RESEARCH ARTICLE

Eco-friendly Environment of Tripura, India Prove to be a Boon for Tasar Cultivation on *Zizyphus mauritiana* L.

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Abstract

Indian silk industry is the second largest producer of silk in the world. India has the unique distinction of being the only country producing all the five known commercial silk, namely, Mulberry, Tropical Tasar, Oak Tasar, Eri, and Muga. Among the four varieties of silk produced in 2015-16, Tasar accounts for 9.90%, i.e., 2,818 MT of the total raw silk production of 28,472 MT. In Tripura, the societies are well acquainted with only mulberry silk production. Temperature plays a very vital role in the growth of Tasar (*Anthereae mylitta*) silkworm also. *Anthereae mylitta* is a species of moth in the family Saturniidae known commonly as the Tasar silkworm and Vanya silkworm. This species is variable, with at least 44 identified eco-races, populations adapted to varied ecological conditions and food plants. Though Tripura is endowed with well demarcated sub-tropical and temperate zones with a low average temperature of 10°C in the winter season which rises to a maximum average of 35°C in the summer, it supports the cultivation of tropical Tasar silkworm in a very unique manner naturally. The present study analyzes the morphological behavior of the Tasar silkworm in a new environment and its interaction to that particular eco-friendly environment to facilitate the socioeconomic upliftment regarding the sericulture practices exhibited by the rural people of the state of Tripura. This study also proves that in the near future Tasar culture will become a boon to the poor people along with Mulberry cultivation.

Keywords: Anthereae mylitta, Eco-friendly environment, Socioeconomic upliftment, Tasar cultivation, Tripura, *Ziziphus mauritiana*.

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Introduction

Tripura (Fig. 1) is the third smallest State of the Country located in the South-West extreme corner of the North Eastern Region of the country. Sericulture in Tripura existed in scattered districts as a practice amongst many people since long. Tripura is mainly demarked by the mulberry cultivation in the field of sericulture of Northeast India. Its climatic conditions mainly favor the growth of the mulberry silkworm in a very praiseworthy way. But recently it has been shown that Tasar silkworm is being cultivated naturally in the south district of the state. Tasar silkworm or *Anthereae mylitta* which is indigenous to Jharkhand, Chhattisgarh, Orissa, Maharashtra, West Bengal, and Andhra Pradesh is also reported from the state of Tripura though it is not native to that place. Tasar sericulture needs a new breakthrough from the viewpoint of new hybrids or new variety/race/species which would be rear able indoor and can obtain more than 90% rearing success. At present, the success of rearing of Tasar silkworm is about 30–40%. Hence, new eco-races are to be investigated by nature. In the past, Hampson (1976), Sathe and Pandharbale (1999, 2008), studied the taxonomy of moths from India. Other taxonomical workers related to genitalia of Tasar moths refer to Zander (1903), Sondgrass (1935), Sen and Jolly (1971), while, eco-races of *A. mylitta* have been studied by Thangavelu (1992a,b), Narasimhanna (1998), Akai (1998), Satpathy and Rao (2003), Rout *et al.* (2004), Mitra and Moon (2009). Up to date, 44 eco-races have been reported from India (Srivastava *et al.*, 2003). This study focused that the Tasar silkworm is naturally grown in the host plant of Tasar *Zizyphus mauritiana* Lam. in a very unique way. The natural growth of the Tasar silkworm in such an environment proves that in the near future they can be reared in an indoor environment which will add a new feather to the sericulture industry of Tripura State.

Fig. 1: Map of Tripura

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Condition Required for Tasar Cultivation

Tasar silk displays a higher value of air permeability as compare to Mulberry silk. It also shows the heavy mortality of larva due to predators, parasites' and climatic hazards (Samhita and Purushotham Rao, 2005). Tropical Tasar silkworm, *Anthereae mylitta* Drury is a commercial variety, which exists in various forms as

44 ecological populations or eco-races in different geographical niches of our country depend on food plants and environmental conditions. In the present study out of the seven eco-races studied, except Andhra local and Bhandari, which are predominantly found in dry tropical forest area, all other eco-races grow in moist deciduous forest areas of red loamy and black clayey regions within maximum temperature range of 30–34°C and a minimum of 18–21°C, the annual precipitation ranging from 925–939 mm in dry deciduous and 1000–1275 mm in moist tropical deciduous forest areas (Suryanarayana and Shrivastava, 2005). The wide range of distribution of the species has encountered diverse geographic and climatic variations of the distinct areas, leading to marked differences in not only phonotypical and physiological traits but also in the commercial and technological aspects.

Present status of Tasar Culture in India

Dominance of Mulberry silk in Indian silk production is an important fact that support global trend in Mulberry silk production. About 83% of the total silk production of India is obtained in the form of mulberry silk. It is produced in twenty-five states. While Tasar silk contributing about 4 % of total silk production of India is produced in thirteen states. As mentioned in earlier paragraphs national scenario regarding Tasar culture is not much different from the global one. Most of the states engaged in sericulture are engaged in moriculture. Tasar culture is confined to some specific states.

From the table 1, it can be concluded that only 9 states are engaged in tropical Tasar culture and 6 states are engaged in Oak Tasar culture.

Sericulture in Tripura

Sericulture in Tripura comes under the Department of Handloom, Handicrafts, and Sericulture (DHHS) and controlled by the Principal Secretary, Industries and Commerce (HHS), Government of Tripura, Agartala at the top.

In Tripura, Sericulture was introduced during 5th five-year plan with the recommendation of North Eastern Council with small infrastructure. Initially, a sericulture activity was confined only in the Government farm. But the impact of sericulture industry was only felt after the 1990s. Gradually extension of sericulture was intensified in the village level covering good numbers of interested beneficiaries under state plan fund. The progress of area coverage and cocoon productivity is still low in compare Indian standard. In Tripura, around 4500 beneficiaries are directly involved in the subsidiary occupation further improving their socioeconomic status.

Materials and methods

For taxonomical studies, materials have been collected from the fields of the South District of Tripura from the host plant *Zizyphus mauritiana* (Figs 2A and B) to Sericulture Training Institute, Santirbazar, Tripura (S) in the month of November–December 2018. The male and female moths (Figs 2E and F) collected have been preserved in the Institute by pinning and drying in the insect box. Taxonomical observations of larvae (Fig. 2C) and cocoons (Fig. 2D) have been characterized with respect to larval length, breadth and weight; along with cocoon weight, shell weight, shell ratio, cocoon length, cocoon width, peduncle length, ring diameter, filament length, and filament shade.

Results and discussion

From the initial study of the Tasar silkworm Larva and Cocoon the following results are obtained:

Larva

The body color of fifth instar larva (Fig. 2C) was greenish in color and body covered with setae. Full-fed 5th instar Tasar silkworm larvae measured 108.65 ± 10.40 mm in length, 20.15 ± 0.85 mm in breadth and weights 21.75 ± 0.55 g under indoor conditions.

Cocoon

The cocoons (Fig. 2D) of A. *militia* were silvery grey (white), suede (grey) daffodil (yellow) in color oval shaped with filament texture. The cocoon parameters are as follows:

1.	Cocoon weight (gm)	11.50
2.	Shell weight (gm)	1.70
3.	Shell ratio (%)	14.784
4.	Cocoon length (cm)	4.1
5.	Cocoon width (cm)	2.6
6.	Peduncle length (cm)	3.8
7.	Peduncle width (mm)	17
8.	Peduncle weight (mg)	0.30
9.	Ring diameter (mm)	4.5
10.	Filament length (mts)	300.14
11.	Reeled weight (gm)	0.56
12.	Denier	16.92

Geo-climatic Condition of Tripura Favoring Tasar Cultivation

The topography is characterized by hill ranges, valleys, and plains. The hills have porous red laterite soil whereas the flood plains and narrow valleys are overlain by alluvial soil. The climate of Tripura exhibits a strong seasonal rhythm. The state is characterized by a warm and humid sub-tropical climate with five distinct seasons, namely, spring, summer, monsoon, autumn, and winter. The altitude of the state also influences the climatic conditions of

Table 1: National engagement in sericulture

Name of the states engaged in moriculture	*Name of the states engaged in Tasar culture*
Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chhattisgarh, Gujarat, Himachal Pradesh, Haryana, Jammu & Kashmir, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Mizoram, Meghalaya, Nagaland, Orissa, Punjab, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttaranchal, Uttar Pradesh, West Bengal.	Tropical Tasar: Andhra Pradesh, Bihar, Chhattisgarh, Jharkhand, Madhya Pradesh, Maharashtra, Orissa, Uttar Pradesh and West Bengal Oak Tasar: Arunachal Pradesh, Jammu & Kashmir, Manipur, Mizoram, Nagaland and Uttaranchal. Source: Report on ISC and CSB (2016–2017)

Source: Report on ISC and CSB (2016–2017)

Figs 2A to F: (A) Host plant (*Zizyphus mauritiana* L.) of Tasar silkworm, (B) Mature larva and cocoon on host plant, (C) Tasar larva of 5th instar, (D) Tasar cocoon, (E) Male moth, (F) Female moth

Tripura state. The state of Tripura influences a monsoonal climate with the well-demarcated sub-tropical and temperate zones. The parameters of Tripura climate are relatively high temperature, the average maximum temperature is 34°C, and the average minimum temperature is 10°C with humidity, generally, high throughout the year. The state receives a very high annual rainfall with the incidence of very high concentration of rainfall (up to 450 mm per day) in the monsoon season, which lasts from June to September. The average annual rainfall in the state is 2024.4 mm (50 years average).

Conclusion

In the present study, the natural habitat of Tasar silkworm was explored and the geographical parameters were recorded as the latitude of Tripura, India is 23.745127, and the longitude is 91.746826, though it is very much unfamiliar to that particular environment previously. But our investigation revealed that they grow quite naturally in that particular eco-friendly environment and they responded positively regarding the natural behavior of Tasar silkworm. Among many agro-based cottage industries in India. Sericulture has been promoted as an agro-based, clever intensive, rural-oriented cottage industry, providing gainful employment mainly to the weaker and marginalized section of the society, especially Tribal. It is remarkable that Sericulture is suited to the lifestyle of the tribe of Tripura because the practice of Sericulture is simple and can be done without any cost and skill. The advantage of Tasar sericulture is that the practice can be adopted by the farmers without any difficulties and within shortage possible time. Initiating Tasar culture by a farmer in Tripura in such an eco-friendly condition invariably leads its generation of further downstream employment in reeling and weaving either in the household or organized sectors. Sericulture provides more than 50% employment to the respondent in a year thus stops the inter-state migration. According to the MGNREGA (Mahatma Gandhi National Rural Employment Guaranty Act), the population must receive 100 days of employment in a year whereas sericulture provides 151–200 days employment, i.e., 64%. Due to these practices' respondents earned around double income compared to their earlier income. Thus, this Tasar silk sector is not only important for generating rural employment and preventing rural migration but also for a role in the protection and preservation of ecology, heritage, and sociocultural values.

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