www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2021; SP-10(12): 1435-1437

www.thepharmajournal.com
Received: 19-10-2021
Accepted: 25-11-2021

M Mithilasri
Forest College and Research Institute, Tamil Nadu Agriculture University, Mettupalayam, Tamil Nadu, India

KT Parthiban
Forest College and Research Institute, Tamil Nadu Agriculture University, Mettupalayam, Tamil Nadu, India

SV Krishnamoorthy
Tamil Nadu Agriculture University, Coimbatore, Tamil Nadu, India

G Umapathy
Tamil Nadu Agriculture University, Coimbatore, Tamil Nadu, India

KA Murugesh
Forest College and Research Institute, Tamil Nadu Agriculture University, Mettupalayam, Tamil Nadu, India

Corresponding Author
M Mithilasri
Forest College and Research Institute, Tamil Nadu Agriculture University, Mettupalayam, Tamil Nadu, India

Clonal evaluation of *Morus* spp at different growth periods

M Mithilasri, KT Parthiban, SV Krishnamoorthy, G Umapathy and KA Murugesh

Abstract
Morus spp is a fast growing multipurpose tree. It has more potential in the fodder contribution to livestock. Owing to its importance, the performance of twenty one genetic resources were analyzed for growth attributes and leaf attributes. The growth attributes include basal diameter, height, number of branches and the leaf traits includes leaf length, leaf width, leaf petiole length, total number of leaves, leaf area. While considering the growth and leaf attributes, three clones viz., MI-0685, MI-0211, MI-0013, MI-0845 and MI-0807 proved its superiority at the periodic intervals of 3 MAP and 6 MAP. It can be further utilized for future improvement program mulberry genetic resources based on the growth and leaf characters.

Keywords: mulberry, clonal variation, growth attributes, leaf traits, leaf area

Introduction
Agroforestry has been playing critical role since time immemorial to meet the demands of wood and food production. However, with the economic development coupled with the associated urbanization and industrialization the demand for wood and wood products has increased rapidly but there is no concomitant plantation development programme.
The forest in the country has been legally closed and there is a shift in forest management from production to conservation oriented approach. The enactment of forest conservation act and the subsequent enunciation of National Forest Policy, 1988 have recognized forest more towards conservation than timber production. This has resulted, decline in domestic wood production and necessitated massive imports. The reduced wood supply and the increased demand for wood products have ushered in a total mismatch between demand and supply.
Similarly, the demand for fodder production in the country is increasing at an alarming rate. The country has recorded the deficit of 61% green fodder, 21% Dry fodder and 64% concentrate feeds which creates threat to the animal husbandry (Datta, 2013) [2]. Animal husbandry is not only a viable livelihood system but also a self-sustaining activity in different parts of the country. It also acts as a source of income and employment generation activity. However, animal husbandry is critically threatened due to shortage of green and dry fodder. Against the above backdrop there is a need to increase the productivity of wood and feed through organised agroforestry systems.
Currently the agroforestry promotional activity in the country is depended primarily on few exotics like Casuarina, Eucalyptus and Populus. These species have their own limitations and they cannot meet the multifunctional demands of the society.
Based on this circumstances there is a necessity to identify and promote fast growing and multipurpose tree species amenable for animal feed. The National Agroforestry Policy, 2014 also directed similar approach of promotion of multipurpose tree species to meet the multifarious demands of the society. Among various indigenous species, the significance of *Morus spp* is very important due to its fast growing nature with multiple utility coupled with organised tree architecture compatible for various agroforestry systems. However, such a multiple utility species gained little research attention towards its improvement through clonal plantations. Hence, the study was carried out to evaluate the growth performance of mulberry genetic resources.

Material and Methods
Twenty nine mulberry accessions of different *Morus spp* were collected from Central

Sericultural Germplasm Resources Centre (CSGRC), Central Silk Board (CSB), Hosur, Tamil Nadu based on comparison tree method (Pitcher *et al.*, 1966) [3] and these germplasms are registered with CSGRC (http://csgrc.res.in/). The seedlings were raised in nursery, based on nursery growth parameters (vigour index and survivability) twenty one clones were selected and these clones were evaluated through clonal test in a Row Column design of 6m X 6m. The clones were evaluated for various growth attributes and leaf attributes viz., basal diameter, height, number of Branches, leaf length, leaf width, leaf petiole length, total number of leaves (Stettler *et al.*, 1986) [8], at 3 Months after Planting and 6 Months after planting (MAP).

Results

I. Growth attributes

1. Plant height

Height growth attributes significantly differs among the 21 clones of *Morus spp* (Table 1). It ranged from 0.46 m to 1.32m at 3 MAP. Maximum height was recorded by MI-0845 (1.32 m) followed by ME-0025 (1.27 m) and MI-0211 (1.25). At 6 MAP, height growth ranged between 2.83 m and 1.04 m. Higher plant height was recorded by ME-0025 (2.83 m) followed by MI-0845 (2.50 m). Lowest was registered by MI-0663 (1.04 m).

Table 1: Growth parameters at two growth periods

Mulberry clones	Basal diameter		Height (m)		No. of branches	
	3MAP	6MAP	3MAP	6MAP	3MAP	6MAP
ME-0025	15.26*	27.38*	1.27*	2.83*	4.00*	6.00*
MI-0211	13.58*	24.83*	1.25*	2.36*	5.00*	8.25*
ME-0001	7.76	18.67	0.54	1.42	2.00	3.15
ME-0109	11.20	22.64	0.73	1.62	2.50	4.00
MI-0013	12.63	24.02*	0.92*	1.86*	5.00*	7.00*
MI-0349	10.93	21.08	0.70	1.60	1.00	1.78
MI-0395	8.72	19.13	0.59	1.46	0.00	1.00
MI-0536	11.42	23.09	0.85	1.72	2.00	4.65
MI-0615	11.33	22.78	0.89*	1.78	4.00	6.23*
MI-0718	11.20	22.64	0.83	1.75	2.00	3.16
MI-0768	13.29*	24.17*	0.96*	1.90*	6.10*	8.10*
MI-0034	9.78	20.07	0.63	1.55	2.00	4.93*
MI-0663	7.06	17.04	0.46	1.04	3.00*	3.67
MI-0685	12.51*	23.92	0.89*	1.78	5.30*	8.76*
MI-0017	10.08	20.98	0.68	1.58	3.00*	5.00*
MI-0308	10.83	21.78	0.86	1.76	2.94*	4.14
ME-0006	14.56*	25.72*	1.17*	2.21*	2.00	3.00
MI-0807	14.98*	25.06*	1.02*	1.99*	3.00*	5.00*
MI-0845	15.92*	26.26*	1.32*	2.50*	1.00	2.78
ME-0220	9.34	19.62	0.60	1.52	3.00*	3.89
ME-0095	6.09	17.62	0.50	1.39	1.00	1.50
Mean	11.36	22.31	0.84	1.79	2.80	4.56
SEd	0.24	0.60	0.02	0.04	0.05	0.10
CD (0.05%)	0.49	1.19	0.04	0.07	0.10	0.20
P Value	0.000	0.000	0.000	0.000	0.000	0.000

*5% Significance

2. Basal diameter

Basal Diameter has significantly differed among the twenty one clones. The maximum basal diameter was recorded by MI-0845 (15.92 mm) followed by ME-0025 (15.26 mm) and MI-0807(14.98 mm) at 3 MAP (Table.1). The least was registered by ME-0095 (6.09 mm). At 6 MAP, Higher basal diameter was recorded by ME-0025 (27.38 mm) and Least was recorded by MI-0663 (17.04 mm).

3. No. of branches

At 3 MAP, Number of branches was ranged from 6.10 to 0.00. The maximum number of branches was observed by MI-0768 (6.10) followed by MI-0685 (5.30). At 6 MAP, number of branches varied between 8.76 and 1.50.

II. Leaf attributes

Among the leaf attributes, leaf Width, leaf length, leaf Petiole length and Total number of leaves were recorded and presented in Table 2.

1. Leaf length

Leaf length significantly differs among the 25 clones. At 3 MAP, Highest was recorded in MI-0807 (23.60 cm) followed by MI-0349 (20.50 cm). Lowest leaf length was registered by MI-0211 (9.60 cm). At 6 MAP, Higher leaf length was recorded by MI- 0807 (29.90 cm) followed by MI- 0845 (24.80 cm) and MI-0349 (42.90 cm). Least was recorded by ME-0001 (12.70 cm).

Table 2: Leaf parameters at two growth periods

Mulberry clones	Leaf length (cm)		Leaf width (cm)		Petiole length (cm)		Total no.of leaves	
	3MAP	6MAP	3MAP	6MAP	3MAP	6MAP	3MAP	6MAP
ME-0025	12.50	15.60	7.70	10.90	3.60	2.80	20.19*	42.00*
MI-0211	9.60	12.80	8.20	9.90	3.90	3.30	25.92*	56.39*
ME-0001	10.10	14.70	7.90	10.90	4.00*	3.50	10.94	22.05
ME-0109	13.50	16.78	10.20	15.60*	3.10	3.70	12.50	28.01
MI-0013	13.50	18.20	8.70	11.10	5.50*	5.30*	26.00*	49.37*
MI-0349	18.50*	22.63*	12.20*	12.70	4.10*	3.80	6.35	12.46
MI-0395	10.20	14.95	8.00	9.50	2.60	2.60	7.33	10.00
MI-0536	16.20*	19.98*	13.40*	12.10	6.00*	4.20*	9.37	32.55
MI-0615	10.60	14.30	6.70	9.70	3.20	3.80	21.46*	43.61*
MI-0718	16.70*	20.40*	13.00*	19.10*	3.90	3.40	11.60	22.12
MI-0768	15.20*	16.96	11.10	11.98	4.81*	4.50*	16.36*	37.08*
MI-0034	12.90	16.67	9.00	12.40	2.10	2.60	10.91	34.51*
MI-0663	14.70	18.30	9.50	12.10	3.50	3.20	16.29*	25.69
MI-0685	11.40	15.95	9.10	10.00	4.70*	4.30*	31.97*	61.32*
MI-0017	14.50	17.60	10.10	13.20	4.30*	4.00*	15.36	35.08*
MI-0308	13.22	17.09	10.92*	12.09	3.86	3.78	14.81	31.36
ME-0006	11.60	16.60	9.20	13.90*	3.40	3.90*	10.00	22.64
MI-0807	23.60*	29.90*	18.60*	22.10*	3.20	3.10	15.00	35.00*
MI-0845	21.20*	24.80*	15.20*	21.80*	3.40	3.80	5.62*	19.46
ME-0220	14.20	18.20	9.60	12.20	2.70	3.10	15.61*	27.23
ME-0095	13.80	16.50	10.60	10.60	3.20	4.30*	7.46	10.50
Mean	14.18	18.04	10.42	13.04	3.77	3.67	14.81	31.35
SEd	0.30	0.44	0.20	0.34	0.09	0.09	0.29	0.85
CD (0.05%)	0.59	0.87	0.40	0.69	0.18	0.17	0.58	1.69
P Value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

*5% Significance

2. Leaf width

3 MAP the leaf width ranged between 18.20 cm (MI- 0845) and 5.70 cm (MI-0615). At 6 MAP, the maximum leaf width was observed MI-0807 (22.10 cm) followed by MI-0845 (21.80 cm) and MI- 0615 (9.70 cm) it was ranged between 22.10 cm and 9.50 cm.

3. Leaf petiole length

Leaf petiole length also significantly differed among the twenty one clones of *Morus spp* at 5% significance level. It ranged between 6 cm (MI-0536) and 3.10 cm (ME-0109) at 3 MAP. The higher leaf petiole length was recorded in MI-0536 (6.00 cm) followed by MI-0013 (5.50 cm) and MI-0768 (4.81 cm) at 3 MAP. At 6 MAP, Higher leaf petiole length was

recorded by MI-0013 (5.30 cm) followed by MI-0768 (4.50 cm) and least was recorded by MI-0395 and MI-0034 (2.60 cm).

4. Total number of leaves

Total number of leaves was ranged between 31.97 and 5.62. This trait has significantly differed among the 21 clones at 5% significance level. Maximum Total number of leaves is recorded in MI- 0685 (31.97) followed by MI-0013 (26.33) and MI-0211 (25.92) were recorded higher total number of leaves at 3 MAP and the least was recorded in MI-0349 (5.62). At 6 MAP, Higher total number of leaves was recorded by MI-0211 (61.32) and Least was registered by MI-0395 (10.00).

Discussion

In the purview of growth attributes, three clones viz., MI-0845, ME-0025 and MI-0211 have registered higher values. The variation among the genetic resources at 3 MAP and 6 MAP was irrational due to its early stage of growth. Similar kind of variations were observed by Tharakan *et al.,* (1998) [9] who found statistically significant differences between clones of Populus and Salix for height, diameter, growth, and leaf area and biomass production. Highly significant differences in mean tree height, basal diameter and volume observed between parental species of poplar and hybrids by Ceulemans *et al.,* (1992) [1] which lends support to the current study. Similar genetic variation for height and diameter under field conditions in poplar clones have been reported by singh *et al.*, (2001) [7] and Sindhu and Dhillon (2007) [6]. Significant differences were observed in Plant height, Diameter at breast height, volume index and bole straightness in the clones of Salix. Highly significant differences among Populus nigra clones for diameter and height and volume index in Populus deltoids hybrids and old plants have been reported. Similarly, Tunctanar (2002) [10] evaluated 53 willow clones in Turkey and found that clones of Salix excelsa were better in growth performance that even poplar check clone which supports the current study.

Overall performance considering the leaf attributes, among 21 clones MI-0685, MI-0211, MI-0013, MI-0845 and MI-0807 proved its superiority over the other genetic resources. Similar kind of variation was reported Zinab *et al.,* (2017) [11] in different accessions of *Ficus carica* in the attributes of leaf length (cm), leaf width (cm), leaf edge shape, leaf top shape, number of leaf lobes, leaf color, leaf texture and leaf neck length (cm) which lend support to the current study. Saddoud *et al.,* (2008) [5] recorded that genetically different fig cultivars with similar morphological characteristics were distinguished from 11 out of 26 plant traits. Podgornik *et al.*, (2010) [4] observed the number and shape of lobes, tree growth habit, size of the tree, degree of branching, number of lobes per leaf, leaf length, leaf width, leaf area, density of hairs/spicules on the leaf supper surface, and petiole thickness were the traits used for the discrimination of fig accessions which supports the present study.

Conclusion

In the present study, clonal variation among the twenty one genetic resources of *Morus spp* was analyzed. Clones were investigated based on the Growth attributes *viz.*, plant height, basal diameter and Number of branches as well as Leaf attributes *viz.*, leaf Width, leaf length, leaf Petiole length and Total number of leaves. Among the growth attributes, three clones viz., MI-0845, ME-0025 and MI-0211 were performed well at 3 MAP and 6 MAP period. Considering the leaf attributes, MI-0685, MI-0211, MI-0013, MI-0845 and MI-0807 clones were showed superiority over the other *Morus* genetic resources.

Reference

1. Ceulemans R, Mugnozza SG, Wiard BM, Braatne JH, Hickley TM, Stettler RF, *et al*. Production physiology and morphology of *Populus* species and their hybrids grown under short rotation. I. Clonal comparisons of 4 years growth and phenology. Canadian Journal of Forest Research 1992;2:1937-1948.
2. Datta D. Indian fodder management towards 2030: A case of vision or Myopia. International journal of management and social sciences research, 2013;2(2):11-15.
3. Pitcher JA, Dorn DE. A new form for reporting hardwood superior tree candidates, Proc.5th central states forest tree improvement, Wooster, Ohil, 1966, 7-12.
4. Podgornik M, Vuk I, Vrhovnik I, Mavsar DB. A survey and morphological evaluation of fi g (*Ficus carica* L.) genetic resources from Slovenia. Sci Hort, 2010;125:380-389.
5. Saddoud O, Chatti A, Salhi- Hannachi M, Mars A, Rhouma M, Marrakchi, *et al*. Genetic diversity of Tunisian figs (*Ficus carica* L.) as revealed by nuclear microsatellites. Hereditas. 2008;144:149-157.
6. Sidhu DS, Dhillon GPS. Field performance of ten clones and two sizes of planting stock of *Populus deltoides* on the Indo-Gangetic plains of India. New Forests. 2007;34(2):115-122.
7. Singh NB, Kumar D, Rawat GS, Gupta RK, Singh K, Negi SS. Clonal evaluation on poplar (*Populus deltoides* Bartr.) in eastern Uttar Pradesh. II- estimates of genetic parameters in field testing. Indian Forester. 2001;127(2):163-172.
8. Stettler RF. Leaf growth characteristics of Fast-Growing *Populus trichocarpa x P. deltoids*, 1986.
9. Tharakan PJ, Abrahamson PJ, Isebrands JG, Robinson DJ. First year growth and development of willow and poplar bioenergy crops as related to foliar characteristics. Paper presented at Bioenergy: Expanding Bioenergy Partnerships, Madison, Wisconsin October, 1998, 4-8.
10. Tunctaner K. Primary selection of willow clones for multi-purpose use in short rotation plantation. Silvae Genetica. 2002;51(2- 3):105-112.
11. Zinab R, Nader Mohamed R, Abdelsalam Kamal F, Latif A, Rehab Abdelhady M. Genetic Diversity of Fig (*Ficus carica* L.) Based on Morphological Characters and Two-Way Hierarchical Cluster Analysis. Alexandria Science Exchange Journal. 2017;38(2):7-20.