Performance of Some Bivoltine Silkworm, *Bombyx mori* L. Hybrids during Summer

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**Authors’ contributions**

This work was carried out in collaboration among all authors. Author NN designed the study, performed the statistical analysis, wrote the protocol, and wrote the first draft of the manuscript. Authors SAB and MFB managed the analyses of the study. Author SAM managed the literature searches. All authors read and approved the final manuscript.

**ABSTRACT**

**Aim:** The present study was aimed to find out the robust hybrid during summer season under temperate climatic conditions.

**Study Design:** Completely Randomized Design (CRD).

**Place and Duration of Study:** College of Temperate Sericulture (CoTS) Mirgund, Sher-e-Kashmir University of Agricultural Sciences and Technology, of Kashmir (SKUAST-K), in the year 2014.

**Methodology:** The disease free layings (dfI’s) of the selected hybrids viz., SK₁₁ × SK₁₃, SK₁₆ × SK₁₈ and CSR₁₈ × CSR₁₉ were obtained from the Germplasm Bank maintained at College of Temperate Sericulture (CoTS) Mirgund, Sher-e-Kashmir University of Agricultural Sciences and Technology, of Kashmir (SKUAST-K). These dfI’s were incubated, brushed and reared up to 3rd instar en masse following the standard rearing procedure. Just after 3rd moult, 3 replications of 100 larvae in each treatment were maintained. Cocoon and post cocoon parameters viz., pupation rate, single cocoon

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Results: No significant difference was recorded in pupation rate among the hybrids. H$_1$ hybrid was found significantly superior over H$_2$ and H$_3$ for single cocoon and shell weight with mean value as 1.957 and 0.406 respectively. On the other hand influence of hybrids over shell ratio remained non significant. The performance of silkworm hybrids with respect to raw silk was recorded higher in H$_1$ (17.98%) followed by H$_2$ (17.96%) and H$_3$ (17.93%), while the fine denier of 2.86 d was reported in H$_3$ followed by H$_1$ (2.94d) and H$_2$ (3.01d). Leaf cocoon ratio was recorded lower in H$_1$ with mean value as 15.16 /100 dfl’s.

Conclusion: Significant differences among the hybrids were observed, but no hybrid performed better in all traits studied, however in maximum traits SK$_{31}$× SK$_{13}$, seems to be superior to the other two studied hybrids.

Keywords: Economic traits; hybrids; silk worm; superior.

1. INTRODUCTION

Silkworm rearing is mostly conducted in spring season in Jammu and Kashmir due to the limitation of leaf and unavailability of season specific silkworm hybrids. However, there has always been a tendency of many rearers to take up 2nd silkworm rearing for augmenting their income and to increase cocoon production, thus making sericulture practice an economically viable venture [1]. Evaluation of silkworm hybrids suitable to specific agro-climatic regions and seasons with emphasis on hardy strains for good commercial yield of cocoons, is one the prime research problems of sericulture. Although, heredity amounts to the transmission of characters pre-fixed by nature, but nurture is equally important. Thus the dual purpose of increasing the economic viability of sericulture and increased income augmentation of farmers at an optimum leaf input necessitates evaluating some summer specific hybrids. So, keeping this in view, the present study was undertaken to evaluate the performance of some bivoltine silkworm, Bombyxm orii L. hybrids during summer.

2. MATERIALS AND METHODS

The disease free layings (dfl’s) of the selected hybrids viz., SK$_{31}$× SK$_{13}$, SK$_{6}$ × SK$_{13}$ and CSR$_{18}$× CSR$_{19}$ were obtained from the Germplasm Bank maintained at College of Temperate Sericulture (CoTS) Mirgund, Sher-e-Kashmir University of Agricultural Sciences and Technology, of Kashmir (SKUAST-K). These dfl’s were incubated, brushed and reared up to 3rd instar en masse following the standard rearing procedure [2]. Just after 3rd moult, 3 replications of 100 larvae in each treatment were maintained. The leaves utilized for the experiment were obtained from mulberry farm of College of Temperate Sericulture, Mirgund. Goshoerami variety of mulberry was utilized for the feeding trials. Various cocoon and post cocoon parameters viz, pupation rate, single cocoon weight, single shell weight, shell ratio, raw silk, denier and leaf cocoon ratio were calculated and recorded during the course of experimentation as per following formulas:

2.1 Pupation Rate (%)

The no of live pupae obtained from total number of cocoons harvested was calculated by the following formulae:

\[
\text{Pupation rate} (\%) = \frac{\text{No. of live pupae obtained from cocoons}}{\text{Total No. of cocoons harvested}} \times 100
\]

2.2 Single Cocoon Weight (g)

Twenty male and twenty female cocoons were randomly selected/picked from each replicate of each treatment and weighed on digital balance to determine average cocoon weight.

2.3 Single Shell Weight (g)

The cocoons used for determining average single cocoon weight were cut at one side to obtain the shells. The resultant shells were weighed to determine the average shell weight.

2.4 Shell Ratio (%)

The ratio between single cocoon weight and single shell weight was calculated by using the following formula:

\[
\text{Shell ratio} (\%) = \frac{\text{Single shell weight}}{\text{Single cocoon weight}} \times 100
\]
2.5 Raw Silk (%)

It was calculated by the following formula:

\[
\text{Raw silk} \, (\%) = \left( \frac{\text{Weight of silk reeled}}{\text{Weight of green cocoons}} \right) \times 100
\]

2.6 Denier (d)

It was calculated as the weight of 9000 meters of silk in grams by using the following formula:

\[
\text{Denier} \, (d) = \left( \frac{\text{Weight of silk filament (g)}}{\text{Length of silk filament (m)}} \right) \times 9000
\]

2.7 Leaf Cocoon Ratio

The ratio between leaves given and weight of cocoons harvested was calculated by using the following formula:

\[
\text{Leaf cocoon ratio} = \left( \frac{\text{Leaves given (g)}}{\text{Wt. of cocoons harvested (g)}} \right)
\]

2.8 Experimental Details

| Mulberry variety | Goshorerami |
|------------------|-------------|
| No. of hybrids   | 03          |
| (H₁) SK31 × SK13 |
| (H₂) SK6 × SK13  |
| (H₃) CSR18 × CSR19 |
| Design of Experiment | Completely Randomized Design (CRD) |

3. RESULTS AND DISCUSSION

In present study, no significant difference was recorded in pupation rate among the hybrids. While as, H₁ hybrid was found significantly superior over H₂ and H₃ for single cocoon and shell weight with mean value as 1.957 and 0.406 respectively. On the other hand influence of hybrids over shell ratio remained non significant. The performance of silkworm hybrids with respect to raw silk was recorded higher in H₁ (17.98%) followed by H₂ (17.96%) and H₃ (17.93%), while the fine denier of 2.86 d was reported in H₁ followed by H₂ (2.94d) and H₃(3.01d). Leaf cocoon ratio was recorded lower in H₁ with mean value as 15.16 /100 dfl's.

3.1 Discussion

3.1.1 Pupation rate (%)

Pupation rate which is one of the important component contributing to the survival of the breed/hybrid and is considered as the main characteristic for evaluating the tolerant silkworms [3]. In present study, no significant difference was recorded in pupation rate among the hybrids.

3.1.2 Single cocoon and shell weight (g)

Cocoon and shell weight are considered important traits in commercial point of view. More the cocoon and shell weight higher will be the silk recovery. In present study single cocoon weight and shell weight was found significantly high in H₁ hybrid followed by H₂ and H₃ which might be due to genetic makeup of the hybrid. The present study is in agreement with the findings of Malik et al [4] and Rahmathulla [5] who reported that cocoon related characters are influenced by genetic constitution of silkworm strain.

3.1.3 Shell ratio (%)

The ratio between shell weight and cocoon weight is termed as shell ratio and is considered as an important post cocoon parameter, as it gives a fair indication of the quantity of raw silk that can be reeled from a cocoon. In the present study, influence of hybrids over shell ratio remained non-significant.

3.1.4 Raw silk (%)

It is the percentage of the raw silk that can be obtained per unit of cocoons and is an important factor in determining cocoon quality. In the present study, comparatively higher silk percentage was recorded in H₁ (17.98%) followed by H₂ (17.96%) and H₃ (17.93%), which might be due to genetic makeup of the hybrid. The present study is in concurrence with the findings of Rahmathulla[5] who reported that cocoon related characters are influenced by genetic constitution of silkworm strain besides rearing seasons, leaf quality etc.

3.1.5 Denier (d)

Denier is the unit used to measure the thickness of silk filament. This value is very important as it
Table 1. Performance of the hybrids during Summer

| Hybrids       | Pupation rate (%) | Single cocoon wt. (g) | Single shell wt. (g) | Shell ratio | Denier (d) | Leaf cocoon ratio |
|---------------|-------------------|-----------------------|----------------------|-------------|------------|------------------|
| SK31 × SK13   | 85.83             | 1.957                 | 0.406                | 20.67       | 2.94       | 15.16            |
| SK6 × SK13    | 85.25             | 1.937                 | 0.397                | 20.43       | 3.01       | 15.40            |
| CSR18 × CSR19 | 85.08             | 1.933                 | 0.393                | 20.33       | 2.86       | 15.53            |
| C.D (p ≤ 0.05) | NS                | 0.0119                | 0.0097               | NS          | 0.037      | 0.085            |

COMPETING INTERESTS
Authors have declared that no competing interests exist.

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