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Cone, seed and germination characteristics in silver fir (*Abies pindrow* Spach) under Kashmir valley conditions

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Abstract
Mature cones of Silver fir (*Abies pindrow*) were collected from phenotypically superior trees at four different sites viz. Sind forest division(S_1), Lidar forest division (S_2), Tangmarg forest division (S_3) and Kehmil forest division (S_4)) in Kashmir valley during mid-Oct. Significant variation in cone characteristics were revealed. The site (S_3) produced the quality cones with maximum cone length (11.05 cm), cone diameter (4.42) cone weight (87.18g) and seed yield per cone (344/cone). The seed characteristics of this site, at dispersal revealed maximum germination percent (39.50) and germination value (4.67) whereas the mean germination time (MGT) was recorded as 21.9 days. The seeds collected from this site recorded maximum seed weight/1000 seeds (87.18g).Stratification increased seed germinability characteristics and maximum germination percent and germination value (GV) was recorded after 60 days of moist stratification and were recorded as 38.00 and 5.07 respectively. The MGT significantly declined from 25.24 (control) to 23.08 days (60 days stratification). Among the selected sites, site A_3 resulted in maximum germination percent (35.00**)**, GV (3.81) with MGT of 22.78 days (minimum).

Keywords: *Abies pindrow,* cones, seeds, stratification, germination percent, germination value and mean germination time

Introduction

Silver fir is distributed from Kashmir to Nepal at an altitudinal range of 2,550-3,350 m a.s.l. It is adapted to a wide range of site conditions is and is found abundantly in different forest divisions of Kashmir Himalaya. Its ability to thrive under different site condition make it an ecologically important tree species to investigate the cone, seed and germination behavior under different prevailing site conditions as environmental conditions have been reported a cause of high variability (Petros *et al.*, 2008) [15]. The variability study therefore assumes the importance for tree improvement programs (Wright, 1976) [22]. Moreover, the genus *Abies* is associated with poor seed cycles which impedes its artificial regeneration works. Identification of sites characterized with quality seed production can be an important strategy to compensate the shortages during the poor seed cycle.

Germination is one of the critical stages in a plant life cycle (Kavanagh and Carleton 1990) [8] which in most conifers is inhabited by intermediate physiological dormancy (Nikolaeva, 1969) [14]. This can be alleviated by moist stratification seeds. This practice can be used to attain vigorous, speedy, maximum and speedy germination. Stratification pre-sowing treatments approximates the environments that autumn-ripening seeds might find themselves upon dissemination (Krugman *et al*. 1974) [11] and depends upon the degree of dormancy (Bonner *et al*., 1974) [2].

Materials and Methods

Experimental sites

Four different experimental sites were selected. The stand characteristics of these sites stand is given in table-1.

Cone and seed collection

Ten phenotypically superior trees were trees were selected from each site at a distance of at least 50 m for cone collection. Cones were collected randomly from all aspects of the tree crown at the selected sites. Fresh weight of the cone were recorded by using electronic balance.

The length and the width (at the widest point) of the cones were measured (Johnson *et al*. 2003) with vernier calipers. The cone scales were detached from cone axis to obtain seed yield. The seeds were de-winged and the seed weight was recorded. The seeds were cut longitudinally for embryo observation and declared as empty (without embryo) and filled (with embryo).

Seed germinability

Seed germination experiments were performed in Petri-dishes lined with two filter paper discs. For stratification, the seeds harvested from the cones were wrapped in a soaked towel for water absorption to avoid the damage caused by the direct absorption (Jones and others, 1991). Germination was recorded after every two days and was considered complete when no additional seeds germinated. A seed was considered to have germinated when the embryonic leaves were released from the seed coat.

Germination value (GV)

The germination value (GV) was calculated following the method of Djavanshir and Pourbeik (1976) [5].

$$GV = \frac{\Sigma DGS}{N \times (GP\ 10)}$$

Where,
DGS = Daily germination speed=Cumulative germination per cent or Number of test days.
N = Frequency or number of DGS during the test
GP = Germination per cent at the end of the test

Mean germination time (MGT)

Mean germination time (MGT) was calculated by the formula given by Bonner (1983) [3].

$$MGT = \frac{\Sigma\ (\text{Daily germination} \times \text{days})}{\text{Number of seeds sown}}$$

Ungerminated seeds at the end of the test will be given value of n+1
Where,
N=Number of days in the test and these values were included in the calculation of means.

Table 1: Characteristics of the sampled forest divisions.

Forest Division	Stand density(N/ha)	Tree height (cm)	Dbh(cm)	Crown Width(m)
Sind(S_1)	401±15.42	23.12±3.91	27±1.12	3.3±0.13
Lidar(S_2)	442±12.35	26.12±3.12	31.1±3.48	3.5±0.29
Tanmarg(S_3)	358±13.45	25.32±4.16	29±2.15	3.91±0.52
Kehmil(S_4)	550±23.50	28.34±2.51	35.66±2.12	3.32±0.53

Results and Discussion

Cone and seed characteristics

Cone morphometric measurements revealed significant variability among the selected sites. Maximum cone length (11.05cm) and cone width (4.42cm) was recorded at site at site S_3. The minimum cone length(10.30cm) was recorded at site with a cone width of 3.80 cm(minimum). The cone weight varied between 87.18 (S_3) and 73.25g (S_4) whereas the seed yield/cone oscillated between 344 (S_3) and 272(S_4) (Table-2). Maximum seed weight of 80.40/1000 was recorded at site (S_3) and differed significantly from 67.22 and 61.15/1000 seeds recorded at S_2 and S_4 respectively. The empty seed percent varied between 20.80 and 31.75 at site S_3 and S_2 respectively. Maximum seed germination (39.50) and GV (4.67) was recorded at site S_3 with MGT OF 20.91(minimum). (Table-3). The sites studied, significantly affected the cone and seed morphological characteristics. The site S_3 produced the quality cones with highest cone weight, cone dimensions and seed yield. The cones on the commencement of dispersal at this site exhibited highest seed weight. The varying cone and seed characteristics can be attributed to a number of causes. The variability among the sites may be caused by the prevailing environment conditions during the cone maturation (Owens and Blake 1985). The heavy investment in cone development at site S_3 could be attributed to lower density recorded at that site which resulted in the development of wide and deep crown thus utilizing the site conditions efficiently. This is in agreement with the finding of petros (2008) [15] who reported heavy reproduction abilities in stands with open canopy cover in case of *pinus pinea.*. Salazar and Quesda (1987) reported variations in seed parameters in *P. wallichiana* may be attributed to different genetic architectures developed as a result of adaptation to diverse environmental conditions. The variation may also be due to the size of the parent tree and its position in the stand (Haq 1992; Arya *et al*., 1994) [6, 1]. Climatic conditions have proven to affect many of the vital activities of plants (Kohmann and Johnsen, 1994) [9]; (Stephenson, 1998) [20]; (Rehfeldt *et al*., 2002) [17]; (Stephenson and Van-Mantgem, 2005) [21]; (Levanic *et al*., 2009) [12].

The germination ability at dispersal revealed variability with maximum germination and germination value at site S_3.This is as a result of heavy seed weight recorded at the site which reduced the mean germination time significantly. The findings further indicate the lower density favours resource allocation in seeds.

Stratification and germinability characteristics

Stratification duration significantly increased the germination value and germination percent. Progressive increase in germination and germination value was recorded on increasing stratification duration whereas the mean germination declined. Maximum germination percent (38.00) and germination value (5.07) was recorded under 60 days of chilling duration whereas the MGT for the same chilling duration was recorded as 21.41(minimum).

Amongst the selected sites, site S_3 resulted in the significantly maximum germination value and germination percent and were recorded as 34.80 and 3.83 respectively whereas the mean germination time for the same site was recorded as21.91 days**.** Stratification method is deployed to match the conditions the seeds undergo upon dispersal. Stratification as a pre-sowing method increased germinability significantly at all sites. With the increase in stratification period progressive increasing trend was recorded in germination percent and germination value while as the MGT decreased therefore indicating the possibility of further improvement of germinability under increasing stratification durations. The cold stratification increases the GA_3 levels which increases the germination. It is a natural growth regulator present in seeds of many woody plants which stimulates germination (Chen *et al*., 2005) [4] Moist stratification also increases the tissue sensitivity to gibberellins and could be the factor that may be involved in controlling the germination (Koorneef *et al*., 2002 [10]. In non- stratified the inhibitors have balance with the growth promoters (Rehman and Park, 2002) [18] which reduce the germination. Stratification alters the balance by increasing GA_3 thus improving germination. Similar results were reported by (Rawat *et al*. (2010) [16] who also recorded the decrease in germination inhibitors during stratification. Mughal and Thapliyal (2013) [13] achieved improvement in seeds of *Cedrus deodara* after stratification. Highest germinability under 60 days of chilling duration at site S_3 is as a result of combined effect of high quality seed and higher stratification duration.

Table 2: Cone variability of *Abies pindrow* in different forest divisions.

Forest division	Cone length (cm)	Cone diameter (cm)	Cone weight (g)	Seed yield/cone
Sind (S_1)	10.30	3.80	75.33	332
Lidar (S_2)	10.78	3.92	70.25	292
Tanmarg(S_3)	11.05	4.42	87.18	344
Kehmil (S_4)	10.32	3.72	72.35	272
CD (≤0.05)	0.63	0.23	6.00	23

Table 3: Seed variability of *Abies pindrow* in different forest divisions at dispersal.

Forest Division	Seed weight(g)	Empty seed percent	Germination %	GV	MGT
Sind (S_1)	75.47	21.00	35.50	4.00	21.20
Lidar (S_2)	67.22	31.75	29.25	2.32	23.82
Tanmarg (S_3)	80.40	20.80	39.50	4.67	20.91
Kehmil (S_4)	61.15	31.00	23.25	1.69	26.40
CD (≤0.05)	6.23	5.40	7.54	0.96	0.81

Table 4: Germination percent as affected by collection sites and chilling duration in silver fir (*Abies pindrow*)

Forest Division	Stratification (days)					Mean
	Control	15	30	45	60	
Sind (S_1)	21.25	28.25	30.75	37.00	40.50	29.31
Lidar (S_2)	15.50	20.25	25.00	29.00	34.50	24.85
Tanmarg (S_3)	17.50	33.25	37.75	39.75	45.75	34.80
Kehmil (S_4)	14.00	22.75	24.25	26.00	33.75	24.15
Mean	17.06	26.13	29.44	32.94	38.00	28.71

CD (≤0.05)
Division : 1.55
Chilling duration : 1.98
Division× Chilling duration : 3.51

Table 5: Germination value (GV) as affected by collection sites and chilling duration in silver fir (*Abies pindrow*)

Forest Division	Stratification (days)					Mean
	Control	15	30	45	60	
Sind (S_1)	1.20	2.35	3.39	4.00	5.12	3.21
Lidar (S_2)	0.87	1.55	2.69	3.00	4.32	2.49
Tanmarg(S_3)	0.80	2.54	4.00	4.92	6.88	3.83
Kehmil (S_4)	0.74	1.02	1.88	2.50	3.94	2.02
Mean	0.90	1.87	2.99	3.61	5.07	2.89

CD (≤0.05)
Division : 0.42
Chilling duration : 0.93
Division× Chilling duration : 1.54

Table 6: Mean germination time (MGT) as affected by collection sites and chilling duration in silver fir (*Abies pindrow*)

Forest Division	Stratification (days)					Mean
	Control	15	30	45	60	
Sind(S_1)	25.54	24.92	22.30	21.75	21.00	23.10
Lidar(S_2)	25.62	23.81	23.55	22.81	22.00	23.56
Tanmarg(S_3)	23.92	22.82	21.45	21.35	20.00	21.91
Kehmil(S_4)	25.88	24.50	23.00	22.82	22.63	23.77
Mean	25.24	24.01	22.58	22.18	21.41	23.08

CD (≤0.05)
Division : 0.72
Chilling duration : 1.10
Division× Chilling duration : 1.70

References

1. Arya SR, Bhagat S, Singh O. Seed fertility in relation to tree size of *Abies pindrow* and *Picea smithiana*. Indian Forestry. 1994; 120:677-681
2. Bonner FT, Mc Lemore BF, Barnett JP. Pre-sowing treatment of seed to speed germination. In: Seeds of woody plants in U.S. Agri Handb No. 450. Forest Service U.S. Dept. of Agric. Washington. D.C, 1974.
3. Bonner FT. Germination responses of loblolly pine to temperature differentials on a two-way thermo gradient plate. Journal of Seed Technology. 1983; 8(1):6-14.
4. Chen S, Li W, Han M, Wang Y, Chien C. Association of abscisic acid and gibberellins with dormancy and germination in seeds of *Prunus buergeriana* Miq. Taiwan Journal of Forest Science. 2005; 20:227-237.
5. Djavanshir K, Pourbeik H. Germination value: A new formula. Silvae Genetica. 1976; 25:79-83.
6. Haq RU. Effect of seed production, distribution, viability, losses and germination on the natural regeneration of silver fir (*Abies pindrow*) in moist temperate forests of Pakistan. Pakistan Journal of Forestry. 1992; 42:102-111.
7. Jones SK, Samuel YK, Gosling PG. The effect of soaking and prechilling on the germination of noble fir seeds. Seed Science and Technology. 1991; 19:287-294
8. Kavanagh K, Carleton TJ. Seed production and dispersal patterns in populations of. Liriodendron tulipifera at the northern edge of its range in southern Ontario, Canada. Can J Forest Res. 1990; 20:1461-1470
9. Kohmann K, Johnsen O. The timing of bud set in seedlings of *Picea abies* from seed crops of a cool versus a warm spring and summer. Silvae Genet. 1994; 43:329-333.
10. Koornneef M, Bentsink l, Hilhorst H. Seed dormancy and germination. Current Opinion in Plant Biology. 2002; 5:33-36.
11. Krugman SL, Stein WI, Schmitt DM. Seed biology. In: Schopmeyer CS (coord) Seeds of woody plants of the United States, 1974.
12. Levanic T, Gricar J, Gagen M, Jalkanen R, Loader NJ, McCarroll D *et al*. The climate sensitivity of Norwayspruce [*Picea abies* (L.) Karst.] in the southeastern European Alps. Trees 2009; 23:169-180.
13. Mughal AH, Thapliyal RC. Effect of Chilling Temperature, Chilling Duration and Incubation Temperature on Germination Characteristics of C*edrus deodara* (D. Don) (G. Don) Seeds. 2013; 1(1):1-11.
14. Nikolaeva MG. Physiology of deep dormancy in seeds Izdatel'styo "Nauka;" leningradb Translated from Russian by Z. Shapiro, National Science Foundation, Washington, DC of India, Calcutta, India, 1969.

15. Petros Ganatsas, Marianthi Tsakaldimi, Costas Thanos. Seed and cone diversity and seed germination of *Pinuspinea* in Strofylia Site of the Natura 2000 Network. Biodivers Conserv. 2008; 17:2427-2439
16. Rawat S, Tomar YK, Rawat V. Effect of stratification on seed germination and seedling performance of wild pomegranate. Journal of American Science 2010; 6:5.
17. Rehfeldt GE, Tchebakova NM, Parfenova YI, Wykoff WR, Kyzmina NA, Milyutin LI. Intraspecific responses to climate in *Pinus sylvestris*. *Global Change Biology*. 2002; 8:912-929.
18. Rehman S, Park IH. Effect of scarification, GA and chilling on the germination of goldenrain tree (*Koelreuteria paniculata* Laxm.) seeds. *Science Horticulture*. 2002; 85:319-324.
19. Salazar R, Quesada M. Provenance variation in *Guazumaulmifolia* L. in Costa Rica. Commonwealth Forest Revue. 1989; 66(4):317-324.
20. Stephenson NL. Actual evapotranspiration and deficit: biologically meaningful correlates of vegetation distribution across spatial scales. Journal of Biogeogr. 1998; 25:855-870.
21. Stephenson NL, Van-Mantgem PJ. Forest turnover rates follow global and regional patterns of productivity. Ecology Letter. 2005; 8:524-531.
22. Wright JW. Introduction to Forest Genetics. Academic Press. New York, 1976, 463.