

SELECTION TRIALS OF *POPULUS CILIATA* WALL. IN PAKISTAN

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Summary

The paper identifies areas for the collection of germ plasm, describes nursery techniques and presents results on progeny and clonal trials of *Populus ciliata* Wall. in Pakistan. Two-year-old seedlings of few individual trees originating from xeric habitat outperformed those of mesic habitat under high rainfall conditions. The saplings raised at 1300 m. altitude and under controlled conditions exhibited better growth thus assisting in early screening of progenies/clones. The species can be easily propagated asexually and the application of hormone had no significant effect on rooting. The narrow and broad-sense heritability was low emphasizing the importance of uniform site conditions and inclusion of a large number of progenies and clones in test plantations. These investigations suggest that a suitable breeding strategy would further bring about genetic improvement in *Populus ciliata*.

Introduction

Populus ciliata Wall. is one of the important indigenous species of Pakistan. The other indigenous species are *Populus alba* L. and *P. euphratica* Olivier which occupy distinct ecological zones in this country. The timber of *P. ciliata* is used in light construction work and in the manufacture of crates and other portable wooden materials. Altitudinal range of the species varies from 5,000–10,000 ft. (1650–3300 m) and it prefers to grow on rich soil and under abundant supply of water. The latitudinal and longitudinal range lies between 33°–36° N and 70°–75° E respectively. It is found mixed with *Pinus wallichiana*, *Picea smithiana*, *Cedrus deodara*, *Aesculus indica* and *Abies pindrow* in the high hill forests of Pakistan. The tree is resistant to borers as compared with hybrid poplar which is easily attacked by insects during early period of its growth. The species grows faster as compared with its associates and can be planted on eroded soils.

Material and Methods

Keeping into consideration importance of the species in forestry, research studies were initiated by Sheikh (1973) and Siddiqui (1978). They made some selection studies and described nursery techniques by covering large parts of species distribution in Pakistan. In present studies, the work was further elaborated by selecting 376 trees of *P. ciliata* in 41 distinct localities of Pakistan. The number of trees, however, vary from 1–25 depending upon the density of the crop. The planting stock was raised at 2 nurseries viz. Nawanshehr (A. Abad) and Bhurban (Murree) lying at 1300 m and 2000 m altitude respectively. The provenance trials were not undertaken as the species is occurring in the form of small patches (even few scattered trees in some places) mainly along river banks in different parts of Pakistan. The details of localities are given in Table 1.

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Table 1.

Geographic data of seed/propagules of *Populus ciliata* in Pakistan.

S. No.	Localities	Latitude°		Altitude (m)	Material collected ⁺	No of parent trees selected
		Longitude°				
1	2	3	4	5	6	
*1.	Sunny Bank (Murree)	33 55 73 32	2000	C,S	19	
*2.	Ghoragali (Galies)	33 55 73 32	1800	C, S	8	
*3.	Kuldana (Galies)	33 55 73 32	2000	C, S	20	
*4.	Jhekagali (Galies)	33 51 73 29	2000	C, S	7	
*5.	Garial (Murree)	33 50 73 26	2000	C, S	6	
*6.	Bhurban (Murree)	33 51 73 26	2000	C, S	10	
*7.	Barian (Galies)	33 0 73 0	2200	C, S	3	
*8.	Ayubia (Galies)	34 81 73 27	2500	C, S	7	
*9.	Nathiagali (Galies)	34 04 73 25	2350	C, S	1	
*10.	Thandiani (Galies)	34 13 73 21	2670	C, S	2	
*11.	Kern (Azad Kashmir)	34 40 73 20	1700	S	4	
*12.	Sharda (Azad Kashmir)	34 10 73 32	2170	S	9	

S. No.	Localities (m)	Latitude°		Altitude (m)	Material collected ⁺	No of Parent trees Selected
		Longitude°	Latitude°			
*13.	Chanian (Karnah) AK	73 54	34 17	2150	S	5
*14.	Lipa (Karnah) AK	73 52	34 18	1830	S	5
*15.	Shogran (Hazara)	73 52	34 44	2250	C, S	11
*16.	Naran (Hazara)	73 38	34 53	2400	C, S	25
17.	Kalam (Swat)	73 34	35 24	2050	S	1
18.	Chail (Swat)	70 29	30 48	2600	S	1
19.	Mataltan (Swat)	70 28	30 48	2700	S	8
20.	Kumrat (Dir)	72 10	35 21	2470	S	10
21.	Patriata (Murree)	70 39	30 42	1830	C	8
22.	Bansragali (Murree)	70 39	30 42	1870	C	10
23.	Dungian (Azad Kashmir)	74 09	34 05	2500	S	6
24.	Naltar (Gilgit)	74 06	35 32	3000	C, S	10
25.	Hunza (Gilgit)	70 48	35 18	2670	C, S	10
26.	Nagar (Gilgit)	70 48	35 32	2670	C, S	7

S. No.	Localities	Altitude (m)	Latitude°		Material collected ⁺	No of Parent trees Selected
			Longitude°			
27.	Yasin (Gilgit)	2670	35 30 70 30	2670	C, S	10
28.	Astor (Gilgit)	2670	35 06 70 58	2670	C, S	10
29.	Dungali (Galies)	2670	30 48 70 48	2670	C, S	10
30.	Sathangali (Hazara)	2350	30 45 70 36	2350	C, S	10
31.	Chirpai (Galies)	2670	30 45 70 45	2670	C, S	10
32.	Barikot (Dir)	2350	35 05 70 24	2350	C, S	4
33.	Kalabagh (Galies)	2670	30 36 70 21	2670	C, S	15
34.	Mochidara (Galies)	2500	30 36 70 21	2500	C, S	10
35.	Kund (Hazara)	1850	34 44 73 21	1850	C, S	10
36.	Patrak (Dir)	2150	35 05 70 24	2150	C, S	10
37.	Satobangla (Galies)	2330	30 36 70 21	2330	C, S	10
38.	Paryai forest (Hazara)	1830	34 26 73 20	1830	C, S	10
39.	Gabral (Swat)	3000	30 54 70 45	3000	S	17
40.	Thore (Chilas)	2350	35 06 70 45	2350	C	22

S. No.	Localities	Latitude°	Altitude (m)	Material collected ⁺	No of Parent trees Selected
		Longitude°			
1	2	3	4	5	6
41.	Jalkot (Chilas)	35 05 70 36	2170	C	5

* - Included in the progeny/clonal field trial at Bhurban, Pakistan.

C- Cuttings

S = Seed.

Observations on the effects of hormones, season of collection of cuttings and soil media on survival were recorded at nursery stage. The data were analysed for ANOVAR and heritability was also estimated among progenies/clones. For this purpose progeny/clonal trials of 41 trees (out of total number of 376 trees) established at Bhurban in 1981 were used. The area receives annual rainfall around 1000 mm. The experiment consisted of 5 replications with 8 plants per progeny/clone in each replication. The planting was done at 2 x 2 m spacing in RCB design.

Results and Observations

The seed is generally collected in July but could not be stored for longer period as it loses its viability very quickly. Care should be taken during transportation and therefore use of muslin bags is preferred. Polythene bags retain moisture during summer season and lower seed viability to a great extent. The seed may be extracted from the catkins under partial shade and in low humidity. The seed should be immediately sown soon after extraction otherwise it will lose its viability and germination capacity. A good, fresh and healthy seed may exhibit more than 90 percent germination. Germinating seedlings may be protected during rainy season by providing kana chicks over the nursery beds.

The cuttings of *P. ciliata* may be easily collected as compared with seed. The cuttings collected from younger trees (10-15 years of age) exhibit better survival as compared with those from older trees. The planting should be completed by March otherwise high temperature may affect sprouting and survival of stem cuttings. It was observed that seedlings raised from stem cuttings and seed had exhibited more than 80% sprouting and survival at nursery stage. Growth of *P. ciliata* seedlings placed inside and outside the green house at Bhurban was also compared. Average height of one-year-old seedlings grown inside and outside the green house was found to be 14.7 and 5.8 cm respectively. The differences were highly significant showing the possibility of early screening of seedlings grown under controlled conditions.

Experiments were conducted at Nawanshehr and Bhurban nurseries to determine the effect of season and medium on rootability and to determine the storage effect on rooting of cuttings. 100 cuttings were planted in 1st week of February, last week of February and Mid

of March in each of three media consisting of soil and sand in the proportion of 2:1, 1:2 and pure sand. Best results were found when 1:2 ratio of soil: sand was used and cuttings were planted in mid March. It is interesting to note that clonal selection exhibits a very small range of distribution and a narrow eco-geographical divergence of the species. On the other hand, progenies originating from xeric habitat were also found to be superior under mesic conditions at Nawanshehr and Bhurban nurseries. These findings may be given due consideration when final evaluation of the progenies/clones is done at different planting sites.

Effect of IBA on stem cuttings was also studied in the nursery and it was observed that the hormone had no significant effect on sprouting and survival of cuttings. It seems that the species can be vegetatively propagated easily even without application of any hormone. Time of collection, storage and size (20–22 cm long) of cuttings are important factors for the successful rooting of the species.

The mean values of 2-years-old 41 progenies of *P. ciliata* at Bhurban indicated that seedlings originating from low rainfall areas had exhibited better growth characteristics than those originating from high rainfall areas.

Analysis of variance was done to find out differences between and within clones and progenies and heritability was estimated for height and diameter. Analysis of variance for clones indicated that there is no significant difference between clones and blocks. Broad sense heritability was found to be 0.04 indicating that large number of trees should be selected to increase heritability. The values also indicated that seedling height was greatly influenced by the environment. However, this conclusion may further be confirmed by increasing the number of clones and establishing the field trials under extremely uniform conditions. Analysis of variance alongwith estimation of narrow-sense heritability for progenies was also accomplished. The differences within the progenies were non-significant but significant among blocks. The heritability values for progenies were also low.

The specific gravity from increment core for 108 trees was also determined. There was great variability from tree to tree and no significant correlation of this trait with the height growth data was confirmed. However, average ring width varied from 4 to 6.8 mm among all the trees.

As a result of these trials, a suitable clone of *P. ciliata* would be released for general plantation in the country in the near future.

LITERATURE CITED

1. Shams-ur-Rehman. 1982. Final Research Report of PL-480 Scheme "Genetic Improvement and Breeding of 3 Poplar Species. Pakistan Forest Institute, Peshawar, 63 pp.
2. Sheikh, M. I. 1973. Selection of *Populus ciliata* Clones. *Pak. Jour. For.* Vol. 23, No. 2, pp. 149–154.
3. Siddiqui, K. M. and S. Ahmad. 1978–1981. Annual Progress Reports of PL-480 Project "Genetic Improvement and Breeding of 3 Poplar Species. Pakistan Forest Institute, Peshawar.