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Silkworm Rearing and Cocoon Parameters: Implications for Quality Silk Production in Southern Karnataka

Akarsha M.R.[1]*, Harshitha C.[1], Aarushi Sharma[2] and Devika Sharma[2]
[1]Department of Studies in Sericulture Science,
University of Mysore, Mysuru (Karnataka), India.
[2]Department of Entomology,
CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur (Himachal Pradesh), India.

(Corresponding author: Akarsha M.R.)*
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ABSTRACT: Sericulture, the cultivation of silkworms (*Bombyx mori* L.) for silk production, is an integral part of rural socio-economic development in India. With an emphasis on the importance of mulberry leaves' quality in cocoon production, the study evaluates the impact of these leaves on the growth and development of *Bombyx mori* L. silkworms. The research was conducted in the Mysuru district, focusing on five farmers and assessing multiple post-cocoon parameters, including cocoon, pupae, and shell weights, as well as filament length, denier, and renditta. Findings highlighted variations among farmers in various metrics. For instance, Farmer-2 had the highest matured larval weight, while Farmer-3 exhibited the highest cocoon weight. Moreover, the quality of silk and cocoon parameters were found to be directly influenced by the nutritive status of mulberry leaves. The study's outcomes concur with previous research, underscoring the significance of the right silkworm-mulberry combination for achieving optimal silk quality.

Keywords: Sericulture, silkworm, cocoon parameters, farmers.

INTRODUCTION

Sericulture is an art and science of rearing silkworms to produce cocoons and silk. It also involves growing of mulberry, reeling of silk thread from cocoons, weaving the silk yarn and further processing to produce the silk fabric. Among all type of silk produced, mulberry silk accounts for 75% of all silk production in India (Kaviraj *et al.,* 2021). Sericulture is an important means for the socio-economic development of the rural sector. It is a highly labour intensive, profit oriented, low input indoor activity that gives frequent periodicity of economic returns, minimum gestation period and expenditure, maximum employment potential and quick turnover of investment. It is also well suited for the women of rural sector. Sericulture is an agro-based industry, par excellence with its agricultural base, industrial super structure and labour intensive nature.

Production of silk depends upon the quantity and quality of the mulberry leaves, and in turn, on cocoons produced. To produce quality cocoons, farmers need to acquire knowledge about new technologies and also show interest to adopt such technologies in the field. It is observed that most of the farmers are reluctant to adopt recommended new technologies due to various socio-economical and biological factors (Lakshmanan *et al.,* 1998).

Mulberry leaf quality plays a predominant role in healthy growth of silkworm and the economic characters such as larval, cocoon and grain age parameters which are influenced largely by the nutritional status of the leaves fed to silkworm. Hence, nutrition of silkworm, *Bombyx mori* L. is of primary importance as the cocoon production is directly influenced by the nutritive status of mulberry leaves (Krishnaswami *et al*., 1971).

The study aimed to evaluate the growth and development of *Bombyx mori* L. silkworms fed with mulberry leaves on farmer's field. Additionally, the research evaluated the post-cocoon parameters, ensuring the silk met desired criteria, as well as the weights of the cocoons, pupae, and shells. Moreover, the shell ratio and the overall silk productivity of the reared silkworms was examined.

MATERIALS AND METHODS

The investigation was undertaken in established irrigated mulberry (V1) in the farmers fields (Ramshetty, Nagamma, Jagaraju, K.L. Ramshetty and Mahadevshetty) of Kempaiaghna Hundi, T. Narasipura Taluk , Mysuru district.

Table 1: Details of farmers in the study area.

Sr. No.	Details	Name of the farmer				
		Ramshetty	Nagamma	Jagaraju	Ramshetty	Mahadevshetty
1.	Passbook no.	112937	112443	101718	20595	107557
2.	Mobile no.	9611834946	9535458285	9945487912	9686660502	9141115963
3.	Age (years)	49	50	58	62	46
4.	Education	Illiterate	Illiterate	Illiterate	7th Std.	Illiterate
5.	Total land holding (acre)	1 .75	1 .50	5.00	2 .50	1 87
6.	Mulberry land holding (acre)	1.00	1.00	1 .87	2.00	1 87
7.	Dry land / irrigated	Irrigated	Irrigated	Irrigated	Irrigated	Irrigated
8.	Soil type	Red	Red	Red	Red	Red
9.	Mulberry variety	V_1	V_1	V_1	V_1	V_1
10.	Age of Mulberry garden (years)	7	8	7	8	15
11.	Spacing in mulberry	3'×3'	3'×3'	2 .5' × 2 .5'	3'×3'	3'×3'
12.	Manure (FYM) (kg)	120	150	-	130	130
13.	Fertilizers (urea & complex) (kg)	30	50	140	50	-
14.	Irrigation method	Furrow	Furrow	Furrow	Drip	Drip
15.	Harvesting method	Shoot	Shoot	Shoot	Shoot	Shoot
16.	Method used for leaf preservation	Wet gunny cloth	Wet gunny cloth	Wet gunny cloth	Wet gunny cloth	Wet gunny cloth
17.	Pruning (in a year)	10	8	6-7	10	6-7
18.	Rearing house	Sheet	Sheet	Sheet	RCC	Sheet
19.	Disinfectants used	-	Ankush	-	-	-
20.	DFLs	150	150	150	150-200	125
21.	Direct brushing/ chawki worms	Chawki worms	Chawki worms	Chawki worms	Chawki worms	Chawki worms
22.	Silkworm breed	$CSR_2 \times CSR_4$	$CSR_2 \times CSR_4$	$CSR_2 \times CSR_4$	$CSR(FC_1 \times FC_2)$	$CSR(FC_1 \times FC_2)$
23.	Bed disinfectant	Lime, Vijetha	Lime, Vijetha	Lime, Vijetha	Lime, Vijetha	Lime, Vijetha
24.	Type of mountage	Plastic collapsible	Plastic collapsible	Plastic collapsible	Plastic collapsible	Plastic collapsible
25.	Cocoon harvesting (on which day)	7-8th day	6-7th day	7 day	7th day	7th day
26.	Crop raised in a year	10	8	6-7	10	7-8

Rearing Parameters of Silkworm

a) Matured larval weight (g)

Matured larval weight in fifth instar was recorded in each farmers rearing condition, replication-wise.

b) Cocoon weight (g)

Cocoon weight was recorded by weighing cocoons individually using sensitive electronic balance.

c) Pupal weight (g)

After obtaining the cocoon weight they were cut open to record the pupal weight.

d) Shell weight (g)

Shell weight was recorded by removing floss layer and cutting open the cocoon to remove pupa and the last larval skin i.e., exuvium.

e) Shell ratio (%): Shell ratio was calculated using the following formula:

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

f) Silk productivity (cg/day): Silk productivity was calculated using the following formula:

$$\text{Silk productivity (cg/day)} = \frac{\text{Shell weight (cg)}}{\text{Fifth instar larval duration (days)}} \times 100$$

Post-Cocoon Parameters of Silkworm

g) Filament length

The total filament length was measured in meters.

Filament length = {Length of raw silk (m) × 1.125 (circumference)} / No. of reeling cocoons.

h) Filament weight

The total filament was weighed accurately. The weight of the total filament was calculated in grams.

i) Denier

The denier can be calculated by using the following formula

$$\text{Denier} = \frac{\text{Filament weight (g)}}{\text{Filament length (m)}} \times 100$$

j) Renditta

$$\text{Renditta} = \frac{\text{Weight of cocoon (g)}}{\text{Weight of raw silk reeled (g)}}$$

The renditta was calculated by using the following formula

RESULS

Economic Characters of Silkworm

Matured larval weight: Among the five farmers, highest matured larval weight was noticed in Farmer-2 (3.818 g) followed by Farmer-1 (3.740 g), Farmer-3 (3.717 g) and Farmer-5 (3.663 g). However, lowest was found in Farmer-4 (3.643 g) (Table 2, Fig. 1).

Cocoon weight: Cocoon weight noticed variation among the farmers, being highest in Farmer-3 (2.087 g) followed by Farmer-2 (1.627g), Farmer-1 (1.472 g), and Farmer-5 (1.455 g), while Farmer- 4 (1.285 g) recorded the lowest (Table 2, Fig. 2).

Pupal weight: Pupal weight was non-significant among the farmers with highest being in Farmer-3 (1.407g) followed by Farmer-2 (1.272g), Farmer- 1 (1.182g) and Farmer-5 (1.100g), but lowest was found in Farmer-4 (0.995g) (Table 2, Fig. 2).

Shell weight: Shell weight was more in Farmer-3 (0.360 g) followed by Farmer-2 (0.345 g), Farmer-5 (0.344 g) and Farmer-1 (0.295 g), while less shell weight was recorded in Farmer- 4 (0.292 g) (Table 2, Fig. 2).

Shell ratio: No variation was found in shell ratio among the farmers, being highest in Farmer-5 (23.88%) followed by Farmer-4 (23.03%), Farmer-2 (21.62%) and Farmer-1 (20.62%), but lowest was found in Farmer- 3 (17.43%) (Table 2, Fig. 3).

Silk productivity: Non-significant difference was noticed in silk productivity among the farmers, higher being in Farmer-3 (5.537cg/day) followed by Farmer-2 (4.930 cg/day), Farmer-5 (4.830 cg/day) and Farmer-1 (4.220 cg/day). However, lower silk productivity was registered in Farmer- 4 (4.18 cg/ day) (Table, 2 Fig. 4).

Filament length: Significant variation was among the farmers with respect to filament length, being longer in Farmer-3 (1128.5m) followed by Farmer-4 (1120.7m), Farmer-5 (1054m) and Farmer-2 (1025.7m) but shorter filament length was found in Farmer-1 (1006.4m) (Table 3, Fig. 5).

Denier: Significant differences were noticed with respect to denier among the farmers, it was finer in Farmer-1 (1.959) followed by Farmer-2 (1.866), Farmer-5 (1.832) and Farmer- 4 (1.801) and Farmer- 3 was thicker (1.440) (Table 3, Fig. 6).

Renditta: Renditta was significantly superior in Farmer-2 (6.793) followed by Farmer-1 (7.117), Farmer-4 (7.527) and Farmer-5 (8.352). However, renditta was inferior with Farmer-3 (10.36) (Table 3, Fig. 7).

Table 2: Rearing performance of silkworm under farmers condition.

Farmer	Matured larval weight (g)	Cocoon weight (g)	Pupal weight (g)	Shell weight (g)	Shell ratio (%)	Silk productivity (cg/day)
F1 = Ramshettty	3.740 ±0.065	1.472 ± 0.093	1.182±0.144	0.295±0.037	20.62±3.570	4.220±0.536
F2 =Nagamma	3.8180±0.060	1.627 ±0.100	1.272±0.097	0.345±0.020	21.61±2.495	4.930±0.294
F3 = Jagaraju	3.7175±0.048	2.087 ±0.185	1.407±0.206	0.360±0.023	17.43±1.127	5.537±0.699
F4=K.L. Ramshetty	3.643±0.076	1.285 ±0.075	0.995±0.063	0.292±0.004	23.03±1.577	4.180±0.069
F5=Mahadevshetty	3.663±0.066	1.455 ±0.055	1.100±0.047	0.344±0.018	23.88±2.030	4.830±0.409
F - value	1.149^{NS}	7.537^{*}	1.585^{NS}	1.774^{NS}	1.174^{NS}	1.524^{NS}

Table 3: Post - cocoon parameters of silkworm under farmers condition.

Farmer	Filament length	Denier	Renditta
F1 = Ramshettty	1006.4±6.490	1.959±0.178	7.117±0.215
F2 =Nagamma	1025.7±5.467	1.866±0.165	6.793±0.058
F3 = Jagaraju	1128.5±6.885	1.440±0.051	10.367±0.429
F4=K.L. Ramshetty	1120.7±12.625	1.801±0.029	7.527±0.127
F5=Mahadevshetty	1054.0±5.930	1.832±0.031	8.352±0.139
F - value	48.62^{*}	3.098*	37.99^{*}

*(p≤0.05)

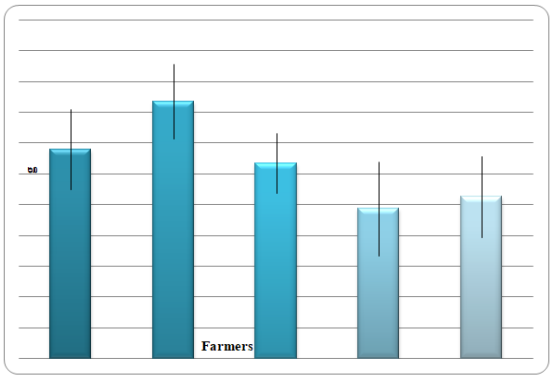

Fig. 1. Matured larval weight under farmers rearing condition.

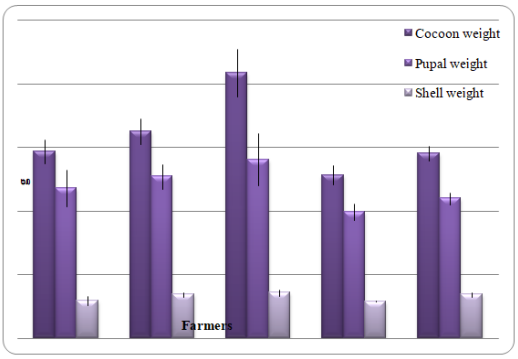

Fig. 2. Cocoon, pupa and shell weights under farmers rearing condition.

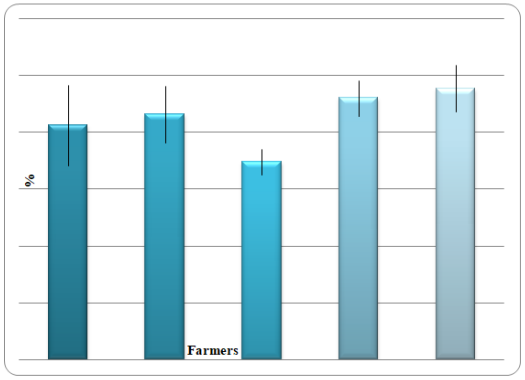

Fig. 3. Shell ratio under farmers rearing condition.

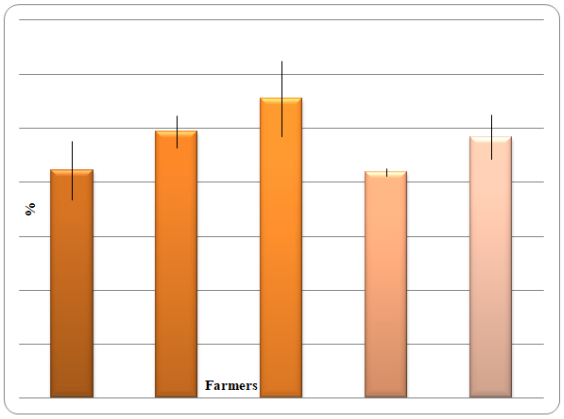

Fig. 4. Silk productivity under farmers rearing condition.

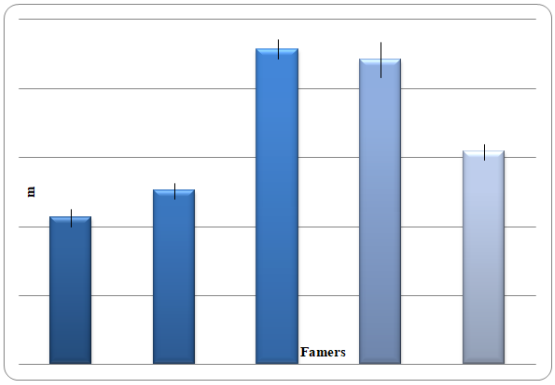

Fig. 5. Filament length under farmers rearing condition.

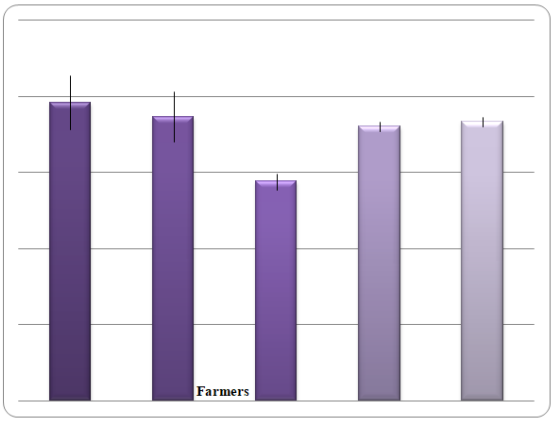

Fig. 6. Denier under farmers rearing condition.

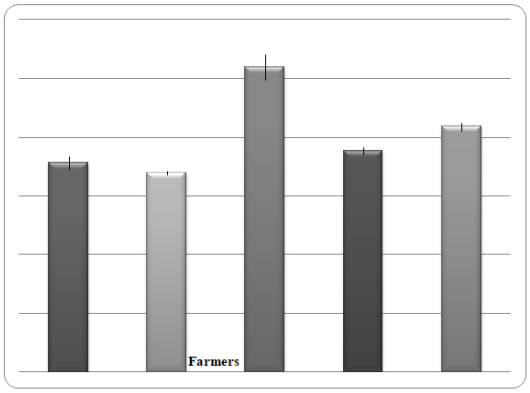

Fig. 7. Renditta under farmers rearing condition.

DISCUSSION

Among the five farmers, matured larval weight was highest in Farmer-2 but lowest was found in Farmer-4. Cocoon weight noticed variation among five farmers being highest in Farmer-3. However, it was found lowest with Farmer-4. Pupal weight was more in Farmer-3. While, it was found less with Farmer-4. Shell weight was more in Farmer-3 while less was recorded in Farmer-4. Among the farmers with respect to shell ratio, highest was found in Farmer-5 but lowest was found in Farmer-3. Silk productivity was more in Farmer-3 and less was registered in Farmer- 4. Significant variation was noticed among the farmers with respect to filament length, longer filament was found in Farmer-3. However, shorter filament was noticed in Farmer-1. Significant difference was noticed with respect to denier being finer in Farmer-1 and it was thicker in Farmer-3. Renditta was superior in Farmer-2. However, renditta was inferior in Farmer-3.

The results are in conformity with the double hybrid silkworm larvae fed with V1 mulberry variety registered superior with larval weight, single cocoon weight, single shell weight, yield/10,000 larvae brushed, cocoon filament length, denier, and effective rate of rearing and inferior with M5 mulberry variety (Rathod *et al.*, 2015). Dandin *et al.* (2005) recorded various characters for CSR2 × CSR4 *viz.*, pupation rate, cocoon shell ratio, filament length, filament size, raw silk percentage and renditta. Quadir and Mir Nisar (2004) evaluated 10 short listed hybrids during spring and autumn season among which highest shell ratio and filament length was recorded in Pam-101 × CSR2 and CSR2 × CSR5 during spring. During autumn CSR2 × CSR4 recorded highest shell ratio and SH6 × Pam11 recorded the highest filament length. Similarly, shorter larval duration might be due to balanced nutritional status of the leaves which enable the worms to mature early due to the faster metabolic activity (Shankar, 1990; Rajanna, 1999).

SUMMARY

Among the five farmers, matured larval weight was highest in Farmer-2 but lowest was found in Farmer-4. Cocoon weight noticed variation among the five farmers, highest in Farmer-3. However, it was found lowest with Farmer-4. Pupal weight was more in Farmer-3 and it was found less with Farmer-4. Shell

weight was more in Farmer-3 and less was recorded in Farmer-4. Among the farmers with respect to shell ratio, Farmer-5 recorded highest, but lowest was found in Farmer-3. Silk productivity was more in Farmer-3. However, less was registered in Farmer- 4. Significant variation was observed among the farmers with respect to filament length, with longer filament being in Farmer-3. However, shorter filament was noticed in Farmer-1. Significant difference was noticed with respect to denier being finer in Farmer-1 and it was thicker in Farmer-3. Renditta was superior in Farmer-2 and was inferior in Farmer-3.

CONCLUSIONS

Sericulture, the practice of rearing silkworms for silk, plays a vital role in rural socio-economic development. This study's findings align with previous research on the optimal combinations of silkworms and mulberries for premium silk production, suggesting that the V1 mulberry variety leads to superior larval weight, cocoon weight, and other silk qualities. In contrast, the M5 mulberry variety produced inferior results. By addressing these specific areas and continuously monitoring results, custom-tailored training sessions can be provided based on each farmer's strengths and weaknesses to provide more consistent and improved quality of silk production in the future.

REFERENCES

Dandin, S. B., Basavaraj, H. K. and Suresh Kumar, N. (2005). Silkworm breeds and hybrids at Bangalore. *Annual Report*, CSR & TI, Mysore, p. 51.

Kaviraj, M., Kumar, U., Chatterjee, S.N., Swain, S. L., Singh, M. and Nandi, K. (2021). Comparative performance analysis of mulberry silkworm (*Bombyx mori* L.) races for integration of superior yield and maximize profit in West Bengal.

Krishnaswami, S., Kumararaj, S., Vijayaraghavan, K. and Kasiviswanathan, K. (1971). Silkworm feeding trials for evaluating the quality of mulberry leaves as influenced by variety, spacing and nitrogen fertilization. *Indian Journal of Sericulture, 10*, 79–89.

Lakshmanan, S., Mallikarjuna, B., Ganapathi Rao, R., Jayaram, H. and Geetha Devi, G. (1998). Studies on adoption of sericultural innovations at farmers' level in Tamil Nadu: An Empirical Analysis. *Indian Journal of Sericulture*, *37*(1), 44-47.

Rajanna, B. H. (1999). Performance of silkworm, *Bombyx mori* L. on mulberry raised by using sericulture byproducts as manure. *M.Sc. (Sericulture) Thesis*, UAS, Bangalore, p. 105.

Rathod, B. S., Nalwandikar P. K., Shetgar S. S., Sawant, C. G. and Sonkamble, M. M. (2015). Effect of feeding proportionately mixed mulberry leaves on double hybrid silkworm. *International Journal of Life Sciences*, *10*(1), 1-4.

Shankar, M. A. (1990). Nutritional management of mulberry and its effect on silkworm growth, development and silk quality. *Ph.D. (Agronomy) Thesis*, UAS, Bangalore, p. 410.

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