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Assessing the potential half-sib progenies of *Pinus roxburghii* Sargent for oleoresin yield

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Abstract
Pinus roxburghii (Chir Pine) belonging to family Pinaceae, is native to the tropical forests of Himachal Pradesh which is being commercially tapped for oleoresin in India. Resin industry, which use oleoresin as a raw material is one of the foremost industry thriving on this product and has got an ever increasing importance in our national economy. Keeping in view the value and importance of oleoresin, progeny trial was conducted to evaluate the oleoresin yielding potential of half-sib progenies of Chir Pine. Experiment was laid out in the main campus area of Dr Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan (HP) and data was collected on oleoresin yield at the end of season. The trees of progenies having more than 30 cm dbh were segregated for oleoresin tapping experiment. In total, 22 out of 60 progenies had minimum one tree above 30 cm dbh in at least two replications. Hence, these progenies were selected for oleoresin tapping. The method employed for oleoresin collection was borehole method. The data pertaining to the oleoresin yield from different selected progenies revealed significant differences. The maximum oleoresin yield (625.00g/season) was noticed in Kaldoo- P3 and minimum in Rakni-P8 (130.00 g/season).

Keywords: *Pinus roxburghii*, progenies and oleoresin yield

Introduction
Pinus is one of the most widely distributed tree-genera extending from polar region to the tropics in the Northern hemisphere. In India, four Pine species (Family-Pinaceae) *viz.*, *Pinus roxburghii*, *Pinus wallichiana*, *Pinus gerardiana* and *Pinus kesiya* are distributed in Himalayas and in the hills of Assam. Amongst all, *Pinus roxburghii* (Chir Pine) is recognized for high oleoresin productivity and moderate wood quality. It is also one of the most important economical and ecological pine species in sub tropical area of Himachal Pradesh.

Resin is an important produce of pine forests in the world. Being an important forest by-product, the crude oleoresin exudates is converted by steam distillation into its primary fractions of rosin (diterpenes) and turpentine (mono and sesquiterpenes), which in turn are processed into chemical products such adhesives, coatings, paper sizing, cleaners, food gums, pharmaceuticals, solvents, cleaning agents for paints and varnishes, production of flavor and fragrances in food industries, perfume, disinfectants, synthetic rubber, coatings and in production of printing inks and water-resistant/water proofing materials (Stubbs *et al*., 1984; FAO, 1995; Lee *et al*., 2001; Kelkar *et al*., 2006; Rodrigues *et al*., 2008; Odaba Ş-Serin *et al*., 2014) [1, 2, 3, 4, 5, 6]. Besides these, other uses include, manufacture of linoleum, explosives, insecticides and disinfectants (Singh and Mehra, 1982; Nimkar and Sharma, 2008) [7, 8]. In addition to this, oleoresin production offers promising revenue generation and employment opportunities to the families residing in the forest vicinity. India is the second largest resin producer in Asia after China. Earlier, India used to export resin, but now consumes all its production internally through its small and large scale industries. With the increase in day by day demand of oleoresin, the dependency on the clones has increased significantly because the oleoresin production from natural stands is insufficient to meet the basic requirement of the resin based industries. To minimize the gap between the demand and supply it has now become necessary to identify pre-potent progenies through breeding programmes such as half-sib progeny evaluation.

Materials and Methods

The progeny trial was located in the main campus area of Dr YS Parmar University of Horticulture and Forestry, Nauni, Solan, near Oachghat which is located at 30° 51' N latitude and 76° 11' E longitude, at an elevation of 1200 m above mean sea level and are within the natural range of *Pinus roxburghii* Sargent. It represents a transitional zone between subtropical and temperate region of the state of Himachal Pradesh. Experiment was laid out on resin tapping potential of Chir Pine progenies of superior trees raised at main campus and data was collected on oleoresin yield. The trees of progenies having more than 30 cm dbh were segregated for oleoresin tapping experiment. In total, 22 out of 60 progenies had minimum one tree above 30 cm dbh in at least two replications. Hence, these progenies were selected for oleoresin tapping. The method employed for oleoresin collection was borehole method (Hodges 1995; Lekha 2002; Kumar and Sharma 2005) [9, 10, 11]. The collection of oleoresin was made from 44 trees. The oleoresin collected from each tree was weighed and recorded at the end of season. The data recorded on oleoresin yield was statistically analyzed by using analysis of variance (ANOVA) for Randomized Block Design (Gomez and Gomez 1984). Wherever the effect exhibited significance at 5% level of probability, the critical difference was calculated.

Fig: Progeny Trial at Dr YS Parmar University of Horticulture and Forestry, Nauni, Solan

Results and discussion

The data pertaining to the oleoresin yield from different selected progenies revealed significant differences (Table1). The maximum oleoresin yield (625.00 g/season) was noticed in Kaldoo P-3 which was further followed by Jubble-PT (492.50 g/season), Leda-P10 (436.67 g/season), Bagthan-PT (427.50 g/season) whereas minimum oleoresin yield (130.00 g/season) was observed in Rakni P-8. Tadessee *et al.* (2001) reported that the high resin yield is strongly influenced by genetic factor in *Pinus pinaster*. High resin yield in trees is due to the presence of more number & bigger size of resin ducts and the high turpentine content, The high turpentine content lowers the viscosity of resin which results in the increase flow of resin. Presences of epithelial cells also contribute in more yield by more synthesis of oleoresin. Burczyk *et al.* (1998) [14] also suggested that the intensity of resin production is influenced by a relatively low number of genes with major effects and the identification of loci for a quantitative trait using molecular marker could be helpful during selection in early stage.

While studying different progenies, Sharma *et al.* (2015) [12] also found significant differences in the oleoresin yield collected from the studied progenies. It was reported that, progeny of the high yielding pine produced more resin in *Pinus sylvestris*. The variation within the progeny was considerable therefore selection within the progeny is essential for the formation of stands of high resin yielders (Stephen and Bolland 1968) [13].

Table 1: Oleoresin Yield of selected Half-sib Progenies at Nauni (main campus)

S. No.	Progeny	Oleoresin Yield (g/season)
1	Leda-P10	436.67
2	Leda-P8	136.67
3	Kaldoo-P4	350.00
4	Chret mansu -4	268.33
5	Kopra-P5	313.33
6	Rakni-P8	130.00
7	Sandrohal-P5	205.00
8	Dhami Shimla PT	337.33
9	Kuthar PT Black centre	325.00
10	Bagthah-PT-Black centre	267.33
11	Dibkon-P3	158.33
12	Kaldoo-P8	305.00
13	Kaldoo-P3	625.00
14	Kaldoo-P1	253.33
15	Leda-P5	307.50
16	Banethi-PT	226.67
17	Jubble-PT	492.50
18	Kaldoo-P10	293.33
19	Bagthan-PT blach top	427.50

20	Bagthan-PT black base	165.00
21	Jai Nagar-PT	195.00
22	Kaldoo-P9	162.50
	C.D (0.05)	SE(d)
Oleoresin Yield	215.82	106.57

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