

Problems and Prospects of Sericulture

I. INTRODUCTION

Sericulture is a cottage industry par excellence with its agricultural base, industrial super structure and labour intensive occupation provides gainful employment. It is remarkable for its low investment, quick and high returns, which fits well into the socio-economic fabric of India. Sericulture is highly recommended by planners and administrators as one of the most effective tools for rural reconstruction.

The history of sericulture in India is as old and eventful since 140 B.C. Sericulture is an agro-based industry which has vast potential for generating income and employment opportunities primarily to the rural masses of Indian states. Other countries of the world like France, Italy, Bangladesh, Vietnam, Baghdad, Tibet, China, Japan, Istanbul, Damascus, are practicing sericulture, but only in India, all four types of silks are produced. Those are Mulberry silk, Eri silk, Tasar silk and Muga silk. Sericulture is practiced both in government and private sectors. The development of sericulture has no doubt resulted in increasing the production of cocoons and there by relieving the silk industry of the problem of scarcity of raw material. But the increased output of silk yarn and fabrics is likely to create problems of marketing as demand for silk yarn is said to be not very high.

In Southern parts of India, majorly mulberry sericulture is in practice, while in Northern states of India, it is non-mulberry sericulture. The Jammu and Kashmir is quite temperate region, where univoltine / bivoltine silkworms are reared.

Majority of the reelers extract silk from cocoons using charaka reeling unit, which is of traditional in nature yielding poor quality of silk. However, with the advancement in silk reeling technology, now, cottage basin, multi-end and automatic reeling machines are used and thus able to produce superior quality of silk which is capturing international market and it is absolutely essential that the industry should devote adequate attention to developing and adopting appropriate and modern technologies.

Currently, India is the second largest producer of silk in the world producing 26,480 MT of silk next to China which is producing 1,30,000 MT of silk. The demand for silk in India is more but production is less. To overcome this India imports silk from other countries. However, India exports silk products at better price. India is facing lot of problems in sericulture; nevertheless India is having better prospects too in sericulture.

II. PROBLEMS OF MULBERRY SERICULTURE

- Mulberry sericulture is limited to certain states and certain regions in Karnataka, Andhra Pradesh, Tamil Nadu, West Bengal and Jammu and Kashmir.
- In mulberry sericulture, univoltine / bivoltine silkworm races are reared only in Jammu and Kashmir but these are reared only one / two times in a year and are susceptible to diseases.
- Bulk of the silk produced in India is from the cross between multivoltine and bivoltine, which is low in quality by international silk standards.
- The cost of production of silk cocoons in India is much higher, which is not affordable by rural people. Hence, they hesitate to take up sericulture as their occupation.
- As the China is number one producer of silk in the world, it dumps its silk in India, by which the price of the Indian silk fetches less. As Chinese silk is very cheaper compared to India.
- The production of mulberry silk needs well mechanized techniques which are not well developed in India, there exist a wide gap in cocoon yields. Hence, India is lagging behind China both in quality and quantity of silk production.
- The price of the cocoons are less, hence the farmers are switching over from mulberry to other agricultural crops. There is a sharp decline in mulberry area due to uprooting of mulberry crop, especially in some of the major mulberry silk producing states like Karnataka, Andhra Pradesh and Tamil Nadu.
- Liberalization during 2005 due to implementation of World Trade Organization (WTO) agreement has discouraged the production of silk in India.
- Establishment of mulberry garden by way of direct planting of cuttings in the main field leads to poor development of saplings resulting in low production of mulberry leaves.
- Majority of the farmers are not adopting the recommended package of practices for cultivation of mulberry viz., varieties, manures, fertilizers, cultural operations, etc., hence leaf yield and quality are less, and hence they are disappointed.
- Majority of the farmers (over 85%) in India rear the young-age (chawki) silkworms in the dwelling houses and it is difficult to regulate / provide optimum environmental conditions, hence cocoon quality is very low, as these worms require highly nutritious leaves and proper care to reap good cocoon harvest.
- Lack of awareness in harvesting and transportation of cocoons lead to poor quality of cocoons.
- Problems of pests and diseases on mulberry and silkworm and their effective management through integrated approach are lacking.

- Stifling of cocoons needs good machines, but majority of the reelers does not possess good quality stifling machines, hence the silk characteristics are low.
- After stifling of cocoons, preservation of stifled cocoons is very important; the cocoons are to be kept rooms having low moisture to prevent the cocoons to absorb moisture. But some reelers fail to protect it.
- Cooking of cocoons with traditional units like open pan leads to improper cocoon cooking. Further, non-availability of good quality reeling water poses great problems in silk reeling to produce good quality silk.
- In India, 50% of the silk is reeled on charaka, which is of traditional one, hence the quality of the silk reeled on this unit far below the international level.

III. PROBLEMS OF NON-MULBERRY SERICULTURE

Problems / constraints of non-mulberry sericulture in India can be categorized into two types namely man-made and inherent biological problems which are unique to wild silkworms and their food plants.

A. Man-made problems

- Non-mulberry sericulture is the inherent strength of Indian sericulture yet undue importance is given to mulberry silk, as the planners and administrators often consider the immediate economic returns to the farmers from mulberry sericulture. However, long term effect of non-mulberry sericulture on ecological and environmental balance are seldom considered. Hence, opportunities, funds and infrastructure made available to scientists for research and development activities in non-mulberry sericulture are highly inadequate to commensurate the numerous and complex problems unique to non-mulberry silks.
- Scarcity of non-mulberry food plantations is a very acute problem. The systematic block plantations introduced with the support of state and central sectors / schemes form less than 1% in tropical tasar and less than 20% in muga and eri sectors which are very inadequate not only from non-mulberry sericulture but also from the point of view of environmental protection.
- Excessive use of chemical fertilizers renders the soil unfertile in long course of time which is highly detrimental. The initial increase in yield observed after fertilization has been decreasing over the years. Moreover, most of the rearers depend on forest plantation where they do not want to apply costly fertilizers.
- Non-mulberry farm cannot be raised by farmers due to non-availability of land, less income and acute competition with other cash crops.

- The forest and economic plantations have been raised through ordinary heterogeneous seeds produced due to open pollination which resulted into heterogeneous population bearing different degrees of productivity levels, quality and susceptibility to various pests and diseases.
- The current spacing of 4' x 4' being followed in case of tropical and temperate tasar food plants is unsuitable for intercropping and also enhances pests and diseases.
- Although *Terminalia tomentosa* has been found better than *Terminalia arjuna* for rearing of *Antheraea mylitta* for commercial purpose, yet most of the economic plantations have been raised with *Terminalia arjuna* alone.
- Non-availability of sufficient quantity of quality silkworm seeds at right time has compelled traditional rearers to switch over to other avocations.

B. Inherent biological problems

- Non-mulberry sericulture has remained as a subsidiary crop maintained at subsistence level for a low supplementary income.
- The recommended pest and disease control measures are not only toxic and uneconomical but also impracticable for scattered and mixed forest plantations due to which tribal's do not want to adopt them.
- Non-mulberry host plants (except castor and tapioca) are generally slow growing.
- Well identified high yielding and qualitatively superior pest and disease resistant varieties of non-mulberry food plants are lacking.
- Non-mulberry silkworms are wild in nature, hence, less amenable to human handling.
- Except eri silkworm, non-mulberry silkworms are reared out door. Hence, they are open to adverse climatic conditions, pests, predators and parasites.
- Non-mulberry silkworms are highly susceptible to diseases which are aggravated by adverse climatic conditions and hence prone to extremely low survival rate under human handling.
- Non-mulberry silkworms exhibit unstable voltinism and unstable crop due to low fecundity and physiological and genetic degeneration of the races.
- Non-availability of genetically distinct and character specific stable races / strains and lack of high yielding cross breeds / hybrids of non-mulberry silkworms.
- Low cocoon yield and low multiplication rate of non-mulberry silkworms.
- Despite occurrence of extensive natural variants in the form of eco-races and physio-genetic forms, maintenance of germplasm is very difficult in wild silkworms.

- Genetics of non-mulberry silkworms is not studied in detail in a systematic way to evolve specific pure lines and determine racial characters.
- Pure lines isolated from existing population of mosaic forms (with different genetic linkage groups) exhibit very low survival rate, hence it is very difficult to maintain pure lines for evaluation and evolution of breeds.
- The non-mulberry silkworms often exhibit loss of robustness of cocoons, health of worms and other quantitative characters in successive generations due to loss of physiological vigour.
- Biotic potential of non-mulberry silkworms in respect of fecundity and silk yield could not be studied.
- Nutritional requirement of the non-mulberry silkworms has not yet been understood.
- Cause of low fecundity, retention of eggs in the ovary, staggered oviposition and consequently the hatching of eggs over 3 to 4 days and low rate of fertilization which are responsible for low multiplication rate have not been properly understood.

IV. PROSPECTS OF MULBERRY SERICULTURE

- As India is a tropical country, except Jammu and Kashmir, all other states falls under tropical climate where mulberry can be cultivated all through the year for production of 5 to 6 silkworm cocoon crops.
- It is an age-old practice and has been contributing income in a big way mainly to the rural people to overcome their poverty.
- In India, mulberry sericulture is practiced majorly in few states *viz.*, Karnataka, Andhra Pradesh, Tamil Nadu, West Bengal and Jammu and Kashmir and hence there is a great prospect for practicing mulberry sericulture in other states.
- It provides better opportunity to earn foreign exchange as export of silk goods steadily increased from a modest level of Rs. 1.7 crores in 1960-61 to an extent of Rs. 2481 crores in 2013-14.
- It keeps the rural population employed in villages and helps in preventing migration to towns.
- The employment is remunerative and utilizes family labour effectively.
- It can be operated successfully on small and medium as well as on large scale.
- It needs minimum investment and low gestation period.
- It provides raw material for cottage and large scale textile industry.
- It facilitates mulberry cultivation on soil not suitable for production of other agriculture crops.

- It helps in transferring wealth from rich to poor, as about 57% of the gross value of silk fabrics flows back to the cocoon growers. The share of income to different groups are detailed below:
 - 56.8 % to cocoon grower
 - 6.8 % to reeler
 - 9.1 % to twister
 - 10.7 % to weaver
 - 16.6 % to trader
- It gives employment potential at higher rate as 7.85 million persons (2013-14) are engaged in various activities of sericulture in India.
- It is estimated that mulberry sericulture can generate employment at 11 to 12 man years per hectare of mulberry cultivation. This potential is par excellence and no other industry generates this kind of employment, especially in rural areas, hence sericulture is used as a tool for rural reconstruction.
- Investment of Rs. 45,000 to 50,000 is sufficient for undertaking mulberry cultivation, silkworm rearing in one acre of irrigated land.
- Mulberry once planted will support silkworm rearing for a period of 15-20 years without much reduction in the yield and quality of the produce.
- By adopting recommended package of practices for cultivation of mulberry and silkworm rearing, farmer can obtain net income upto Rs. 30,000/acre/year.
- It is a women friendly occupation as 60% of the activities are carried out indoor. Even mulberry garden management, leaf harvesting and silkworm rearing can be undertaken by women.
- Most of the activities in sericulture are done in small holdings and hence only family members are enough for cultivation of mulberry and rearing of silkworms.
- Both mulberry cultivation as well as silkworm rearing is interdependent and the respective byproducts are useful in this field itself.
- The byproducts generated from mulberry cultivation namely fruit, bark, root, etc., are of great applied value in the field of pharmaceutical industry. The byproducts of silkworm rearing are of great manurial value.
- As it is a labour intensive and eco-friendly activity, it does not produce hazardous/poisonous chemicals.
- Mulberry being a tap root system, can be planted in vacant lands, hill slopes and watershed areas and it can be cultivated as intercrop with numerous plantations.

- Currently about 0.1 % of the arable land is under mulberry cultivation, hence great opportunity to bring more area under mulberry.
- The end-product users are mostly from the higher economic groups, the money flows from high end groups to low end groups.
- Cases of landless families engaged in cocoon production using mulberry contracted from local farmers are common in some states.
- Mulberry sericulture provides employment and entrepreneurial opportunities in different fields like, Kisan nursery, mulberry cultivation, vermi-composting, grainages, chawki rearing centres, silkworm rearing, silk reeling, etc.

V. PROSPECTS OF NON-MULBERRY SERICULTURE

Host plants

- Vast tracts of forest based host plants are available in India, if judiciously exploited for rearing of non-mulberry silkworms, can offer supplementary gainful employment for tribals.
- New ventures can be launched for raising economic plantations of all non-mulberry food plants with elite genotypes having high nutritive value and resistance to drought, pests and diseases to tackle the problem of shortage of food plants.
- Survey can be made for collection, maintenance, characterization and evaluation of all available natural variants of non-mulberry food plants towards improving the existing genotypes / varieties.
- The spacing between the host plants and rows can be enhanced from 4' x 4' to 8' x 8' or 9' x 9' to facilitate intercropping of leguminous crops which will not only fix nitrogen in the soil, but also fetch vegetables / pulses and also serve as green manure.
- The yield and quality of the host plants can be enhanced by adopting cost effective and efficient package of practices like foliar spray of urea, diammonium phosphate, hormones, minerals, botanicals, etc.
- *In-vitro* culture and propagation methods through cuttings can be developed for all main non-mulberry food plants for raising homogenous plantations.
- Encouraging of eco-friendly neem derivatives under integrated pest management programmes to control pests of non-mulberry host plants.
- Molecular characterization of non-mulberry host plant genotypes can be carried out to avoid duplications in germplasm banks as well as improvement of existing varieties.

Non-mulberry silkworms

- As non-mulberry silkworms comprises of 400-500 species which are widely distributed and can be reared both in temperate and tropical regions.
- Among the non-mulberry silkworms, eri silkworm spins open type of cocoon which does not require stifling and hence can be reared easily for the production of silk.
- Non-mulberry cocoon production can be integrated with agriculture, silviculture, pisciculture, mushroom culture and dairy to benefit the farmers/rearers.
- Good quality chaddars, carpets, sarees and many more decorative from non-mulberry silks to earn income.
- Non-mulberry sericulture is mainly practiced in north-eastern states of India namely Manipur, Meghalaya, Assam, etc. and same can be extended to other states of India where host plants of non-mulberry silkworms are available in nature.
- Survey, collection, maintenance, characterization and systematic evaluation of all available natural variants of wild silkworms can be taken up to evolve genetically stable pure lines which may be used for evolution of specific lines based on genetic and bio-chemical parameters. These specific / pure lines can be made available for synthesis of high yielding cross breeds / hybrids in the pattern of cross breeds of mulberry silkworm.
- Suitable rearing techniques can be developed for maintenance and evaluation of wild silkworm germplasm to assist the breeders to evolve suitable high yielding and stable races and cross breeds / hybrids.
- The biomolecular characterization of non-mulberry silkworms can be taken up to avoid duplications in the germplasm as they are more reliable.
- Rearing technologies specific for production of seed cocoons during adverse climatic conditions and production of commercial cocoons during favourable seasons can be developed with specific approaches and methods. Similarly, silkworm rearing techniques for different rearing seasons (monsoon, spring, autumn, etc.) can be developed for higher cocoon production.
- Adverse climatic conditions prevailing during wild silkworm rearing can be minimized by restructuring the host plant canopy by increasing aeration in rearing site to prevent excess moisture and reduce high temperature which will greatly reduce incidence and spread of diseases in non-mulberry silkworms.

- Cost effective and eco-friendly disinfectants can be used to contain the diseases of non-mulberry silkworms in open habitat on dwarf bushes as well as large trees.
- Organic farming can be practiced to produce quality leaves with high nutritional value for feeding the silkworms which will have greater impact on disease resistance in silkworms.
- Artificial diet can be developed to facilitate indoor rearing of wild silkworms at least during the young stages to produce robust and healthy young silkworms resistant to diseases.
- Indoor rearing methods can be developed to domesticate wild silkworms especially tropical tasar and muga silkworms to facilitate maintenance of genetically pure lines.
- Non-mulberry sericulture provide job for tribal people and thus prevents migration. Further, employment is remunerative and utilizes family labour effectively.
- By taking this occupation one can earn much profit by taking care of trees and silkworms. Hence, Chalox, Kharika, Khora, Jalis, egg laying box, are used as advance technology in vanya sericulture.

The study provides insight into the current status of sericulture in India along with problems / constraints encountered in mulberry and non-mulberry sericulture. Further, prospects for development of sericulture have been provided to enhance the production and productivity level of raw silk.