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Basic Seed Stock Maintenance and Multiplication in Indian Tropical Tasar Silkworm *Antheraea mylitta* Drury-A Strategic Approach

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Daba ecorace of *Antheraea mylitta* Drury (Lepidoptera: Saturniidae), the semi domesticated Indian tropical tasar silkworm being reared outdoor; the egg and silk yields are dependent of genotype environment interaction. The insufficient maintenance and multiplication of its P4 seed stock need a coherent as well as scientific strategy to safeguard breed potential, being commercially applied ecorace. The sort-out lines of P4 stock studied over five generations highlighting on commercial trait up gradation suits for a tropical crop season, revealed enhanced performance. The line with high pupal parents (T2) shown improved fecundity (12.9%) and the line with high shell parents (T3) recorded higher shell weight (40.0%) and silk ratio (24.1%). While, the line of high pupal female and high shell male (T4) reveal enhancement in fecundity (9.0%), egg hatching (14.1%), shell weight (50.0%), silk ratio (35.2%) and absolute silk yield (52.0%) indicating the need and role of varied basic seed stock lines. The approach could improve economically vital egg fecundity and cocoon shell weights besides balancing them in same line for commercial operation. The progressive show of lines (T1 to T4) along successive generations (G1 to G5), in spite of passing through seed crop (Jul-Aug) and commercial crop (Sep-Nov) seasons emphasize their compatibility. The study infers that the strategic plan of combining preferred parental phenotypes, methodical selection for desired commercial trait(s) through generations with best possible genotype environment interaction has enriched P4 stock with elevation in needy trait(s) besides assuring choice of suitable lines for seasons and regions and timely replenishment of basic seed of Daba ecorace.

Key words: *Antheraea mylitta*, P4 seed, Basic seed, Stock maintenance, Stock replenishment

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Introduction

The Indian tropical tasar silkworm, *Antheraea mylitta* Drury (Lepidoptera: Saturniidae) is an wild sericigenous polyphagous insect of commercial importance, primarily feeds on nature grown *Shorea robusta* (Sal), *Terminalia tomentosa* (Asan) and *Terminalia arjuna* (Arjun) besides, secondary food plants like *Anogeissus latifolia*, *Zizyphus jujube*, *Terminalia catappa*, *Terminalia belerica* and *Madhuca indica* (Suryanarayana *et al*., 2005). Over generations the species adapted to different environments and forty four ecoraces have been recognized in tropical India with significant phenotypic and behavioral variations (Suryanarayana and Srivastava, 2005). The Raily from Chhattisgarh, Modal from Orissa, Sarihan and Laria from Jharkhand, Bhandara local from Maharashtra and Andhra local from Andhra Pradesh are some of the wild ecoraces contributing for major tasar raw silk production. The Daba, a bi and trivoltine from Singhbhum of Jharkhand state and Sukinda, a trivoltine from Sukindagarh of Orissa state were exploited commercially and in need of systematic basic seed support. The continuous rearings in tropical sericulture with repeated and unplanned multiplication leads to inbreeding depression and loss of breed vigor (Bhat *et al*., 1996). The prolonged inbreeding and continuous multiplication of basic seed of Muga silkworm by P4 units leads to poor yield and genetic drift and its systematic maintenance is of immediate importance (Sahu *et al.*, 1997; Senapati *et al.*, 2001). The primary aim of breeding should be to combine productivity and adaption and it is imperative to select productivity in adapted breed and adaption in a productive breed. Also, the selection of parental breeds/races should be based on region, season and commercial requirement (Mulder and Bijma, 2005; Munoz *et al.*, 2004; Raju, 1999; Sinha and Sinha, 1994). Different types of mating systems can balance the desired traits in selected race and target of such stock maintenance is to be for high egg recovery, easy rearing and egg handling followed by high cocoon and silk yield (Yamaguchi, 2001). The basic stock maintenance is necessary to retain the parental characters and source for further multiplication and breeding (Benchamin, 2002; Datta *et al.*, 1996). Due to continuous use of same ecoraces since long time there is gradual erosion of commercial characters and it is essential that one way multiplication of three tier system (P3, P2 and P1) from Breeder's stock (P4) is essential to maintain the breeds true to its characters and also for their successful economic exploitation. Race maintenance, selection methods, crossing techniques, understanding of ecological requirements during different processing steps has great influence on commercial seed quality and viability (Jong and Bijma, 2002; Kumar *et al.*, 2008; Malik and Reddy, 2007; Singh *et al.*, 1994). The seed cocoon preservation is vital for both quantitative and qualitative reproductive success (Nayak *et al.*, 2000) and the sound seed organization system is for upliftment of silk industry (Thangavelu, 2002). The different components involved in present system of tasar seed multiplication could not function as per desired model and the seed stocks are not being replenished periodically by breeder's stock, which are essential for quantitative and qualitative expansion of tasarculture. Apropos above, the strategic and scientific approach to maintain optimal vigor of commercially exploited Daba ecorace and its basic stock maintenance and multiplication to meet the quality needs of commercial tropical tasar seed production is the aim of present study.

Materials and Methods

Cocoon assessment and preservation

The stabilized cocoon stocks of Daba ecorace of *Antheraea mylitta* obtained from reserve pool of Central Tasar Research and Training Institute, Ranchi were used for the study. The cocoons were assessed for pupal weights, shell weights and pupal sexing to segregate high pupal weight and high shell weight groups with both sexes; while the other as high pupal female and high shell male group in addition to a mixed group of cocoons without any selection. The said seed cocoons of four varied groups were maintained separately in tasar grainage house following integrated package of tasar seed cocoon preservation (Narain *et al.*, 2001).

Grainage operation and preparation of Dfls

The disease free layings (Dfls) of Daba ecorace for varied lines are prepared using integrated package of tasar silkworm seed production (Narain *et al.*, 2001) by crossing parents based on pupal and shell weights with high pupal female x high pupal male as **T2** (P×P), high shell female ×high shell male as **T3** (S×S) and high pupal female× high shell male as **T4** (P×S) along with random female× random male, the control as **T1**. The cocoon stocks of subsequent progenies of said four lines (T1 to T4) were maintained separately and prepared Dfls during Sep/Nov '06, Jul/Aug '07, Sep/Nov '07 and Jul/Aug '08 following integrated package of tasar silkworm seed production to continue the stocks of different lines.

Silkworm rearing and cocoon production

The Dfls prepared under four lines of Daba ecorace were reared following integrated tasar silkworm rearing package (Narain *et al.*, 2004) successively for five generations during Jul/Aug '06 (**G1**), Sep/Nov '06 (**G2**), Jul/Aug '07 (**G3**), Sep/Nov '07 (**G4**) and Jul/Aug '08 (**G5**). The cocoons produced under four varied lines of each generation were utilized to continue their progenies successively from G1 in Jul/Aug '06 to G5 in Jul/Aug '08.

During the course of stock maintenance and multiplication the parental cocoons were considered based on better fecundity and egg hatching percentage, period of larval spinning, uniform shape and color of cocoons, better pupal weight, shell weight, silk ratio percentage and higher absolute silk yields in addition to pupal and shell weights for different lines. Three replications have been maintained in each line (treatments T1 to T4) considering larvae of one Dfl as one replication during all rearing seasons (generations G1 to G5) and observations were recorded for fecundity (FEC), egg hatching percentage (HAT), effective rate of rearing (ERR), cocoon yield/Dfl (YLD), single cocoon weight (SCW), single pupal weight (SPW), single shell weight (SSW), silk ratio percentage (SRP) and absolute silk yield (AYD). The data recorded on different parameters in the study were subjected to statistical analysis.

Results

Assessment of performance and morphometric particulars

The results on particulars and performance potential of Daba ecorace under *in-situ* conditions (Table 1) indicate

Table 1. Particulars and performance potential of Daba ecorace under *in-situ* conditions

Place of origin	Singhbhum (Jharkhand)	Cocoon length (cm)	4.85-5.21
Altitude (AMSL)	500'	Cocoon width (cm)	2.95-3.17
Place of use/practice	All tasar producing states	Cocoon volume (cc)	26.70-32.24
Food plants	*Terminalia species*	Cocoon weight (g)	09.20-12.83
Voltinism	Bi & Trivoltine	Pupal weight (g)	07.72-10.33
Cocoon availability	Silkworm rearing	Shell weight (g)	1.25-2.36
Level of adaptability	Wider adaptability	Silk ratio (%)	14.13-16.28
Pre dominant cocoon color	Grey	Silk yield/1000 cocoons (g)	812-1417
Fecundity (no.)	180-280	Silk recovery (%)	52-71
Hatching (%)	80-90	Silk filament length (m)	475-1240
Cocoon yield/dfl (no.)	45-70	Non-breakable filament length (m)	79-475
Peduncle length (cm)	3.51-6.83	Denier (d)	9-11

Table 2. ANOVA for commercial traits of Daba ecorace over treatments and generations

SOURCE		MEAN SUM OF SQUARES								
Variation factors	DF	FEC	HAT	ERR	YLD	SCW	SPW	SSW	SRP	AYD
Replicates	2	119	28	23	22	0.4	0.3	0.03	1.2	46
Treatments (T)	3	3658***	530***	208***	1062***	0.25*	0.29**	0.54***	39***	4282***
Generations (G)	4	327 NS	165***	380***	988***	4.9***	2.4***	0.68***	28***	1394***
T vs G	12	288 NS	38***	32**	131***	0.07 NS	0.06 NS	0.05***	3.9***	601***
Error	38	157	8.6	11	31	0.07	0.06	0.01	0.56	62
Total	59	372	52	50	168	0.43	0.24	0.09	5.1	476

FEC: Fecundity (no.); HAT: Hatching (%); ERR: Effective rate of rearing (%); YLD: Cocoon yield/Dfl (no.); SCW: Single cocoon weight (g); SPW: Single pupal weight (g); SSW: Single shell weight (g); SRP: Silk ratio (%); AYD: Absolute silk yield (g) *Significant at 5%; **Significant at 1%; ***Significant at 0.1%; NS: Non significant

its wider adaptability and rearing areas, varied voltinism, better egg hatching and cocoon yields in spite of its origin from Singhbhum area of Jharkhand state, India. The results on morphometric, commercial and post cocoon characters also show wider range of performance of Daba ecorace under different *in-situ* conditions by way of adaptation. The ANOVA (Table 2) for nine commercial traits of Daba ecorace among four treatments viz., **T1**-control, **T2**-high pupal female x high pupal male, **T3**-high shell female x high shell male, **T4**-high pupal female x high shell male and five successive generations viz., **G1**-Jul/Aug, 06, **G2**-Sep/Nov, 06, **G3**-Jul/Aug, 07, **G4**-Sep/Nov, 07, **G5**-Jul/Aug, 08 indicates that the variance was significant (0.1% to 5% levels) except for fecundity among generations; fecundity, single cocoon and pupal weights among treatments verses generations, which were non-significant.

Studies on varied treatments

The impact of parental selection on commercial traits of Daba ecorace as varied treatments (Table 3) found significant at 5% level with maximum improvement in fecundity (12.9%) and Pupal weight (9.5%) in **T2**, maximum egg hatching (14.1%), shell weight (50%), silk ratio (35.2%), absolute silk yield (52%) in **T4** in addition to retain the level of cocoon yield as of **T1**. The performance of **T3** was moderate, though it out do **T2** in egg hatching (7.5%), cocoon weight (12.8%), shell weight (40%), silk ratio (24.1%) and absolute silk yield (11.6%), it was less in fecundity and pupal weight. However, the performances of both treatments, **T2** and **T3** are inferior to **T4** in all traits except for fecundity of **T2**.

Studies through different generations

The impact of different generations on commercial traits of Daba ecorace (Table 4) was found significant except in fecundity, though it improved marginally over generations. The data indicate improvement in all parameters over first generation (**G1**), except for ERR which was negative in all generations and cocoon yield was negative up to fourth generation (**G4**) but for its improvement in fifth generation (**G5**). The improvement of cocoon characters were better in generations of commercial crop seasons (**G2** and **G4**) over the generations of seed crop seasons (**G3** and **G5**) as well as over the first generation (**G1**).

Table 3. Impact of parental selection on commercial traits of Daba ecorace (values represents mean, ±SE and percent change over control –T1)

FACTORS		FEC	HAT	ERR	YLD	SCW	SPW	SSW	SRP	AYD
Treatments	T1	255±4.1	58.3±1.7	32.9±2.0	49.3±2.9	9.4±0.1	8.4±0.1	1.0±0.0	10.8±0.1	50.0±3.0
T1=control T2=High pupal female × high pupal male	T2	288±4.9 +12.9	54.7±0.9 –6.2	21.9±2.0 –33.4	34.4±3.1 –30.2	10.3±0.2 +9.6	9.2±0.1 +9.5	1.1±0.04 +10.0	10.8±0.3 –0	37.1±2.6 –25.8
T3=High shell female × high shell male	T3	260±2.9 +1.9	62.7±1.3 +7.5	24.5±1.8 –25.5	40.4±3.1 –18.1	10.6±0.2 +12.8	9.1±0.1 +8.3	1.4±0.06 +40.0	13.4±0.4 +24.1	55.8±3.9 +11.6
T4=High pupal female × high shell male	T4	278±3.5 +9.0	66.5±1.6 +14.1	27.8±1.8 –15.5	49.6±3.2 +0.6	10.6±0.2 +12.8	8.9±0.1 +6.0	1.5±0.1 +50.0	14.6±0.7 +35.2	76.0±6.2 +52.0
CD at 5%		9.3	2.2	2.5	4.1	0.20	0.19	0.07	0.55	5.8

FEC: Fecundity (no.); HAT: Hatching (%); ERR: Effective rate of rearing (%); YLD: Cocoon yield/Dfl (no.); SCW: Single cocoon weight (g); SPW: Single pupal weight (g); SSW: Single shell weight (g); SRP: Silk ratio (%); AYD: Absolute silk yield (g)

Table 4. Impact of generations on commercial traits of Daba ecorace (values represents mean, ±SE and percent change over first generation-G1)

FACTORS		FEC	HAT	ERR	YLD	SCW	SPW	SSW	SRP	AYD
	G1	255±4.1	58.3±1.7	32.9±2.0	49.3±2.9	9.4±0.1	8.4±0.1	1.0±0.0	10.8±0.1	50.0±3.0
Generations	G2	268±5.2 +5.1	62.1±1.8 +6.5	18.1±2.0 –45.0	30.3±3.7 –38.5	10.9±0.1 +15.9	9.3±0.11 +10.7	1.5±0.07 +50.0	14.4±0.6 +33.3	50.5±6.8 +1.0
G1 = July/August ’06 G2 = Sept/Nov ’06	G3	274±7.5 +7.4	61.2±2.2 +5.0	25.6±1.5 –22.2	42.8±3.2 –13.2	10.8±0.1 +14.9	9.4±0.08 +11.9	1.3±0.05 +30.0	12.0±0.4 +11.1	53.8±4.2 +7.6
G3 = July/August ’07 G4 = Sept/Nov ’07	G4	273±5.3 +7.1	65.3±2.1 +12.0	24.7±1.6 –24.9	43.8±3.6 –11.2	11.0±0.1 +17.0	9.4±0.08 +11.9	1.5±0.09 +50.0	14.2±0.8 +31.5	70.9±8.6 +41.8
G5 = July/August ’08	G5	275±5.3 +7.8	67.9±2.3 +16.5	29.7±1.1 –9.7	53.9±2.7 +9.3	10.5±0.1 +11.7	9.1±0.08 +8.3	1.3±0.06 +30.0	12.4±0.5 +14.8	70.9±5.5 +41.8
CD at 5%		NS	2.4	2.7	4.6	0.22	0.21	0.07	0.62	6.5

FEC: Fecundity (no.); HAT: Hatching (%); ERR: Effective rate of rearing (%); YLD: Cocoon yield/Dfl (no.); SCW: Single cocoon weight (g); SPW: Single pupal weight (g); SSW: Single shell weight (g); SRP: Silk ratio (%); AYD: Absolute silk yield (g)

Studies on performance of treatments versus generations

The impact on performance level of Daba ecorace in commercial traits under different treatments verses generations and generations verses treatments (Table 5) indicate their significance at 5% level except for fecundity, single cocoon and single pupal weights as against their respective controls of **T1×G1** to **T4×G1** in treatments verses generations and vice versa.

Discussion

The performance levels of Daba ecorace clearly indicate its commercial potential and wider adaptability to varied tasar producing locations, also by changing its voltinism. Though, there are forty four ecoraces of tasar silkworm, *Antheraea mylitta*, only Daba and Sukinda ecoraces are being used for commercial rearings for their amenability to human handling during rearings and seed production operations. The performance of Daba ecorace was mixed and comparatively inferior under commercial rearings than its *in-situ* habitat, which is common exposition of ecoraces under *ex-situ* habitats and however, on systematic maintenance and multiplication they regain their original status of performance potential. For the reason, one way of four tier maintenance system of basic (breeder’s/nucleus/reproductive) seed has been recommended in all breeds of sericulture including tasarculture. However, the different voltinism, inevitable exposure to huge variations of outside rearing climate, pupal diapause and subsequent erratic grainage behavior with unforeseen disease out breaks hampers the proposed stock maintenance and multiplication system to a major extent.

To minimize and overcome said problems to the extent possible, an attempt made through systematic and scientific approach of ecorace maintenance over five successive generations find positive results. The ANOVA for nine commercial parameters among the treatments, generations; and treatments verses generations specify the

Table 5. Impact on performance levels of treatments verses generations in commercial traits of Daba ecorace (values represents mean and ±SE)

FACTORS		FEC	HAT	ERR	YLD	SCW	SPW	SSW	SRP	AYD
Treatments vs	T1×G1, to T4×G1 (C)	255±4.1	58.3±1.7	32.9±2.0	49.3±2.9	9.4±0.1	8.4±0.1	1.0±0.0	10.8±0.1	50.0±3.0
Generations	T1×G2	250±7.4	68.6±1.1	28.6±2.2	49.0±3.5	11.2±0.2	9.6±0.2	1.5±0.0	13.5±0.3	73.5±5.2
	T1×G3	253±12.0	68.4±0.9	30.6±2.6	53.3±5.9	10.7±0.2	9.5±0.1	1.2±0.03	11.7±0.3	65.9±6.1
	T1×G4	260±2.0	71.2±1.2	29.1±1.6	53.3±2.0	11.3±0.1	9.7±0.1	1.5±0.03	13.7±0.4	81.9±4.8
FEC: Fecundity (no.)	T1×G5	257±4.0	73.4±1.3	31.1±1.3	58.6±4.3	10.4±0.1	9.2±0.2	1.1±0.03	11.2±0.5	68.2±3.5
HAT: Hatching (%)	T2×G2	286±5.0	54.3±2.4	11.7±0.9	18.0±1.0	10.5±0.3	9.3±0.3	1.2±0.03	12.1±0.4	23.0±0.6
ERR: Effective rate of rearing (%)	T2×G3	309±10.0	50.6±1.7	19.8±0.8	30.6±1.2	10.7±0.2	9.6±0.2	1.1±0.06	10.0±0.2	32.8±1.1
YLD: Cocoon yield/	T2×G4	295±6.4	54.5±1.1	19.1±1.5	30.6±2.6	10.6±0.3	9.4±0.2	1.1±0.1	10.8±0.8	34.6±0.9
Dfl (no.)	T2×G5	287±8.2	55.7±2.0	26.1±2.3	41.6±3.3	10.3±0.2	9.2±0.1	1.1±0.1	10.6±0.7	45.3±0.2
SCW: Single cocoon	T3×G2	257±5.5	59.8±1.2	14.9±0.9	23.3±2.8	11.0±0.1	9.4±0.1	1.6±0.0	14.7±0.2	37.7±4.9
weight (g)	T3×G3	262±9.4	61.7±3.9	24.6±2.0	40.0±4.0	10.7±0.1	9.2±0.1	1.4±0.03	13.1±0.3	55.8±4.9
SPW: Single pupal weight (g)	T3×G4	256±5.9	65.1±0.7	20.7±0.7	34.6±1.2	11.1±0.1	9.4±0.03	1.6±0.07	14.8±0.4	57.2±3.8
SSW: Single shell	T3×G5	261±3.7	68.8±0.9	29.4±0.8	53.0±1.5	10.6±0.1	9.2±0.1	1.5±0.06	13.8±0.3	78.4±4.5
weight (g)	T4×G2	278±5.8	65.6±2.3	16.9±0.9	31.0±3.5	10.9±0.1	9.0±0.1	1.9±0.06	17.2±0.5	67.8±10.0
SRP: Silk ratio (%)	T4×G3	273±4.3	64.2±1.1	27.1±3.4	47.3±5.8	10.8±0.3	9.4±0.2	1.5±0.06	13.4±0.3	60.6±2.0
AYD: Absolute silk	T4×G4	283±4.0	70.4±1.2	29.8±2.5	56.3±4.5	11.1±0.1	9.1±0.03	1.9±0.09	17.7±0.7	110.0±5.1
yield (g)	T4×G5	294±4.0	73.7±2.6	32.0±3.4	62.3±2.0	10.4±0.2	8.9±0.2	1.4±0.07	14.0±0.8	91.8±7.2
CD at 5%		NS	4.9	5.5	9.2	NS	NS	0.15	1.2	13.0

role of parental selection over generations, systematic stock maintenance, role of generations in retaining or improving desired characters in the race along with positive interaction between treatments and generations. However, the non significant variation in respect of fecundity among generations and cocoon and pupal weights and fecundity among treatments verses generations; indicate the impact of parental selection with specific characters over continuous generations along with treatment generation compatibility (Raju, 1999; Singh *et al*., 1994; Sinha and Sinha, 1994; Yamaguchi, 2001).

The levels of performance average among different treatments of varied parents found interesting compared to control T1, i.e. parents randomly mated without selection, with their deviation on either way in the traits studied. Particularly, the positive deviation of fecundity in T2 i.e. parents mated among high pupal weights indicates the need for different lines to improve a particular trait of economic importance (Ghosh *et al*., 1996; Raju, 1999; Singh *et al*., 1994), which is presently lacking in commercial tasarculture. While rearing such separate lines, considerable cocoon quantities are to be maintained for implementing effective selection pressure on desired trait and to have batches of disease freeness. Also, different types of mating systems will balance desired traits in selected race and target of such stock maintenance is to be for high egg recovery with better hatching followed by high cocoon and silk yield (Yamaguchi, 2001). Same way, the other treatments T3 i.e. parents mated among high shell weights and T4 i.e. parents mated among high pupal female and high shell male, could clearly influence the related traits like cocoon weight, shell weight and silk ratio in T3 and all the traits except for fecundity in T4. The said positive deviation in commercial traits among different treatments, in spite of their beginning from same parental stock, clearly indicate the role of systematic parental selection at every stage of silkworm rearing, grainage activities over generations to improve breed with desirable characters. However, tasarculture need diverse lines as it faces different crop seasons i.e. seed (Jul-Aug) and Commercial (Sep-Nov) in an year with simultaneous emergence, coupling and egg laying of non diapause destined cocoons generated under seed crop unlike undergoing long period of 6~7 months of hibernation of diapause destined cocoons generated under commercial crop. Also, the cocoons of seed crop are with thin shell and less silk content and cocoons of commercial crop are with thick shell and high silk content have specific commercial importance of seed and silk emphasizes the need for maintenance and multiplication of all possible and suitable lines at basic seed level.

Phenotype is the combined produce of genotype and environment (Jong and Bijma, 2002; Mulder and Bijma, 2005; Munoz *et al*., 2004; Zhao *et al*., 2007) and tasarculture being an outdoor practice and providing required environment is not under control, it will be more logical to evolve a race or breed performs comparatively better in foreseen seasons. Environmental conditions have a great influence on effectiveness of selection, so do selections that take advantage of season's different characteristics (Kumar *et al.*, 2008; Mulder and Bijma, 2005; Munoz *et al.*, 2004). In commercial rearing season, selection of quantitative characters such as cocoon weight and filament length should be stressed because of favorable weather, feed and lengthy feeding period of larvae (Jong and Bijma, 2002). While in seed crop rearing season, temperature and humidity fluctuates highly like quality of feed, the priority should be given to additional fecundity with better egg hatching so to provide more population to compensate larval loss (Zhao *et al.*, 2007). The positive improvement of different lines over five successive generations indicate their attachment and interactions with respective seasons and generations with clear cut trait wise performances or deviations. The improvement in fecundity along with egg hatching found very encouraging, as these traits together can contribute considerably towards number of brushed larvae, which was all along a persistent problem in tasarculture. This is a clear forecast for improving cocoon yield, in spite of larval loss with fluctuating environment and lower effective rate of rearings (ERRs). The absolute silk yield, main parameter of economic importance of tasar growers, and its improvement at G5, in spite of generation being seed crop season could compete with commercial crop season of G4. This is one of the salient impacts of systematic multiplication of tasar basic seed and could happen with contribution of every other associated trait from fecundity, egg hatching percentage, ERR and cocoon yield to shell weight (Sinha *et al.*, 2001). Hence, maintenance of host plantation with optimal packages to provide quality feed, disease free and viable seed (Dfls) besides using appropriate disease control measures for hygienic rearing environment along with supervision of trained technical and scientific personnel are the other vital requisites for tasar basic seed operation.

As performance of ecoraces varies with regions and seasons, the maintenance and multiplication of basic seed under different tasar growing locations will enhance overall productivity of the country besides replenishment of breeder's stock within the time schedule. The individual treatment wise interactions with each generation and individual generation impact on each treatment on common controls of T1xG1 to T4xG1 indicate the deviations on performance of different commercial traits of Daba ecorace. The levels of deviation in traits were found minimum in control (T1) compared to other treatments (T2, T3 and T4) indicating the role of parents selected over generations in positively modifying the breed in desired direction. The fecundity level in T2 has improved from 257 in G1 to 287 in G5, with highest of 309 eggs in third generation (G3) emphasizing the contribution role of high pupal parent in enhancing fecundity (Ghosh *et al.*, 1996; Singh *et al.*, 1994). However, the levels of egg hatching were in decreasing trend in spite of improving fecundity is of great economic concern. Interestingly, the fecundity levels remained unchanged in T3, while the levels of egg hatching were improved over generations. However, while selecting the parents, selection pressure has been specified uniformly on the traits studied for all treatments throughout five generations. The positive deviation in shell weight, ERR and cocoon yield was minimum in T2, reflecting same trend in absolute silk yield, which has nullified fecundity improvement and the trend was vice versa in T3, where the absolute silk yield (78.4 g), improved over T2 in spite of non improvement in fecundity (261). But in T4, where in parents are mixture of high pupal and high shell weights, the improvement in fecundity, egg hatching, cocoon yield and shell weight contributed for highest absolute silk yield (91.8 g) in spite of marginally negative ERR. The deviation of cocoon and pupal weights are insignificant in all treatments and generations indicates the combined impact of seasons of the generation, parental selection in treatments and the extent of selection pressure induced at every stage of experiment. Though, said deviation is insignificant in crop seasons, it found uniform in all treatments over generations. The highest silk ratio percentage (17.7) recorded in T4 at G4 was due to significant improvement of single shell weight (1.9 g) with least change in cocoon weight and the highest absolute silk yield in T4 at G4 (110 g) and G5 (91.8 g) levels was due to overall influence of fecundity, egg hatching, cocoon yield and shell weight with retained level of ERR. This indicate the importance of systematic and scientific method of basic seed maintenance and multiplication of ecorace along with interactions of parental selection in treatments, imposed selection pressure on economic traits at every stage and continued multiplication of breed through five generations, G1 to G5.

The maintenance and multiplication of basic seed stock of Daba ecorace under different parental lines over varied rearing seasons and regions can open avenues for choice of appropriate and suitable line for optimal exploitation of commercial cocoon production and productivity. It further supports to overcome unforeseen exigencies due to environmental vagaries and disease out breaks for planned and timely replenishment of basic breeder's seed down the line from P4 to P1. The study infers that the systematic selection pressure through generations, genetic combination with selected parents and genetic gain of desired traits in the direction wanted with optimal genotype environment interactions could be achieved in tasar ecorace Daba through a strategic plan of basic seed maintenance and multiplication.

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