International Journal of Entomology Research
www.entomologyjournals.com
ISSN: 2455-4758
Received: 30-01-2026, Accepted: 02-03-2026, Published: 17-03-2026
Volume 11, Issue 1, 2026, Page No. 541-542

Comparative analysis of commercial traits between PM×CSR2 and CSR2×PM cocoons of *Bombyx mori L.*

Darshan S, Mallikarjuna N Angadi
Department of Studies in Sericulture Science, Manasagangotri, University of Mysore, Mysuru, Karnataka, India

Abstract
The present investigation was undertaken to evaluate and compare the commercial cocoon and silk quality traits of two reciprocal bivoltine silkworm hybrids of *Bombyx mori*, namely PM×CSR2 and CSR2×PM. A comprehensive assessment of key economic parameters including cocoon weight, shell weight, shell ratio, filament length, denier, raw silk percentage, and renditta was carried out under uniform rearing and environmental conditions by following the standard evaluation procedures outlined by Benchamin and Nagaraj (1987). The results revealed distinct and consistent differences between the reciprocal hybrids, clearly demonstrating the presence of reciprocal effects on important commercial traits. These variations can be attributed to maternal inheritance and cytoplasmic influences affecting growth and silk production, which is in agreement with earlier findings reported by Datta (2000) [3] and Ramesha *et al*. (2010) [8].

Keywords: *Bombyx mori*, reciprocal crosses, PM×CSR2, CSR2×PM, cocoon traits, silk quality

Introduction

Sericulture is a vital agro-based rural industry that plays a significant role in generating sustainable employment and income for millions of farming families, particularly in developing countries like India (Datta, 2000) [3]. It contributes substantially to the national economy by supporting silk production, textile industries, and export earnings. The success and profitability of sericulture primarily depend on the availability of high-yielding silkworm hybrids that possess superior cocoon characteristics and enhanced silk quality traits (Nagaraju, 2002) [5, 6]. These hybrids must consistently perform well under diverse agro-climatic conditions to ensure economic stability for sericulturists. Commercially important traits such as cocoon weight, shell weight, shell ratio, filament length, raw silk recovery, and renditta are widely recognized as key indicators of productivity and economic feasibility in silkworm rearing (Benchamin & Nagaraj, 1987; Ramesha *et al*., 2010) [1, 8]. Improvement in these traits directly influences silk yield and quality, thereby increasing returns to farmers and reelers. Hybridization has therefore been extensively employed in silkworm breeding programs to exploit heterosis, resulting in enhanced growth performance, cocoon yield, and silk productivity (Suresh Kumar *et al*., 2013) [10]. Furthermore, reciprocal hybrid crosses often exhibit noticeable differences in performance due to maternal inheritance, cytoplasmic effects, and the influence of sex-linked genes, which can significantly affect commercial traits (Nagaraju & Goldsmith, 2002) [5, 6]. These variations highlight the importance of systematically evaluating reciprocal hybrids before their recommendation for large-scale commercial use. In this context, the present investigation aims to comparatively assess the commercial performance of the reciprocal hybrids PM×CSR2 and CSR2×PM of *Bombyx mori*, with the objective of identifying the superior cross for commercial exploitation.

Materials and Methods

1. Silkworm Hybrids

Two reciprocal bivoltine hybrids were used:

- **PM×CSR2** (PM ♀ × CSR2 ♂)
- **CSR2×PM** (CSR2 ♀ × PM ♂)

CSR2 is a well-known productive bivoltine line developed by the Central Silk Board (CSB), India (Datta *et al*., 2001) [4].

2. Rearing Conditions

Silkworm rearing was conducted under standard laboratory conditions following the methods described by Benchamin and Nagaraj (1987) [1]. Temperature was maintained at 25–28 °C with relative humidity of 70–85%. Larvae were fed with fresh mulberry leaves of uniform quality throughout the rearing period, as recommended by Rahmathulla (2012) [7].

3. Evaluation of Commercial Traits

Cocoons were harvested and evaluated for commercial traits following standard reeling and cocoon assessment procedures (CSB, 2014) [2]:

- Cocoon weight (g)
- Shell weight (g)
- Shell ratio (%)
- Filament length (m)
- Denier
- Raw silk percentage (%)
- Renditta

Shell ratio was calculated as suggested by Benchamin and Nagaraj (1987) [1]:
Shell ratio (%)=Shell weight/Cocoon weight×100

4. Statistical Analysis

Data were expressed as mean ± standard error (SE). Statistical analysis was carried out using standard biometric methods to compare the hybrids, and significance was tested at $P < 0.05$ (Snedecor & Cochran, 1994) [9].

Results

1. Cocoon and Shell Traits

PM×CSR2 recorded higher cocoon weight, shell weight, and shell ratio compared to CSR2×PM (Table 1). Similar improvements in cocoon traits due to favorable cross direction have been reported earlier (Ramesha *et al*., 2010; Suresh Kumar *et al*., 2013) [8, 10].

Table 1: Cocoon and shell traits of PM×CSR2 and CSR2×PM

Trait	PM×CSR2	CSR2×PM
Cocoon weight (g)	1.78 ± 0.03	1.65 ± 0.02
Shell weight (g)	0.38 ± 0.01	0.33 ± 0.01
Shell ratio (%)	21.3 ± 0.2	20 ± 0.2

2. Filament and Silk Quality Traits

PM×CSR2 exhibited longer filament length and higher raw silk percentage, whereas CSR2×PM showed comparatively higher denier and renditta (Table 2). Longer filament length and lower renditta are desirable traits for efficient reeling and better silk recovery (Datta, 2000; CSB, 2014) [2, 3].

Table 2: Filament and silk quality traits of PM×CSR2 and CSR2×PM

Trait	PM×CSR2	CSR2×PM
Filament length (m)	1025 ± 18	960 ± 15
Denier	2.45 ± 0.04	2.60 ± 0.05
Raw silk (%)	16.8 ± 0.3	15.9 ± 0.2
Renditta	5.95 ± 0.10	6.30 ± 0.12

Discussion

The observed differences in the performance of PM×CSR2 and CSR2×PM hybrids clearly indicate the existence of significant reciprocal effects on important commercial traits. Such variations between reciprocal crosses can be largely attributed to maternal inheritance and cytoplasmic influences, which play a crucial role in regulating larval growth, metabolic efficiency, and silk gland development, ultimately affecting cocoon and silk yield (Nagaraju & Goldsmith, 2002) [5, 6]. The influence of the female parent on egg quality, early larval vigor, and nutrient utilization may further contribute to the differential expression of economic traits in these hybrids. The superior performance of the PM×CSR2 hybrid with respect to cocoon weight, shell weight, shell ratio, and filament length corroborates earlier reports highlighting the advantages of specific bivoltine hybrid combinations in enhancing silk productivity (Ramesha *et al*., 2010; Suresh Kumar *et al*., 2013) [8, 10]. These findings reinforce the importance of selecting appropriate parental combinations in silkworm breeding programs to fully exploit heterosis. Overall, the results emphasize the necessity of evaluating reciprocal hybrids in order to identify the most promising cross combinations for commercial sericulture and sustainable silk production.

Conclusion

The present study clearly demonstrates that the PM×CSR2 hybrid is superior to its reciprocal cross, CSR2×PM, with respect to most commercially important traits, including cocoon weight, shell ratio, filament length, and raw silk recovery. The consistent improvement observed in these parameters indicates the significant influence of reciprocal effects on the expression of economic traits in silkworm hybrids. These findings underscore the necessity of systematic evaluation of reciprocal crosses prior to their recommendation for large-scale commercial sericulture, as also emphasized by Datta (2000) [3] and Nagaraju (2002) [5, 6]. Selection of the appropriate hybrid combination based on such evaluations can enhance silk productivity, improve economic returns to farmers, and contribute to the sustainable development of the sericulture industry.

References

1. Benchamin KV, Nagaraj CS. Silkworm rearing techniques. Central Silk Board, Bangalore, India, 1987.
2. Central Silk Board (CSB). Silk reeling manual. Ministry of Textiles, Government of India, 2014.
3. Datta RK. Sericulture and its role in rural development. Indian Silk,2000:39(5):5–8.
4. Datta RK, Nagaraju J, Ramesh Babu M. Breeding of bivoltine silkworms for tropics. Indian Journal of Sericulture,2001:40(2):87–93.
5. Nagaraju J. Application of genetic principles in silkworm breeding. Current Science,2002:83(4):409–414.
6. Nagaraju J, Goldsmith MR. Silkworm genomics—progress and prospects. Current Science,2002:83(4):415–425.
7. Rahmathulla VK. Management of climatic factors for successful silkworm rearing. Journal of Entomology,2012:9:1–10.
8. Ramesha C, Suresh Kumar N, Seshagiri SV. Evaluation of bivoltine silkworm hybrids for commercial traits. Indian Journal of Sericulture,2010:49(1):11–16.
9. Snedecor GW, Cochran WG. Statistical methods (8th ed.). Iowa State University Press, 1994.
10. Suresh Kumar N, Ramesha C, Mathur VB. Heterosis studies in bivoltine silkworm hybrids. Journal of Applied and Natural Science,2013:5(2):420–425.