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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.

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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 (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). Thesedfl's were incubated, brushed and reared up to 3rd instar en masse following the standard rearing procedure. Just after 3rdmoult, 3 replications of 100 larvae in each treatment were maintained. Cocoon and post cocoon parameters viz, pupation rate, single cocoon

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weight, single shell weight, shell ratio, raw silk, denier and leaf cocoon ratio were calculated and recorded during the course of experimentation.

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, *Bombyxmori*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 3rdmoult, 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 PupationRate (%)

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:

$$\text{Raw silk (\%)} = \frac{\text{Weight of silk reeled}}{\text{Weight of green cocoons}} \times 100$$

2.6 Denier (d)

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

$$\text{Denier (d)} = \frac{\text{Weight of silk filament (g)}}{\text{Length of silk filament (m)}} \times 9000$$

2.7 Leaf Cocoon Ratio

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

$$\text{Leaf cocoon ratio} = \frac{\text{Leaves given(g)}}{\text{Wt. of cocoons harvested(g)}}$$

2.8 Experimental Details

Mulberry variety	**:**	**Goshoerami**
No. of hybrids	**:**	03 • (H_1) SK31 × SK13 • (H_2) SK6 × SK13 • (H_3) 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, 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.

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 H_1 hybrid followed by H_2 and H_3 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 H_1 (17.98%) followed by H_2 (17.96%) and H_3 (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
SK_{31}× SK_{13}	85.83	1.957	0.406	20.67	2.94	15.16
SK_6 × SK_{13}	85.25	1.937	0.397	20.43	3.01	15.40
CSR_{18}× CSR_{19}	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

indicates the number of cocoon filaments to be assembled for obtaining the required size of reeled silk. Thin denier silkworms produce superior quality of silk with longer filament length, more reliability and more silk percentage [6]. Among the hybrids 2.86 d was reported in H_3 followed by H_1 (2.94d) and H_2 (3.01d). The present findings are in concurrence with the earlier findings of Watanabe [7,8] and Kogure [9], who reported that the thickness of silk filament is not only controlled by the genes but also influenced by the silkworm race, environmental factors such as nutrition, incubation, temperature etc.

3.1.6 Leaf cocoon ratio

t is the ratio between the leaf given and cocoons obtained/harvested (by weight) and is considered as an important criterion for evaluating the silkworm breed/hybrid. As lower the ratio better will be the breed/hybrid and vice-versa. In the present study better ratio among the hybrids was recorded in $H_1$with mean value as 15.16 /100 dfl's. In a similar study Datta [10], reported 17.3 and 16.5 leaf cocoon ratio for rearing 100 dfl's of bivoltine silkworms in April-May and October-November seasons respectively under tropical conditions.

4. CONCLUSION

From the above study, it is concluded that the significant differences among the three hybrids were observed during summer under temperate climatic conditions, 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.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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