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SEX, SEASON AND YEAR-WISE VARIATIONS IN QUANTITATIVE TRAITS OF RAILY ECORACE, A WILD TASAR SILKWORM OF *ANTHERAEA MYLITTA D.*

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The ecorace 'Raily' of *Antheraea mylitta* D. is endemic to Bastar plateau of Chhattisgarh, India and is a eurythermic, wild, polyphagus, bivoltine in nature. It is mainly of Sal (*Shorea robusta* Roxb.) origin but also feeds on large number of secondary tasar flora. The present study evinces the morphometric variations in the quantitative traits of cocoons of seven ecopockets of two seasons and of two years *i.e.* of 1990 and 2000 recorded associated variations at an interval of a decade. The study conferred significant variations for the seven traits under study between the sexes and between the crops ($p<0.01$, df = 12) except for shell weight in 1st crop ($p>0.05$, df = 12). These traits presented no differences in pooled samples of both the sexes ($p>0.05$, df = 12; NS : Not significant). The seven traits under study during the year 1990 and 2000 for the first and second crops surmised no differences within the sex and pooled samples of both the sexes (($p>0.05$, df = 12).

Key words : Ecorace Raily, *Antheraea mylitta* D., morphometric variations, quantitative traits, seasons, ecopockets, years.

INTRODUCTION

Raily, an ecorace of *Antheraea mylitta Drury* (Lepidoptera : Saturniidae) is endemic to Bastar plateau of Chhattisgarh, India. Bastar plateau is bestowed with varying climatic conditions conferring population diversity for a wide variety of flora and fauna especially the insects. The Indian wild tasar silkworm, *Antheraea mylitta Drury* too is widely distributed in nature in numerous forms and eco-populations. These populations exhibit great genetic diversity in their characters including natural adaptation to isolation and specific habitat forming different ecoraces *viz.* Daba (Bihar) and Sukinda (Orissa) are being exploited commercially throughout the tropical tasar growing areas of India. In recent past years, decline in the few population, *viz.* Modal (Orissa), Raily (Chhattisgarh), Bhandara (Maharashtra) and Andhra Local (A.P.) has been noticed (Sinha *et al.;* 1992) which appears to be due to change in ecosystem/environment and biotic factors caused by over exploitation of both flora and fauna.

Studies on variability in morphometric characters of cocoons is useful to identify suitable parents/hybrids for breeding and evolution to produce uniform shape cocoons with uniform filament size as well as to know the variability among silkworm strains and their hybrids. Population variability in ecoraces of *Antheraea mylitta D* has been studied by Sen *et al.* 1976, Chatterjee *et al.*, 1983, Siddiqui *et al.*, 1985 & 1988b). The present communication presents an analytical association of the sex associated traits, magnitude of seasonal association among the quantitative traits and the temporal variation in the quantitative traits adducing the level of stability.

MATERIALS AND METHODS

Nature grown Raily ecorace of *Antheraea mylitta D.* was taken as a material for the present study. Cocoons were collected from seven ecopockets of Bastar forests namely Darbha, Nangoor, Tokapal, Tongpal, Kondagoan, Narayanpur and Geedam areas. Observations were made on 100 cocoons from each ecopockets (except 34 cocoons in Narayanpur during 1st season) of both seasons during the year 2000, however in 1990, 50 and 40 cocoons from each ecopockets during 1st and IInd seasons respectively were observed. Thus, the observations were made on 1334 samples during the year 2000 and 590 cocoon samples during 1990.

Data of the nature grown Raily cocoons were recorded for the seven characters *i.e.* cocoon weight (CW), pupal weight (PW), shell weight (SW), silk ratio (SR%), cocoon length (CL), cocoon breadth (CB) and cocoon volume (CV). Measurements were taken with the help of vernier calliper, volume by water displacement method and weight by electronic balance. Mean, standard deviation, coefficient of variations (CV%) and 't' tests were calculated following the standard statistical procedure. The results of both the sexes (male and female) of the two seasons (July-August and October-December), of 2000 were compared with the samples of 1990.

RESULTS AND DISCUSSION

Difference between sexes

Mean, range and coefficient of variations for different morphometric characters studied indicated that there is variability in all characters under study in both sexes, however the pattern of variation during the two crop seasons were identical (Table I). It is observed that mean performances of most of the characters were higher in female cocoons than male cocoons (except silk ratio). Similar patterns were observed during the both crop seasons.

Coefficients of variations in respect of most of the characters were higher in male cocoons than female cocoons in both seasons. Highest values of CV% was recorded in single shell weight (16.58 %) of female cocoons during 1st season and the lowest CV% in single cocoon length (4.45 cm) of the female cocoon during second seasons.

Higher values of most of the cocoon characters in female cocoons may be due to the association of some proportion of the body weight of the silkworm with the vested potential production of eggs.

Difference between seasons

Mean, range and coefficient of variations recorded in male, female and sex pooled samples during different seasons are presented in the Table II. The 't' test conducted in samples of 1st and IInd season showed non- significant differences in male, females and sex pooled samples (except pupal weight of female cocoons).

Coefficients of variations were higher in first season than second season in respect of all the characters in male, female and sex pooled samples. Difference in this variability may be due to the difference in environmental conditions during the first season. During the first season temperature and relative humidity is optimum and the difference between

Table I : Variability in morphometric characters of raily ecorace in different sexes.

Character	Sex	Male			Female			't' value
		Mean	Range	C.V. %	Mean	Range	C.V. %	
CL	First	4.87	4.05-5.78	5.37	5.33	4.08-6.16	5.35	06.8452**
CB	df=12*	3.22	2.70-4.48	5.36	3.52	2.68-4.53	5.88	08.0000**
CV		27.24	18-45	15.17	35.86	18-55	14.84	0'6.2391**
CW		11.39	6.09-19.50	13.11	15.75	5.76-21.21	13.12	11.4000**
PW		8.97	4.77-15.74	13.60	12.90	4.69-17.68	13.31	37.8978**
SW		2.42	1.15-3.77	15.82	2.85	1.08-4.21	16.58	01.5104^{NS}
SR%		21.28	11.66-35.13	10.33	18.04	9.17-25.08	10.31	11.7349**
CL	Second	4.89	3.62-5.48	4.60	5.28	4.16-5.98	4.45	12.0400**
CB	df=12*	3.24	2.75-4.48	4.74	3.49	2.25-4.05	4.96	0'8.9930**
CV		27.53	18-38	11.57	34.58	22-48	12.04	09.4289**
CW		11.19	6.55-16.05	11.80	15.47	10.08-20.78	11.52	26.6500**
PW		8.78	4.90-12.59	12.40	12.75	8.38-17.44	12.12	25.1425**
SW		2.42	1.13-3.51	13.28	2.80	1.68-4.13	13.01	11.9874**
SR%		21.65	17.26-28.84	8.96	18.14	14.52-25.09	9.06	13.7970**

** : p<0.01, df : 12; NS : Not significant.

Table II : Variability in morphometric characters of raily ecorace during different seasons.

Character	Sex	First crop, 2000			Second crop, 2000			't' Value
		Mean	Range	C.V. %	Mean	Range	C.V. %	
CL	Male	4.87	4.05-5.78	5.37	4.89	3.62-5.48	4.60	0.3831^{NS}
CB	df=12*	3.22	2.70-4.48	5.36	3.24	2.75-4.48	4.74	0.6390^{NS}
CV		27.24	18-45	15.17	27.53	18-38	11.57	0.2997^{NS}
CW		11.39	6.09-19.50	13.11	11.19	6.55-16.05	11.80	0.8503^{NS}
PW		8.97	4.77-15.74	13.60	8.78	4.90-12.59	12.40	1.0526^{NS}
SW		2.42	1.15-3.77	15.82	2.42	1.13-3.51	13.28	0.0000^{NS}
SR%		21.28	11.66-35.13	10.33	21.65	17.26-28.84	8.96	1.1451^{NS}
CL	Female	5.33	4.08-6.16	5.35	5.28	4.16-5.98	4.45	0.3663^{NS}
CB	df=12*	3.52	2.68-4.53	5.88	3.49	2.25-4.05	4.96	0.8670^{NS}
CV		35.86	18-55	14.84	34.58	22-48	12.04	1.0342^{NS}
CW		15.75	5.76-21.21	13.12	15.47	10.08-20.78	11.52	0.8199^{NS}
PW		12.90	4.69-17.68	13.31	12.75	8.38-17.44	12.12	4.7170**
SW		2.85	1.08-4.21	16.58	2.80	1.68-4.13	13.01	0.6053^{NS}
SR%		18.04	9.17-25.08	10.31	18.14	14.52-25.09	9.06	0.5230^{NS}
CL	Pooled	5.12	4.05-6.16	6.97	5.12	3.62-5.98	5.90	0.0000^{NS}
CB	df=12*	3.34	2.68-4.53	7.29	3.38	2.25-4.48	6.10	1.4084^{NS}
CV		31.98	18-55	20.50	31.64	18-48	17.30	0.3894^{NS}
CW		13.82	5.76-21.21	20.67	13.69	6.55-20.78	19.41	0.4911^{NS}
PW		11.16	4.69-17.68	22.19	11.05	4.90-17.74	21.38	0.5429^{NS}
SW		2.66	1.08-4.21	18.46	2.64	1.13-4.13	15.01	0.2857^{NS}
SR%		19.49	9.17-35.13	13.30	19.59	14.52-28.84	12.74	0.4216^{NS}

** : p<0.01; df : 12; NS : Not significant.

maximum and minimum temperature and humidity is very less which is an important factor for growth and survival of the silkworm during the rearing period.

Difference between different years

Observations made in respect of morphometric characters in male, female and sex pooled samples of Raily cocoons collected during the year 2000 were compared with the samples of year 1990. Mean, range and CV% recorded during *1st* crop and II nd crop seasons are presented in the Tables III & IV, respectively. The environmental conditions i.e. temperature, humidity and rainfall prevailing during the year 1990 and 2000 have been shown in Figs. 1 & 2.

a) ***Difference in first multiplication season of different years*** **:** Studies indicated that there is a decrease in the values of most of the cocoon characters during 2000 in comparison to 1990. The differences were non-significant for mean performances of these morphometric characters. However, the differences were significant in silk ratio of female cocoons as well as sex pooled samples during the two years.

Table III : Variability in morphometric characters of raily ecorace during first crop season in different years

Chara --cter	Sex	First Crop, 2000			First Crop, 1990			`t' Value
		Mean	Range	C.V. %	Mean	Range	C.V. %	
CL	Male	4.87	4.05-5.78	5.37	4.86	4.05-5.60	5.99	0.1395^{NS}
CB	df=12	3.22	2.70-4.48	5.36	3.21	2.21-4.05	6.71	0.2207^{NS}
CV		27.24	18-45	15.17	26.21	20-45	18.67	0.8294^{NS}
CW		11.39	6.09-19.50	13.11	11.52	7.73-17.65	13.49	0.4373^{NS}
PW		8.97	4.77-15.74	13.60	9.00	6.04-13.52	14.19	1.1444^{NS}
SW		2.42	1.15-3.77	15.82	2.55	1.17-4.13	17.46	0.1511^{NS}
SR%		21.28	11.66-35.13	10.33	22.13	12.92-31.51	12.09	1.6663^{NS}
CL	Female	5.33	4.08-6.16	5.35	5.34	4.45-6.02	5.81	0.0988^{NS}
CB	df=12	3.52	2.68-4.53	5.88	3.53	2.97-4.15	5.90	0.1706^{NS}
CV		35.86	18-55	14.84	34.96	20-50	16.43	0.4517^{NS}
CW		15.75	5.76-21.21	13.12	16.09	10.37-20.71	12.40	0.5484^{NS}
PW		12.90	4.69-17.68	13.31	13.04	7.93-17.82	12.71	0.2850^{NS}
SW		2.85	1.08-4.21	16.58	3.08	1.16-4.42	18.88	1.6073^{NS}
SR%		18.04	9.17-25.08	10.31	19.06	10.74-26.23	12.91	3.3686^{**}
CL	Pooled	5.12	4.05-6.16	6.97	5.11	4.05-6.02	7.38	0.1295^{NS}
CB	df=12	3.34	2.68-4.53	7.29	3.37	2.21-3.01	7.90	0.6185^{NS}
CV		31.98	18-55	20.50	30.58	15-50	22.76	0.9694^{NS}
CW		13.82	5.76-21.21	20.67	13.83	7.73-20.71	20.97	0.0229^{NS}
PW		11.16	4.69-17.68	22.19	11.02	6.04-17.82	22.77	0.4328^{NS}
SW		2.66	1.08-4.21	18.46	2.82	1.16-4.79	20.78	1.3201^{NS}
SR%		19.49	9.17-35.13	13.30	20.60	10.74-31.51	14.89	13.0300^{**}

**: $p<0.01$, df : 12; NS: Not significant

Table IV: Variability in morphometric characters of raily ecorace during second crop season in different years.

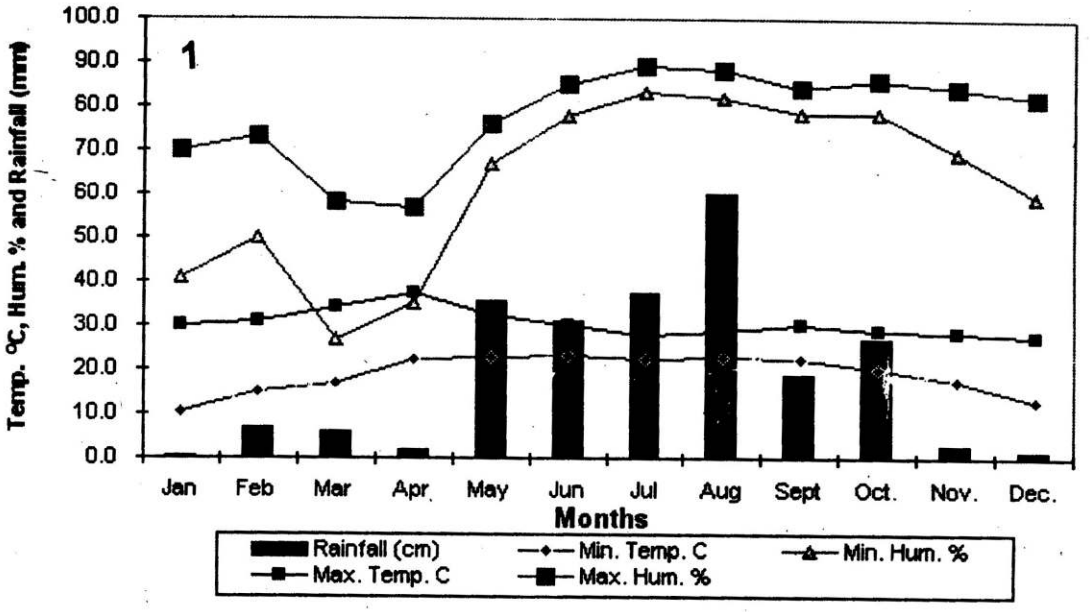
Character	Sex	Second Crop, 2000			Ssecond Crop,1990			`t' Value
		Mean	Range	C.V. %	Mean	Range	C.V. %	
CL	Male	4.89	3.62-5.48	4.60	4.83	3.37-5.71	5.42	1.3825^{NS}
CB	df=12	3.24	2.75-4.48	4.74	3.17	2.48-3.63	4.50	2.5179*
CV		27.53	18-38	11.57	25.95	19-38	11.42	1.7606^{NS}
CW		11.19	6.55-16.05	11.80	10.88	7.25-15.83	11.98	1.4188^{NS}
PW		8.78	4.90-12.59	12.40	8.45	5.55-12.80	12.49	1.7742^{NS}
SW		2.42	1.13-3.51	13.28	2.42	1.04-3.54	15.66	0.0000^{NS}
SR%		21.65	17.26-28.84	8.96	22.26	12.86-31.78	10.62	0.4119^{NS}
CL	Female	5.28	4.16-5.98	4.45	5.39	4.62-6.58	4.66	1.8062^{NS}
CB	df=12	3.49	2.25-4.05	4.96	3.58	3.00-4.09	4.61	2.1276^{NS}
CV		34.58	22-48	12.04	36.91	22-52	11.37	1.5542^{NS}
CW		15.47	10.08-20.78	11.52	16.39	8.40-20.78	11.39	2.8786*
PW		12.75	8.38-17.44	12.12	13.05	7.28-17.47	11.69	1.1919^{NS}
SW		2.80	1.68-4.13	13.01	3.20	1.12-4.70	15.13	4.2328**
SR%		18.14	14.52-25.09	9.06	19.64	13.12-26.02	10.29	6.3559**
CL	Pooled	5.12	3.62-5.98	5.90	5.11	3.37-6.58	7.56	0.2451^{NS}
CB	df=12	3.38	2.25-4.48	6.10	3.38	2.48-4.09	7.67	0.0000^{NS}
CV		31.64	18-48	17.30	30.02	19-52	21.16	0.9273^{NS}
CW		13.69	6.55-20.78	19.41	13.57	7.25-20.78	23.14	0.4971^{NS}
PW		11.05	4.90-17.74	21.38	10.76	5.55-17.47	24.71	2.3481*
SW		2.64	1.13-4.13	15.01	2.81	1.04-4.70	21.01	1.6412^{NS}
SR%		19.57	14.52-28.84	12.74	20.94	12.86-31.78	12.37	5.4150**

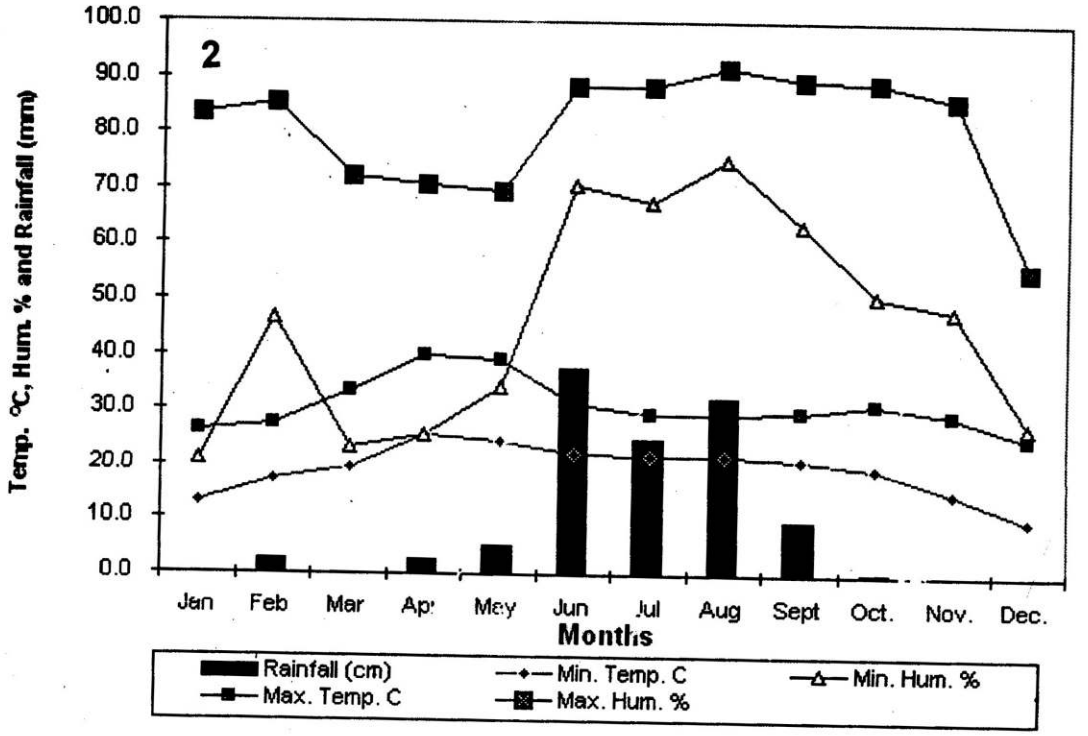
: $p<0.05$,: $p<0.01$; df : 12; NS : Not significant.

The coefficients of variations were higher in most of the morphometric characters in male, female and sex pooled samples of the year 1990 in comparison to the samples of 2000. Higher coefficient of variations recorded in the morphometric characters of the cocoons of year 1990 samples may be attributed to the human interference and higher amount of rainfall during that year in comparison to the year 2000.

b) Difference *in second multiplication season of different years* : There was an increase in the mean performances of different morphometric characters studied in the male cocoons during second season of the year, 2000 in comparison to 1990. However, these differences were not significant in most of the character in male cocoons (except single cocoon breadth). In females as well as sex pooled cocoons, the characters were higher during the year 1990 in comparison to 2000 and the differences were significant in respect of most of the characters (except single cocoon volume and single pupal weight). The differences were not significant in respect of most of the characters (except pupal weight and silk ratio) when the sexes were pooled together.

The coefficients of variations recorded in respect of most of characters of male cocoons as well as sex pooled samples were higher during the year 1990 whereas in female cocoons it was higher during the year 2000. Higher coefficient of variations





Figs. 1-2 : Environmental conditions in different years at Bastar (Chattisgarh).
1. During 1990; **2.** During 2000.

recorded in the morphometric characters of the cocoons of year 1990 samples may be attributed to the human interference and higher amount of rainfall during that year in comparison to the year 2000.

Thangavelu & Sinha (1993) reported that the female cocoons of modal ecorace are larger in size and volume and greater in cocoons and shell weight compared to those of male cocoons, however shell ratio was reported to be more in males in different ecotypes of modal ecorace of Orissa. Nayak & Guru (1998) while studying the cocoon biometry of bivoltine Daba ecorace reared at Bangriposi (Orissa) reported that female cocoons are bigger than the male cocoons in length, volume diameter, weight and shell weight. Female pupa is also reported to be longer voluminous and heavier than male pupa and there is significant difference between them. Similar observations have also been made on the nature grown ecorace of Adava forest range in Gajapati District, Orissa and Raily ecorace of Bastar (Chhattisgarh) during the present study. The lower shell weight in male cocoon might be the cause of earlier emergence of male moths from the cocoons and thereby allowing the prenuptial flight of the male moths and to help in its active mating with the virgin female moths later on. (Nayak & Guru, 1998)

Shell productivity of autumn season crop has been reported to be superior for *A. paphia* due to prevalence of optimum temperature (28.6^{0}C) and humidity (76.6^{0}C) (Dash *et al.*, 1994). Barah *et al.* (1988) observed variation in cocoon characters of *A. assama* during different seasons due to climatic conditions and nutritive quality of leaves. Srivastava *et al.* (2000) reported that the cocoons of Daba ecorace produced under identical conditions in different seasons are not uniform in their qualitative and quantitative characters. In the present observations on wild ecorace Raily, no significant differences could be observed in respect of almost all the cocoon characters studied (except shell ratio of two different years) during the two seasons as well as during different years.

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REFERENCES

BARAH, A., PHUKAN, S.N. AND SAMSON, M.V. 1988. Variation in cocoon characters of *A. assama* Ww during different seasons. *Sericologia.* **28**(2) 215-218.

CHATTERJEE, S.N., BANSAL, A.K., VATSAULIA, P.K., SENGUPTA, A.K. & SENGUPTA, K. 1983 The variability studies in tropical tasar *A. mylitta* D. *Natl. Sem. on Silk Research & Development*, 10-13 March, pp. 168, Bangalore, India.

DASH, A.K., PATRO, P.C., NAYAK, B.K. & DASH, M.C. 1994. Cocoon crop performance of the Indian wild tasar silkworm *A. paphia* (Lepidoptera : Saturniidae) reared on different food plants. *Int. J. Wild Silkmoth and Silk* **1** :72-74

NAYAK, BIKRAM, K. & GURU, B.C. 1998. Studies on cocoon biometry of the bivoltine tasar silkmoth *Antheraea mylitta* D. (Lepidoptera : Saturniidae) reared at Bangriposi. *Bull. Ind. Acad. Seri.* **2**(1) : 31-34.

SEN, S.K., SENGUPTA, A.K., DAS, M.G. & JOLLY, M.S. 1976. Studies on genetic variability, correlations, Path co-efficient analysis and discriminant functions in *Antheraea mylitta D. Ind. J. Ser.* **15**(1) : 9-14.

SIDDIQUI, A.A., DEBNATH, A. & SENGUPTA, K. 1985. Variability and correlation studies of shell weight and their contributing traits in *A. mylitta* D. *Sericologia.* **25**(1) 45-50.

SIDDIQUI, A.A., SENGUPTA, A.K., AJIT KUMAR. & SENGUPTA, K. 1988. Genotypic and phenotypic variability of some characters in *A. mylitta* D. *Sericologia.* **28**(1) : 187-192.

SINHA, A.K., SHARMA, K.K., SINHA, R.K., SINHA, B.R.R.P. & THANGAVELU, K. 1993. Conservation Conservation of Genetic resources of tropical tasar silkworm *Antheraea mylitta* Drury (Lepidoptera : Saturniidae). *J. Non-Timber Forest Products,* Vol. II : 118-121.

SRIVASTAVA, A.K., NAQVI, A.H., ROY, G.C. & SINHA, B.R.R.P. 2000. Temporal variation in qualitative and quantitative characters of *Antheraea mylitta Drury. Int. J. Wild Silkmoth & Silk.***5** : 54-56.