



Effect of Time of Cone Collection on Seed Germination and Seedling Vigour Index of *Abies spectabilis* (D. Don) Spach

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ABSTRACT

An experiment was conducted to study the effect of time of cone collection on the germination of *Abies spectabilis* seeds. The seeds collected at 15 days interval (fortnightly basis) during September, 2011 to November, 2011 were subjected to germination testing. Significant differences were observed in germination percentage, moisture content of seeds and specific gravity of cones of *Abies spectabilis* collected during different collection period. The study revealed that seed collected during second fortnight of October recorded maximum germination (42.00%) with average seedling length (7.56cm) and seedling vigour index (318.60). At the time of optimum maturity, seed color was Brown Group 200B and moisture content of seed was 8.73% whereas cone colour was Blue Group 103A and specific gravity of cones was 0.64%. On the basis of present investigation, it is recommended that seeds of *A. spectabilis* should be collected during second fortnight of October before their dispersal in the natural forest.

Key Words:

Abies spectabilis, Collection Period, Germination Percent, Moisture Content, Specific Gravity

INTRODUCTION

Abies spectabilis (D. Don) Spach syn. *Abies webbiana* Lindl. is one of the indigenous and ecologically important conifer of higher temperate regions of Western Himalayas. It belongs to the family Pinaceae. It is commonly known as "Talispatra". In Himachal, it is locally called as "Pan", "Tosh" etc. It is a pyramidal tree and grows up to a height of 50 m or more. The crown is broadly conical with horizontally spreading branches. The bark is dark gray, rough and scaly, whereas, the shoots are red-brown, deeply grooved and pubescent in the grooves. The cones are cylindrical, violet-purple when young and turn

brown in colour on maturity (Vidakovic 1991). The young shoots have short brown hairs. The cones are shorter and thicker than *Abies pindrow* (Troup 1921). It grows at an altitude of > 3000m above msl occurring towards the upper limits of the tree growth in moist and cool areas mostly in northern aspects.

It occurs mostly in association with tree species viz., *Abies pindrow*, *Acer caesium*, *Acer acuminatum*, *Betula utilis*, *Corylus jacquemontii*, *Picea smithiana*, *Pinus wallichiana*, *Prunus cornuta*, *Quercus semicarpifolia* and *Taxus wallichiana*. Talispatra is well known for its medicinal value and is commonly used in Indian

system of medicine especially in Ayurvedic system for preparing different medicines.

The natural regeneration of *A. spectabilis* is very poor even in its natural zone of occurrence, owing to many biotic and abiotic factors. The seed germination is often poor, usually taking about 6 – 8 weeks time in the nursery. The information regarding optimum time of cone/seed collection in *Abies spectabilis* is not available in the literature. Therefore, need is being felt to find out the optimum time of cone collection in *A. spectabilis* for getting maximum germination in the nursery. In this context, the present study was carried out to determine the effect of time of cone/seed collection on the germination of *Abies spectabilis* seeds under laboratory conditions.

MATERIALS AND METHODS

The cones of *A. spectabilis* were collected periodically on 15 days (fortnightly) interval starting from 1st September onwards till 15th November, 2011 from the healthy and middle aged trees from Kalabagh near Churdhar area in Shimla Wildlife Division. Cones of *A. spectabilis* were packed in paper bags and immediately brought to the Seed Laboratory of Himalayan Forest Research Institute, Shimla for further studies. The cones were spread in shade for two weeks for proper drying. After drying of cones, the seeds were extracted manually by hand rubbing and subsequently cleaned and processed for further studies. The colour of cones and seeds collected during different collection time were recorded by matching their colour with Royal Horticultural Society Colour Chart, London (2007) to judge the cone and seed colour changes during different time of collection.

The moisture content of seeds collected during different collection time were taken by oven dry method by placing the seeds in oven at a temperature of $103 \pm 2^\circ\text{C}$ for 17 hours as per International Seed Testing Association Rules (ISTA, 1985). The specific gravity of cones was measured by water displacement method (Barnett, 1979). The seeds collected during different harvest

time were considered as treatments and were subjected to germination testing giving uniform treatment of overnight soaking in water to determine the effect of time of harvest on germination of the seeds. The treatments used in the experiment were: T₁: seeds collected during 1st fortnight of September, T₂: seeds collected during 2nd fortnight of September, T₃: seeds collected during 1st fortnight of October, T₄: seeds collected during 2nd fortnight of October and T₅: seeds collected during 1st fortnight of November.

Germination Test

300 seeds each of the experimental treatment were sown on the thick moist filter paper placed above the cotton in petri-dishes in a lot of 100 seeds using completely randomized design with three replications per treatment as per ISTA rules (1985). The petri-dishes containing seeds were kept in the seed germinator and allowed to germinate at a constant temperature of 20° C. Watering was done as and when required. Seed germination was noticed when radicle emerged. The germination data was taken daily after the commencement of germination until it was over and constant germination was obtained. The total germination percentage was calculated at the end of the experiment. The data of germination percentage and moisture content of samaras and seeds thus obtained were subjected to analysis of variance (ANOVA) to establish the significance of differences between the treatments. The critical difference (CD) was calculated for the variables studied using a computer program "SX"-a statistical package for Social Sciences.

RESULTS AND DISCUSSION

The data on cone and seed colour of *A. spectabilis* recorded during different time of collection is given in Table 1. Cone colour of *A. spectabilis* varied from Violet Blue Group 98C to Brown Group 200B with the advancement of collection time from first fortnight of September to first fortnight of November. Similarly, seed colour also varied from Greyed Orange Group 165 A to Brown Group 200B with the advancement of

collection time from first fortnight of September to first fortnight of November. However, the maximum germination was obtained in Treatment T₄ i.e. seed collected during second fortnight of October when the cone colour was recorded Blue Group 103A where as seed colour was recorded Brown Group 200B respectively. Bhardwaj *et al.* (2002) correlated the fruit colour of *Albizzia chinensis* for standardization of its seed collection time and Singh *et al.* (2005) also correlated the fruit colour of *Fraxinus micrantha* for identification of optimum seed collection period. Negi and Sharma (2015) and Jeena *et al.* (2012) also correlated fruit and seed colour for determining the optimum time of seed collection in *Fraxinus xanthoxyloides* and *Adina cordifolia*.

The specific gravity of cones and moisture content of seeds of *A. spectabilis* recorded during different time of collection (Table 1) revealed that specific gravity of cones was maximum in treatment T₁ (0.77%) which is followed by treatments T₂(0.76%), T₃(0.71%), T₄(0.64%) and T₅ (0.63%) respectively, whereas, moisture content of seeds were recorded maximum in treatment T₃ (9.32%) which is followed by treatment T₂(9.26%), T₁ and T₄(8.73%) and T₆ (8.66%) respectively. The moisture content of seeds of *A. spectabilis* first tends to increase from first fortnight of September to first fortnight of October with advancement of collection period and after that it showed decreasing trend with advancement of collection period.

Table 1. Effect of time of collection on maturity indices parameters of *Abies spectabilis*

Treatment	Time of Collection	Cone Colour	Seed Colour	Specific Gravity of Cones (%)	Moisture content of Seed (%)
T ₁	1 st fortnight of September	Violet Blue Group 98C	Greyed Orange Group 165 A	0.77	8.73
T ₂	2 nd fortnight of September	Blue Group 102B	Greyed Orange Group 177A	0.76	9.26
T ₃	1 st fortnight of October	Blue Group 103B	Greyed Orange Group 177 B	0.71	9.32
T ₄	2 nd fortnight of October	Blue Group 103A	Brown Group 200B	0.64	8.73
T ₅	1 st fortnight of November	Brown Group 200B	Brown Group 200B	0.63	8.66

Germination per cent of the seeds of *Abies spectabilis* collected under different collection period varied significantly (Table 2). The maximum germination per cent was observed in the seeds collected during second fortnight of October i.e., treatment T₄ which was recorded 42.00% germination and significantly better than

all other treatments followed by treatment T₃ (30.00%), T₂ (25.00%), T₅(20.00%) and T₁ (10.00%) respectively.

The average seedling length also varied significantly among the seeds collected during different collection period. The maximum seedling length of 7.56 cm was recorded in T₄ i.e., seeds

collected during 2nd fortnight of October which is at par with T₅ (7.41cm) but significantly better than other collection period. The minimum seedling length of 6.42cm was recorded in T₁ i.e., seeds collected during 1st fortnight of September. The seedling vigour index (SVI) also varied significantly among the seeds collected during different collection time. The maximum seedling vigour

index of 318.60 was recorded in T₄ i.e., seeds collected during 2nd fortnight of October which is significantly better than all other treatments and followed by Treatment T₃ (196.20), T₂(164.90) and T₅(148.70). The seeds collected during 1st fortnight of September recorded minimum seedling vigour index of 64.15.

Table 2. Effect of time of seed collection on seed germination and seedling vigour index of *Abies spectabilis*

Treatment	Time of Collection	Germination Percent (%)	Seedling Length (cm)	Seedling Vigor Index
T ₁	1 st fortnight of September	10.00	6.42	64.15
T ₂	2 nd fortnight of September	25.00	6.55	164.90
T ₃	1 st fortnight of October	30.00	6.57	196.20
T ₄	2 nd fortnight of October	42.00*	7.56*	318.60*
T ₅	1 st fortnight of November	20.00	7.41	148.70
S. Em. ±		2.46	0.29	21.62
C. D. (0.05)		5.25	0.63	46.09

*Significant at 0.05% level

The results of the study revealed that optimum time of seed collection in *A. spectabilis* is found to be second fortnight of October (T₄) as the seed collected during second fortnight of October gives best germination percent of 42.00 % (T₄) where as other collection times recorded less germination percent. This study is also in conformity with the studies conducted by Singh et al. (2005) in Himalayan Ash (*Fraxinus micrantha*) which revealed that the maximum germination (44.50%) was found in seeds collected during 15 October and thus, recommended that the seeds of this species should be collected in the second fortnight of October (180 days after anthesis) at a time when the fruit colour changed to grey orange for better germination, seedling growth and vigour index. Singh (1989) reported that in *Picea*

smithiana (Spruce) optimum time of seed collection was found to be second fortnight of October with maximum (50%) germination percent where as Singh et al. (1996) revealed that in *Abies pindrow*, seeds collected during mid-September or at the beginning of October recorded best germination and is in conformity with the present study. Similarly, Sharma et al. (1996) reported that in *Acacia catechu*, the seeds collected on 10th December gave the highest percentage germination (62.27) and germination value (29.32), and subsequently produced the most vigorous seedlings with the greatest shoot (36.96 cm) and root (32.00 cm) length. Paul and Nayital (1995) also reported similar results during the studies on effect of seed maturity on growth and quality of *Grewia optiva* trees growing at

Solan where best seed germination, seedling growth and quality with respect to time of fruit collection were obtained with seeds harvested on October 16 from the medium diameter trees. The result of the present study indicates that cones of *Abies spectabilis* should be collected during second fortnight of October for getting better results. The specific gravity of cones and moisture content of seeds of *A. spectabilis* during the best time of seed collection is 0.64 and 8.73% respectively.

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REFERENCES

- Barnet, James P. 1979. An easy way to measure cone specific gravity. In: Karrfalt, R.P., Comp. Proceedings of the seed collection workshop; May 16-18, 1979; Macon, GA. SA-TP-8. Atlanta, GA: U.S Department of Agriculture, Forest Service, State and Private Forestry: 21-23.
- Bhardwaj SD, Sharma Sandeep and Panwar Pankaj 2002. Standardization of date of collection and mother tree diameter class for harvesting *Albizia chinensis* seeds. Seed Research, 30(1): 30-35.
- Chauhan N S 2006. Medicinal and Aromatic Plants of Himachal Pradesh. Indus Publishing Company, New Delhi. P 47-49. (632)
- Chopra RN, Nayar SL and Chopra IC. 1986. *Glossary of Indian Medicinal Plants (Including the Supplement)*. Council of Scientific and Industrial Research, New Delhi. ISTA 1985. International Rules for Seed Testing. Rules and Annexure. International
- Jeena LS, Kaushal R, Dhakate PM, Tewari SK 2012. Seed maturation indices for better regeneration and multiplication of Haldu (*Adina cordifolia* Roxb.). Indian Journal of Agriculture Sciences 82 (4):381-383.
- Manandhar NP. 2002. *Plants and People of Nepal*. Timber Press. Oregon. ISBN 0-88192-527-6
- Negi PS and Sharma S 2015. Effect of time of fruit collection on the seed germination of *Fraxinus xanthoxyloides* (Wall. Ex G. Don) DC. Indian Forester. 141 (4): 379-383.
- Singh V 1989. Seed maturity indices in Spruce (*Picea smithiana*). *Indian Forester*, 115 (5): 342-347.
- Singh O, Lalhal JS and Prasad B. 1996 . Artificial ripening and seed maturity in Silver Fir (*Abies pindrow* Spach). *Indian Forester*, 122 (5): 386-389.
- Singh V, Lavania SK, Shah VK and Kumar S. 2005. Studies on the effect of date of fruit collection on seed germination and early seedling growth in Himalayan ash (*Fraxinus micrantha*_ Lingelsh). *Indian Forester*, 131(1): 31-36.
- Sharma DP, Bhardwaj SD and Nayital RK. 1996. Effect of seed collection time and tree vigour on germination and growth of *Acacia catechu* Willd seedlings. *Range Management and Agroforestry*, 17(1): 75-80.
- Troup RS 1921. *The Silviculture of Indian Trees*, Vol-III, Oxford at the Clarendon Press. 1195p.
- Varghese P and Nayital RK 1995. Effect of seed maturity on growth and quality of *Grewia optiva* Drummond seedlings. *Range Management and Agroforestry*. 16(1): 87-92.
- Vidakovic M. 1991. *Conifers: morphology and variation*. Croatia: Graficki Zavod Hrvatske. 754p.