CHAPTER - I

INTRODUCTION
INTRODUCTION

1.1 Importance of muga culture:

Assam is well known for its abundance in various natural resources. The unique climatic conditions, topography, soil and geographical position contributed to the growth and distribution of vast number of diversified flora and fauna in Assam. Some sericigenous insects and their food plants are skillfully used for production of exclusive dress and furnishing materials. The muga silk worm (Artheraea assama) is reared largely in Assam besides in some neighbouring States in small quantities. The rearing of muga silk fabric are age-old practice in Assam, which are entwined with tradition, culture and religion of the Assamese society. The natural golden colour, glorious lusture and durability of muga silk are unique and possession of a pair or two muga dress materials is considered to be pride of every Assamese lady. Travellers from outside Assam are also largely fascinated by the elegance of muga fabric. Since muga culture involve, tree plantation for its food plants, rearing and extraction of silk, it is considered as one of the environment friendly activity in present day hazard prone industrial pollution. Muga silkworm feeds mainly on Som and Soalu Leaves and rearing is conducted outdoor on trees. The Larvae after maturation crawl down the tree at dusk. Which are then hand-picked and placed in jiali (Cocoonage) for spinning of cocoons. For continuation of generation seed cocoons are selected and kept in grainage hall for emergence of moth and production of eggs. Remaining good cocoons are stifled for reeling purpose. “Normally 1Kg. of muga raw silk can be obtained from 4500 - 6000 cocoons depending upon the quality, compactness and weight of the shell. Muga silkworm is multi-voltine and 5-6 crops can be taken up annually. A farmer can earn about Rs. 15,000 to Rs 30,000 from one acre of land annually from
2 crops with moderate to very good harvest. To understand the different activities involved in muga silk production, a flow chart is given below:

1.2 Flow Chart of Muga Culture activities

Raising of food plants to provide leaves for feeding the silkworms

Rearing of silkworm Larvae (feeding of Leaves to them) to full maturity

Spining of Cocoons by matured Larvae

Harvesting and segregation of cocoons into reeling, filmsy and seed cocoons categories

Stifling of reeling cocoons (killing and drying) to check emergence of moths and to facilitate preservation

Cooking and reeling of cocoons to produce filament silk yarn

Incubation of eggs for hatching

Consignment of seed cocoons to grainage house

Collection of waste from reeling basin

Weaving of varieties of fabrics like sarees, dress and furnishing materials

Storage of disease free eggs and distribution of the some farmers

Grainage operation (storage of seed cocoons emergence & coupling of moths, egg laying, microscopic examination and disinfection eggs)

Collection of pierced cocoon from grainage operation

Spinning of reeling waste, filmsy cocoons and pierced cocoons

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1.3 Present position of world silk industry:

"At present 58 Countries all over the world are actually engaged in various sericultural activities. China maintains its glorious first position in mulberry raw silk production, while India superseded Japan in this regard and occupies prestigious second position in 1987. The other three top mulberry raw silk producing countries in order of higher production are U.S.S.R., Republic of Korea and Brazil."¹ Sericulture is providing ample employment opportunities to the labour force in the underdeveloped and developing countries. To generate employment opportunities, over 25 Countries in Asia, Africa and South Africa are at present taking keen interest in the development of sericulture. In contrast to this, a reverse trend can be observed in the industrially and economically developed countries like France, Italy, Spain, Japan and South Korea, which were once major silk producing countries in the world. But demand for raw silk and silk finished products is in fact increasing day by day in the developed countries, due to the excellent features of the natural silk in comparison to the synthetic fibres. This growing trend of the world silk industry has opened up new vista for flow of fund from industrially developed countries to the labour rich underdeveloped and developing countries.

Present position of world silk industry in the underdeveloped and developing countries have to improve the quality of their raw silk and silk finished products. In addition to low paid rural labour force, the third world

¹ Dr. Gogoi, Buddhin—(1999) “Studies on various aspects of Dighloti as an important muga food plant” p.-16
countries have favourable weather conditions, unpolluted natural environment and ever important bio-diversity which can be fully exploited in the improvement of silkworm strains and its food plants species through genetic upgradation and breeding. Despite these tremendous prospects and potentialities for development of sericulture industry in the third world countries, sericulture remained an age old cottage industry in those country. They could not improve the quality of raw silk and finished goods through technological evolution and modernization. Some technologically developed Countries like Italy, France, Switzerland, Federal Republic of Germany, Britain and South Korea are regularly importing raw silk from developing countries for their silk processing industries and capturing a world market by producing classic and quality finished products. It is worth mentioning that in the past few years, some sort of ‘Silk-Craze’ has been developed world wide among the consumers and this has encouraged the third world countries to develop sericulture activities.

Among the developing countries, India and Thailand have made positive efforts in developing technologies for manufacturing classic and quality silk products, which has obviously enhanced their export potential. According to U.N. experts, the world raw silk production will continue to increase in the years to come.

We may conclude from the above facts that the future prospects of world silk industry is very bright.
1.4 Present position of Indian Silk industry:

In the global textile parlance the term ‘silk’ refers to the silk of mulberry origin, as the bulk of world production constituting 95 percent is mulberry silk (Ullal and Narasimhana, 1987). But silk in India customarily refers to four varieties of silk, namely, mulberry, tassar, eri and muga. Thus, India has the unique distinction of being the only country in the world, producing all these four varieties of silk commercially.

"The origin of sericulture in India, however, was lost in antiquity. Traces of tassar silk fabric tied around an urn had been found in Maharastra, believed to have been buried four thousands years ago (Choudhury, 1985)." According to some historians, raw silk was exported from India to Rome during the reign of Khiska in 58 B.C. (Sampath, 1992). Some others believe that the art of sericulture had its origin in South-East Asia or even in the Himalayan foot hills where the eco-claimatic conditions are more congenial for proper growth and development of silkworm and its food plants (Choudhury, 1985). Even today diverse forms of silkworm races are found in the Himalayan foot hills and north eastern region of India (Gogoi and Goswami, 1995a, 1996c). Moreover the vernacular name applied to the Various silkworm races which are found in the legend and literature, fable and folklore of India, indicates that the introduction of sericulture might have taken place at some remote period. Thus, It is evident from the above facts that India has its own history

1. Dr. Gogoi, Buddhin—(1999) “Studies on various aspects of Dighloti as an important muga food plant” p.-17

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of sericulture. In its long history Indian sericulture has passed through ages of ups and downs known from its great prosperity as well as adversity. "Though efforts were made to patronise silk culture in India, in the 18th, 19th and early part of the 20th century by the Britishers when the sericulture suffered a serious set back, during that period it started to revive back to the path of prosperity after the world war II is over in 1945". Thus, the sericulture industry of India, which had a glorious historical past once again entered a new golden era. India has made thereafter rapid progress in production of raw silk and diversified finished goods during the last two decades. India, is the second largest producer of silk is planning to gearup its production in a big way. At present the country produces about 16059 metric tons of silk annually of which 80 percent is consumed domestically. The demand for silk in India is primarily attributed to the traditional use of silk on ceremonial occasions and on religious rituals. In the export front, India is also emerging as a viable alternative to China particularly for the handwoven, hand printed, hand embroidered items of silk goods. India has all the potential to emerge as the leading exporter of Value-added silk products. "Total Silk export earnings of India during the years 1999-2000 is Rs. 1501.78 Crores and during 2000-01 upto December is Rs. 1163.84 Crores." India is now poised for a great leap forward in the sericulture development with its rich silkworm and food plan bio-diversity backed by congenial eco-climatic conditions and much needed low cost labour resources.

2. Workshop on Rural development through sericulture in North East, 28th to 30th May, 2001, Organised by Directorate of Sericulture. Govt. of Assam
Silk is the way of life for the Indian people. It has become inseparable part of Indian Culture, Tradition and economy over thousand of years. In the social and religious occasions silk apparels are used, particularly by the women-folk. The fine quality Indian finished silk products are well-known world wide. The following are some of the Indian silk goods having international reputations are expertly designed brocades of varanasi, the luxurious crepes, georgettes and chiffons of Karnataka, the tie and dye craft of Andhra Pradesh, Gujrat and Orissa, the delicate silks of Kasmir, pure brilliant fabrics of Bandej, Temple silks of Kancheepuram, strong and glittering golden yellow muga silk and comfortable eri silk cloths of Assam. The development of modern printing textile technology was created new dimension for diversification of Indian silk products. These printed silk goods have increased the market demand for bulk of Indian export alongwith the masterly designed traditional handloom products.

At present, 23 Indian states are producing Indian silk items. Among these, Karnataka, Andhra Pradesh, Tamil Nadu, West Bengal, Jammu and Kashmir are traditional and others are non-traditional Sericulture States. Prospects of introduction of sericulture in the new regions are being studied and surveyed by the Central Silk Board and introduction of sericulture in certain areas has already been started on pilot basis. Indian sericulture is distributed both in temperate and tropical zones. Temperate sericulture is limited to kashmir, sub-Himalayan and other hilly regions. The rest of India practices tropical sericulture. In the temperate region, sericulture can be practised only once in
a year i.e. during Spring seasons but in tropical region sericulture can be
practised throughout the year. Sericulture is an ideal enterprise in India because
of quick and high returns with minimum investment which fits well into the
Indian socio-economic structure. In the recent times, economists and scientists
working on sericulture have recommended to the planners, policy makers and
administrators in India to recognise sericulture as the most effective way for
rural reconstruction and prosperity of the rural society. Earlier, sericulture was
considered to be a subsidiary occupation in India. But this notion has been
changed and today it is considered to be the most remunerative profession
as reflected from the increased acreage of food plant cultivation and higher
raw silk production every year. This has been made possible through the
development and introduction of new technology in all the phases of sericulture
activities. It is note-worthy that an ambitious Multipurpose National Sericulture
Project (MNSP) has been launched by the Government of India in 1989-90.
The main objective is to upgrade the quality of Indian silk and to increase
the quantity of raw silk production to the level of 15000 tonnes by 1994-95
through Research and Development activities. The infra-structural facilities in
India for silk reeling, twisting and weaving are made available. Silk reeling
in India is done in charkas, cottage basins and filatures. Silk weaving is mainly
undertaken with the help of handloom. About 65 percent of Indian silk is woven
on handlooms, 30 percent on traditional powerlooms and the rest 5 percent
is woven on modern silk weaving factories. A total ten spun silk mills are
functioning in India for production of spun silk yarn from silk wastes. Three of them, namely, Channapatna (Karnataka), Jagiroad (Assam), and Bhagolpur (Bihar) are under public sector and the remaining seven are under private sector. Major silk printing centres are located in Bombay, Varanasi, Delhi and Banglore. India’s exports are diversified sericultural products in the traditional and non-traditional markets. About 90 percent of the country’s total mulberry raw silk production covers from the traditional status. The rest is produced in the non-traditional States, namely, Assam, Bihar, Gujrat, Himachal Pradesh, Kerala, Madhya Pradesh, Maharastra, Orissa, Punjab, Rajasthan and Uttar Pradesh. The major tassar raw silk producing States are Bihar, Orissa, Madhay Pradesh, Andhra Pradesh, West Bengal. While minor amount of tassar raw silk is also produced by Maharastra and Uttar Pradesh. Major States of eri raw silk production are Assam, Meghalaya, Manipur and Bihar, while Arunchal Pradesh, Mizoram, Tripura, Nagaland and Orissa are also producing on a small scale. Manipur, Nagaland, Mizoram, Arunachal Pradesh, Himachal Pradesh, Uttar Pradesh, Assam, Meghalaya, Jammu and Kashmir are producing Oak tassar silk.
The following table shows the sericultural production in different States of India.

**Table -1.1**

<table>
<thead>
<tr>
<th>States</th>
<th>Types of Culture</th>
<th>Non-Mulberry</th>
<th>Mulberry</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Muga</td>
<td>Eri</td>
</tr>
<tr>
<td>1. Andhra Pradesh</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>2. Arunachal Pradesh</td>
<td>+</td>
<td>+</td>
<td>—</td>
</tr>
<tr>
<td>3. Assam</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>4. Bihar</td>
<td>—</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>5. Himachal Pradesh</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>6. Jammu &amp; Kashmir</td>
<td>—</td>
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<td>—</td>
</tr>
<tr>
<td>7. Karnataka</td>
<td>—</td>
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<td>—</td>
</tr>
<tr>
<td>8. Manipur</td>
<td>—</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>9. Maharashtra</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>10. Madhya Pradesh</td>
<td>—</td>
<td>—</td>
<td>+</td>
</tr>
<tr>
<td>11. Mizoram</td>
<td>+ (recently)</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>12. Meghalaya</td>
<td>+</td>
<td>+</td>
<td>—</td>
</tr>
<tr>
<td>13. Nagaland</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>14. Orissa</td>
<td>—</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>15. Punjab</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>16. Tamil Nadu</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>17. Tripura</td>
<td>—</td>
<td>+</td>
<td>—</td>
</tr>
<tr>
<td>18. Uttar Pradesh</td>
<td>+ (recently)</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>19. West Bengal</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>20. Rajasthan</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>21. Gujrat</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>22. Kerela</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>23. Sikkim</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

*Source: Annual Reports (1999) Central Silk Board, Guwahati - 5, P.-21*
1.5 Silk industry in North East:

At present a total of 27,504 hectares of land is used in North Eastern States under different varieties of silkworm food plants. Besides, 2,88,894 families are directly involved in various sericultural activities as per breakup given below.

**Table - 1.2**

Silk industry in North East

<table>
<thead>
<tr>
<th>States</th>
<th>Area (Hect)</th>
<th>Family</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mulberry</td>
<td>Muga</td>
</tr>
<tr>
<td>Assam</td>
<td>2813</td>
<td>2302</td>
</tr>
<tr>
<td>Arunachal Pradesh</td>
<td>200</td>
<td>50</td>
</tr>
<tr>
<td>Manipur</td>
<td>3570</td>
<td>130</td>
</tr>
<tr>
<td>Meghalaya</td>
<td>135</td>
<td>234</td>
</tr>
<tr>
<td>Mizoram</td>
<td>1200</td>
<td>14</td>
</tr>
<tr>
<td>Nagaland</td>
<td>612</td>
<td>64</td>
</tr>
<tr>
<td>Tripura</td>
<td>656</td>
<td>Nill</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>9186</strong></td>
<td><strong>2794</strong></td>
</tr>
</tbody>
</table>

*Source: Annual Report (99), Regional Development Office, Central Silk Board, Guwahati-5*

From the above table - 1.2, it is observed that 2302 (hect) Area of land in Assam is now used for *muga* food plantation. It is followed by Meghalaya (234 hecetor). There is no *muga* culture in Tripura due to unfavourable climatic conditions for *muga* culture, but there are a few mulberry cultivation. Manipur is the highest mulberry producer State in North-East Region. In *eri* culture,
Assam ranks first in North Eastern Region. It is observed from the above table that there is immense scope for muga cultivation for generating income and employment potentialities in this backward region of India.

1.6 Muga culture in Assam:

Among all the four silk varieties golden yellow muga silk is the most elegant, strong and durable indigenous product of the North Eastern Region. Muga silk worm (Antheraca assama, Westwood, family-saturnidae) is exclusively endemic to the North-Eastern Region of India possibly because of the congenial eco-climatic conditions prevalent around its natural habitant. Muga culture is thus a traditional avocation of the Assamese people. Constituting an inseparable component of their socio-economic life and cultural heritage for centuries. The muga silk worm is polyphagous and feed on the leaves of several kinds of tree species. Which are abundantly found in the natural habitant of the region. The muga food plants are also classified into primary, secondary and tertiary types, depending upon the various qualitative and quantitatives aspects of the plants and feeding behaviour of the insects in relation to the ultimate production of quality silk fibre som and soalu are used as primary food plants. Secondary food plants of muga silkworm are Dighloti, Mejankari, Chapa, Panchapa, Tita chapa, Patichanda. The tertiary food plants are namely—Bogori, Bhomtoli, Bajramani, Gomari, Kathalua, Gonsoroi and Tejpat.
Muga culture is mainly confined to the State of Assam which produce 99 percent of the total muga raw silk of our country. In addition to Assam, except Manipur and Tripura, other four States of North-Eastern Region i.e. Meghalaya, Arunachal Pradesh, Nagaland and Mizoram are also engaged in muga culture. However, muga culture has been recently introduced to the Coach Bihar district of west-Bengal where Soalu plants are found to have grown abundantly. A research extension centre has been established there in May 1988 under the Regional Muga Research Station (RMRS) at Boko, Kamrup, Assam, to study the prospects of muga culture in this new zone.

It has been established that muga culture in this new zone is quite promising (B.B. Singha, 1991) though the commercial muga culture is mainly confined to the North-Eastern Region of India, the muga silk moth is also distributed to the other Indian States. The muga silk cloth is called 'the Queen of fabric' due to its strongness, durability, exquisite, and elegant lustrous natural golden colour. Muga silk is strongest of all the natural silk. Tenacity of RMRS-VI reeled yarn of muga silk in 5.201g/d (S.K. Sengupta et. al, 1991) that of eri silk is 3.3-50 g/d; machine reeled tropical tassar silk is 1.8-2.562 g/d, Oak tassar is 2.8-3.0 g/d (S.K. Majhi et. al, 1991) and machine reeled mulberry silk is 3.8-4.1 g/d (T.N. Sanwalker, 1991). Tenacity of muga silk fibre can be increased if muga reeling technology can be improved through automation and modernization. The Oak tassar is finer than the tropical tassar (10 denier).
Muga silk is as fine as oak tassar (4 denier). Eri silk is the finest 2.2–2.5 denier among non-mulberry silk (S.K. Majhi et. al, 1991). The filament denier of bivoltine mulberry silk is 2.30 and multivoltine ranges from 2.40–2.46 (T.N. Sanwalkar, 1991). Moisture regain capacity of muga silk is the highest i.e. 30p/c (S.N. Choudhury, 1992) followed by 13percent in eri, 12percent in tassar and 11percent in mulberry fibre (Neeru Saluja et. al 1993). Due to the highest tenacity, muga silk is the strongest and most durable among the natural silk. Muga silk fibre also has the highest hyproscopicity and therefore, muga silk cloth is comfortable to wear and hygenic. There is a traditional belief amongst the Assamese people that muga silk cloth improve the quality of skin and even can cure certain skin diseases. Due to this belief Assamese women are found of muga silk cloth as a measure of beauty care. The scientific validity of the belief can be explained in this way that muga silk cloth due to its high hyproscopicity keep the skin dry by absorbing moisture thereby inhibiting the fungal and bacterial growth responsible for skin disease. Other notable qualities of muga silk fibres are highly bad-conductor of electricity, easily blendable with Ramie, Cotton and Polyester, More over muga silk can retain its crystallinity bad conductivity, hardness, golden yellow colour and other qualities upto a temperature of 200°C. Many physical changes of muga silk fibre have been observed when it is dropped in iodine and florin (M. N. Bora, 1993). Therefore muga silk fibre has opened up a new vista in various modern
technology development in addition to its use as the best textile fibre.

Despite tremendous potentialities for developing a monopoly market of muga silk yarn and fabric in and outside India, muga silk production could not be increased even to meet the demand of the local people. Science & Technology have enormously progressed but it could not back up the centuries old muga silk industry to transform it into a scientifically organised sector like mulberry industry. It still remained as a rural based, out dated, primitive cottage industry. The price of muga cloth is increasing as sky rocketing and is far beyond the reach and purchasing power of the common man.

The age old muga silk industry is deteriorating due to many factors. Different species of muga host plants and their various morphotypes are quickly depleting from the scene, some are endangered and some others have already become extinct due to environmental degradations. The environmental pollutions of tea, petroleum, cement, coal and fertilizer industries have caused tremendous damage to the rich muga cogenous flora and fauna of Assam (B. Gogoi & B.C. Gowasami, 1998a). The ever important wild races of muga silk worm are no more available which were once abundantly found in the foot hills of North-Eastern-Region and else where. Muga silkworm and its consumption of various food plants bio-synthetically leads to the ultimate production of golden yellow muga silk fibre that are unique wealth of the world. It needs affectionate care, protection and conservation for it fullest utilization as the best natural
textile fibre in the years to come by transforming the muga culture into a scientifically organised sector like mulberry silk industry.

It is evident from the table -1.3 that the production of tassar and eri raw silk is increasing and is satisfactory but production trend of unique muga silk is fluctuating and declining. It is really unfortunate that despite tremendous scientific and technological developments in the production of mulberry raw silk in India for last two decades muga culture could not be fully supported for its development to increase the production of raw silk to a reasonable height from what it was almost five decades before. The table 1.3 indicates the position of Non-mulberry silk in India.
Table - 1.3

Position of Non-Mulberry Silk in India

<table>
<thead>
<tr>
<th>Year</th>
<th>Tassar</th>
<th>Eri</th>
<th>Muga</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1979-80</td>
<td>384</td>
<td>183</td>
<td>45</td>
<td>612</td>
</tr>
<tr>
<td>1980-81</td>
<td>265</td>
<td>135</td>
<td>48</td>
<td>448</td>
</tr>
<tr>
<td>1981-82</td>
<td>257</td>
<td>147</td>
<td>44</td>
<td>448</td>
</tr>
<tr>
<td>1982-83</td>
<td>284</td>
<td>213</td>
<td>37</td>
<td>534</td>
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<tr>
<td>1983-84</td>
<td>418</td>
<td>270</td>
<td>54</td>
<td>742</td>
</tr>
<tr>
<td>1984-85</td>
<td>444</td>
<td>279</td>
<td>55</td>
<td>778</td>
</tr>
<tr>
<td>1985-86</td>
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<td>52</td>
<td>868</td>
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</tr>
<tr>
<td>1989-90</td>
<td>465</td>
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<tr>
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</tbody>
</table>

Inspite of a long heritage *muga* culture in Assam still remains as a traditional cottage industry without much scientific backing. All the credits for sustaining this traditional *muga* culture can be attributed mainly to the rearers, and weavers. It is they, who kept alive their unique industry as a part of their cultural heritage and subsidiary occupation which is practised in the same age-old manner. Improved technology, Like mulberry silk industry is any sphere of operation of *muga* culture is yet to be developed. No package of practices for systematic raising of *muga* food plants with suitable morphotypes based on chemical analysis has been developed as yet. *Muga* rearing is traditionally practised under outdoor conditions which exposes the highly sensitive silkworms to natural calamities, harmful pollutants of the environment and various pests and predators, occasional storms, hailstorms, frequent heavy showers of rain and high temperature cause 50 percent damage to the muga silkworm during summer months. Moreover, 80 percent of the total damage occurs in the first 2/3 stages of worm (A. K. Sengupta et. al. 1992). A scientifically sound and commercially viable indoor rearing technique like mulberry culture is yet to be established to overcome such environmental effects on *muga* activities. The indoor rearing technique which has been recently developed for chawki rearing on *muga* silkworm upto the end of 3rd instar stage by Regional Muga Research Station, Boko, is not rearers friendly at all and lack of commercial viability.

The indoor rearing technique that has been developed at the Institute of Advance
Study in Science and Technology, Khanapara, is supposed to have extended to the rearers of the Assam Science Technology and Environment Council is not based on a conclusions of extensive research, covering all aspects of muga rearing authenticated by multilocational trials especially in the commercial muga growing areas of upper Assam. Further, before transferring this technology to the rearers at the earliest opportunity, it should have been thoroughly discussed in a proper scientific forum for wide acceptance by the scientists involved in the study of muga culture and commercial adoptability of its indoor rearing by the farmers in muga commercial zones of Assam. A desirable aspect of popularizing muga indoor rearing requires not only the study of rearing performance but all other related multifaceted parameters that support a technology development in an area like muga culture as the muga silkworm is highly sensitive to environmental factors. These, further require frequent feedback from the rearers and then finally transfer the technology in an acceptable form. Developing a sound indoor rearing technology and its transfer to the rearers is a most welcome step. But before it is transferred to the commercial level from the laboratory research a full proof technology covering all parameters of muga culture must be established. Another problem area of muga culture at present is the non availability of healthy muga silkworm seed. Unlike mulberry culture, the channel of seed production in muga culture still remains unorganised and haphazardly multidirectional and unscientific. After establishment
of a full-fledged Regional office of the Central Silk Board (C.S.B.) at Guwahati under which Muga Seed Development Project (MSDP) is functioning with branch offices in the various places of the North-Eastern-Region. It is expected that the gap between demand and supply of healthy muga silkworm seed will be minimised. But Muga Seed Development Project (MSDP) could produced only a total of 3,59,735 numbers of disease free laying’s (dfl’s) as on 1990-91, since its inception in 1983-84, against an actual demand of more than one crore dfl’s every year. This is one of the greatest lacuna in the commercial muga raw silk production. However, Central Silk Board (C. S. B.) could slightly change its strategy to improve the efficiency by producing 1,12,000 disease free layings in 1992-93 and 2,26,000 dfl’s in 1993-94.

Professional muga silk reeling is still continued in a traditional way in Bhowri, which is mainly confined to Sualkuchi in Kamrup district. Das type, Choudhury type and Trivedi type reeling machines are slightly improved over the traditional Bhowri have been developed later but are not used in large scale reeling purposes. These are available in the Government reeling centres only. No sophisticated muga silk reeling device could be developed as yet, which is a major drawback in the production of quality muga silk yarn and quality fabrics. Regional Muga Research Station (RMRS) Boko, Kamrup, fabricated a series of reeling machines among which RMRS-VI is the latest one. This is an impressive development towards the modernization of muga silk reeling
but these are not produced in large scale and not made available to the commercial reelers. All type of operation relating to muga silk weaving is also of traditional type. Weaving of muga silk cloth is entirely done by fly-shuttle handlooms without any quality control which is also mainly confined to Sualkuchi. Modernization through automation and sophisticated devices in the weaving sector is yet to be initiated. Only machine made fine quality muga fabrics can be exported. But poor quality muga fabrics are produced only in the handloom sector which cannot afford to developed a quality consciousness among the weavers. Therefore, muga fabric cannot bring to high class quality fabric for the international market. Another major problem area of muga silk industry is the absence of a dependable muga cocoon market. That is why the middle man are availing the undue advantage of purchasing the commercial cocoons from the Upper Assam districts and selling the same to the reelers and weavers of Sualkuchi at high profit margin and thereby creating unwanted price rise of the muga products. The idea of Muga Raw Material Bank (MRMB) of Central Silk Board (CSB) is the commercial cocoon producing areas become inoperational due to the unorganised transaction procedure and very low government support price. The supreme muga silk fabric despite its unique natural golden colour and exquisite nature, remained confined to the State of Assam due to the lack of quality consciousness among the reelers and weavers of Assam and there is lack of systematically organised good marketing facility
to encourage the buyers. The price of thousands (1000) muga reeling cocoons, per kilogram muga raw silk and per kilogram of muga silkwaste at Guwahati market are in under of Rs. 500.00 (five hundred), Rs 2700.00 (two thousands and seven hundred), and Rs. 60.00 (sixty) respectively (source: Indian Silk, 1992). But at present the price of per thousands muga cocoons ranges from Rs. 500.00 to Rs. 800.00 depending upon the quality and season and price per kilogram of muga raw silk ranges from Rs. 3500 to Rs. 4500 depending upon the fineness, neatness, colour and season.

The golden yellow muga silk industry of Assam has a very bright prospect. The muga culture can be expanded to the entire North-East Region due to most congenial eco-climatic conditions and geographical position. Muga silkworm rearing can be successfully undertaken particularly in the sub-Himalayan Region in the North, foot hills of Barail Range and the shillong plateau in the North-East due to the ideal habitat of the various muga food plants and congenial ecological conditions. An approach towards organising a national and international network for coordination and interaction between scientists is to be made to survey and study the feasibility of introducing muga culture in the new zones where muga food plants and muga silkworm are naturally distributed. This attempt will definitely help to expand the muga culture and research in other parts of the country.

Muga silk yarn and fabric has a very high potential in international market.
A national and international monopoly market of *muga* finished products can be developed by improving the rearing technology of *muga* silkworm and modernization of reeling and weaving technology through automation and sophistication. This will not only contribute to the national economy but also create tremendous employment opportunities in *muga* culture and trade.

*Muga* silkyarn and *muga* silkwaste can be blended with DMT polyester yarn produced by Bongaigaon Refinery & Petrochemicals (BRPL) Ltd. *Muga* silk yarn can also be blended with remie, an indigenous best fibre of the east (S. N. Choudhury, 1987). Moreover, this *muga* silk can also very well be blended with other natural spun and related silks, if blending technology of *muga* silk fibre with other synthetic fibres and other natural fibres of both plant and animal origin can be properly developed an indefinite varieties of textile products can be obtained suitable for all seasons and acceptable to all. *Muga* silk fibre can also offer scope for blending with the reeled *muga* silk for ultimate production of various textile finished products at a law price. Therefore, *muga* silk industry can be developed as a regional textile industry in Assam which can produce fine finished products of export quality. This will invariably generate ample employment opportunities in the Region.

Large scale plantation of *muga* host plants through social forestry scheme in the ceiling surplus land of tea gardens and other fellow land, road sides, premises of the various establishment and institutions will not only enable the
rearers to use these plants, but also will protect soil erosion and eco-logical balance. Multipurpose farms where muga culture along with pisciculture and poultry farming can be feasible, may be encouraged to grow simultaneously, As the muga pupae are very nutritious food for the poultry and fishes, muga can profitably support both the culture. Inter-cultivation of various horticulture plants alongwith muga food plants can give more incentives and profits to the muga silkworm rearers in per unit area of land. This aspect of multipurpose muga farming is to be thoroughly studied.

There is bright prospect of muga by-product industry in Assam. Various by-products of muga silk industry can be utilised to grow different new industries. The unused and old plants, branches after pruning can be utilised as fuel, timber and raw materials for pulp and paper industry. Som seeds can be used for preparation of a dye and mejankari seeds, leaves and bark can be used for extraction of a very fine aromatic oil. Guts and sutures can be manufactured from matured muga silkworm which is used for surgical stiching. In addition to use it as food for cattle, fish and poultry. The pupae can also be used for production of oil. This oil can be used for preparation of soap, cosmetic and candle. This refined pupae oil may be used as alternative edible oil and dalda. Pupae and litters are good manure for agricultural and horticultural farms. Moreover, silkworms litters can also be effectively utilised in the bio-gas plant with cowdung. The muga pupae are also utilised as delicious
and nutrients and it is particularly the people of some communities in Assam. An extensive research is needed to study the efficient use of these muga by-products as raw material for new industries. Thus, muga silk industry in Assam has very bright prospect for its development in the near future, provided the State Govt. announces a policy decision in this regard.

With grand reputation and glorious rich heritage and a bright prospect for future development, golden muga silk industry of Assam at present is undulating with uncertainty and is under great threat of decline and extinction. There are many reasons for this unfortunate present status. One of the reasons is that environmental degradations caused by deforestation, industrialization, urbanization, population explosion, natural calamities, shifting cultivation, mechanized agriculture and other developmental activities. Different species of muga host plants and their various ecotypes and morphotypes are quickly disappearing from their natural habitat. The bivoltine wild races of muga silk worm which were once abundantly found in this natural State is no more available. This wild races are essential for evolving genetically stable and improved hybrid races with desired characters. Even the cultivated form of muga silkworm is badly affected by the pollutant created by tea, petroleum, fertilizer, coal and cement industries of Assam. Sometimes the entire brood is damaged by such environmental pollution. As a consequence, the traditional muga rearers lose interest on muga culture and go in search of alternative
lucrative business. If this present trend of deterioration and decline is continued, this unique muga culture of human civilization will be vanished from the earth forever, like the mejankori culture in the past. Therefore, it is the responsibility of all concerned and need of the hour to protect the unique muga culture from further decline and deterioration and conserve it for the future generation to be utilised to its fullest extent.

Scientists, policy makers and the administrators have the greatest role to play for a glorious future of muga silk industry of this country, particularly in Assam.

1.7 Rationale of the study:

In view of the above, it is an essential need to undertake an empirical study on muga culture in Assam, with reference to income and employment potentiality of muga activities. The famous Sualkuchi village stands as witness for muga culture. If improved technique and scientific rearing is used, it would open up a new vista in this economically backward region of our country. Inspite of the such age old cultural heritage in the North-East, the muga culture is still unorganised and practiced by and large in traditional manner using old naturally available trees and skill borrowed down from the earlier generation. It is the responsibility of the present generation to preserve this culture, improve and exploit its uniqueness for international acceptance as one of the most eco-friendly product. Muga culture can be used as an effective tool for socio-
economic reforms and to combat the present unrest arising out feeling of insecurity and unemployment. *Muga* silk, being the monopoly of Assam, its prosperity and sustenance has to be ensured by the people of Assam through concerted efforts by all concerned.

Therefore, this study is a modest attempt to find out the factors that are commonly associated with the success of *muga* rearing, its income earning and employment generation in Assam.

### 1.8 Objectives:

The following are the objectives of this study—

1. To study the present position of *muga* culture in the State of Assam.
2. To examine the economic and commercial viability of *muga* activities in Assam.
3. To evaluate the role of *muga* culture in providing employment opportunities and enhancement of income to *muga* farmers.
4. To study the problems faced by the *muga* farmers.
5. To suggest measure for the development of *muga* activities in the State.

### 1.9 Research questions:

To achieve the above objectives the following research questions are formulated to answer in course of the study.

1. Whether *muga* activities are economically and commercially viable?
2. Whether the *muga* activities are playing a positive role in providing employment opportunities in the State of Assam?
3. To evaluate the role of *muga* culture in providing employment opportunities and enhancement of income to *muga* farmers.

4. To study the problems faced by the *muga* farmers.

5. To suggest measure for the development of *muga* activities in the State.

1.10 Methodology:

This study is carried out to understand the existing *muga* rearing activities and evaluate its contribution to Assam economy. Efforts were made to find out strength, weakness and opportunities including the pre-cocoon activities, so that better cocoon production can be provided to the *muga* farmers.

Therefore, methodology was adopted according to the need of investigation. After setting up objectives it was known that what are the information to be collected for the study. The study is based both on primary data collection and secondary information. Primary data were collected through field survey with the help of questionnaire, personal interview and the secondary information were collected from Central Silk Board bulletins; Reports of State Government; journals and periodicals; Regional Muga Research Station; (Boko); Directorate of Sericulture, Assam; Regional Sericulture Research Station. Jorhat; Central Muga Research Training Institute (CMR&TI), Lahdoigarth (Jorhat); Demonstration-cum-Technical Service Centre (DCTSC), Sualkuchi; Institute of Advance Studies on Science & Technology Centre, Khanapara; R.R.L. Jorhat; National...
As it is clear from the above mentioned objectives, the information required for the study are specific. The study attempts to obtain a comprehensive description and analysis of the *muga* cocoon market. The study therefore be designed to provide for the collection of all necessary information, keeping the above design adopted here is explorimg in nature.

As it has been said that primary data were collected with the help of one set of questionnaire. Basically while designing the questionnaires it was kept in mind that all the required information are being collected through the questionnaire. Each question was devoted towards finding out some specific information. It was taken care of that the questionnaire donot become too much lengthy and boresome for the respondent to answer them.

A pilot survey was conducted among some rearers of the Kamrup district. This survey helped to formulated the relevant questions needed for finding the information to analyse the objectives of the study.

1.1.1 Periodicity of the study: This study covers a period of three years from January 1999 to December 2002.
Data collection method:

A. Data source: The data needed has been mainly collected from the primary source, i.e. through questionnaire and personal interviews from the muga farmers. A little of secondary data were used which has been collected from printed circulars of the organization and from the magazines of the Central Silk Board and Directorate of Sericulture, Assam.

B. Research instruments:

The questionnaire method of survey was undertaken due to main advantage of versatility, speed and cost. The questionnaire was by and large structured and designed as far as the muga farming and activities for which the study was being undertaken.

The questionnaire was designed only after the attributes of muga farming were identified by a pilot survey. Considerable amount of work had been done upto the phase of making the questionnaire short, simple and precise. For the collection primary data the whole universe covering all 7 blocks of muga farming of Kamrup district was selected. The universe consisted of heterogeneous rearers of 7 (seven) blocks. The blocks were numbered from 1 to 7 and the total number of rearers of each block was used to select a group of rearers to carry out the investigation. Due to time constraint and the vastness of topic it was not possible to cover all the rearers of the district within a specific period. Hence sampling methods were used to select the blocks as well as the
rearers so that the sample obtained was truly representative of the population and the results obtained from it were accurate to a great extent. The sampling process and in this study consisted of the following sequential steps.

**Step 1 : Defining the population** : The primary step was to defined in terms of (i) elements (ii) sampling unit (iii) extent

(i) Elements : Muga farmers.

(ii) sampling units : Blocks consisting of Muga rearers were taken as first stage of unit then Muga producing village as second stage unit and rearers as the third or final stage unit.

(iii) Extent : Kamrup district.

**Step 2 : Identifying the sample frame** : The next step was to identify the sampling frame. Since, this study two stages sampling process was involved hence those sampling frames were needed. These sampling frames were—

(i) A list of blocks consisting muga framing.

(ii) A list of villages of muga farmers.

**Step 3 : Selecting the appropriate sampling design** :

For collecting of primary data, the following sampling methods were used.

Stratified Random Sampling.

The total number of muga farmers of a particular block was divided into mutually exclusive and collectively exhaustive strata. The total number of rearer of a particular block will be divided into three strata based upon
their annual income viz, high, middle and low income group. The classification of income groups (strata) was as follows:

Low income group: Below Rs 20,000 (annually)

Middle income group: Rs. 20,000 to Rs. 40,000 (annually)

High income group: above Rs. 40,000 (annually)

After that the list of muga rearers of each village was divided into the above three strata, separate simple random samples of equal sizes were selected from each stratum was done on a disproportionate basis as the number of rearers selected from each stratum was not proportional to its share of the total number of rearers of the block. The annual income of the rearers was obtained through the following information.

(i) The details of occupation, profession furnished by the rearers in the questionnaire.

(ii) The details of annual income as mentioned by the rearers in the questionnaire.

The simple random samples of rearers from each stratum was selected using the random number table.

**Step 4. Determining the sample size** the next step was to determine how large a sample should be taken for the study. Due to time constraint and convenience
20 present rearers were selected randomly from the 7 (seven) blocks of the district. The effective sample size was 736, out of total 3681 muga rearing families of the district.

**Step 5 : Select the sample :**

The next step was selecting actual numbers of the sample for the study. The questionnaire designed for collecting the primary data was then given to the rearers selected randomly to get their responses and suggestions.

**Tools of data collection :**

The primary data were collected with the help of a questionnaire will have 29 items. The questionnaire is based on the likert scale. This likert scale comprises of a series of evaluative statement/items concerning on attitude objectives. A response sheet attached to the questionnaire and it was divided into four parts to collect information on the following.

(i) Response to 29 items/questions.

(ii) Complaints if any.

(iii) Suggestions if any, and

(iv) Personal information.

**1.12 Limitations :**

The present study has the following limitations:

(1) It is observed during the field survey that muga farmers of the village have shown reluctance to part with information necessary for the study.
Though attempts have been made to collect necessary information through informal discussions with rearers, yet there might have been some omissions.

(2) Majority of the rearers have provided some quantitative information such as, figures of annual muga cocoons harvesting, annual income from muga cultivation, amount of investment in plantation and amount received as incentives from the Government etc. from their memory other than from books of accounts. Most of the rearers have not maintained proper books of accounts. Out of the sample rearers, only 15 percent rearers have given information from books of accounts and records maintained by them.

(3) During the survey, it is observed that the Directorate of Sericulture (DOS), Assam; Regional Development Office (RDO), Central Silk Board, Guwahati, have not maintained proper annual accounts as regards to various incentives provided by them from time to time to muga growers of various blocks which is mentioned above. This created a lot of difficulties in studying the impact of income and employment generation in Kamrup district through Muga Culture.

1.13 Plan of work:

The study is divided into six chapters.
Chapter I : Introduction, present position of world silk industry, present position of Indian Silk Industry, Silk Industry in North East, Muga Culture in Assam, Rational of the Study, Objectives of the Study, Research questions, Methodology, Limitations,

Chapter II : Review of Literature

Chapter III : Present position of Muga Culture in Assam.

Chapter IV : Socio-economic profile of Kamrup district and Analysis of Data.

Chapter V : Problems of Muga Culture.

Chapter VI : Findings, Suggestions and Conclusion.

In the next chapter, Review of Literature has been discussed.