REPRODUCTIVE BEHAVIOUR OF SARIHAN ECORACE OF WILD TASAR SILKMOTH, ANTHEREA MYLITTA DRURY UNDER EX-SITU CONDITION IN SIMILIPAL BIOSPHERE RESERVE, ODISHA, INDIA.

*Pandit J.K.¹, Dey D.G.² and Satpathy S.K.³

¹Department of Zoology, Betnoti College, Betnoti - 757025, Mayurbhanj, Odisha, India ²Department of Zoology, Udala College, Udala, Mayurbhanj-757041, Odisha, India ³Research Extension Centre, Central Silk Board, Bangiriposi- 757032, Mayurbhanj *Author for Correspondence

ABSTRACT

Sarihan ecorace of Antherea mylitta Drury an endemic, predominant and wild ecorace of tropical Tasar silkworm is mainly found in the forests of Saraiahat in Dumka district of Jharkhand. It is a lepidopteran insect mainly feeds on plants like *Terminalia arjuna* (Arjun) *Terminalia tomentosa* (Asan) under *in situ* condition. Reproductively it behaves as trivoltine insect in nature. In the forest of Dumka it is distributed between 100 mASL to 200 mASL altitude. As Saraiahat place in Dumka of Jharkhand and Jadida of Similipal Biosphere in Mayurbhanj of Odisha has the same ecoclimatic condition, so an attempt was taken to study reproductive behaviour (grainage => reproductive efficiency and rearing performance => productive efficiency) of Sarihan ecorace under *ex-situ* condition in Similipal Biosphere. From reproductive behaviour it has been concluded that Sarihan is less adaptive in Similipal Biosphere but it can be reared here in *ex-situ* condition as a substitute if any epidemic will broke out in its natural abode of this insect in Saraiahat of Dumka region.

Keywords: Antherea Mylitta, Sarihan Ecorace, Grainage, Rearing Performance

INTRODUCTION

Tasar culture is a forest based agro-industry being traditionally practised by the tribes of eastern and central part of India. Though the tropical tasar silkworm has 44 ecoraces, yet very few are domesticated; and larger commercial potential is yet to be explored (Hansda *et al.*, 2008; Ojha *et al.*, 2009). The wild ecoraces are naturally grown in the forests and the tribal collect them traditionally. Among them the Sarihan ecorace is wild and endemic to the forests of Dumka of Jharkhand. Dumka is the predominant tasar producing region where the tribal collect such cocoons from the forests. It is located at the North-eastern plateau zone of Jharkhand having the latitude 24.26° N, longitude 87.25° E and an average altitude of 137 m ASL. The district has the geographical area of 6,212 square km. among which 637 sq km. are covered by natural forests, constituting 10.25 % of the total area. Tropical moist deciduous forest is mainly found in this region which favours the sustainability of the above ecorace. The tasar culture provides live hood and employment to the tribal of this region. As a lot of study has been conducted on this insect so, it is essential to know the productivity as well as its conservation in ex-situ condition.

The studies of reproductive behaviour of Sarihan ecorace of *Antheraea mylitta* was undertaken on the basis of food plants, on specific crop season and even in a particular altitude in *in-situ* condition. But no attempts have been made in to study the productivity of such wild tasar silkworm in *ex-situ* condition. Therefore an attempt has been made to study the reproductive behaviour of Sarihan ecorace of wild tasar silk moth, A. *mylitta* under *ex-situ* condition at Jadida in Similipal forest which covers an area of 2750 sq. kms. It is located in the Mayurbhanj district

© Copyright 2014 / Centre for Info Bio Technology (CIBTech)

of Odisha state between 21°30' North latitude 86°31' East longitudes. The land of Similipal forest is undulating and filled with Tropical moist deciduous forest. The altitude varies from 50 to 1150 m. ASL. The main aim of the study is to rear them in *ex-situ* condition which not only prevents the extinction of such ecorace but also it will help to study its sustainability under different climatic conditions. Now a day the wild Tasar biodiversity in India are facing a threat of extinction from their natural abode due to deforestation and climatic change. So such wild insects need conservation both under *in situ* and *ex situ* condition. The present study is done on reproductive behaviour (grainage => reproductive efficiency and rearing performance => productive efficiency) of Sarihan ecorace of *A. mylitta* under *ex-situ* condition in Similipal Biosphere Reserve.

MATERIALS AND METHODS

The cocoons of sarihan ecorace are randomly collected from the tribals of Saraiahat forest region of Dumka district of Jharkhand thrice in a year i.e. in the month of March, August and December as it is trivoltine in nature. The geographical and climatological data of that region along with grainage and rearing data are obtained from RTRS (Regional Tasar Research Station), Dumka. The outdoor grainage and rearing are done both at Saraiahat (Site-1) of Dumka and Jadida (Site-2) region of Similipal Biosphere Reserve of district Mayurbhanj, Odisha.

Evaluation of rearing performance at two study sites (in-situ and ex-situ) during different rearing seasons were done in Asan plant (Terminalia tomentosa) over a span of three years from 2009 to 2012. Package and practices of tasar rearing were followed as per Jolly et al., (1979) and Nayak (1988). But every year and in every season rearing was conducted on fresh food plants in order to provide equal rearing condition to the larva. For studying rearing efficiency 3000 freshly hatched healthy worms of Sarihan ecorace in three separate groups of 1000 for each group are brushed on Asan (Terminalia tomentosa) food plants in each rearing season at different study sites. The biometries of cocoons are carried out as per standard procedure adopted by Nayak (1997). The performance of Sarihan ecorace of A. mylitta in terms of reproductive efficiency (grainage performance) such as percentage of pupal survivability, coupling, fecundity, hatching of eggs etc. and the productive efficiency (rearing performance) such as effective rate of rearing, cocoon weight, pupal weight, shell weight, shell ratio, total shell production etc. of are assessed following standard procedures. The rearing efficiency are evaluated by taking 200 cocoons at random from the harvested cocoons in different rearing season using common gravimetric methods and by using the different formulae (Sokal and Rohlf, 1981). The meteorological data like temperature, humidity and rainfall per month are observed daily at the rearing sites. From three years of observation season-wise values of the above parameters are calculated. The climatological parameters of Dumka and Dumka regions were compared with the reproductive behaviour of Sarihan ecorace.

RESULTS AND DISCUSSION

Results

The tasar silkmoth of *Antheraea mylitta* belong to Sarihan ecorace produce three crops (rainy, autumn and winter seasons) in a year as the species shows trivoltinism. The grainage performance (reproductive parameters) such as percentage of emergence, coupling and fecundity are shown in Table 1. It is observed that during grainage of rainy season, the emergence percentage of moth is increasing in ex-situ condition i.e., 55.8 in Saraiahat and is 62.1 in Jadida but the reverse trend is marked in coupling of insect (52.8 % at Saraiahat and 45.4% at Jadida).

In autumn season the emergence of moth is also increasing in ex-situ condition compared to insitu condition i.e., 52.4% in Saraiahat and 56.3% at Jadida. But the coupling of moth is decreasing i.e., 48.4% in Saraiahat as compared to 42.7% in Jadida during autumn season. In winter season grainage, the percentage of emergence is increasing from 49.5 to 54.8 and coupling of moth is decreasing from 50.5% to 43.5% in ex-situ and in-situ conditions respectively. Similarly during both rainy and autumn season the fecundity of moth is decreasing from 156.35 & 142.6 and 139.8 & 134.6 in ex-situ and in-situ conditions respectively whereas during winter season it is increasing from 142.3 to 144.6 (Table 1).

It is observed that the percentage of hatching is declined from in-situ to ex-situ condition in rainy (65.58 to 58.37), autumn (59.38 to 51.83) and winter (58.3 to 52.65) season. The productive efficiency and biometry of Sarihan ecorace of *A. mylitta* such as effective rate of rearing (ERR), cocoon weight, pupal weight, shell weight and shell ratio of cocoons in different crop seasons in different study sites are shown in Table 1. The effective rate of rearing of Sarihan at both *in-situ* and *ex-situ* ecopockets (Saraiahat and Jadida) during all seasons is decreasing from 26.65 to 24.43 in rainy, 23.32 to 21.08 in autumn and 26.14 & 22.2 in winter. So far as cocoon characters (cocoon weight, shell weight, silk ratio) are concerned, the superior variety cocoons are produced in all seasons (rainy, autumn and winter) at *in-situ* condition than *ex-situ* condition. It is observed that the cocoon weight is decreasing from in-situ to ex-situ condition in rainy (13.37 to 11.25), autumn (11.35 to 10.67) and winter (12.33 to 10.93). It is also observed that the shell weight is decreasing the percentage of silk ratio the same trend is observed like shell weight from in-situ to ex-situ condition in rainy (13.18 to 12.45), autumn (12.99 to 12.53) and winter (12.81 to 12.78) crops (Table1, Figure 1, Figure 2 & Figure 3).

Reari ng	Stud y	Emerge nce	Coupli ng (in	Fecundi ty	Hatchi ng (%)	Cocoon harveste	ERR (in	Cocoo n	Cocoo n	Shell weig	Silk Rati
Seaso n	Site	(in %)	%)	(in No)		d (in No)	%)	volum e (in cc)	weight (in gm)	ht (in gm)	0 (in %)
Rainy Crop	Dum ka	55.8	52.8	156.3	65.58	169.5	26.65	13.37	8.04	1.06	13.18
		± 2.56	±1.75	±5.64	± 7.56	±7.21	± 0.05	±0.28	±0.1	± 0.05	±0.21
	Jadid a	62.1	45.4	142.6	58.37	142.6	24.43	11.25	7.79	0.97	12.45
		±2.14	±2.36	± 8.58	±13.3	±16.72	±2.33	±0.57	±0.15	± 0.08	±0.33
Autum n Crop	Dum ka	52.4	48.4	139.8	59.38	138.5	23.32	11.35	7.54	0.98	12.99
		±2.15	±3.96	±4.76	±8.29	±7.23	±1.24	±0.27	±0.09	±0.04	±0.24
	Jadid a	56.3	42.7	134.6	51.83	109.2	21.08	10.67	7.26	0.91	12.53
		±2.25	±2.79	±4.92	±10.16	±10.35	±1.37	±0.18	± 0.07	±0.02	±0.21
Winter Crop	Dum ka	49.5	50.5	142.3	58.30 ±7.53	152.4	26.14	12.33	7.96	1.02	12.81
		±2.67	±1.98	±3.89		±6.65	±0.92	±0.24	±0.05	±0.06	±0.28
	Jadid a	54.8	43.5	144.6	52.65	116.8	22.20	10.93	7.35	0.94	12.78
		±2.83	±4.7	±6.45	±9.83	±12.46	±1.59	±0.39	±0.11	±0.04	±0.34

Table 1: Grainage and Rearing Performance of Sarihan ecorace under in-situ and ex-situ conditions

© Copyright 2014 / Centre for Info Bio Technology (CIBTech)

Cibtech Journal of Zoology ISSN: 2319–3883 (Online)

An Open Access, Online International Journal Available at http://www.cibtech.org/cjz.htm 2014 Vol. 3 (2) May-August, pp. 83-88/Pandit et al.

Research Article

Seaso	easo Rainy season					Autumn season				Winter season					
n Mont h	June July			August		Sept		Oct		Nov		Dec			
Site	Site -1	Site- 2	Site- 1	Site -2	Site- 1	Site- 2	Site- 1	Site- 2	Site- 1	Site- 2	Site- 1	Site- 2	Site- 1	Site- 2	
Avera ge	31.2 8	30.6 0	28.6 5	29.1 0	28.9 0	28.70 ±0.8	27.9 8	28.1 0	25.9 8	26.8 0	22.8 2 ±0.1	24.6 0 ±0.6	18.2 6 ±0.7	22.2 0 ±0.7	
Temp ⁰ C	±0.4 7	±0.5 3	±0.0 9	±0. 67	±0.6 5	0	±0.5 2	±0.6 3	±0.1 3	±0.9 4		3	4	7	
R. H (%)	62.3 3	85.8 0	78.1 1	92.2 0	81.3 3	91.10	75.5	93.4 0	75.5	93.3 0	68.6 7	87.2 0	59.8 3	83.9 0	
	±5.4 2	±3.2 8	±5.1 0	±1. 42	±3.9 2	±3.3 8	±2.9 4	±0.6 3	±2.2 7	±1.1 1	±3.7 9	±3.6 8	±2.7 8	±3.6 7	
Rain fall	90.8 +14	142. 20	278. 88	318. 40	324. 11	298.6 0	248. 28	285. 80	76.8 3	108. 80	11.7 5 +4 2	30.6 0 +10	Nil	5.20 ±2.6 8	
(mm)	8	±40. 65	±24. 67	±83 .89	±109 .3	±64. 26	±26. 5	±38. 72	±6.6 3	±32. 40	1	6		0	





Figure 1: Grainage and Rearing performance of Figure 2: Grainage and Rearing performance of Sarihan ecorace under *in-situ* & *ex-situ* conditions in rainy season

Sarihan ecorace under *in-situ* & *ex-situ* conditions in autumn season



Figure 3: Grainage and rearing performance of Sarihan ecorace under *in-situ* & *ex-situ* conditions in winter season

Discussion

Sarihan ecorace of *Antherea mylitta* is predominant silk moth in Dumka region having trivoltine nature has shown a low adaptiveness when it is cultured in *ex-situ* condition like the forest of Similipal Biosphere Reserve (Jadida). Both Dumka and Jadida having the same type of forest are more or less suitable for *A. mylitta* existence. But the climatological factors like quantity of rainfall, relative humidity and temperature may be playing vital role for regulating grainage and rearing of silkworm at both the sites for race adaptation. The reproductive behaviour (grainage) of the insect has shown that the percentage of emergence at Jadida is little bit more in all rearing seasons, which may be due to more relative humidity percentage (Table-2). However the coupling percentage of rainy, autumn and winter seasons at *ex-situ* condition is comparatively less which may be due to more temperature range.

The commercial traits like cocoon volume, cocoon weight, shell weight and silk ratio are also less at *exsitu* (Jadida) condition in all seasons due to irregular rainfall which disturb the larval feeding. The lower rearing performance during autumn season in *ex-situ* condition is due to high temperature, high humidity and stormy weather (Nayak, 1997). Further, high temperature (Ullal and Narasimhanna, 1987) and high relative humidity (RH) (Tanaka, 1964) are related to the production of poor quality of cocoons in *Bombyx mori*. Though the cocoon characters of Sarihan ecorace at *ex-situ* condition are inferior as compared to *insitu* condition, but survival of Sarihan ecorace at Jadida of Similipal Biosphere Reserve is a commendable success for maintenance and conservation of germplasm. As no methods have evolved by anybody else for ex-situ conservation of this wild ecorace, it leads researchers for further study and maintenance of germplasm of Sarihan ecorace under *ex-situ* conditions in case of epidemic situation arises or drastic change in climatological factor occurs due to natural calamities at *in-situ* conditions, which would protect extinction of race in nature.

REFERENCES

Alam MO, Pandey RK, Yadav GS, Sinha BRRP and Sinha SS (1998). Studies on rearing performance of wild ecorace Modal of Tasar silkworm, *Antherea mylitta* on different food plant. *Proceedings of Third International Conference on Wild Silk moth & Silk* 5 82-86.

Dash AK, Patro PC, Nayak BK and Dash MC (1994). Cocoon crop performances of the wild tasar silkworm *Antheraea paphia* Linn. (Lepidoptera: Saturniidae) reared on different food plants. *International Journal of Wild Silkmoth & Silk* 1(1) 72-75.

Dey DG (2003). Environmental Impact Assessment on reproductive behaviour and decreasing population of Modal ecorace of wild tasar silkmoth, *Antheraea paphia* Linn in Similipal Biosphere Reserve, Mayurbhanj, Orissa, India. Ph.D. Thesis, Utkal University 84-87.

Hansda GR, Reddy, Manohar, Sinha MK, Ojha NG and Vijay Prakash NB (2008). Ex situ stabilization and utility prospects of Jata ecorace of tropical silkworm *Antheraea mylitta* Drury. *International Journal of Industrial Entomology* **17** 169-172.

Nayak BK (1988). Seed multiplication, grainage operation and modern practices in tasar silkworm rearing. *Proceedings of Seminar on Sericulture in Orissa*, 16-18 March, 1988. Regional Development Office, Central Silk Board, Bhubaneswar, Govt. of India 1-23.

Nayak BK (1997). Ecology of Tasar silkworm of Orissa (Resource survey, reproductive biology, feeding and commercial rearing). Ph.D. Thesis, Sambalpur University 84-85.

Nayak BK and Dash MC (1998). Studies on Biology, Ecology and Culture practice of the wild tasar silk moth, *Antheraea paphia* Linn. of Similipal Biosphere Reserve, Orissa, *Bulletin of Indian Academy of Sericulture* 2(1) 113.

Nayak BK, Dash AK, Dash MC and Akai H (1993). Environmental regulation of voltinism in *Antheraea paphia* Drury (Lepidoptera: Saturniidae). In: *The Indian tasar silk insect, Wild Silk moth* '92 edited by Akai H, *International Society for Wild Silkmoths* 47-56.

Ojha NG, Reddy RM, Hansda G, Sinha MK, Suryanarayan N and Prakash NBV (2009). Status and potential of Jata, a new ecorace of Indian tropical tasar silkworm (*Antheraea mylitta* Drury), *Academic Journal of Entomology* **2** 80-84.

Sokal RR and Roholf FJ (1981). Biometry: The principle and Practice os Statists in Biological research, W.H.O Freemans and company, Sanfrancsisco.

Singh BMK and Srivastava AK (1997). Eco-races of Antheraea *mylitta* and exploitation strategy through hybridization. Current *technology seminar on non-mulberry sericulture*, conducted by Central Tasar Research & Training Institute, Ranchi.

Tanaka Y (1964). Sericology. Central Silk Board, Bombay, India 1-277.

Ullal SR and Narasimhanna MN (1987). *Handbook of practical sericulture* (3rd edition) (Central Silk Board), Bangalore, India 1-164.