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Studies on germination behaviour of *Rubus ellipticus* seeds collected from different seed sources in Himachal Pradesh, India

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ABSTRACT

A seed germination trial was conducted to study the germination behaviour of *Rubus ellipticus* seeds collected from different sources in Himachal Pradesh. Significant differences were observed in the germination per cent of seeds collected from different sources. The maximum germination of 84.00% was recorded in seeds collected from the Darlaghat source whereas the minimum germination of 59.00% was recorded in seeds collected from Bharan in Shimla district of Himachal Pradesh. The seeds collected from Shoghi recorded the highest moisture content of 6.46% whereas the minimum moisture content of 5.39% was recorded from seeds collected from Joharji in the Solan district. The maximum seed weight of 0.07 g (100 seeds) was recorded in seeds collected from Joharji, whereas, the minimum seed weight of 0.05 g was recorded in seeds collected from Beolia in the Shimla district of Himachal Pradesh. It is recommended on the basis of the present investigation that seeds of *R. ellipticus* be collected from the Darlaghat seed source in Solan district for the raising of seedlings in the nursery owing to better germination.

INTRODUCTION

Rubus ellipticus Sm. Syn. *Rubus obcordatus* (Franch.) Thuan is an important wild edible plant of the North-West Himalayan region. It is commonly called "Yellow Himalayan Raspberry" or "Golden Himalayan Raspberry". Besides this, locally it is known by various names, *viz*., Ankhey, Ainselu, Hirey, Hinser, and Hisalu in the Nort-West Himalayan region. It is a shrubby plant commonly found in Pine Forests in the North-West Himalayan States of Himachal Pradesh, Uttarakhand and Jammu & Kashmir UT at altitudes of 1200-2100 m above msl. It grows in association with *Pinus roxburghii, Cedrus deodara, Pinus wallichiana, Quercus leucotrichophora, Prunus cerasoides, Ficus palmata, Prinsepia utilis, Berberis lycium, Rosa moschata, Valeriana jatamansi, Hedychium spicatum, Viola serpens, Polystichum aculeatum, Onychium japonicum*, *Pteris cretica* etc. It grows both in shady as well as exposed conditions. It bears multiple spinescent shoots and grows up to a height of 3-4 m. It flowers during February-March and the fruit matures during May-June. It is well known for its edible berries and is highly relished by local communities in its zone of occurrence. The berries of *Rubus ellipticus* have a short shelf life and it perishes immediately. The fruit is sold in local markets by the local communities to supplement their additional income in the Himalayan region (Parmar & Kaushal,1982).

The bark of this shrubby plant is used in the Tibetan system of medicine for the treatment of renal disorders and as an anti-diuretic (Tsarong, 1994). The juice obtained from the fruit and roots of this plant is also used to treat cough, fever, diarrhoea, dysentery, gastric trouble, and sore throat (Manandhar, 2002). The plant is also traditionally grown as live fences around agricultural fields in the northwestern Himalayas (Sharma & Devi, 2013). Seed sources play a significant role in the production of quality seedlings in nurseries. The seeds collected from mature, healthy, and disease-free plants from best seed sources not only improve the germination per cent of seeds but also ensures the production of uniform and vigorous growth of seedlings in the nursery. Thus, evaluation and identification of best seed source of plant species significantly contribute to the production of quality seedlings in the nursery. In order to raise quality seedlings, the use of seeds from identified seed sources is always preferred by nursery managers all over the world. The use of quality seeds result in getting better germination and the production of uniform seedlings in the nursery. The seed sources of *R. ellipticus* are not evaluated and

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identified in Himachal Pradesh. Therefore, a need is being felt to find out the best seed source of *Rubus ellipticus* for getting better germination and production of quality planting stock in the nursery. Therefore, the present investigation was carried out to study the influence of five different seed sources on the germination behaviour of seeds under laboratory conditions.

MATERIALS AND METHODS

The berries of *Rubus ellipticus* were collected in May, 2021 from 5 different seed sources in Himachal Pradesh. The geographical coordinates of 5 seed sources, *viz*., altitude, latitude and longitude were recorded. The berries were packed in paper bags and brought to the Seed Laboratory of ICFRE - Himalayan Forest Research Institute, Shimla for further studies. The seeds were extracted from the berries manually through repeated cleaning and subsequently dried in the laboratory. Eight replications of 100 seeds each were weighed in the analytical balance and an average of the eight replications were recorded to obtain 100 seed weights. The moisture content of the seeds was determined by placing the seeds in an oven at 103±2°C for 17 hours (ISTA, 1985, 2010).

$$\text{Moisture content (\%)} = \frac{\text{Weight of fresh seeds - Weight of oven dried seeds}}{\text{Weight of fresh seeds}} \times 100$$

The details of seeds collected from 5 seed sources from Solan, Shimla and Hamirpur districts of Himachal Pradesh along with geo-coordinates were given in Table 1. The seeds collected from different seed sources were considered as treatments and were subjected to germination testing after overnight soaking in water to study the effect of seed sources on germination behaviour as per ISTA rules (2010). The treatments used in the experiment were: T_1: Darlaghat, T_2: Joharji, T_3: Beolia, T_4: Shoghi and T_5: Bharan

***Germination Test*:** 300 seeds from each seed source were sown on the thick moist filter paper placed above the cotton in Petri dishes in a lot of 100 seeds per replication using a completely randomized design with three replications per treatment as per ISTA rules (1985, 2010). The Petri dishes containing seeds were then kept in the seed germinator and then allowed to germinate at a constant temperature of 20°C. Watering was done as and when required. Seed germination was recorded after the emergence of radicle from the seed. The germination data was taken daily after the commencement of germination until it was over and constant germination was obtained. The germination started after 10-12 days of seed sowing and culminated within a month. The total germination per centage was calculated at the end of the experiments.

$$\text{Germination per cent} = \frac{\text{No. of seeds germinated}}{\text{Total no. of seeds sown}} \times 100$$

The data of germination per cent and moisture content (%) were transformed to arcsine$\sqrt{(x/100)}$ after angular transformation following the method of Snedecor and Cochran (1967). Thereafter, data of germination per cent, moisture content (%) and 100 seed weight (g) 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 agricultural sciences.

RESULTS AND DISCUSSION

The data on germination per cent, moisture content, and seed weight of *Rubus ellipticus* as affected by different seed sources is given in Table 2. A perusal of data from Table 2 revealed that seed sources significantly influenced the germination per cent of *Rubus ellipticus* seeds collected from different seed sources in Himachal Pradesh. The maximum germination of 84.00% was recorded in seeds collected from the Darlaghat seed source (T_1) followed by 72.50% germination in seeds collected from Joharji (T_2) and is significantly better than all other treatments. It was subsequently followed by 70.50%

Table 1. Geo-coordinates of Seed Sources of *Rubus ellipticus* in Himachal Pradesh.

Name of the Seed Source	Altitude (m)	Latitude (N)	Longitude (E)
Darlaghat	940	31°15'04.61"	76°54' 13.47"
Joharji	1444	30°49'13.08"	77°03'54.05"
Beolia	1716	31°03'24.06"	77°09'02.35"
Shoghi	1792	31°02'57.05"	77°08'10.36"
Bharan	1937	31°00'39.23"	77°40'11.45"

Table 2. Germination per cent, Moisture content and Seed weight of *Rubus ellipticus* seeds as affected by different seed sources in Himachal Pradesh.

Name of the Seed Source	Germination Per cent	Moisture Content (%)	100 Seed weight (gm)
Darlaghat	84.00 (66.50)	5.73 (13.78)	0.07
Joharji	72.50 (58.41)	5.39 (13.37)	0.07
Beolia	70.50 (57.24)	5.97 (13.95)	0.05
Shoghi	70.00 (57.00)	6.46 (14.70)	0.05
Bharan	59.00 (50.21)	6.43 (14.62)	0.07
S.Em ±	**2.93**	**NS**	**NS**
C.D. Value at 5% Level	**6.38**		

NS- Non Significant

*Values in parentheses are arcsine transformed values

germination in seeds collected from Beolia (T_3), 70.00% germination in seeds collected from Shoghi (T_4), and are statistically at par with each other but significantly better than 59.00% germination which was recorded in seeds collected from Bharan seed source (T_5) in Shimla district.

The moisture content of seeds collected from different seed sources did not vary significantly. The maximum moisture content of 6.46% was recorded in seeds collected from the Shoghi seed source (T_4) followed by 6.43% moisture content in seeds collected from the Bharan seed source (T_5), 5.97% moisture content in seeds collected from Beolia (T_3) and 5.73% moisture content in seeds collected from Darlaghat (T_1) in a decreasing order whereas seeds collected from Joharji (T_3) from Solan district recorded minimum 5.39% moisture content. The results of 100 seed weight revealed that the seeds collected from different seed sources also did not vary significantly. The maximum weight of 0.07 g was recorded in seeds collected from the Darlaghat, Joharji, and Bharan seed sources followed by Shoghi and Beolia seed sources which recorded 0.05 g seed weight in a decreasing way.

The findings of the study carried out to assess the germination behaviour of *Rubus ellipticus* seeds collected from five different seed sources in Himachal Pradesh, revealed that seeds collected from the Darlaghat seed source in the Solan district in Himachal Pradesh is the best seed source having a maximum of 84.00% germination. This study further reveals a significant difference in germination per cent of *Rubus ellipticus* seeds collected from different seed sources. It is in conformity with the studies undertaken on *Khaya senegalensis* (Kuje, Agera & Amonum, 2019) in which they reported significant differences in germination per cent of *Khaya senegalensis* seeds collected from different locations. Nayak and Sahoo (2020) also reported significant variation in germination and seedling growth of *Madhuca latifolia* seeds collected from different provenances in Odisha. Uniyal, Bhatt and Todaria (2002) reported significant variation in seed characters of *Grewia oppositifolia* collected from different provenances in Uttarakhand and Himachal Pradesh. Singh, Bhatt and Prasad (2004) also observed significant variation in germination per cent of *Celtis australis* seeds collected from different seed sources. Similarly, significant variations were also observed in the germination per cent of *Pinus wallichiana* (Thapliyal et al., 2008, Rawat & Bakshi, 2011), *Pinus sylvestris* (Batkhuu et al., 2020) and *Pinus gerardiana* (Negi et al., 2022) collected from different seed sources/provenances. Further, Patil et al. (2011) also observed significant variation in seed germination per cent and seedling growth parameters *of Pongamia pinnata* seeds collected from different agro-climatic regions.

CONCLUSION

The result of the present study reveals that seeds collected from the Darlaghat seed source in Solan district is the best seed source of *Rubus ellipticus* among the studied seed sources. Hence, seeds of *R. ellipticus* preferably be collected from Darlaghat in the Solan district of Himachal Pradesh for getting better germination.

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