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COMPARATIVE PERFORMANCE OF POLYVOLTINE x BIVOLTINE HYBRIDS OF SEX-LIMITED COCOON COLOUR BREEDS OF SILKWORM, *BOMBYX MORI* L. UNDER DIFFERENT ENVIRONMENTAL CONDITIONS

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In the present study an attempt has been made to evaluate the performance of the bivoltine sex-limited cocoon colour breeds with normal breeds and their polyvoltine x bivoltine hybrids under three different temperature and humidity conditions (25±1°C (65±5% RH), 31±1°C (50±5% RH) and 36±1°C (85±5% RH). By utilizing four bivoltine breeds *viz.* CSR2 normal, CSR2(SL) sex-limited for cocoon color, NB4D2 and CSR8(SL) sex-limited for cocoon color and 6 polyvoltine breeds *viz.* PM, Nistari, BL67, MY1, RD1, and PV1, 24 polyvoltine x bivoltine hybrids were prepared and studied. Significant differences were noticed for majority of the characters in bivoltine and polyvoltine breeds and their hybrids at different environmental conditions. The results of this study indicate that the performance of sex-limited cocoon colour bivoltine breed CSR2(SL) was marginally better than the normal bivoltine breed, CSR2 and also indicate that hybrids of sex limited breed CSR2(SL) with all polyvoltine breeds performed better than other breeds at adverse conditions. Therefore, it is concluded that sex-limited cocoon colour breed CSR2(SL) can be used as male component for preparation of polyvoltine x bivoltine hybrids throughout the year.

Key words : *Bombyx mori*, sex-limited cocoon colour breeds, Polyvoltine × bivoltine hybrids, different environmental conditions, performance.

INTRODUCTION

The success of silkworm rearing depends upon several factors of which the impact of the environmental factors such as biotic and abiotic factors is of vital importance. Among the biotic factors, temperature plays a major role on the growth of productivity in silkworm, as the silkworm is a poikilothermic insect (Benchamin & Jolly, 1956). It is known that the late age rearing silkworm prefers relatively lower temperature than the young age and fluctuation of temperature during different stages of larval development was found to be more favorable for the growth and development of the larvae than constant temperature. There is sufficient literature available that good quality cocoons are produced within a temperature range of 22-27°C beyond which the cocoon quality worsen (Krishnaswami *et al.*, 1973). Suresh Kumar & Yamamoto (1995), Datta *et al.* (2001), Naseema Begum *et al.* (2001) and Suresh Kumar *et al.* (2001), while studying the effect of high temperature on F1 hybrids between polyvoltine and bivoltine indicated that the hybrids are more tolerant than pure races. There was maternal effect regarding temperature tolerance as evidenced from the better performance of those hybrids where the female parents used were more tolerant as pure races. Hesich, *et al.* (1995) made studies on the thermo-tolerance of silkworm and concluded that high temperature (36 ± 1°C) affected the survival rate more than other characters and the polyvoltines are more tolerant to high temperature than bivoltine strains during 4th and 5th instar and pupal stage.

Tsenov (1998) reported that the high temperature during 5[th] instar of silkworms decrease the food ingested, digested and assimilated and this cause the physiological imbalance. Suresh Kumar *et al.* (1999) indicated that the deleterious effect of high temperature and high humidity was more pronounced in productive bivoltine hybrids than the robust bivoltine hybrids. Expression of hybrid vigour was different in hybrids at different temperature treatments and all the hybrids excelled their parents in many characters with significant positive heterosis over MPV and BPV (Suresh Kumar *et al.*, 2000). In sericulturally advanced countries like China, distinct bivoltine silkworm breeds suitable for rearing during summer and autumn are evolved (He *et al.*, 1991). Japanese scientists have studied the influence of high temperature on silkworm growth and development (Takeuchi *et al.*, 1964; Ohi & Yamashita, 1977). Kato *et al.* (1989) also studied the adverse effect of temperature on silkworm and reported that the temperature tolerance is a heritable character and it may be possible to evolve thermo- tolerant silkworm breeds. Suresh Kumar *et al.* (2003) studied that during the hostile environmental conditions especially in summer months, it is advisable to use the robust bivoltine breeds / hybrids as male components rather than using productive bivoltine breeds/ for better survivability and stable cocoon crop.

In the present study, an attempt has been made to evaluate the performance of the bivoltine sex-limited cocoon colour breeds with normal breeds and their polyvoltine x bivoltine hybrids under three different temperature and humidity conditions.

MATERIALS AND METHODS

In the present study, four bivoltine breeds *viz*. CSR2 normal, CSR2(SL) sex-limited for cocoon color, NB4D2 and CSR8(SL) sex-limited for cocoon color and 6 polyvoltine breeds, PM, Nistari, BL67, MY1, RD1, and PV1 were utilized for preparation of 24 polyvoltine x bivoltine hybrids (PM x CSR2, PM x CSR2(SL), PM x NB4D2, PM x CSR8(SL), Nistari x CSR2, Nistari x CSR2(SL), Nistari x NB4D2, Nistari x CSR8(SL), BL67 x CSR2, BL67 x CSR2(SL), BL67 x NB4D2, BL67 x CSR8(SL), MY1 x CSR2, MY1 x CSR2(SL), MY1 x NB4D2, MY1 x CSR8(SL), RD1 x CSR2, RD1 x CSR2(SL), RD1 x NB4D2, RD1 x CSR8(SL), PV1 x CSR2, PV1 x CSR2(SL), PV1 x NB4D2 and PV1 x CSR8(SL).

Test Temperature : Two bivoltine sex-limited cocoon colour (CSR2(SL), CSR8(SL), and two normal (CSR2, NB4D2, control), six polyvoltine parents (PM, Nistari, BL67. MY1, RD1, PV1) along with 24 hybrids were utilized as materials for the study. All the parents of bivoltine, polyvoltine and hybrids were subjected for three different temperature and humidity schedules, 25±1°C (65±5 % RH), 31±1°C (50±5% RH) and 36±1°C (85±5% RH). According to earlier studies in Japan (Kato *et al.* 1989), it was observed that there are two phases during the fifth age larval duration *i.e.* first two days as early phase and rest of the day till spinning (vulnerable to high temperature and high humidity conditions) as late phase. Hence, the thermal treatment at 36±1°C temperature was affected to the third day old larvae of fifth age for 6 hrs daily till mounting, with relative humidity maintained above 85% (Suresh Kumar *et al.*, 1999).

Table 1 : Mean of pure breeds at three different temperature treatments (Mean of 9 replications)

Breed	Pupation rate (%)			Yield/10.000 larvae (kg)			Cocoon weight (g)			Cocoon shell weight (g)			Cocoon shell percentage		
Poly - voltine	25±1°C 65±5% RH	31±1°C 50±5% RH	36±1°C 85±5% RH	25±1°C 65±5% RH	31±1°C 50±5% RH	36±1°C 85±5% RH	25±1°C 65±5% RH	31±1°C 50±5% RH	36±1°C 85±5% RH	25±1°C 65±5% RH	31±1°C 50±5% RH	36±1°C 85±5% RH	25±1°C 65±5% RH	31±1°C 50±5% RH	36±1°C 85±5% RH
1		2			3			4			5			6	
PM	87.4 (69.5)	81.3 (64.4)	58.2 (49.7)	9.99	8.12	6.22	1.134	0.998	0.955	0.160	0.144	0.134	14.1	14.5	14.0
Nistari	90.4 (72.0)	83.4 (66.0)	66.1 (54.4)	9.54	8.34	6.39	1.028	1.000	0.965	0.141	0.138	0.130	13.8	13.8	13.4
BL67	86.9 (68.9)	76.3 (60.9)	47.5 (43.5)	12.30	11.17	7.39	1.487	1.464	1.258	0.253	0.255	0.220	17.0	17.4	17.5
MY1	93.7 (76.4)	69.2 (56.3)	47.6 (43.6)	15.17	7.18	4.75	1.518	1.055	1.021	0.239	0.160	0.146	15.8	15.2	14.3
RD1	85.2 (67.8)	71.3 (57.6)	39.6 (38.9)	12.24	8.52	4.00	1.272	1.217	1.003	0.165	0.150	0.129	13.0	12.3	12.8
PV1	88.9 (71.1)	70.7 (57.3)	41.4 (40.0)	12.94	7.62	4.55	1.191	1.073	1.081	0.172	0.168	0.160	14.4	15.7	14.8
CD at 5%	(4.2)	(2.0)	(3.0)	0.77	0.43	0.58	0.045	0.053	0.042	0.004	0.008	0.004	0.4	0.4	0.6
2 - way anova															
Tr ACD at 5%	(1.3)			0.24			0.019			0.003			0.20		
Tr BCD at 5%	(1.8)			0.33			0.026			0.004			0.29		
Env*Br (AxB)															
SE ±	1.13			0.21			0.02			0.002			0.18		
CD at 5%	(3.1)			0.58			0.046			0.007			0.50		

Table I : (continued .....)

Bivoltine																
1		2			3			4			5			6		
CSR 2	89.1 (71.2)	26.6 (31.0)	15.7 (23.3)	17.27	4.50	1.97	1.922	1.696	1.259	0.451	0.389	0.243	23.5	22.9	19.3	
CSR2(SL)	90.8 (72.6)	32.4 (34.6)	20.6 (26.9)	14.76	4.87	2.63	1.625	1.503	1.274	0.347	0.298	0.241	21.4	19.8	18.9	
NB4D2	90.8 (72.6)	43.4 (41.2)	33.4 (35.3)	15.86	6.91	3.96	1.746	1.590	1.184	0.377	0.312	0.203	21.6	19.6	17.2	
CSR8SL	87.9 (69.0)	42.7 (40.7)	29.6 (32.0)	14.80	5.94	3.51	1.597	1.460	1.141	0.324	0.283	0.227	20.2	19.8	19.9	
CD at 5%	--	(1.9)	(1.5)	--	0.57	0.29	0.054	0.041	0.064	0.017	0.012	0.014	0.70	0.67	0.90	
2 - way anova																
Tr ACD at 5%	(1.2)			6.18			0.029			0.007			0.39			
Rt B CD at 5%	(1.4)			--			0.034			0.008			0.45			
Env*Br (AxB)																
SE ±	0.8[illegible]			4.40			0.02			0.005			0.28			
CD at 5%	(2.4)			12.36			0.058			0.015			0.73			

Values in parentheses are angular transformed.

Table II. : Mean of hybrids at three different temperature treatments (Mean of 9 replications)

Hybrid	Pupation rate (%)			Yield/10,000 larvae (kg)			Cocoon weight (g)			Cocoon shell weight (g)			Cocoon shell percentage		
	25±1°C 65±5% RH	31±1°C 50±5% RH	36±1°C 85±5% RH	25±1°C 65±5% RH	31±1°C 50±5% RH	36±1°C 85±5% RH	25±1°C 65±5% RH	31±1°C 50±5% RH	36±1°C 85±5% RH	25±1°C 65±5% RH	31±1°C 50±5% RH	36±1°C 85±5% RH	25±1°C 65±5% RH	31±1°C 50±5% RH	36±1°C 85±5% RH
1		2			3			4			5			6	
PM × CSR2	91.5 (73.1)	85.0 (67.2)	71.6 (57.8)	16.04	13.37	10.40	1.685	1.573	1.452	0.308	0.275	0.243	18.3	17.5	16.7
PM × CSR2(SL)	93.8 (75.7)	85.7 (67.8)	72.7 (58.5)	16.60	12.89	10.94	1.681	1.505	1.505	0.302	0.279	0.264	17.9	18.6	17.6
PM × NB4D2	94.0 (75.9)	84.9 (67.1)	73.1 (58.8)	16.60	13.70	10.21	1.709	1.614	1.395	0.287	0.268	0.244	16.8	16.6	17.5
PM× CSR8SL	93.2 (75.9)	80.2 (63.7)	72.6 (58.6)	19.78	12.33	10.37	1.964	1.557	1.442	0.355	0.274	0.245	18.1	17.6	176.
NISTARI × CSR2	91.9 (73.5)	85.2 (67.4)	79.8 (63.3)	15.71	13.78	10.98	1.641	1.617	1.376	0.281	0.254	0.215	17.1	15.7	15.6
ISTARI × CSR2(SL)	96.9 (80.2)	88.1 (69.9)	80.9 (64.1)	17.07	13.90	11.54	1.725	1.578	1.427	0.306	0.267	0.237	17.7	16.9	16.6
NISTARI × NB4D2	94.8 (76.9)	87.9 (69.7)	80.3 (63.7)	16.60	14.53	11.36	1.673	1.653	1.414	0.288	0.267	0.234	17.2	16.1	16.5
NISTARI × CSR8SL	95.5 (78.6)	84.1 (66.7)	67.2 (55.1)	19.54	12.33	9.40	1.945	1.505	1.433	0.355	0.266	0.226	18.2	17.7	15.8
BL67 × CSR2	93.5 (75.4)	83.2 (65.8)	76.7 (61.1)	15.82	14.38	13.00	1.804	1.727	1.695	0.361	0.336	0.332	20.0	19.4	19.6
BL67 × CSR2(SL)	94.7 (76.8)	86.9 (68.8)	77.7 (61.8)	16.75	14.04	13.08	1.742	1.684	1.615	0.329	0.309	0.302	18.9	18.3	18.7
BL67 × NB4D2	91.7 (73.3)	85.7 (67.8)	77.2 (61.5)	16.16	14.46	12.55	1.714	1.688	1.627	0.319	0.310	0.300	18.6	18.4	18.5
BL67 × CSR8SL	89.7 (72.4)	73.2 (58.9)	53.1 (46.8)	18.88	11.36	5.92	2.016	1.628	1.682	0.387	0.322	0.289	19.2	19.8	17.2

Table II : (continued .....)

1		2			3			4			5			6	
MY1×CSR2	92.3 (75.6)	76.4 (61.0)	35.0 (36.2)	20.01	11.37	4.13	2.098	1.474	1.561	0.406	0.259	0.285	19.4	17.6	18.3
MY1×CSR2SL	96.0 (79.2)	76.1 (60.8)	40.8 (39.6)	20.39	11.29	4.79	2.066	1.465	1.419	0.385	0.264	0.254	18.7	18.0	17.9
MY1×NB4D2	92.5 (74.7)	82.6 (65.5)	39.6 (38.9)	19.59	12.53	4.64	1.980	1.529	1.600	0.375	0.271	0.285	18.9	17.7	17.8
MY1×CSR8	89.1 (71.1)	85.9 (68.2)	41.4 (40.1)	20.76	12.88	4.79	2.112	1.545	1.542	0.387	0.272	0.272	18.4	17.6	17.7
RD1×NB4D2	91.0 (73.1)	60.2 (50.9)	47.2 (43.4)	16.74	9.05	5.31	1.642	1.499	1.441	0.287	0.269	0.244	17.5	17.9	16.9
RD1×CSR8	89.6 (71.6)	63.9 (53.1)	36.6 (37.2)	16.84	9.66	4.18	1.670	1.546	1.543	0.278	0.261	0.238	16.6	16.9	15.4
PV1×CSR2	94.1 (75.9)	62.6 (52.4)	54.3 (47.5)	17.93	10.46	6.20	1.814	1.726	1.463	0.363	0.322	0.271	20.0	18.7	18.5
PV1×CSR2SL	92.5 (75.5)	67.1 (55.1)	60.1 (50.9)	17.82	10.43	6.83	1.861	1.587	1.440	0.368	0.310	0.263	19.8	19.5	18.3
PV1×NB4D2	95.1 (77.2)	82.9 (65.8)	60.1 (50.8)	16.21	12.27	6.94	1.711	1.469	1.444	0.345	0.276	0.260	20.2	18.8	18.0
PV1×CSR8	95.6 (78.6)	73.4 (59.0)	69.3 (56.5)	17.84	10.75	7.84	1.781	1.453	1.441	0.337	0.276	0.250	18.9	19.0	17.3
CD at 5%	(4.4)	(2.5)	(2.5)	1.35	0.72	0.75	0.105	0.051	0.051	0.028	0.009	0.010	0.67	0.48	0.52
2 - way anova															
Tr A CD at 5%	(0.7)			0.21			0.016			0.004			0.12		
Tr B CD at 5%	(1.9)			0.59			0.046			0.012			0.35		
Env*Br (AxB)															
SE ±	1.18			0.37			0.03			0.007			0.22		
CD at 5%	(3.3)			1.02			0.080			0.020			0.60		

Values in parentheses are angular transformed.

Silkworm rearing : The silkworm rearing was conducted in three replications following the standard method (Krishnaswami, 1978), till second day of fifth instar. Four hundred and fifty larvae were counted and retained after third moult. The bivoltine sex-limited parent with their normal parent and 24 polyvoltine x bivoltine hybrids were subjected to three different temperature treatments *i.e.* 25±1°C (65±5% RH), 31±1°C (50±5% RH) and 36±1°C (85±5% RH). After 48 hrs of fifth instar, 100 larvae were separated from each replication for two different thermal treatments (31±1°C temperature, 50±5% RH, 36±1°C temperature, 85±5% RH). The remaining 250 larvae of each replication served as control at 25±1°C and 65±5% RH. For thermal exposure, the larvae were kept in small plastic trays and reared in SERICATRON (Artificially designed environmental chamber) at 36±1°C and 85±5% RH and other treatment 31±1°C and 50±5% RH, the larvae were continuously reared till spinning . The cocoons were harvested on 7th day and assessment was made on the subsequent day. The survival rate was calculated as the number of live pupae to the number of larvae treated at 25±1°C, 31±1°C and 36±1°C, respectively. The various parameters such as pupation rate, cocoon weight, shell weight and shell percentage were calculated for the batches reared at three different temperatures.

RESULTS AND DISCUSSION

The performance of rearing was estimated under three different temperature schedules of 25±1°C (65±5% RH), 31±1°C (50±5% RH) and 36±1°C (85±5% RH) in two sex-limited cocoon colour CSR2(SL), CSR8(SL) with their normal breeds (CSR2 and NB4D2) , six polyvoltine breeds (PM, Nistari, BL67, MY1, RD1 and PV1) and twenty-four hybrids of *Bombyx mori* L.

Performance of pure breeds : The rearing performance, based on pupation rate, yield/10000 larvae and cocoon characters such as cocoon weight, cocoon shell weight and cocoon shell percentage of three trials was evaluated under three temperature schedules of (25±1°C and 65±5% RH), (31±1°C and 50±5% RH) and (36±1°C and 85±5% RH) are presented in Table I. The perusal of the data clearly indicate that there was no significant difference in pupation rate in the bivoltine breeds whereas significant difference was observed in the polyvoltine breeds at 25±1°C and 65±5% RH. With regard to yield/10000 larvae there was no significant difference in the bivoltine breeds but significant difference was observed in the polyvoltine breeds at 25±1°C and 65±5% RH . The cocoon weight, shell weight and the shell percentage of the bivoltine as well as polyvoltine breeds at 25±1°C & 65±5% RH showed significant difference.

At 31±1°C and 50±5% RH, the performance of all the breeds, both bivoltine and polyvoltine were lower when compared to the normal temperature and humidity conditions. There was significant difference for all the breeds for all the characters. The pupation rate ranged from 26.6 to 83.4% with highest of 83.4% recorded for Nistari and lowest of 26.6% recorded for CSR2. The yield/ 10,000 larvae ranged from 4.5 to 11.17 kg with the highest of 11.7 kg recorded for BL67 and the lowest of 4.50 kg recorded for CSR2. The cocoon weight ranged from 0.998 to 1.696 g with the highest of 1.696 g recorded for CSR2 and the lowest of 0.998 g recorded for pure Mysore. The cocoon shell weight ranged from 0.138 to 0.389 g with the highest of 0.389 g recorded for CSR2 and the lowest of

0.138 g recorded for Nistari. The cocoon shell percentage ranged from 12.3 to 22.9% with the highest of 22.9% recorded for CSR2 and the lowest of 12.3% recorded in RD1.

At 36±1°C and 85±5% RH, the performance of all the breeds was the lowest when compared to other two temperature treatments. There was significant difference for all the breeds for all the characters. The pupation rate ranged from of 15.7 to 66.1% with the highest of 66.1% recorded for Nistari and the lowest of 15.7% recorded in CSR2. The yield/ 10000 larvae ranged from 1.97 to 7.39 kg with the highest of 7.39 kg recorded for BL67 and the lowest of 1.97 kg recorded for CSR2. The cocoon weight ranged from 0.995 to 1.274 g with the highest of 1.274 g recorded for CSR2(SL) and the lowest of 0.955 g recorded for pure Mysore. The cocoon shell weight ranged from 0.129 to 0.243 g with the highest of 0.243 g recorded for CSR2 and the lowest of 0.129 g recorded for RD1. The cocoon shell percentage ranged from 12.8 to 19.9% with the highest of 19.9% recorded for CSR8(SL) and the lowest of 12.8% recorded for RD1.

Performance of Hybrids : The rearing performance of all the hybrids considered for the study are presented in Table II. Perusal of the data clearly indicate that that there was significant difference in all the characters for all the hybrids.

The pupation rate at 25±1°C and 65±5% RH ranged from 89.1 to 96.9% with the highest of 96.9 % was recorded for Nistari × CSR2 and the lowest of 89.1 % was recorded for MY1 x CSR8(SL). The yield/ 10000 larvae ranged from 15.71 to 20.76 kg with the highest of 20.76 kg recorded for MY1 x CSR8 SL and the lowest of 15.71 kg recorded for Nistari x CSR2. The cocoon weight ranged from 1.641 to 2.112 g with the highest of 2.112 g recorded for MY1 x CSR8(SL) and the lowest of 1.641 g recorded for Nistari x CSR2. The cocoon shell weight ranged from 0.278 to 0.407 g with the highest of 0.407 g recorded for MY1 x CSR2 and the lowest of 27.78 g recorded for RD1 x CSR8(SL). The cocoon shell percentage ranged from 17.1 to 20.1% with the highest of 20.1 recorded for BL67 x CSR2 and the lowest of 17.1% recorded for Nistari x CSR2.

The pupation rate at 31±1°C and 50±5% RH, ranged from 60.2 to 88.1 with the highest of 88.1% recorded for Nistari x CSR2SL and the lowest of 60.2% recorded for RD1 x NB4D2. The yield/ 10000 larvae ranged from 9.05 to 14.46 kg with the highest of 14.46 kg recorded for BL67 x NB4D2 and the lowest of 9.05 kg recorded for RD1 x NB4D2. The cocoon weight ranged from 1.474 to 1.727 g with the highest of 1.727 g recorded for BL67 x CSR2 and the lowest off 1.474 g recorded for MY1 x CSR2. The cocoon shell weight ranged from 0.254 to 0.336 g with the highest of 0.336 g recorded for BL67 x CSR2 and the lowest of 0.254 g Nistari x CSR2. The cocoon shell percentage ranged from 15.7 to 19.5% with the highest of 19.5% recorded for BL67 x CSR2 and the lowest of 15.7% recorded for Nistari x CSR2.

The pupation rate at 36±1°C and 85± 5% RH ranged from 31.7 to 80.9% with the highest 80.9% recorded for Nistari x CSR2 and the lowest of 31.7% recorded for RD1 x CSR2. The yield/ 10000 larvae ranged from 3.46 to 13.08 kg with the highest of 13.08 kg recorded for BL67 x CSR2(SL) and the lowest of 3.46 kg recorded for RD1 x CSR2. The cocoon weight ranged from 1.376 to 1.682 g with the highest of 1.682 g recorded for BL67 x CSR8(SL) and the lowest of 1.376 g recorded for Nistari × CSR2. The cocoon shell weight ranged from 0.215 to 0.332 g with the highest of 0.332 g recorded for BL67 x CSR2 and the lowest of 0.215 g recorded Nistari x CSR2. The cocoon shell percentage ranged from 15.6 to 19.6% with the highest of 19.6% recorded for BL67 x CSR2 and the lowest of 15.6% recorded for Nistari x CSR2.

Like the pure breeds the interaction of different rearing parameters with different temperature treatments for the hybrids were also calculated by employing ANOVA. The data clearly indicate that the interaction of pupation rate, yield/10000 larvae, cocoon weight, cocoon shell weight and cocoon shell percentage with the different temperature treatments are highly significant.

In the life cycle of silkworm, environmental factors especially temperature and relative humidity play an important role. The sericultural country like India, indigenous races are well adapted to the fluctuating climatic conditions characterized by high temperature, but they are very poor in productivity, Keeping in view, efforts over a decade to improve the quality of raw silk has resulted in the development of many productive and qualitatively superior breeds (Basavaraja *et al.*, 1995). One of the main aims of the breeders is to recommend to the farmers breeds that are stable under different environment conditions. The silkworm breeds reared over a series of environments exhibiting less variation are considered more stable. It was observed in this study that the performance of hybrids was better than the pure races and is in concurrence with earlier works of Kato *et al.* (1989) and Suresh Kumar *et al.* (1999).

Hybridization coupled with selection has been exploited as an important tool by many silkworm breeders for the improvement of silkworm for their maximum gain. Whatever may be the hybrid vigour shown by the hybrids, it may not give anticipated yield and cocoon characters in adverse environmental conditions. The results of the present study indicated the deleterious effect of high temperature on the rearing performance and the cocoon parameters of all the pure races and hybrids and corroborates the earlier works of Suresh Kumar *et al.* (2003). It was suggested that the any study involving temperature as one of the environmental factors affecting viability followed by cocoon traits is a trend setter to provide basis to formulate appropriate selection policies for required environments. It was also recorded that when both the parental strains and the hybrids are raised in unfavorable conditions, performance of the hybrids will be superior to both the parental strains (Nagaraju *et al.*, 1996).The main objective of the study was to evaluate the performance of sex-limited cocoon colour breeds under fluctuating temperature conditions in comparison with the normal breeds CSR2 and NB4D2 witch are in use as male component with the polyvoltine breeds particularly Pure Mysore and Nistari .

The results of this study indicate that the performance of sex-limited cocoon colour bivoltine breed CSR2(SL) was marginally better than the normal bivoltine breed, CSR2. This study also indicates that hybrids of sex-limited breed CSR2(SL) with all polyvoltine breeds performed better than other breeds at adverse conditions. Therefore, it is concluded that sex-limited cocoon colour breed CSR2(SL) can be used as male component throughout the year.

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