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ANALYSIS OF QUANTITATIVE TRAITS OF MULTIVOLTINE SILKWORM, *BOMBYX MORI* L. (LEPIDOPTERA : BOMBYCIDAE) IN VARIED ENVIRONMENTS

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The quantitative performance of 10 evolved multivoltine silkworm breeds of *Bombyx mori* L. were studied under varied environmental condition to evaluate different quantitative traits. Statistical analysis (ANOVA) revealed that the overall performance of AB_5, O yellow (Ovai), NJB(Y), M_2 and BC_5 (C) were better and may be utilised through hybridization.

INTRODUCTION

The multivoltine indigenous breeds are dominated in the tropical belt as they can withstand different environmental conditions but their yield and quality of silk is very poor (Sengupta & Datta, 1973; Sengupta *et al.*, 1974 & 1976; Datta, 1984 & 1986; Nomani *et al.*, 1990; Goldsmith, 1991). As such, attention is being given from time to time to evolve high yielding multivoltine silkworm breeds by many workers (Joliy, 1983; Sidhu, 1967 & 1984; Narasimhanna *et al.*, 1976; Raju & Krishnamurthy, 1984; Sreerama Reddy, 1984) through different breeding techniques and thus a number of breeds have been evolved. To exploit genotype - environmental interaction, the ecological races are required to be identified. It is also important to find out the congenial and optimum environmental conditions for expression of quantitative traits of genotypes that are controlled by additive and non-additive genes (Sharma *et al.*, 1985).

The maintenance of germplasm and evaluation of the breeds under varied environmental conditions are most essential parameters for silkworm breeding plan. This can be achieved through analysis of the quantitative performance of silkworm breeds in both favourable and unfavourable seasons. The performance of silkworm breeds were studied by several workers (Krishnaswami & Tikoo, 1971; Sidhu, 1974; Sengupta *et al.*, 1976; Tayade, 1987; Nomani *et al.*, 1990; Haque & Barman, 1991).

The present study is dealing with the analysis of quantitative performance of 10 evolved multivoltine breeds *viz.* $A_{14}d$(Y); AB_5; O-yellow (Oval); O; B; NJB (Y); CB_2; M_2; BC_5 (C) and S_{10} (P) reared to evaluate the efficacy of these breeds under different environmental conditions.

MATERIAL AND METHODS

The distinct morphological features of 10 evolved multivoltine breeds and their mode of evolution are furnished below :

Name of Breeds	Evolved at	Mode of evolution	Larval marketing	Coccon shape	Cocoon colour
$A_{14}d(Y)$	CSR&TI, Berhampore	Hybridization	Marked & plain	Oval	Yellow
AB_5	-do-	Mutation & Hybridization	Marked	-do-	-do-
O yellow (Oval)	-do-	Hybridization	-do-	-do-	-do-
O	-do-	-do- & mutation	-do-	Elliptical	-do-
B	-do-	-do-	Plain	-do-	-do-
NJB (Y)	-do-	Hybridization	Marked & plain	-do-	-do-
CB_2	-do-	Mutation & hybridization	Marked	Oval	-do-
M_2	-do-	-do-	-do-	-do-	-do-
BC_5 (C)	-do-	-do-	-do-	Elliptical	-do-
S_{10} (P)	-do-	Hybridization	Plain	Spindle	-do-

For the present study 10 dfls of each of the evolved multivoltine breeds were crushed and standard schedule of rearing was followed (Krishnaswami, 1978 & 1979). After second moult, larvae were distributed in 3 replications, each with 300 larvae. Every year three rearings during favourable seasons (October - March) and three rearings during unfavourable seasons (April - September) were conducted. Observations were recorded for number of eggs laid/female (Fecun.); larval period (LAR Pd.) in days; survival percentage (Surv. %); yield per 10,000 worms (ERR Wt.); single cocoon weight (SCW); single shell weight (SSW); Cocoon shell ratio (SR%) and filament length (Fil. Leng.) in metres and the last 4 years data were statistically analysed.

RESULTS AND DISCUSSION

Analysis of variance (ANOVA) for statistical significance of different quantitative traits of 10 evolved multivoltine silkworm breeds during favourable and unfavourable seasons, their mean values and C.D. values are presented in Table I.

Significant difference ($P \leq 0.05$) was observed for all characters except filament length for year and season, but their interaction was significant except fecundity, survival percentage and single cocoon Wt.; significant difference ($P \leq 0.05$) was also noticed among different breeds for all characters except fecundity, survival percentage and ERR wt.; interaction between breed & environment was not significant which depict that additive gene effect of these evolved breeds has a significant role for expressing quantitative traits under varied environment.

Fecundity: (No. of eggs laid by female moth) : No significant difference was observed among the breeds and between season and breed. Maximum fecundity was found in AB_5 (462) and minimum in $A_{14}d(Y)$ (432).

Larval period in days (Lar. Pd.): Shortest larval period was noted in A_{14} d(Y) (21.38) followed by O and NJB (Y) (21.79) and longest larval period in S_{10} (P) (23.33).

Table I. Performance of the evolved multivoltine breeds.

Breed	Season	Fecund	Lar.Pd.	Surv%	ERR.Wt.	SCW	SSW	SR%	Fil.Leng.
$A_{14}d$(Y)	UNFAV	409	19.92	77.35	7031.67	0.996	0.137	13.74	553.33
	FAV	456	22.83	90.18	9621.00	1.101	0.149	13.49	543.33
	MEAN	432	21.38	83.77	8326.33	1.049	0.143	13.61	548.46
AB_5	UNFAV	423	20.42	76.99	7558.58	1.103	0.159	14.45	582.92
	FAV	501	23.42	90.47	9955.58	1.143	0.168	14.75	577.42
	MEAN	462	21.92	83.73	8757.08	1.123	0.164	14.60	580.17
O Yel(O)	UNFAV	434	20.33	67.40	7444.75	1.172	0.156	13.29	602.17
	FAV	465	23.50	90.11	10717.83	1.236	0.172	13.54	624.92
	MEAN	449	21.92	78.76	9081.29	1.204	0.164	13.41	613.54
O	UNFAV	422	20.25	67.31	7282.92	1.106	0.158	14.34	589.83
	FAV	460	23.33	90.54	10548.92	1.128	0.161	14.21	592.50
	MEAN	441	21.79	78.93	8915.92	1.117	0.160	14.28	591.17
B	UNFAV	414	20.58	65.03	6134.08	0.975	0.126	12.97	492.00
	FAV	484	23.75	88.54	9271.92	1.041	0.146	14.00	486.92
	MEAN	449	22.17	76.78	7703.00	1.008	0.136	13.49	489.46
NJB(Y)	UNFAV	423	20.17	67.93	7263.08	1.133	0.150	13.22	604.08
	FAV	470	23.42	89.79	11061.00	1.247	0.170	13.60	631.67
	MEAN	447	21.79	78.86	9162.04	1.190	0.160	13.41	617.88
CB_2	UNFAV	421	20.25	68.57	6976.25	1.095	0.151	13.91	599.42
	FAV	473	23.42	92.83	10630.75	1.191	0.171	14.47	578.42
	MEAN	447	21.83	80.70	8803.50	1.143	0.161	14.19	588.92
M_2	UNFAV	430	20.33	67.65	6842.25	1.127	0.155	13.75	633.33
	FAV	473	23.33	91.61	10548.08	1.212	0.176	14.55	652.33
	MEAN	452	21.83	79.63	8695.17	1.170	0.166	14.15	642.83
BC_5(C)	UNFAV	417	21.00	80.01	7031.42	0.916	0.116	12.71	474.33
	FAV	458	23.75	90.07	8586.83	1.006	0.130	12.97	487.25
	MEAN	438	22.38	85.04	7809.13	0.961	0.123	12.84	480.79
S_{10}(P)	UNFAV	422	22.00	72.75	7133.67	0.997	0.127	12.67	409.75
	FAV	470	24.67	90.91	9638.08	1.074	0.146	13.62	366.00
	MEAN	446	23.33	81.83	8385.88	1.035	0.136	13.15	387.88
CD at 5%									
for	A:	19.015	.550	4.764	524.065	.039	.006	.381	NS
	B:	13.446	.389	3.368	370.570	.028	.005	.270	NS
	C:	NS	.870	NS	NS	.062	.010	.603	47.825
	A x B:	NS	.778	NS	741.139	NS	.009	.539	42.776
	B x C:	NS	NS	NS	NS	NS	NS	NS	NS
	SE:	30.523	.883	7.647	841.237	.063	.010	.612	48.553

A: Year; B: Season (UNFAV / FAV) and C: Breed; NS : Not significant.

Survival percentage (Surv. %): Significant difference was observed for season and highest surv. % was recorded in BC_5 (C) (85.04) followed by $A_{14}d$ (Y) (83.77) and AB_5 (83.73), minimum surv.% was notice in B (76.78).

Yield per 10,000 worms (ERR Wt.): The highest ERR Wt. was found in NJB (Y) (9162.04 gms) followed by O-yellow (Oval) (9081.29 gms) and lowest in B (7703.00 gms).

Cocoon characters : Maximum average single cocoon weight was noticed in O-yellow (Oval) (1.204 gms) followed by NJB (Y) (1.190 gms) and M_2 (1.170 gms). The highest single shell weight was observed in M_2 (0.166 gms) followed by O yellow (Oval) and AB_5 (0.164 gms). SR% was found in AB_5 (14.60) followed by O (14.28). The average maximum filament length was recorded in M_2 (642.83) which is significant among breeds.

During unfavourable season O yellow (Oval) showed better performance for fecundity and single cocoon wt.; maximum survival percentage and filament length were recorded in BC_5 (C) and M_2 respectively and AB_5 exhibits highest value for ERR Wt., SSW and SR% and shortest larval period noted in A_{14} d(Y).

During favourable season AB_5 was found better for fecundity and SR%; NJB (Y) showed better ERR Wt. and single cocoon Wt., M_2 for single shell wt. and filament length; shortest larval period and maximum surv. % were recorded in $A_{14}d$ (Y) and CB_2 respectively.

The overall performance of all the breeds showed that AB_5 was better for fecundity and SR%, $A_{14}d$ (Y) for shortest larval period, BC_5 (C) for highest surv. %, NJB(Y) for ERR Wt., O Yellow (Oval) for SCW and M_2 for SSW and filament length. (Table I). Therefore, AB_5, O Yellow (Oval), NJB(Y), M_2 and BC_5(C) may be commercially exploited subjected to their combining ability studies followed by field trials.

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