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BIODIVERSITY AND CONSERVATION OF TASAR ECORACES

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Abstract:
India has a long tradition and experience in the production of silk. It also occupies unique position of not only being the 2nd largest producer of silk but also distinction of being the only country producing all major varieties of natural silk viz., eri, muga, tasar, and mulberry (FAO, 1987; Khurad *et al.,* 1998) Mulberry silk occupies the prime position accounting to 90 percent of total raw silk production in country during 2014-15. Tasar and Eri silk, contribute significantly to the non-mulberry raw silk produces.

Introduction

Tasar culture is practiced in the forest using host plant in natural conditions. It does not require any investment on plantation of host plant, rearing house and appliances etc. unlike mulberry sericulture. Tasar culture not only checks the destruction of forest but also gives opportunity to utilize the vast natural resources with minimum investment along with huge employment generation for rural community. It is indispensable for growing part of tribal culture and a medium for transformation of economic improvement of rural and nation as whole. Beside these advantages the silk production potentials within the country and demand of the product in foreign countries promoted commercial exploitation of tasar culture. The production scenario of tasar raw silk during past two decades indicates a fluctuating trend. Further, looking into the decreasing trend in tasar raw silk production, the biodiversity and conservation of tasar silkworm with their natural flora and discussed.

Tasar Host Plants:- Species and Distribution

Tasar silkworm is polyphagous in nature, having primary and secondary food plant based on preference. The tasar silkworm thrives well on three main food plants namely Asan (***Terminalia tomentosa***), Arjun (***Terminalia arjuna***) both belonging to family Combretaceae and Sal (*shorea robusta*) belonging to family Dipterocarpaceae. The other primary host plants include a few species of lagerstroemia and *Ziziphus mauritiana* and *Hardiwickia binata*. The secondary host plants comprise of *Terminalia chebula, T. bellerica T. catappa T. paniculata, Ziziphus jujube T. tectona grandies*, few ficus species and several others, which are enlisted below:-

In India tasar food plant grow luxuriantly at lower altitudes of up to 600m ASL and extending mainly around "Torrid, tropical zone or hot Zone" (Between 231/2 N and 231/2 S latitudes and distributed up to 400 latitude on either direction. Tasar sericulture practiced in two different climatic zones.

1) Tropical zone which has distinct belt of humid and dense forest spread in the state, Madhya Pradesh, Orissa, Bihar, West Bengal, and parts of Uttar Pradesh, Maharashtra, Andhra Pradesh and Karnataka.

2) Temperate Zone, which extends from Western Part of Jammu and Kashmir up to Eastern Part of Manipur. A vast weather of tasar silkworm food plant is estimated about 11.16 Million ha. In Tropical and 1.26 million ha. In temperate zones. Presently onloy about 5% of the tropical tasar host plant are being exploited for the production of tasar silk (Mohanty 1998)

Out of total 38 miollion of total tribal population in India, about 26 million live in tropical and 4.0 million in temperate zones having tasar host cultivated plants. (Singh and Sinha, 2000). In Maharashtra, tasar sericulture is confined to only four districts of Vidarbha and about 2262 farmers families are involved directly or indirectly in tasar silkworm rearing (Mathur et at., 2000). Terminalia species has a wide distribution throughout the country, more concentrated from to Central India covering Eastern part (Table II)

Other primary food plants like *Largerstroemia* have a distribution from base of western Himalaya to the South of Indo Gangetic plain and extending up to central India. *Hardwickia binata (Anjan)* is more prevalent in western and peninsular India. Most of these host plants are available in other tropical countries like Nepal, Burma, shrilanka, Malasia, Australia, Africa, Afganistan and Vietnam etc.

Threat to Tasar Food Plants:

The tasar food plants are generally affected by several pest parasites, predators and diseases causing to loss of host plants to tasar silkworm. Several control measures though

indentified becomes impracticable due to its wild nature. Insects of Coleoptera, Lepidoptera, Hemiptena, Thysanoptera and Isoptera are regular pests. (Table III)

Tasar Silk Worm: Ecoraces and Distribution :

The silkworm *Antheraea mylitta* (tropical S.W.) belong to family *Saturnidae*. The distribution of this species extends over a large area from West Bengal to Karnataka. The availability of different host plants, ecological conditions and geometerological factors has lead to large number of variants within the species, generally termed as ecoraces. Nearly 34 ecoraces have been identified (Alam *et al.*,1998) occupying different geographical regions with specific host plant relationship. These ecoraces show variability with regard to their voltinism and economic cocoon parameters (Table 4) Most of the ecorace exist in Bihar, Orissa and Madhya Pradesh and few in other states like Assam, West Bengal, Maharashtra, Andhra Pradesh and Karnataka. Among these states the prominent tropical tasar ecorace district are Bhandara in Vidarbha Maharashtra, Singbhum and Santhal Paragana in Jharkhand, Raigad and Jagadalpur in Chhatisgarh (Madhya Pradesh). Mayurghanj and Keonjhar in Orissa. Cacher zone in Assam, Purula and Bankura in West Bengal, Adilabad and Warangal in Andhra Pradesh and Belgaun in Karnataka.

Table 1: Different Host Plants of *Antheraea mylitta D*

Sr. No.	Family	Scientific Name	Local Name
1	Apocynaceae	*Carissa carandus*	Karaunda or Karinda
2	Anacardiaceae	*Semecarpus anacardium*	Bhelwa
3	Caesaloinaceae	*Cassia lancelata* *Bauthinia variagata L*	Kanchan
4	Celastraceae	*Celastrus paniculatus*	Nalkangni
5	Combretaceae	*T. Arjuna Bedd*	Arjun, Sadar
		T. belerica Roxb.	Bhaira, Behera
		T. Catappa L	Jungli Badam
		T. Chebula	Harada
		T. Tementosa W & A	Asan, Ani, Saja
		Anogeissus latifolia wall	Dhaura
6	Dipterocarpaceae	*Shoera robusta Gaertn*	Sal or Sakooa
7	Euphorbiaceae	*Ricinus communis*	Arund or Castor oil Plant
8	Lytheraceae	*Largerstroemia indica*	Daiyeti, Telinga, China
9	Malvaceae	*Bombax malalabaricum DC*	Silk cotton tree
10	Malvaceae	*Ciopadessa fruticosa BI*	Billu
11	Moraceae	*Ficus religiosa L*	Aswat, peepal
12	Myrtaceae	*Careya arborea Roxb*	Kumbi
		Eugenia cumin Druse (L)	Jamun
13	Rhamnace	*Zizyphus jujube*	Ber
14	Rosaceae	*Prunus domestica*	Plum
15	Rhizophoraceae	*Rhizophora calceolaria*	-
16	Rubiaceae	*Canthium diecocum (Gaerth)*	Merill
17	Sapindaceae	*Dodonaea viscose Jacg (L)*	Sanalta
18	Sapotaceae	*Bassia longifolio*	-
19	Verbenaceae	*Toctona grandis*	Sagun

Table 2: Distribution of Primary Food Plants of Tropical Tasar Silkworm.

Sr. No.	Food Plant	Distribution
1.	*Terminalia*	India, Nepar, Burma, Laos, Khmer, Srilanka, Indonesia, Malaysia, Near Guinea, Australia and Africa
2.	*T. Tementosa*	North India up to Nepal and Central India
3.	*T. arjuna*	Central and eastern India
4.	*Shorea robustria*	Throughout the tropics and sub tropics
5.	*Lagerstroemia sp*	India, Srilanka, China, Vietnam, Malaysia, Indonesia, Australia.
6.	*Hardwikia binata*	Tropics particularly Africa and Western peninsular India
7	*Ziziphus amnuritiana*	India, Afganistant, Malaysia, China, Archipeloga, Australia

Table 3 Pest of Foods Plants:

Sr. No	Pests/Diseases	Food Plants attached
	Stem borrer	*Terminalia arjuna*
1.	*Acolasthes holocericea*	*Terminalia tomentosa*
2.	*Sphenoptera Knonibierensis*	
3.	*Sphenoptera Cupriventris Kerr.*	
	Gall Fly	
	Phylloplecta Hirsute and Trioza flatcheri	*Terminalia Tomentosa*
	Termites *Microtermes, Odontotermes and Trinervitermes sp.*	All the food plants.
	Beetle (Defoliators) *Anomala sp.*	All the food Plants.
	Steam Cancer	*Terminalia tomentosa*
	Leaf curl	*Terminalia arjuna* *T. tomentosa*
	Root rot	*T. tomentosa*
	Ganoderma lucidum	*Shorea robusta (Sal)*

Source Jolly *et al.,* 1997 and Reddy *et al.,* 1998

Table 4 Economic Norms of Different Ecoraces of Antherea mylitta

Sr. No	Ecorace	State	Food Plant	Cocoon wt (g)	Shell wt (g)	Filament Length (m)
1)	Andhra Local	Andhra Pradesh	*Terminalia sp*	8.0	0.8	600
2)	Bhandara Local (Mulki)	Maharshtra	*Terminalia sp*	8.0	0.8	600
3	Barhawra	Bihar	*Terminalia sp*	13.8	1.91	1234
4)	Belgaum Local	Karnataka	*Hardwickia binata*	9.0	0.8	600
5)	Daba	Bihar	*Terminalia sp*	12.1	1.8	1000
6)	Laria	Bihar	*Shorea sp*	8.4	1.0	590
7)	Laria	Madhya Pradesh	*Terminalia sp*	10.5	1.2	785
8)	Modia	Bihar	*Shorea sp*	15.3	2.60	1300
9)	Moonga	Bihar	*Terminalia sp*	7.7	1.0	600
10)	Modal	Orissa	*Shoeia sp*	16.0	2.8	1500
11)	Mugia	Bihar	*Terminalia*	11.1	1.6	900
12)	Nalia	Orissa	*Shorea sp*	10.0	1.1	700
13)	Railey	Chattisgarh	*Shorea sp*	16.0	3.0	1600
14)	Sukinda	Orissa	*Terminalia sp*	11.0	1.4	800
15)	Tira	West Bengal	*Lagerstroemia*	10.0	1.2	600

(Source- Jolly *et al.,* 1997)

Table 5: Natural Enemies of Tasar Silk Worm:

Sr. No	Name	Family	Damage	Stage of attack
	Parasite			
1.	Uzufly- Blepharipa Zebina	*Tachinidae*	20-25%	III & IV stage/ s.w. rearing
2.	Ichneuman fly (Pimple Punctata	*Ichnumonidae*	10-15%	Spinning stage
	Predators			
1.	Sting bug, Sycanus Furcellata	*Pentatomidae*	10-15%	1st, IInd & early III stage
2.	Reduviid bug, Sycanus Collaris	*Reduvidae*	7-10%	Ist to late 4th stage
3.	Praying mantis, Hierodula bipapilla	*Mantidai*	5- 7%	3rd & 4th stage
4.	Oecophylla smarafdina	*Formicidae*	5-7%	1st & IInd stage
5.	Vespa orientalis	*Vespidae*	10-15%	2nd & early 3rd stage
6.	Polistes hebraeus	*Vespidae*	10-15%	2nd & early 3rd stage
7.	Rat			
8.	Snake			
9.	Birds			

Grainage Behaviour of Ecorace

Ecoraces of topical tasar provide a large variability and gene pool to be exploited in the synthesis and fixation of new breed. Some high yielding breeds have been evolved at Central Tasar Research & Training Institute, Ranchi from these ecoraces though synthesis and selection. Multivoltine pure race Daba is the major source of production of tasar commercial silk. It has higher viability and poor productivity where as commercially important nature grown ecoraces such as railly (BV) exhibits higher productivity but poor viability under captivity. The cross between Daba x Railly and its reciprocal showed heterosis to the extent of 50% over mid-parental value for shell weight (Jolly *et al.,*1997). F1 crosses between Railly x Daba and Railly x Sukinda has resulted better performance than their parent (Shankar rao *et al.,* 1999) having 9% reduction in larval duration 35% augmentation in cocoon yield and 28% enhancement in ERR.

Threat to Ecoraces

Inportant and major cause of concern over conservation of Ecoraces are (A) Rampant Collection of nature local cocoons from its habitat by tribal and traders for seed production and raw silk production without leaving sufficient population to multiply in nature. (B) De-nudation of forest flora, change in climatic conditions with increase in on tasar silk worms by their natural enemies like parasites and prediators. (Table 5)

Conservation of Ecoraces and Stratagies:

Pressure on ecorace- After the introduction of races Sukinda and Daba the rearing of local ecoraace at farmers level has considerable been reduced because of poor stability of the crop and poor multiplication at farmer level. With heavy deforestation there will be tremendous loss of genetic diversity of plants and associated fauna. India is a developing agricultural nation, has a lot of economic growth avenues through sericulture. Tasar culture being carried out by tribals to a greter extent, tasar biodiversity including its flora need to be saved to nourish the various authorities by creating the conducive environment Diversity in A. mylitta is the result of it is adaption to different ecogeographical condition. Only a small portion of this biodiversity has been put in commercial use. Continuous collection in the form of cocoons for seed and reeling purpose has caused misbalance in natural environment of different ecoraces,. In Maharashtra Bhandara local (Mulki) ecorace is needed to conserve it has better shell percentage and Pebrine resistance.

Hence conserving the diversity play a key role in proper utilization of this species for silk production and sustainable use. Conservation of different ecorace in situ in their own ecosystem specific to ecotypes. While considering the important of ecology to conservation, three application like conservation, of the race, ecosystem and biosphere may be looked into. The devastation of population has been fluctuating its existence the emigrants (from other population of this race) compensate the loss of the population to some extent to maintain its dynamics, but original loss over gain happens to be more and hence unable to be recovered. The race thus has become race in number and declining gradually, calling for immediate measure of conservation (G. S. Yadav *et al.,* 1988)/

There are following important steps for conserving the diversity.

A. Collection of Cocoons And Exploration – The existing ecotypes distributed over entire range of tasar belt should be explored and collected which can serve better ecotype identification (R. Nilika *et al.,* 2002)

B. Evaluation of Character of Cocoons. The ecotype should be evaluated systematically and qualitative characters. Further they should be subjected for stability test over a number of locations for future exploitation

C. Conservation: Conservation at the collected site and its natural ecosystem should be done properly. The duplication be avoided by of ecotypes should be avoided.

In order to conserve an in situ conservation five method were adopted to release the ecorace into forest (reserve forest) patch isolated from adjacent forest. The methods are 1. Release of seed Cocoon 2. Release of male and female month 3. Release of gravid moths 4. Release of eggs in leaf cup and 5. Release of chawki worms. Analysis of cocoons collected from various methods of release show that all the method were effective in genetic conservation of ecorace. Release of eggs in leaf cups found to economically viable and having maximum profitable, index to maintaining original commercial characters. Several models have been worked out by State Department of Chattisgarh (Rao *et. al.,* 1998). Similarly in Orissa a model has been suggested to protect the ecorace. Maharashtra DOS has submitted a project to CSB for the conservation of Bhandara local (*Mulki*) ecorace.