Research Paper

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Genetic Variation Studies on the Different Morphometric Characters of Chilgoza Pine (Pinus Gerardiana Wall.)

Forestry

KEYWORDS : Pinus gerardiana, heritability, genetic gain, phenotypic coefficient of variation, genotypic coefficient of variation

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ABSTRACT

Pinus gerardiana Wall. (Chilgoza) is the most important amongst all the pine species found in N-W Himalaya. It is valued for its nut in the fruit trade. The distribution of chilgoza is restricted to only two districts of Himachal Pradesh i.e, Chamba and Kinnaur. Hence 2 populations were selected from chamba district and 12 populations were selected from Kinnaur districts of Himachal Pradesh. For the estimates of genetic parameters, heritability and genetic gain was found maximum in number of stomata per needle (97 %) and in weight per cone (38.75) respectively. Weight per cone was found most variable character among all the characters with highest phenotypic coefficient of variation (25.92) as well as genotypic coefficient of variation (22.08). It was suggested that selection should be made on the basis of weight per cone for the improvement of economical traits.

INTRODUCTION

Chilgoza (Pinus gerardiana Wall.) is well known in dry fruit trade and its fruit is highly valuable as an edible nut. The tree is valued for its edible seed and hard, tough resinous wood. Chilgoza is an important social forestry species of the area yielding edible nuts, which fetches high price ranging from Rs. 750- 900/ kg in the open market because of its high price, each and every cone is collected (about 95%), leaving very little for natural seeding. Nevertheless, chilgoza is now categorized as an endangered conifer of India and listed so in the Red Data Book of IUCN (Sehgal and Sharma, 1989). There is thus, an urgent need to standardize best harvesting date and size of tree for getting quality stock for large scale planting in the species. The species needs to be scientifically managed and properly conserved. It is a prerequisite to assess the existing variations in any species before starting any conservation and improvement work. Several conditions must be met before the success of genetic improvement. The present paper deals with the analysis of variation, coefficient of variation, phenotypic coefficient of variation, genotypic coefficient of variation, heritability and genetic gain for 14 different morphometric characters .

MATERIAL AND METHODS

Since the distribution of the species is confined to Kinnaur, Bharmour and Pangi areas in the state of Himachal Pradesh surveys of the populations namely Dubling, Pooh, Nesang, Moorang, Thangi, Kanam, Skiba, Akpa, Rarang, Jangi, Purvani, Tangling, Pangi in Kinnaur district and Pangi and Bharmour areas of Chamba districts was surveyed and studied for genetic variation on the morphometric characters of P. gerardiana.

At each location, data was recorded on cone bearing trees classified into three diameter classes viz., 30-40 cm, 40-50 cm and 50 cm above. It was necessary to make diameter classes for recording the replicated data, because the information relating to age of the trees was completely lacking. The component of variance and coefficient of variation were calculated. The genotypic coefficient of variation, phenotypic coefficient of variation, heritability, genetic advance and genetic gain for each characters were calculated (Burton and Devane, 1953; Johnson et al., 1955 and Namkoong, 1979).

Table 1:- Details of various populations of Pinus gerardiana

Sr. No.	Population	Altitude(m)	Latitude	Longitude
Populations located at Chamba				
1	Pangi (Chamba)	2710	31^0 58' N	78 ^{0}27' E
2	Bharmour(Chamba)	2889	32^0 44' N	76 ^{0}53' E
Populations located at Kinnaur				
3	Skiba	2670	31^0 83' N	77^0 16' E
4	Tangling	2200	31^0 52' N	78^0 29' E
5	Moorang	2438	31^0 60' N	78^0 44' E
6	Dubling	2981	31^0 74' N	78^0 63' E
7	Kanam	2670	31^0 67' N	78^0 45' E
8	Purvani	2821	31^0 83' N	77^0 16' E
9	Nesang	2675	31 ^{0} 64' N	78^0 52' E
10	Rarang	2591	31^0 60' N	78^0 35' E
11	Thangi	2550	31^0 55' N	78^0 48' E
12	Pangi	2556	31^0 53' N	78^0 25' E
13	Akpa	2662	31^0 58' N	78^0 38' E
14	Jangi	2556	31^0 60' N	78^0 42' E

RESULTS AND DISCUSSION

The analysis of variance of different populations of P. gerardiana at different locations indicated that these populations differed significantly for eleven out of the fourteen traits studied. Height of the trees showed significant differences between various sites. The maximum tree height was recorded at Bharmour (18.44 m) and minimum at Dubling (8.38 m). Although the diameter (dbh) showed a range of variation yet statistically the differences among the various sites were found to be non significant. Similarly the characters like crown spread and crown height also showed a lot of variability amongst the sites. However, needle length and needle thickness did not varied significantly though minimum needle length and needle breadth was exhibited at Dubling and Kanam respectively. For the cone and seed characters, the differences among the sites on the basis of Cone length, cone breadth, Weight per cone, no. of seeds per cone, weight of 100 seeds, seed length and seed breadth were found to be significant. Cone and nut characters had been studied by various authors in conifers and had found a lot of variation between various traits (Matziris,1998; Mahadevan et al., 1999 and Singh and Chaudhary, 1993). It was reported that no. of stomata/ needle varied significantly among different sites.

	Height (m)	DBH (m)	Crown spread (m)	Crown ht (m)	Needle length (cm)	Needle thickness (mm)	No. of stomata/ needle
Pangi	18.42	00.59	06.63	04.94	10.82	00.52	364.33
Bharmour	18.44	00.60	05.80	05.20	10.92	00.54	361.67
Skiba	17.71	00.51	06.43	04.35	11.22	00.50	393.33
Tangling	18.14	00.53	06.87	04.76	10.36	00.57	346.67
Moorang	12.23	00.46	05.63	03.22	10.18	00.47	320.33
Dubling	08.38	00.48	05.00	02.87	08.84	00.43	260.98
Kanam	11.83	00.47	04.99	03.18	10.00	00.42	294.67
Purvani	16.68	00.50	06.53	04.00	10.88	00.53	313.33
Nesang	15.56	00.48	05.32	03.53	10.94	00.45	351.33
Rarang	17.82	00.55	06.80	04.57	10.38	00.52	332
Thangi	14.64	00.49	06.23	03.30	09.53	00.46	275
Pangi	18.14	00.58	06.93	04.77	10.36	00.57	331.33
Akpa	17.62	00.56	07.57	03.98	10.38	00.44	343.67
Jangi	17.66	00.54	07.23	04.07	10.46	00.56	373.45
Range	08.38 18.44	00.46 00.60	04.99 07.57	02.87 05.20	08.84 11.22	00.42 00.57	260.98 393.33
Mean	15.95	00.52	06.28	04.05	10.38	00.50	333.01
SE	01.91	00.06	00.77	00.57	00.72	00.07	5.51
S D.	03.56	00.08	01.11	00.92	00.98	00.09	37.07
C.D. at 5%	03.92	00.13	01.57	01.18	01.49	00.14	11.33

Table 2: Variability in different tree characters among different sites

Table 3: Variability in different cone and seed characters among different sites

	Cone length (cm)	Cone breadth (cm)	Wt. per cone (gm)	No. of seeds/cone	Wt. of 100 seeds (gm)	seed length (mm)	seed breadth (mm)
Pangi	14.34	07.86	496.87	79.43	50.12	22.13	7.67
Bharmour	13.81	07.85	404.17	77.57	40.22	21.31	7.04
Skiba	14.80	07.80	681.20	81.37	50.83	22.43	7.85
Tangling	17.57	10.08	716.03	100.83	42.26	21.88	7.71
Moorang	14.17	07.88	508.18	88.33	50.36	22.12	7.51
Dubling	13.26	08.21	375.33	61.20	38.87	20.42	7.33
Kanam	13.97	07.36	392.00	54.60	40.27	20.12	7.28
Purvani	13.05	06.90	359.00	92.00	39.29	20.72	7.27
Nesang	13.35	07.76	628.00	101.33	39.89	20.92	6.88
Rarang	14.10	07.87	399.33	81.63	36.77	19.95	7.03
Thangi	13.96	07.72	423.67	114.83	42.64	20.56	7.23
Pangi	13.77	07.52	495.67	75.23	41.78	21.44	7.51
Akpa	14.19	07.98	440.83	93.20	53.25	24.41	8.08
Jangi	14.64	08.14	525.57	88.80	54.84	23.7	8.22
Range	13.05 17.57	07.36 10.08	359.00 716.03	54.60 114.83	36.77 54.84	19.95 24.41	6.88 8.22
Mean	14.21	07.93	488.99	85.03	44.39	21.58	7.47
SE	00.85	00.62	54.20	03.34	02.35	0.55	0.20
S D.	01.37	00.93	111.74	15.75	06.36	1.42	0.43
C.D. at 5%	01.75	01.28	111.42	06.87	04.83	1.14	0.42

As per the table 4, the highest coefficient of variation was observed for crown height and lowest coefficient of variation was observed for seed breadth. Heritability indicates the degree to which parents pass their characteristics along to their offsprings and also determine the similarity between individuals related by linear or co lateral decent (Sharma, 1994). In the present study high heritability and genetic gain were recorded for characters such as No. of stomata per needle, No. of seeds per cone, Weight of 100 seeds, Seed length, Weight per cone and height. Heritability along with estimates of expected genetic gain was more useful than heritability itself in predicting the resultant effect for selecting the best genotypes for a given trait [Johnson et al. (1955) and Volker et al. (1990)]. However, the heritability and genetic gain for number of stomata per needle and number of seeds per cone were also comparable to these characters which were found to have highest heritability and somehow moderate genetic gain in the present study.

Table 4: Estimates of various genetic parameters

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Phenotypic coefficient of variation was found high for weight per cone character followed by crown height whereas genotypic coefficient of variation was found high for weight per cone followed by height. However, in all the cases genotypic coefficient of variation was less than the phenotypic coefficient of variation which suggest there may be higher modifying influence of environment on the expression of these traits. The present study concluded that selection can be made on the basis of weight per cone for high yielding genotypes to improve the economical status.

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