignonioides* in the specific context of the Kashmir Himalayas, this study seeks to bridge the existing knowledge gap and provide valuable insights for horticulturists, seed collectors, and environmental practitioners involved in the cultivation and conservation of this species. The findings of this research will contribute to the sustainable management and propagation of *Catalpa bignonioides*, ensuring its continued presence in the natural and cultivated landscapes of the region.

MATERIALS AND METHODS

Study area: Kashmir valley is located in Northwest extremity of India between 32°-17' and 38°-58' north latitude and 73°-35' and 80°-36' east longitude. The average altitude of Kashmir valley ranges between 1,500-23,00 m above mean sea level. Kashmir valley is bestowed with temperate climate, winters are severe from December-March. There is wide range of temperature from minimum of -8°C in winter to a maximum of 34°C in summer. Annual precipitation ranges from 676-1193 mm. Forest nursery of the Faculty of Forestry is located between 34°-08' N latitude and 74°-83' longitude, with average mean sea level of 1587 m. Nursery is located at Shalimar campus that is around 14 km southeast to Srinagar city. Nursery has well drained silty loam soil.

Seed collection and processing: Seeds of Indian bean tree were collected fortnightly starting from mid-August from phenotypically identified superior trees situated at Shalimar campus, Botanical Garden and Faculty of Forestry SKUAST- Kashmir. In order to determine the optimal time of harvest the seeds were continuously evaluated for different tests.

Data collection and analysis: The change in fruit/seed colour was judged at the intervals of 15 days (ISTA, 1981). Fruit/pod colour was observed by ocular judgement by comparing it with colour chart. Seed dimensions were recorded with the help of digital caliper. Moisture percentage was calculated by Schubert and Adams, 1971 formula. Specific gravity (Oliver, 1974). Seed weight of 100 seeds was recorded with the help of sensitive top balance. Collected seeds were subjected to germination tests by using Petri plates covered internally at bottom by double fold germination paper. Seeds were placed sparsely and moistened with distilled water regularly in Petri plates. The test was run for 28 days. Regular watch and ward were maintained so that Petri plates were free of fungal attack. As soon as radicle emerged, seed was considered germinated. Germination per cent was calculated in four replications with 100-seeds in each replication (ISTA, 1981). The experiment was conducted by using CRBD and collected data was analyzed statistically.

RESULTS AND DISCUSSION

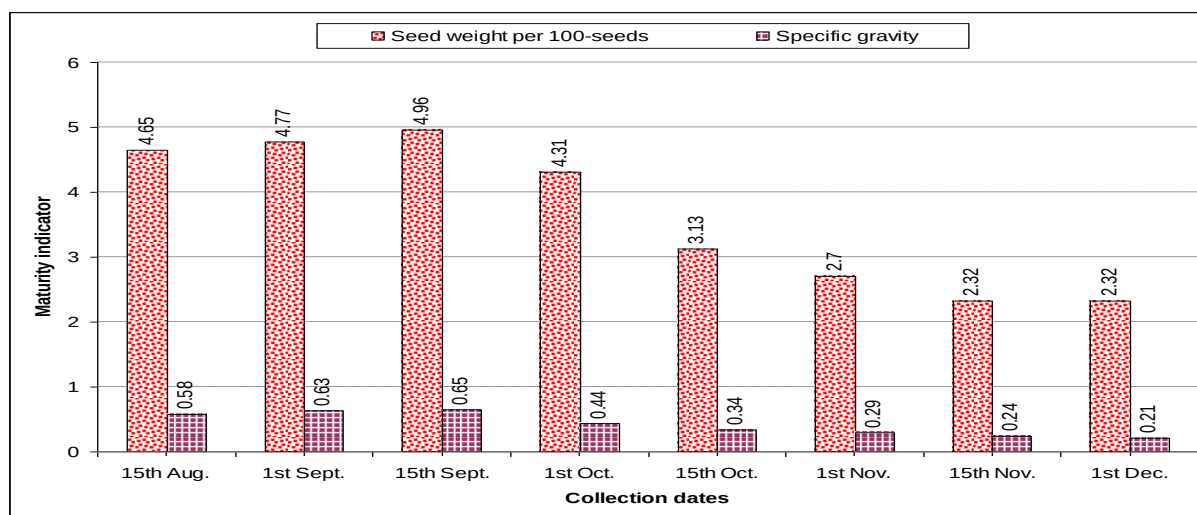
Seed/Fruit Colour: The change in colour was observed at each collection. The colour as observed through ocular observation was green in mid-August and changes to light brown with greenish orange by mid-September and finally silvery grey by mid-October. Thereafter no further change in colour was observed (Table-1). It clearly indicates that change in colour gives a clue towards maturity of seeds of catalpa. The findings are in conformity with Willians (1985) who observed that colour change in cone/fruit is a reliable criteria for judging maturity of seed. A relationship is often established between maturity and their colour, which is used to identify physiological maturity of tree seed such as in *Liquidambar styraciflua* and *Platanus orientalis* (Bonner, 1972) and in *Quercus* species (Bonner, 1974). During maturity when colour change was recorded silvery grey by mid-November germination was recorded maximum. The study is also in conformity with the studies conducted by Singh *et al.* (2010) who observed the fruit colour was dark green during the first collection and pale yellow at final collection in *Aisandra butyracea*.

Seed weight and seed dimensions: During initial collection (1st week of August) when the seed colour was green, seed weight per 100-seeds was recorded 4.65 g, after 30 days i.e. by mid-September seed weight per 100-seeds was 4.96 g which was highest, thereafter it starts decreasing due to drying of seeds and on mid-October seed weight per 100 g was recorded 3.13 g. Furthermore, it declined continuously reaching a minimum value of 2.32 g/100-seeds by mid-November (Table-1, Fig. 1). The seed dimensions (length and breadth) varied with each collection. The average length and breadth of seeds recorded in mid-August were 40.8 mm and 4.11 mm, respectively. The seed size increased initially and attained maximum length and breadth in 1st week of September. Thereafter the seed size decreased from mid-September onwards. The minimum length and breadth of seeds i.e. 24.46 mm and 3.92 mm were recorded in mid-November and remained constant thereafter.

Table-1: Indicators for maturity of seeds in Indian Bean tree (*Catalpa bignonioides* Walt.)

S. No.	Date of collection	Colour	Seed weight per 100-seeds (g)	Specific gravity	Moisture (%)	Seed dimensions (mm)		Germination (%)
						Length	Breadth	
1.	15 th August	Green	4.65	0.58	50.8	40.8	4.11	0
2.	1 st September	Green	4.77	0.63	42.30	42.30	4.35	0
3.	15 th September	Light brown	4.96	0.65	37.90	38.80	4.23	11.25
4.	1 st October	Light brown to silvery grey	4.31	0.44	32.75	33.90	4.00	45.60
5.	15 th October	Silvery grey	3.13	0.34	28.12	31.9	3.98	62.31
6.	1 st November	Silvery grey	2.70	0.29	18.51	28.46	3.95	69.10
7.	15 th November	silvery grey	2.32	0.24	9.69	24.46	3.92	89.40
8.	1 st December	Silvery grey	2.32	0.21	8.34	24.46	3.92	88.90
CD_(0.05)			0.45	0.23	1.48	1.65	0.22	2.29

Increase in seed weight and seed dimensions despite the fact the moisture content shows decreasing trend throughout the collection period could be attributed to the synthesis and accumulation of food resources. However, on 15th September and 1st October seed dimensions and seed weight starts decreasing, respectively due to loss of moisture in reaching the full maturity of seed as it confirms with seed maturity is closely related with decline in moisture per cent of seed (Adam and Rinnie, 1981; Pandit *et al.* 2002). The findings of present study are also in conformity with the studies conducted by Bhat *et al.* (2017), Kumar *et al.* (2022) and Bhat and Ram (2015).

**Fig. 1: Indicators for maturity of seeds of Indian bean tree (*Catalpa bignonioides* Walt.) collected on different dates**

Specific gravity: It is evident from Table-1 and Figure 1 that the specific gravity initially increases until mid-September, after which it starts decreasing, reaching a minimum value of 0.21 in the first week of December. During the first seed collection in mid-August, a specific gravity of 0.58 was recorded. Subsequently, it increases to 0.63 by mid-September, 0.65 by the first week of September, and then decreases to 0.44 in the first week of October, 0.34 by mid-October, 0.29 by the first week of November, and finally 0.21 during the first week of December. The decline in specific gravity and the increase in seed germination are related, as explained by various works in conifer species (Oliver, 1974; Singh, 1998). Furthermore, with a further decrease in specific gravity from 0.24 to 0.21 on December 1st, the germination also slightly decreases from 89.4% to 88.9%. This

may be attributed to a hard seed coat or the presence of inhibitors on the surface of the seed (Hartman and Kester, 1976). The findings of the present study are consistent with studies conducted by Bhat *et al.* (2017), Kumar *et al.* (2022) and Bhat and Ram (2015).

Moisture content: Moisture content showed a declining trend throughout the collection period. The highest value for moisture content was recorded as 50.8 per cent on mid-August. After that, it showed a declining trend i.e. 37.9 per cent in mid-September, 28.12 per cent in mid-October and finally 8.34 per cent in 1st week of December (Table-1, Fig.2). Singh and Kachari (2006) reported that germination per cent of seeds increases with decreasing moisture content in cones of *Pinus kesiya* (Khasi pine). The findings of present study are also in conformity with the studies conducted by Bhat *et al.* (2017), Kumar *et al.* (2022) and Bhat and Ram (2015).

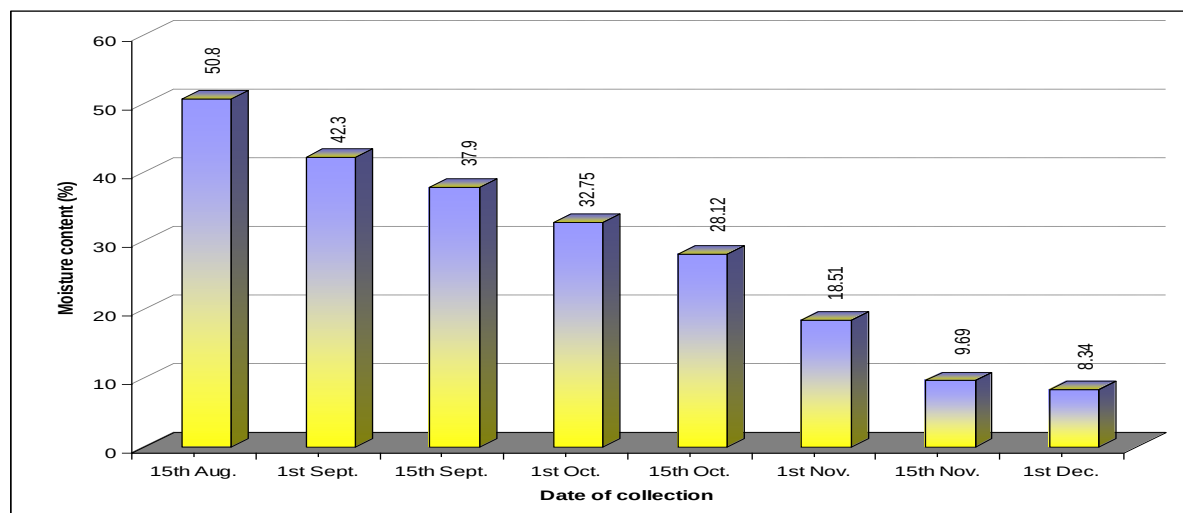


Fig. 2: Moisture content (%) as an indicator of seed maturity of Indian bean tree (*Catalpa bignonioides* Walt.) collected on different dates.

Germination per cent: Initially no germination was recorded in the beginning from mid-August to 1st week of September when the seed colour was green. With the onset of colour change, germination also commenced and reached to maximum of 89.4 per cent by mid-November and thereafter the germination per cent decreased. Similar findings were reported in the previous studies conducted by Bhat *et al.*, (2017), Kumar *et al.*, (2022) and Bhat and Ram (2015).

CONCLUSION

The study conducted on *Catalpa bignonioides* seeds revealed significant findings regarding their maturation and optimal collection time for successful nursery raising. The observation of seed color change from green to silver grey by mid-November indicates the maturity of the seeds. Moreover, seeds collected during this period exhibited the highest specific gravity, seed weight per 100 seeds, moisture content, and germination percentage. These results provide compelling evidence that *Catalpa bignonioides* seeds reach their full maturity by mid-November. The findings of this research have important implications for foresters and conservationists involved in the management and conservation of *Catalpa bignonioides* populations. The recommended collection period of mid-November ensures the acquisition of mature seeds that are more likely to result in successful propagation and nursery raising. By following this recommendation, foresters and conservationists can enhance their efforts in preserving and maintaining the population of *Catalpa bignonioides*. The identification of the optimal collection period will enhance the success rates of nursery raising, leading to the establishment of healthy and sustainable populations.

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