Chapter – 1

INTRODUCTION
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1.1 Introduction

Man has domesticated beneficial animals since ages for his variety of needs and benefits. Mulberry silkworm *Bombyx mori* Linneous has also been domesticated ever since it was discovered by Chinese some 4000 years ago to serve man by producing proteinacious fibre, the silk.

Silk is the "Queen of textile fibres". It is a natural fibre secreted by the larvae of certain insects which are commonly known as silkworms. These silkworms belong to the families Bombycidae and Saturniidae of the order Lepidoptera. The insect due to its instinctive habit secrete a fibrous covering during its last larval period for undergoing a prolonged period of rest. The man being the wisest of all could exploit it for his material benefit. This humble beginning of an organism has been exploited to such an extent that many silk industries now entirely depend on it.

Silk has been mentioned as a material for making exquisite textiles and royal dresses since time immemorial. It was first discovered from China. The Shangtung province in China is known to be the original
home of silk and as such the Chinese silk is world famous. In Rig-Veda silk has been mentioned as "Chingnangshu". This very clearly suggests its Chinese origin. Now, the silken clothes are so popular that it has become difficult to meet the increasing demands.

Sericulture in India is as old as its ancient culture. Silk is a way of life in India. Over thousands of years, it has become an inseparable part of Indian culture and tradition. No ritual is complete without silk apparel. The Indian silks are known for the fine quality, lustrous sheen and traditional colours.

Historically, silk was discovered in China more than 4000 years ago. Around 2640 B.C. it is said, the legendary emperor Huang – ti asked his bride, Hsi-Ling-Shih (Lei-Tsu), to study the little worms that were destroying the groves of mulberry trees in the imperial garden. The young empress gathered some of the cocoons in her hand and took them into the palace to see what they were made of. She called for a bowl of hot water and dropped a cocoon in the steaming water. To her amazement, a magical cobweb like tangle separated itself from the cocoon. She picked up the gauzy mass and found that one slender thread was unwinding itself almost without end from the cocoon. Hsi-Ling-Shih had discovered silk.
She was so pleased with the soft, fine thread that she wove a ceremonial robe for the emperor out of the cocoon threads. Silk is the product of secretion from the silk glands of the silkworm. It is a thread of proteinaceous fibre.

Silk-fibre is made up of two types of proteins, viz., fibroin, the actual silk fibre and sericin, the gummy material which coats the filament through out through the spinneret of the mouth part of the silk moth larva. The worm ultimately makes a silken-case i.e., cocoon in order to protect itself from natural calamities and enemies and undergoes metamorphosis to become adult.

During the two days a silk worm spends spinning its silken cocoon, it will produce, on average, a massive 1300 meters of the silk in one continuous strand. To produce one kilogram (2.2 pounds) of silk, it requires 1500 silkworms, which must have been fed with 250 kilograms of mulberry leaves. It is so fine that a kilometer long thread would weigh only a quarter of gram. It has good dyeability, durability and draping qualities. Silk is the perennial queen of textiles as no other fabric can match it in luster and elegance. Silk may be defined as "Yarn reeled from
the cocoons spun by the caterpillars of silk producing insects”. Silk is the only thread that can be woven directly into fabric.

'Silk' what is commonly called as silk is the mulberry silk. It is produced by the silkworm called "Bombyx mori", and 95 percent of the world's silk production comes from mulberry silkworm. The silkworms of this type are fed on mulberry leaves and are monophongous. Other silks are called non-mulberry silks as mulberry is not the food plant. They are called as wild-silks' because they are produced by wild silkworms belonging to Antheraea and Samia species of the family Saturniidae: Tasar, eri and muga are popularly known as non-mulberry silks. The wild silk produced by these wild sericigenous insects makes only about 1-2 p.c. of the total output.

The insects associated with the production of such a fine silken-threads are of four types.

i) Mulberry silkworms

ii) Tasar – silkworms

iii) Muga – silkworms and

iv) Eri – silkworms
1.2 Silk producing organisms

Silk is a fibrous protein of animal origin. Nearly 400-500 species are known to produce silk but only very few are commercially exploited. Silk producing insects belong to the Order Lepidoptera, Superfamily Bombycoidea and Families Saturniidae. There are four kinds of silk of commercial importance in the world i.e., mulberry, tasar, eri, muga. India has the unique distinction in the field of sericulture as it is the only country producing all the four varieties of silk. The silk produced in all countries falls under the following two major kinds:

i) Mulberry silk 

ii) Non-mulberry silk

Mulberry silk

Mulberry silk produced by the silkworm called 'Bombyx mori' and 95 percent of the world's silk production comes from mulberry silkworm. The silkworms of this type are fed on mulberry leaves. Mulberry raw-silk is produced out of the cocoons of the worm after subjecting to a complicated process called reeling and spinning. Mulberry silk is distributed all over the world and has been entirely domesticated since more than 4000 years.
Mulberry sericulture is also known as moriculture. Mulberry silk dominates the field of sericulture in various aspects like quantity and quality of production.

Other insects associated with the mulberry silk production are, *Bombyx mandarina* Moore found in Japan and Menchuria etc. and *Theophila huttoni* Boisd, *Theophila religiosa*, distributed in wild conditions in Assam, Manipur, Sikkim and Himachal Pradesh. They are considered to be the ancestors of *Bombyx mori* L. Under the Non-Mulberry Silk, there are Tasar Silk, Eri Silk and Muga Silk.

**Tasar silk**

Tasar silk is the product of secretion from silk glands of *Antheraea mylitta* and *Antheraea proylei*, the tropical and temperature tasar silkworms respectively. China is the largest producer of tasar silk in the world followed by India. China produces only temperate tasar silk while India has got distinction in producing both tropical and temperate varieties. India is the only country where tropical tasar silk is produced.
Tasar is copperish coloured silk and does not possess the luster of mulberry silk. Tasar silkworm rearing is practiced by the Adivasis and the tribals from the time immemorial in tropical belt.

The four important kinds of tasar silkworms are:

- **Indian Tropical Tasar**

  This silkworm commonly found in tropical India is called Antheraea mylitta. It is a multivoltine worm having a number of generations in a year and can be reared throughout the year. Its principal host are Asian (*Terminalia tomentosa*) and arjun (*T. arjuna*) and its secondary host plants are *shorea robusta* and *zizyphus sp*. The cocoons are grey white, tough and pedunculate.

- **Indian Temperate Tasar**

  This is also called Indian Oak tasar. The silkworm producing this tasar silk is *A. proylei*. It is a hybrid between the Chinese *A. pernyi* and the Indian *A. roylei*. It feeds on the leaves of the oak trees belonging to the genus *Quercus*. The cocoons of this worm are grey white in colour.

- **Chinese Tasar**

  Chinese Tasar silkworm produces large quantity of non-mulberry silk in the world. It feeds on oaks of the genus *Quercus* and on a few
other trees. It is the largest of the silkworms of the world. Its cocoons are grey brown in colour and the silk reeled from it is used for making embroidery threads and also for weaving fabrics.

- **Japanese Tasar**

  It is found mainly in Japan. It feeds on oak belongs to the species, *A. yamamai*. The silk is greenish and used for fabrics and embroidery work.

**Eri silk**

The Eri Silk is also known as Endi or Errandi. Eri silkworms are of two types-one is wild and occurs in nature and the other is domesticated. The wild eri silkworm belongs to *Philasamia Cynthia* and is also called Ailanthus Silkworm. It is bivoltine and is not reared indoors. It has been introduced in Europe, Africa and Eastern United States. Another silkworm is called castor silkworm and belongs to *Philasamia ricini*. The principal host plants of this worm are castor, kesseru and tapioca. It is a domesticated insect and can be reared successfully as mulberry silkworm. Eri cocoons are white and brick red in colour with shades, varying according to the fauna and plant used.
The cocoons of Eri Silkworms cannot be properly reeled because the filament of cocoon is spun by these worms is not continuous and uniform so the moths are allowed to emerge and pierced cocoons are used for spinning in order to produce the Eri silk yarn. So it is also known as Ahinsa Silk; as we are not killing pupa as in other silks.

Muga silk

The muga silk is a golden lustrous silk produced from the worms *Antheraea asamensis*. The worm is found in the Bramhaputra valley because of its availability of food plants associated with worm and moist climatic conditions which is not met with in other parts of the world. The silkworm feeds on som and soalu trees. This silk is produced only in India and that of only in Assam state. Rearing is done outdoors and only recently the indoor rearing of young worms has been introduced. The cocoons are weakly pedunculate, large and strong. They are smaller than the tasar cocoons and are reelable.

1.3 Central Silk Board

Central Silk Board is a statutory body under the administrative control of the Ministry of Textiles, Government of India. Central Silk Board is assigned with the overall responsibilities of developing silk
industry covering the whole spectrum of sericultural activities in the
country, from the development of food plants to the production of fabrics,
including the formulation of policies governing imports and exports. It is
one of the earliest commodity boards constituted in April, 1949 under an
act of the Parliament (Act No. LXI of 1948). It is located at Bangalore.

The Central Silk Board continues to be a member of the
International Sericulture Commission (ISC) stationed at Lyon, France.

1.4 Functions of Central Silk Board

The major functions of the Board are:

i) Promoting the development of silk industry by such
measures as if things fit.

ii) Undertaking, assisting and encouraging scientific,
technological and economic research in the various aspects
of sericulture.

iii) Developing and distributing healthy silkworm seeds.

iv) Devising means for improved methods of mulberry
cultivation, silkworm rearing, silk reeling and spinning.

v) Rationalization of marketing and stabilization of prices of
silk cocoons and raw silk.
vi) Initiating measures of standardization and quality control of silk and silk products.

vii) To advise the central government on all matters relating to the development of silk industry including import and export of raw silk, silk fabrics and silk wastes.

viii) Collection of statistics pertaining to mulberry acreage, fabrics, cocoons harvested, raw silk produced, etc.

ix) To prepare and furnish relevant reports relating to silk industry as may be required by the Central Government from time to time.

1.5 Members of Central Silk Board

The Central Silk Board has been assigned with the overall responsibilities of developing the silk industry, covering the whole series of sericultural activities in the country. The Board has a composition of 36 members including the Chairman, Vice-Chairman, Member Secretary, representatives of the Lok Sabha and the Rajaya Sabha, nominees of the Central and state Governments and representatives from among rearers, reelers, the trade and industry. The Board is reconstituted every three years.
1.6 Organisation set-up of CSB

The Central Silk Board has been expanded into a big organization. In order to correlate the sericulture development programmes in different states, the Central Silk Board has established four Regional Offices (ROs) at New Delhi, Mumbai, Kolkata and Jammu and five Regional Development Offices (RDOs) at Bhubaneswar, Guwahati, Hyderabad, Lucknow and Chennai. The activities of ROs/RDOs are:

a) To co-ordinate with state institutions/governments and central units in assisting implementation of all sericulture development programmes/projects in the respective state/region/zone.

b) To organize demonstrations, farmer's meets and entrepreneurship development programme.

c) To collect sericultural statistics and send periodical reports to the headquarters to facilitate monitoring of the development of sericulture in the country and to work out strange for further development.

d) To co-ordinate with the Directors of the Resource Institutes in their control in respect of field trials and surveys.

e) To undertake voluntary equality inspection of silk goods meant for exports.
1.7 Entrepreneur Development Programme

The Corporate & Enterprise Development Cell of the Central Bank Board organizes various entrepreneurship and other related training programmes like Entrepreneurship Development Programme, Bankers' Training Programme to attract investments and generate employments in the silk sector; Technology Upgradation Programmes to create a link between stakeholders and the research institutes through appropriate training initiatives. It also organizes different Research and Management Development Programmes, workshop on communication skill and Team Building Competence Enhancement Training Programme etc. for the executives and officials of DOSs, NGOs and CSB to facilitate them to empower participants, stack-holders, women employees, beneficiaries, mentally and intellectually and enhance their quality knowledge base so that they can play and plan their roles effectively.

During the year 2005-06, a total of 20 such training programmes were organized covering 477 participants. The details of these programmes are as follows:
<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name of the Programme</th>
<th>Duration</th>
<th>State</th>
<th>Place</th>
<th>No. of Programs</th>
<th>No. of participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Entrepreneurship Development programme</td>
<td>4 weeks</td>
<td>Assam</td>
<td>Guwahati</td>
<td>1</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Andhra Pradesh</td>
<td>Dharmavaram</td>
<td></td>
<td>25</td>
</tr>
<tr>
<td>2.</td>
<td>Technology upgradation programme</td>
<td>2 days</td>
<td>Andhra Pradesh</td>
<td>Sumandapalli</td>
<td>1</td>
<td>60</td>
</tr>
<tr>
<td>3.</td>
<td>Trainers Training Programme/ Resource Dev. Programme</td>
<td>2 weeks</td>
<td>Karnataka</td>
<td>Bangalore (For Bhadravati Project)</td>
<td>1</td>
<td>19</td>
</tr>
<tr>
<td>4.</td>
<td>Banker's Training Programme</td>
<td>1 week</td>
<td>Tamil Nadu</td>
<td>Madurai</td>
<td>1</td>
<td>40</td>
</tr>
<tr>
<td>5.</td>
<td>Resource Development Programme</td>
<td>2 weeks</td>
<td>Mizoram</td>
<td>Aizwal</td>
<td>1</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Himachal Pradesh</td>
<td>Mandi</td>
<td>1</td>
<td>28</td>
</tr>
<tr>
<td>6.</td>
<td>Management Dev. (Skill Dev. Program/ competencies training prog. etc.)</td>
<td>1 week</td>
<td>Jharkhand</td>
<td>Ranchi</td>
<td>1</td>
<td>41</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Chhattisgarh Karnatak</td>
<td>Ranchi</td>
<td>1</td>
<td>41</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Karnatak Kerala</td>
<td>Kerala</td>
<td>1</td>
<td>41</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>41</td>
</tr>
</tbody>
</table>

**Sub-Total**

|                | 16 | 356 |

**B. Total Manipur Sericulture Project**

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name of the Programme</th>
<th>Duration</th>
<th>State</th>
<th>Place</th>
<th>No. of Programs</th>
<th>No. of participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Resource Dev. Programme</td>
<td>2 weeks</td>
<td>Imphal</td>
<td>Manipur</td>
<td>2</td>
<td>58</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 weeks</td>
<td>West Bengal</td>
<td>Berhampore</td>
<td>2</td>
<td>63</td>
</tr>
</tbody>
</table>

**Sub-Total**

|                | 4   | 121 |

**Grand-Total**

|                | 20  | 477 |

**Source:** Annual Report 2005-06, Central Silk Board

### 1.8 Silk mark organisation of India

Silk Mark organization of India is a society which has brought out Silk Mark—a quality assurance label for silk. It is a society approved by
the Central Silk Board for the development of silk and silk industry in India.

Silk Mark organisation of India has efficient textile experts having knowledge in silk testing and having experience in silk industry. It has ten centers across the country located in the major weaving groups and cities having the silk tradition with sufficient testing facilities. Silk mark organization of India has Head Quartered at Bangalore.

The Silk Mark is a quality guarantee for pure silk and in addition provides as a label for general promotion of pure silk. The Silk Mark is under the process of registration as a trade mark.

The Silk Mark can be used in all silk products ranging from yarn stage to the finished products like dress materials, garments, sarees, carpets etc.

Silk Mark Scheme is introduced by Silk Mark Organization of India, a registered society, sponsored by the Central Silk Board, Ministry of Textiles, Government of India. The then Hon'ble Union Minister of Textiles, Shri Shankersingh Vaghela, launched the Silk Mark on 17th June 2004 at Bangalore. This launch was followed by the launches in Mumbai,
Chennai, Kancheepuram and Hyderabad. Since its launch till 2009-10, SMOI has a membership of over 1400 members and around 91 lakhs of silk mark labeled products have reached the market which has helped the consumers significantly in identifying pure silk.

During 2009-10 under XI Plan, 301 New Members were added to SMOI, 298 members were registered as authorized users of silk mark and over 22.22 lakh of silk mark labeled products reached the market. SMOI had participated in as many as 410 exhibitions/workshops and road shows.

**Silk mark achievement for 2009-10**

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Achievement</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Members enrolled</td>
<td>301</td>
</tr>
<tr>
<td>No. of Authorised Users</td>
<td>298</td>
</tr>
<tr>
<td>Sale of Silk Mark Label (in lakhs)</td>
<td>22.22</td>
</tr>
<tr>
<td>No. of Programmes/events/road shows</td>
<td>410</td>
</tr>
</tbody>
</table>

*Source: Annual Report 2009-10, Central Silk Board*

1.9 **History and origin of sericulture**

Sericulture as an art of rearing wild silkworms to produce silk is said to have originated from China about 5000 years ago. It remained a
national secret for about 3000 years by imposition of death penalty for carrying the secret abroad.

The legend goes that a Chinese prince who got married to King of Khotan in Tibet secretly brought silkworm and mulberry seeds and thus spread sericulture outside China. From Tibet, it is reported to have spread to India.

However, Chinese archaeological have unearthed silk clothes and yarn at a Neolithic site, revealing their age at around 2750 BC. This shows that sericulture was very well developed in ancient China.

Growth in sericulture has resulted trade link with the west. The Silk road, the oldest and longest commercial road was opened from China to Rome in 138-118 BC. It was the route used by Buddhists priests and traders alike who exchanged goods as well as ideas of the two great civilizations of the time. Chinese silk was exchanged for gold, wool, horses, jade and glass of the west and ideas between Buddhism and Christianity were exchanged. The 6400 km. long Silk Road (a caravan tract) started in what is now Sian, followed the Great Wall of China to North West across the Pamir Mountains and the Takla Makan deserts to cross Afghanistan to Antioch in Syria, and from thence via Egypt and the
Mediterranean ports to Europe. It was a hazardous route. Few persons traveled the entire route. The famous Venetian Marco Polo traveled by the Silk Road and brought silk from China.

The Silk Road was not used after the fall of the Roman Empire until it was revived by the Mongols. India was on this route. Indian caravans laden with luxury goods like spices and indigo traded for silk from China. The road now partially exists in the form of a paved highway connecting Pakistan and Sinkiang in China.

Sericulture in Japan was propagated by Korean slaves and prisoners of war brought by general Sarasimus. Japan was holding the first position in the world sericulture map but today it is third largest silk producing country in the world, next only to China and India.

1.10 Sericulture and economic development

Sericulture is one of the most labour intensive activities in the Indian economy combining both agriculture and industry. Being a rural and labour intensive industry, it offers relatively high returns on modest investments. The sector employs about 6 million people, mainly in rural areas. Sericulture is being practiced in about 50918 villages involving about 817605 lakh families. The quantity of mulberry cocoons produced
in the country during the year 2009-2010 is 131661 MTs. The industry has nearly 266331 nos. filature/cottage basins and about 28014 Charka basins in the reeling sector.

Sericulture development fits well in the country's programme for increasing rural employment. While income from agricultural crop production is seasonal, sericulture provides a year-round income, which is an important incentive for the small farmers to take up sericulture. It directly helps in increasing crop production through making funds available for the purchase of essential inputs like seed, fertilizers etc. Thus, the contribution of sericulture to the nation's economic development is unique.

Sericulture is highly recommended by planners and administrators as one of the most effective tools for rural reconstruction and development of the rural society. The industry provides whole or part-time employment to more than 30 percent who are mainly drawn from the Schedule Castes, Scheduled Tribes and other backward sections. Introduction of new technology of sericulture has led to making the industry a highly remunerative crop and demand for skilled labour has increased. High yielding varieties of silkworm races have evolved as a
result of continuous efforts of research institutions. Employment opportunities have been increasing and the standard of living of the farmers are in a position to maintain a decent living. Involvement of house labour has decreased and an infrastructure facilities has increased to a greater extent.

Women folk are attached to sericulture from time immemorial and have played a great role in the success of silk industry. It is not exaggerating to say that sericulture would not have been what it is today without the involvement of women. Nearly 60 percent of the labour requirement of the sericulture industry is fulfilled by women. Sericulture also provides self-employment opportunities to the educated unemployed youth of rural areas. Employment avenues in sericulture industry may broadly be divided into two types:

i) Direct employment which relates to employment in mulberry cultivation, silkworm rearing and cocoon production

ii) Indirect employment which includes reeling of cocoons, twisting, warping, dyeing and weaving. The former activities are rural in nature and the latter are semi urban and urban. Sericulture activities are generally environment friendly.
The Silk industry plays a vital role in transferring wealth from the richer sections to the poorer sections of the society. As silk is consumed mostly by the affluent and the money generated is distributed among sericulture farmers, silk yarn reelers, twister, weavers and traders. The percentage distribution of sale proceeds to each segment of the industry is given in table 1.1.

Table 1.1
Percentage distribution of sale proceeds to various segments

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Category of persons</th>
<th>Soft Silk Fabric of</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>40 gms/mts</td>
<td>50 gms/mts</td>
<td>60 gms/mts</td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Cocoons producer</td>
<td>51.5</td>
<td>54.6</td>
<td>56.8</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Reeler</td>
<td>6.2</td>
<td>6.6</td>
<td>6.8</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Twister</td>
<td>8.3</td>
<td>8.7</td>
<td>9.1</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Weaver</td>
<td>14.5</td>
<td>12.3</td>
<td>10.7</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Trader</td>
<td>19.5</td>
<td>17.8</td>
<td>16.6</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>100.0</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Source:** Central Silk Board, Silk in India, Statistical Biennial, 1992

From the table 1.1 it is clear that, a major portion of the income (51.5%) from the sale of one metre of 40gm. weight silk cloth goes to the cocoon producer. The reeler, twister, weaver and trader receive 6.2, 8.33, 14.5, 19.5 respectively. The share of cocoon producer increases to 60 gms. per metre.
Silk, a way of life in India, has become an inseparable part of Indian culture and tradition. The multifarious and catching forms of silken fabrics such as the fascinating designs of Varanasi silks, the georgettes, crapes and Chiffons of Karnataka, the tie and dye craft of Andhra Pradesh, Gujarat and Orissa, the soft, fine and delicate silks of Kashmir and the temple silk of Kanchipuram have gained world wide fame.

Silk accounted for the export earnings for sericulture was Rs. 2892.44 crore in 2009-2010 and the export basket consisted of natural silk yarn, fabrics, made-ups readymade garments, silk carpets and silk
waste. India exports substantial quantum of silk goods and the value of these silk goods are estimated at about 25% of the total raw silk production. India's export trade is highly concentrated with the 10 leading buyers around the world viz., USA, UK, Hong Kong, German, Italy, France, Spain, Saudi Arabia, UAE and Singapore. The share of total Indian exports to these countries is around 80%.

Although the silk production in India has increased enormously yet it accounts for only 17% of the total world production. The quality of raw silk also does not meet the international standards. This is because bulk of Indian silk comes from multivoltine breeds producing inferior quality silk. As such, silk industry needs more attention and greater emphasis to exploit the potential of bivoltine breeds offering immense scope for increasing the production of high grade raw silk matching the international standards.

1.11 Silk production in the world

World silk production has estimated to be doubled during the last 30 years in spite of man-made fibres replacing silk for some users. During this period, China and Japan together manufactured 50% of the world production each year. In the late 1970's China, the country that first
developed sericulture thousands years ago unexpectedly increased its silk production and has become the world's leading producer of silk.

The coming of synthetic fibres such as nylon and polyester, which are stronger than silk and lower in price, but do not possess the same quality, has caused a huge reduction in silk production and consumption. World production in 1940 was 59 million kg. By 1950 it had dropped to 19 million kg but by the mid 1980s had climbed to about 68 million kg.

According to ISA (International Silk Association) survey, the world demand for silk has increased steadily at present even though there was a slight downfall after World War II due to its high cost and the advent of cheap synthetic fibres. The synthetic fibres had only a short period of matchlessness. But the changing habits of using natural fibres have been brought about by the ongoing environmentalist movement. Hence much more severity is there in the production of natural fibres compared to man-made fibres. Silk does not produce any skin allergies; no other fabric can match it in luster and elegance. As a natural fibre, silk is very light and smooth.

China and India are the major producers of silk among the silk producing countries of the world. China produces mainly 81% of the total
raw silk production in the world and India produces 15.50%. The major silk producers are China, India, Japan, Brazil, Korea Republic, Uzbekistan, Thailand and Vietnam. The trend in the silk production of these principal silk producers are given in Table 1.2

### Table 1.2

**World mulberry raw silk production**

(Unit: MT)

<table>
<thead>
<tr>
<th>Country</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>% Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>87800</td>
<td>93100</td>
<td>78000</td>
<td>70980</td>
<td>84000</td>
<td>81.06</td>
</tr>
<tr>
<td>India</td>
<td>15445</td>
<td>16525</td>
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<td>811</td>
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<tr>
<td>Vietnam</td>
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<td>Others</td>
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<td>1000</td>
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<td><strong>Total</strong></td>
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<td><strong>115092</strong></td>
<td><strong>98680</strong></td>
<td><strong>90992</strong></td>
<td><strong>103627</strong></td>
<td><strong>100.00</strong></td>
</tr>
</tbody>
</table>

**Note:** Figures of India is for Financial year April to March.

**Source:** Silk Industry in China (e-mail); ISC web-site update as on January, 2010; SS:11-05-2010.
Diagram 1.2
Country wise mulberry raw silk production in percentage

Table 1.3
World raw silk production (Unit : MT)

<table>
<thead>
<tr>
<th>Country</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>% Share</th>
</tr>
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<tbody>
<tr>
<td>China</td>
<td>105360</td>
<td>130000</td>
<td>108420</td>
<td>98620</td>
<td>104000</td>
<td>81.89</td>
</tr>
<tr>
<td>India</td>
<td>17305</td>
<td>18475</td>
<td>18320</td>
<td>18370</td>
<td>19690</td>
<td>15.50</td>
</tr>
<tr>
<td>Japan</td>
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<td>150</td>
<td>105</td>
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<tr>
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<tr>
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<td>0.52</td>
</tr>
<tr>
<td>Vietnam</td>
<td>750</td>
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<td>750</td>
<td>680</td>
<td>550</td>
<td>0.43</td>
</tr>
<tr>
<td>Others</td>
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<td>1000</td>
<td>500</td>
<td>350</td>
<td>304</td>
<td>0.24</td>
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<tr>
<td>Total</td>
<td>128870</td>
<td>153942</td>
<td>131175</td>
<td>121392</td>
<td>126995</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Note: Figures of India is for Financial year April to March.

Source: Silk Industry in China (e-mail); ISC web-site update as on January, 2010; SS:11-05-2010
World raw silk production in 2009 was 126995 MTs of which India's share was 19690 MTs (15.50%). China produced highest quantity of raw silk (104000 MTs) with 81.89% share in the world production. Out of 103627 MTs of world mulberry silk production, China's share was 84000 MT, followed by India (16322 MT).

China is the largest producer of tasar silk in the world followed by India. China produces only temperate tasar silk while India has got distinction in producing both tropical and temperate varieties. India is the only country where tropical tasar silk is produced.

Both the demand and the production of silk are increasing at the global level, according to the statistics of ISA. The principal silk
consuming or importing countries are USA, Canada, Germany, France, Italy, Denmark, Sweden, Netherlands, Switzerland, Japan, Austria and Australia. Japan and Italy import high quality (2A and 3A grade) raw silk from China and turn into fashionable dress materials and readymade garments and export them. The principal exporter of silk is China, which accounts for nearly 90%. The quality of Indian silk is very poor, almost ungradable according to international standards and has no place in exporting raw silk. Its handloom goods of entangled designs and products like ties, scarves, chaddar, carpets etc. are exported in large quantities.

1.12 Sericulture in India

Another school of thought propounds that mulberry insect originated from slopes of Himalayas (Thangavelu and Joshi, 1983) and later the Aryans and other ancient tribes spread it to other parts.

Silk fabric is mentioned in Hindu epics more than 2000 years old. However records reveal practice of sericulture much earlier. But sericulture as an industry grew in importance only 500 years back as a flourishing trade much before Dutch and English trade was established in Indian soil.
Sericulture in the pre-British period

Silk had a prominent place in the culture and commerce of India even in the pre-vedic times. Sericulture passed through periods of prosperity and decline. Once patronized by kings, Nawabs and Jamindars, it had a glorious past. But it slipped back and lost its worldwide reputation. Mughals (1526-1857) brought back its earlier glory by patronizing silk industry in Bengal and Kashmir. Malda in Bengal became the centre of silk industry.

Sericulture during the British period

Indian silk industry laid the foundation during the British Period. British colonization of India, under the banner of East India Company brought Indian silk industry to a higher platform. Export of silk was to the tune of 2.54 lakh kg. per annum during 1761 to 1795. Separate sericulture departments were created in Karnataka (1911) and Madras (1919). Formation of Mysore Silk Association (1927), Mysore Silk Weaving Factory (1932), Mysore Spun Silks (1936), the Silk Conditioning and Testing House at Mysore (1942) and Sericulture Research Station in Berhampore (1943) helped the sericulture industry in India to make rapid strides. Withdrawal by East China Company from the trade resulted in
losing the market to Japan and China. However during British Rule, Kashmir Silk Industry got revitalize. Bengal silk Industry got back its earlier reputation after independence.

Sericulture after independence

After independence, Government of India passed an Act No. LXI of 1948 by which a statutory body, Central Silk Board, was constituted under the administrative control of Ministry of Textiles. With the establishment of Central Silk Board and due to World Bank assistance, sericulture in Karnataka get a boost elevating the position of India to number second in the sericulture map of the world as against the fifth position in 1938. The industry is flourishing as an agro-industry, after independence, giving employment to over 3.5 million people in the country.

1.13 Manipur: Its geographical setting

Manipur is a land-locked isolated, hilly state having a geographically distinct identity. It is situated in the eastern most part of North-Eastern India. It lies between 93°58' and 94°45' E longitudes and 25°50' and 25°42' N latitudes. The state is almost rectangular in shape, covering an area of 22,327 sq. km. The area is broadly divided into two
natural regions, viz. the hills and the valley. The area of the valley is recorded as 2,238 sq. km. constituting only about 10 percent of the state's total area. The hill region spreads over an extensive area of 20,089 sq.km. and cover more than nine-tenths of state's total area. The hills have sub-temperate to temperate climate and the valley has sub-tropical to sub-temperate climate.

Administrative set up

The state of Manipur consists of nine Administrative Districts, viz. Imphal East and Imphal West Districts, Chandel District, Senapati District, Ukhrul District, Thoubal District, Tamenglong District, Bishnupur District and Churachandpur District. Five districts are in the hill and four districts are in the valley. Imphal East and Imphal West were divided only in 1997. There are 3 Community Development Blocks and 7 Municipalities in the state as per 1991 census.

Population and occupational structure

Manipur has a total provisional population of 23.88 lakhs as per 2001 census. The growth rate of population was 30.02% during 1991-2001 as against a growth rate of 29.29% during the 1981-91 periods. Out
of the total population, 58.9% were settled in the valley and the remaining 41.1% are in the hills.

According to 2001 Census, the density of population of Manipur was 107 persons per sq. km. But the population in the state was unevenly distributed. In Imphal West Districts, the density of population was 847 persons per sq. km. to 25 persons per sq. km. in Tamenglong.

Table 1.4 shows the districts of Manipur, according to the provisional results of 2001 census. The uneven distribution of population is also seen between the hills and the valley districts. The density of population per sq. km in the valley is 628 persons while the density of population of the hill districts is only 49 persons per sq. km.
Table 1.4
Distribution of population by districts of Manipur, according to the provisional results of 2001 census.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Persons</td>
<td>Males</td>
<td>Females</td>
<td></td>
</tr>
<tr>
<td>i. Valley districts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Imphal West</td>
<td>4,39,532</td>
<td>2,18947</td>
<td>2,20,585</td>
<td>1007</td>
</tr>
<tr>
<td>Imphal East</td>
<td>3,93,780</td>
<td>1,97,710</td>
<td>1,96,070</td>
<td>992</td>
</tr>
<tr>
<td>Bishnupur</td>
<td>2,05,907</td>
<td>1,02,772</td>
<td>1,03,135</td>
<td>1004</td>
</tr>
<tr>
<td>Thoubal</td>
<td>3,66,341</td>
<td>1,83,338</td>
<td>1,83,003</td>
<td>988</td>
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<tr>
<td>ii. Hill Districts</td>
<td>9,83,074</td>
<td>5,04,571</td>
<td>4,78,503</td>
<td>948</td>
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<tr>
<td>Senapati</td>
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<tr>
<td>Tamenglong</td>
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<td>57,994</td>
<td>53,499</td>
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<tr>
<td>Churachandpur</td>
<td>2,28,707</td>
<td>1,14,740</td>
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<td>993</td>
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<tr>
<td>Ukhrul</td>
<td>1,40,946</td>
<td>73,413</td>
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<td>920</td>
</tr>
<tr>
<td>Chandel</td>
<td>1,22,714</td>
<td>61,778</td>
<td>60,936</td>
<td>986</td>
</tr>
<tr>
<td>Manipur</td>
<td>23,88,634</td>
<td>12,07,338</td>
<td>11,81,296</td>
<td>978</td>
</tr>
</tbody>
</table>

Source: Census of India 2001
Provisional Population Totals
Series 1 paper 1 of 2001. P-130
Registrar General & Census Commissioner, India

Agriculture is the main occupation of Manipur in rural areas.

About 70% of the total working populations are engaged in agriculture.

The agricultural economy in the state is so important that the estimates of
the State Domestic Product fluctuate sharply from year to year according to the success or failure of crops.

The growth of agriculture in the state has been quite uneven and unsatisfactory for the reason that its production still depends on nature. The limited availability of land, the limited cash returns and agriculture being confined to one or two seasons in the year have compelled farmers to take up activities in non-farm sectors such as animal husbandry, poultry, fisheries, social forestry, sericulture etc. Agriculture and sericulture are adopted simultaneously by the agriculturists in regions where the ecological conditions are favourable.

In Manipur, there are no large and medium industries except cottage-based and handloom industries. Thus, majority of the rural people are economically backward and disadvantaged from the socio-economic point of view. To develop regional economy and promote rural welfare in the state, the Government of Manipur intends to develop agro-based industry i.e. sericulture, one of the oldest and traditional occupation practiced since time immemorial for the production of traditional silk fabrics. The present study focuses its attention on the role and impact of sericulture in the economic development of Manipur.
1.14 Need of the study

Sericulture has been developed in Manipur as an agro-based cottage industry with adequate scope to contribute to the rural economy. It holds high promise as an employment intensive occupation, especially for people in rural and semi-urban areas.

The sericulture is one of the most labour intensive sector combining both agriculture and industry. Of late, sericulture has turned out to be a highly remunerative cash crop with minimum investment. It is perhaps the only cash crop which provides frequent attractive returns to therearers throughout the year. Being a labour intensive rural based industry it offers a qualitative and quantitative change in the poverty alleviation with a chain creation of employment from unskilled farm labourer to skilled artisans, especially women folk. It will generate income for people living below the poverty line in the rural masses particularly for women.

Agriculture is the main occupation in the rural areas. In Manipur, majority of the rural people are economically backward. The main source of livelihood of the Manipur people is based on the traditional rice production in the valley area and the forest resources and jhum
cultivation in the hilly area. Therefore, unemployment rate of educated youth is very high compared with that of other states.

The sericulture in Manipur started in the pre-historic period. Rearing of silk worms has been a tradition in Manipur since time immemorial. But sericulture productions in Manipur still continue as a traditional-cum-small scale cottage based industry. Manipur is lagging behind in the silk market in India. Yet it has been granted exclusive sericulture producing zone for both mulberry and non-mulberry silk. It is the only industry in the state where both literate and illiterate persons could be engaged gainfully.

Women are best suited to sericulture. They play a leading role in the sericulture industry, because it leads itself to flexibility in organization with reference to place and time of work. Nearly 60 percent of the labour requirement of the sericulture industry is fulfilled by women.

In short, the main advantages of the industry are low investment, maximum employment in rural areas, checks labour migration from rural to urban areas, earns foreign exchange and protect jhum cultivation and deforestation.
1.15 Objectives of the study

The objectives of the study are:

i. To study the growth and development of silk industry in Manipur.

ii. To understand and analyse sources of livelihood from silk industry in Manipur particularly of the rural women folk.

iii. To find out different new areas of employment within the silk industry.

iv. To identify different spots or locality where silk industries are being carried out through traditional means and new growth areas after the entry of Manipur Sericulture Project.

v. To study the economic and commercial changes of silk industry in Manipur after the advent of the Project.

vi. The study the existing financial and marketing structure of the industry and chart out new areas for improvement and growth.

vii. To examine the various problems associated with modernizing silk industry and suggest measures to remove those problems.
1.16 Limitation of the study

The present study is on Sericulture Industry – Its Role in the Economy of Manipur. Accordingly, both secondary and primary data from the concerned Departments and the individual farmers, weavers and rearers were collected. The secondary data were collected and analysed from the Directorate of Sericulture, Government of Manipur, the library of the Regional Tasar and Research Station, Imphal, different journals of the Central Silk Board and from the internet.

The primary data were collected from field visits to different districts. Though every effort was made to cover all the districts of Manipur it is admitted that due to the prevailing law and order situation it was not possible to do so. Hence the scholar concentrated the study on three valley districts of Manipur viz., Imphal East, Imphal West, Bishnupur and one hill district, Ukhrul with respect to ten different factors.

1.17 Hypothesis

In the present study the null hypothesis have been tested:

1. Income level of sericulturists does not vary in four districts of Manipur - Imphal West, Imphal East, Bishnupur and Ukhrul.
2. Income level of sericulturists does not vary according to different status of sericulture industries.

3. Income level of sericulturists does not vary according to type of sericulture.

4. Income level of sericulturists does not vary according to age or period of sericulture industries, they run.

5. Income level of sericulturists does not vary according to different religion.

6. Income level of sericulturists does not vary according to their educational level.

7. Income level of sericulturists does not vary according to their different family size.

8. Income level of sericulturists does not vary according to their age categories.

9. Income level of sericulturists does not vary according to their earlier occupation.

In regression analysis, the null hypothesis \((H_0)\) of the present analysis is constructed as:

\[
H_0 : \beta_i = 0, \text{ where } \theta \text{ is a vector.}
\]
It is to say that all the parameters, expressed as regression coefficients are zero. In other words, the family income after having sericulture in the family can not be changed or influenced by the independent variables of interest. $H_0$ is so defined as against the alternative hypothesis $(H_i)$, given by

$$H_i : \beta_i \neq 0, \text{ (two tailed)}$$

The family income level after having sericulture farms in the household has significantly been influenced by the independent variables under consideration.

1.18 Methodology

The study is made on the basis of primary and secondary data. The secondary data are drawn mostly from the Directorate of Sericulture, Government of Manipur and other sources including annual administrative report, internet, research journal, Indian Journal of Sericulture, annual report of Central Silk Board.

The primary data have been collected by conducting a field visit in the districts of Manipur. The size of the sample is 80 beneficiaries who are selected for the present study from the four districts of Manipur. The
primary information is collected from individual farmer, weaver and rearer through questionnaires and personal interview. After collecting primary data, a statistical analysis has been carried out to arrive at the meaningful conclusion.

Statistical tests like t-test and F-test and analysis of variance (ANOVA) with its Post-HOC test has been adopted. The processing and analysis of the data has been performed through Statistical Package for Social Sciences (SPSS) Vs 16.

1.19 Sample size determination

To determine the sample size of the present study a pilot survey was conducted. It involves 15 sericulturists under random selection mode. Considering the monthly income generated from sericulture, its mean ± standard deviation ($\bar{x} \pm \sigma$) is found to be Rs. 3,112 ± Rs. 697.

The formula for determining the sample size ($n$) may be defined by

$$n = \frac{4\sigma^2}{e^2}$$

Where, $n = \text{sample size}$

$$\sigma = \text{standard deviation of the values of selected parameters based on prior information}$$
e = permissible error to the mean value of the selected parameter

Here $\bar{x} = 3,112$, $\sigma = 697$

$e = 5\%$ of $\bar{x}$ (It is decided by researcher)

Now, $n = \frac{4(697)^2}{(5\% \text{ of } 3112)^2}$

$= 80.26$

$\therefore n \approx 80$

In view of the feasibility of the study, only four districts say Imphal West (IW), Imphal East (IE), Bishnupur (BP) and Ukhrul (Ul) have been taken. The general populations of the districts according to 2001 census are expressed in terms of ‘000 as:

IW = 444
IE = 395
BP = 208 and
Ul = 141

Thus the sample size of 80 sericulturists is proportionally allocated into the districts, which is given by

$$\frac{IW}{444} = \frac{IE}{395} = \frac{BP}{208} = \frac{Ul}{141} = \frac{80}{1188}$$

$\therefore IW = 29.89 \approx 30$
IE = 26.59 \approx 27
BP = 14.01 \approx 14
Ul = 9.49 \approx 9$
It means that the feasible sample of size 80 sericulturists has to be taken as 30, 27, 14 and 9 from Imphal West, Imphal East, Bishnupur and Ukhrul respectively.

1.20 Plan of the study

The entire study has been discussed under five chapters. The First Chapter includes the introduction of sericulture, Central Silk Board and its functions. It also includes history and origin of sericulture, sericulture and economic development. It also highlights silk production in the world and sericulture in India. It has analysed the need of the study, objectives of the study, limitation of the study, hypothesis, methodology, plan of the study and review of literature.

The Second Chapter deals with the sericulture in India including emergence of sericulture in India, trends in mulberry sericulture, employment, export earnings. It also includes the present status of sericulture industry in India and its economic importance and the progress of sericulture in India under Five Year Plans.

Sericulture in Manipur is discussed in the Third Chapter. In this chapter, the history and the origin of sericulture in Manipur, raw silk production in the state, catalytic development programme, cluster
development project are also discussed. Silk industry during the plan period and Manipur Sericulture Project are also included in this chapter.

The Fourth Chapter presents the statistical analysis of sericulture industries in Manipur, which was prepared on the basis of information collected from 80 beneficiaries of sericulture industries through questionnaires from four district of Manipur viz. Imphal East, Imphal West, Bishnupur and Ukhrul with respect to ten different factors. The factors are district, type of sericulture, status of sericulture, period/age of sericulture industries, gender of sericulturists, religion of sericulturists, educational level of sericulturists, size of family, age at start of the sericulture industries and earlier occupation.

The Fifth Chapter, which is the concluding chapter of this thesis, summarized the various findings of the study and put some suggestions for the future improvement.

It suggests how Manipur is well suited to compete with other states by scientifically producing/procuring silkworm races adopted for the Manipur climate. Different bye-products of sericulture have economic dividends. Manipuri women involvement in sericulture from historic time to this day is discussed and their adaptation and skill is admired. Women
exclusive capacity building programmes are also suggested. Shortcomings of the industry and their solutions are also recommended.

In short, this thesis can be a handy tool for policy makers, sericulture department officials and other stake-holders interested in the growth of sericulture industry in Manipur.

1.21 Review of literature

Ramana's (1987) 'Economics of Silk Industry in India' gave a brief picture of the sericulture activity during the eighties, and consider both its agricultural side and industrial aspects. The author discusses the role of sericulture in economic development and the status of sericulture and silk industry in the world. He also presented an evaluation of the economics of sericulture bringing out its significance in terms of income and employment generation.

Hanumappa (1986), edited 'Sericulture for Rural Development' consisting of eleven papers presented by renowned professors and scholars, which underlined sericulture in Karnataka right from mulberry cultivation down to research development and training activities. The book as a whole gave a clear picture of the role of sericulture in rural development.
Abdul and Hanumappa (1985), in the book 'Silk Industry, problems and prospects' have undertaken an overall study of silk industry. It is a compilation of essays by different scholars. In this book different function and activities relating to sericulture and its development are discussed.

Mahesh (1990), in his book 'Silk Production, Processing and Marketing' gives a fair picture of silk producing activities and a detailed scenario of the history of silk in the world.

Shantha (1986), in his work 'Silk Handloom Industry in Andhra Pradesh', reviewed the methods of works and conditions of weavers, the process of manufacturing the wrap and weft etc. He also explained the organization of silk business from raw silk to the final product. He also offered some suggestions to better the lot of weavers.

Narayana's (1979), book 'Economics of Sericulture in Rayalaseema', was a detailed study of sericulture in the four Rayalaseema districts, namely Kurnool, Cuddapah, Chittoor and Anantapur of Andhra Pradesh. This study points out that sericulture is mainly concentrated in the Chittoor and Anantapur district. It gives a detailed account of the
economics of sericulture, the problems of sericulture and also the scope for its development.

Raj and Govinda (1981), in their book 'Employment and Income in Sericulture', present sericulture as an instrument which helps to increase employment opportunities in rural economy. The role of sericulture in generating employment and income is discussed in a very definite manner. The formation of employment and income in silk reeling units is also dealt with.

Sanjay’s (1986), book 'The Development of Indian Silk', gave a clear picture of sericulture in the Indian economy. The position of sericulture in India, the products and production systems, the policy and micro-economic issues in silk production are discussed in this book.

Charssley (1982), in the book 'Culture and Sericulture' discussed at length on the importance of the livestock industry and sericulture, based on agriculture which in India have been subject to schemes of intensive development.

Koshy (1993), in his book 'Silk Exports and Development', has tried to educate the silk exporters about the products they deal with. Part-I
of his book deals with various aspects of sericulture like silk production, processing and procurement and Part-II is about silk trade and export procedures.

Venkala (1992), in his book 'Sericulture in India' analyze in detail the progress of sericulture in India. He points out that sericulture, which is an agro-based cottage industry, fits very well in India's rural structure, where agriculture continues to be the main industry. This book contributes significantly to a better understanding of the advantages and shortcomings of sericulture operations. It also offers some useful practical suggestions to overcome the various current problems and hindrances faced by the industry, and to ensure overall development.

Ganga and Sulochana's (1991), book 'An introduction to Sericulture', gives an overall idea of sericulture. In this book the authors discussed in detail the history of sericulture, the importance of sericulture and present a package of practices for mulberry cultivation. They also give an account of the diseases and pests generally to which silkworms are prone. The physiological aspects of silk worms were also given in detail.
J. Acharya, (1993), in his book 'Sericulture and Development' gives a brief report of his field studies in sericulture in the southern states of Karnataka, Andhra Pradesh and Tamil Nadu. The book cover the whole series of issues regarding sericulture development, women and children, technology and increase pattern of sericulture in different agro-climatic zones, problems of sericulture under water scarcity zones etc.

Afifa and Amin (2000), 'Principles of Temperate Sericulture' was meant to serve those engaged in research and extension activities in sericulture or its allied sciences. The authors have tried to give the beginner the information he requires to start sericulture, latest advancement in the field allied to insect as well as their own work with respect to certain aspects. They also pointed out that sericulture is one such important activity that involves use of natural resources and thus, offers scope for conserving production potentialities of agriculture for its sustained growth and development without changing the environmental balance.

Ojha and Panday (2004), in the book 'Silk Production' dealt with the role of feed on silk and egg production by tropical tasar silkworm. The study has generated basic information on various aspects of
quantitative nutrition of tasar silkworm. They highlighted the role of
different food plants on development, reproduction and silk production of
different eco-races in different crops.

to present the position of silk industry in India covering in a nutshell
aspects like plantation, rearing, production, distribution, marketing etc.
The author hoped that the book will fill a gap in the literature on the
subject and could serve as a ready guide to the sericulturists, researches
and also general public interested in sericulture.

Hiware (2001), in the book 'Agro Cottage Industry Sericulture',
covered all important and critical steps involved to make sericulture
industry successful. The inevitable part of sericulture industry i.e.
moriculture, grainage operation, rearing of silkworms, diseases and pests
of mulberry and mulberry silkworms are discussed in detail.

Lakshmi (2003), in the book 'Problems and Prospects of
Sericulture' concentrates on the growth and development of sericulture in
Kurnool district and also analyze the effective factors for the
development of sericulture in the district.
Sandhyarani (1998), in her book 'Sericulture and Rural Development' tried to analyze the progress of sericulture in India in general and in Andhra Pradesh and Karnataka in particular. The author concluded that Karnataka and Andhra Pradesh are showing enormous growth potential in sericulture which in turn has improved the economic standards of their rural population.

Raikumar (1988), in his book 'A Class Book of Sericulture' tried to analyze the success of sericulture depends to a great extent on the utilization of suitable races of silkworms. Many parasitic flies which cause considerable damage to the silkworms are also discussed in detail.

In addition to the above books, there are a number of papers by prominent scholars expressing their views favouring sericulture as an effective tool for eradication of poverty, unemployment and for raising the standard of living of the rural masses.

Hanumappa and Mangala (1986), in the paper on "Issues in Sericulture Activities-Macro Perspectives", (Institute for Social and Economic Change, Bangalore), the authors presented a brief note on the nature and extent of sericulture and allied activities in Karnataka. They
also pointed out that sericulture has served as the main as well as a subsidiary occupation to thousands of agriculturist in Karnataka.

Boraiah (1986), 'Mulberry Cultivation', published in Lecturers on Sericulture covered not only mulberry silk but also Eri, Tasar and Muga silks. The author however, emphasized top priority to mulberry cultivation and considers some ways of successful cultivation of mulberry gardens to obtain high productivity.

Devasurappa (1980), envisaged a general idea of the performance of the silk industry in Karnataka in his paper, 'Silk Industry in Karnataka'. He presented a picture of the origin and growth of sericulture in the state. The various activities involved in sericulture commencing from mulberry cultivation to silk weaving are discussed in detail.

Veeraiah (1991), brings out the important factors that have contributed to the stability of the cocoon crop in his paper. 'A Critical Look at the Mulberry Cultivation in Karnataka'. He also gives a brief account of mulberry cultivation and cocoon production.

Hanumappa, expressed his views on sericulture as a tool for the upliftment of rural poor in his paper, 'Concurrent Evaluation of Larger
Rural Development Projects—Some Experiences with Karnataka Sericulture Project. He suggested that employment opportunities in rural areas would be increased by changing the cropping pattern from less labour intensive crops to more labour intensive crops leading to high level incomes.

Sonwalkar (1977), Director, Central silk Technological Research Institute, Bangalore, shared some reasons for the low productivity of cocoons in his paper 'Factors Influencing Reeling, Efficiency'. He also suggested some measures to overcome this problem.

There are also some research papers which dealt with the purely biological aspects of sericulture. Narasimhanna (1986), Director, National Silkworm Seed Project, Central Silk Board, Bangalore has two papers. In his first paper 'A Sound Seed Organization vital for Sericulture Industry' (1986) discusses the organization of seed in India and advanced countries like Japan, the U.S.S.R. and China. He emphasizes that a three-tier seed multiplication programme, systematic moth examination and supply of young age silkworms alone can bring the country better prosperity through sericulture.
Another paper on Silkworm Seed Production, Narasimhanna (1986) explained how silkworm seed production can be managed efficiently in a tropical country like India. Poor quality of silkworm seed reduces the cocoon yield and silk recovery. As a result, the net return will be poor and sericulture cannot complete successfully with other cash crops. Hence, efficient management of seed production is needed.

Krishnaswami (1978), studied on the new technique in silkworm, *Bombyx mori* and showed vigorous growth at a temperature and relative humidity of 27°C and 80-90% respectively. Under these ecological conditions it completed its growth in a short period.

Prasad and Singh (1981), reported *Parasarcophaga knabi* (Parker) for the first time as the parasite of *Antheraea proylei* in Manipur. The parasite was found attacking the different larval instars like, 3rd, 4th and 5th instar silkworm larvae during the month of April and May resulting nearly 10% loss in the silk cocoon production.

There are also some studies on the problems and prospects of sericulture development. Periswamy (1977), discussed many problems of sericulture, commencing from mulberry cultivation to cocoon production in his paper, entitled, 'Problems and Prospects of Sericulture'. He suggests
some techniques and measures to overcome these problems. He also gives an account of the status of sericulture in China, the leading country in mulberry silk production.

Thimmaiah and Rao, discuss various problems faced by the sericulturists in Karnataka in their paper 'Problems and Prospects of Sericulture Development in Karnataka – A field review'. They also present a sketch of the prospects of sericulture development in the state.

Sen Gupta (1985), reported the various problems and prospects of non-mulberry sericulture in India. The problems were cultivation of the food plants, rearing of the silkworms and extraction of the silk from the cocoons. The food-plants were difficult in propagation and slow growing after pruning or planting. As the silkworms were reared in outdoor conditions they were subjected to climate hazards like temperature, gale and storms besides pest and predator attack. In silk extraction also various chemicals and equipments were needed for easy unwinding out of the silk filaments from the cocoon. Despite the various problems, the non-mulberry sericulture has its own immense prospects. The food plants are available in plenty as nature grown trees. The labour and investments for rearing house, equipment etc. are negligible. They are remarkable for
their permanent natural colours like light greenish in *A. yamamai*, light creamish in *A. pernyi* and *A. proylei*, fawn colour in *A. mylitta* and golden in *A. assama*. Technical know how for easy in cultivation, in rearing and in reeling of silk have been worked out from the research centres.

Sastry (1986), reported a clear picture of the development of sericulture industry in Manipur since First Five Year to Seventh Five Year Plan showing also the prospects of the rolling plan period. He mentioned that in the Fifth and Sixth Five Year Plan period ending upto 1985 this industry opened into a new chapter in the history of sericulture industry by introducing a new oak tasar silkworm, *Antheraea proylei*. J.
References


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Articles


