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Evaluation of some promising strains of Eri Silkworm, *Samia ricini* in climatic condition of Vidarbha Region of Maharashtra

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Abstract

The evaluation of 4 promising strains of eri silkworm viz Greenish Blue Zebra (GBZ), Yellow Zebra (YZ), Yellow Plain (YP) and Greenish Blue Plain (GBP) was done under the climactic condition of Vidarbha region of Maharashtra. The origin of eri silkworm is in the climatic conditions of North East Region of India. The Climatic condition of Vidarbha region of Maharashtra is different from the source of origin of eri silkworm. These eri silkworm strains are quite different from each other both in morphology (colour polymorphism) and genetic traits. The evaluation was done considering various parameters *i. e.* Cocoon weight, shell weight, shell ratio, larval duration, ERR %, fecundity and life cycle duration. The Greenish Blue Zebra (GBZ) and Yellow Zebra (YZ) show better performance in the all economic characters, fecundity and better adaptability than Yellow Plain (YP) and Greenish Blue Plain (GBP) in the climatic condition of Vidarbha region of Maharashtra.

Key words : Eri silkworm, *Ricinus communis*

Eri-culture is practised by the tribals and other weaker society in North-Eastern India. Recently the eri-culture has spread to other states like Karnataka, Gujarat, Tamil Nadu, Andhra Pradesh, Uttar Pradesh, Bihar and Rajasthan. Eri silkworm is polyphagus and feeds on a wide range of food plants. Castor (*Ricinus communis*) is the primary food plant of eri silkworm. In India the production of eri raw silk has reached to 2645 metric tonnes[5] in 2010-2011. There are total 19 species of Eri (genus=*Samia*) all over the world of which only

three species are reported from India and out of which two from NE region. These are *Samia canningi* which is a wild species and *Samia ricini*, a totally domesticated species[3]. The structure of the genitalia, wing pattern and chromosome number demonstrates that *Samia ricini* (Danovan) is derived from its wild form *Samia canningi* (Hutton). Seven eco-races of eri silkworm (*Samia ricini*) were collected from different locations of North East India. The Ecoraces are *Borduar, Titabar, Khanapara, Nongpoh, Mendipathar, Dhanubhanga, Sille, and Kokrajhar.* These races were evaluated during 1995-97[8]. Sarmah *et al.*,[5] studied the diversity of eri silkworm eco-races and their utilization for sustainable development in north east India. Six pure line strains of eri silkworm were isolated from Borduar and Titabor eco-races. These are yellow plain (YP) yellow spotted (YS), yellow zebra (YZ), greenish blue plain (GBP) greenish blue spotted (GBS) and greenish blue zebra (GBZ). Phenotypic diversity and characterization of different six strains of eri silk worm may be useful for selection of breeding components for developing high silk productive breeds of silk worm. Singh *et al.*,[9] carried out study on morphological characters of eco races and six strains of eri silk worm and find out their rearing performance. They had recorded Yellow Zebra as the best strain in terms of rearing performance. This strain can be reared in bulk. Although, several workers attempted evaluation of best eri silkworm strains under different climatic conditions in India, no works have so far been done in this line under climatic condition of Vidarbha Region of Maharashtra. Therefore, in this context of study attempt has been made to evaluate the best strain of eri silkworm under climatic condition of this region for future establishment of eri culture.

Maharashtra is one of the Non-traditional state for Sericulture due to other cash crops like cotton, Sugarcane, grapes, soybean, onion etc. Recently the sericulture is gaining importance in the state. The state has 6700 acres of mulberry plantation with production of 570 Metric tones of cocoons. Besides mulberry sericulture Vidarbha region of Maharashtra is also well known for tasar cocoon production. The annual production of tasar raw silk in the state is 9 Metric tones. In Maharashtra the castor (*Ricinus communis*) which is the primary host plant of eri silkworm is cultivated in an area of about 39700 acres[1]. The crop is cultivated as an intercrop with ginger and turmeric and also for seed oil purpose. The income get from the castor seed is very low as compared to other cash crops. Therefore, in order to provide additional income from castor crop, farmers must have to adopt eri silkworm rearing on castor leaves. The present study was carried out to evaluate the suitability of the climatic condition and rearing performance of some promising strains of eri silkworm in Vidarbha region of Maharashtra for commercial exploitation of eri silkworm as composite farming with castor seed production.

The rearing of 4 strains (Fig. 1) of eri silkworm *i.e.* Greenish Blue Zebra (GBZ), Yellow Zebra (YZ), Greenish Blue Plain (GBP), Yellow Plain (YP) was carried out during October-November 2013 at Karanja (Gh.) tahsil, District Wardha of Vidarbha region of Maharashtra. The eggs of eri silkworm were obtained from Regional Eri Research Station (Central Silk Board), Mendipathar (Meghalaya). Collected eggs were incubated

separately at room temperature. The hatched eri silkworm larvae about 200 larvae from each strain were maintained and, reared separately in plastic trays covered with paraffin paper. The rearing was carried out as per the practices suggested earlier by Sarkar[4], Patil and Savanurmath[2]. First instar larvae of eri silkworm were given equal amount of tender castor leaves twice in a day, and then thrice a day up to II and III instar. Castor leaves were collected from the same cultivated plot. The IV and V instar larvae given equal feeding with mature castor leaves four times a day. Different parameters of complete life cycle were studied covering from hatching of eggs, larval rearing, cocoon spinning, emergence of moth from cocoon, mating of moths to egg laying. The temperature and relative humidity and other parameters viz larval weight, larval duration, ERR%, cocoon weight, pupa weight, shell weight, shell ratio, mortality, moth weight and size, fecundity and hatching were recorded.

During rearing in months of October – November 2013, slight fluctuation in temperature was recorded throughout the period. The average minimum and average maximum temperature ranges from 24ºC to 29ºC throughout entire rearing period (Table-1). Similarly in case of relative humidity also a narrow range of fluctuation *i. e.* 83% - 91% was recorded (Table-1). The results of the rearing show prominent variation in the body weight of larvae among these 4 different strains. The highest larval weight was recorded in Greenish Blue Zebra (7.339 g) and Yellow Zebra (7.253 g) followed by 6.688g in Yellow Plain and 6.665g in Greenish Blue Plain (Table 2). Thus, higher growth was found in GBZ and YZ whereas slower growth was recorded in YP and GBP. Singh *et al.*,[10] also reported higher larval weight in Yellow Zebra (YZ) and Greenish Blue Zebra (GBZ) when reared on castor food plants during November-December under north India climatic condition. Priyanki Sarmah and Jogesh Chandra Kalita[6] also reported highest larval body weight in YZ under climatic condition of Assam. Regarding larval period, no significant difference was found among the 4 strains. The larval period was 18 days 2 hr. in GBZ followed by 18 days 3 hr. in YZ and similar 18 day 6hr. was recorded in YP and GBP which are normal in prevailing climatic conditions.

It was found that much variation exists in economic characters such as cocoon weight, shell weight and shell ratio among these 4 strains. The highest cocoon weight (2.803g) was recorded in GBZ with shell weight (0.380g) and shell ratio (13.55 %) followed by YZ with cocoon wt(2.730 g), shell wt (0.376 g) and shell ratio (13.77%) while least was recorded in YP with cocoon wt (2.402g), shell wt (0.320g) and shell ratio (13.32%) and, in GBP with cocoon wt (2.356 g), shell wt (0.316g) and shell ratio (13.41 %). Thus, all the economic characters that are concern in commercial rearing have been found higher in GBZ and YZ than YP and GBP. Singh *et al.*, [10] also reported higher cocoon weight and shell weight in GBZ and YZ when reared on different host plant. Priyanki Sarmah and Jogesh Chandra Kalita[6] in their study reported similar type of results.

In pupal duration, these strains exhibited much variation. About 10 hour's difference

Yellow Zebra (YZ)

Greenish Zebra (GBZ)

Yellow Plain (YP)

Greenish Blue Plain (GBP)

Fig. 1. Strains of eri silkworm, *Samia ricini*

exist between GBZ and GBP strain. The minimum length of pupal period (11day 8hr.) and (11day 10 hr.) was recorded in GBZ and YP strain respectively. While maximum (11day16hr) and (11day18hr) was recorded in YP and GBP strain respectively. Differences in this metamorphosis activity clearly indicate that these strains are also different at least to some extent in genetic traits.

Minimum larval mortality (1.0%) was recorded in YZ strain. While maximum mortality (3.0%) was recorded in YP strain. Minimum mortality in YZ and GBZ strains indicates more sustainability. Thus, these eri silkworm strains are of differentially susceptible to environmental disease infection. Yellow Plain strain show comparatively higher susceptibility to disease infection during rearing whereas YZ is more resistant to disease infection.

Comparative cocoon production and lower mortality rate had been found in YZ that gave maximum 99% ERR followed by GBZ (98.50%). Lower ERR were found in GBP (97.05%) and YP (97.0%). Thus, YZ strain has been found more promising among all eri strains studied.

The highest body weight of male moth ♂(0.754 g) and female ♀ (1.627g) was recorded in GBZ strain with higher wing expansion of 11.2 cm (♂) & 10.6cm (♀) and, body size (♂ 2.6 cm & ♀ 3.1 cm), while least were recorded in GBP strain with moth wt (♂0.570g & ♀1.287g), wing expansion (♂10.9 cm & ♀10.4cm) and body size (♂2.5cm & ♀3.0cm).

The maximum number of egg laying (384) with highest percentage of hatching (91.4%) was recorded in YZ strain. On

Table-1. Temperature and Relative Humidity maintained & recorded during rearing of 4 strains of eri silkworm, *Samia ricini* in early winter (October-November 2013)

Stage	Temperature ºC		Humidity (%)	
	Average Min	Average Max	Average Min	Average Max
I Instar	24 ºC	27 ºC	90%	91%
II Instar	26 ºC	27 ºC	91%	91%
III Instar	28 ºC	28 ºC	91%	91%
IV Instar	28 ºC	28 ºC	88%	88%
V Instar	28 ºC	29 ºC	88%	88%
Spinning-Moth Emergence	28 ºC	29 ºC	83%	83%

Table-2. Rearing performance of 4 strains of eri silkworm, *Samia ricini* during rearing in early winter (October-November 2013)

Sr. No	Parameters		Eri Silkworm Strains			
			GBZ (Greenish Blue Zebra)	YZ (Yellow Zebra)	YP (Yellow Plain)	GBP (Greenish Blue Plain)
1.	Larval weight (g)		7.339 ±0.07	7.253 ± 0.07	6.688 ±0.044	6.665 ± 0.120
2.	Larval duration(days.hrs)		18.02	18.03	18.06	18.06
3.	Cocoon weight (g)		2.803 ±0.03	2.730 ±0.01	2.402 ±0.02	2.356 ±0.03
4.	Shell weight (g)		0.380 ±0.00	0.376 ±0.00	0.320 ±0.00	0.316 ±0.00
5.	Shell ratio (%)		13.55 ±0.23	13.77 ±0.26	13.32 ±0.26	13.41 ±0.34
6.	Pupa weight (g)		2.423 ±0.035	2.354 ±0.020	2.082 ±0.027	2.040 ±0.027
7.	Pupal period (days.hrs)		11.08	11.10	11.16	11.18
8.	Larval mortality (%)		1.5%	1.0%	3.0%	2.5%
9.	ERR%		98.50%	99.00%	97.00%	97.05
10.	Moth weight	♂	0.754 ±0.044	0.680 ±0.042	0.577 ±0.009	0.570 ±0.016
		♀	1.627 ±0.062	1.516 ±0.016	1.334 ±0.016	1.287 ±0.021
11.	Moth wing expansion	♂	11.2 ±0.045	11.1 ±0.032	10.9 ±0.044	10.9 ±0.081
		♀	10.6 ±0.049	10.5± 0.063	10.4 ±0.039	10.4 ±0.057
12.	Moth body length	♂	2.6 ±0.024	2.6 ±0.023	2.5 ±0.013	2.5 ±0.016
		♀	3.1 ±0.013	3.1 ±0.013	3.0 ±0.013	3.0 ±0.015
13.	No. egg laying		369 ±3.03	384 ±3.50	362 ±2.11	311 ±4.43
14.	Hatching %		91.4 ±0.86	92.2 ±0.75	92.80 ±0.56	89.80 ±0.61
15.	Life cycle duration (days.hrs)		40.04	40.06	40.16	40.18

11. ± Standard error

contrary, minimum egg laying (311) with lowest hatching percentage (89.80%) was recorded in GBP strain.

In the life cycle duration also these eri strains show variation among them. The minimum life cycle duration *i. e.* 40 days 04hrs was recorded in GBZ followed by YZ (40 days06.hrs) and maximum (40 days16hrs) and (40 days18hrs.) in YP and GBP respectively.

Previous studies by a good number of researchers revealed conspicuous differences in different parameters among the eri strains under respective climatic conditions. This study also clearly establish the facts that these eri strains are of different in most of the characteristic as they exhibit under climatic condition of Vidarbha Region of Maharashtra. Molecular study by using Randomly Amplified Polymorphic DNA (RAPD) marker conducted by Shivashankar *et. al*[7] and, on protein profile by sodium dodecyl sulfate polyacrylamide gel electrophoresis (SDS-PAGE) by Singh *et. al*.[9] reported differences in DNA and Protein Profiles among the eri strains. It is thus confirmed from this study that GBZ and YZ strains are better perform in all important economic characters under the climatic condition of Vidarbha region of Maharashtra and can be established for commercial exploitation for the interest of castor cultivating farmers of the region. Singh *et al.,*[10] also reported better performances of GBZ, YZ strains as compared to other strains.

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