

***Ex-situ* Stabilization and Utility Prospects of ‘Jata’ Ecorace of Tropical Tasar Silkworm *Antheraea mylitta* Drury**

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Indian tropical tasar silkworm, *Antheraea mylitta* D is reported to have forty four ecoraces by way of their adoption to different topographical and vegetational conditions. Of late, another ecorace ‘JATA’ - univoltine under *in-situ* condition has been explored which is localized in Thakurmunda area of the foot hills of Simlipal biosphere (Mayurbhanj district) of Orissa, India. The ecorace ‘Jata’ exhibits superior economic characters over widely commercialized ecoraces of Daba and Sukinda. The cocoon production of localized ‘Jata’ ecorace is depleting day by day in *in-situ* condition. In the present study, efforts were made to stabilize the ecorace ‘Jata’ under *ex-situ* condition at Ranchi (Jharkhand), where the ‘Jata’ ecorace silkworms were reared on *Terminalia tomentosa* for four successive generations during 2006 and 2007 and the cocoons were preserved in grainage house under prevailing climatic conditions. The results indicated change in voltinism behaviour of the ‘Jata’ ecorace from univoltine to bivoltine. The rearing performance and grainage efficiencies indicate the tendency of ‘Jata’ ecorace towards acclimatization and stabilization under Ranchi climatic conditions. The ‘Jata’ ecorace manifests the prospects for acclimatization, stabilization and commercial exploitation.

Key words: *Antheraea mylitta*, Ecorace, *Ex-situ*, *In-situ*, Jata, Daba, Sukinda

Introduction

The tropical tasar silkworm *Antheraea mylitta* D is widely distributed from West Bengal in East to Andhra Pradesh in South covering natural forest inhabitation of Jharkhand, Bihar, Orissa, Chhattisgarh, Madhya Pradesh and Maharashtra states of India. These species encounters diverse ecological conditions and as a result of conspicuous adaptation over generations to different ecological pockets, they formed into different ecotypes with wide variations in phenotypic, physiological and behavioral characters (Sinha and Srivastava, 2004; Srivastava and Thangavelu, 2005; Suryanarayana *et al.*, 2005). The forty four ecoraces of *Antheraea mylitta* (Srivastava *et al.*, 2002, 2003, 2004; Suryanarayana and Srivastava, 2005; Thangavelu *et al.*, 2000) have been identified through survey, collection and exploration in different states of tropical India. But still only two ecoraces i.e. Daba and Sukinda of tasar silkworm have commercially been exploited. Of late, another ecorace ‘Jata’ has been explored, which is localized in Thakurmunda area (1000'AMSL) of the foot hills of Simlipal biosphere, Mayurbhanj district of Orissa state, India. Under *in-situ* condition the race behaves as univoltine and it exhibits superior economic characters like cocoon weight, pupal weight, shell weight, silk ratio %, fecundity and filament quality over widely commercialized varieties of Daba and Sukinda. During the course of survey to the aforesaid particular area of Orissa, it was observed that the cocoon production of highly localized and the race ‘Jata’ is depleting day by day in its *in-situ* condition. The climatic conditions (temperature and relative humidity %) of Ranchi (2000'AMSL) was found not much different from the *in-situ* area (Thakurmunda-Orissa) of ‘Jata’ ecorace. Therefore, in the present study, efforts were made to stabilize the ecorace ‘Jata’ in the field laboratory condition of Central Tasar Research and Training Institute, Ranchi, Jharkhand (India) for its conservation, acclimatization and utilization for breeding programme.

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Table 1. Comparison of Commercial characters of 'Jata' ecorace with 'Daba' and 'Sukinda' ecoraces

Characters	Jata		Daba		Sukinda	
	Range	Av.	Range	Av.	Range	Av.
Cocoon weight (gm.)	12.24 - 14.80	13.52	9.20 - 12.83	10.63	9.10 - 12.11	10.19
Pupal weight (gm.)	9.90 - 12.44	11.17	7.72 - 10.33	9.02	8.11 - 10.50	8.85
Shell weight (gm.)	1.60 - 2.34	2.35	1.25 - 2.36	1.80	0.99 - 2.00	1.30
Silk ratio (%)	15.94 - 18.95	17.45	16.28 - 14.13	15.00	11.92 - 13.25	12.16
Fecundity (no.)	250 - 350	315	180 - 230	200	165 - 230	195
Cocoon yield/ dfl (no.)	15 - 19	17	50 - 75	60	40 - 60	50
Silk filament length (m)	840 - 1550	1184	475 - 1240	962	500 - 1100	870
Non-breakable filament length (m)	52 - 635	325	79 - 475	230	45 - 365	210
Voltinism	Univoltine		Bi/Trivoltine		Trivoltine	

Table 2. Performance of different characters of 'Jata' ecorace under *ex-situ* climatic conditions during 1st season (July-August) rearing

Characters studied	<i>In-situ</i> (mean)	Jul-Aug 2006 (<i>Ex-situ</i>)	Jul-Aug 2007 (<i>Ex-situ</i>)	Deviation % from mean in 2006	Deviation % from mean in 2007	Year - year deviation (%)
Fecundity (no.)	300	210	216	30	28	2.8
Hatching %	90	58.0	47.03	35.47	47.74	19.0
Larval Wt. (g)	46.40	30.15	30.5	35.02	34.26	1.16
Larval duration (days)	33.00	29.00	29.5	12.12	10.60	1.72
Yield/ dfl (no.)	17	63	66	270.58	288.23	4.76
Cocoon wt.(g)	13.52	9.48	9.23	29.88	31.73	2.63
Pupal wt. (g)	11.16	8.36	8.06	24.64	27.77	3.58
Shell wt (g)	2.36	1.12	1.17	52.54	50.42	4.46
Silk Ratio %	17.45	11.48	12.67	34.21	27.39	10.36

Materials and Methods

A quantity of 200 seed cocoons of 'Jata' ecorace were collected from Tasar Rearers Cooperative Societies (TRCSs) in Thakurmunda, Kendujuani, Mohuldiha and Kuldiha areas of Orissa state, India during April, 2006. The seed cocoons were preserved in grainage house of Central Tasar Research and Training Institute, Ranchi under prevailing climatic conditions. The cocoons were assessed on the basis of phenotypic traits and commercial parameters. The cocoons were compared with other two commercially exploited ecoraces, i.e. Daba and Sukinda, which are being maintained under Ranchi conditions. Grainage efficiencies of 'Jata' ecorace were recorded following integrated package of seed cocoons preservation and seed production (Narain *et al.*, 2001). Silkworm seed of 'Jata' race in 05 replications were reared on raised plantation of *Terminalia tomentosa* (W&A) successively for four generations during the years 2006 and 2007 with integrated package of rearing (Narain *et al.*, 2004). Directional selection method was applied for all the desired traits of commercial importance. The climatic condition of Ranchi

during July/August reveals that temperature ranges from 22~30°C and relative humidity from 50~70%; whereas the same during September/November was 17~27°C and 60~80% respectively. The climatic conditions of Thakurmunda, Orissa i.e. *in-situ* area of 'Jata' ecorace during July/August reveals that temperature ranges from 19~28°C and relative humidity 57~75%; whereas the same during September/November was 17~26°C and 60~85% respectively. Performance of the race 'Jata' in rearing parameters and grainage efficiencies for both the seasons during the years, 2006 and 2007 were recorded and the data processed for analysis.

Results

The comparison of commercial characters of Jata with semi domesticated Daba and Sukinda (Table 1) indicate superiority of 'Jata' in almost all the parameters except cocoon yield, which was more in Daba and Sukinda. The results on rearing performance (Tables 2 and 3) showed that the 'Jata' race behaved as bivoltine under *ex-situ* con-

Table 3. Performance of different characters of 'Jata' ecorace under *ex-situ* climatic conditions during 2nd season (September-November) rearing

Characters studied	<i>In-situ</i> (mean)	Oct-Nov. 2006 (<i>Ex-situ</i>)	Oct-Nov. 2007 (<i>Ex-situ</i>)	Deviation % from mean in 2006	Deviation % from mean in 2007	Year- year deviation (%)
Fecundity (no.)	300	209	201	30.33	33.0	3.82
Hatching %	90.00	65.24	52.83	37.51	41.30	19.02
Larval Wt. (g)	46.40	38.75	39.15	16.45	15.62	1.03
Larval duration (days)	33.00	38.60	39.50	16.96	19.69	2.33
Yield / dfl (no.)	17	49	43	188.23	152.94	12.24
Cocoon wt.(g)	13.50	10.99	10.45	18.71	22.70	4.91
Pupal wt. (g)	11.16	9.26	8.77	17.02	21.41	5.29
Shell wt (g)	2.36	1.62	1.68	31.35	28.81	3.70
Silk Ratio %	17.45	14.74	16.07	15.53	7.90	9.02

Table 4. Grainage efficiency of 'Jata' ecorace under *ex-situ* climatic conditions

Year	Season	Emergence (%)	Coupling (%)	Fecundity (no.)	Hatching (%)
2006	1st crop	67.54	82.45	210	58.00
2007	1st crop	69.66	85.71	216	47.03
	Average	68.60	84.08	213	52.51
2006	2nd crop	71.65	78.62	209	65.24
2007	2nd crop	81.55	89.57	201	52.83
	Average	76.60	84.09	205	59.03

Table 5. Rank of stabilization trend of 'Jata' for different characters in two seasons

Seasons (I & II)	Fecundity (no.)	Hatching %	Larval weight	Larval duration	Yield/ dfl	Cocoon weight	Pupal weight	Shell weight	Silk Ratio%
Season-I (Jul/Aug)	4	9	1	2	7	3	5	6	8
Season-II (Oct/Nov)	4	9	1	2	8	5	6	3	7

ditions and could be reared in both the seasons during 2006 and 2007. The performance levels of different rearing parameters of 'Jata' race under *in-situ*, *ex-situ* conditions and deviation percentage from *in-situ* mean values and year to year deviation percentage in seasons July/August and September/November of 2006 and 2007 were almost in similar trend but for their level of deviation. The grainage efficiencies in respect of four parameters studied (Table 4), the race 'Jata' shown consistent behavior during both the seasons of 2006 and 2007. The trend of stabilization sequence (Table 5) for rearing parameters was found similar for egg and larval characters and was varying for yield and cocoon characters in the two seasons i.e. July/August and September/ November.

Discussion

The superior cocoon characters of Jata race over Daba and Sukinda reveal its commercial and economic value and

need for its conservation as potential genetic resource. The stabilization and utilization of this race will support tasariculture in enhancing the cocoon production/productivity and the income of rearers. Any character of race which deviates little from its mean value under different conditions is said to be stabilized. Though, the ecorace 'Jata' was univoltine in *in-situ* condition, it behaved as bivoltine under *ex-situ* condition and rearings could be successfully conducted both during 1st crop (July/August) and 2nd crop (September/ November) seasons in two consecutive years (2006 and 2007). The rearing performances of first season differ from second season, which quite natural is being two rearings experience entirely different climatic conditions and as like any insect exhibit better performance with favorable environment. Being univoltine in nature the mean value of all the characters except yield in *in-situ* condition showed superior in comparison to *ex-situ* condition. However, under *ex-situ* condition the cocoon yield showed positive sign being 63 and 66 cocoons/dfl in 1st season (July/August, 2006 and 2007)

and 49 and 43 cocoons/dfi in 2nd season (September/November, 2006 and 2007), against the yield of 17 cocoons under *in-situ* condition. This indicates the positive tendency for acclimatization or stabilization of the 'Jata' ecorace to *ex-situ* conditions prevailed at Ranchi. The performance of rearings over two years with amenability to human handling unlike other wild ecoraces, indicate the acclimatization of 'Jata' race to the *ex-situ* conditions and the observations are in conformity with the findings of Sinha and Srivastava (2004) and Srivastava *et al.*, (2004). The stabilization trend in the two seasons (July/August and September/ November) was found almost similar for egg and larval characters i.e. Fecundity (4); hatching (9); larval weight (1); larval duration (2). However, for yield and cocoon characters i.e. Yield/dfi (7 and 8); cocoon weight (3 and 5); Pupal weight (5 and 6); shell weight (6 and 3) and SR% (8 and 7) the stabilization trend was found varying. The rank variation for shell weight i.e. silk content differ significantly being 6 in first season and 3 in second season followed by cocoon weight being 3 in first season and 5 in second season, indicates that the expression of cocoon and shell weights are greatly influenced by the change of season i.e. genotype and environment (G x E) interaction and the observations are in conformity with the findings of Srivastava *et al.*, (2004). The race registered an average value of 68.60% moth emergence, 84.08% couplings and 213 eggs fecundity and 52.51% hatching during first grainage of 2006 and 2007; where as in second grainage 76.60% emergence, 84.09% couplings, 205 eggs fecundity and 59.03% hatching were observed, indicating its consistency through stabilization over four continuous generations. The rearing performance and grainage efficiencies indicate the tendency of the 'Jata' ecorace towards acclimatization and stabilization to Ranchi climatic conditions.

The change in voltinism, synchronized grainage efficiency, consistent rearing performances and amenability to human handling in respect of 'Jata' ecorace under the environmental conditions of Ranchi, (Jharkhand) substantiate its *ex-situ* stabilization and utility prospects. Further, the race needs to be tested under different agro climatic conditions especially in potential tasar growing areas to obtain correct G x E interaction and to arrive at its adoptability levels.

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