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## Variation in growth characteristics of different clones of *Morus alba*

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### Abstract

Variation among different morphometric characters were studied among fifteen selected clones of *Morus alba*. These fifteen clones were selected out of the originally twenty seven clones based on their growth performance over the years in a clonal evaluation trial. The significant differences were found among clones with respect to various morphometric traits viz, basal diameter, number of primary branches, crown spread, lamina width, lamina length, petiole length, leaf area and green leaf yield clones Tr10, S146, S36, S799 and Mandaley showed higher values. Hence, these clones can be further used for site interaction trials etc and therefore recommending the end users in a particular area.

**Keywords:** Growth characteristics, clones, *Morus alba*

### Introduction

Mulberry (*Morus* spp.) are characterized as a highly valued multipurpose tree species that is used for silkworm rearing, cattle fodder, furniture making and in pharmaceutical industries. The leaves of the multipurpose perennial shrub, mulberry (*Morus* sp), traditionally used for silkworm rearing, is known for its high protein content with good amino acid profile, high digestibility, high mineral content, low fibre content and very good palatability (Sanchez, 2002) [3, 8]. The high biomass yield of the plant together with its low tannin content (Patra *et al.*, 2002; Singh and Makkar, 2002) [6] make it an attractive fodder resource for ruminants particularly, as a supplement to low quality basal diets. There is evidence that mulberry foliage compares favourably to commercial concentrates (Patra *et al.*, 2002) [6], whilst maintaining optimum animal performance (Gonzales and Milera, 2002; Liu *et al.*, 2002; Sanchez, 2002) [3, 4, 8], through improvements in the rumen functions (Singh and Makkar, 2002).

White mulberry (*Morus alba* L) is a fast-growing, small to medium sized tree which grows 10–20 m tall. It belongs to family Moraceae. *Morus alba* is cultivated in northern India from Jammu and Kashmir to Assam. It grows on a variety of soils ranging from sandy loam to clay loam but alluvial, deep loamy soil with sufficient moisture supply supports its best growth. Soil texture and depth are the important factors affecting growth. It produces large quantity of renewable biomass in the form of branches, shoots, leaves and fruits.

In order to establish priorities for the conservation and improvement of tree genetic resources understanding of the degree of diversity among and between trees is required. Variations are essential for adaptation and improvement and the amount of variation determines the potential for improving species through breeding programmes. The species (*Morus alba*) offers an opportunity for studying variation among clones and to select superior individuals for further use in clone×site interaction trials etc. therefore the study was conducted to determine variation for growth characteristics of different clones in the species.

### Materials and Methods

The present investigations were carried out in the experimental field and laboratory of the Department of Tree Improvement and Genetic Resources, College of Forestry, Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan (H.P.) during 2016-2018 to evaluate different clones for various morphometric traits. Total fifteen clones were selected, out of the originally twenty seven clones raised in a field clonal evaluation trial, based on the growth performance of these clones over the years (Table 1). The observations were recorded on tree growth characteristics like basal diameter, number of branches per plant and crown spread/area etc. In case of leaf characters the observations were taken on lamina width, lamina length, petiole length, leaf area and green leaf yield the whole data was analyzed statistically by using Randomized Block Design with three replications as per the method given by Panse and Sukhatme, 1967 [5].

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## Results and Discussion

Variation in growth and leaf characteristics w.r.t to Basal diameter (cm), Number of branches per plant, Crown spread/area, lamina width, petiole length, lamina length, leaf area (cm<sup>2</sup>) and green leaf yield were observed. Analysis of variance showed significant difference among clones for different morphometric traits viz; basal diameter, number of primary branches, crown area and different leaf characters viz; lamina width, lamina length, petiole length, leaf area and green leaf yield

**Table 1:** Details of 15 selected top clones of *Morus alba*

S. No.	Name of clone	Place	State
1	Kanva 2	Panchkula	Haryana
2	S30	Sahaspur	Uttarakhand
3	Phillipino	Sahaspur	Uttarakhand
4	China White	Sahaspur	Uttarakhand
5	K2MS	Sahaspur	Uttarakhand
6	S146	Sahaspur	Uttarakhand
7	S1531	Sahaspur	Uttarakhand
8	S799	Sahaspur	Uttarakhand
9	Mandaley	Sahaspur	Uttarakhand
10	Berhampore	Jammu	Jammu & Kashmir
11	S36	Jammu	Jammu & Kashmir
12	S1307	Jammu	Jammu & Kashmir
13	ME-65	CSGRC, TN	Tamil Nadu
14	Tr10	Sahaspur	Uttarakhand
15	Nauni	Nauni	Himachal Pradesh

The results in table 2 revealed the maximum basal diameter for clone Tr10 (14.07 cm) which was significantly at par with clones K2MS (13.10 cm), Berhampore (12.99 cm), S799 (12.95 cm), China white (12.10 cm), S1531 (12.00 cm), S146 (11.95 cm), S30 (11.84 cm) and Mandaley (11.45 cm). The minimum basal diameter was recorded for clone S36 (9.45 cm). Maximum number of branches were observed for clone Tr10 (7.00) which was statistically at par with clones Kanva 2 (6.67), Phillipino (6.33), S1531 (6.33), S1307 (6.33), S146 (5.67), S30 (5.33), Mandaley (5.33), K2MS (5.00) and ME-65 (5.00). However, the minimum value for this character was obtained for clone S799 (3.00). The maximum crown area was observed for clone Tr10 (21.99 m<sup>2</sup>) which was significantly different from all other clones, however minimum crown area was found for Kanva 2 (2.57 m<sup>2</sup>) (table 2).

**Table 2:** Variation in growth characters among different clones of *Morus alba*

Clone	Basal diameter (cm)	Crown area (m <sup>2</sup> )	No. of primar branches
Kanva 2	10.09	2.57	6.67
S30	11.84	4.04	5.33
Phillipino	10.62	4.16	6.33
China White	12.10	13.83	3.67
K2MS	13.10	4.63	5.00
S146	11.95	10.29	5.67
S1531	12.00	4.99	6.33
S799	12.95	7.10	3.00
Mandaley	11.45	4.07	5.33
Berhampore	12.99	7.95	3.67
S36	9.45	6.88	2.67
S1307	11.04	8.87	6.33
ME-65	9.78	8.82	5.00
Tr10	14.07	21.99	7.00
Nauni	10.85	4.52	3.33
Mean	11.62	7.65	5.02
C.D <sub>0.05</sub>	2.63	6.14	2.73

In case of leaf characteristics, maximum lamina width was observed for clone S146 (11.93 cm) followed by clones S1531 (10.61 cm), Kanva 2 (9.89 cm), S799 (9.65 cm), S36 (9.51 cm), Tr10 (9.32 cm) and Mandaley (9.15 cm). However, minimum value was shown by clone K2MS (5.78 cm) (table 3). The maximum lamina length was observed for the clone S146 (17.50 cm) which was significantly different from all other clones, whereas minimum lamina length was recorded for clone S1307 (8.89 cm). Petiole length was maximum for the clone Berhampore (4.63 cm) which was significantly at par with clones Mandaley (4.49 cm), S146 (4.25 cm), S799 (4.24 cm), Kanva 2 (3.91 cm), S36 (3.78 cm), Tr10 (3.73 cm), S146 (3.51 cm) and S30 (3.23 cm). Clone Phillipino (2.24 cm) showed the minimum value for petiole length. Maximum leaf area was observed for the clone S146 (178.61 m<sup>2</sup>) which was significantly different from all other clones, whereas minimum leaf area was recorded for the clone S1307 (51.55 m<sup>2</sup>). Green leaf yield was maximum for the clone Tr10 (7.37 kg/tree) which was significantly different for all other clones, however minimum green leaf yield was recorded for the clone ME-65 (3.82 kg/tree).

**Table 3:** Variation in leaf characters among different clones of *Morus alba*

Clone	Lamina width (cm)	Lamina length (cm)	Petiole length (cm)	Leaf area (cm <sup>2</sup> )	Green leaf yield (kg/tree)
Kanva 2	9.89	12.37	3.91	82.03	4.85
S30	7.86	13.90	3.23	86.31	5.80
Phillipino	7.23	10.11	2.24	60.38	4.27
China White	6.99	12.63	2.53	56.35	4.84
K2MS	5.78	12.28	3.01	57.48	5.32
S146	11.93	17.50	4.25	178.61	5.63
S1531	10.61	10.17	3.51	65.90	6.29
S799	9.65	12.40	4.24	75.31	5.27
Mandaley	9.15	12.43	4.49	148.64	4.52
Berhampore	7.79	10.87	4.63	77.81	6.29
S36	9.51	10.25	3.78	65.65	6.38
S1307	7.36	8.89	2.77	51.55	4.64
ME-65	7.74	12.09	2.37	75.57	3.82
Tr10	9.32	12.57	3.73	95.43	7.37
Nauni	8.44	11.05	2.53	52.37	5.45
Mean	8.62	11.97	3.41	81.96	5.39
C.D <sub>0.05</sub>	2.85	0.90	1.40	5.06	0.45

Overall the clones Tr10, S146, S36, S799 and Mandaley were found to be better for all the growth characteristics. The superiority of these clones could be ascribed to their superior genetic makeup (genotype) as the environment in which they were grown was the same for all. The above findings are in line with the investigations of Tikader and Kamble (2009) [10] who reported significant differences in growth and yield traits of different accessions of *Morus* spp. They revealed that the relationship among different growth traits indicates that leaf yield is dependent on number of branches per plant. It is also supported by the findings of Peris *et al.* (2014) [7] in mulberry and Bajpai *et al.* (2015) [1] for different quantitative morphological characters of *Morus alba*.

## Conclusions

On the basis of growth performance of different clones in terms of morphometric and leaf characteristics clones Tr10, S146, S36, S799 and Mandaley were found to be superior than others, hence, these clones can be further used in site×clone trials.

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