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Evaluation of various mulberry genotypes for yield and yield attributing characters in different seasons under Kashmir climatic conditions

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Abstract
Leaf yield and yield attributing parameters play an important role in improvement of mulberry quality and quantity. The present study was conducted during the spring and autumn seasons of 2021- 2022 at College of Temperate Sericulture, Mirgund, SKUAST-Kashmir. Ten superior mulberry genotypes made up the experimental material for this investigation. The 10 mulberry genotypes studied showed significant seasonal variation in leaf yield between genotypes. Goshoerami was superior in respect of leaf yield per plant (6.75 kg in spring and 7.69 kg in autumn), fresh weight of 100 leaves (520.90 g in spring and 606.91 g in autumn), internodal distance (5.46 cm in spring and 6.90 cm in autumn) and single leaf area (343.65 cm^2 in spring and 375.19 cm^2 in autumn).The highest number of shootlets (65.00) and total shootlet length per plant (2524.78 cm) in spring was recorded in Chinese white where as the highest number of branches (48.33) and total branch length per plant (6861.75 cm) in autumn was recorded in Rokokoyoso.

Keywords: Mulberry, evaluation, genotypes, growth, yield

Introduction
The amazing sericulture sector first appeared in China around 3000 B.C. Poor farmers all over the world engage in this significant and extremely lucrative agro-based vocation, which significantly contributes to the reduction of poverty by creating jobs. According to Sharma *et al.* (2000) [16], it is distinguished by a high employment potential, little capital investment, and high level of compensation. Only the quality and quantity of mulberry leaves can determine how productive and profitable sericulture is. The only food source for the silkworm, *Bombyx mori* L., is the leaf of the mulberry (*Morus* sp.). Mulberry leaf has been determined to contribute the most (38.2%) to the success of a cocoon crop, hence qualitative and quantitative improvement in mulberry leaf is a prerequisite for the development of sericulture (Miyashita *et al.*, 1986) [7]. To compete in the global market, there has been a lot of focus recently on producing raw silk of exceptional quality. In order to do this, efforts are being made to boost the production of high-quality mulberry leaves, which have a direct impact on the caliber and output of raw silk. Plant breeders face a formidable challenge in creating a variety that performs equally well under various environmental circumstances. Mulberry accounts for more than 60% of the cost of producing cocoons in commercial sericulture. The "Queen of Textiles" around the world is silk. On the other hand, because its production is highly employment-oriented, capital-efficient, and lucrative, it represents a source of income for millions of people. (Sastry *et al.*, 1980) [11]. Mulberry is a perennial crop grows throughout the year. Mulberry leaf yield is a complicated quality that is jointly provided by several constituent characters and is greatly influenced by various genotypes. Studying the genetics of yield components and the degree of relationship with yield is crucial since yield as a whole may not be the optimum selection criterion. Attempts have been undertaken to identify mulberry genotypes from the germplasm that respond less to seasonal fluctuations in order to employ them in rearing in order to create a season insensitive variety with a consistent pattern of growth and leaf yield throughout the year (Pillai and Jolly, 1985) [9]. Leaf yield is contributed by the branching behavior of the genotype concerned, length of branches, internodal distance, leaf weight and other various yield attributing characters. In order to select parents for the creation of improved varieties, evaluation is the most crucial component of germplasm conservation (Dandin and Giridar, 2010) [4].

To choose and use promising cultivars for better sericulture practice, temperate cultivars must be carefully chosen based on plant quality characteristics and their effects on growth and cocoon yield metrics of *Bombyx mori* races in various agro-climatic settings. Evaluation of mulberry genetic resources' primary goal is to encourage direct use by breeders for program improvement. It is crucial to assess mulberry genetic resources for growth and yield features in order to accomplish these goals. Therefore, the current study was conducted to evaluate elite mulberry genotypes throughout the year.

Material and Methods

Studies on evaluation of various mulberry genotypes for growth and yield parameters was carried out under rainfed condition in the College of Temperate Sericulture, Mirgund SKUAST-Kashmir. The experimental material for the present study comprised of ten mulberry genotypes *viz*., Goshoerami, Ichinose, KNG, Rokokoyoso, Kokuso-20, Kokuso-21, Limoncina, Ensatakasuke, Chinese white and Kairyoroso. The evaluation for growth and yield parameters was conducted during two seasons *viz*., spring and autumn seasons of the year 2021-2022. The plantation was appropriately cared for in accordance with the set of techniques suggested for Kashmir's moderate climate (Ahsan *et al*., 1990) [1]. Pruning was done just once a year, during the first week of June, by removing the branches from the crown. For growth and yield metrics, the genotypes were assessed 65 days after sprouting and pruning in spring and fall, respectively. ANOVA statistical analysis was performed on the average data for each genotype for each season.

Results and Discussion

Different mulberry genotypes showed considerable seasonal variation in leaf yield and growth metrics. During spring season, no single genotype was superior in respect of all the traits studied. The genotype Goshoerami was superior in respect of different traits like highest internodal distance (5.46 cm), fresh weight of 100 leaves (520.90 g), leaf yield per plant (6.75 kg) and single leaf area (343.65 cm^2). However, Chinese white was superior for highest number of shootlets (65.00) and total shootlet length per plant (2524.78 cm) (Table-1). During autumn season also, Goshoerami was superior in respect of different traits like highest internodal distance (6.90 cm), fresh weight of 100 leaves (606.91 g), leaf yield per plant (7.69 kg) and single leaf area (375.19 cm^2). However, Rokokoyoso was superior for highest number of branches (48.33) and total branch length per plant (6861.75 cm) (Table-2). The number of branches per plant ranged from 25 to 97, the intermodal distance was 2.54 to 5.29 cm, the leaf area ranged from 64.03 to 242.00 cm2, and the leaf yield per plant ranged from 1.25 to 23.00 kg, according to Tikader and Roy's (2006) [14] observations. Tikader *et al.* (2004) [15] reported similar outcomes as well. The importance of growth associated traits in mulberry for better yield and quality have been documented by Sori and Gebbreselassie (2016) [12]. Genotypic variations in yield and yield attributing characters were also reported by Magadum and Singh (2021) [5], Baksh *et al*. (2001) [2] and Mir *et al.* (2003) [6]. Bigger leaf size, more leaf area and higher weight of 100 leaves are regarded as dependable characters associated with leaf yield Rangaswami *et al.* (1976) [10], Susheelamma *et al.* (1988) [13] and Bindroo *et al.* (1990) [3]. The results of the present study are in conformity with the findings of Bari *et al.* (1988) [17]. Banerjee *et al.* (2007) [18] recorded maximum leaf output per plant for S-13 (1399.7 g) and ME-27 (1658.0 g) in the spring and fall, respectively. Pandit and Koul (2003) [8] too have reported that leaf yield is controlled by a number of quantitative characters with fresh leaf weight being a major component. The findings of the above authors are in line with the findings of present research programme.

Table 1: Growth and yield parameters of various mulberry genotypes during spring season

Parameter Genotype	Number of shoot lets per plant	Total shoot let length per plant (cm)	Internodal distance (cm)	Fresh weight of hundred leaves (g)	Leaf yield per plant (kg)	Single leaf area (cm^2)
G1: Goshoerami	40.50	1937.16	5.46	520.90	6.75	343.65
G2: Ichinose	30.66	1260.80	4.30	285.31	4.35	175.00
G3: KNG	39.33	1326.91	5.07	305.74	4.83	236.80
G4: Rokokoyoso	50.50	2413.63	5.40	259.82	3.48	142.21
G5: Kokusu-20	36.33	1836.96	4.42	292.11	4.62	247.70
G6: Kokuso- 21	33.33	1822.95	4.22	285.99	4.27	226.50
G7: Limoncina	44.16	2462.76	4.57	205.91	2.27	133.01
G8: Ensatakasuke	31.83	1657.38	4.00	266.74	4.25	147.06
G9: Chinese White	65.00	2724.78	5.40	254.42	2.41	137.86
G10: Kairyoroso	48.66	2340.31	4.30	257.15	3.27	139.45
C.D ($p \leq 0.05$)	1.392	32.434	0.13	1.786	0.458	0.641

Table 2: Growth and yield parameters of various mulberry genotypes during autumn season

Parameter Genotype	Number of branches per plant	Total branch length per plant (cm)	Internodal distance (cm)	Fresh weight of hundred leaves (g)	Leaf yield per plant (kg)	Single leaf area (cm^2)
G1: Goshoerami	44.50	6522.33	6.90	606.91	8.44	375.19
G2: Ichinose	36.50	4437.20	4.97	377.73	5.14	189.83
G3: KNG	44.50	5822.00	6.30	339.85	5.61	279.22
G4: Rokokoyoso	61.33	6861.75	5.22	320.66	4.55	149.85
G5: Kokusu-20	40.83	5961.85	6.38	393.27	7.28	259.29
G6: Kokuso- 21	40.33	5675.88	6.87	309.76	6.95	237.03
G7: Limoncina	47.83	6363.96	4.67	320.71	3.17	141.41
G8: Ensatakasuke	37.00	4547.23	4.33	427.76	4.83	152.61
G9: Chinese White	54.83	6499.53	5.15	323.59	3.28	145.60
G10: Kairyoroso	57.16	6545.56	4.80	320.69	4.32	144.52
C.D ($p \leq 0.05$)	1.309	58.385	0.183	1.478	0.490	0.505

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