

EVALUATION OF IMPROVED POLYVOLTINE x BIVOLTINE HYBRIDS OF SILKWORM *BOMBYX MORI* L. UNDER LARGE SCALE IN-HOUSE TESTING

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In the present study, an attempt has been made to assess the in-house large scale performance of new polyvoltine x bivoltine hybrids of silkworm *Bombyx mori* L., AGL3 x CSR2 and AGL5 x CSR2 under simulated farmers conditions for their rearing and reeling characters in comparison with the existing commercial hybrid, PM x CSR2. All the hybrids were reared thrice in four replications at the rate of 50 dfls/replication. Data was collected for twelve qualitative and quantitative economic parameters and analyzed statistically. The results indicated that, the new hybrids studied have excelled in their performance for most of the traits studied over the existing commercial hybrid, PM x CSR2 and proved promising for commercial exploitation. Among the new hybrids tested AGL5 x CSR2 recorded higher survival (85.25 %), cocoon yield (72.055 kg/50000 eggs) and fetched higher cocoon rate (Rs.138.00) compared to the control.

Key words : *Bombyx mori* L., cocoon uniformity, in-house testing, large-scale evaluation, polyvoltine x bivoltine hybrids

INTRODUCTION

In southern states, raw silk is mainly produced from polyvoltine x bivoltine hybrids. Tazima (1958) opined that the existing polyvoltine breed, Pure Mysore though a hardy race and withstands varied agro climatic conditions but spins poor quality cocoons resulting in production of inferior quality of raw silk. Hence, he has emphasized the necessity of replacing the Pure Mysore to bring quantitative and qualitative improvement in sericulture. Keeping this in view Silkworm breeding laboratory of Central Sericultural Research and Training Institute (CSRTI), Mysore (Karnataka), India has developed and introduced many polyvoltine x bivoltine silkworm hybrids (Ravindra Singh *et al.*, 2001; Narayanaswamy *et al.*, 2002; Dandin *et al.*, 2007). It is a widely accepted fact that many silkworm hybrids developed earlier have not accepted by the farmers and there is a wide gap between laboratory results and field realization (Nagaraju *et al.*, 1993; Deepa & Sujathamma, 2005; Vijayaprakash & Dandin, 2005). The major reason analyzed for this wide gap are mini scale experimentation at laboratories and magnified implementation in the field, conducting experiments at ideal situation which is seldom available in the farmer's condition and lack or poor information/ experience on large scale implementation prior to field recommendation. Selection of potential hybrid combination for commercial exploitation is one of the pre-requisites contributing to the success of hybrids under the given environment. Proper evaluation of silkworm hybrids under large scale as per the farmers practice helps to critically analyze the most effective hybrid combination before choosing for commercial exploitation.

In this background the present investigation has been undertaken to evaluate the performance of newly improved polyvoltine x bivoltine hybrids through large scale in-house testing under simulated farmers conditions before recommending them to the field.

MATERIALS AND METHODS

The present study was carried out at Central Sericultural Research and Training Institute (CSTRI), Mysore during 2008. Two newly improved polyvoltine x bivoltine hybrids of silkworm *Bombyx mori* L., namely AGL3 x CSR2 and AGL5 x CSR2 developed at Silkworm Breeding Laboratory of CSRTI, Mysore and PM x CSR2 as control were utilized in this study. The improved polyvoltine breeds, AGL3 and AGL5 were developed through the application of androgenetic technique. These hybrids were reared thrice during March/ April 2008, June/ July 2008 and November/ December 2008 under large scale as per the shoot rearing technique (Kawakami, 2001). Four replications were maintained with 50 disease free laying (dfIs) each. The cocoons were harvested on 6th day of mounting and assessed on the next day. A sample of three kg cocoons from each replication was reeled on multiend reeling machine at Silk Reeling Unit of CSRTI, Mysore for assessing the reeling parameters. To assess the uniformity of cocoon shape and size, 100 cocoons were taken at random from each replication. The individual cocoon length and CD ; d125 were measured using a Vernier calipers specially designed for the purpose. Cocoon length and breadth uniformity index was calculated by using the following formula (Mano, 1994):

$$\text{Cocoon uniformity Index (\%)} = \frac{\text{Length of cocoon (cm)}}{\text{Width of cocoons (cm)}} \times 100$$

Cocoons were marketed at Government cocoon market, Ramanagara, a premier cocoon market in Karnataka to assess the cocoon price fetched by the individual hybrid combination.

Observations on various economic traits recorded from three rearing trials were pooled together and analyzed statistically by 2way ANOVA using Indo-stat package. The cocoon indices were analyzed statistically to know the Standard Deviation (SD) and Co-efficient of Variation (CV). Variability in cocoon size was determined on the basis of SD and CV. The cocoon possessing less SD and CV were considered uniform in cocoon shape.

RESULTS

The mean performance of the new hybrids and control hybrid in respect of economic traits of rearing and reeling are presented in Table I.

Larval duration : The total larval duration was insignificant among the hybrids tested with a larval duration of 528 h. in the new hybrids as against 530 h in the control.

Survival and cocoon yield : The cocoon yield/ 50,000 eggs was higher in AGL5 x CSR2 (72.055 kg with 85.25 % survival) followed by AGL3 x CSR2 (67.535 kg with 81.22 % survival) compared to PM x CSR2 wherein the cocoon yield was 60.603 kg with a survival of 77.31 %.

Cocoon price per kg of cocoons : Rate per kg of cocoons fetched in the market for the hybrids studied ranged from Rs.114.00 to 138.00. The new hybrids, AGL5 x CSR2 and AGL3 x CSR2 registered significantly higher cocoon rate of Rs.138.00 and 137.00, respectively as against Rs 114.00 in the control.

Table 1 : Seasonal performance of the polyvoltine x bivoltine hybrids of silkworm *Bombyx mori* L. under large-scale in-house evaluation.

Hybrid combination	Larval duration (h)	Survival (%)	Cocoon yield/ 50000 eggs (kg)	Rate/kg (Rs)	Cocoon weight (g)	Cocoon shell weight (g)	Cocoon shell (%)	Filament length (m)	Filament size (d)	Raw silk (%)	Reelability (%)	Neatness (p)
AGL3 x CSR2 (T1)	528	81.22	67.535	137.00	1.806	0.364	20.17	922	2.79	13.83	77.67	91.33
Improvement over C (%)	-0.38	5.06	11.44	20.18	3.85	10.30	6.27	16.71	-0.36	9.10	4.49	0.73
AGL5 x CSR2 (T2)	528	85.25	72.055	138.00	1.910	0.389	20.38	948	2.80	14.27	79.00	92.00
Improvement over C (%)	-0.38	10.27	18.90	21.05	9.83	17.88	7.38	20.00	0.00	12.54	6.29	1.47
PM x CSR2 (C)	530	77.31	60.603	114.00	1.739	0.330	18.98	790	2.80	12.68	74.33	90.67
SE	1.12	0.46	0.31	3.01	0.015	0.004	0.15	9	0.07	0.35	0.81	0.4
CD at 5%	NS	1.32*	0.95*	7.90*	0.043*	0.013*	0.46*	23*	NS	1.09*	2.30*	NS

Each value is the mean of three trails of four replications; T : New hybrid; C : Control hybrid; NS : Non significant; * p< 0.05.

Cocoon traits : Single cocoon weight and shell weight were significantly more in AGL5 x CSR2 (1.910 g and 0.389 g) followed by AGL3 x CSR2 (1.806 and 0.364 g) as compared to 1.739 and 0.330 g in PM x CSR2. The cocoon shell percent was maximum in AGL5 x CSR2 (20.38%) and it was on par with AGL3 x CSR2 (20.17%) where as the cocoon shell percent recorded in PM x CSR2 was 18.98%.

Reeling parameters : The filament length was significantly longer in AGL5 x CSR2 (948 m) and AGL3 x CSR2 (922 m) compared to 790 m in PM x CSR2. The filament size was insignificant among the hybrids tested with a denier ranged from 2.79 to 2.80. The new hybrids, AGL5 x CSR2 and AGL3 x CSR2 recorded significantly higher raw silk percent of 14.27 and 13.83, respectively compared to 12.68% in the control. Reelability in the hybrids tested ranged from 74.33 to 79 % and AGL5 x CSR2 recorded significantly a higher reelability. The neatness of reeled silk in the hybrids studied ranged from 90.67 to 92 p indicating non significant difference among the hybrids tested.

Cocoon size uniformity : Cocoon size variability in the new hybrids and the control hybrid is presented in Table II. It is clear from the data that SD on cocoon indices of the hybrids studied ranged from 6.45 to 8.09 with a minimum value of 6.45 observed for AGL5 x CSR2 followed by AGL3 x CSR2 (8.00). The CV on cocoon indices ranged from 4.29 to 4.79% with a minimum mean value observed for AGL5 x CSR2 (4.29 %) followed by 4.59% in AGL3 x CSR2.

DISCUSSION

The higher survival coupled with higher cocoon weight recorded in the new hybrids tested confers their superiority with regard to consistency in the expression of productivity traits.

The highest cocoon rate obtained in the new hybrids is mainly due to the high silk content and uniform cocoons. Cocoon filament length is one of the important economic traits and is considered to have direct bearing on the merit of the hybrid. New hybrids recorded higher filament length compared to control hybrid. The increase or decrease in filament length is dependent on the increase or decrease of the thickness of the filament and cocoon shell weight. Significant variations were recorded for fiber characteristics of the hybrids studied. Higher values recorded for raw silk percent are due to the recombinant genetic vigour of the breeds utilized in the hybrid preparation. The trait neatness is highly heritable (Gamo, 1976) and reported to be controlled by major genes.

The less cocoon size variability observed in the hybrids is due to more uniformity of cocoons (Nakada, 1998; Ravindra Singh *et al.*, 1998). The higher cocoon rate fetched by

Table II : Cocoon size variability in new polyvoltine x bivoltine hybrids of silkworm *Bombyx mori* L. under large-scale in-house evaluation.

Hybrid combination	Cocoon length (cm)	Cocoon width (cm)	Cocoon index (L/Wx100)	CV on cocoon index (%)
AGL3 x CSR2	3.44 ± 0.05	2.07 ± 0.09	161.25 ± 08.00	4.59
AGL5 x CSR2	3.36 ± 0.09	2.10 ± 0.08	159.90 ± 06.45	4.29
PM x CSR2	3.39 ± 0.06	1.96 ± 0.09	172.96 ± 08.09	4.79

L : Cocoon length; W : Cocoon width; Data are mean ± SD of 100 cocoons.

the new hybrids may also be due to uniform size of the cocoon, which is important for getting uniform yarn. Significant variation in cocoon shape and cocoon size in hybrids results in variation in filament size as well as the quality of the reeled silk. To obtain uniform filament size especially in auto and semi-automatic reeling machine cocoon size uniformity is very important (Mano, 1994). Cocoon size variability was found less in the new hybrids as indicated by standard deviation for cocoon index which is within the admissible limit (≤ 8.00) and minimum Co-efficient of Variation. The results are in agreement with that of Ravindra Singh *et al.* (1998).

It is evident from the above results that both the new hybrids studied have excelled in their performance in large scale evaluation under farmers simulated conditions for most of the traits compared to the control hybrid, PM x CSR2. The results are in conformity with the findings of Nirupama *et al.* (2008). The better performance of the new hybrids may be due to more vigorous nature of AGL5 and AGL3 strains and may exhibit general fitness character such as wider adaptability (Das *et al.* 1994). The hybrids AGL5 x CSR2 and AGL3 x CSR2 have performed significantly superior for most of the cocoon and fibre characteristics than the existing PM x CSR2. Hence, it may be inferred that these newly improved hybrids can be popularized in the field to improve the cocoon productivity at farmers level.

ACKNOWLEDGEMENT

The authors wish to express thanks to the staff members of Technology Validation and Demonstration Centre at CSRTI, Mysore for their help during rearing. Thanks are also due to Mr. A. K. Palit, Assistant Director (Statistics) for his help in analyzing the data.

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