



Sericulture: Importance and Potentials

Tania Roy

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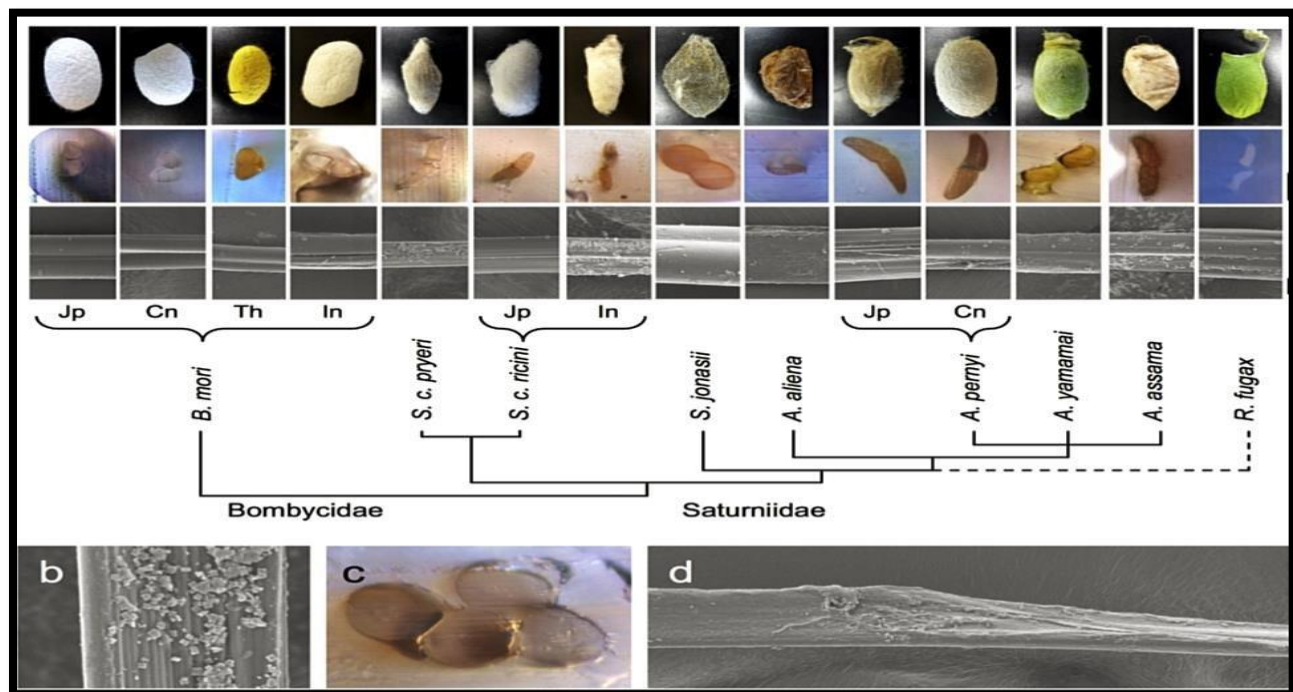
JIS University

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Introduction

The rearing of the silkworms to produce raw silk is known as sericulture. Silk is the protein secretion by larvae of particular Lepidopteran moths. It is fibrous by its nature, and mostly used for the preparation of art clothes.

According to one source of origin of silk is from India during 200 B.C. (Himalayan region). Whereas another view says that it is basically originated from China. The knowledge of silk production spread far and wide by the time span. In present days many Western nations along with Japan, Russia, and Persia, Africa and India are practicing the culture and production of silk. The moths belonging to two major families, Bombycidae and Saturniidae of Lepidoptera family of insects produce commercial silk in India. Based on the quality and lustre of the silk fibers 4 types



of silk are produced by die different forms of silk secreting moths. The main species of silk secreting moths are Bombyx sp. Attacus sp. and Anthracea sps .

Physical And Chemical Properties of Silk

The silk fiber quality and quantity mainly depend on its size and robustness of cocoon. It is estimated that on an average a cocoon gives silk filament of 600-1200 m. To produce 1 lb. of raw silk about 2300-2600 cocoons are required. In terms of weight about 11 kg., of cocoon' may yield 1 kg., of raw commercial silk and 1.5 kg of waste silk for spinning.

The filaments have a great tensile strength (tensile strength of silk 64,000 lb/ssq. Inch and that of iron 90,000 Ib/sq. inch) and elasticity (the silk fibre can stretch one fifth of its original length). These two properties of silk owe much of its excellence as a textile material. Silk filaments are formed of an inner core of material called fibroin covered by another substance called sericin. Fibroin constitutes about 70-80% of the filament. It is an amphoteric colloidal protein of formula C₁₅ H₂₂ N₅ O₆. Fibroin when heated burns and gives the smell of burned feather. This property is used to distinguish genuine silk from artificial silk. Sericin is also a protein of albuminous nature.

Types of Silk

There are four major types of silk of commercial importance, obtained from different species of silkworms which in turn feed on a number of food plants. These are:

A. Classification on the basis of species. All are different species.

- Mulberry
- Oak Tasar & Tropical Tasar
- Muga
- Eri



B. Classification on the basis of occurrence.

- Domesticated – Mulberry, Reared tasar
- Wild- Tasar Muga and Eri. Wild silks are also called Vanya Silk.

C. Classification on the basis of Ecoraces

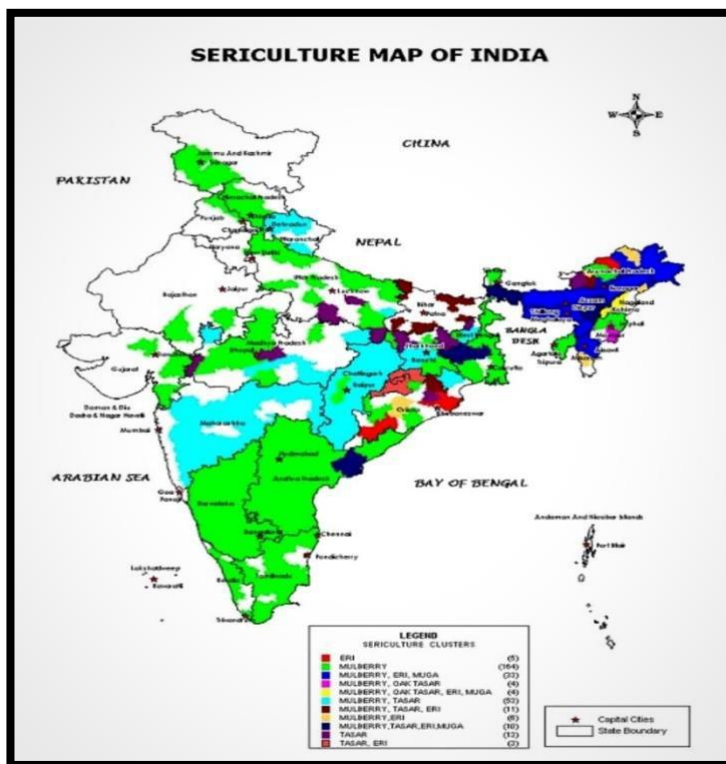


- Mulberry – Various geographic varieties.
- Tasar- Natural, reared,

D. Classification on the basis of life cycles per year.

- Multi Voltine – More than 2 lifecycles per year. Mulberry and tasar in central and south India.
- Bi Voltine – Two life cycles per year. Tasar in Tropical areas. Mulberry in tropical areas as an improved variety.
- Uni Voltine- One life cycles per year. Oak tasar and Mulberry in temperate areas. Kashmir, Himachal and China.

Silk Production in India



India has the distinction of being the one and only country, producing all the five known commercial silks namely, mulberry, tropical tasar, oak tasar, eri and muga, of which muga with its golden yellow glitter is unique and prerogative of India.

Mulberry sericulture is mostly practised in states such as Karnataka, Andhra Pradesh (AP), Assam and Bodoland (Kokrajhar, Chirang, Baksa and Udalguri districts of Assam), West Bengal(WB), Jharkhand and Tamil Nadu which are major silk producing states in this country. North East has the unique distinction of being the only region producing four varieties of silk such as, Mulberry, Oak Tasar, Muga and Eri. Overall NE region contributes 18% of India's total silk production.

India is second largest producer of silk in world. Among the four varieties of silk produced in 2020- 21, Mulberry accounted for 70.72% (23,860 MT), Tasar 8.02% (2,705 MT), Eri 20.55%



(6,935 MT) and Muga 0.71% (239 MT) of the total raw silk production of 33,739 MT (Provisional).

The production of silk has been reduced in the country during 2020-21 due to the disruptions caused by the Covid-19 pandemic. The total raw silk production in the country during 2020-21 was 33,739 MT, which was 5.8% lesser than the production achieved during the previous year 2019-20 and registered around 86.5% of achievement against the annual silk production target for the year 2020-21. The bivoltine raw silk production declined by 3.4% to 6,772 MT during 2020-21 from 7,009 MT during 2019-20. Similarly, vanya silk, which includes Tasar, Eri and Muga silks, have reduced by 13.8%, 3.7% and 0.8%, respectively during 2020-21 over 2019-20. The area under mulberry has reduced by 0.8% in 2020-21 compared to previous year. (2.38 lakh ha.) The export earnings during 2020-21 were Rs. 1418.97 crores. The estimated employment generation under sericulture in the country was 8.7 million persons during 2020-21 compared to 9.4 million persons in 2019-20, indicating a reduction of 7.4%.

Importance Of Sericulture in Developing Countries

The art of silk production is called sericulture which mainly comprises the cultivation of mulberry, silkworm rearing and post cocoon activities leading to production of silk yarn. Sericulture provides a gainful employment, development in economy and improvement in the quality of life to the people in rural area and therefore it plays an important role in the anti-poverty program and prevents migration of rural people to urban area for searching the employment. Hence several developing nations like China, India, Brazil, Thailand, Vietnam, Indonesia, Egypt, Iran, Sri Lanka, Philippines, Bangladesh, Nepal, Myanmar, Turkey, Papua New Guinea, Mexico, Uzbekistan and some of the African and Latin American countries have taken the sericulture to provide employment to rural people.

Multipurpose Use of Sericulture

Besides silk, there are several other by-products from sericulture. The fruit of mulberry are rich in minerals and vitamins and from the roots, barks and mulberry leaves several ayurvedic and herbal medicines are prepared. Some woody mulberry trees provide timber which are resistant to termites and the timber is used for making sports items, toys etc. The mulberry branches after silkworm feeding are generally dried and used for the fuel specifically in the villages. The foliage of mulberry is used as fodder for cattle. The mulberry trees are planted in the embankment area for protection of the soil to prevent soil erosion, and mulberry trees are planted as the avenue trees. The silkworm pupae are rich in oil content and pupal oil is used in the cosmetic industry and the remaining pupal cake is the rich source of protein suitable for poultry and fisheries. In some tribal population, the people eat eri pupa as a source of protein and nourishment. The silkworm litter is used for the production of bio gas and used as a fuel for cooking in the rural area. Thus, sericulture not only provides silk for fashionable clothing's, it also provides several very useful by products to the human society. Therefore, development of sericulture provides opportunities to improve the living standards of people in the rural area in developing countries



Future Demand for Silk

In present the global silk production is fluctuating around 70, 000 to 90, 000 M.T. and the demand for silk is annually increasing by 5%. With the increasing population and also with the increased demand for fashionable clothing items due to fast changing fashion designs in developed countries, the demand for silk is bound with the increase even more. For increasing the silk production, we require highly productive mulberry varieties and silkworm races and also silkworm races tolerant to adverse climatic conditions and diseases which can come mainly from the sericultural germplasm resources and also from the wild relatives of *Bombyx* available in the natural habitats.

Present Status of Silkworm Germplasm at Global Level

Though accurate data are not available on the silkworm germplasm in different countries of the world, an approximate information indicate that there are 4310 silkworm germplasm accessions available in different countries in the world. For instance, the silkworm germplasm from China, Japan, France, Russia and India might be represented in the germplasm collection of other countries since these are the principal source of the sericultural germplasm and also several countries might have been exchanged some silkworm germplasm for silkworm breeding and hence a proper documentation on the availability of silkworm germplasm in different countries is very much required.

Importance Of Conservation of Silkworm Genetic Resources

During the recent years, biodiversity conservation programs have drawn the attention of many countries including developing nations, because of the genetic erosion due to indiscriminate use of bio resources and damage to the environment, destruction of forest, human interference in eco-system, upsetting the equilibrium of the biosphere. The Convention on Biological Diversity (CBD) organized by United Nations Conference on Environment and Development (UNCED) at Rio de Janeiro Earth Summit in 1992 made an awakening call to draw the global attention for conservation of biodiversity. Since then, the biodiversity conservation and gene bank maintenance have gained greater momentum since the germplasm resources are considered as "Common Heritage of Mankind" and "Sovereign Right of Nations". The issues related to access the genetic resources and its sustainable use, benefit sharing, farmers rights are being deliberated at various national and international fora.

Realizing the importance of biodiversity conservation for sustainable development of agriculture, the Consultative Group on International Agricultural Research (CGIAR) established the International Board for Plant Genetic Resources (IBPGR) in 1974 at Rome with a global network of genetic resources centers, mainly for conservation of natural genetic resources including the wild species to promote crop improvement programs and increase the food production. The role of wild relatives and wild species in agricultural crop improvement are well known (Rana, 1995). Similarly, there is an urgent need for Seri biodiversity conservation, particularly the wild relatives of *Bombyx* and *Bombycidae*.



The genus *Bombyx* Hubner (1818) has two species, *Bombyx mori* L. and *Bombyx mandarina* Moore. Apart from the genus *Bombyx* there are eleven other genera in the family Bombycidae Hubner; 1) Genus

- *Theophila* Moore (1867), 2) Genus - *Ocinara* (Walker 1856), 3) Genus - *Mustilia* (Walker 1865), 4) Genus
- *Gunda* (Walker 1862), 5) Genus *Penicillifera* (Walker) 6) Genus - *Ernolatia* (Moore) 7) Genus
- *Norasuma* Moore 8) Genus - *Trilocha* Dieri, 9) Genus - *Prismosticta* (Swinhoe), 10) Genus
- *Andraca* (Walker), and 11) Genus - *Ectrocta* (Hampson).

Among these genera, *Theophila* and *Ocinara* are very close to the genus *Bombyx*. The wild sericigenous species of *Bombyx*, *Theophila* and *Ocinara* are naturally distributed in the Himalayan ranges of Indo-China range and also in Andaman Islands in India, besides, Jawa, Sumatra, Borneo and Malaya Peninsular (Barlow, 1982). The wild species of these genera have not been explored for transferring the useful genes to confer resistance to diseases and tolerance to adverse agro-climatic conditions into the domesticated species, *B.mori*. The useful genes from the wild relatives of *B. mori* may be cloned and these cloned genes may be transferred into the germ cells of the silkworm to develop transgenic silkworm. Hence, there is an urgent need to collect and conserve the wild species of *Bombyx*, *Theophila* and *Ocinera* and study their genetics for possible use in the breeding programme of *B.mori* and widen the genetic base as well.

Importance Of Sericulture

1. High employment potential

About 60-100 lakh people are engaged in the various sericulture activities in our country. It is estimated that Sericulture can generate employment @ 11 man days per kg of raw silk production (in on-farm and off-farm activities) throughout the year. This potential is par-excellence and no other industry generates this kind of employment, specially in the rural areas. Provides vibrancy to village economies About 57 % of the gross value of silk fabrics flows back to the cocoon growers with share of income to different groups. 56.8 % to cocoon grower ,6.8% to the reeler,9.1% to the twister, 10.7% to the weaver ,16.6% to the trade Thus, large chunk of income goes back to the villages from the cities.

2. Low Gestation, High Returns

Mulberry has taken only six months to grow for commencement of silkworm rearing. Mulberry once planted will go on supporting silkworm rearing year after year for 15-20 years depending on inputs and management provided.

3. Five crops can be taken in one year under tropical conditions. By adopting stipulated package of practices, a farmer can attain net income levels up to Rs.50000 per acre per annum. hardworking farmers with proper maintenance and inputs can reach up to an income of 2 lac peryear from one acre.

Women friendly Occupation

According to historical documents, Emperor Huang-di's wife, Lei-Su, taught people silkworm rearing and silk reeling in 2600 B.C. Until today, women play a huge role in the sericulture industry. Women constitute over 60 % of those employed in down-stream activities of sericulture in the country. This is possible because sericulture activities starting from mulberry garden management, leaf harvesting and silkworm rearing is more effectively taken up by the women folk. Even silk reeling industry including weaving is 100% supported by them. Sericulture is an ideal avocation for women because of the following facts-

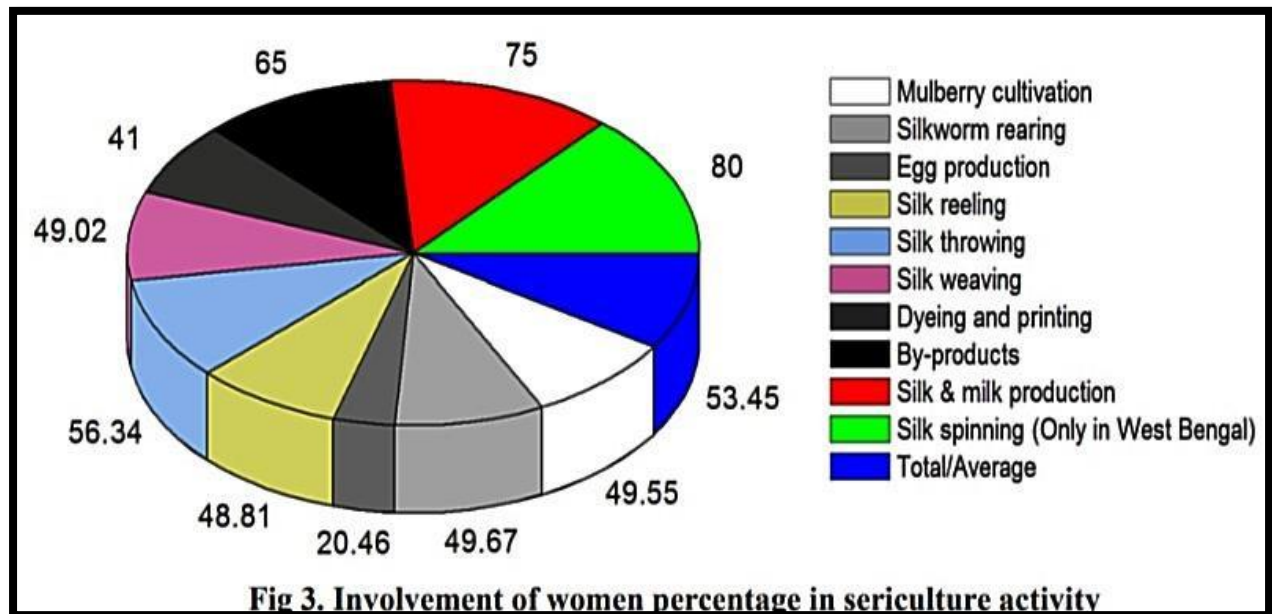


Fig 3. Involvement of women percentage in sericulture activity

Being rural based, sericulture needs less specialized skill and hence, suits women well. Involves mostly indoor activities, less physical energy and manual labour. Work is evenly spread over during the day, with intermittent gaps, offering leisure time and proximity to living place.

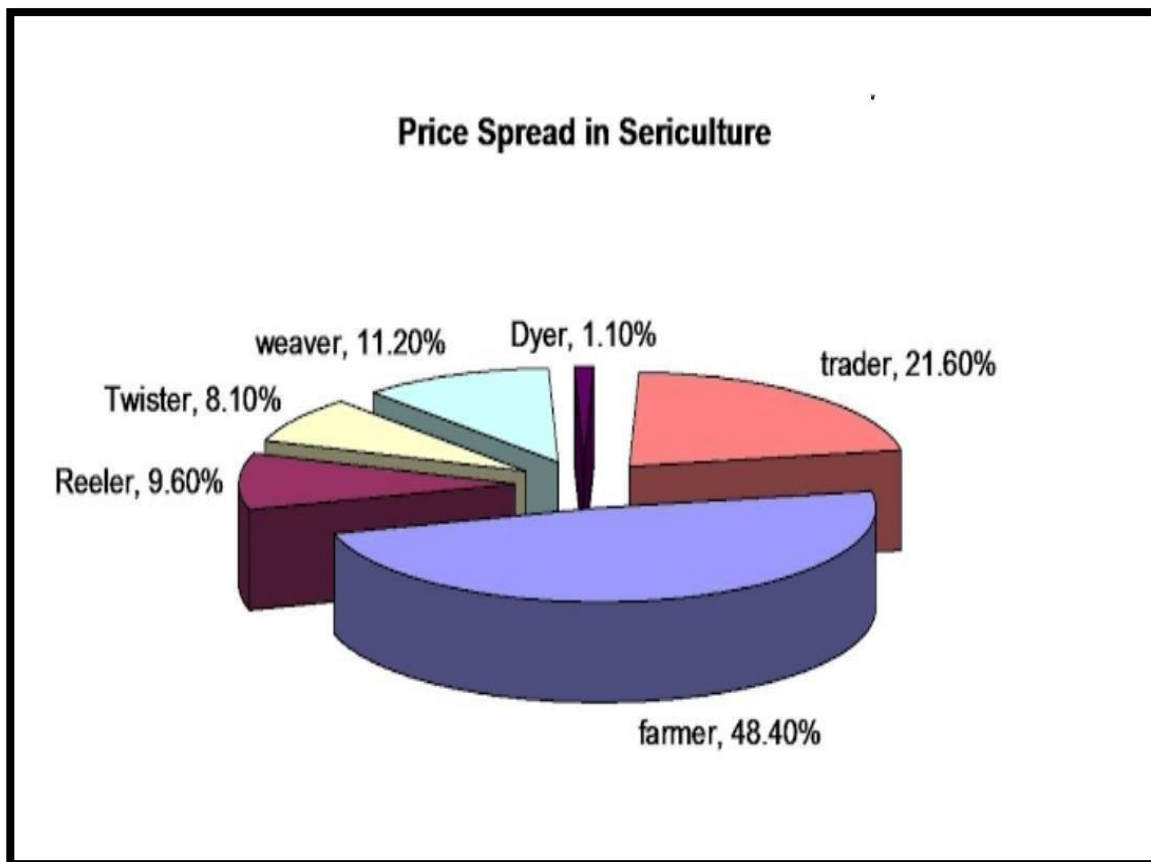
4. Ideal Program for Weaker Sections of the Society
5. Sericulture can be practiced even with very low land holding. One acre of mulberry garden and silkworm rearing can support a family of five without hiring labour.
6. Features such as low gestation, high returns make sericulture an ideal program for weaker sections of the society. Silkworms are also low-maintenance, which make sericulture an ideal project for students. Silkworms need to be fed only 1-2 times a day, reach a maximum length of only 3 inches during their 45-day growing period, and have a short life cycle.
7. Vast tracts of forest based tasar food plantations available in the country, if judiciously exploited for rearing tasar silkworms, can offer supplementary gainful employment for tribal.
8. Eco-friendly Activity.
9. As a perennial crop with good foliage and root-spread, mulberry contributes to soil conservation and provides green cover. Waste from silkworm rearing can be recycled as inputs to garden. Dried mulberry twigs and branches are used as fuel in place of firewood and therefore reduce the pressure on vegetation/forest.
10. Being a labour intensive and predominantly agro-based activity, involvement of smoke-emitting machinery is minimal.
12. Developmental program initiated for mulberry plantation are mainly in upland areas where un-used cultivable land is made productive.



- 13. Mulberry can also be cultivated as intercrop with numerous plantations.
- 14. Mulberry being a deep-rooted perennial plant can be raised in vacant lands, hill slopes and watershed areas.
- 15. Currently, only about 0.1 % of the arable land in the country is under mulberry cultivation.
- 16. Satisfies Equity Concerns Benefits of sectorial value-addition primarily accrue to rural households. As the end-product users are mostly from the higher economic groups, the money flows from high end groups to low end groups.

Fuels Rural Economies

In Thailand, 20,000 weaving families rely on sericulture industries. Data also shows that approximately 57% of the sales on silk fabrics flow back to the growers, generally rural communities. Therefore, sericulture supports the vitality of many villages in various countries.



Silkworm as Food

You don't have to own agricultural land to engage in sericulture. Silkworms can be reared in small boxes with proper ventilation.

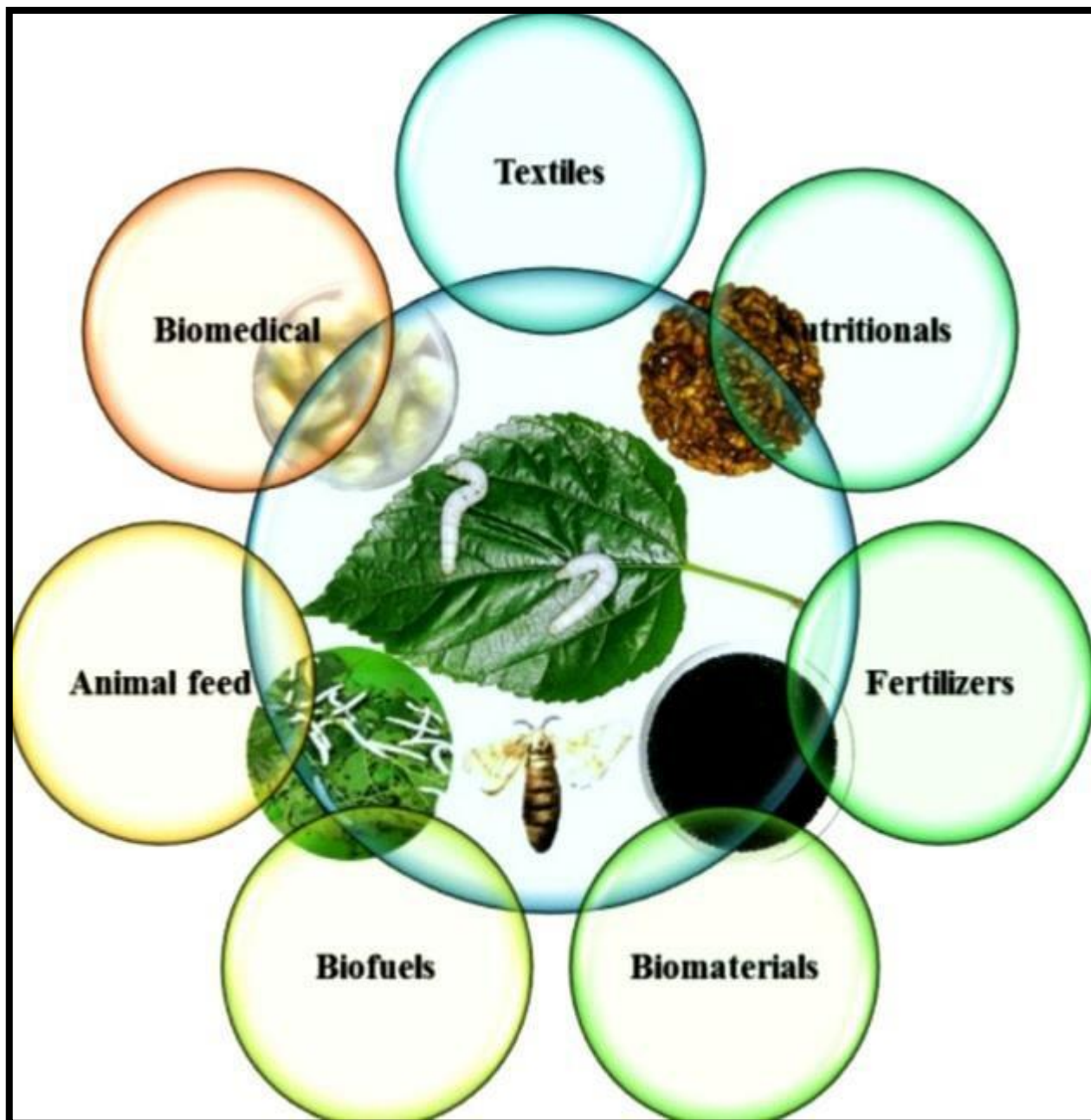


The protein content in the silkworm surpasses that of pork, beef, and chicken. Because of this, researching is investigating the potential of the silkworm pupae as food for space travels. You can also farm silkworm at home for pet feeding.

According to a home management specialist from Direct Appliance Rentals, “Sericulture can be taken on at home because the silkworms are small and low maintenance. Buying rearing packs from a reliable local supplier is a good way to start. Silkworms are easy to handle because they don’t have sharp appendages and are slow-moving”.

Biomedical Properties

There is growing popularity on skincare products that contain silk cocoon. According to studies, the cocoon’s microfibrils slow down collagen breakdown and boost the effects of other ingredients. The cocoon fibrils are also being studied because they might give more information on preventing Alzheimer’s-causing plaques in the brain.



R&D (Research and Development) achievements like development of indigenous mulberry varieties with highest leaf yields in the world, new bivoltine silkworm hybrids eminently suited to the tropical regions of the country, farmer-friendly technologies, cost-effective new package of practices for cultivation of food plants, rearing and reeling coupled with huge natural and man-made resources and trained manpower clearly indicates the future prospects of sericulture industry to emerge as a promising indicator of economic development for the upliftment of the socially deprived communities and the downtrodden. The strengths, weakness, opportunities and challenges (SWOTSWOT analysis) of Indian silk industry have been given in Table 5(above)

**Table 5: SWOT analysis of the Indian silk industry**

Strengths	Weakness	Opportunities	Threats
Large production base, availability of skills, land and labour.	Gaps in technology transfer and extension support.	Generation of rural employment and reduction of migration to urban areas.	Heavy dumping from China at low prices.
Established infrastructure, availability of silkworm breeds / hybrids.	Inadequate market accessibility, poor linkage among different stake holders.	Liberalization policies of Govt. of India in line with WTO Agreements.	Unpredictability of China's silk policies.
Low investment, short gestation period and higher returns.	De-centralized nature of the industry inhibits financial institute from extending financial support to the sector.	Reduction of production of silk even by traditional silk countries like Japan, USSR etc.	Inability of the silk industry to react and adopt to the changing needs in terms of quality both for the domestic and export markets.
Easily adoptable technologies and strong domestic demand-pull.	Lack of quality based pricing system in the market, frequent price fluctuations and large scale imports from China at low prices.	Garment exports are on a steady increase with huge employment opportunities.	Lack of awareness in the domestic market to respond to the demand-driven milieu.

Seri-Bio-Diversity

Among 34 mega biodiversity countries in the world, India is home to many species of insects with a diverse silk moth fauna. In addition to the diverse silkworm races, there are vast genetic resources of mulberry, tasar, muga and eri host plants spread over diverse geographical locations. This offers a great opportunity for economic utilization of the natural flora and fauna. However, due to deforestation and destruction of habitats, there is a challenge to bring about development without disturbing the ecological balance.

Sericulture And National Economy

In India, sericulture related activities ensure the livelihood security of the over six million families spread in some 59,000 villages across country. The silk sector is also a valuable foreign exchange earner for our country. The export earnings stood during 2011-2012 at Rs. 2,353 crores. In



addition, there is an opportunity to double the export earnings with free trade atmosphere in Europe and USA. It is estimated that India needs 25,000 MT of raw silk per year to meet its domestic requirement. The growing demand of the silk in the domestic market can make our industry a valuable enterprise which in turn can provide employment for the rural masses ensuring assured economic returns at the individual family level.

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Sericulture And Rural Development

Sericulture is being the farm-based enterprise is highly suited for both large and small land holdings, with low capital investment. The very nature of this industry with its rural based on-farm and off-farm activities and enormous employment generation potential has attracted the attention of many planners and policy makers to recognize the industry as one of the most appropriate avenues for the socio-economic development of a largely agrarian economy like ours. Generally, the silk goods are purchased by particularly urban rich and middle-class consumers and it is estimated that around 57 % of the final value of silk fabrics flows back to the primary producers in rural areas. Sericulture can play a very important role in alleviating rural poverty due to its high work participation rate and thereby can check migration from rural to urban areas.

Sericulture And Employment Generation

Raw silk production is most appropriate tool to provide gainful employment to the poorer sections of our society, as net incomes range from Rs. 12,000 to 70, 000 per annum depending upon the variety of the silk to be produced and the unit area (under host plants). It is estimated that the sericulture can generate employment @ 11 man-days per kg of mulberry raw silk production (in on-farm and off-farm activities) throughout the year.

Policy Initiatives Taken for The Development of Silk Industry

Sericulture is functional area under the Ministry of Textiles. Some of the recent policy initiatives taken by the Ministry to promote sericulture are as follows.



National Silk Policy 2020

Sericulture is included as agriculture allied activity under RKVY. This enables the sericulturists to avail the benefits of the scheme for the entire sericulture activities up to reeling.

THE CSB (Amendment) ACT, Rules and Regulations have been notified by the Govt. of India to bring quality standards in silkworm seed production.

Forest Conservation Act, has been amended to treat non mulberry sericulture as forest-based activity enabling the farmers to undertake Vanya silkworm rearing in the natural host plantation in the forests.

Anti-Dumping Duty on Chinese Raw Silk - The Director General of Antidumping & Allied Duties (DGAD), New Delhi has recommended imposition of antidumping duty on Chinese raw silk of 3A Grade & Below in the form of fixed duty of US\$ 1.85 per Kg on the landed cost of imported raw silk vide notification No.14/17/2014/DGAD dated 4-12-2015.

CDP-Mgmrega Convergence Guideline have been finalized and issued jointly by the MOT and MORD. These guidelines will help sericulture farmers to avail assistance from MGNREGAscheme.

Conclusion

We can conclude that sericulture is very effective and economically helpful tool. Sericulture production was significant for development of human civilization from different aspects. Clothing is a very essential component for human shelter. Since the very early stage of the human civilization, one of the most important reasons why clothes were often worn by people was to upgrade their social status. Textiles has been attached not only with economic factors, it was also attached with socio, religious and political aspects of men of the entire world.1 Cloth production happened through various types of components, but silk cloth had always been different and unique from very early stage of civilization. The silk piece goods had been modified in various times as per demand of the consumers.