Screening of Selected Mulberry (Morus) Germplasm Varieties Through Propagation Parameters.

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Abstract

Nine mulberry varieties along with one check variety M5 were field tested at Bethamangala village of Kolar district, Karnataka. These mulberry varieties were evaluated for the propagation parameters, like sprouting, survival, shoot growth and rooting behaviour. Results showed that, sprouting percentage was above 95% in TR8, TR12 and S1708 mulberry varieties, while survival rate was as high as 93% in S1708. Mulberry variety S1708 recorded highest shoot length of 62.63cm and shorter shoot length was recorded in C6 (35.55cm). Mulberry varieties studied exhibited considerable variations in fresh shoot and dry shoot weight. Among the mulberry varieties studied, Matigara black showed the longest root length (25.99cm) followed by TR12 (23.57cm) and TR8 (21.98cm). Numbers of roots / sapling were recorded more in Matigara black (42) and less in TR8 (14). Root volume was significantly high in Matigara black (16.27ml) and TR20 (14.21ml) when compared to other varieties. Overall the mulberry variety S1708 showed better results in many propagation characters followed by TR8 and TR29 mulberry varieties.

Key Words: Growth, mulberry germplasm; sprouting; survival; rooting; root length, root volume.

1. Introduction.

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. Hence, in recent years maximum attention has been given for the improvement of mulberry both in terms of quality and quantity. The major objective of mulberry crop improvement is to evolve new elite mulberry varieties for high leaf yield, resistance to pests, drought and their adoptability to different agroclimatic conditions. The genus Morus L. is highly heterozygous with a lot of variations in the off springs.Propagation of mulberry is done through vegetative means such as planting of cuttings or by grafting so as to preserve the phenotypical characters. Most of the mulberry species in the tropical conditions display tremendous rooting ability because of this mulberry propagation is invariably carried out through planting of cuttings (Doss, 2000). Survival rate is considered as one of the important criteria as mulberry varieties are propagated through vegetative means (Tikader and Kamble, 2009). Kolar district is the traditional sericulture belt in Karnataka. It enjoys a moderate climatic condition with an annual rainfall of 600mm-700mm, mean temperature of 32°C and low humidity of 40%. Sericulture is one of the main occupations covering all 11
taluks in Kolar. Many farmers are depending upon sericulture for their livelihood. The total area under mulberry is around 29,136 ha. and the industry provides employment to about 68,700 persons. Two popular mulberry varieties namely M_5 and Mysore local are used for cultivation both under irrigated and rainfed condition. With the development of sericulture industry and the recent increase in the technical know-how, it has become very essential to evolve better performing mulberry varieties to fulfill the demand of Sericulturists. Hence, it becomes obligatory to examine the agrobotanical parameters while evaluating mulberry germplasm. Therefore, the present investigation was initiated to identify and record suitable mulberry variety for the Kolar agroclimatic region.


2.1. Study Area

The experiment was conducted at Bethamangala village of Bangarpet taluk in Kolar district, Karnataka during 2007-2011. This village is located at 12º37’ north of the equator and 78º28’ east longitudes and 793m altitude above MSL, with an annual rainfall of 650mm. Soil of the experimental plot was red loamy with slightly acidic condition.

2.2. Collection and Preparation of Sampling

Mulberry varieties TR_8, TR_12, TR_20, S_1788, MS_5, Matigara black, Morus nigra, C_6 and C_10 were selected from the germplasm bank maintained at CSGRC, CSB, Hosur, Tamil Nadu based on the morpho-anatomical parameters were used in the investigation. The variety M_5 is used as a check variety for the purpose of comparison. The hard wood stem cuttings of all the taxa were prepared choosing the middle part of the Juvenile twigs in order to maintain the optimum moisture and desired level of carbon-nitrogen ratio (Starting, 1923). Each cutting measured about ½” in diameter and 12” in length possessing 3-4 active vegetative buds. Cuttings free from pathogen and pests were chosen for multiplication. Due care was taken to avoid damages to the buds and cut ends while preparing the cuttings (Hartman and Kester, 1978; Bindroo et al., 1988).

2.3. Experimental Analysis

Cuttings were planted in the freshly prepared nursery 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; Krishnaswami, 1986a). The experiment was carried out in RBD method with 5replications / variety. 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 (Dandin and Jolly, 1986; Das et al., 1987; Shamachry and Jolly, 1988; Dandin and Kumar, 1989; Bhat and Shilaja Hittalamani, 1992) from time to time in the different season’s viz., summer, rainy and winter.

2.4. Statistical Analysis

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; Singh and Choudhary, 1979).
3. Results

The data on the propagation parameters of the selected nine mulberry varieties were compared with the check variety M5. The values are presented in table. Significant variations were observed in respect of sprouting, survivability and root proliferation characters among the varieties.

3.1. Sprouting

The capacity and quickness of sprouting determine the subsequent growth and yield in fodder crops like mulberry (Hartman and Kester, 1978). Success of the establishment of a new mulberry garden mainly depends on sprouting ability of the mulberry variety. It is an established fact that, sprouting is an inherent capacity of the varieties to unfold buds and produce new shoots. However, the role of moisture and other agro climatic features cannot be ruled out in favouring sprouting of mulberry genotypes (Dandin and Kumar, 1989). In the present investigation, the taxa studied showed variation in sprouting. Mulberry varieties Tr8 (97%), S1708 (96%) and Tr12 (95.5%) exhibited good sprouting ability followed by TR20 (91%), Matigara black (87%), C10 (83%), MS5 (83%), Morus nigra (80%). Lowest sprouting was recorded in C6 (79.5%). However, the check variety M5 revealed higher sprouting percentage (98%) over other varieties is attributable to the fact that, the variety being a local cultivar that can easily acclimatized to the existing climate (Table-1).

3.2. Survivability

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 93.25% to 67.75%. Mulberry variety S1708 showed highest survival percentage (93.25%) followed by M5 (90.75%) and TR8 (82.00%). On the other hand varieties C10 (75%) C6 (71.5%), TR12 (70%), Morus nigra (69%), Matigara black (68.75%), MS5 (68.5%) and TR20 (67.75%) recorded significant decrease in survivability when compared to S1708 mulberry variety (Table-1).

3.3. Root proliferation parameters

The important criterias 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 (Hartman and Kester, 1978). Studies on rootability are extremely important for characterizing 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 S1708 (62.63cm) followed by TR4 (57.50cm), TR20 (55.87cm), Matigara black (54.43cm), M5 (54.12cm), TR12 (51.48cm), MS5 (48.56cm), C10 (45.50cm), Morus nigra (40.15cm) and C6 (35.55cm). Fresh shoot weight in the varieties studied also varied significantly. Highest fresh shoot weight was found in the variety S1708 (78.89 gm) and lowest was found in Morus nigra (24.00 gm). The varieties TR20, TR8, Matigara black, M5, C10, TR12, MS5 and C6 showed the fresh
shoot weight of 57.25gm, 40.52gm, 32.39gm, 30.16gm, 27.02gm, 26.63gm and 26.14gm respectively. A considerable variation among the varieties screened with respect to dry shoot weight was also observed. Highest dry shoot weight was recorded in S1708 (26.75gm) followed by TR20 (13.98gm), TR6 (10.92gm) and Matigara Black (8.92gm). Lowest dry shoot weight was found in variety Morus nigra (6.86gm). The varieties M5, C10, TR12, C6 and MS5 showed 8.78gm, 8.63gm, 8.28gm, 7.54gm and 7.15gm of dry shoot weight respectively. With respect to number of roots / sapling, the mulberry varieties studied showed considerable variations. Roots were more in Matigara black (42), TR12 (31), Morus nigra (27), MS5 (26) and C10 (24) varieties. All other varieties viz., S1708 (18), M5 (18), TR20 (16), C6 (16) and TR8 (14) recorded less number of roots. Root Length was longer in Matigara black (25.99cm), TR12 (23.57cm), TR8 (21.98cm) and Morus nigra (21.83cm) compared to other varieties. M5 variety revealed shorter root length (16.06cm). Fresh root weight was highest in Matigara black (16.67gm) followed by TR20 (13.86gm) and lowest fresh root weight was recorded in M5 (2.57gm). Mulberry varieties TR8, S1708, Morus nigra, TR12, MS5, C10 and C6 recorded (7.51gm), (5.51gm), (5.18gm), (4.81gm), (3.95gm) and (2.57gm) fresh root weight respectively. The root weight has a relation to root volume of the plant. The root volume also significantly varied among the varieties. Matigara black recorded highest root volume (16.27ml) followed by TR8 (12.14ml). Overall, the variety M5 recorded least root volume (4.17ml) in the field trial (Table-1).

4. Discussion

4.1. Sprouting

A few workers carried out similar work in the earlier years. Jolly and Dandin (1986) in the mulberry varieties Kalikutahi, China white, Assambola, Sujanpur1, local male, S11, ACC112, AB x Phil.P6, Miz x BCP12 and AB x Phil.P6 with 92% sprouting and reported that tropical mulberry varieties are good in sprouting. They are also of the opinion that, though sprouting is a genetic feature of the strain, soil moisture and temperature also contribute equally for the cause. Susheelamma et al., (1990) enlisted Sujanpur-L1 is the best sprouting one among the varieties studied. Susheelamma et al., (1992) observed highest sprouting in mulberry variety S1 (89.4%) followed by Local (87%). Agastian et al., (1995) reported that, mulberry varieties S36, S10 and BC259 registered good sprouting ability when compared to other varieties studied. Hardhan Sahu et al., (1995) studied 36 mulberry accessions for their sprouting ability. They enlisted the variety Himachal local is best in sprouting (95.1%) followed by ACC165, MS4, MR2, MS6, Surat, ACC121 and S13 varieties screened. Sujathamma and Dandin (1998a) observed highest sprouting (97.17%) in Sujanpur5 mulberry variety followed by Tr4 (88.42%) and OPH1 (41.04%). Baksh et al., (2000) reported that, mulberry genotype ACC48 registered highest sprouting (97.92%) followed by C4 (97.22%), S1301 (95.83%) and Tr8 (95.14%). Doss et al., (2000); Eswar Rao et al., (2000); Vijayan et al., (1998) have studied the propagation characteristic features of diploid, triploid and tetraploid mulberry genotypes in nursery conditions. They found that, triploids saplings possess larger leaves and grow more quickly than those of diploid and tetraploid genotypes. Eswar Rao et al., (2000) were opined that, highest sprouting percentage of mulberry cuttings was recorded in diploid varieties (93.33%) followed by triploids (91.35%) and tetraploids (80.98%). Similar observations were also confirmed from the present findings. Chandrashekar et al., (2001) noticed good sprouting in mulberry varieties V1, M5, DD and S10. Santosha Gowda V. Patil (2002) reported that, mulberry variety S1631 cultivated under 60cm x 60cm recorded 98% of sprouting.
4.2. Survivability

Sujathamma and Dandin (1998a) recorded highest survival rate in Sujanpur5 (96.17%) followed by TR10 (93.75%) and MS5 (30.08%). Vijayan et al., (1998) stated that, triploid mulberry varieties usually reveal 96.67% of survivability rate. Sharma (1993) observed 79%-90% survival rate in Mandalay, K2, TR10 and S146 mulberry varieties when cultivated in Uttar Pradesh. Similar observations were made by Hardhan Sau et al., (1995) in the mulberry variety Surat which showed highest survival rate (97.1%) followed by K2, ACC115, ACC121, MR1, ACC120, ACC153, Punjab local, Sujanpur5 and Shrim6. Chandrashekar et al., (2001) reported that, mulberry genotypes V1, M5, DD and S10 were best in survivability rate compared to other genotypes studied. Darshan Singh et al., (2001) were of the opinion that, triploid mulberry varieties are good in survivability when compared to temperate varieties.

4.3. Root proliferation parameters

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 (Honda, 1970; Susheelamma and Jolly, 1986; 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). The present observations are more or less similar to the findings of Susheelamma and Jolly (1986). They suggested the existence of high variability among the mulberry varieties in root growth characters and better scope for the selection. Regeneration capacity, growth and root induction varies greatly among the genotypes. Jolly and Dandin (1986) enlisted ACC117, ACC165, Miz x BCP9, English black, RFS135, ACC121, Kaliakutahi, Kokuso21. Local male and Sujanpur3 are the best ten in rooting ability (90%-100%) among the mulberry varieties studied. Fotadar et al., (1989) studied some temperate mulberry varieties and they reported that, among the varieties observed, china white showed the best rooting (62.7%). Susheelamma et al., (1990) enlisted LS1 and English black are best in rooting ability among the varieties examined. Further, they have also reported that tropical mulberry varieties are good in rooting. Mala et al., (1992) reported that, mulberry varieties Kokuso21 a hybrid of Morus multicaulis and Kokuso13 and a hybrid of Morus bombycis and Morus latifolia produce highest rooting percentages (76.67%-90.00%). Susheelamma et al., (1992) observed highest rooting in local mulberry variety (95.5 %) followed by ACC203 (94.2%). Hardhan Sau et al., (1995) observed the best rooting performance in the mulberry varieties ACC165, ACC118, S36 and Punjab local. Agastian and Vivekanandan (1997) reported highest rooting potential in BC259, S36, S36 and ACC235 mulberry genotypes. Sujathamma and Dandin (1998a) reported that, mulberry variety Sujanpur5 was superior among all the genotypes tested with 96.17% rooting ability. Eswar Rao et al., (2000) observed that cutting from 1-3 year old plants had 82.6% to 94.66% rooting. Triploid forms rooted better than diploids and tetraploids. Similar results were also observed in the present findings. Masilamani et al., (2000)
studied 18 mulberry genotypes for their growth parameters and related traits. They reported that, high phenotypic and genotypic coefficient of variation were recorded for shoot to root ratio by dry weight per plant (38.42% and 37.09%) and volume of roots per plant (37.91% and 34.62%), indicating wide range of variability (93.24% and 83.29%) coupled with high genetic advance over mean (73.55% and 65.13%) recorded by these traits. Shoot length and number of roots per plant had moderate values of heritability (72.67% and 68.05%) and genetic advance over percentage of the mean (46.51% and 50.70%). Baksh et al., (2001) screened twenty-seven mulberry genotypes comprising 18 tropical and 9 sub-tropical cultivars for their rooting and leaf yield. They reported that S36 and Mandalay exhibited more stable in rooting and they opined that there is no correlation between rooting ability and leaf yield. Sinha et al., (2001) evaluated four elite mulberry varieties viz. S1, K2, C763 and C776 under partially irrigated conditions on the basis of growth parameters like extension growth, branching, no. of leaves, leaf area, 100 leaf weight, weight of 100 sq cm laminar area, total photosynthetic area, fresh leaf yield and moisture content of leaf and reported that, mulberry variety S1 was found to be the best from sericulture point of view and NPK @ 150:50:50 kg/ha/yr. in combination of FYM @ 10 MT/ha/yr. was found to be the most cost-effective fertilizer level under partially irrigated conditions. Santosha Gowda V. Patil (2002) noticed that, mulberry genotype S1635 grown under 60cm x 60 cm plants spacing revealed good rooting (87%) compared to M5 (81%). Adolkar et al., (2007) evaluated six mulberry varieties K2, Thailand, Thika, S1, S2 and S36 for growth and yield parameters and reported that, all the varieties differ significantly in results and mulberry variety S36 exhibited superiority in characters over other cultivars tested. Paul and Quiyyum (2010) reported that, irrigation has significant effect on leaf yield and some of its components. Twice irrigation in a month with mulberry variety BM4 gives higher leaf yield. Gnanaraj et al., (2011) reported that, among the four saline tolerant mulberry genotypes S1635, S36, S13 and MR2 studied, S1635 gives good results in growth and yield parameters compared to other 3 genotypes.

Conclusion.

Nine indigenous mulberry varieties were evaluated in the field condition for growth and propagation parameters. Clonal population is popular in mulberry cultivation since mulberry is a cross pollinated and heterozygous plant. In the present investigation observations revealed that, two mulberry varieties namely S1708 and TR8 performed notably well when compared to other varieties selected for investigation. Further, these two mulberry varieties require detailed bio-chemical, bio-assay studies and multilocational tests to qualify to become authorised cultivars for commercial exploitation. Experiments are underway to confirm the superiority of these varieties.

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References.


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Table - 1: Propagation parameters of selected mulberry germplasm varieties
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