INVESTIGATION ON THE CHARACTERS OF PARENT SILKWORM BREEDS PAK 1 AND PAK 2 AND THEIR F_1 HYBRID CROSS

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ABSTRACT

Two pure silkworm breeds, *PAK 1* and *PAK 2* of Japanese and Chinese origin, respectively, were developed through breeding by line-separation. The reproductive eggs of these races and those of their F_1 hybrid, obtained during Spring 1986 and used for these studies during Spring 1987 resulted in 96.77% cocooning ratio, 21.46% cocoon shell ratio and 1.91 gm cocoon weight in F1 hybrid as against 19.58% cocoon shell ratio and 1.301 gm cocoon weight in parent breeds. Further, hybrid vigour in respect of cocoon weight (46.81%), cocoon shell weight (60.78%) and cocoon shell ratio (9.6%) was found to be highly significant.

INTRODUCTION

The most important step in silkworm rearing, for developing silk industry is the production of silkworm eggs. The reproductive eggs, intended for producing seed cocoons, are obtained by breeding pure lines belonging to different regional races (Japanese, Chinese, European or Tropical) of silkworm. The commercial eggs, obtained from the seed cocoons, are generally specific hybrids between two or more pure lines of different races of silkworm. The hybrids, because of their high vigour, easy rearing and high silk production, are reared by the sericulturists for producing cocoons on commercial scale for reeling purposes.

Since the introduction of hybridization system, mostly hybrids are exploited for commercial cocoon production in different countries. In Japan, the entire country has taken up rearing of hybrids (Krishnaswami et al. 1973). Suitable improved hybrid combinations are, therefore, continuously being established for the production of hybrid seed for commercial rearing.

Akapanthu et al. (1971) conducted research on several hybrids to find out a hybrid possessing good combination of practical characters. Similar studies were also carried out by Hygashi (1971) on two breeds, Mayu and Kan and their F_1 hybrid (Mayu x Kan). The characters studied by the aforementioned authors included larval duration, cocooning ratio, single cocoon weight, cocoon shell weight and cocoon shell ratio. The author, from the data recorded on various characters, also derived hybrid vigour rate, hybrid effect and vigour index (Mayu x Kan).

In Pakistan non-availability of pure lines of parent silkworm races for producing commercial hybrid eggs has been one of the major constraints in the development of silk production. This study was, therefore, undertaken for investigating the practical characters of the newly developed pure lines, PAK 1 and PAK 2 of Japanese and Chinese origin, respectively, and for determining the compatibility of their F_1 hybrid cross (PAK 1 x PAK 2) for producing commercial eggs.

MATERIALS AND METHODS

The pure silkworm breeds, PAK 1 and PAK 2 of Japanese and Chinese origin, respectively, were developed through breeding by line-separation for several generations at Sericulture Research Laboratory, Lahore. These were picked up on the basis of the difference in their racial characters as prescribed by Shimizu and Tajima (1972) and are reproduced (Table 1).

The reproductive eggs of these two breeds and those of their F_1 hybrid (PAK 1 x PAK 2) were obtained during Spring, 1986. These eggs were subjected to trial rearing during Spring, 1987 for investigating the characters of the pure breeds and for studying the performance of their hybrid.

The eggs were incubated at 25°C and 75% R.H. The larvae were brushed on February 20-21, 1987 and feeding was started on the same day at 11.00 a.m. The larvae were administered five feeds per day at 7, 11, 15, 19 and 22 hours. The first and second instar larvae were reared at 25°C and 75% R.H. and the rest of the instars under laboratory conditions (22°C to 24°C and 65 to 70% R.H). Larval period was also recorded.

For studying the characters of the pure breeds and their F_1 hybrid, 900 fourth instar larvae of each variety were taken at random and grouped in three batches of

Table 1. Racial characters after Shimizu and Tajima (1972)

Characters	Races	
	Japanese	Chinese
a. Larva		
Marking	Quail	Plain
Body colour	Blackish brown	Whitish
Duration	Slightly slow	Comparatively fast
b. Cocoon		
Shape	Peanut	Round or oval
Colour	White or straw	White or yellow
c. Voltinism	Uni/bivoltine	Uni/bivoltine

300 each. The fullgrown larvae were mounted on cocooning frames. The cocoons were harvested after seven days of mounting of larvae and the following characters were studied in case of each variety:-

(a) Larval marking and cocoon shape

(b) The survival percentage of the hybrid larvae, expressed on the basis of cocooning ratio by the following formula:

$$\text{Cocooning Ratio} = \frac{\text{Number of cocoons spun}}{\text{Number of sampled larva}} \times 100$$

(c) Cocoon Weight

Female and male cocoons, 25 each, were taken at random from normal cocoons of each group of each variety at harvest and their weight (gm) determined and averaged.

(d) Cocoon Shell Ratio

The shell weight (gm) of the cocoons (d) was determined after removing the pupae from the cocoons and cocoon shell ratio, expressed (in percentage) by the following formula:-

$$\text{Cocoon Shell Ratio} = \frac{\text{Cocoon shell weight}}{\text{Cocoon weight}} \times 100$$

(e) Hybrid Vigour Rate (V.R.)

The hybrid vigour rate of the F_1 (PAK 1 X PAK 2) in respect of cocoon weight; cocoon shell weight and cocoon shell ratio were determined as under:-

$$\text{(i) Cocoon Weight} = \frac{\text{Wt. of cocoons F1 hybrid} - \text{Mean average wt. of cocoons of parents}}{\text{Mean av. wt. of cocoons of parents}} \times 100$$

(ii) Cocoon Shell Weight

The cocoon shell weight, expressed in percentage, was worked out by replacing cocoon weight by cocoon shell weight in the above formula given at e (i).

(iii) Cocoon Shell Ratio

This too was determined by the above formula at e (i) by replacing cocoon weight by cocoon shell ratio and expressed in percentage.

(f) Hybrid Effect (S)

The hybrid effect in respect of cocoon weight, cocoon shell weight and cocoon shell ratio was determined by the following formula, where F1 stands for the values of hybrid and MP for the mean values of parents:-

$$S = F1 - MP$$

(g) Vigour Index (V.I)

The vigour index in respect of cocoon weight, cocoon shell weight, cocoon shell ratio and larval duration were worked out by the formula given below:-

$$V.I. = \frac{F1}{MP} \times 100$$

RESULTS AND DISCUSSION

The data recorded on different characters of parent stock and their hybrid are given in the Table 2.

Table 1. Characters of parent silkworm breeds PAK1 and PAK2 and their F1 hybrid during Spring, 1987

Name of breed	Origin of the breed	Larval marking	Colour of larvae	Larval duration		Single cocoon weight (g)	Cocoon shell weight (g)	Cocoon shell ratio (%)	Shape of Cocoon	Colour of cocoon	Cocooning ratio (%)
				Total life (days)	Fifth instar (days)						
1	2	3	4	5	6	7	8	9	10	11	12
Parents											
PAK1	Japanese strain	Normal marking (Quail)	Brown	29.0	8.5	1.233	0.240	19.45	Peanut	White	-
PAK2	Chinese strain	Plain	White	28.0	7.5	1.370	0.270	19.71	Oval/short elliptic	White	-
Average (MP)	-	-	-	28.5	8.0	1.301	0.255	19.58	-	-	-
Hybrid (PAK1 x PAK2)	Cross hybrid	-Normal marking	White	27.0	7.5	1.91	0.41	21.46	Slightly constricted	White	98.77
Hybrid vigour rate (%)				-	-	46.81	60.78	9.60	-	-	-
Hybrid effect (g)				-	-	0.609	0.155	1.83	-	-	-
Vigour index (%)				-	-	146.81	160.78	109.60	-	-	-

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Hybrid Vigour Rate, Hybrid Effect and Vigour Index in respect of cocoon weight, cocoon shell weight and cocoon shell ratio were found to be 46.81%, 60.78%, 9.60 gm., 0.609 gm., 0.155 gm., 1.88 and 146.81%, 160.78%, 109.60%, respectively. The Vigour Index of larval duration was 94.73 per cent

The racial characters viz., larval marking, larval colour and cocoon shape established in case of Pak 1 and Pak 2 and compared with those prescribed by Shimizu and Tajima (1972) indicated that the breeds used in these studies were pure and true to type.

The results achieved in respect of the practical characters of the hybrid (PAK 1 x PAK 2) go well in agreement with those of the hybrid (MAYU x KAN); rather cocoon weight, cocoon shell weight and cocoon shell ratio of the former are more significant as compared to those of the latter.

ACKNOWLEDGEMENTS

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