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COMPARATIVE STUDIES OF SILK WORM SPIECES IN AMBIKAPUR DISTT SURGUJA (C.G.)

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ABSTRACT

Sericulture also known as silk farming where the silkworm arereared to produce silk. There are varities of silk prouduced all over the world. This article throws an insight into the cultivation of silkworm and creation of the beautifully refined silk. Many cottage and small scale textile industries, agriculture outputs includings, engage in such farm- based labour intensive commercial economic activity providing employment to the rural farmers and attracts profit seeking entre preneurs as it requires low investment with relatively higher returns and the production of high quality textiles. An attempt has been made to formulate a strategic model of sericulture in Ambikapur, District – Surguja, Chhatisgarh State. We report results of the comparative studies relating to the silk production and productity at Ambikapur, District – Surguja from the silkworm species *Antheraea mylitta* and *Bombyx mori.* The research study indicates the commercial perspective of silkworm high production at Ambikapur, District Surguja.

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INTRODUCTION

Sericulture or silk farming is the cultivation of silkworms to produce silk. Today China and India are the two main producers with more than 60% of the worlds annual production. India is the second largest producer of silk in world and contributes 18% of the total world raw silk production. In India silk is available with varieties such as Mulberry, Eri, Tasar and Muga. Mulberry silk is produced extensively in the states of Karnatka, West Bengal, Jammu & Kashmir similarly Tasar silkworms are reared traditionally by the tribes of Madhya Pradesh, Bihar and Orissa Muga and Eri silk are produced exclusively in Assam. The food plant of silkworm is Mulberry for producing Mulberry silk. Tasar silk producing silkworm feed on *Terminalia Tomentosa and Terminalia Arjuna* similarly Muga silk producing silkworm feed on *scalu or som*, Eri silk producing silkworm feed on Castor (*Ricinus Communis).*

All the section of sericulture industry viz, mulberry cultivation, silkworm seed production, silk rearing, reeling and weaving of the silk and collection of by products and its processing provide a large scale employment, there by a source of livelihood for the rural and tribal people (Gregory, 1994 and Srivastava, 2003). Silk is composed of two major proteins a fibrous protein (fibroin) and 2nd globular gumming protein (sericin) (Takasu, 2002 and Mondal, 2007). Chhattisgarh state is a very high quality kosa silk production. Silk way of life in Chhattisgarh has become an inseparable part of Indian culture and tradition should be considered for rural management and development (Dewangan *et al*, 2011) Chhattisgarh three types of silk viz, mulberry, tasar, Eri silk are producing (Singh 1993) in six district such as Raigarh, Bilaspur, Korba, Champa, Baster and Ambikapur (Surguja). In Chhatishgarh State is the producer of both types mulberry and tasar. The silk final product of this industry.

Silk production is expensive , consequently silk is considered a fiber of luxury. It is thought that silk expense, beauty and hand contributed to the beginning of the manufactured fiber, industry. People wanted fabrics that look and felt like but with out the cost so they tried to manufacture fiber similar to silk. Eventually rayon was developed from these efforts of trying to artificially produce silk. Cultivated silk is a beautiful luxurious hand. This type of silk can be dyed and printed in bright color that are very pleasing to the eye.

MATERIALS AND METHODOLOGY

Area of study

The present research study has been carried out in Ambikapur district Surguja Chhattishgarh state. Ambikapur were both types of silk namely Mulberry and Tasar are being produced. Based on Kosa silk many villagers are running unit for producing kosa saress and dress materials of export quality. The study area has about 10 akad (acres) under mulberry cultivation through effective area is only 8 acres, mulberry garden are 7 in number and mulberry grainages are 1 in Ambikapur, mulberry reeling unit in 1 number at Ambikapur, Surguja district is major tasar growing area where tribal are engaed in sericulture activities. Tasar culture is a traditional and exclusive craft of the tribal of study area and is being practice from 20 years. Maximum numbers production of tasar cocoons in the Ambikapur, Surguja district. Total area covered under tasar centers is about 10 acres though effective area is about 8 acre.

Climate Factor: The weather in Ambikapur varies during different months. In the summer the temperature can vary from 30 ºc to 41 ºc and lasts during the month from march to may the temperature during this pre monsoon period increases rapidly during the night and day. It's usually extremely dry during this time. During the monsoon which last from june to September, the maximum temperature is 38 ºc in the month of June and in the month of September the temperature goes down to 24.50 ºc. At time the monsoon also extends up to mid October. Even though the temperature drops to 17.10 ºc during the night of October, the official winter season starts from December and goes on to the month of February to January with the minimum temperature going down to 13.20 ºc (Chakraborty, 2015).

Sample Collection

The present investigation was carried out in Ambikapur distict Surguja at Chhattisgarh state was elected for the study, as it is largest production of tasar cocoons in Ambikapur, where both types of sericulture mulberry and tasar are being accomplished. The present research study has been carried out in nearby sericulture centre in Ambikapur district Surguja such as Darima, Udaipur, lakhanpur, lundra, sitapur, batoli and mainpat.

Rearing of Silkworm

Rearing of tasar and mulberry silkworm was carried out on *arjuna*(*Terminalia arjuna*) and mulberry plant respectively. For this freshly hatched healthy silkworms were brushed on to each of the plant species during the 1st crop (July-August) season following the rearing protocol developed by central silk board, Banalore (Dandin, 2010).

***Antheraea mylitta* D:** These are sericigenous fauna belonging to the family *Saturnidae*(Super family *Bombycoideae)* are mostly wild silkmoths. These are used as important tools in basic entomological and biotechnological research in various countries. These are medium to very large in size, and this family includes the largest moths. The word Tasar apparently derives from the Sanskrit word "Trasara" (Shuttle). Tasar silk is mentioned in literature dating back to 1950 B.C. The Indian Tasar silkworm,*Antheraea mylitta* is a natural fauna of tropical India. Wide distribution and polyohagy of this insect species has resulted in extensive variation in the population. As high as nineteen ecoraces have been reported in this species this feed primarily on *Terminalia* species and *Shorea robusta* and also no. of secondary food planta. The ecoraces uni, bi of trivoltine depending upon the geo-ecological conditions and differ from each other in qualitative and quantitative traits. Tasar cocoons are reported to be largest among all the silk producing insects in the world (Akai 2000). These complete their life cycle in four different metamorphologing phases, egg, larva, pupa and adult (moth). Between larva and pupa a hard protective oval structure formed by larva this is called cocoon. After some days/months the pupa in process of metamorphosis changes in to adult or moth and flying in nature.

Egg: The egg is oval, dorsoventrally symmetrical alog the antero-posterior axis.Its about 3mm. in length and 2.5mm. in diameter, its weight approximately 10 mg. At oviposition it is a dark brown owing to the gummy coating of meconium. Two brownish parallel lines along the equatorial plane of the egg divided the surface into three zones, disk, streak, edge.

Larva: It is typically cruciform and has a hypognathous head with biting and chewing mouth parts. On hatching it is dull brownish yellow with black head. The body usually turns green and the head brown after 48 hrs. of hatching. But also blue, yellow of almond colour larvae found occasionally. Body coloration is retained throughout the larval period. Larva has five stages they differ in size only and the development of some organs.

Pupa: These are obtect adectious, having a well defined segmented body. The dark brown pupa weight about 10 gms. The ventral genital markings are on eight and ninth abdominal segments.

Moths: The moths exibits distinct sexual dimorphism. The female are bigger with a distended abdominal and narrow bipectinate antennae. The females are poly-morphic in colour, being grey and yellow, wheras males are brown. Yellow males and brown females are rare.

Cocoon: The cocoon is the single shelled, pendent, oval, closed and reelable having a hard nonfleshy shell with fine grains. At the anterior end there is a well formed dark brown peduncle with a ring at the distal end. The cocoons are generally yellow or grey. The female spins larger cocoon than the male.

***Terminalia arjuna*:** This is a Ayurvedic plant which is especially seen in the Himalayan forests, Bengal, Bihar, Mahya Pradesh, Chhattisgarh in India. It is communally found in dry hill areas in the side of water bodies, rivers, streams and ravines. It is also planted in many part of India for shade and for ornamental purpose.

It thrives best on loose moist, fertile alluvial loams and light deep sandy soils, often overlying more or less impervions rock. The soil should have ample water supplies but normally be well drained. The soil under this tree becomes rich in calcium as the leaves are rich in this element.

The plant: These trees are about 60-70 ft. in hight. The tree of arjuna is large evergreen with a spreading crown and drooping branches.

Bark: It is simple, grey and smooth on external surface. The bark is thick, soft and of red in inside.

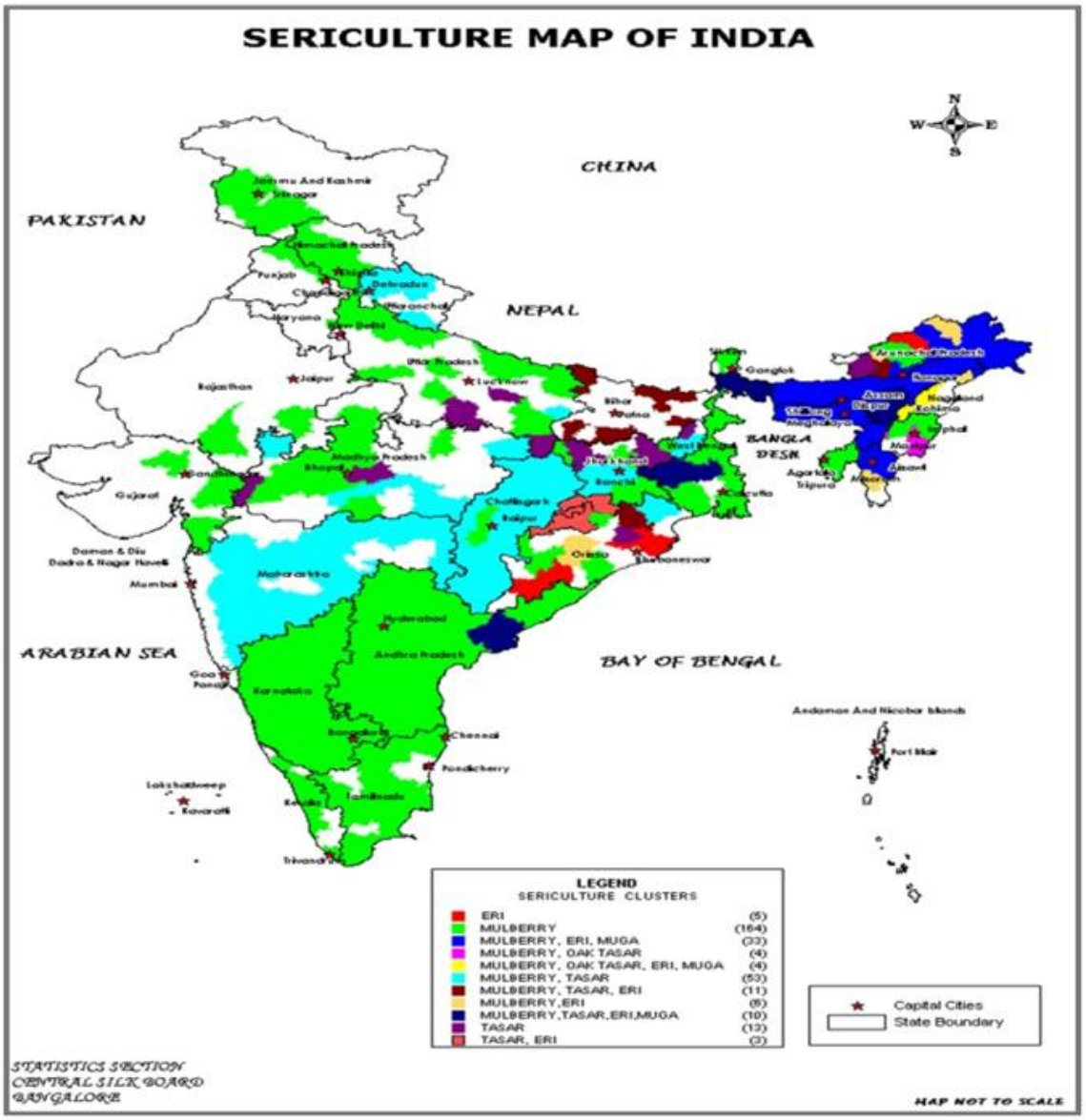
Leaves: Leaves are 4-6 inch long and 2-3 inch wide, sub-opposite, glabrous and often in equilateral. The margin is crenulate with apex at obtuse or sub-acute angle the base is rounded or cordate. Petioles are run for 0.5-1.3 cm.

Flower: White are yellow flowers are founds in groups. Flowering occurs in Summer and fruits appear in winter or spring seasons.

Fruits: The fruits are 1-1.5 inch in diameter and with five longitudinal lobes. There are glabrous with five wings, woody and fibrous fruits is drupe and is often notched near the top with oblique upward curving striations.

Tasar Silkworm

The tasar silkworm belong to the genus *Antheraea* and they are all wild silkworm, the Indian tasar feeds on leaves of *Terminalia* and several other minor host plants. The *Antheraea mylitta* silkworm leave and moth as shown in Figure2. The worms are either uni or bivoltine and their cocoons like the mulberry silkworm cocoons can be reeled into raw silk. In tasar 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 ago with spacing of 4×4' are maintained by purring at the height of 3×4' pruring should be done during February- March and March- 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.

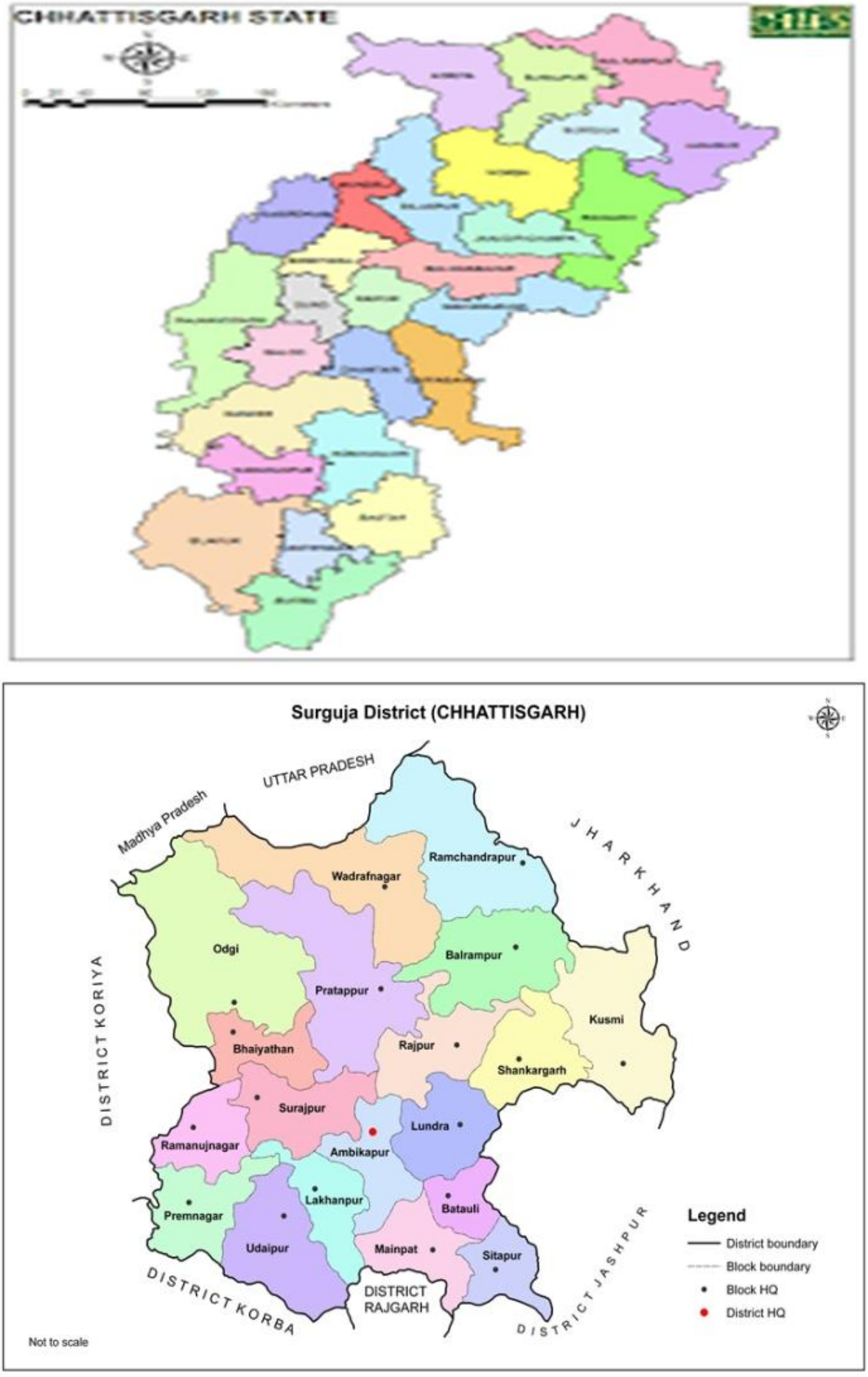


Figure . 1. Map of sericulture in ambikapur, surguja, Chhattisgarh India

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.

Figure 2. Bombyx morisilkwormlarva and moth in mulberry plant antheraea mylittalarva and moth in arjun plant respectively

Life Cycle *Antheraea mylitta and Bombyx mori*

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 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.

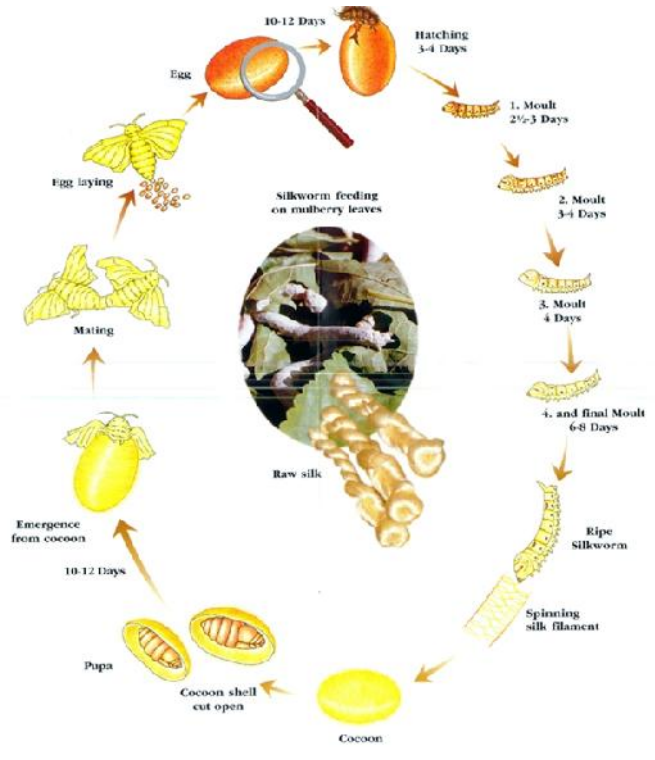


Figure 3. Life cycle of silk worm Bombyxmori

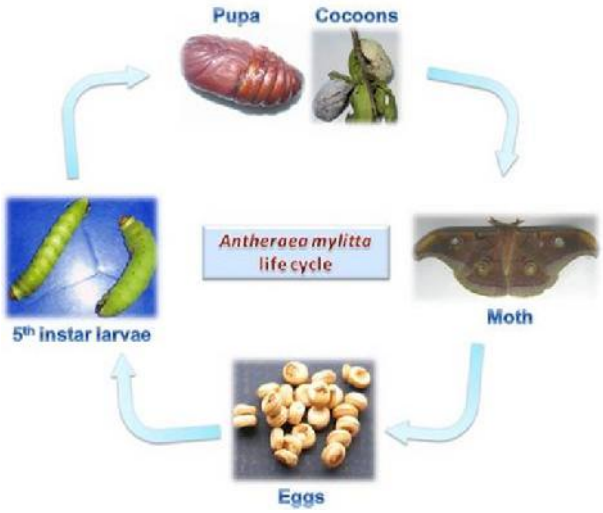


Figure 4. Life Cycle of Silk Work Antheraea mylitta

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 period 12-15 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 hatch within 11-12 days and produce second generation normally during summer and it is the 3rd generation egg which undergo hibernation and hatches in the next spring and thus producing two 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 and yellowish brown in colour while males are smaller and brick red 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- 4.

ANALYSIS

Research methodology applier in this study was a combination of descriptive analytical and quantitative methods and statistical methods. Primary and secondary data was analyzed using 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

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 women form 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 industry which is rearded as an important tool for economic development of a country.

RESULTS AND DISCUSSION

The result in this study has been supported by the statistical data analysis presented in the form of tables given under different sections. Cocoon yield and seed quality of *Bombyx mori* and *Antheraea mylitta* is dependent on variety and nutritional status of host plant but farmers for the economic advantage use alternative food plants based on availability and accessibility.

The rate of leaf production, quantity, gestation period of host plants in relation to season compared to primary food plant and their commercial feasibility is an important factor for silkworm rearing and grainage performance. The study shows that tasar rearing and graninage behaviour is better when the larvae were fed *Terminalia arjuna* food plant though commercial traits viz, cocoon weight, silk ratio and egg fertility are much better than mulberry host plant for *Bombyx mori*.

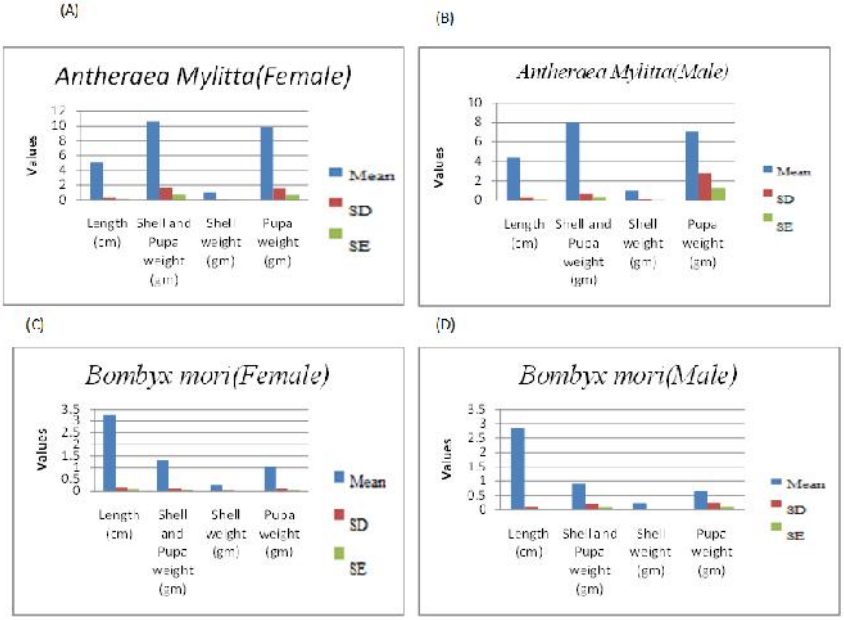


Fig. 5. Statistical data of cocoon parameter from (A) antherea mylitta (Female), (B) Antheraea Mylitta (Male), (C) Bombyx Mori (Female), (D) Bombyx Mori (Male)

Table 1 Data showing length (cm), Shell and Pupa weight (gm), Shell weight (gm) and Pupa weight (gm) of antheraea Mylitta (Female)

S.N.	Length (cm) A	Shell and Pupa weight (gm) B	Shell weight (gm) C	Pupa weight (gm)
1.	5.4	12.60	0.91	11.60
2.	5.1	11.80	1.10	11.20
3.	5.0	11.37	1.01	10.31
4.	5.2	8.95	0.89	8.60
5.	4.6	8.60	0.85	7.60
∑x/N	25.3/5	53.32/5	4.76/5	49.3/5
Mean	5.06	10.664	0.952	9.862
SD	0.2653	1.5959	0.0908	1.5310
SE	0.1186	0.7137	0.0406	0.6847

Table 2. Date showing length (cm), Shell and Pupa weight (gm), Shell weight (gm), and Pupa weight (gm) of Antheraea Mylitta (Male)

S.N.	Length (cm) A	Shell and Pupa weight (gm) B	Shell weight (gm) C	Pupa weight (gm) D
1.	4.8	7.32	1.0	7.10
2.	4.5	8.09	1.20	7.90
3.	4.6	9.30	1.26	7.39
4.	4.3	7.92	0.90	6.91
5.	4.0	7.52	0.91	6.20
∑x/N	22.2/5	40.15/5	5.27/5	35.5/5
Mean	4.44	8.03	1.054	7.1
SD	0.2727	0.6917	0.1490	2.8019
SE	0.1219	0.3093	0.0666	1.253

Table 3. Data showing length (cm), Shell and Pupa weight (gm), Shell weight (gm) and Pupa weight (gm) of Bombyx Mori (female)

S. N.	Length (cm) A	Shell and pupa weight (gm) B	Shell weight (gm) C	Pupa weight (gm) D
1.	3.5	1.42	0.30	1.10
	3.4	1.40	0.28	1.20
3.	3.3	1.35	0.24	1.00
4.	3.2	1.08	0.22	0.89
5.	3.0	1.39	0.26	1.16
∑x/N	16.4/5	6.64/5	1.30/5	5.35/5
Mean	3.28	1.328	0.26	1.07
SD	0.1720	0.1260	0.0282	0.1124
SE	0.0769	0.0563	0.0126	0.0502

Table 4. Data showing length (cm), Shell and Pupa weight (gm), Shell weight (gm) and Pupa weight (gm) of Bombyx Mori (male)

S.N.	Length (cm) A	Shell and Pupa weight (gm) B	Shell weight (gm) C	Pupa weight (gm) D
1.	2.8	0.88	0.21	0.63
2.	2.7	0.69	0.20	0.50
3.	2.9	1.20	0.23	1.02
4.	2.9	1.05	0.25	0.82
5.	3.0	0.64	0.26	0.34
∑x/N	14.3/5	4.46/5	1.15/5	3.31/5
Mean	2.86	0.892	0.23	0.662
SD	0.1019	0.2117	0.0228	0.2341
SE	0.0456	0.0947	0.0101	0.1047

This is indicative of availability of suitable nutrients cocoon weight 12.60 gm was recorded for species *A. mylitta* (female) as compared to *Bombyx mori* (female) cocoon weight 1.42 gm rainy season which are shown in table 1 and 2 . Wherever, the highest cocoon weight 9.30 gm was recorded for species *A. mylitta* (male) compared to *Bombyx mori* (male) cocoon weight 1.20 gm, rainy season which are shown in table 3 and 4 . Comparative mean data for cocoon production from two silkworm species have shown in table 4 . Productivity of cocoon in outdoor rearing is poor due to attack of number of pests and predators besides natural vagaries such as wide fluctuating temperature, heavy rain and stormy wind etc. Production of quality tasar seed is one of most challenging task of tasar silk industry at base lavel. A systematic and methodological approach of silkworm seed production of quality seed. Tropical tasar *A. mylitta* is wild sericigenious insect of commercial importance of tropical India. The rearing performance of *A. mylitta* (female) is presented in table 1 and 2 . The cocoon traits like cocoon length and cocoon weight, single shell weight, pupal weight in rainy season is related to the host plants fed to larvae. Figure5(A and B) shows the statistical data of cocoon parameter from *A. mylitta* (female and male). The rearing performancy of *B. mori* (female) is presented in table 3 and 4 . The cocoon traits like cocoon length and cocoon weight, single shell weight, pupal weight in rainy seasons is related to the host plants to larvae. Statistical data of cocoon parameter from *Bombyx mori* (female and male) has been shown in Figure5 (C and D).

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Conclusion

Going through the quantitative analysis, following conclusion may be drawn, globalization is change in its dimension of approach which identifies a number of trends. The multidimensional approach of globalization is characterized by a new brand of trade that has certain fundamental features. Thus the term globalization implies for reduction and lowering barriers to import goods and services and permitting greater foreign investment. It has been observed that physical factor such as demotic change often leads to flood and drought which causes the poor production of mulberry plant in the region. Similarly economic factor also play a vital role in declining production of reeling cocoon and raw silk. Sericulture a capital intensive industry is facing major constraints and challenges on economic front- which induce insufficient money delay in financial credit system, little amount for investment in mulberry sector and no provision for time bound financial assistance. Then attractive jobs opportunity in metro potion cities, good and timely was and other opportunities of living of standards. The study reveals that majority of sericulturists depends upon the village money lenders as well as friends and relative for getting finance to meet their requirement, because of reluctance of commercial banks in extending credit to sericulture operation.

During the course of field investigation on the selected respondents reported the problems like incidence of pest and diseases, scarcity of irrigation, poor quality of mulberry cutting, lack of demonstration farms in mulberry cultivation, attack of uzifly pest, poor quality of cbdfls, lack of chawkie rearing centres rearing sheds, lake of adequate number of cocoon markets, lake of storage facilities, transport facilities and absence of minimum support of price for cocoon etc. In Chhatishgarh tropical Tasar and mulberry are reared on commercial scale. Tasar is really homedas kosa. Ambikapur dist. Surguja in major tasar growing area where tribal are engaged in sericulture activities. Present study confirms that, bivoltine silkworm are superior over cross breed and multi-voltine silkworm in biochemical contents in different body tissues analysed of the races. Screening of silkworm genetic resources using biochemical analysis as a tool may be more dependable for the selection in silkworm breeding programs as well as for commercial explocitation of silkworm races.

REFERENCES

Ahamathullah V.K. 2009. (Central Sericulture Research and Training Institute),

Bunning, T.J, Jiang, H, Adams, W.W. Crane, R.L, Farmer, B. Kaplan, D. 1994. Application of Silk. In ACS Symposium Series, American Chemical Society, 544, 353-353.

Caroline S. Awmach, 2001. (Department of Entomology, University of Wisconsin), Simon R. Leather (Department of Biology and NERC centre for population Biology,

Imperial College, Silwood Park, Ascott, Berkshive, (V.K.).

Chakraborty, S., Muthulakshmi, M., Vardhini, D., Jayaprakash, P., Nagaraju, J., Arun Kumar K.P. 2015. Genetic Analysis of Indian Tasar Silkmoth (*Antheraea mylitta*) Population Sci, Rep. 5, 15728.

Dandin, S.B. and Giridhan, K. 2010. 'Handbook of sericulture Technologies, Central Silk Board, Ed.

Dewangan, S.R. Sahu, K.R., Achari, K.V. Soni, S. 2001. Socio-economic empowerment of tribal women through Sericulture a Study of Lailunga Block of Raigarh District, Chhatishgarh, India, Int, J.B. Manag. 6, 297.

EI-Sayed E.I. 1985. (Department of Biology, College of Education University of Riyadh). Effect of different host plant on larval development and on response of the black cut worm Argotis ipsilon (Hufnage).

Gerrit de Boer (Department of Entomology, University of Kansas Lowrence, Ks 66045, (U.S.A.) Effect of Different Food plants of larva of insects vol. 37 pp 736-769, 1991.

Gregory, S 1914. Rural Labour and sericulture: Typology strategies and prospects, *Indian J. Ind. Relat* 1, 365-376.

Gregory, S. 1914. Rural Labour and sericulture : Typology strategies and prospects, Indian J. Ind. Relat 1, 365-376.

Hazarika, A.Kataky, S. Bardoli, (Department of Entomology, Assam, Agriculture University, Johrat, Assam, India), C.N. Saikia, J. Hazarika, (Reional research Laboratory, Counsil of Scientific and Industrial Research, Johrat, M. Assam, India), 2001.

Li, G, Liu, H, Li, T, Wang, J. 2012. Surface Modification and Functionalization of Silk Fibroin fibres/fabric toward high performance application, mater,sci, Eng. C. 32 (2012) 627-636.

Mathur Vinod B. 2002. (Central Sericulture Research and Training Institute), Rahamathulla V.K. (Central Sericulture Research and Training Institute), Bhaskar O. Vijaya (Central Sericulture Research and Training Institute).

Ming Xue, Hong-Xian Liu 2006. (Department of Entomology, Texas Agrilife Research Texas),

Mondal, M. 2007. The Silk Proteins, Sericin and Fibroin in Silkworm, *Bombyx mori Linn.,* A Review, Caspian Journal of Enviromental Sciences, 5, 63-76.

R.P. 2014. Syzygium cumini L.-A potential new host of tropical tasar silkworm, Antheraea mylitta Drury (Lepidoptera : Saturniidae). Journal of Entomology and Zoology studies 2(1) 33-37. Jolly, M.S. Sen, S.K. and Das, M.G. (1976), Silkworm the Forest, Unasylva 28 (114) 20-23.

Rahaman A.H. Khan, N. Khan 2013. Spatio-Temporal changes of growth and production of sericulture in Asia, An analytical and comparative study J.Geogr Reg. Plann. 6, 63.

Reddy, R.M. 2010. Conservation need of tropical tasar silk insect Antheraea mylitta drury (Lepidoptera : Saturniidae) – strategies and impact. Journal of Entomoloy 7(3), 152-159.

Reddy, R.M. Prasad, .V. 2011. Silk the prospective compatiable bio- material for advanced functional application. Trends appl. Sci. Res. 6, 89.

Saha, M. Mahendran, B. and Kundu, S.C. 2008. Development of random amplified polymorphic DNA markers for tropical tasar silkworm Antheraea mylitta. Journal of Economic Entomoloy 101(4), 1176-82.

Sheela Patel, R.K. Singh and Shweta Sao 2016. Comparative Studies of two Silkworm Species in Raigarh district for High quality yield. International Journal of Development Research vol. 6, 10509-10514.

Shruti Rai, K.K. Agrawal and C.R. Babu, 2006. (Environment Natural Resource Management Society New Dehli).

Singh, C. 1993. An Economic analysis of sericulture production in raigarh district of Madhya Pradesh, Agricultural Economics Research Review, 6, 52-53.

Srivastava, S. Kapoor, R. Thathola, A. Srivastava, R.P. 2003. mulberry (momsalba) leaves as human food, a new dimension of sericulture. Int. J. Food Sci. Nutr, 54, 411-416.

ULLAL, S.R. & Narasimhanna M.N. 1987. Mulberry Cultivation In, Hand Book of Practical Sericulture (Sampath J.Ed.) Central Silk Board, *Bungalore*, pp 7-32, Indian Journal of Sericulture, 29 (2), 263-272.

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