Evaluation of Tasar elite seed Rearing performance under Replenishment program

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Abstract: Tasar silk sector qualifies as one of the most appropriate agro based cottage industry which provides employment to tribal youth. Tasar culture activity is essentially an agro and forest based industry which covers both agricultural and industrial activity. The activities covers production of egg, cultivation of host plants, silkworm rearing and cocoon production. Tasar silkworm rearing is a traditional activity of tribal's in forest dwellings of Andhra Pradesh, Telangana, Bihar, Chhattisgarh, Jharkhand, Madhya Pradesh, Orissa and West Bengal extending to the fringes of Uttar Pradesh and Maharashtra. To ensure the production of quality tasar seed and their supply to the tribal farmers, Central silk Board has established Basic Tasar Silkworm Seed Organization (BTSSO) under which Central Tasar Silkworm Seed Station (CTSSS) is working for production of elite seed (P3). Further under BTSSO, Basic Seed Multiplication and Training Centers (BSMTC's) were established in tropical areas of the country for rearing of elite seed and production of nucleus and basic seed. In the present paper the rearing performance of Daba Bivoltine (DBV) and Daba Trivoltine (DTV) pertaining to the elite seed supplied by CTSSS to various BSMTC's located in different states is compiled, analyzed and discussed.

Introduction

Indian tasar industry has a long heritage and is inseparably interwoven with traditional livelihood of tribals of Jharkhand, Bihar, Chhattisgarh, Madhya Pradesh, Orissa, Andhra Pradesh, Telangana, Maharashtra, West Bengal and Uttar Pradesh. The tasar industry by its nature is a cluster of many non-farm and on-farm activities and has a strong need for many forward and backward linkages. It has been contributing towards the socio-economic up-liftment of rural poor, especially tribes who otherwise occupy the status of people below poverty line. Because of its potential in harbouring gainful rural employment, tasar culture is an effective tool for raising tribal economy and promoting cottage industry. Tasar industry is a backbone for tribal development, the Government of India and respective state Governments have initiated several developmental and welfare measures for the tribals through tasar culture. It is a way of life for various tribes and forest dwellers. About 1.25 lakh tribal families' area associated with tasar culture in the country. In recent years, the tasar industry has acquired a big role in improving socio-economic status.

Tasar silkworm rearing is a traditional activity of tribal's inhabitating the central – southern plateau region including the dense humid forest areas. The consumption of leaf by silkworm during final instar accounts for more than 80% of the total consumption during its larval life. Food consumed in this stage is effectively utilized for the production of silk protein as well as to support its metabolism (1, 2). Due to thinning of forests, the diversity and density of Tasar food plants has reduced considerably. Tasar silk includes tropical tasar and oak tasar Tasar silkworm (*Antheraea mylitta* D.) is wild in nature and mainly feeds on leaves of *Terminalia arjuna* (Arjun), *T. tomentosa* (Asan) and *Shorea robusta* (Sal) respectively. The genus Terminalia is extensively distributed in the tropical forests all over India. It is of immense economic importance in various industries like sericulture, pharmaceutical, timber, paper, soap, food, fodder, fuel, etc. In North-west conditions, *Antheraea proyeli* is exploited for production of oak tasar. The oak tasar culture has got substantial employment and income generation potential for the women folk living on the hills, with an edge on conservation of the eco-system and biodiversity.

In Tasar industry, production of quality seed is one of the most challenging tasks, a systematic and methodological approach of silkworm seed production is required to sort out the problems which in turn leads to higher production of cocoons. The tropical Tasar silkworm is wild in nature and it undergoes pupal diapauses. The diapauses period is dependent upon the voltinism, regulation and emergence patterns are greatly influenced by abiotic factors thereby making the task

of conducting successful grainage is of complicated in nature. The diapause nature of pupae, outdoor nature of rearing coupled with changing climatic conditions results into pupal mortality, erratic and un-seasonal emergence during preservation and unsynchronized moth emergence, prolonged emergence duration, low mating percent, low fecundity and poor hatching together with extended duration of egg laying and hatching thereby causing loss of valuable seed material. Keeping these constraints, Central Silk Board has streamlined and established the Basic Tasar Silkworm Seed organization under which different Basic Seed Multiplication and Training Centers (BSMTC's) to meet the requirement of tribal farmers in different states. Further, Central Tasar Silkworm Seed Station (CTSSS) was also established for production of elite seed (P3).

Materials and Methods

The elite Tasar silkworm seed (P3) is being supplied by Central Tasar Silkworm Seed Station (CTSSS), Kota, Central Silk Board, Govt. of India, Chhattisgarh to various Basic Seed Multiplication and Training Centers (BSM&TC's) under replenishment programme. This is the only unit to prepare quality P3 tasar silkworm seed and their supply to BSM&TC's and these units are conducting the rearing of elite seed, multiplication and production of the nucleus and basic tasar Dfls. During the preparation of quality Dfls, all the technical precautions were ensured including methodological mother moth examination to detect any pebrine disease. As per the action plan, the elite seed of Daba bivoltine (DBV) was supplied during 2^{nd} crop and Daba Trivoltine (DTV) for 3^{rd} crop. DBV and DTV are characterized by large size shell with short peduncle, weights 10 – 14g, shell weight 1.5 – 2.0 g and medium denier filament. At each of the center, on the day of hatching tasar silkworms were brushed on well maintained *Terminalia arjuna* (Arjun) and Terminalia *tomentosa* (Asan) plants and rearing was conducted following the standard rearing practices.

In the present paper, data pertaining to rearing performance of elite tasar silkworm seed during the years 2012 – 13, 2013 – 14 and 2014 – 15 of Daba eco-race of Bivoltine (DBV) and Tirvoltine (DTV) was collected from all the BSMTC's located in Orissa, Jharkhand, Bihar, Chhattisgarh, Madhya Pradesh, Andhra Pradesh, Telangana, West Bengal, Uttar Pradesh and Maharashtra. The data thus collected compiled and analyzed for evaluation of the performance at each of the BSM&TC for DBV and DTV respectively.

Results and Discussion

Mean data pertaining to the Tasar silkworm rearing performance of elite seed at different BSM&TC's during the years 2012 – 13, 2013 – 14 and 2014 – 15 of Daba eco-race of Bivoltine (DBV) and Tirvoltine (DTV) was collected, compiled and presented Table 1 & 2 respectively. The perusal of data of DBV indicates (Table 1) that maximum number of Dfls were reared at Keonjhar (1050) followed by Balaghat (1000). With regard to the hatching %, maximum was recorded at Bastar (91 %) and minimum of 80% was at Bhandara. Highest number of cocoon yield / Dfl was harvested (Fig. 1) at Nabrangpur (77) and the reasons could be attributed to completely isolated area where chance of disease contamination may be low and minimum at RC Varam (19) due to coastal area and prevailing of high temperature and humidity. With regard to maximum cocoon weight was recorded at Bhagalpur (13.487 g) and minimum at Boirdadar (10.575) with an average of 11.824 g. The Shell weight (g) was ranged to a maximum of 2.030 g (Ambikapur) and minimum of 1.325 g (Bhandara) where as with regard to Shell Ratio (%) the data reveals that maximum of 17.89 % was recorded at Ambikapur and minimum of 11.97 % at Nabrangpur (Fig. 3).

The perusal of data of DTV indicates (Table 2) that maximum number of Dfls were reared at Sundargarh (1070) and lowest at Balaghat (600). With regard to the hatching %, maximum was recorded at Bastar (92 %) and lowest at Bilaspur (85%). Highest number of cocoon yield / Dfl was harvested (Fig. 2) at Balaghat (97) as the area is demarcated as DTV zone and minimum at RC Varam (34) due to coastal area and prevailing of high temperature and humidity. With regard to maximum cocoon weight was recorded at Balaghat (12.52 g) due to rearing conducted on well maintained *T. tomentosa* (Asan) and minimum at Boirdadar (9.46) due to the area under plantation is polluted due to rapid growth of industrialization with an average of 10.867 g. The Shell weight (g) was ranged to a maximum of 1.61 g (Narsapur) and minimum of 1.10 g (Bhandara) where as with regard to Shell Ratio (%), the data reveals that maximum of 15.75 % was recorded at Narsapur and minimum of 10.09 % at Nabrangpur (Fig. 4.).

Production of quality tasar seed is one of the most challenging tasks of tasar silk industry at base level. A systematic and methodological approach of silkworm seed production is required to sort out the problems during the preparation of quality seed. Tropical tasar *Antheraea mylitta*

is wild sericigenous insect of commercial importance of tropical India. The distribution of tasar silkworm in the Indian sub-continent is wide ranging between $10^{0\ to}\ 32^{0}$ N latitude and 76^{0} to 93^{0} E longitudes and it experiences varied environmental conditions. Foraging of silkworm on variety of food plants, annual precipitations, day length, plant succession and factors like latitude, longitude, the altitude of different areas lead to expression of wide variations in phenotypic, physiological and behavioural traits resulted in formation of eco-races (3) and even in the present study results are corroborating the findings. Under adverse environmental conditions it undergoes pupal diapauses and shows different type of voltinism. At higher latitudes it behaves as univoltine, at mid-latitudes it behaves as bivoltine or trivoltine and low latitude it behaves as trivoltine or multivoltine. This voltinism is modified in isolated conditions, depending upon the altitude of place (4). Though, the *A. mylitta* has wide gentic as well as phenotypic variability in its population, also a good material for the exploitation of heterosis, besides it has many constraints in silkworm hybridizations (5). The genotype – environment interaction associated with host plant quality has highly significant influence on the fecundity and other quantitative and qualitative parameters (6). Since, tropical tasar silkworm, *A. mylitta* is under commercial exploitation in the country, it has to be maintained by ensuring the racial traits (7). Season specific performance of Tasar silkworms on commercial cocoon traits were studied (8, 9). The main thrust of tasar seed production rested on the multiplication chain involving the BSM&TCs for which elite seed is being supplied by CTSSS. However the concept of seed rearer and private graineures has opened new dimensions for production of commercial tasar seed in private sector. The total sericulture industry revolves round the seed sector and the quality seed is vital aspects in tasar silk industry.

Tasar silkworm growth and subsequent cocoon production are normally influenced by the breed, feed and the rearing environment. The Tasar silkworm rearing being an outdoor practice mostly on nature grown food plants, the success of the crop go with breed engaged for rearing (7, 10) and in the present results are also confirming the findings. The amount of consumption and utilization of food are very important factors for determining the nutritional aspects of the phytophagous larvae. For instance, poor growth may not be due to the nutritional adequacy of the diet but, a low rate of intake due to the absence of a non nutrient with phyto-stimulatory activity which might lead to an increased growth, although the nutrient is neither required not

utilized (11). Earlier works reported that the higher feeding rates, better food assimilation, conversion efficiency and growth rate for lepidopterans can be taken as adaptive features to meet the energy requirement (12, 13). These values will influence the non feeding life stages and further on the cocoon production. The variability in tasar silkworm populations could be of immense application to exploit or to demonstrate heterosis effect in acquiring important quantitative and qualitative traits. Though the seed organization is a multi-tier system of seed multiplication for meeting the demand of seed to a greater extent, the production is still adequate to meet the ever increasing demand of seed for higher silk production. The BSM&TCs under BTSSO have been mandated to produce the total requirement of nucleus seed and some portion of basic seed and supply to the states (14). To ensure the quality supply of seed to the tribal farmers, supply of elite seed to the BSM&TCs is of vital importance.

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Table 1. Mean Performance of elite seed of DBV eco-race at BSM&TCs

Sl. No	Name of the BSMTC	No. of Dfls Supplied	Hatc-hing%	Cocoons harvested	Yield /dfl	Cocoon characters		
						Cocoon Wt.	Shell Wt.	S.R.%

						(gm)	(gm)	
1	Patelnagar	550	83	34297	62	12.600	1.610	12.78
2	Bhagalpur	907	85	52402	58	13.487	1.740	12.90
3	Kharswan	800	86	43390	54	11.310	1.655	14.63
4	Bhandara	800	80	45200	57	11.000	1.325	12.05
5	Chinoor	800	86	38350	48	11.050	1.700	15.38
6	Ambikapur	800	90	40500	51	11.350	2.030	17.89
7	Sundargarh	800	84	39385	49	12.400	1.675	13.51
8	Nabrangpur	800	90	61700	77	11.700	1.400	11.97
9	Balaghat	1000	81	35860	36	13.150	1.760	13.38
10	Boirdadar	680	84	38115	56	10.575	1.565	14.80
11	Bilaspur	800	85	53979	67	10.960	1.685	15.37
12	Keonjhar	1050	85	38750	37	12.720	1.580	12.42
13	Dudhi	700	83	39900	57	11.775	1.465	12.44
14	Kathikund	600	88	34800	58	11.250	1.710	15.20
15	Madhupur	600	90	33100	55	12.750	2.000	15.69
16	Pali	750	90	23158	31	12.290	1.960	15.95
17	Bastar	600	91	38600	64	11.030	1.800	16.32
18	RC Varam	600	83	11606	19	10.800	1.830	16.94
19	Narsapur	600	85	11800	20	12.450	1.820	14.62
	Average	**749**	**86**	**37626**	**50**	**11.824**	**1.701**	**14.43**
	S.D.	**140**	**3**	**12408**	**15**	**0.876**	**0.189**	**1.75**
	CV (%)	**19**	**4**	**32.98**	**31**	**7.41**	**11.11**	**12.12**
	Maximum	**1050**	**91**	**61700**	**77**	**13.487**	**2.03**	**17.89**
	Minimum	**550**	**80**	**11606**	**19**	**10.575**	**1.325**	**11.97**

Table 2. Mean Performance of elite seed of DTV eco-race at BSM&TC's

Sl. No	Name of the BSMTC	No. of Dfls Supplied	Hatc-hing %	Cocoons harvested No.	Yield/dfl No.	Cocoon characters		
						Cocoon Wt. (gm)	Shell Wt. (gm)	S.R.%
1	Pali	750	88	70975	95	10.425	1.405	13.48
2	Bastar	830	91	42275	51	10.260	1.370	13.35
3	Nabrangpur	800	89	43300	54	10.900	1.100	10.09
4	RCVaram	1000	90	70750	71	11.200	1.330	11.88
5	Balaghat	960	92	75420	79	12.520	1.440	11.50
6	Patelnagar	1000	90	54335	54	11.050	1.330	12.04
7	RC Varam	750	90	25434	34	10.900	1.340	12.29
8	Balaghat	600	85	58000	97	12.500	1.430	11.44
9	Boirdadar	700	90	35350	51	9.460	1.330	14.06
10	Bilaspur	800	85	65786	82	10.200	1.220	11.96
11	Sundargarh	1070	86	99602	93	11.500	1.520	13.22
12	Chinoor	900	91	70200	78	11.200	1.400	12.50
13	Narsapur	1000	85	51170	51	10.220	1.610	15.75
14	Bhandara	600	85	31799	53	9.800	1.100	11.22
	Average	**840**	**88**	**56743**	**67**	**10.867**	**1.352**	**12.48**
	S.D.	**152**	**3**	**20260**	**20**	**0.903**	**0.141**	**1.41**
	CV (%)	**18**	**3**	**35.70**	**30**	**8.31**	**10.46**	**11.26**
	Maximum	**1070**	**92**	**99602**	**97**	**12.52**	**1.61**	**15.75**
	Minimum	**600**	**85**	**25434**	**34**	**9.46**	**1.10**	**10.09**

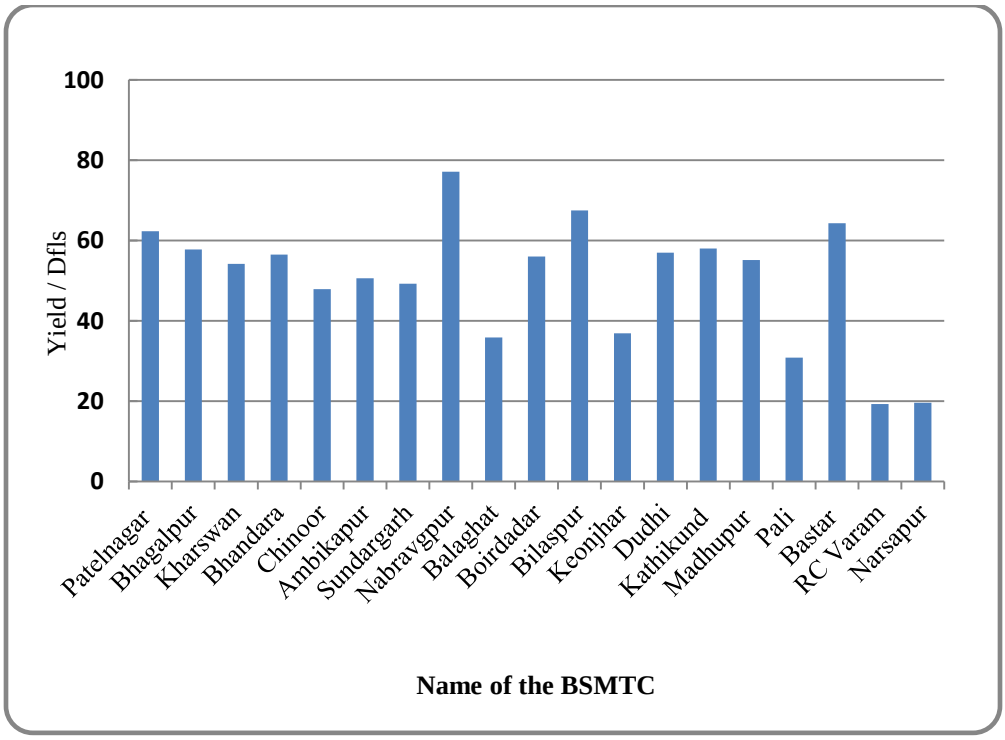

Fig. 1. Tasar cocoon Yield / Dfl of DBV at different BSMTC's

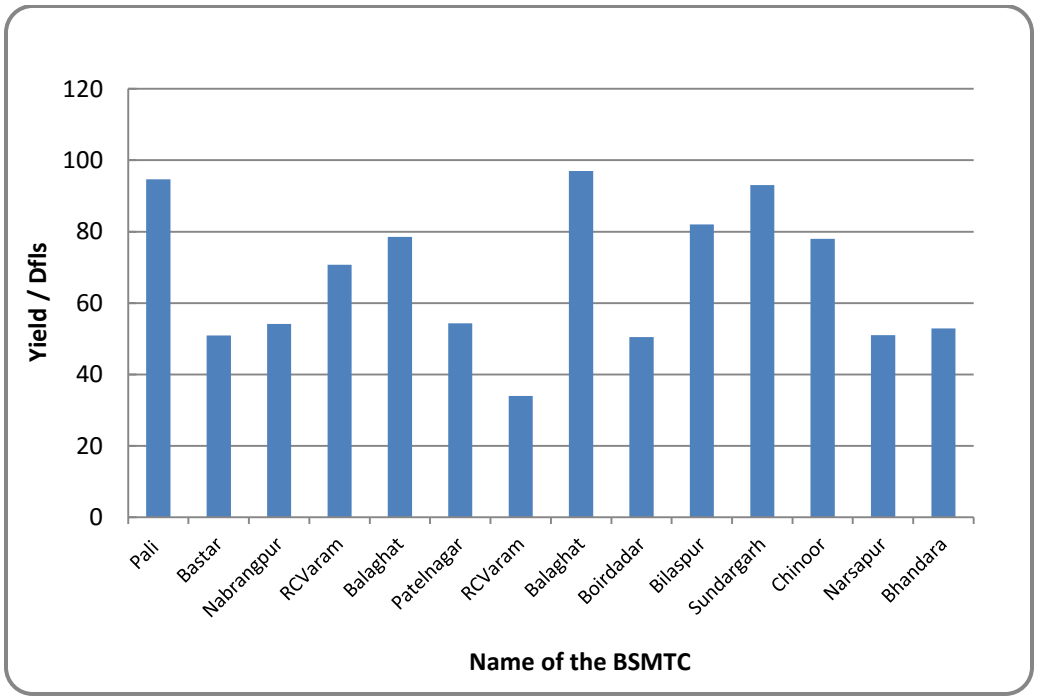

Fig. 2. Tasar cocoon Yield / Dfl of DTV at various BSMTC's

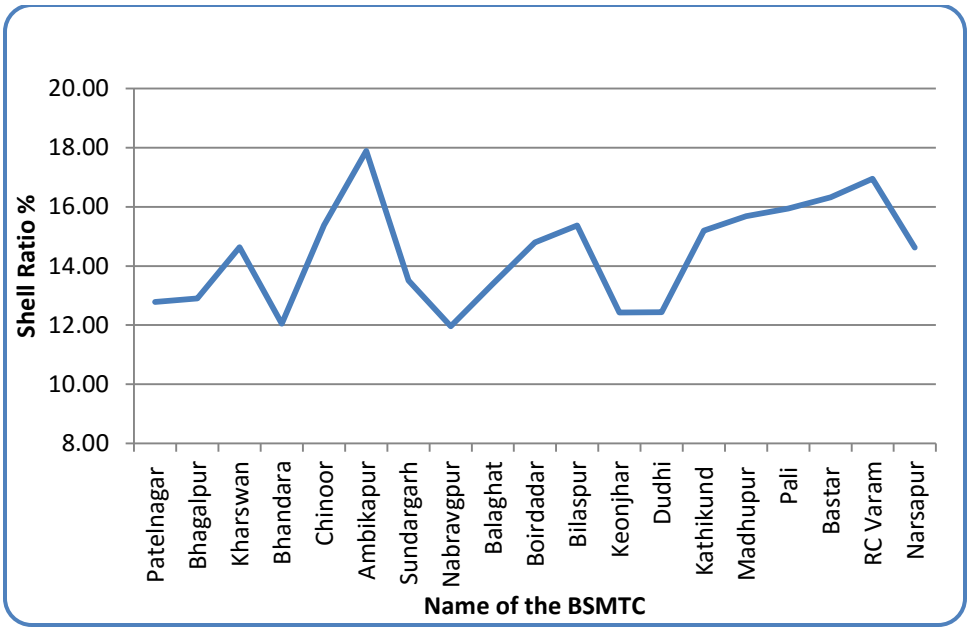

Fig. 3. Shell Ratio % of DBV eco-race at various BSMTCs

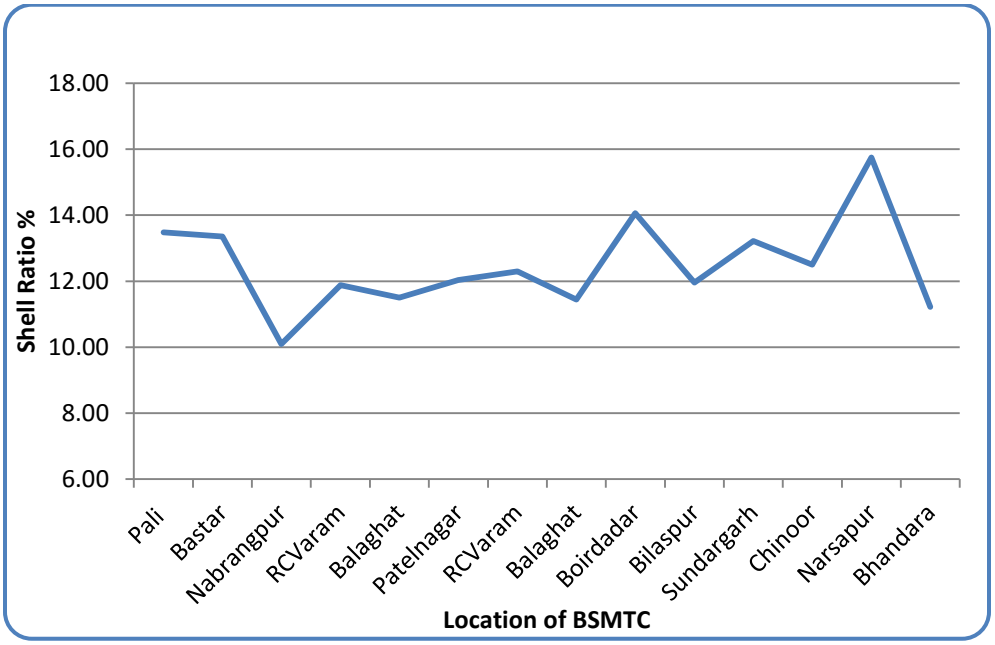

Fig. 4. Shell Ratio % of DTV eco-race at various BSMTCs