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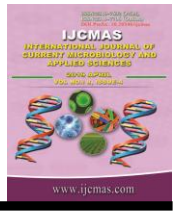

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Performance of Silkworm on Tree Mulberry, *Morus alba* L.

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A B S T R A C T

A study was undertaken in farmer's field condition by utilizing established five tree mulberry gardens of one-year-old and above and one bush mulberry garden as a control in each of the Chikkaballapura and Kolar Districts. The silkworm hybrids namely PM×CSR_2 in Chikkaballapura cluster and double hybrid (FC_1×FC_2) in Kolar cluster were reared on leaves harvested from both tree and bush mulberry plantations and economic parameters were recorded. The silkworms reared on leaves harvested from tree mulberry leaves expressed significant differences compared to those batches reared on bush mulberry except for shell ratio in Kolar district. The larval (4.16 and 4.79 g), cocoon (1.74 and 1.78 g), shell (0.39 and 0.43 g) and pupal weights (1.36 and 1.36 g) and shell ratio (20.94 and 24.61%), respectively in Chikkaballapura and Kolar Districts were significantly maximum in the batches fed with tree mulberry leaves. The fifth instar larval duration was recorded to be shorter when reared on tree mulberry leaves (224.40 and 240.00 h) and the cocoon yield was comparatively maximum when worms fed with leaves of tree mulberry [94.95 and 110.67 kg/100 Disease Free Layings (DFLs)], respectively in Chikkaballapura and Kolar Districts.

Introduction

Silk, a highly priced agricultural commodity, accounts for about 0.20 per cent of the total World production of textile fibers. Silk is the cultural heritage of India and Sericulture is an agro-based industry, wherein the money flows from rich to poor. India is the second largest producer of raw silk and also has the distinction of being the World's largest consumer of pure silk. Presently, India produces 21,273 MT of raw silk against its annual requirement of 33,840 MT; of which 5,266 MT is bivoltine silk and 16,007 MT is multivoltine silk. The total area of mulberry in the country is around 2,08,947 ha (Anonymous, 2017a). In India, Karnataka is the major silk producing state in which 1,34,661 farmers are involved in sericulture and they are producing 61,419 MT of cocoons from 1,66,000 ha of mulberry gardens, of which 590 ha is under tree mulberry plantation (Anonymous, 2017b). Mulberry foliage is the only food for the silkworm (*Bombyx mori* L.) and is grown under varied climatic conditions, ranging from temperate

to tropical. Mulberry leaf is a major economic component in sericulture since the quality and quantity of leaf produced per unit area have a direct bearing on cocoon harvest (Datta, 2000). Hence, the growth and development as well the quality and quantum of cocoons produced are largely influenced by leaf quality, since the mulberry leaf contributes 38.20 per cent of silk production followed by climate (37.00%), rearing techniques (9.30 %), silkworm breed (4.20%) and other factors (8.20%) (Miyashitha, 1986). Mulberry being a sole food plant, which can be cultivated in three different forms *i.e.,* bush, low-cut and tree (Qader *et al.,* 1991). The mulberry leaves from bush and tree systems of plantation have been found to differ in respect of quality as seen from rearing practices (Dasguptha, 1961; Krishnaswami *et al.,* 1970; Maribashetty *et al.,* 1999). In the present study, the effect of feeding of leaves harvested from tree mulberry on silkworm (*Bombyx mori* L.) in comparison with bush mulberry leaves has been undertaken.

Materials and Methods

Five tree mulberry gardens of one-year-old and above with spacing of 10'×10' and one bush mulberry garden with the spacing of (5'×3′) ×2′ of V_1 variety as a control were identified in each of the Chikkaballapura and Kolar Districts. The silkworm rearing was taken up in the farmer's field, wherein the worms were fed with leaves harvested from tree gardens from the chawki stage upto till the ripening of the worms. Meanwhile, the observations on the silkworms, reared on bush mulberry were also recorded in each cluster. In Chikkaballapura cluster, the multivoltine cross breed silkworm, PM×CSR_2 and in Kolar cluster, the bivoltine double hybrid (FC_1×FC_2), were reared. Prior to commencement of rearing, the rearing room with rearing stands were cleaned, washed thoroughly and properly disinfected with four per cent formalin solution using a foot pump as adopted by Dandin *et al.,* (2003). After spraying, the room was kept closed for 48 hours for effective disinfection. After 24 hours of disinfection, the doors and windows were kept open to allow the fresh air into the rearing room.

The observations from two crops were recorded during July, 2017 upto January, 2018. The worms were fed three times a day with V_1 variety of mulberry leaves at 6.00 AM, 12.00 PM and 9.00 PM. After fourth moult the rearing stands were labelled and samples were drawn randomly from different places and the silkworm parameters like fifth instar larval weight, fifth instar larval duration, cocoon weight, shell weight, pupal weight, shell ratio and yield per 100 DFLs were recorded. The qualitative / biochemical parameters such as moisture content, moisture content after 6 h of harvest, total carbohydrates, total proteins, phenols, Nitrogen, Phosphorous, Potassium,. Calcium, Magnesium and Sulphur contents in leaves were estimated by adopting standard procedures. The relationship between the qualitative parameters of tree mulberry leaves and the commercial parameters of silkworm were established by adopting standard statistical tool. The paired t-test was used to compare population means of tree and bush mulberry in order to assess the silkworm performance on tree mulberry.

Results and Discussion

Silkworm performance on tree mulberry leaves

All the parameters among the silkworm batches reared on tree and bush mulberry leaves were significantly differed from each other, except for shell ratio in Kolar District, which was observed to be non-significant. The batches fed with tree mulberry leaves

expressed maximum larval (4.16 and 4.79 g), cocoon (1.74 and 1.78 g), shell (0.39 and 0.43 g) and pupal weights (1.36 and 1.36 g), shell ratio (20.94 and 24.61 %) and cocoon yield per 100 DFLs (94.95 and 110.67 kg), respectively in Chikkaballapura and Kolar Districts compared to the silkworms fed with bush mulberry leaves with regard to larval (4.03 and 4.56 g), cocoon (1.67 and 1.72 g), shell (0.32 and 0.40 g) and pupal weights (1.34 and 1.34 g), shell ratio (1886 and 23.74 %) and cocoon yield per 100 DFLs (79.00 and 88.50 kg), respectively in Chikkaballapura and Kolar Districts (Table 1). There was an improvement in larval weight by 3.22 and 5.04 per cent, cocoon weight by 4.19 and 3.48 per cent, shell weight by 21.87 and 7.50 per cent, pupal weight by 3.62 and 1.49 per cent and cocoon yield by 20.18 and 25.05 per cent, respectively in Chikkaballapura and Kolar Districts in silkworms fed with tree mulberry leaves over batches fed with bush mulberry leaves. However, the larval duration was reduced by 17.03 and 21.56 per cent, respectively in Chikkaballapura and Kolar Districts. Tewary *et al.*, (2008) reported that weight of ten mature larvae (31.50 g), cocoon weight (1.56 g) and shell ratio (17.00 per cent) was maximum in silkworms fed with tree mulberry leaves compared to the bush mulberry (30.83 g, 1.53 g and 16.56 per cent, respectively). Maribashetty *et al.*, (1999) reported that the larval duration in the silkworm batches reared on tree mulberry leaves (26 days 20 hours) was shorter than the batches fed with bush mulberry leaves (27 days 5 hours), which are on par with the present results. They have also studied the economic parameters of silkworms fed with tree mulberry in two breeds, namely NB_4D_2 and KA, wherein cocoon weights of 1.81 and 1.69 g, 1.82 and 1.71 g and 1.72 and 1.72 g and shell weight of 0.37 and 0.34 g, 0.36 and 0.33 g and 0.35 and0.34 g, respectively were recorded at P_4, P_3 and P_2 levels. Narayanaswamy *et al.*, (2003) reported that the pupal weight (1.64 g) showed significant difference when the silkworm breed, CSR_2 was fed with tree mulberry leaves, which is on par with the present results.

Table.1 Performance of Silkworm on tree mulberry vis-à-vis bush mulberry in Chikkaballapura (PM×CSR2) and Kolar Districts (FC1×FC2)

Parameter	Chikkaballapura District					Kolar District				
	Tree Mulberry	Bush Mulberry	t-value	t-test	Per cent deviation over bush mulberry	Tree Mulberry	Bush Mulberry	t-value	t-test	Per cent deviation over bush mulberry
Larval wt. (g)	4.16±0.22	4.03±0.06	3.47	*	3.22	4.79±0.45	4.56±0.45	3.54	*	5.04
Vth instar larval duration (hours)	224.40	270.00	-	-	-17.03	240.00	306.00	-	-	-21.56
Cocoon wt. (g)	1.74±0.03	1.67±0.02	10.9	*	4.19	1.78±0.03	1.72±0.03	14.54	*	3.48
Shell wt. (g)	0.39±0.01	0.32±0.02	7.63	*	21.87	0.43±0.01	0.40±0.05	2.79	*	7.50
Pupal wt. (g)	1.36±0.02	1.34±0.02	3.62	*	1.49	1.36±0.04	1.34±0.02	3.62	*	1.49
Shell ratio (%)	20.94±0.82	18.86±0.92	6.60	*	11.02	24.61±1.05	23.74±0.74	1.78	NS	-
Cocoon yield per 100 DFLs	94.95	79.00	-	-	20.18	110.67	88.50	-	-	25.05

*Significant at 5%, NS- Non-significant (Each value is mean of two crops)

Table.2 Correlation coefficient between nutritional parameters of mulberry and silkworm parameters in Chikkaballapura and Kolar Districts

Parameter	Larval wt.		Cocoon wt.		Shell wt.		Pupal wt.		Shell ratio	
	CBP	Kolar	CBP	Kolar	CBP	Kolar	CBP	Kolar	CBP	Kolar
Moisture	-0.139	0.310	0.149	-0.055	-0.184	-0.257	0.205	0.172	-0.171	-0.237
Moisture after 6 hours	-0.158	0.307	0.071	-0.106	-0.055	-0.151	0.043	0.117	-0.026	-0.122
Total carbohydrates	0.172	0.066	-0.028	-0.493*	0.016	0.212	-0.007	-0.311	-0.170	0.219
Total protein	-0.091	-0.853*	0.086	0.150	0.061	-0.096	0.068	-0.082	-0.147	-0.119
Total phenol	0.132	-0.414*	-0.342	-0.253	-0.085	0.321	-0.298	-0.471*	-0.182	0.314
Nitrogen	-0.099	-0.846*	0.103	0.160	0.036	-0.090	0.101	-0.088	-0.182	-0.115
Phosphorous	0.325	0.272	-0.095	-0.374	-0.104	0.034	-0.071	-0.253	-0.273	0.028
Potassium	0.202	-0.719*	-0.357	0.089	0.076	-0.106	-0.292	-0.119	-0.110	-0.159
Calcium	-0.363	0.163	0.227	-0.558*	0.128	0.266	0.138	-0.359	0.105	0.291
Magnesium	-0.372	-0.086	0.135	-0.358	-0.159	0.489*	0.216	-0.478*	-0.023	0.518*
Sulphur	-0.016	0.059	0.156	-0.284	0.380	0.173	-0.048	-0.125	0.451	0.214

* Significant at 5 %, CBP- Chikkaballapura.

They also reported that, the worms fed with tree mulberry leaves showed higher shell ratio than the bush mulberry, which corroborates with the present results. The quality of the mulberry leaves influences the quality of cocoons. Since the leaves from tree mulberry shows better in nutritional composition, therefore higher cocoon yield is observed when silkworms reared on tree mulberry leaves.

Correlation between nutritional parameters of mulberry and silkworm parameters

In Chikkaballapura District, the correlation between qualitative parameters and economic traits of silkworm was non-significant. In Kolar District, there was a significantly negative correlation ($p<0.05$) between total carbohydrates and cocoon weight (r= -0.493), between total protein and larval weight (r= -0.853), between total phenols with larval weight (r= -0.414) and pupal weight (r= -0.471) between nitrogen content and larval weight (r= -0.846), between potassium and larval weight (r= -0.719), between calcium and cocoon weight (r= -0.558) and between magnesium and pupal weight (r= -0.478) in silkworms reared on tree mulberry leaves, while significantly positive correlation was observed in tree mulberry for magnesium and shell weight (r= 0.489) and shell ratio (r= 0.518) (Table 2). Kana Tanaka *et al.,* (2009) reported that, there was a correlation between the mulberry leaf quality and the silkworm performance.

From the present findings, it is summarized that the silkworm hybrids reared on leaves of tree mulberry exhibited higher larval and cocoon parameters compared to silkworms reared on bush mulberry leaves, due to superior quality of tree mulberry leaves. Hence, the cultivation of mulberry as a tree under water limited conditions is better choice for harvesting quality leaves and silk cocoons.

References

Anonymous, 2017a. Annual Report (2016-17). Central Silk Board, Bengaluru, p. 7

Anonymous, 2017b. Annual Report (2016-17). Department of Sericulture, Karnataka, p.18.

Dandin, S. B., J.Jayswal and K.Giridhar, 2003. Hand Book of Sericulture Technologies, CSB Publications, India, P.230.

Dasgupta, K. P., 1961. A comparative analytical study on the effect of feeding with different types of mulberry leaves obtained by different methods of cultivation on silkworm, *Bombyx mori* L. Indian Silk. 1 (4): 5-8.

Datta, R. K., 2000. Mulberry cultivation and utilization in India. FAO Conference on Mulberry and Animal Production. pp.1-24.

Kana Tanaka, Yusuke Uda, Yukiteru Ono, Tatsuro Nakagawa, Makiko Suwa, Ryohei Yamaoka and Kazushige Touhara, 2009. Highly Selective Tuning of a Silkworm Olfactory Receptor to a Key Mulberry Leaf Volatile. Current Biology. 19 (11): 881-890.

Krishnaswami, S., D.ROY and S.K.Mukherjee, 1970. Yield and nutritive value of mulberry leaves as influenced by planting season, spacing and frequency of pruning. India Journal of Sericulture. 9 (2): 38-42.

Maribashetty, V. G., R.RAGHURAMAN, H. Venkatesh and S. Puttaswamy, 1999. Comparative nutritive value of bush and tree mulberry leaves in bivoltine seed rearing. Sericologia. 39 (1): 67-72.

Miyashitha, V., 1986. A Report on Mulberry and Training Methods Suitable to Bivoltine Rearing in Karnataka. Central Silk Board, Bengaluru. p. 1-7.

Narayanaswamy, K. C., Manjunath Gowda and H.R.Shivakumar, 2003. Impact of feeding mulberry leaves from tree and

bush plantations on grain age parameters of a few bivoltine silkworm breeds. National Seminar Silkworm Seed Production. SSTL, Bengaluru. pp. 35-37.

Qader, M. A., A.A. Sarker and S.U. Ahmed, 1991. Comparative study on the nutritive value of bush, low-cut and tree mulberry leaves at different maturity stages. Sericologia. 31 (3): 429-435.

Tewary, P.K., M.K. Singh, U.P.S.SINHA and Bajpai, 2008. Mulberry as small tree – a new approach for sustainable sericulture in Jharkhand. Indian Silk. 46 (7): 10-11.

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