EVALUATION OF HIGH RESIN YIELDERS AND CHECK TREES IN CHIR PINE (*PINUS ROXBURGHII* SARGENT) FOR ANATOMICAL CHARACTERS

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Introduction

Pinus roxburghii Sargent is one of the important species among six Himalayan pines and is commonly known as 'Chir pine' or 'Himalayan long leaf pine'. It is the principal pine commercially tapped for oleoresin in India. It is also one of the most widely used commercial timber species in the hills and plains of Northern India. The timber obtained from Chir pine is put to a variety of uses such as furniture, packing cases, boxes, building construction, railway sleepers, packing cases, matchboxes, paper and pulp etc. Chir wood is a suitable raw material for making paper pulp. It gives 40-43.5 per cent yield of bleached grade pulp with satisfactory strength properties having highest tear and burst factor among the species used in India for paper manufacture (Horn, 1974).

To meet the increasing requirement of rosin and turpentine for industrial use, the necessity for increasing oleoresin production from the Chir pine forests is generally appreciated. Oleoresin is an important Non-Timber Forest Produce (NTFP) and on distillation yields an essential oil, commonly known as turpentine oil (a clear liquid with a pungent odour and bitter taste) and a non-volatile product, the rosin or colophony (a brittle, transparent, glossy, faintly aromatic solid) (Chadha, 1982).

Turpentine oil finds a wide variety of industrial uses such as perfumery industry, pharmaceutical preparations, synthetic pine oil, disinfectants, insecticides and denaturants.

Rosin is chiefly used in paper, soaps, detergents, cosmetics, paints, varnish, rubber and polish industries, manufacturing of linoleum, explosives etc. (Anon., 1969).

This species becomes a material of paramount importance to be worked upon especially for its future benefits owing to its diverse uses. Keeping in view the above economic importance of species, the present investigations were undertaken to know the extent of variation in anatomical traits of high resin yielders and check trees selected from different locations in Himachal Pradesh in order to utilize the findings and developing future strategies for screening and multiplication of high resin yielders in this regard.

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Material and Methods

The study was conducted on 26 high resin yielders and 10 check trees of Chir pine (*Pinus roxburghii*) marked at different location in Himachal Pradesh. For screening these trees, in the first year, survey of the area of Chir pine distribution was conducted and the persons involved in resin tapping were contacted to identify high resin yielding trees. Those trees yielding very low amount of resin in one season was designated as check trees. The first hand information so collected was again confirmed in the next year. The wood samples were chipped at breast height with the help of hammer and chisel from the marked trees for studying the anatomical traits at Department of Forest Products, College of Forestry, Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan (HP). The data recorded for the anatomical traits was statistically analyzed by using completely randomized design in three replicates for each treatment as described by Panse and Sukhatme (1967) and Chandel (1984). Observations were recorded for three anatomical parameters, viz., tracheid length, diameter of resin ducts and number of resin ducts. Tracheid length was determined by macerating the shavings of wood in Jeffery's fluid i.e. 10 per cent chromic acid and 10 per cent nitric acid for 48 hours (Pandey *et al.*, 1968). The measurements of tracheid were made with the help of occular micrometer fitted in the eye piece of microscope at 10x magnification standardized with the help of stage micrometer as per the method suggested by Berlyn and Miksche (1976). The length of 15 tracheids was observed in each treatment. For number of resin ducts and diameter of resin ducts, the sections (15-20 μm) in cross planes of wood of each treatment were obtained on a sledge microtome. The sections were stained and passed through different series of alcohol and xylene (Johanson, 1940). The resin ducts were observed in cross sections of the wood under microscope. The numbers of ducts were counted at 5x by 4x magnification in a microscopic field. The diameter of the microscopic field was taken and the area of the microscopic field was calculated. The number of resin ducts per unit area was converted into number of resin ducts per mm^2 by dividing the number of resin ducts of microscopic field which was found to be 19.62 mm^2. In total, five sections were observed in each replicate. The diameter of oleoresin ducts was measured at 10x magnification. For each duct, the diameters at two perpendicular directions were measured and the average was calculated for each duct. The diameter for 15 ducts was recorded in each treatment.

Results and Discussion

The data on tracheid length, diameter of resin ducts and number of resin ducts per mm^2 exhibited significant variation in different high resin yielders and check trees in *Pinus roxburghii* (Table 1). High resin yielders showed slightly longer tracheids (5.35 mm) as compared to check trees (4.81 mm) (Fig. 1). The longest tracheids were noticed in Barsar-4 HRY (7.95 mm), and showed statistical parity with Barsar check-1 (7.85 mm). The smallest tracheids (3.80 mm) were recorded in Nihari-check, which was statistically similar to Platu-2 (3.86 mm), Nihari (3.92 mm) and Sarkaghat-1 (3.93 mm) HRYs. Spurr and Hyvarinen (1954) revealed that tracheid length varies widely with position in stem as well as between

Table 1

Tracheid length, diameter and number of resin ducts of high resin yielders and check trees in Chir pine (Pinus roxburghii Sargent)

Sr. No.	Locality	Tree no.	Tracheid length (mm)	Dia. of resin ducts (mm)	No. of resin ducts (per mm^2)
1	2	3	4	5	6
1.	Barsar	B-1	7.42	0.20	0.75 (75)
2.	Barsar	B-2	7.33	0.22	0.67 (67)
3.	Barsar	B-3	7.52	0.19	0.72 (72)
4.	Barsar	B-4	7.95	0.21	0.63 (63)
5.	Barsar	B-Check-1	7.85	0.15	0.34 (34)
6.	Barsar	B-Check-2	5.95	0.15	0.30 (30)
7.	Bumbloo	5A	7.35	0.21	0.81 (81)
8.	Bumbloo	5B	7.23	0.18	0.88 (88)
9.	Bumbloo	Check	4.35	0.14	0.41 (41)
10.	Chabal	C-1	4.35	0.23	0.53 (53)
11.	Chabal	C-2	5.10	0.21	0.58 (58)
12.	Chabal	C-Check	4.28	0.15	0.27 (27)
13.	Ghandir	G-1	5.14	0.18	0.62 (62)
14.	Ghandir	G-2	4.56	0.18	0.68 (68)
15.	Ghandir	G-3	5.19	0.19	0.73 (73)
16.	Ghandir	G-Check	4.79	0.15	0.35 (35)
17.	Hareta Road	HR-6	7.10	0.20	0.78 (78)
18.	Hareta Road	HR-7	7.04	0.22	0.66 (66)
19.	Jhojonbailly	J-1	4.75	0.19	0.83 (83)
20.	Jhojonbailly	J-2	4.80	0.2	0.76 (76)
21.	Jhojonbailly	J-Check	4.54	0.15	0.30 (30)
22.	Nihari	N	3.92	0.18	0.81 (81)
23.	Nihari	N-Check	3.80	0.14	0.33 (33)
24.	Platu	P-1	4.00	0.21	0.68 (68)
25.	Platu	P-2	3.86	0.22	0.65 (65)
26.	Platu	P-3	3.96	0.19	0.61 (61)
27.	Platu	P-Check	4.46	0.16	0.27 (27)
28.	Sarkaghat	S-1	3.93	0.2	0.84 (84)
29.	Sarkaghat	S-2	4.13	0.21	0.92 (92)
30.	Sarkaghat	S-Check	3.98	0.14	0.39 (39)
31.	UHF	1	4.48	0.17	0.95 (95)

Contd...

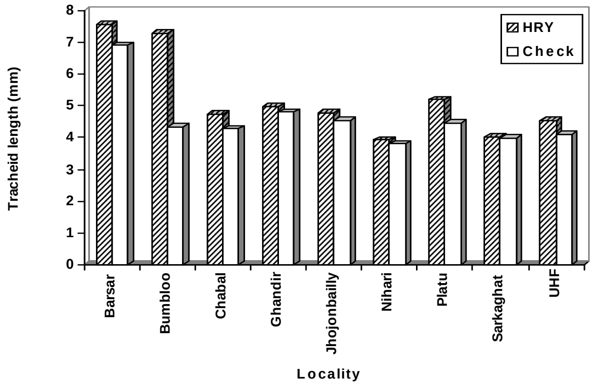
1	2	3	4	5	6
32.	UHF	2	4.72	0.17	0.66 (66)
33.	UHF	3	4.40	0.22	0.76 (76)
34.	UHF	4	4.23	0.18	0.82 (82)
35.	UHF	5	4.79	0.24	0.71 (71)
36.	UHF	UHF-Check	4.10	0.16	0.37 (37)
Mean			5.20	0.19	0.62 (62)
Mean for HRY			5.35	0.20	0.73 (73)
Mean for Check			4.81	0.15	0.33 (33)
S.E. (d)			0.0704	0.0040	0.0206
$CD_{0.05}$			0.1395	0.0079	0.0408

* Figures in parenthesis are number of resin ducts per cm^2

individual trees selected at random. Panshin and DeZeeuw (1970) accumulated considerable information on interspecific and within tree variation in tracheid length. Tracheid length in conifers was also reported to be genetically controlled (Dodswell *et al.*, 1961; Jackson and Greene, 1958; Zobel, 1961). All marked high resin yielders exhibited maximum diameter (0.20 mm) of oleoresin ducts whereas, check trees recorded minimum (0.15 mm) (Fig. 2). The diameter of resin ducts was maximum for UHF-5 (0.24 mm) and showed statistical similarity with Chabal-1 (0.23 mm) while lowest diameter of 0.14 mm was found in Bumbloo check, Sarkaghat check and Nihari check trees respectively. Potapova (1984) observed that resin duct dimensions are moderately variable in pines. Significant difference in diameter of oleoresin ducts was reported by Mutum (1997) in *Pinus roxburghii*. To date there is no reference on high resin yielding trees having more tracheid length and maximum diameter. However, no plausible explanation has been put forward and it needs further confirmation.

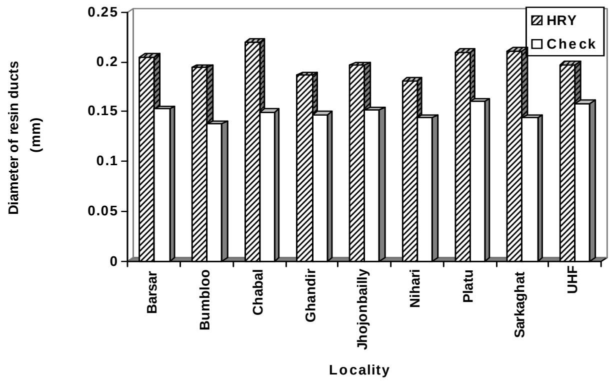
Number of resin ducts influences the oleoresin yielding capacity of the trees. The present investigation reveals maximum number of resin ducts (0.73 per mm^2) in high resin yielders while, minimum number (0.33 per mm^2) was observed in check trees (Fig. 3). The number of resin ducts/mm^2 was found maximum in UHF-1 (0.95), which showed non-significant differences with Sarkaghat-2 (0.92). The minimum number was observed in Chabal and Platu check (0.27) and did not exhibit significant difference with Jhojonbailly and Barsar check-2 (0.30). Mocalov (1970) has reported that trees with high resin production exhibited more resin canals per centimetre in Scots pine. Hodges *et al*. (1981) reported that the number of radial resin ducts was significantly higher in Slash pine (*P. elliottii*) than in Loblolly (*P. taeda*), longleaf (*P. palustris*) and shortleaf pines (*P. echinata*).

Fig. 1



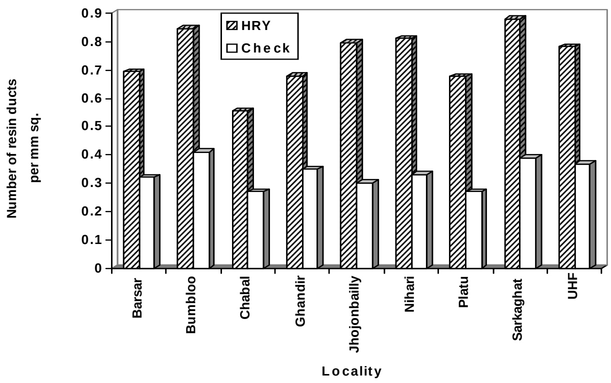
Effect of locality on tracheid length of HRYs and check trees of *P. roxburghii*

Fig. 2



Effect of locality on diameter of resin ducts of HRYs and check trees of *P. roxburghii*

Fig. 3



Effect of locality on number of resin ducts of HRYs and check trees of *P. roxburghii*

Acknowledgement

The first author is thankful to Indian Council of Forestry Research and Education, Dehra Dun (Uttaranchal) for providing financial assistance in the form of research fellowship during doctorate degree in forestry.

SUMMARY

Studies were conducted to investigate the high resin yielder and check trees in Chir pine (*Pinus roxburghii* Sargent) for anatomical parameters. The data on tracheid length, diameter of resin ducts and number of resin ducts per mm² exhibited significant variation in different high resin yielders and check trees in *Pinus roxburghii*. High resin yielders have shown slightly longer tracheids (5.35 mm) as compared to check trees (4.81 mm). All marked high resin yielders were exhibited maximum diameter of oleoresin ducts (0.20 mm) whereas, check trees recorded minimum (0.15 mm). Maximum number of resin ducts per mm² were found in high resin yielders (0.73) while, minimum number was observed in check trees (0.33). From this study it could be concluded that the tracheid length, diameter of resin ducts and number of resin ducts influences the oleoresin yielding capacity of the tree.

शारीर विशेषताएं जानने के लिए अधिक रेजिन उत्पादकों और जांच पड़ताल वृक्षों का चीड़ (*पाइनस राक्सबर्घिआई* सार्जेंट) में मूल्यांकन करना

आशीष यु० निमकार व कुलवंत राय शर्मा

सारांष

शारीर परिमापों का पता लगाने के लिए चीड़ (*पाइनस रॉक्सबर्घिआई* सार्जेट) के अधिक रेजिन उत्पादकों और जांच पड़ताल वृक्षों को अन्वेषित करने के लिए अध्ययन किया गया। *पाइनस राक्सबर्घिआई* के विभिन्न अधिक रेजिन उत्पादकों और जांच पड़ताल वृक्षों की वाहि–कोशा लम्बाई रेजिन–नालियों के व्यास और प्रति मिमी² रेजिन नालियों की संख्या के आंकड़ों में काफी अंतर रहता पाया गया। जांच–पड़ताल वृक्षों की वाहिकोशा लम्बाई (4.81 मिमी) की तुलना में अधिक रेजिन उत्पादकों की वाहिकोशाओं की लम्बाई कुछ ज्यादा (5.35 मिमी) दिखाई पड़ी। चिह्नित किए सभी अधिक रेजिन उत्पादकों (वृक्षों) की तैलीय राल नालियों का व्यास न्यूनतम (0.20 मिमी) रहा जबकि जांच–पड़ताल वृक्षों का व्यास न्यूनतम (0.15 मिमी) पाया गया। प्रति मिमी² रेजिन नालियों की अधिकतम संख्या (0.73) भी अधिक रेजिन उत्पादकों में पाई गई जबकि उनकी न्यूनतम संख्या (0.33) जांच पड़ताल वृक्षों में मिली। इस अध्ययन से यह निष्कर्ष प्राप्त किया जा सकता है कि वाहिकोशा लम्बाई रेजिन नालियों का व्यास और रेजिन नालियों की संख्या वृक्षों की तैलीय राल प्राप्ति देने की क्षमता को प्रभावित करते हैं।

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