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A Preliminary Study on the Provenance Variation in Chir Pine (*Pinus soxburghii* Sargent)

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In 1978, provenance variation studies were undertaken on Chir pine (*Pinus soxburghii*) in Himachal Pradesh with an aim to determine the range of variability. Six provenances were demarcated on the basis of river basins and the occurance of high mountains. A total of 207 trees in 23 locations was selected for studying variation with regard to height, diameter, crown length and needle length. Volume of wood and specific gravity of wood. The results was showed that the height, diameter, crown length and needle length were variable in the provenances and in locations except the diameter. The other characters such as volume of wood and specific gravity were found to be variable in locations. This predicted that there is a great potential to adopt the breeding programmes in this species on the basis of variability among these characters.

Chir pine is the tree species restricted to the North - Western and central Himalayas. Its wood is the best and cheapest among the pine tree species. The species shows high range of phenotypic variations in its natural stands (Khosla *et al.*, 1980). Provenance is the ultimate natural origin of a tree or a group of trees. In genetic improvement programme of any species, the assessment of variation with regard to commercially important triats is a prime consideration. The variation can be easily studied by using the provenances. Most of the provenances possess abundant natural variation in economically desirable traits. This is the raw meterial which tree breeders will utilise to meet the wood production goals of future. The choice of wrong provenance can have a marked effect on the health and yield of resulting crops; in extreme cases it may also mean success or failure of the plantations. In the present context, preliminary observations on genetic variation in the species were studied by analysing the natural variation in merchantable timber characteristics among the various provenances as have been delimited in the species in Himachal Pradesh.

MATERIAL AND METHODS

The present studies were carried out in the whole natural distributional Chir pine zone of Himachal Pradesh in 1978. Singh et *al.* (1970) considered the river basins as the basis for geographical zone delimitation and proposed seven different zones of coir pine in Himachal Pradesh. In the present study river basins and high mountain ranges which bring discontinuity in the gene flow among variation of populations in the species were treated for provenance

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delimitation. In view of the lack of any discontinuity (gene flow) barrier among yamuna Basin and Left Bank of Sutlej Basin, both these geographic zones were merged into one provenance. Accordingly, six provenances are recognised taking the catchment area on either side of each river and high mountain ranges as the basis of demarcation for each river and high mountain ranges as the basis of demarcation for each provenance. The provenances are :-

1. Pabar valley, 2. Yamuna Basin and Left Bank - Sutlej Basin,
3. Right Bank - Sutlej Basin,
4. Left Bank - Beas Basin,
5. Right Bank - Beas Basin and
6. Ravi Basin

Initially, a total of 684 trees in 23 locations was selected and surveyed with regard to height, diameter, crown length, needle length, volume of wood and specific gravity. The height of trees was taken along the contours and measured with Abney's level instrument and recorded in m. The diameter was measured at breast height i. e. 1.37 m. from the sides of the tree and average was taken. The length of the crown was measured at the point of starting of the first branching of the tree. The bole of the tree was measured and then this height of bole was substracted from the total height of the tree and measured in m. The needle length was measured by simple scale in cm. The needle length represents the average of three measurments each from long, medium and short shoots.

The volume of different trees was calculated by using the formula (Palmberg Christel, 1975) as under :

$$V = \text{Height} \times \Pi \times F \left(\frac{\text{Diameter}}{2}\right)^2$$

where, V = Volume of tree (m^3)
Π = Constant (22/7)

F = Form factor The form factors were used as given by Sagreiya (1967) for Chir pine. For calculating the specific gravity, bore samples were taken by Pressler's Borer. Before oven-drying at $102 \pm 1°$ C' green weight was measured and volume of the bore sample was calculated by using the formula Πr^2, where Π is a constant (22/7) and r is the radius of bore sample which was measured with the help of Vernier caliper. Oven dry weight was taken when the samples got dried and specific gravity was calculated for different samples by using the formula (Anon., 1970) as under.

$$S = \frac{Wo}{Vg.}$$

where, S = Specific gravity
Wo = Oven dry wt. at $102 \pm 1°$ C
Vg = Volume in green condition.

For statistical analysis, Randomized Block Design was applied with 23 treatments and three replications. In each replication the average of three trees were taken into consideration, thus, amounting nine trees in each location. Thus, for analysis of variance, only 207 trees were considered. The diameter was taken as the basis of replications viz., R_1 having the diameter $\angle$ 50 cm.,

TABLE Values of each character in each provenance

Provenance	Height (m)	Diameter (cm)	Crown length (m)	Needle length (cm)	Volume (m)	Specific gravity
P—1	27.72 NS	63.37 NS	8.77 NS	26.19 NS	2.681 NS	0.6691*
P—2	25.07*	57.81 NS	8.78 NS	25.33 NS	3.232*	0.4774 NS
P—3	27.79 NS	55.49 NS	9.62 NS	27.06 NS	2.354 NS	0.5142 NS
P—4	26.41**	56.56 NS	8.63 NS	26.50**	3.167*	0.5584*
P—5	30.24*	55.40 NS	10.03**	25.12**	2.882 NS	0.5296 NS
P—6	28.22 NS	54.29 NS	7.52 NS	20.92 NS	2.025 NS	0.5558*
Total	27.50*	56.72 **	8.99**	25.52**	2.725*	0.5501*

* Significant at 5% level
** Significant at 1% level
NS Non-significant

R_2 having the diameter between 51 and 60 cm and R_3 was having the diameter 760 cm.

RESULTS AND DISCUSSION

The height, diameter, crown length needle length, volume and specific gravity were the important morphological traits studied for provenance variation in chir pine. The height of the trees shows both intra-and inter-provenance variation (Table). The maximum average height was 30.24 m. in the Right Bank - Beas Basin provenance and, minimum average height was 25.07 m in P-2. Diameter was less variable than height and maximum average diameter range was observed in Pabar Valley provenance (63.37 cm) and minimum in P-6 (Ravi Basin) (54.29 cm) Intra-provenance variation was negligible and diameter tended to be uniform in the different locations of any provenance. The occurrance of significant intra-provenance variation with regard to height and diameter, parallel to the present studies was observed in *Tectona grandis* trials in Nigeria (Egenti, 1978).

The crown length in various provenances was statistically variable. Intra-provenance variation was significant only in P-5. Conical form of crown is considered to be better than the other shapes due to its property of occupying less space (Suri, 1975). The maximum average crown length was

found in P-5 (10 03 m) and minimum in P-6 (7.52 m). The needle length was found to be statistically variable only in P 4 and P-5. Thames (1963) studied needle length variation in four geographic sources in loblolly pine. Mergen (1968) reported the genetic control of many adaptions of leaf characters. The volume of trees showed a high range of variation among the provenances. Maximum timber volume was noted in P-2. Specific gravity was found to be the highest in P-1 (0.6693) and the lowest (0 4774) in P-2. The specific gravity of wood was recorded to be variable from tree to tree and among various parts of tree (Hughes, 1965).

Evidently, considering the high variation in the provenances based on the presently studied parameters, there is a strong need to emphasize the evaluation of these characters in detail in any breeding programme of chir pine.

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