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Genetic variability studies in Eri silkworm (*Samia ricini* Donovan) of North Eastern Region of India

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Abstract

Three eri silkworm breeds namely SRI-001, SRI-010 and SRI-024 have been identified as the most promising for the agro climatic conditions of North Eastern region of India. Breed SRI-010 showed the highest cocoon yield (20.88 kg) followed by SRI-024 (20.01kg) and SRI-001 (18.82 kg). Cocoon yield is positively is correlated with larval period (0.201), effective rate of rearing (0.302) and fecundity (0.668) and negatively correlated with cocoon weight (–0.061), cocoon shell weight (–0.002). Genotypic co-efficient of variation (GCV) and Phenotypic co-efficient of variation (PCV) showed closeness for the characters like ERR, cocoon yield and hatching indicated minimal influence on the expression of these traits. High heritability coupled with high genetic advance (GA) percent mean and high GCV in traits shown in cocoon yield, hatching percentage and pupal weight.

Key words: Genetic variability, screening, eri silkworm, *Samia ricini*, north-eastern region

Introduction

Samia ricini (Donovan) locally known as Eri silkworm is a domesticated multivoltine species evolved from the wild eri silkworm, *Samia canningi* (Hutton), found in natural habitat in North Eastern region of India [1]. Eri silkworms revealed wide variation in morphological characters such as colour of larvae, colour of cocoons, cocoon yield and its economic traits [2, 3]. The genetic variation among genotypes and the relation between major yield contributing traits are of vital importance in the breeding programme that aim to produce improved genotypes [4]. The biotic and abiotic factors of the environment during different crop seasons influence growth and development of the silkworms. Although fairly good number of reports are available in eri silkworm [6-8], information on genetic variability on eri silkworm breeds from north-eastern region of India are scanty.

The present study was undertaken to estimate the genetic variability of eri silkworm breeds and their performance on economic traits in different seasons to identify the promising breeds for commercial exploitation and future breeding programme.

Materials and methods

Twelve eri silkworm breeds *viz*., SRI-001, SRI-002, SRI-005, SRI-010, SRI-011, SRI-012, SRI-014, SRI-015, SRI-016, SRI-019, SRI-022 and SRI-024 were taken from eri silkworm germplasm bank of Central Muga Eri Research and Training Institute (CMER&TI), Lahdoigarh, Jorhat, Assam, India for the study. Eight trials were conducted over a period of two years. Three replications of 300 larvae of each breed were reared in completely randomized design (CRD) following standard rearing techniques. Observation was recorded on larval period (days), larval weight (g), cocoon weight (g), pupal weight (g), shell weight (g), effective rate of rearing (ERR) (%), cocoon yield/10000 larvae (kg), fecundity (nos.) and hatching (%) of egg. Mean data were analyzed by employing the statistical model [9]. Analysis of mean data was done for genetical parameters viz., phenotypic and genotypic co-efficient of variation, broad sense heritability and genetic advance following standard statistical procedures.

Results and discussion

Eri silkworm breeds showed wide variation in larval duration (22.25-23.75 days), larval weight (6.44-7.91g) and pupal weight (2-2.57g), cocoon weight (2.32-3.77g), shell weight (0.32-0.4 g), cocoon yield (14.89-20.88 kg), fecundity (297.84 to 342.25) and hatching of egg (67.84-75.49 %) (Table 1). Amongst the breeds, SRI-010 showed the highest cocoon yield (20.88 kg) followed by SRI-024 (20.01 kg) and SRI-001 (18.82 kg). Breed SRI-010 revealed maximum fecundity (343.25 nos.), hatching of eggs (77.67%) and larval weight (7.91 g).

Table1. Mean performance of growth and economic traits of eri silkworm breeds

Silkworm breed	Larval period (day)	Larval weight (g)	Cocoon weight (g)	Pupa weight (g)	Shell weight (g)	ERR (%)	Cocoon yield	Fecundity (no)	Hatching (%)
SRI-001	22.50	7.52	3.77	2.46	0.37	75.84	18.82	338.58	77.67
SRI-002	22.25	7.19	2.66	2.30	0.36	72.75	15.73	325.83	75.42
SRI-005	23.50	7.08	2.81	2.44	0.35	71.67	18.02	328.08	70.58
SRI-010	22.75	7.91	2.88	2.50	0.39	76.17	20.88	343.25	77.67
SRI-011	23.75	6.69	2.51	2.18	0.33	67.75	18.72	319.33	67.92
SRI-012	23.25	6.44	2.37	2.04	0.33	67.00	16.74	296.59	68.17
SRI-014	23.00	6.83	2.68	2.31	0.37	67.50	14.89	325.25	72.00
SRI-015	23.00	6.46	2.50	2.17	0.33	69.25	16.3	321.75	69.08
SRI-016	23.25	6.44	2.32	2.00	0.32	67.08	17.94	297.84	67.84
SRI-019	23.50	6.67	2.58	2.24	0.34	67.75	15.7	320.33	74.00
SRI-022	23.75	6.53	2.47	2.15	0.32	67.00	18.06	304.59	66.92
SRI-024	22.50	7.79	2.97	2.57	0.4	69.17	20.01	342.25	75.49
Mean	23.08	6.96	2.63	2.28	0.35	69.98	17.65	319.53	71.59
S.Ed±	0.12	0.17	18.19	11.57	0.01	1.44	0.91	7.64	1.55
CD-5%	0.23	0.33	36.13	23.00	0.02	2.87	1.80	15.19	3.03
MSS	79.77	1.46	493.20	194.80	0.00	95.40	28.35	1624.24	244.49
F	3828.77**	34.48**	0.99 NS	0.97NS	21.83**	30.46**	22.99**	18.50**	67.71**
Erro	0.02	0.04	497.77	201.25	0.00	3.13	1.25	87.82	3.16

Like wise, breed SRI-001 showed the highest cocoon weight (3.77g) followed by breed SRI-024 (2.97g). Breed SRI-024 revealed the highest shell weight (0.4g) followed by breed SRI-010 (0.39 g). Analysis of the growth and economic traits of cocoon revealed breed SRI-010 as the most promising among the breeds which can be utilized for commercial exploitation and for breeding programme.

The coefficient of variability, heritability and genetic advance as percentage of mean for various quality traits are presented in Table 2. In the present study, high GCV was observed for cocoon yield, (16.781) followed by hatching of eggs (12.494) and pupal weight (10.95). Moderate to high variability observed for the traits such as cocoon weight (10.6), shell weight (9.62) and larval weight (9.86) indicated better scope for genetic improvement in these characters. The closeness between GCV and PCV for the characters like ERR, cocoon yield and hatching indicated minimal influence of the environment on the expression of these characters. Apart from showing high to moderate GCV, the traits such as cocoon yield (95.7%), hatching (95.6%), larval weight(92.2%), cocoon weight (92.4%), ERR (91.1%) and pupal weight (90.07%) exhibited high heritability. The genetic advance as percent of mean was high for cocoon yield (33.81), hatching (25.17) and pupal weight (21.51)

Table 2. Genetic parameters for growth and economic traits of eri silkworm breeds

Characters	Range	PCV (%)	GCV (%)	Herita-bility (%)	GA as %mean
LW (g)	5.84-8.96	10.26	9.86	92.2	19.49
CW (g)	1.96-3.14	11.03	10.6	92.4	20.93
PW(g)	5.82-8.96	11.50	10.95	90.7	21.51
SW(g)	0.29-0.44	10.24	9.62	88.3	19.96
ERR (%)	57-81	8.33	7.94	91.0	15.61
Cocoon yield (kg)	13-25.34	17.16	16.78	95.7	33.81
F (no)	239-353	7.67	7.08	85.4	13.48
HP (%)	52-85	12.78	12.49	95.6	25.17

GCV: Genotypic co-efficient of variation; PCV: Phenotypic co-efficient of variation; LW: Larval weight; CW: Cocoon weight; PW: Pupal weight; SW: Shell weight; ERR: Effective rate of rearing; F: Fecundity and HP: Hatching percentage

Table 3. Correlations of different quantitative traits of eri silkworm breeds

	LP	LW	CW	PW	SW	ERR	Yield	F	HP
LP	1.000	-0.409**	-0.265**	0.121	-0.319**	0.045	0.201*	0.005	0.099
LW		1.000	0.782**	-0.103	0.783**	0.631**	0.140	0.652**	0.601**
CW			1.000	-0.085	0.344**	0.119	-0.061	0.246**	0.158
PW				1.000	-0.129	-0.049	0.142	-0.062	-0.084
SW					1.000	0.472**	-0.002	0.564**	0.523**
ERR						1.000	0.302**	0.668**	0.833**
YIELD							1.000	0.267**	0.312**
F								1.000	0.701**
HP									1.000

*,**Significant at the 0.01 and 0.05 level respectively; LP = Larval period

moderate for cocoon weight (20.93), larval weight (19.49) and shell weight (19.96). Heritability estimates considered along with genetic advance will be more helpful in predicating the gain under selection. High heritability coupled with moderate to high genetic advance and high genotypic co-efficient of variation in traits such as cocoon yield, hatching percentage, pupal weight, larval weight and shell weight indicate the predominance of additive gene action for these traits. Hence selection based on these traits will be highly rewarding.

Correlation of different traits of eri silkworms showed either positive or negative correlation. Larval period was negatively correlated with larval weight (–0.409**), cocoon weight (–0.256**), shell weight (–0.319**) and positively correlated with cocoon production (0.201**). The larval weight showed positive correlation with cocoon weight (0.722**), shell weight (0.783**), effective rate of rearing (0.631**), fecundity (0.652**) and hatching percentage (0.601*).The shell weight revealed positive correlation with ERR (0.472*), fecundity (0.564*) and hatching percentage (0.523**).

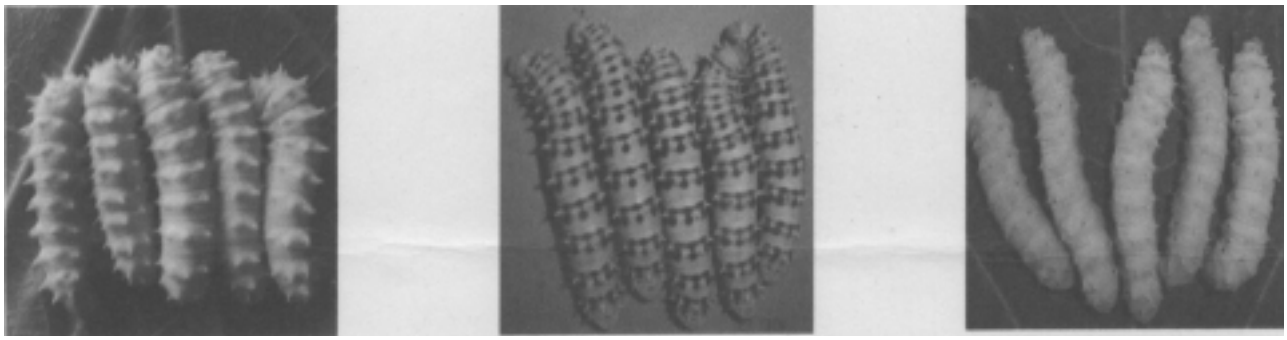

Fig. 1. Larvae of selected accession of eri silkworm

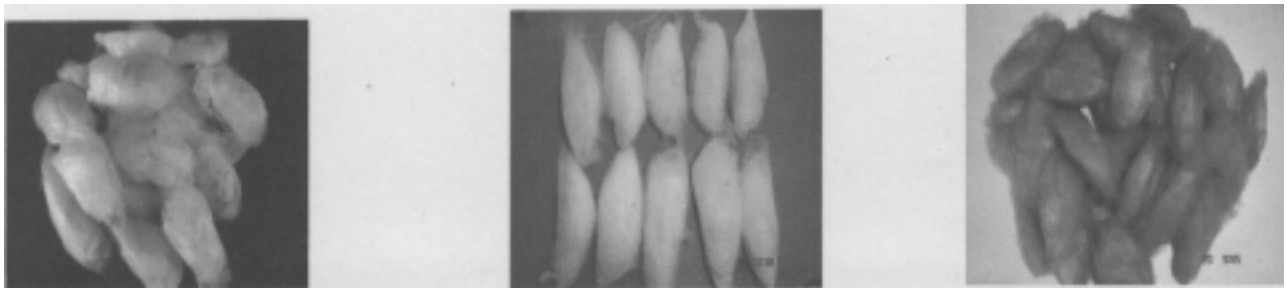

Fig. 2. Cocoon of selected accession of eri silkworm

Yield of cocoon showed positive correlation with larval period (0.201**), effective rate of rearing (0.302**) and fecundity (0.668**) and negative with cocoon weight (–0.061**) and cocoon shell weight (–0.002). Similar observation were reported in mulberry silkworm [10].

This study indicated the wide variability in eri silkworm breeds of north-eastern region of India. The traits of eri silkworm *viz*., cocoon yield, hatching , larval weight, cocoon weight and pupal weight appears to be of high importance and based on these traits indirect selection is likely to be more effective in genetic improvement of this species.

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