CHAPTER I

INTRODUCTION
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Assam is the only place in the world where all commercially exploited varieties of silk viz. Mulberry (Pat), Eri, Muga and Oak tasar silk are produced. Each of the silkworm species is specific in its feeding habits. The mulberry silkworm (*Bombyx mori* Linn.) is of three types i.e. Uni, bi and multivoltine. The univoltine silkworm, ‘Borapolu’ or ‘Barpat’ and the multivoltine, ‘Chotopolu’ or ‘Sarupat’ and ‘Moria’ are endemic to this region. It is a monophagous insect which reared on the leaves of mulberry only; the morin present in the leaves helps to attract the silkworm. The important species which are cultivated for food are *Morus alba* Linn, *M. indica* Linn. *M. lavogata* Wall., *M. bombycis* Koidz. are widely available, while *Morus australis* Poir and *Morus aciosa* Griff. are endemic to this region. In addition, a number of improved cultivars of mulberry have been evolved by the Research Institutes of Central Silk Board, which are found to be popular in the field. Among these, mention may be made of V1, Kanva-2, S1, S799, TR10, BC259 and S54. Some improved cultivars from Japan and other countries have also been introduced in India with encouraging results. Some of these are Ichinose, Goshoeorami, Kosen (Japan) and Limoncine (Italy). Tasar silkworm *Antheraea mylitta* D is a polyphagous insect which are reared outdoors. The important food plants are Arjun (*Terminalia arjuna* Roxb. Fr. De Wright & Am.), Asan (*T. tomentosa*, W & A) and Sal (*Shorea robusta* Gaertn.). Besides these, the silkworm feeds on Phutuka (*Melastoma melabathricum* Linn.), Bogori (*Zizyphus jujuba* Mill) etc. are some of the endemic species of the tropical region of India. The temperate species of this silkworm, namely, *Antheraea proylei* Jolly, feeds on different species of *Quercus* which are widely distributed in this region. Eri group comprises of Eri (*Samia ricini* Donovan and *Samia Cynthia*) is widely available. Besides this wild silkworms like *Attacus atlas* and *Cricula* species are distributed in this region. Among Eri food plants Castor (*Ricinus communis* Linn.)
commonly distributed in this region. The other food plants are Kesseru (*Heteropanas fragrans* Roxb.), Borkesseru (*Ailanthus excels* Roxb.), Topioca (*Manihot esculanta Crantz*) are endemic to this region. Muga group comprises of *Antheraea assama* Westwood, *A. knyvetty, A. compta* and *A. helferi* are endemic polyphagous insect and feeds on 15 different host plant species mainly Som (*Persea bombycina* Kost.), formerly named as *Machilus bombycina* (King ex Hook. f.) and Soalu (*Litsea monopetela* Roxb. = *polyantha* Juss.) and few other food plants, likewise Digloti (*Litsea salicifolia* Hook), Mejankari (*Litsea cubeba* Lour.), Bogori or ber (*Zizyphus jujuba* Mill), Champa (*Michelia champaca* Linn.), Bhomloti (*Symlocous grandifolia* Wall.), Patihonda (*Actinodaphnae obovata* Blume), Gamari (*Gamelina arborea* Linn.) Panchapa (*Magnolia sphenocarpa* Roxb.), Katholua (*Cyclicodaphne nitida* Roxb.), Gansarai (*Cinnamomum glanduliferum* Meissu), Bojramoni (*Xanthoxylum rhesa DC.*). Moreover, heterozygous nature of muga host plants leads to genetic variability among the species. Muga silkworm (*Antheraea assama* Westwood) is a single species without the race concept as in mulberry, eri and tasar silkworm colour polymorphs of the silkworm like yellow, blue and orange are available. The wild counterpart with facultative diapauses is found in the foothills of Meghalaya and Nagaland bordering Assam. Its distribution in wild state is reported from Myanmar to Sub-Himalayan belt viz., valley of Kumaon and Kangra in Northern India. Besides North East the occurrences of the species and its food plants is reported from Sikkim, Himachal Pradesh, Utter Pradesh, Gujrat and Pondichery in India and aboard from Nepal, Bangladesh, Sri Lanka. Som and Soalu plants are distributed in Burma, Malaysia, Bhutan and Indonesia. The food plants of Western and sub Himalayan belts are variable in different morphometric characters with those of Assam. Assam is the original home of muga silkworm. The natural golden hue with liquefacent luster fine silk producer muga silkworm indigenous to North-East India, particularly to Brahmaputra Valley and no where else in the world. (Hooker, 1885; Gait, 1905; Bora, 1909; Basu, B.C. 1915; Choudhury, 1959, 1982; Barua, 1966; Mani, M.S. 1968;
Bharali, 1969; Kanjilal et al., 1992; Yadav and Goswami, 1992; Hazarika et al., 1995). The culture is also spread in different districts of neighbouring states viz., East Garo Hills, West Khasi Hills and Re-Bhoi districts of Meghalaya; Mokokchung, Tuensung, Kohima and Wokha districts of Nagaland; Tamenglong district of Manipur; Aizawl district of Mizoram and Dibang Valley, Lohit, Changlang and Papumpare districts of Arunachal Pradesh. Recently, it has also been extended to Cooch Behar and Jolpaiguri districts of West Bengal. Test rearing was already conducted in Uttaranchal and Andhra Pradesh (Singh and Mishra, 2003).

North East Region contributes to nearly 7% of the total raw silk production in India of which muga is 99.8%. Muga culture spreads more or less in all the districts of Assam covering 6755 hectares out of 9241 hectares of muga host plants available all over the North East. It is mainly confined to the districts of upper Assam are North-Lakhimpur, Sibsagar, Golaghat, Jorhat, Dibrugarh, Nagaon, Darrang and in the lower Assam especially in Kokrajhar, Kamrup and Goalpara district. Muga culture is playing vital role in the economy of Assam by providing livelihood to large rural folks nearly 0.31 lakhs. The annual production of muga raw silk in Assam ranges from 69.00 MT to 101 MT only during the last 6 decades (1951-2009) (Anonymous, 2009).

The district of Goalpara is well known for its production of quality muga seed cocoons and reeling cocoons. A part of the population of various tribal communities like Mech, Cachari, Rabha, Garo, Hajong, Koch etc., Schedule caste and General classes also taken up Sericulture as their primary source of income. Around 1982 nos. families are engaged directly in muga culture from 244 nos. villages of 8 development blocks and 610 Hectares acres area covered with 4, 37, 267 nos. of Som plants in Goalpara district (Table 4.2).

The rearing of muga silkworm largely practiced outdoors, extraction of its silk and weaving of muga silk fabric are age-old practice, which are entwined with
tradition, culture and occupies an important place in the life of the people of Assam and considered almost a symbol of the state. Weaving of muga silk fabric is pride of every Assamese lady. Mostly the rural poor mass identified Muga culture having great potentialities to economic substance for livelihood and to generate more employment and involvement of women to the extent of 60% with low-investment and more profit. It can check the urban migration. Since muga culture involve tree plantation for its food plants it is considered as one of the eco-friendly in present day hazard prone industrial pollution. Tourists from outside Assam are also greatly fascinated by its natural golden hue and rich traditional design and due to the elegancy of the fabric its demand grown more and more. It is also a valuable source of foreign exchange. The pupa is used for various purposes. Waste from silkworms rearing can be recycled as inputs to the garden. The use of muga silkworm being a versatile and unique species needs to be protected from the different vagaries of nature.

The environmental factors like temperature, humidity, light, air current during the period of hatching to cocooning of larvae have an intimate relation to the growth, development of larvae, quality and quantity of cocoon production (Rahman, A. 1999).

Variation is the law of nature. The variations take place at micro levels at short space and a little period, but these become apparent only over a large space and a big time gap. The variety and variability of organisms occurs every where and at every moment. It plays a significant role in nature. It provides major clues to the scientists about the origin an evolution and the specification process of the species. It also acts as a major tool for assessing the impact of various factors in influencing the process of diversification. It is an indicator of the habitat of particular area and its potential to sustain life.

*Persea bombycina* Kost. belongs to family *Lauraceae* is a medium size evergreen tree with spreading branches, bark and foliage usually aromatic, alternate leaves grows abundantly in its natural habitat in Assam particularly Brahmaputra
Valley up to an elevation of about 500 meters (MSL), apart from its distribution extend to Khasi and Jayantia Hills in India (Kanjilal et al., 1992), along the Lower Himalaya and as far as to the west of Nepal (Hooker, 1885). The tree is locally known as “Som” (Bennet, 1987) and perhaps a cultivated form of Machilus gambili or Machilus kurz Hooker, (1878). It is one of the most significant primary food plants for muga silkworm. It is perhaps one of the very rare tree species, which can serve all the important requirements of mankind namely, fodder, fibre, raw material, timber and fuel. Som trees are preferred by the rearers due to its natural fast growth, evergreen, perennial, long life span, less maintenance cost and more resistance to insects attack. The effective rates of rearing and commercial cocoons characters are higher if silkworm reared on Som. Besides, these Som is also a good component of forestry programme for green covers and soil conservation.

In nature, a great number of morphological variations or morphotypes are observed in Som plantations. The macro and micro morphological variation may differentiate according to their growth, leaf-yield, shape, size, colour of the leaf and pollen. The morphological characters are vital tools for taxonomic identification of the species. Systematic survey of different Som morphotypes is essential for proper understanding of it taxonomy and dimensions of their suitability for muga culture for sustained development of this industry. Many attempts have been made to unfold the intricacies involving the different Som morphotypes. But many of them appear to be inconclusive. Though few works were conducted on variations among Som genotypes based on morphology (Choudhury, 1982; Raja et al., 1993) and taste of leaves (Bharali, 1971), chemical compositions (Siddiqui et al., 1998, 2000) and feeding behaviour of muga silkworm on Som, but no systematic study specific research work has been conducted at the biochemical, physiological, or molecular level on the bi-diversified Som plant found in North East India.
Molecular markers successfully developed during the last two decades have largely overcome the problems associated with phenotype-based classification (Awasthi et al., 2004; Orhan et al., 2007). Moreover, for breeding or improving promising cultivars, precise determination and discrimination of the genotype are required. The most desirable varieties of food plants and a suitable silkworm race with disease resistance or high-yield characteristics can be developed using molecular markers in selection and breeding. A more recently employed approach in plant systematic and population biology is random amplified polymorphic DNA (RAPD) markers, a PCR-based (polymerase chain reaction) technique (Fu et al., 2003).

The RAPD markers in this study may be attributed to more uniform clusters, which are expected for progenies of wild-grown plants with predominant cross-pollination (Amholdt-Schmitt, 2000). Understanding patterns of genetic variation within tree species is of fundamental importance for successful management in tree conservation programs. Knowledge of possible adaptive variation among areas is essential to the evaluation of biodiversity within and among populations to reveal information on population evolution. This study shows that RAPD is a very effective and useful tool for estimating the degree of genetic diversity as well as for determining the pattern of genetic relationships between genotypes of Som with polymorphism levels sufficient to establish informative fingerprints with a single RAPD primer.

The information obtained from this study could be of practical use for mapping the Som genome as well as for classical breeding. The putative species-specific bands can be used as genetic marker for proper identification of economically and commercially viable Som plants. Further, putative species-specific RAPD markers could be converted to sequence-characterized amplification regions after sequencing and designing primer pairs to develop robust species-specific markers. The study also provides a basis for Som breeders to make informed selections of
parental material based on genetic diversity to help to overcome some of the problems usually associated with a tree crop improvement program. The information can then be used in identifying and prioritizing areas with comparatively high genetic diversity for monitoring, management, and protection. Knowledge of population structure is important for ex-situ and in-situ conservation of natural populations (Williams and Hamrick, 1996) by maintaining the total evolutionary potential and minimizing consanguinity.

The traditional muga rearers have been using the age-old practices and muga silkworm exhibit different feeding habits to different types of Som morphotypes. The leaves of all the morphotypes are not equally edible for muga silkworms. Some morphotypes are preferred and eaten completely, some are partially or some are totally discarded as a result silkworm become unhealthy, irregular growth and susceptible to diseases and it causing considerable losses to them. A plantation with uniform characteristics homogenous nature will be ideal for uniform physiological condition, growth and development of muga silkworm. The larvae can be induced to mature almost simultaneously as physiological development would be uniform. A healthy larva is more robust and thereby resistant to diseases. It can be expect only by providing more succulent, high moisture content leaves during rearing. Therefore the improvement of host plant, higher yield of leaves per unit areas, effective land management is essential to make sericulture economic. Using best plant materials can increase productivity of cocoon in a unit of area. Negligence in any one of the activities from leaves to cocoon or fabric production may result in failure.

Hence, it is essential to select high yielding Som morphotypes with faster growth rate responding to horticultural practices which is the best for rearing of muga silkworm to get higher production and quality of silk an ultimate goal to increase the production and productivity of the cocoon per unit area and time with low cost of
production for improving economic condition of the poor sericulture farmers. In this context the present study has been undertaken with the following aims and objectives-

THE SPECIFIC OBJECTIVES OF THE PRESENT STUDY

- To survey and identify the Som morphotypes available in the study area.
- To study their growth, development and plant architecture.
- To study the rearing performance and cocoon characters on different Som morphotypes.