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Impact of High Temperature (36+1ºC) and Low Humidity (35+5%) on Overall Performance of *Bombyx mori* L.

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Abstract: ***The impact of 36+1ºC temperature with 35+5% humidity on rearing, breeding and economic traits of Bombyx mori L. was observed during present research work for each parameter of each breed under study. On the basis of average EI of all parameters it became evident that four breed showed good suitability during 36+1ºC temperature with 35+5% humidity because their average EI remained more than 50. Among all breeds evaluated during above stated climatic conditions SK6 (57.46), SH6 (57.27), SK1 (56.16) and CSR4 (52.31) acquired 1st, 2nd, 3rd and 4th rank respectively, on the basis of average EI. Thus, it became evident that 36+1ºC temperature with 35+5% humidity remain better for these breeds as compared to other breeds of Bombyx mori L. undertaken during present study. It was observed that SK6 breed shows good results during said climatic condition because this breed acquired 1st rank on the basis of average results of all parameters, evaluated during present research work. On the basis of average EI, it can be said that 36+1ºC temperature with 35+5% humidity not remain suitable for rearing of most of the bivoltine breeds of Bombyx mori L. Thus, it became evident from overall evaluation that SK6 breed can tolerate high temperature with low humidity as well as three other breeds such as SH6, SK1 and CSR4 also shows tolerance upto some extent. So, bivoltine breeds of mulberry silkworm such as SK6, SH6, SK1 and CSR4 can be reared even at extremes of temperature and humidity conditions.***

Keywords: High temperature, Low humidity, Overall performance, Bombyx mori L

1. Introduction

Selection of a suitable strain of *Bombyx mori* adaptable to specific regional environmental conditions such as humidity and temperature is must for successful sericulture. Virk *et al*. (2011) and Ramesha *et al*. (2012) also conducted studies for selection of suitable breed of mulberry silkworm and observed that in different geographical locations, the ecological factors differently affect the physiological, biochemical and quantitative characters of silkworm. These factors finally affect the growth and development of silkworm as well as quality and quantity of silk produced. Rajan and Himantharaj (2005) stated that selection of suitable mulberry variety and suitable silkworm strains are necessary for successful sericulture.

2. Materials and Method

Twelve biovoltine breeds of mulberry silkworm were reared in randomized block design, under high temperature (36+1ºC) and low humidity (35+5%). This experiment was conducted in controlled laboratory conditions. Different rearing, breeding and economic traits of each breed were observed and recorded. Observed data were analysed.

3. Result and Discussion

The data observed regarding rearing and breeding parameters such as fecundity (average number), hatching percentage, larval duration, as well as weight of single larva and pupa of 12 breeds of *Bombyx mori* L. under high temperature (36+1ºC) and low relative humidity (35+5%) conditions is presented in Table - 1. It became evident after analysis of data mentioned in this table that maximum value for fecundity was observed for CSR breed as 521 followed by CSR 4 (513), SK 6 (491), SK 28 (471) and other breeds undertaken during present study. Minimum fecundity was observed for NB4D 2 as 395. But maximum hatching percentage was observed for this breed of *Bombyx mori* L. as 85.20%. Hatching percentage above mean value (78.68%) was observed for CSR 4, CSR 18, CSR 19, SK 1, SK 6, SH 6 and NB4D 2 breeds. Other breeds of *Bombyx mori* L. undertaken during present study showed hatching percentage below mean value. Maximum larval duration was observed for SK 1 breed as 27 days 1 hrs and minimum as 25 days 5 hours for SK 28 and NB4D2 breeds when reared under high temperature and low humidity conditions. Maximum larval weight was observed as 4.21 gm for SK 6 breed followed by SK 31 (4.18gm), NB4D2 (4.18gm) and other breeds undertaken during this study. Minimum larval weight was observed for DUN22 breed as 3.75 gm. Maximum weight of pupa was observed for SK 1 as 1.61gm and minimum for CSR 18 as 1.31 gm (Table - 1).

Values calculated for evaluation index for rearing and breeding parameters of 12 breeds of *Bombyx mori* L. under high temperature and low humidity conditions was present in Table - 2. EI regarding fecundity remained more than 50 for CSR 2 (67.19), CSR 4 (65.25), SK 1 (64.04) and SK 6 (59.92). Highest EI value for fecundity remained as 67.19 (CSR2). EI value remained more than 50 with respect of hatching of CSR4 (50.01), CSR 18 (56.75), CSR 19 (56.32), SK 1 (62.30), SK 6 (56.79), SH 6 (62.25) and NB4D2 (81.20). Thus higher EI value regarding hatching remained as 81.20 for NB4D2 breed. EI for larval duration remained 50 or more than 50 with respect of CSR2, SK1, SK6, SK31, SH6, DUN6 and DUN22 breeds. Highest EI value for larval duration was observed for SH6 breed as 64.55. EI value regarding larval weight remained more than 50 for CSR2,

CSR4, CSR18, SK1, SK6, SK28, SK31 and NB4D2 breeds. Highest EI value for larval weight was showed by SK6 (54.32). EI value for weight of pupa remained 50 or more than 50 for SK1, SK6, SK28, SK31, SH6 and NB4D2 breeds.

Table 1: Rearing and breeding performance of 12 breeds of *Bombyx mori* L. under high temperature (36+1ºC) and low humidity (35+5%)

Sl. No.	Mulberry Silkworm Breeds	Fecundity (Average Number)	Hatching Percentage	Larval Duration (d: h)	Larval Weight (gm)	Pupa Weight (gm)
1	CSR 2	521	75.60	26: 8	4.11	1.33
2	csr 4	513	79.10	25: 6	4.08	1.35
3	csr 18	448	80.09	25: 9	4.15	1.31
4	csr 19	419	80.00	26: 0	3.85	1.32
5	sk 1	508	81.25	27: 1	4.10	1.61
6	sk 6	491	80.10	26: 2	4.21	1.60
7	sk 28	472	78.25	25: 5	4.13	1.43
8	sk 31	410	74.13	26: 1	4.18	1.51
9	sh 6	412	81.24	27: 0	3.95	1.45
10	DUN 6	402	76.11	26: 3	3.90	1.42
11	DUN 22	412	73.07	26: 5	3.75	1.39
12	NB4D2	395	85.20	25: 5	4.18	1.46
	Mean	450	78.68	26: 1	4.05	1.43
	SD	41.31	2.09	0.66	0.37	0.09
1	CSR 2	67.19	35.26	54.24	51.62	38.88
2	csr 4	65.25	50.01	37.88	50.81	41.11
3	csr 18	49.52	56.75	39.85	52.70	36.67
4	csr 19	42.50	56.32	49.40	44.59	37.78
5	sk 1	64.04	62.30	65.15	51.35	70.00
6	sk 6	59.92	56.79	50.61	54.32	68.89
7	sk 28	55.33	47.94	37.27	52.16	50.00
8	sk 31	40.32	28.23	50.00	53.51	58.89
9	sh 6	40.80	62.25	64.55	47.30	52.22
10	DUN 6	38.80	37.70	51.21	45.95	48.89
11	DUN 22	40.80	23.15	52.42	41.89	45.56
12	NB4D2	36.69	81.20	37.27	53.51	53.33

Table 3: Performance of Economic traits of 12 breeds of *Bombyx mori* L. under high temperature (36+1ºC) and low humidity (35+5%)

Sl. No.	Mulberry Silkworm Breeds	Cocoon Weight (gm)	Shell Weight (gm)	Shell Ratio (%)	Silk Filament Length (mtr.)
1	CSR 2	1.31	0.24	18.32	920.15
2	CSR 4	1.42	0.27	19.01	865.28
3	CSR 18	1.31	0.24	18.32	825.84
4	CSR 19	1.30	0.25	19.23	880.15
5	SK 1	1.27	0.26	20.47	742.12
6	SK 6	1.45	0.30	20.69	721.84
7	SK 28	1.29	0.27	20.93	628.50
8	SK 31	1.27	0.22	17.32	675.33
9	SH 6	1.55	0.32	20.65	691.25
10	DUN 6	1.36	0.32	23.53	711.28
11	DUN 22	1.35	0.31	22.96	721.42
12	NB4D2	1.30	0.25	19.23	714.15
	Mean	1.35	0.27	20.06	758.10
	SD	0.07	0.02	1.05	41.65

Table 4: Values of Evaluation Index (EI) for Economic traits of 12 breeds of *Bombyx mori* L. under high temperature (36+1ºC) and low humidity (35+5%)

Sl. No.	Mulberry Silkworm Breeds	Cocoon Weight	Shell Weight	Shell Ratio	Silk Filament Length	Average EI of all parameters studied under 36+1ºC temp. & 35+5% humidity	Rank
1	CSR 2	44.29	35.00	32.43	88.91	49.76	V
2	CSR 4	60.00	50.00	40.00	75.73	52.31	IV
3	CSR 18	44.29	35.00	32.43	66.26	45.94	X
4	CSR 19	42.86	40.00	42.10	79.30	48.32	VIII
5	SK 1	38.57	45.00	53.90	46.16	56.16	III
6	SK 6	64.29	65.00	56.00	41.29	57.46	I
7	SK 28	41.43	50.00	58.29	18.18	45.62	XI
8	SK 31	38.57	25.00	23.90	30.13	38.73	XII
9	SH 6	78.77	75.00	60.50	33.95	57.24	II

10	DUN 6	51.43	75.00	55.62	38.76	49.26	VI
11	DUN 22	50.00	70.00	77.62	41.19	49.18	VII
12	NB4D2	42.86	40.00	42.10	39.45	47.38	IX

Data related to performance of economic traits such as cocoon weight, shell weight, shell ratio and silk filament length of 12 breeds of *Bombyx mori* L. under high temperature and low humidity conditions is presented in Table - 3. The cocoon weight remained maximum as 1.55 gm for SH6 and minimum as 1.27 gm for SK1 and SK31 breeds, when reared under 36+1ºC temperature and 35+5% humidity level. The value for this parameter remained above the mean value (1.35) for CSR4, SK6, SH6 and DUN6 breeds. Weight of the single shell remained maximum as 0.32 gm for SH6 and DUN6 breeds whereas minimum as 0.22 gm for SK31 breed. Maximum shell ratio was recorded as 23.53 for DUN6 followed by DUN22 (22.96) and other breeds under study. Minimum shell ratio was observed as 17.32 for SK 31 breed. Maximum length of silk filament was recorded as 920.15 mts for CSR2 followed by CSR 19 (880.15 mtrs), CSR 4 (865.28 mtrs), CSR 18 (825.84 mtrs) and other breeds of *Bombyx mori* L. undertaken during present study. The silk filament length was observed more than mean (758.10 mtrs) for CSR2, CSR4, CSR18 and CSR19 breeds. Minimum length of silk filament was observed for SK28 breed as 628.50 meters.

Values of evaluation index calculated for economic traits such as weight of cocoon and shell as well as shell ratio and silk filament length of 12 breeds of *Bombyx mori* L. reared under high temperature (36+1ºC) and low humidity (35+5ºC) are presented in Table - 4. It became evident from the data mentioned in this table that highest EI remained as 78.57 for SH6 and minimum as 38.57 for SK1 and SK31 breeds. The EI value as 50 or more than 50 was observed for CSR4 (60.00), SK6 (64.29), SH6 (78.57), DUN6 (51.43) and DUN22 (50.00). EI for shell weight remained highest for SH6 and DUN6 breeds as 75.00 and minimum as 25.00 for SK31 breed. The EI for shell weight remained as 50 or more than 50 for CSR4, SK6, SK28, SH6, DUN6 and DUN22 breeds. EI value remained highest as 77.62 for DUN22 breed with regard to shell ratio and lowest as 23.90 for SK 31 breed. The EI for shell ratio remained more than 50 for SK1, SK6, SK28, SH6, DUN6 and DUN22 breeds. EI with regard to silk filament length was observed above 50 for CSR2 (88.91), CSR 19 (79.30), CSR4 (75.73) and CSR 18 (66.26). The EI with regard to silk filament length remained below 50 for SK1, SK6, SK28, SK31, SH6, DUN6, DUN22 and NB4D2 breeds.

Venugopala and Krishnaswami (1987) observed the impact of high temperature during later stages of the growth of mulberry silkworm and stated that adaptability of *Bombyx mori* remain dependent on different climatic conditions of tropical environment. Joan *et al*. (2022) evaluated the performance of *Bombyx mori* under controlled environmental conditions and observed that larval duration remained highest during the wet season. Gong *et al*. (2020) stated that changing environmental conditions can affect the development of silkworm. Rahmathulla (2012) stated that regulation of environmental conditions of rearing can improve silkworm crop.

Nalabadi *et. al* (2015) observed impact of high temperature (36+1ºC) on weight of larva, cocoon and shell in 20 breeds of *Bombyx mori* L. They observed differential impact of high temperature on different breeds. They observed low pupation rate of CSR 2 breed in high temperature condition; but highest weight of Cocoon. During present study highest silk filamental length was observed for CSR 2 (Table - 3). They also observed high weight of cocoon and shell for CSR 17 breed. They pointed out that heat stress affects DNA and RNA alongwith protein synthesis adversely in most of the breeds examined by them. Kumar *et. al*. (2002) also pointed out that temperature above 25ºC shows decline in rearing parameters. The results of present study also corresponds with the results obtained by Kumar *et. al*. (2002). Thus it became clear that this silkworm remain very sensitive to fluctuations in environmental conditions.

4. Conclusion

In conclusion, this study reinforces the importance of selecting appropriate strains of bombyx mori for successful sericulture, especially under varying environmental conditions such as high temperature and low humidity. The findings reveal significant differences in rearing and breeding performance among the 12 breeds tested, emphasizing the adaptability of certain strains like csr 2 and sh 6. These results highlight the need for careful consideration of local climatic conditions when choosing silkworm breeds, as environmental factors play a crucial role in determining both the quality and quantity of silk produced.

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