International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2018; 6(5): 1511-1514

Received: 25-07-2018
Accepted: 30-08-2018

Aruna N
Department of Sericulture, Forest College and Research Institute, Mettupalayam, Tamil Nadu, India

Krishnamoorthy SV
Professor (Agrl. Entomology) Department of Sericulture, Forest College and Research Institute, Mettupalayam, Tamil Nadu, India

Umapathy G
Professor (Agrl. Entomology) Department of Sericulture, Forest College and Research Institute, Mettupalayam, Tamil Nadu, India Nadu

Correspondence
Aruna N
Department of Sericulture, Forest College and Research Institute, Mettupalayam, Tamil Nadu, India

Evaluation of mulberry accessions for rearing performance and economic traits of silkworm (*Bombyx mori.* L)

Aruna N, Krishnamoorthy SV and Umapathy G

Abstract
Twenty four mulberry accessions *viz.*, MI-0017, MI-0034, MI-0349, MI-0395, MI-0425, MI-0490, MI-0497, MI-0535, MI-0536, MI-0543, MI-0558,MI-0613, MI-0615,MI-0651, MI-0652, MI-0658, MI-0663, MI-0677, MI-0685, MI-0686, MI-0718, MI-0763, MI-0768, MI-0845 along with V-1(check variety) were evaluated for leaf quality using double hybrid (CSR 6 X CSR 26) X (CSR 2 X CSR 27) silkworm at the Department of Sericulture, Forest College and Research Institute, Mettupalayam during 2017-18. Results revealed that, silkworm larvae reared on MI-0615 leaves recorded the highest larval weight (34.23 g), cocoon weight (16.8 g), single shell weight (4.2 g), shell ratio (25 %), silk filament length (995.47 m), less denier (2.27) and silk productivity (4.73 cg/day). Accession MI-0495 recorded the lowest larval weight (26.35 g), cocoon weight (13.8 g), shell weight (2.9 g), shell ratio (19.74 %), pupal weight (10.00 g), silk filament length (812.83 m), less denier (2.80) and silk productivity (3.52 cg/day). Standard check V1 recorded 30.10 g of larval weight, 15.5 g of cocoon weight, 3.6 g of shell weight, 23.22 percent of shell ratio, 15.78 g of pupal weight, 875.30 m of filament length, 2.20 of denier and 4.00 cg/day of silk productivity. Among the twenty four mulberry accessions tested for leaf quality, MI-0615 was found to be superior in terms of imparting better larval rearing and cocoon economic parameters.

Keywords: mulberry accession, cocoon characters, rearing

Introduction
The silkworm (*Bombyx mori* L.) is a monophagous and highly domesticated insect. Mulberry (*Morus* spp.) is the sole food plant of silkworm that plays vital role in the growth and development of silkworm and in turn the silk production. Leaf quality and quantity not only influence the silkworm growth and development, but also the cocoon production as well as quality of raw silk. Good variety of mulberry, appropriate agronomic practices and plant protection measures determine the quality of leaves (Aruga, 1994) [1]. Mulberry leaves contain a rich source of protein and amino acids which influence the shell weight of cocoon (Seidavi *et al.*, 2005) [14]. The nutritional composition of mulberry leaves vary with cultivars and could also influence the larval growth and cocoon production (Nagaraju, 2002) [10] which ultimately reflect in the economic traits namely larval weight, cocoon and shell weight (Ravikumar, 1988) [13]. The quality of mulberry leaves and environmental conditions influence the dietary efficiency and growth of silkworm (Bongale and Chaluvachari, 1995) [3]. The performance of any mulberry variety with respect to leaf quality and cocoon production varies with agro-climatic conditions and cultivation practices. Hence, the present study was carried out to evaluate different mulberry accessions for rearing performance and economic traits of silkworm

Materials and Methods
The present investigation was carried out in Complete Randomized Design (Ramani *et al.*, 2005) [12] with three replications for each accession in rearing house, Department of Sericulture, Forest College and Research Institute, Mettupalayam, Tamil Nadu during 2017-18. Disease free layings of silkworm double hybrid (CSR 6 X CSR 26) X (CSR 2 X CSR 27) were procured from chawki rearing center, Kariampalayam, Coimbatore district. Chawki rearing was carried out at mass level. After II instar, mulberry leaves of twenty four accessions *viz.*, MI-0017, MI-0034, MI-0349, MI-0395, MI-0425, MI-0490, MI- 0497, MI-0535, MI-0536, MI-0543, MI-0558,MI-0613, MI-0615,MI-0651, MI-0652, MI-0658, MI-0663, MI-0677, MI-0685, MI-0686, MI-0718, MI-0763, MI-0768, MI-0845 and V-1(check variety) were fed individually to larvae four times in a day. Fifty larvae were maintained for each test

accession of mulberry leaves. The healthy larvae in the rearing tray were enumerated and unhealthy larvae removed periodically. Fully ripened worms were picked manually and mounted on bamboo spinning tray. The worms spun the cocoons within 48 to 72 hours. The pupae remained inside the cocoons till emergence. The harvesting of cocoon was carried out on sixth day of release of worms on mountages. Randomly selected ten cocoons of each treatment were used for recording rearing parameters and economic traits as detailed below.

1. Larval weight (g): Larval weight was recorded at 5th day of V instar. The weight of ten randomly selected larvae from each treatment was taken and weighed with an electronic balance and the mean was expressed in gram.

2. Cocoon weight (g): After complete spinning of the cocoons, ten cocoons were weighed and the mean was expressed in gram.

3. Shell weight (g): The shell weight was recorded from selected ten cocoons by cutting open the cocoon and mean were expressed in gram.

4. Shell ratio (%): The shell percentage was determined by using the following formula. The mean was expressed in percent.

$$\text{Shell percentage} = \frac{\text{Shell weight (g)}}{\text{Cocoon weight (g)}} \times 100$$

5. Pupal weight (g): The pupal weight was recorded from ten randomly selected cocoons and mean was expressed in gram.

6. Silk filament length (m): Five cocoons from each replication were reeled on epprouvette and the filament length was determined by the following formula and expressed as meters.

$$L = Rx1.125$$

Where,

L= total length of the silk filament
R= number of revolutions recorded
1.125=circumference of epprouvette in meter

7. Denier: It was calculated by using the formula

$$\text{Denier} = \frac{\text{Single cocoon filament weight (g)}}{\text{Single cocoon filament length (m)}} \times 9000$$

8. Silk productivity (cg/day): The silk productivity was calculated replication wise by adopting the formula,

$$\text{Silk productivity (cg / day)} = \frac{\text{Weight of cocoon shell (cg)}}{\text{Fifth instar duration (days)}}$$

Results and Discussion

Rearing parameters: The data presented in table 1 revealed that the highest larval weight (34.23 g) of ten mature larvae was recorded in accession MI-0615 and it was followed by MI-0685 (31.76 g). MI-0685 on found to be on par with MI-0677 (31.65 g), MI-0686 (31.73), MI-0663 (30.20 g) and MI-0490 (30 g). The highest cocoon weight of 16.8 g was again recorded in MI-0615 and it was followed by MI-0685 (16.5 g). MI-0685 was on par with the accessions MI-0652 (15.9 g), MI-0543 (15.8 g), MI-0677 (15.6 g), MI-0017 and MI-0349 (15.7 g). Maximum shell weight was recorded in accession MI-0615 (4.2 g) followed by MI-0685 (3.9 g), which was on par with the accessions MI-0651 (3.6 g) and MI-0349 (3.6 g). The highest of 25 percent of shell ratio was recorded in MI-0615 and was on par with the accessions MI-0685 (24.63%) and MI-613 (24%). Pupal weight was the highest in MI-0615 (16.02 g). It was followed by MI-0685 (15.99 g) which was on par with the accession MI-0490 (15.89 g), MI-0763 (15.48 g) and MI-0651 (15.12 g). Accession MI-0495 recorded the lowest larval weight (26.35 g), cocoon weight (13.8 g), shell weight (2.9 g), shell ratio (19.74%) and pupal weight (10.00 g). Standard check V-1 recorded 30.10 g of larval weight, 15.5 g of cocoon weight, 3.6 g of shell weight, 23.22 percent of shell ratio and 15.78 g of pupal weight.

Growth and development of *Bombyx mori* and in turn economic traits *viz.*, cocoon weight, shell weight and shell ratio were greatly influenced by the nutritional level of mulberry leaf. The present study is in conformity with the findings of Krishnaswami *et al.*, (1971) [9], who reported that larval weight of silkworm *Bombyx mori* L. varied in the range of 30.61 g to 34.80 g and variety V-1 (34.80 g) was superior among tested varieties followed by Kanva-2 (34.67 g), Mizosava (34.59 g), BER-1 (34.51 g) and S-34 (34.40 g) whereas the lowest larval weight was recorded in larvae fed on leaves of P-16 (30.61 g) variety of mulberry.

It is quite evident that tender, succulent and nutritious leaves are known to favour the good growth and development of young age silkworms whereas progressively mature leaves with less moisture content are required for late age silkworms (Krishnaswami, 1990) [8]. Degree and uniformity of moulting varies with mulberry leaf quality that favours the higher moulting ratio, ensures better growth rate and silkworm larval weight (Benchamin and Anantha Raman, 1990) [2]. Chaluvachari and Bongale (1996) [4] reported that S41 variety with higher protein and lower sugar content encouraged higher larval weight and lower moulting ratio. Ichinose leaves resulted in higher weight of mature larvae and improvement of economic traits of cocoon such as cocoon and shell weight among three improved Japanese cultivars of mulberry *viz.*, Ichinose, Gosherami and Kokusu-27. Pillai and Jolly (1985) [11] reported that S54 encouraged higher values in larval weight, single cocoon weight, shell weight, silk filament length and denier.

Economic parameters of cocoon: Results of the present investigation revealed that the highest silk filament length (995.47 m) and the lowest denier (2.27) were recorded when larvae were fed on accession MI-0615 and it was followed by MI-0685 (985.76 m) which was on par with the accession MI-0425 (984.75 m) and in terms of denier MI-0615 was on par with the accessions MI-0685 (2.31), MI-0686 (2.32) and MI-0425 (2.32). The shortest cocoon filament length and the highest denier were recorded in larvae fed on leaves of MI-0495 (812.83 m and 2.80). Silk productivity was recorded maximum when larvae were fed on accession MI-0615 (4.73 cg/day) and was on par with the accession MI-0685 (4.71 cg/day), 0535 (4.71 cg/day), MI-0686 (4.64 cg/day), MI-0763 (4.69 cg/day) and MI-0652 (4.66 cg/day). Whereas, the lowest silk productivity was recorded in larvae fed on leaves of MI-0495 (3.52 cg/day) and standard check V1 recorded 875.30 m of filament length, 2.20 of denier and 4.00 cg/day of silk productivity. Similarly**,** Gangawar (2010) reported that, among eight mulberry varieties viz., S1, S146, S1635, AR12,

AR14, TR10, BR2 and K2 evaluated for nutritional potential by silkworm rearing experiments, silkworm larvae fed on BR2 variety leaves showed higher larval weight and improved economic traits like cocoon weight, shell weight and silk percentage in comparison to other varieties. According to FAO (1999) [6], total silk filament length ranged from 600m-1500m out of which only 80% was reelable and cocoons recovered from silkworms reared on S1708 mulberry variety leaves produced the longest filament length and the lowest denier. In the present study, silk filament length of cocoons recovered from silkworms reared on different mulberry varieties fell within the same range of 600-1500m. Twenty five mulberry varieties evaluated with two silkworm races *viz.*, the crossbreed PM×CSR_2 and PM×$NB4D_2$ revealed that, larvae fed with different mulberry varieties Tr-10 and MR-2 varieties showed significant differences in all parameters *viz.*, larval weight, cocoon weight, shell weight, shell ratio, average filament length and filament denier (Sujathamma *et al.*, 2001) [15].

Table 1: Bioassay performance on different mulberry accessions

Sl. No	Accession number	Weight of ten larvae (g)	Weight of ten cocoon (g)	Shell weight (g)	Shell ratio (%)	Weight of ten pupae (g)	Silk filament length (m)	Denier	Silk productivity (cg/day)
1	MI-0017	28.32	15.7	3.1	21.01	13.72	910.11	2.40	4.43
2	MI-0395	26.40	13.9	3.0	21.58	10.95	832.90	2.42	3.53
3	MI-0349	28.20	15.7	3.6	22.92	13.84	859.23	4.40	4.30
4	MI-0034	29.85	14.2	3.4	23.94	13.88	973.20	2.42	4.51
5	MI-0425	28.35	14.9	3.0	20.13	11.32	984.75	2.32	4.42
6	MI-0490	30.00	14.9	3.3	22.14	15.89	961.82	2.39	4.41
7	MI-0652	28.33	15.9	3.2	20.12	12.93	834.65	2.38	4.66
8	MI-0535	27.30	14.4	3.4	23.61	10.95	851.50	3.37	4.71
9	MI-0543	27.45	15.8	3.2	20.25	11.20	863.78	2.38	4.60
10	MI-0536	26.50	14.5	3.1	21.37	11.32	928.94	2.67	3.56
11	MI-0558	28.23	14.9	3.4	22.81	11.00	894.74	2.76	3.56
12	MI-0613	27.54	13.8	3.4	24.00	11.98	893.55	2.76	3.55
13	MI-0615	34.23	16.8	4.2	25.00	16.02	995.47	2.27	4.73
14	MI-0651	26.44	15.0	3.6	23.63	15.12	848.39	2.40	4.33
15	MI-0495	26.35	13.8	2.9	19.74	10.00	812.83	2.80	3.52
16	MI-0658	27.35	15.1	3.2	21.19	13.25	888.40	2.42	4.48
17	MI-0677	31.65	15.6	3.4	21.79	12.84	856.77	2.40	4.39
18	MI-0685	31.76	16.5	3.9	24.63	15.99	985.76	2.31	4.71
19	MI-0686	31.73	15.4	3.2	20.77	14.30	975.60	2.32	4.64
20	MI-0763	27.47	15.2	2.4	15.78	15.48	844.36	2.39	4.69
21	MI-0718	28.46	14.8	3.1	20.94	13.28	873.24	2.48	4.58
22	MI-0768	27.54	15.2	3.2	21.05	14.00	928.43	2.36	3.54
23	MI-0663	30.20	14.2	3.0	21.12	11.55	799.45	2.38	4.35
24	MI-845	27.92	15.3	3.2	20.91	13.96	958.20	2.38	4.28
25	V-1 (check variety)	30.10	15.5	3.6	23.22	15.78	875.30	2.28	4.00
	SEd	1.077	0.389	0.129	0.957	0.5823	42.548	0.101	0.175
	CD (0.05%)	2.163	0.756	0.260	1.923	1.1697	85.470	0.204	0.353

Conclusion

Rearing performance of double hybrid silkworm proved to be better when fed with MI-0615 mulberry accession leaves. Commercial cocoon characters were recorded well in cocoons from silkworm reared on MI-0615 leaves. Next to MI-0615 mulberry accession, MI-0685 proved promising. Leaves of these accessions supported good growth and development of silkworm larvae, which was reflected in better commercial cocoon characteristic features. From the results, it could be concluded that mulberry accession MI-0615 turned out to be superior in silkworm rearing tests compared to other accessions examined under identical agro climatic conditions.

Acknowledgement

Authors thank the authorities of CSGRC, Central Silk Board, Govt. of India, Hosur, Tamil Nadu and Special thanks to Mulberry division Head Dr. K. Jhansi Lakshmi for providing the germplasm mulberry accessions.

References

1. Aruga H. Principles of Sericulture. Oxford and IBH publishing Co. Pvt. Ltd, 66 Janpath New Delhi, India, 1994, 376.
2. Benchamin K, Anantharaman KV, Standardization of moulting test to evaluate mulberry leaf quality under tropical conditions. Indian Journal Sericulture, 1990; 29(2):255-262.
3. Bongale UD, Chaluvachari. Evaluation of eight mulberry germplasm varieties by leaf biochemical and bio-assay moulting studies. Sericologia, 1995; 35:83-94.
4. Chaluvachari, Bongale UD. Bioassay moulting response of silkworm *Bombyx mori* L. in relation to leaf nutritive constituents in mulberry (*Morus* spp.) genotypes. Indian Journal of Sericulture, 1996; 35(2):160-162.
5. Dar HU, Singh TP, Das BC. Evaluation of mulberry varieties by feeding to *Bombyx mori*. Indian Journal of Sericulture, 1998; 27:16-22.
6. FAO. Silk reeling and testing manual. Agricultural Services. *Bulletin* No 136. Rome, Italy. 1999, 65-75.
7. Gangwar SK. Impact of varietal feeding of eight Mulberry varieties on *Bombyx mori* L. Agriculture and Biology Journal of North America, 2010; 1(3):350-354.
8. Krishnaswami S. Improved method of rearing young age (Chawki) silkworms. *Bulletin No.2*, Central Silk Board, Bangalore, India. 1990, 1-24.

9. Krishnaswami S, Kumarraj S, Vijayaraghavan K Kasiviswanathan K. Silkworm feeding trails evaluating the quality of mulberry leaves as influenced by variety, spacing and nitrogen fertilization. Indian Journal of Sericulture, 1971; 10:79-90.
10. Nagaraju J. Application of genetic principles in improving silk production. Current Science, 2002; 83(4):409-415.
11. Pillai SV, Jolly MS. An evaluation on the quality of mulberry varieties raised under hill conditions and the crop results of *Bombyx mori* L. Indian Journal of Sericulture, 1985; 24:48-52.
12. Ramani S, David J, Catherine loader. Statistical analysis of modified complete randomized designs: applications to chemo-orientation studies. Journal of Experimental Biology, 2005, 208.
13. Ravikumar C. Western ghat as a bivoltine region prospects, challenges and strategies for its development. Indian Silk, 1988; 26(9):39-54.
14. Seidavi A, Bizhannia AR, Sourati R, Mavvajpour M. The nutritional effects of different mulberry varieties on biological characters in silkworm. Asia Pac J Clin Nutr, 2005; 14:122
15. Sujathamma P, Dandin SB and Savithri. Quality evaluation of mulberry (*Morus* spp.) genotypes through bioassay under rayalaseema conditions of Andhra Pradesh. Indian Journal of Sericulture, 2001; 40(1):27-34.