

Status, potentials, constrains and strategies for development of sericulture farming system in West Bengal state of India (review)

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Abstract

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West Bengal Sericulture and rural areas are facing multiple socio-economic changes, including a transition from an agriculture-based to a service-based economy. This restructuring forces agricultural and rural sector-networks to reformulate their (self-) definitions. Farming is an important and key factor for the economy of developing countries. Since last several years, farmers once again welcomed many traditional farming systems to get crop yield for completion of food requirement. Although, traditional techniques are not much sufficient in new agriculture world because farming is getting new challenges from biotic and abiotic factors. New techniques and systems are getting popularity in present farming because of their important benefits which can solve all challenges on farming. Sericulture is a short gestation period labour intensive enterprise which can go a long way in promoting inclusive growth and alleviating poverty in rural areas. However, sericulture industry development in the state has been inactivated with a rapid change of its political and economic system and a large portion of sericulture farmers has consequently given up cocoon production activities thus to lose their job opportunities and income resources. The review paper indicates the current scenario, identifies the state's existing potential and constraints and suggests future planning for the development of sericulture & silk industry in the state.

Keywords: sericulture; livelihood; problems; prospects; West Bengal

Abbreviations: CSB: Central Silk Board; MT: Metric Tonne; dfls: Disease Free Layings; DGCI&S: Directorate General of Commercial Intelligence and Statistics; TRYSEM: Training of Rural Youth for Self-Employment; IPCC: Intergovernmental Panel on Climate Change

Introduction

The term 'Socio-economic aspects' is often discussed in a broad term as the satisfaction of needs, feelings of well-being, good or bad working conditions, and other indicators. Such a conceptualization of it encompasses all the material aspects of human life and may extend beyond to cover the physical and psychological dimensions. It covers diverse and innumerable human need.

Sericulture, the technique of silk production, is an agro-industry, playing an important role in the rural economy of India. In a strict sense, the term "sericulture" would refer to the processes involved in the production of natural silk. Silk is a natural filament created by the silkworm. Therefore, sericulture means the raising or rearing of silkworms for the production of silk. India has the unique distinction of being the only country producing all the five known commercial silks, viz. Mulberry, Tropical Tasar, Oak Tasar, Eri and Muga, of

which Muga with its golden yellow glitter is unique and prerogative of India.

West Bengal is major traditional silk producing a state in India. Traditionally, historically-documented activity in West Bengal since in the very distant past, and it has an important economic, cultural and spiritual impact, maintained until the present day. From the scientific point of view, silk has been a research topic in various domains, such as agriculture, nutrition science, medicine, industrial activities, art, geography, environmental sciences, etc. However, the term “silk” is most commonly associated with textiles, specifically the fibers unraveled from cocoons spun by the silkworm *Bombyx mori* (Vollrath et al., 2009). This “queen of textiles” has been used by humans for thousands of years in the production of luxury apparel due to its appearance, soft touch, and durability (Babu, 2013), and is produced on a commercial scale in quantities of hundreds of thousands of tonnes per annum (FAOSTAT, 2016). As a main or alternative economic activity, being at the border between rural and urban environment, silk has important development potential, including on a community level, and a significant role in sustaining a lifestyle which is in line with modern environmental challenges. Also, as it only needs small capital investments and a small work volume (in relation to the number of families) and as it is compatible with alternative activities, and having the potential to involve the entire household in its exploitation, silk is seen as a solution to reduce poverty in vulnerable areas.

This review paper synthesizes research on the current status of sericulture farming, socio-economic and management of West Bengal, and also includes the need for reviewing West Bengal sericultural policies has arisen due to that fact that current sericultural practices in the state are found to be related to environmental, social and economic problems. There has also been a growing perception among State researchers and Scientists to find solutions to such environmental, social and economic problems that have resulted in the transformation of economic activities from the sericultural sector to the manufacturing sector. There is no doubt

that new scientific knowledge coupled with concerns for the environmental, social and economic aspects of sericulture brought West Bengal Sericulture into a state of transition. These topics span an enormously diverse range of literature. As such, different subtopics are necessarily dealt with succinctly. An attempt was made to include the most significant publications as well as a good number of the less noted, but also important research works. The extensive bibliography can serve as a resource for readers interested in further exploration of the subject.

Current Status of Sericulture in the World

The Sericultural sector continues to play a crucial role in creating global levels for economic development in various countries. According to the International Sericultural Commission (2018), the main silk producing countries in the world are: China followed by India, Uzbekistan, Brazil, Japan, Republic of Korea, Thailand, Vietnam, DPR Korea, and Iran (Table 1). Few other countries are also engaged in the production of cocoons and raw silk in negligible quantities; Kenya, Botswana, Nigeria, Zambia, Zimbabwe, Bangladesh, Colombia, Egypt, Japan, Nepal, Bulgaria, Turkey, Uganda, Malaysia, Romania, Bolivia, etc.

At present, increasing consumption of silk products witnessed in most of the developed countries leads to high demand in the global level market. It plays an important role in foreign exchange earning the opportunity for developing countries in the world. There has also been a growing perception among world researchers and scientists to find solutions to such environmental, social and economic problems that have resulted in the transformation of economic from sericulture sector to the manufacturing sector. There is no doubt that new scientific knowledge coupled with concerns for the environmental, social and economic aspects of sericulture brought global sericulture into a state of transition. Because, silk is considered a premier textile material in the world due to its high tensile strength, its shine and ability to bind chemical dyes. Despite facing keen competition from

Table 1. World raw silk production: (Quantity in Metric Tonnes)

Country	2012–13	2013–14	2014–15	2015–16	2016–17
China	130000	146000	170000	158000	142000
India	26480	28708	28523	30348	31906
Uzbekistan	980	1100	1200	1256	1200
Thailand	680	692	696	712	680
Brazil	550	560	600	650	600
Vietnam	475	420	450	523	520
Iran	123	110	120	125	120
Others	449.1	467.6	481.8	498.27	48138

Source: International Sericultural Commission

man-made fibers, silk has maintained its supremacy in the production of luxury apparels and high-quality specialized goods (Babu, 2015).

Current Status of Sericulture in India

India is the second largest producer of silk in the world and has 18 percent share in global raw silk production (CSB, 2013). In India, Sericulture traditionally is practiced in tropical environmental regions such as Karnataka, Tamil Nadu, Andhra Pradesh, West Bengal and to a limited extent in the temperate region of Jammu & Kashmir. These five major mulberry silk producing states collectively account for more than 80% of the total area under mulberry cultivation and 97% of raw silk production in the country. During 2017–18, the total raw silk production in the country was 31 931 MT. India has the unique distinction of being the only country producing all the five kinds of silk namely, Mulberry (*Bombyx mori*), Eri (*Samia ricini*), Muga (*Antheraea assamensis*), Tropical Tasar (*Antheraea mylitta*) and Temperate Tasar (*Antheraea proylei* J.). Among them, mulberry silk is the most popular variety, which contributes around 79% of the country's silk production. Among the five varieties of silk produced in 2017–18, Mulberry accounts for 69.09% (22 062 MT), Tasar 9.45% (3018 MT), Eri 20.86% (6661 MT) and Muga 0.60% (190 MT) of the total raw silk production of 31 931 MT. (CSB note, 2017–18). Now, as a result of growing realization, sericulture is gaining ground in non-traditional areas too.

India has tremendous potential for silk development but yet unexploited, however, development is not far away (Dewangan et al., 2011). After few decades of planning and with the establishment of central silk board Bangalore, sericulture has shown an increasing trend. With the result, sericulture is not restricted to traditional states only but now sericulture is showing an increasing trend in non-traditional states as well.

Current Status of Sericulture in West Bengal

West Bengal has 6 agro-climatic zones & offers a diverse variety of environments for agriculture production. Sericulture in West Bengal has a long tradition and the traditional practices demand an orientation towards the adoption of the latest technologies for sustaining the activity with better returns. But in the last decades, the industry declined due to the frequent epidemic of diseases, competition for land generated by an increased price of food grains, and a failure to introduce new technology. Additionally, fluctuating climatic conditions hampering silkworm rearing; Closed mulberry plantation mostly with low yielding local variety; Rearing of Nistari on a large scale offering poor productivity (15–20 kg/dfls); most important problem is feeding of diseased

leaves. That reason, silk production of West Bengal is static. West Bengal witnessed sluggish growth in silk production in 2017–18 as compared to 2016–17. During the year under review, the state produced 2577.28 MT of raw silk in 2017–18 as against 2565.2 MT in 2016–17, due to diversified crop cultivation, only a few regions are practicing sericulture activities with unskilled labor and lack of technologies compared to other states. While in the other traditional states sericulture has an increasing trend in the area under cultivation, due to increasing in demand of raw silk in India, whereas in respective state government has provided more financial assistance and subsidies to start sericulture in other states. At present, in West Bengal, mulberry is grown in 15 districts and among them, Malda, Murshidabad, and Birbhum have the highest area although marginal fluctuation in different years is indicated. Now a day, on the basis of feeding of the silkworm, four types of sericulture have been practiced in West Bengal i.e., Mulberry, Tasar, Muga, and Eri (Mandal, 2008).

The Role of Sericulture in National Economy

The country is rich in natural resources and has identified the fact that taking appropriate measures can speed its economic development. Economic development is receiving a great deal of attention today, both in India and in the world at large. There are two prerequisites for developing a low-income agrarian society into a wealthy industrial nation. First, agriculture must be productive enough so that only a small part of the resources are needed to produce food and fiber. Second, opportunities are needed for the transfer of resources from agriculture, as it becomes more efficient, into the nonfarm sector of the economy. This process has been going on in our country for a long time. According to the Indian Fiscal commission, "Agriculture is not merely an occupation; it is a way of life which for centuries has shaped the thought and outlook of many millions of people."

Indian economy reportedly suffers from a high incidence of rural poverty un-employment and under-employment. Rural poverty has many forms and is a much more complex phenomenon. Poverty alleviation requires suitable policy interventions and appropriate technological options that can increase agricultural productivity without adversely affecting the productive capacity of natural resources (Dewangan et al., 2011). The farm and non-farm activity of Sericulture create sixty hundred thousand employments every year mostly in rural India (Roy et al., 2012). Sericulture industry today occupies a pride of place in the rural economy of the country. It is a well established agro-based industry and it is an effective tool for rural development as it generates more income and employment. Sericulture, the production of silk-

worms and thus ultimately of silk fiber (Ganga & Chetty, 1991), has become a promising rural activity in India because of its minimum gestation period, minimal investment, maximum employment potential and quick turnover for investment (Kasi, 2011).

Silk is an export-oriented product and is exported to more than 50 countries like USA, UK, Italy, UAE and Saudi Arabia. Some European and Asian countries are the main buyers of Indian silk. The role of export and import in the development of a country's as well as state economy is of crucial importance, particularly in the context of its trade position. Export offers various benefits such as earning foreign exchange, industrial development and effective utilization of available resources and the creation of employment opportunities on a massive scale. Export and imports are considered to be the engine of the economic growth of a country or state, particularly in its developing stage. It is fact that economy and trade move together. It is, in fact, the catalyst for economic growth. Exports and imports are also influenced by the competitiveness of farm goods in the world market. Figure 1 indicates, during the last five years, 2012 to 2017 India has earned a total of 1393.44 Million Euro by exporting silk (goods) while raw silk import was to the tune of 830.03 Million Euro. It is again shown that we have a tremendous demand for raw silk in our domestic market itself because still, we are importing silk from outside of our country.

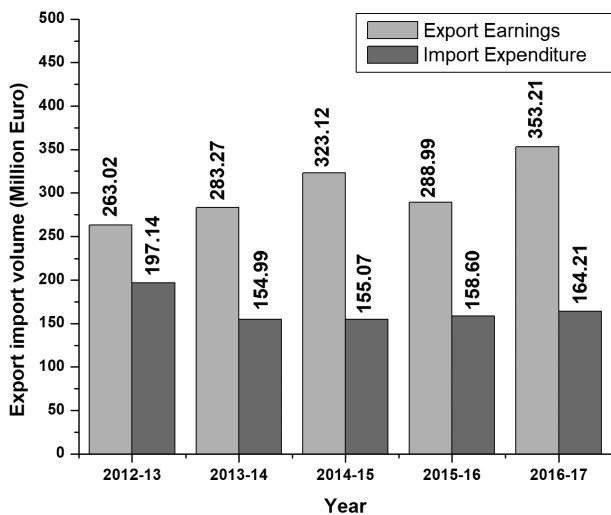


Fig. 1. Export Import scenario of Indian raw silk
(Source: DGCIS, Kolkata)

The role of Sericulture in State Economy

The new technological breakthrough which took place in Indian agriculture during the mid-sixties aimed at increasing the productivity of some selected crops by the use of high yielding seeds, fertilizers, pesticides, and water. This breakthrough has not significantly influenced the increase in income and employment. The increase in employment and the resultant income increase 'Would reflect rural development. Though there are ways and means of creating employment and augmenting income in agriculture through alternative crop activities, the governments have chosen various other programmes such as 'National Employment Scheme, TRYSEM, etc. as an ad-hoc measure. In recent years, sericulture activity has emerged as one of the potentials for creating 'significantly employment opportunities as well as continuous income among farmers in rural areas. West Bengal is India's sixth largest economy had a gross state domestic product (GSDP) of US\$ 140.56 billion in 2016–17. Agriculture is the chief occupation in the state and contributed 18.8 percent to the GSDP in 2014–15.

Sericulture, an Agro-based Cottage Industry, is an important rural avocation in West Bengal providing employment and livelihood to more than 1 hundred thousand families who predominantly dwell in rural and semi-urban areas. It has been one of the age-old agro-based activities that have been playing an important role in the generation of employment and income in the slowly growing rural economy of West Bengal. Sericulture industry is unique in its advantages and suitability to the rural setup of Bengal. Mulberry Sericulture in West Bengal can be found in almost all the districts but Malda, Murshidabad, and Birbhum district contribute significantly to the total silk production of the state. Tribal dominated districts like Medinipur, Purulia, and Bankura are known to produce Tasar silk and a small amount of Eri and Muga silk is also available in Coochbehar and Jalpaiguri district too. This shows the diverse spatial distribution of Sericulture farmers in the state and most of them come from the backward classes of the society. This unique distribution implies that inclusive socio-economic development is quite possible through Sericulture. The development of sericulture and silk industry can achieve good ecological, economic and social benefit. Figure 2 below depicts that sericulture has got ample scope for employment generation and entrepreneurship development in its entire value chain.

Sericulture Farming System in West Bengal

Farming systems in subsistence agriculture are rather complex; they are based on agroecological, socioeconomic and technological factors, and are strongly influenced by farmers' perceptions, experiences, and needs. Sericulture is

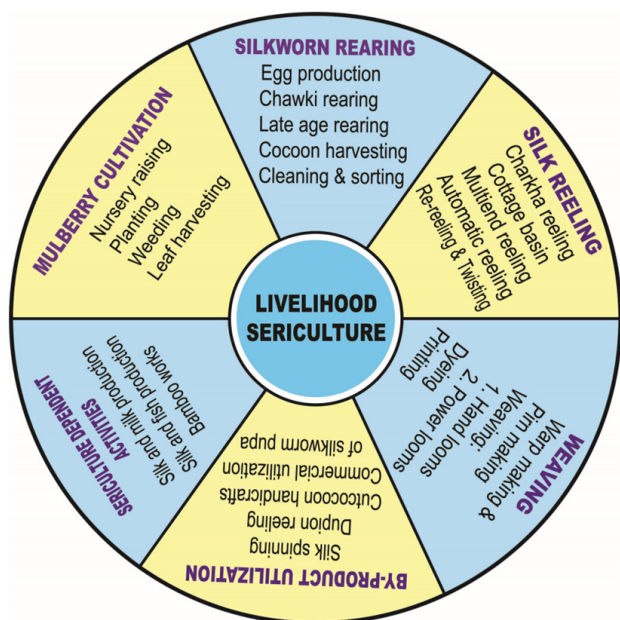


Fig. 2. Entrepreneurship Opportunities in Sericulture

an agro-based industry with short gestation period, low investment, continuous cash flow and high pay off. A noteworthy feature of sericulture is that the mulberry crop could be raised under wide-ranging production environs and by small and marginal farmers. Being labour intensive, Sericulture is ideally suited to India for creating gainful employment to the ever-increasing labour force, particularly women. Considerable research in the past several decades has indicated that the small scale and family farming sector plays a key role in environmental sustainability and farmer livelihoods (Chappell et al., 2013), and, given the non-market values generated by agriculture (Sandhu et al., 2015), the true contribution to the global economy is likely much larger than the US\$ 2.2 trillion figure. Generally, five crops in a year are produced in

West Bengal out of November and February crops are most profitable under irrigated condition. The number of crops per year reduced to five in case of the rainfed condition. Most widely cultivated mulberry variety is S₁₆₃₅ under both the condition.

Benefits of Sericulture Farming Practices

It is estimated that one hectare of mulberry can create employment for 13-16 persons per year and their location-specific analysis showed that for production of 1kg of raw silk 11 man days are needed which in turn employ 30 mandays for production of silk fabric (Vijaykumar et al., 2007). A study conducted in Maharashtra (Hajare, 2008) (Table 2) showed that mulberry Sericulture generates 170 man-days in comparison to other crop combinations like soyabean-wheat, soyabean-gram, and cotton-pigeon pea generates 66, 65 and 65 Mondays, respectively.

India is blessed with a favorable climate and round the year mulberry leaf availability, especially for cocoon production. Compared to other rural activities, sericulture offers returns even at the present low yields. Prospects of sustained growth in sericulture are very good since domestic demand for silk is increasing at a fast rate. Weaving and garment manufacturing sector are also well developed and export potential appears good for the production in excess of domestic requirements. Thus, the substantial potential exists for sericulture to contribute significantly to India’s employment potential, income generation, and foreign exchange earnings.

Performance of Bengal Silk Industry

West Bengal, state of India, located in the eastern part of the country, which is the sericulture production base of Malda, Murshidabad and Birbhum districts. However, at present in West Bengal, mulberry is grown in 15 districts. Table 3 below indicates the performance of Bengal silk Industry which has got the potential to flourish but not performing up to the mark. Even though production of bivoltine has started but the spread

Table 2. Employment Generation in Sericulture: A comparative analysis

Location	Crops	Gross Income Generate(Rs)/ha/yr	Employment (mandays)/ha/yr
Khobana village, Maharashtra	Mulberry Sericulture	82315	170
	Paddy-Sunflower	33242	52
	Soyabean-Wheat	23744	66
	Soyabean-Gram	18995	61
Dhapewada village, Maharashtra	Mulberry Sericulture	87778	170
	Cotton-Pigeon pea	27633	65
	Soyabean-Wheat	26008	66
	Soyabean-Gram	21133	61

Table 3. Raw Silk Production in West Bengal (Quantity in Metric Tonnes)

Year	Mulberry		Tasar	Eri	Muga
	Bivoltine	Cross Breed			
2012–13	7.16	2011	43.76	7.2	0.26
2013–14	14	2016	42	7	0.18
2314–15	27	2423	43	6	0.27
2015–16	31	2320	34	6	0.21
2016–17	38	2486	37	4	0.20
Total	117.16	11256	199.76	30.20	1.12

Source: International Sericultural Commission

and growth are very slow. Tasar, Eri and Muga production is there but the pace of growth is slow. Even though all four kinds of silk are being produced by the state but still scenario of production and growth is not that much encouraging.

Role of Women in Sericulture

Women make important contributions to the agricultural and rural economies of all regions of the world. However, the exact contribution both in terms of magnitude and of its nature is often difficult to assess and shows a high degree of variation across countries and regions. Their roles vary considerably between and within regions and are changing rapidly in many parts of the world, where economic and social forces are transforming the agricultural sector. Rural women often manage complex households and pursue multiple livelihood strategies. Their activities typically include producing agricultural crops, tending animals, processing and preparing food, working for wages in agricultural or other rural enterprises, collecting fuel and water, engaging in trade and marketing, caring for family members and maintaining their homes. Many of these activities are not defined as “economically active employment” in national accounts but they are essential to the wellbeing of rural households.

Sericulture clearly provides remunerative ‘employment’ for family members and economic benefit to farming households. Sericulture can be an alternative land-based production system, which improves land productivity, increases the income of smallholder farmers and, concomitantly, improves soil health. Approximately 8 million families (of these 80% are rural poor) are involved in silk production as part of their livelihood, engaging in sericulture as an agro-based cottage industry in India. Sericulture has got the enormous scope to involve women in its all sphere of activities. On an average 53.45 percent of the sericultural activities are attended by the women sometimes it may even go up to 80 percent also depending upon the type of activity (Figure 3).

Due to favorable agro-climatic conditions (suitable temperature and humidity), traditional skills and market potential, silk production is mostly confined to states like Karnataka, Andhra Pradesh, West Bengal, and Jammu & Kashmir. Of these, a sizeable number of workers belong to the economically weaker sections of society (Best & Maier, 2007; Bhatta & Rao, 2003; Geetha & Indira, 2011). There is substantial involvement of women in this Industry (Patil et al., 2009).

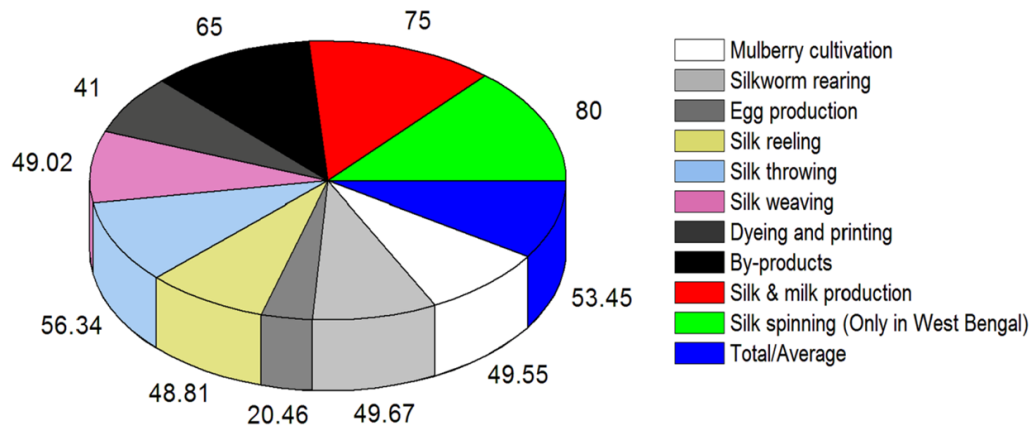


Fig 3. Involvement of women percentage in sericulture activity

Presently Women Labour Involvement in Sericulture

Labour is a critical factor in the success of sericulture as it is a labour intensive work. A huge manpower is required for sericulture activities throughout the year and the sericulture farmers utilize their family members particularly the aged persons and women in it. Although the women in agricultural families perform many farm-related activities, the pattern of division of labour between men and women varied greatly from regions and activities. Women are involved in most of the operations in agriculture, including subsidiary enterprises like dairy, poultry, beekeeping, mushroom cultivation, sericulture, fish culture, social forestry etc. (Prasad & Chandra, 1991). No wonder women play a dominant role in the sericulture sector, as the activities are mostly home-based. Women have been contributing in all the stages starting from on-farm activities such as Mulberry plantation for feeding the silkworm, indoor rearing of silkworm (Lakshmi Raju et al., 1997) to off-farm activities such as decision making, trading, and marketing. The importance of sericulture in rural development and utilization of rural women labour force in it is well documented (Roy Chowdhuri et al., 2011). A good comparison has been done between male and female labour involvement in Sericulture by Usha Rani (2007), the establishment of one-acre mulberry garden for rearing 300 dfls (disease free layings) of silkworms in two months generates 96.36 man-days of employment, of which 72.70 percent are by women (Table 4).

Role of NGOs

Non-Governmental Organizations (NGOs) particularly those working for rural livelihood promotions have

a great role to play in the sericulture sector. NGOs sometimes play a major part in bringing about changes in social structure and technology. Sericulture being an agro-industrial avocation mostly practiced by the backward sections of the society or by tribals which can be used an opportunity to uplift them socially and economically. Programmes like Mahila Kisan Sashaktikaran Pariyojna (MKSP) on Tasar implemented by NGOs in collaboration with Central Silk Board, has made a significant impact in the country and West Bengal also.

Constraints of Sericulture in West Bengal

For a long term, West Bengal state has been insisting on the mulberry cultivation mode of combining three sections, i.e. “small mulberry field, mulberry on four side, and intercropping mulberry”, which has resulted in fragmented distribution, small-scale industrial structure, low level of large-scale, low quality of unit yield, and the sericulture industry has been the production and management mode of “cultivation-sericulture-cocoon-filature”. The single development mode of “a tree, a leaf, a silkworm and a thread” inevitably lead to the high dependence of sericulture industry on the market condition of cocoon and silk.

• Lack of Investment Mechanism

In the development of sericulture industry, cocoons purchase firms and sericulturists are the main investors. However, due to the disorderly competition of cocoons purchase market, the purchase firms are not willing to invest as their investment income can't be guaranteed.

Table 4. Comparison between male and female labour involvement in Sericulture

Operation	Male labour (man days)	Female labour (man days)	% Female labour involvement
Field preparation	5.13	2.69	34.4
Planting	4.09	6.49	62.0
Fertilizer Application	1.76	2.95	62.6
Weeding	3.08	11.2	78.3
Harvesting, Chopping	1.73	3.7	68.1
Transport(mulberry)	2.15	10.8	83.7
Cocoon, Sorting of seed	0.16	2.11	97.6
Sexing	0	1	100
Egg Incubation	0	1	100
Brushing	0.17	1.93	91.9
Rearing	1.78	7.13	80.0
Feeding	3	6.93	69.7
Transport to Chandrikas	1.45	6.01	80.5
Cocoon Sorting	1.57	4.51	74.2
Mounting &Cooking	0.35	1.67	82.7
Total	26.3	70.1	72.7

Also the sericulturists wouldn't like to invest because of sharp increase and decrease of cocoon price and instable income. Thus, the development of sericulture industry confronts a serious shortage of necessary funds, leading to weakening of sericulture technology innovation, instability of technical service system, and lagging behind of infrastructure.

● **Risk Mechanism has not been Established**

Sericulture and silk industry is a typical export-oriented industry, which has long industrial chain and complex process, spans both animals and plants fields, and involves the interests of agriculture, industry and trade as well. The source of the industrial chain is cultivating mulberries and silkworms. These two processes reflect relatively slow to market. When the international market demand declines, mulberries may have become forest, and silkworms have been made already. On the contrary, if they abandon, cut down and destroy mulberries on depressive international market, silkworms will decrease substantially. And it is difficult and slow to turn around on market upturn. In addition, mulberry and sericulture also have to confront the natural risks as worms of leaves and silkworms' illness. In order to enhance the risk prevention of sericulture industry and protect the stable development and the interests of producers and operators, it is very necessary to establish risk prevention system of the industry. At present, it is lack of risk prevention mechanism in West Bengal; therefore, sericulturists must experience a serious shock as soon as encountering sharp fluctuation of cocoon price and ill silkworms, which will greatly affect their confidence on the development of sericulture industry.

● **Shortage of Labor and Low Utilization of Mulberry Resources**

The main use of mulberry globally is as feed for the silkworm but, depending on the location, it is as appreciated for its fruit (Consumed fresh, in juice or as preserves) as a delicious vegetables (young leaves and stems), for its medicinal properties in infusion (mulberry leaf tea), for landscaping and as animal feed. There are several countries where mulberry is utilized traditionally as a feed in mixed forage diets for ruminants, such as in certain areas of India, China, and Afghanistan. The present population of West Bengal is 1.04 Million Euro (Census, 2011), among which agricultural population accounts approximately 68%. The area of agricultural land in West Bengal has been reducing gradually due to overpopulation and urbanization. The above consideration, added to small and medium-size farmers lack access to appropriate production technologies; high population growth; and other aspects related to the socio-economic situation of

West Bengal, Indicated the necessity for novel solutions that will allow substantial changes to be made in current production practices. The shortage of labors becomes one of the important factors of restricting sericulture industry development. No control on mulberries and no sericulture of silkworm caused a big waste of mulberry resources.

● **Climate Change**

The climate change one of the most discussed modern topic which is having a cascading effect on human civilization and Sericulture too in the World. The Intergovernmental Panel on Climate Change suggested that if temperature rise by about 2.0 degree C over the next 100 years, negative effects of global warming would begin to extend most regions of the World, it is believed likely that approximately 20–30% of plant and animal species will be at an increased risk of extinction (IPCC 2007). Even though still it is not proved with scientific experiments and publication but reports on the adverse effect of climate on Sericulture are started coming from the field from India and West Bengal too. It is predicted that the global warming will lead to low production mulberry and raw silk, breakages in silk thread during spinning or reeling, an outbreak of increased pest and disease incidence, risk of soil acidification and salinization, crop-weed competition, change of silkworm rearing schedule etc. (Ram et al., 2016).

Recommendations

● Sericulture in West Bengal is mainly practiced by a large number of small and marginal farmers spread over the vast area of the state West Bengal. Therefore Sericulture in Bengal needs to be practiced not as a subsidiary occupation to agriculture; rather it should be practiced on a large scale as an entrepreneur mode.

● Climate change is impacting every sphere of this earth and sericulture is not out of that. So we need to have a season and region-specific varieties both for mulberry and silkworm to have climate resilient Sericulture.

● Silk the ultimate commercially valuable product of sericulture. The silk yarn production in West Bengal is multi-sectoral like charkha, cottage basin, and multi-end reeling machine etc. which ultimately leads to the production of dis-uniform quality of silk. Therefore we need to have an automatic reeling machine which is able to produce import substitute bivoltine silk.

● Till today none of the financial institutions of the country is providing credit for developing Seri-enterprise. So both central and state govt. needs to intake some initiative for sensitization of financial institution so that they can provide finance for Seri-entrepreneurship.

- It has been observed many times that Seri-farmers are not getting the proper price of their products only because of the absence of proper cocoon market. Moreover, there is no price stabilization mechanism/ no MSP for cocoons in the country. Farmers are always uncertain about the price of their produce. Therefore, the state should immediately take some initiative for proper and fair cocoon marketing system in Bengal.

- We have seen many times that in spite of having the technology, barriers farmers sometimes particular crop failed to perform. Therefore the success of any agro allied crop depends on the delivery of technologies in the field. Still, Seri-extension system is very poor particularly with reference to West Bengal. So the appointment of extension professional/ subject matter specialist is a must.

Conclusions and Future Directions

Sericulture is labour intensive agro avocation, ideally suited for the development of the rural economy of India and West Bengal, but still practiced as a subsidiary occupation to agriculture. According to an estimate, the Indian sericulture market during 2017 was INR 205 Billion, which is further projected to reach INR 553 Billion by 2023. The driving force of the Indian silk industry is exports and a very strong domestic demand. Seri industry has got many challenges like fragmented nature of the industry, quality and productivity improvement, poor flow of credit to the sector, lack of revolving fund for reeling sector, frequent market distress situation due to policy changes and weak extension mechanism etc. But still, there are a lot of hopes, scopes, and opportunities too. Sericulture is being practiced by the 1 210 299 families from 66 631 villages of the country which in turns generated employment to 86.04 hundred thousand persons. Still, we are having a production gap of 5500 MT and importing around 3712 MT of silk in the current year itself.

Therefore it can be said that there are challenges and opportunities exist together. We need to have a proper plan with sound sericulture and silk industry development policies for the country and for West Bengal in particular. So that it can become a very good tool for poverty alleviation as well as can contributes to the country's economy.

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