ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 12, Iss 4, 2023

CURRENT & COMPARATIVE STUDY ON THE PRODUCTIVITY AND QUALITY OF TASAR SILKWORM, ANTHERAEA MYLITTA D. (SATURNIIDAE: LEPIDOPTERA)

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ABSTRACT:

Silk is the most beautiful, wonderful and precious gift given by the nature. Silk and silk product are used for different purpose whether medicine, cosmetics and cloths etc and having many other uses. Silk is the most common rearing agro based industries world wise practicing and is not only valuable this is ultimate and wonderful boon of the nature are produced by Sericigenous insects belonging families **Bombycidae** and **Saturniidae** of order Lepidoptera. Silk produced by the silkworm consists of two major kinds of proteins, viz. fibroin and sericin. Tropical tasar silkworm, is one of the most commercial vanyasilk production in the country and presently, about 03.50 lakh families are directly or indirectly associated from tasar culture. We need to improve races/breeds in order to enhance tasar silk production and bring improvement in its quality. So that we can meet the increasing needs and I want make tasar product common for everyone.

Keywords: - Tasar silk, Antheraea mylitta, tasar silkworm, Sricin fibroin and sericin,comparative Study

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1. INTRODUCTION

Silk fiber is the most common and essential component for the textile industry, or sericulture industry, is mainly produced by a number of silkworms belonging to the **Bombycidae** and **Saturniidae** of order Lepidoptera. As per the data statistics, published by the International Sericulture commission, in the year 2019 and 2020, **1,09,111.10** and **91,771.00** MT of silk cocoons respectively was produced globally. Silk fibers are mainly composed of two types of protein, fibroin and sericin as an adhesive substance; sericin surrounds the exterior of fibroin, which lies at the center of silk fibers. In the degumming process, sericin is usually separated from fibroin and discarded, and only the fibroin is used as silk. Sericin is detached from fibroin by the silk industry in order to improve the smoothness, luster, lightness, and dyeability of the fibers. As sericin is a

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major component of raw silk, it has been estimated that out of 4.0 lakh tons of dry cocoons produced worldwide, around 50,000 tons of sericin are usually discarded as waste in sewage, representing an environmental hazard.

Sericigenous insects are used from ancient to now for the production of natural silks viz; mulberry, tasar, eri and muga of great commercial importance. The different species of Sericigenous insects, among Antheraea frithi Mr; Antheraea roylei Moore; Antheraea proylei Jolly; Antheraea yamamai Guer. and Antheraea mylitta Drury are well recognized and known species for the producing of tasarsilk in the tasar producing belts of different countries at global level. Among these Antheraea mylitta D. is the principal tasarsilk producing indigenous insect so called "Indian Tasar silkworm". It is usually reared on the foliages of primary (Terminalia arjuna, Terminalia tomentosa and Shorea robusta) and secondary (Terminalia catappa, Terminalia chebula, and Terminalia belerica, etc.) tasar host plants in the forest areas during the seed crop (July-August) and commercial crop (September-October) seasons. The tasar silkworms observe eight months pupal diapause under unfavorable environmental conditions. It is wild, bivoltine/multivoltine and polyphagous.

Currently various methods of tasar culture such as outdoor, indoor, food transfer method and culture of tasar worms on artificial diets are practiced in view of better and desired tasar crop in respect of productivity and quality of tasar cocoons as well as tasar silk yarn. However, a comparative evaluation of different methods of tasar culture has not yet been studied as a result we fail to understand the relative effect of said methods in relation to rearing performances of A.mylitta. In view of said fact present investigation has been designed to test the relative impact of different methods of larval culture of tasar silkworm. A. mylitta in the larger interest of tasar culture.

Current status:

India is the second largest producer of raw silk after China and the biggest consumer of raw silk and silk fabrics. An analysis of trends in international silk production suggests that sericulture has better prospects for growth in the developing countries rather than in the adv anced countries. Silk production in temperate countries like Japan, South Korea, USSR etc., is declining steadily not only because of the high cost of labour and heavy industrialization in these countries, but also due to climatic restrictions imposed on mulberry leaf availability that allows only two cocoon crops per annum. Thus, India has a distinct advantage of practicing sericulture all through the year,

ISSN PRINT 2319 1775 Online 2320 7876

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yielding a stream of about 4–6 crops as a result of its tropical climate. In India, sericulture is not only a tradition but also a living culture. It is a farm-based, labour intensive and commercially attractive economic activity falling under the cottage and small-scale sector. It particularly suits rural-based farmers, entrepreneurs and artisans, as it requires low investment but, with potential for relatively higher returns. It provides income and employment to the rural poor especially farmers with small land -holdings and the marginalized and weaker sections of the society. Several socio -economic studies have affirmed that the benefit -cost ratio in sericulture is highest among comparable agricultural crops Currently, the domestic demand for silk, considering all varieties, is nearly 30,000 MTs, of which only around 23,000 MTs (2012-13) is getting produced in the country and the rest being imported mainly from China. Indian domestic silk market has over the years been basically driven by

multivoltine mulberry silk. Due to inferior quality of the silk produced, India could not meet the international quality standard. Though, R&D efforts have been made to improve the quality of multivoltine silk, even the best of multivoltine silk produced could not match the bivoltine silk in quality. Therefore, it is essential to enlarge the production base and improve current productivity levels of bivoltine silk to meet the international standards and quality demands of the power loom sector. Steps need to be taken to ensure that export oriented units having automatic state of the art weaving machinery. Except mulberry, other non-mulberry varieties of silks are generally termed as vanya silks. India has the unique distinction of producing all these commercial varieties of silk.

2. Literature survey (Background)

Reviews of literatures are indicative of the fact that attempts have been taken to understand the rearing performances of tasar silkworm under the different methods of larval culture. Jolly (1971) conceived an idea of "Indoor rearing" of tasar culture to protect the larvae from the natural vagaries of traditional outdoor method of larval culture in the forest areas of tropical tasar belts. Further, Jolly etal. (1973) reported that the Indoor larval culture of tasar worms resulted in to better productivity (E.R.R. %) without affecting the quality of tasar cocoons. Jolly (1985) reported species differentiation of genus Antheraea. Choudhari etal. (1987) mentioned that the indoor rearing of Antheraea mylitta D. Under the controlled conditions lessened the rate of larval mortalities resulting in to relatively better rate of productivity of tasar cocoons as compared to conventional outdoor method of rearing. Rath etal.(1999) reared the tasar silkworm, Antheraea mylitta D. on different primary and secondary tasar host plants and found that the rearing

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performances of tasar silkworms are relatively better on the primary tasar food plants as compared to secondary tasar food plants on account of significant differences in nutrient contents in the foliages of two different categories of host plants. Sinha etal.(2000) worked on the impact of "Interchange of food plants" method between primary and secondary host plants of tasar silkworm and investigated that the relative rate of consumption of foliages at latter stages(IVth and Vth) of larval culture of A.mylitta is relatively greater than the culture of tasar silkworm at initial stages(Ist to IIIrd). They further reported that larval rearing of indigenous tasar silkworms by the interchange of food plants method for the larval culture of tasar silkworm. Shamitha (2007) reported successful Indoor rearing of tasar silkworm under the laboratory by regulating the required conditions. Thangavelu etal.(1990) also reported the feasibilities of Indoor method of larval culture of tasar silkworm on account of protection from the vagaries of nature against theoutdoor usual practice of tasar culture. Sharma etal.(2013) reported the significant impact of environmental factors on the Indoor rearing performances of Antheraea mylitta D. Kumar etal.(2017) reported the relative impact of some factors on the coupling behavior of indigenous tasar silkworm. Arora etal.(1979) carried out detailed studies on the taxonomic status of Indian non-mulberry silk moths. Bindroo etal.(2007) studied the relative impact of host plants on the behavioural manifestation of eri silkworm and found that the dietary variations have significant impact on the quantitative and qualitative characters of eri silkworm. Krishnaswamy (1978) presented new technology of silkworm rearing. Mishra (2014) reported significant role of foliar constituents on the growth and development of tropical tasar silkworm. Kumar (2016) mentioned variation in the free amino acid contents in the larval haemolymph of Antheraea mylitta in relation to dietary changes.

3. MATERIALS AND METHODS

A set of 100 freshly hatched larvae of Antheraea mylitta divided in to five replications (20 x5) were brushed on the foliages of Terminalia arjuna tasar host plant under outdoor and Indoor conditions of larval culture. A part from this a set of 100 larvae with five replications were mounted on the foliages of primary host plant T.arjuna upto IIIrd stages and thereafter transferred to secondary host plant Terminalia belerica and vice-versa. Thus the four sets of larvae divided into five replications were evaluated under outdoor, indoor and food transfer methods in respect of rearing performances of indigenous tasar silkworm as per the methods suggested by Jolly (1971) and Krishnaswamy (1976).

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The Indoor method of larvae culture involves the rearing the larvae on cut branches of host plant inserted in water filled earthen pots under the controlled laboratory conditions. Tasar silkworm rearing was conducted on Terminalia arjuna, primary tasar host plant and Terminalia belerica the secondary tasar host plant by providing tender and mature foliages to freshy hatched larvae till the formation of cocoons. Tasar cocoons were harvested separately as per different methods of tasar culture considered for their relative impact on their rearing performances. The data on the rearing performances and quality of cocoon were carefully assessed and analyzed and thereafter presented in table with histogram.

COMPARATIVE STUDY

Tasar Silkworm

The tasar silkworm belong to the genus Antheraea and theyare all wild silkworm, the Indian tasar feeds on leaves of Terminalia and several other minor host plants. The Antheraeamylitta silkworm leave and moth as shown in Figure. The worms are either uni or bivoltine and their cocoons like the mulberry silkworm cocoons can be reeled into raw silk. Intasar culture the silkworm are reared out doors on the trees, for better manement of rearing it is desirable that the plants are given proper height and shape. Since in tasar culture it is the leaf and not the wood or fruits, which are required plants should be induced to produce more of quality leaves. The plants cut at 6’ height for Arjun and 7’ height for Asan while in light pruning only the branches of 1’ diameter or less are cut. arjun and asan plantation of more than four years agowith spacing of 4×4’ are maintained by purring at the height of 3×4’ pruring should be done during February- March andMarch- April for 1st and 2nd crop, respectively

Mulberry Silkworm

Cultivation of mulberry plant is mainly for its leaves the sole food for the silkworm. Bombyx mori L. for commercial production of raw silk. The silkworm are actually larve of the silk mothas shown in Figure2. They temperature and humidity and regurarly fed mulberry leaves. At a certain stage they convort themselves into cocoons. These cocoons are made for a single filament of material secreted by the pupa and wrapped around itself. On an average 1 acre of plantation would yied 240 kg of cocoons in a year starting from 100 DFLS. Depending upon whether it is dryland or irrigated mulberry. Farmers can harvest the cocoons 4 to 8 times in a year.

Life cycle of Antheraea mylitta and Bombyx mori have been studies. Life cycle of silkworm consists of four stages i.e. adult, larva and pupa , the duration of life cycle is six to eight weeks

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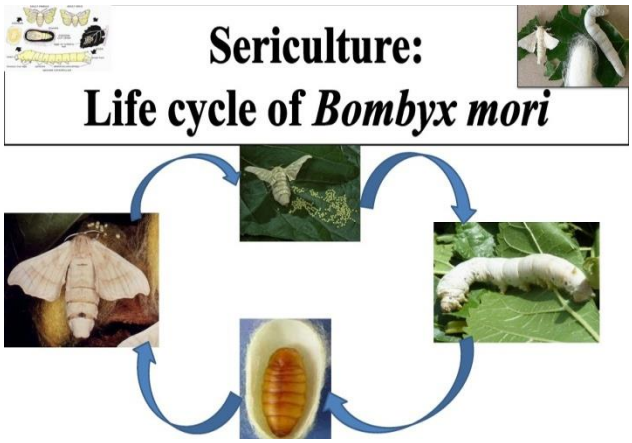
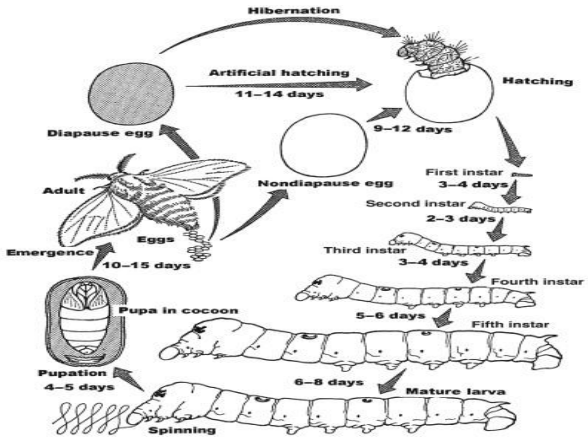
depending upon racial characteristics and climatic conditions. Multivoltine races found in tropicalareas have the shortest life cycle with the egg, larval, pupal,and adult stages lasting for 9-12 days, 20-24 days, 10-12 days, 3-6 days respectively.





Seven to eight generations are produced in multi-voltine races. In uni-voltine races, the egg period of activated egg may last for 11-14 days, the larval period 24-28 days, the pupal period12-15 days and the adult stage 6-10 days. The life cycle of Bombyx mori has been shown in Figure3. In nature, univoltine races produce only one generation during the spring and the second generation of egg goes through a period of rest or hibernation till the next spring. In case of bivoltine races, however the second generation egg do not hibernate and hatchwithin 11-12 days and produce second generation normallyduring summer and it is the 3rd generation egg which undergohibernation and hatches in the next spring and thus producingtwo generatian in one year. Several species of Antheraea are exploited for production of wild silk known as tasar silk. The tasar moths are fairly large insects. Female are larger andyellowish brown in colour while males are smaller and brickred in colour. The antennae of males are bushy and abdomen is narrower in comparison to female. The important stages of the tasar silkworm life cycle have shown in figure.

ANALYSIS

Research methodology applier in this study was a combinationof descriptive analytical and quantitative methods andstatistical methods. Primary and secondary data was analyzedusing various statistical tools viz, mean standard daviation, standard error,in addition to usual statistical measures coefficient correlation techniques were employed at appropriate context in the study to evaluate and analyze the collected data.

Importance Sericulture

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Sericulture suits both marginal and small scale land holders because of its low investments high assured returns, short gestation period, rich opportunities for enhancement of income and creation of family employment round the year. In reality, it is an occupation by women and for women because womenform more than 60% of the work force and 80% of silk is consumed by them. The nature of work involved in the sericulture industry such as harvesting or leaves, rearing of silkworm, spinning or reeling of silk yarn and weaving are carried out by women. It's a high income generating industrywhich is rearded as an important tool for economic development of a country.

4. RESULTS AND DISCUSSIONS

Results obtained in relation to relative impacts of outdoor, indoor and food transfer methods of larval culture of Antheraea mylitta D., the tropical indigenous tasar silkworm on the larval weight, effective rate of rearing (E.E.R.%), average cocoon weight, shell weight and shell ratio have been recorded in the table 1. Table clearly reveals that the larval culture of A.mylitta D. under Indoor (Larval wt.30gm., E.R.R.69.0%, cocoon wt.11.48gm., shell wt.1.82gm. and shell ratio 10.76%), outoor (Larval wt.41.0gm., E.R.R.62.0%, cocoon wt.12.85gm., shell wt.2.01gm. and shell ratio 12.56%), transfer of food from primary to secondary food plant (Larval wt.18.0gm., E.R.R.26.0%, cocoon wt.10.02gm., shell wt.1.39gm. and shell ratio 8.12%), and transfer food from secondary to primary food plant (Larval wt.35.0gm., E.R.R.58.0%, cocoon wt.11.84gm., shell wt.1.90gm. and shell ratio 10.98%), methods present significant variation among themselves as far as the productivity and quality of tasar cocoons are concerned. Further the results are indicative of the fact that the percentage of effective rate of rearing (E.R.R.%) of A.mylitta under indoor rearing as compared to outdoor rearing is relatively better. However, the quality of cocoon under indoor larval culture is inferior than the outdoor rearing. As far as the impact of transfer of food technique is concerned the rearing performances of tasar larvae initially reared on secondary food plant and there after transferred to primary food plant are relatively better to its vice-versa in respect of productivity and quality of tasar cocoon of A.mylitta.

The better productivity (E.R.R.%) of tasar cocoons under indoor condition than the outdoor condition of larval culture of A.mylitta is probably on account of the fact that the larvae are more protected under Indoor condition from the pests, predators and also from the Vagaries of nature (Jolly, 1973). However the quality of tasar cocoon is relatively better under outdoor condition as compared to indoor condition because of the fact that tasar larvae due to wild nature prefer outdoor

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natural conditions for their desired metabolic and behavioural manifestations. Tasar larvae do not get properly acclimatized with indoor artificial conditions to accept domestication in view of natural instinct inherited for outdoor conditions (Sharma etal.2013).

Table 1: Table showing relative performances of *Antheraea mylitta* D. under threedifferent methods of tasar culture.

Sl No.	Methods of Larval Culture	AV Larval weight (gm)	AV. E.R.R. (%)	AV. Cocoon weight (gm)	AV. Shell weight (gm)	AV. Shell ratio (%)
1.	Indoor rearing on *T.arjuna* host plant	30.0	69.0	11.48	1.82	10.76
2.	Outdoor rearing on *T.arjuna* host plant	41.0	62.0	12.85	2.01	12.56
3.	Initial rearing upto IIIrd stage on *T.arjuna*(P) and then after on *T.belerica*(IVth & Vth stages)(s)	18.0	26.0	10.02	1.39	8.12
4.	(P-S) Food transfer Method	35.0	58.0	11.84	1.90	10.98
	Initial rearing upto IIIrd stage on *T.belerica*(S) and then after transferred to *T.arjuna*(P) upto IVth& Vth stages (S-P) Food transfer method					
	Mean	31.0	53.75	11.54	1.78	10.60
	C.D. at 5% level	**	**	*	*	*

E.R.R. = Effective rate of rearingP =Primary host plant S = Secondary host plant
**= Highly significant
* = Significant

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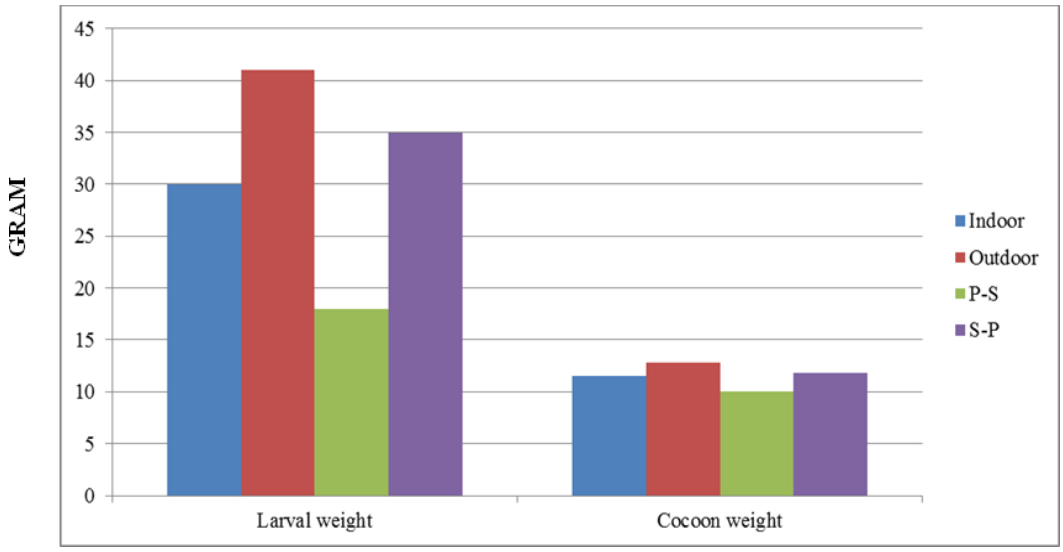
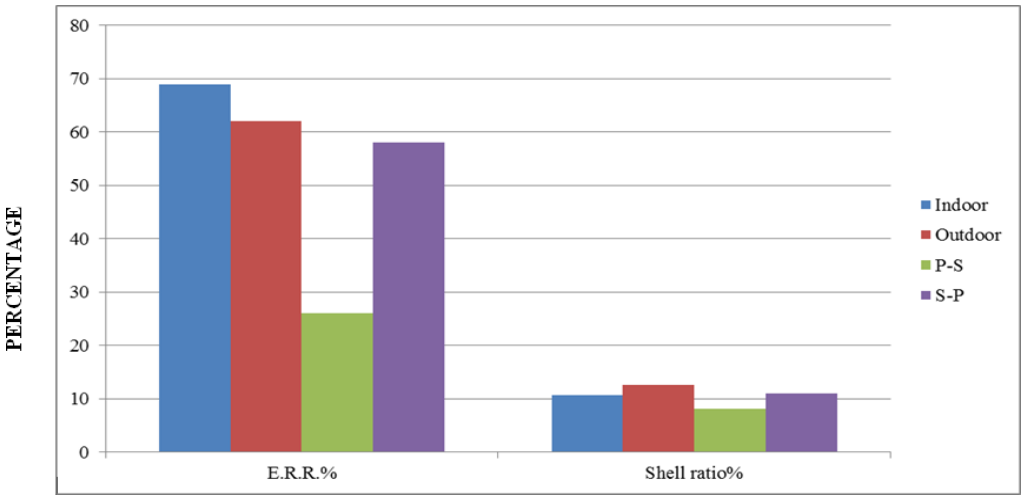


Histogram 1: Showing relative impact of different methods of larval culture ofA.mylitta on the larval weight and cocoon weight.

Histogram 2: Showing relative impact of four different methods of larval



culture ofA.mylitta on the effective rate of rearing and shell ratio.

5. Conclusion

Results obtained further reveal that the larval culture of tasar silkworm initially on the foliages of secondary food plant and thereafter transferred to foliages of primary host plant as compared to its vice-versa under the interchange of food plants technique of larval culture has resulted into better productivity and quality of tasar cocoons of A.mylitta. The relative variation in relation to impact

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of two dietary conditions on the quantitative and qualitative characters of tasar appears to be the outcome in the differences between the nutrient contents of primary and secondary food plants of tasar silkworm. Kumar (2016) has mentioned that foliages of primary food plants as compared to secondary food plants have greater biochemical constituents with better nutrient value essentially required for the growth and development of tasar silkworm. Rath etal. (1999) reported that rate of consumption of foliages by tasar larvae at initial stages (Ist to IIIrd) is very less than the rate of consumption of foliages at latter stages(IVth & Vth) of larval culture of tasar silkworm. It is thus very clear that the tasar larvae require more quantity of rich diet at latter stages than the initial stages of tasar culture. Therefore, the results so obtained are very much in conformities with the earlier investigations carried out by Jolly (1973), Sharma etal. (2013), Kumar (2016), Rath etal. (1999) and many other sericologists.

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