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SCREENING OF MULBERRY (*MORUS*) GERMPLASM ACCESSIONS FOR PROPOGATION PARAMETERS

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ABSTRACT
Eighteen mulberry genotypes were field tested at Department of Sericulture, UAS, GKVK, Bangalore, Karnataka. These mulberry genotypes*viz.,* V-1, M-5, DD-1, S-34, Mysore Local, MR2, S-36, S-54, RFS-135, RFS-175, S-41, S-13, MI-11, *M. Indica*, Dudia white, UP-105, Himachal local and MS-3 were evaluated for the propagation parameters, like, survival, shoot growth and rooting behaviour. Results showed that,survival rate was above 75% was recorded in UP, MR-2, S-13, M5 and V-1. Mulberry variety V-1 recorded highest shoot length of 51.61cm and shorter shoot length was recorded in S-54 (16.99 cm). Mulberry varieties studied exhibited considerable variations in fresh shoot and dry shoot weight. Among the mulberry varieties studied, DWshowed the longest root length, (18.11 cm), more numbers of roots/sapling (13.8) highest fresh weight (2.75 gm) and Root volume (3.37 ml) when compared to othergenotypes and UP showing least values with respect to all these root traits. So, these two genotypes will use as a parents for making root specific mapping population for further genomic studies.

INTRODUCTION

Mulberry which besides, constituting the only food for silkworms is best suited for afforestation programme and is generally grown as trees (Rajat Mohan *et al.,* 2010; Baqual *et al.,* 2012). It is a well-established fact that, in commercial sericulture, more than 60% of the total cost of cocoon production goes towards mulberry production alone. However, in India, large area of mulberry is either rainfed or under limited irrigation (around 70 %). Further, with its receding availability, water has now become the single most limiting input in agriculture. The unpredicted monsoons multiplied the scarcity of water contributing to reduced productivity. Root characteristics can be important in determining the response of plants to drought. Water deficit not only decreases shoot growth rate, plant height, and yield but also affects root growth. The rooting of mulberry varieties for their survival and quick propagation has been of great concern and as such evolution of varieties which among other parameters are best rooters is the need of hour. Phenotypic characterization is the first step in the description and classification of the germplasm. Different authors highlighted the efficient screening of germplasm for better survivability (Sujathamma and Dandin, 1998), root proliofiration parameters (Eswar Rao *et al.*, 2000; Baksh *et al.*, 2001) and growth and yield parameters (Wani *et al.,* 2014; Adolkar *et al.,* 2007; Sinha *et al.*, 2001) . Due to wide behavioral variation in mulberry there are many practical difficulties in the selection procedure. Improvement of a crop depends on the variation existing in genetic stock. The processes of selection indicated the association of parameters for better rooting performance among the germplasm accessions. Evaluation of any crop is a continuous process to evolve new varieties suitable for specific zones for commercial utilization. The present scenario of sericulture industry demands new varieties suitable for various agro- climatic conditions especially in rain-fed conditions. Identification of suitable parents from large number of germplasm accessions is a prerequisite for the purpose. Hence the present study was undertaken to characterize the 18 mulberry genotypes and assess the phenotypic variability for root and their associated traits.

MATERIALS AND METHODS

The experiment was conducted at Department of Sericulture, UAS, GKVK, Bangalore during 2013-14. Mulberry genotypes namely V-1,M-5, DD-1, S-34, Mysore Local, MR2, S-36, S-54, RFS-135, RFS-175, S-41, S-13, MI-11, *M. Indica*, Dudia white, UP-105, Himachal local and MS-3 (Table-1) were selected from the germplasm bank maintained at Dept. of Sericulture, UAS, GKVK, Bangalore, Karnataka based on the morpho-anatomical parameters were used in the investigation. Cuttings were planted in the black polythene bags containing well-dried pulverized garden soil, sand and well-decomposed farmyard manure in the proportion 1:1:1 and maintained with consistent care (Jolly and Dandin, 1986). The experiment was carried out in RCBD method with 5replications / genotype. During the course of investigation, growing saplings were used to score the various propagation parameters *viz.,* sprouting percentage, survivability, shoot length, fresh shoot weight, dry shoot weight, number of roots/sapling, root length, fresh root weight, root volume were recorded by following the

standard descriptor (Bhat and Shilaja Hittalamani, 1992) from time to time. The data collected on various parameters subjected to statistical analysis by adopting "Method of Analysis of Variance" appropriate to the design of the experiment (Sundarraj *et al.*, 1972).

RESULTS AND DISCUSSION

The data on the propagation parameters of the selected 18 mulberry genotypes values are presented in Table 2. Significant variations were observed in respect of survivability and all other root proliferation characters among the genotypes.

Survivability is the capacity of a plant to with stand and survives under varied agro climatic conditions. Survivability rate depends on genetic constitution as well as the influence of ambient environmental conditions (Honda, 1970). Higher the survival percentage better will be the performance of the mulberry variety. In the present findings, mulberry varieties studied revealed significant variations in survivability ranging from 79% to 43.27%. UP showed highest survival percentage (79%) followed by MR2 (78.60%) and S-13 (78.45%). On the other hand varieties S-54 (57.5%) S-34(56.18%), RFS-135 (50.83%), DD-1(50.39%), MS-3 (47.43%), *M. indica* (44.35%) and S-36 (43.27%) recorded significant decrease in survivability when compared to other mulberry accessions.

The important criteria considered in vegetatively propagated crop plants are the rooting ability and root initiation, since a well-developed root system determines the maximum utilization of nutrients from the soil for growth and development. Studies on rootability are extremely important for characterisizing different plant genotypes and their general growth pattern in response to various edaphic and agro climatic conditions as well as their efficiencies in nutrient and water uptake. Root proliferation parameters like shoot length, fresh shoot weight, dry shoot weight, number of roots/sapling, root length, fresh root weight and root volume are variable according to mulberry varieties and also influenced by existing agro climatic factors (Fotadar *et al.*, 1989). Present results revealed that, shoot length was longer in V-1(51.61cm) followed by M-5 (46.87cm), Acc 118(37.18 cm), *S-13* (34.59), DD-1 (32.53 cm), S-34 (31.84 cm) and least was recorded in S-54 (16.99cm). Fresh shoot weight in the varieties studied also varied significantly. Highest fresh shoot weight was found in the variety V-1 (15.42 gm) and lowest was found in S-41 (2.13 gm). The varieties M-5, Acc-118, S-34, DD-1, S-13, DW, MR2 and *M. indica* showed the fresh shoot weight of 10.42gm, 5.496, 5.48, 5.47, 5.32, 4.304, 3.612 and 3.532 gm respectively. A considerable variation among the genotypes screened with respect to dry shoot weight was also observed. Highest dry shoot weight was recorded in V-1 (5.716gm) followed by M-5 (2.818 gm), DD-1 (1.942 gm) and DW (1.708 gm). Lowest dry shoot weight was found in variety *S-41* (0.198 gm). The varieties S-34, Acc-118, S-13, MR2, *M. indica* and S-36 showed 1.658 gm, 1.646 gm, 1.64 gm, 1.088 gm 0.868 gm and 0.786 gm of dry shoot weight respectively.

Table 1: Mulberry germplasm accessions used in the study

S. No	Acc. No	Name	Origin
1	MI-11	Acc118	Selection
2	MI-0143	*M. indica*	Selection
3	MI-0013	S-36	Mutation
4	MI-0308	V-1	CPH
5	MI-0047	S-41	Mutation
6	MI-0049	S-54	Mutation
7	MI-0060	Dudia White	Clonal Selection
8	MI-0119	UP	Clonal Selection
9	MI-0021	DD-1	Collection
10	MI-0025	MR2	Clonal Selection
11	MI-0014	M5	OPH Selection
12	MI-0052	Mysore Local	OPH Selection
13	MI-0160	S-34	Mutation
14	MI-0007	Himachal Local	Selection
15	MI-0002	MS-3	Selection
16	MI-0048	RFS-135	Clonal Selection
17	MI-0066	RFS-175	Clonal Selection
18	MI-0012	S-13	OPH Selection

With respect to number of roots / sapling, the mulberry varieties studied showed considerable variations. Roots were more in DW (14), Mysore Local (11.6), M-5 (9.2), V-1 (8.5) and S-34 (8.4) varieties. UP (4.6) recorded less number of roots. Root Length was longer in *Dudia white* (18.11cm), Acc-118 (17. 42cm), S-13 (17.31cm) and RFS-135 (17.18cm) compared to other varieties. UP revealed shorter root length (8.59cm). Fresh root weight was highest in *DW* (2.75 gm) followed by M-5 (2.72gm) and lowest fresh root weight was recorded in UP (0.352gm). The root weight has a relation to root volume of the plant. The root volume also significantly varied among the varieties. DW recorded highest root volume (3.37ml) followed by M-5 (3.16 mL). Overall, the variety UP recorded least root volume (1.17mL) in the field trial.

The cultivable varieties like MR2, S-13, S-54, S-34 and DD-1 showing better survivability along with UP. Similar observations were reported earlier (Chandra shekar *et al.,* 2001). Since mulberry is chiefly propagated through cuttings, rooting behaviour assumes paramount importance in choosing a promising mulberry variety for cultivation. Rooting behaviour of a variety is purely genetic character and plays a prominent role in the cultivation of vegetatively propagated crops (Goel *et al.,* 1998). Lin (1981) opined that lower rooting mulberry varieties have 2-3 layers of overlapping sclerenchyma tissues whereas in high rooting varieties they were scattered over the primary cortex.

Profusely rooting varieties showed higher activity of growth substances. There are positive correlations between carbohydrate, total sugar and rootability. High C/N ratio and more aspartic acid and cystine were found in good rooting mulberry varieties. The development of root system in terms of spread, depth and density control the utilization of soil resources for plant nutrient supply and also rooting in mulberry varied greatly between genotypes and various edaphic conditions (Bhatt and Hittalamani, 1992).

In the present study high variability was observed among the genotypes with respect to root proliferation parameters. Similar results were reported by Susheelamma and Jolly (1986) who suggested that, the existence of high variability among the mulberry varieties in root growth characters give the better scope for the selection. Hardhan Sau *et al.* (1995) observed the best rooting performance in the mulberry varieties like ACC118 and S36. Agastian and Vivekanandan (1997) reported

Table 2: Propagation parameters of selected mulberry germplasm accessions

Mulberry accessions	Survival (%)	leaf length (cm)	Leaf width (cm)	Shoot l ength(cm)	Fresh shoot weight (g)	Dry shoot weight (g)	Fresh biomass weight(g)	Dry biomass weight(g)	No.of roots	Fresh root weight(g)	Dry root weight (g)	Root length (cm)	Root volume (ml)
DW	63.86	8.54	6.62	31.78	4.30	1.70	14.64	4.64	13.80	2.75	0.84	18.11	3.37
S-34	56.18	11.20	8.71	31.84	5.48	1.65	22.22	5.71	8.40	2.46	0.57	15.38	2.31
ML	63.95	9.35	7.17	23.54	2.83	0.75	14.56	3.63	11.60	2.59	0.594	15.07	2.66
V1	75.00	14.58	9.28	51.61	15.42	5.71	38.77	11.75	8.5320	1.94	0.60	14.66	2.47
MR2	82.50	11.48	7.40	21.85	3.61	1.08	15.70	3.87	8.40	2.69	0.57	16.33	2.42
DD-1	50.39	11.43	9.62	32.53	5.47	1.94	23.31	6.60	5.60	2.68	0.68	15.35	1.89
M5	79.61	13.67	10.30	46.87	10.42	2.81	36.27	10.18	9.20	2.72	0.60	15.60	1.91
S-36	28.64	8.36	7.35	18.33	2.80	0.78	14.34	3.61	8.20	1.52	0.36	12.48	1.22
S-54	57.50	6.20	5.30	7.22	0.73	0.19	3.65	0.87	6.80	1.52	0.16	12.26	1.28
UP	85.00	9.21	6.72	24.32	2.60	0.73	9.73	2.63	4.60	0.35	0.12	8.59	1.17
MS-3	40.00	8.36	5.51	17.51	1.47	0.36	7.23	1.73	5.60	0.65	0.34	10.59	1.19
HL	65.83	10.25	8.43	28.42	2.66	0.71	11.45	2.85	5.40	0.48	0.17	9.47	1.17
RFS-135	50.83	10.32	7.92	17.24	2.53	0.63	15.28	3.50	5.60	1.84	0.44	17.18	1.80
RFS-175	69.34	11.11	8.25	20.24	2.44	0.72	13.29	3.24	5.40	0.83	0.24	12.27	0.69
S-41	70.00	8.60	6.38	20.89	2.59	0.71	12.60	3.67	7.00	2.48	0.64	15.34	3.16
S-13	82.50	13.41	8.47	34.59	5.32	1.64	21.35	5.54	7.40	2.54	0.59	17.31	2.58
M. indica	30.53	11.42	8.43	24.19	3.53	0.86	13.46	3.51	6.60	1.36	0.36	10.39	0.99

highest rooting potential in S30, S36 and ACC235 mulberry genotypes. Phenotypic variation was highly observed in dry weight per plant and root volume. It was earlier reported by Masilamani *et al.* (2000). With respect to different root characters, viz., number of roots, fresh root weight, dry root weight, root length and root volume DW recorded highest values when compared to other genotypes. All these rooting characters are positively correlated with each other. These results are in line with Baksh *et al.* (2001) who reported that increase in root length and number of roots there is a positive increase in fresh weight and root volume of a plants. Surprisingly UP showing lowest values with respect to all these rooting characters.

Thus, it is evident from the present finding that DW was the superior genotype with respect to all rooting characters and UP showing least values. So DW can withstand low soil moisture content because of good rooting ability which can uptake the water from deeper layers in rainfed conditions. There is a need to conduct the bio-chemical and bio-assay studies with respect to determine the quality of the leaves. In another way, to identify the gene which is responsible for good rooting ability, for this molecular studies has to be conducted for identifying the specific genomic regions nothing but QTLs for root traits. So this study given a basic platform for conducting molecular research because DW and UP showing a contrasting root traits.In future these two germplasm lines will use as a parents for making root specific mapping population for genomic studies.

REFERENCES

Adolkar, V. V., Raina, S. K. and Kimbu, D. M. 2007. Evaluation of various mulberry *Morus spp*. (Moraceae) cultivars for the rearing of the bivoltine hybrid race Shaanshi BV-333 of the silkworm *Bombyxmori*(Lepidoptera: Bombycidae). *Int. J. Tropical Insect Science*, **27:** 6-14.

Agastian, P. and Vivekanandan, M. 1997. Evaluation of mulberry genotypes for saline tolerance by chemo and bio-assay. *Indian J. Seric.* **36(2):** 142-146.

Baksh, S., Mir, M. R., Darzi, G. M., Khan, M. A. and Ahsan, M. M. 2001. Performance of some mulberry varieties under temperate climatic condition of Kashmir. *Proceedings of Natl. Semi. Mulb. Seri. Res.*, November, KSSR&DI, Bangalore, India: **97:** 26- 28.

Baqual, M. F., Mir, M. A., Kamili, A. S., Singh, K. N., Raja, T. A. and Sharma, R. K. 2012. Behaviour of some indigenous mulberry genotypes of kashmir valley under polyhouse. *I. J. S. N.* **3(3):** 592-598.

Bhat, G. G. and Hittalamani, S. 1992. Clonal differences in mulberry (*Morus*spp.) for root growth parameters. *Indian J. Seric.* **31(1):** 5-8.

Chandrashekar, S., Prakash, B. G. and Shaila, H. M. 2001. Evaluation of different mulberry varieties with respect to establishment and yield. *Proceedings of Natl. Semi. Mulb. Seri. Res.*, November, KSSR&DI, Bangalore, India: **99:** 26-28.

Eswar Rao, M. S., Mallikarjunappa, R. S. and Dandin, S. B. 2000. Evaluation of tetraploid and triploid mulberry genotypes for propagation, growth and leaf yield parameters. *Proceedings of Natl. Conf. Stra. Seri. Res. Devpt.*, November, CSR&TI, Mysore, India: **2:** , 16-18.

Fotadar, R. K., Ahsan, M. M., Dhar, K. L. and Bhakuni, B. S. 1989. Evaluation and utilization of genetic variability in mulberry. *Indian J. Seric.* **28(2)**: 150-158.

Goel, A. K., Ravindran, S., Ananda Rao, A., Girish Naik, V., Tikader,

A., Mukherjee, P. and Sekar, S. 1998. Variability in rooting parameters at Juvenile stage in mulberry (*Morus*spp.) Germplasm. *Indian J. Seric.* **37(2):** 109-112.

Hardhansau, Pradip Kumar, S., Dayakar Yadav, B. R. and Saratchandra, B. 1995. Evaluation of mulberry (*Morus*spp.) genetic resources-I sprouting, survival and rooting ability. *J. Environ. Res.* **3(1):** 11-13.

Honda, T. 1970. Studies on the propagation of mulberry trees by cuttings. *Bull. Seric. Expt. Sta,* Tokyo, Japan. **24(1):** 133-145.

Jolly, M. S. and Dandin, S. B. 1986. Collection, Conservation and Evaluation of Mulberry (*Morus*spp.) Germplasm. C.S.R & T.I., Mysore, India: 43.

Lin, S. H. 1981. Histological and biological studies on the rooting of hardwood cutting in mulberry (*Morus*spp.). *Seric. J. Korea*. **23(1):** 1-31.

Masilamani, S., Reddy, A. R., Sarkar, A. and Jayaswal, K. P. 2000. Selection of quantitative traits in mulberry (*Morus*spp.) for root growth parameters. *Madras Agricultural J.* **87(10/12):** 689-690.

Rajat Mohan, Ranjan, T., Anil, D., Sardar, S., Bhat, M. M. and Khan, M. A. 2010. Sericulture and environment are complementary: plantation of improved mulberry genotypes at different altitudes of Himanchal Pradesh. *The Bioscan.* **1:** 217-224.

Sinha, P. S., Gangwar, S. K., Singh, B. D., Jaiswal, J. and Griyaghey, U. P. 2001. Evaluation of some elite mulberry *(morusalba*l.) varieties and NPK levels under partially irrigated conditions from sericulture view point. *Indian J. Agric. Res*. **35(2):** 71-78.

Sujathamma, P. and Dandin, S. B. 1998. Evaluation of mulberry (*Morus*spp.) genotypes of propagation parameters. *Indian J. Seric.*, **37(2):** 133-136.

Sundararaj, G. L., Nagaraju, M. N. and Venkataramuand Jaganath. 1972. Design and Analysis of field experiments. *U.A.S., Misc., Series No. 22, Bangalore,* India. pp. 424-440.

Susheelamma, B. N. and Jolly, M. S. 1986. Evaluation of morpho-physiological parameters associated with drought resistance in mulberry. *Indian J. Seric.* **25(1):** 6-14.

Wani, S. N., Malik, G. N., Mir, M. R., Parveez, G., Naina Majid and Ashraf Bhat, M. 2014. Evaluation of mulberry germplasm based on leaf and quality parameters. *The Bioscan*. **9(4):** 1399-1404.