INTRODUCTION

Sericulture is an agro-based, labour intensive and foreign exchange earning commercial activity. It is an important cottage industry in India. Sericulture has been successful in eradication of rural poverty, resulting in social as well as economic development, mainly in rural areas. This industry is capable of generating employment and earning income continuously with low investment. Sericulture includes two sectors namely farm and industry. The farm sector involves growing food plants of silkworm, rearing silkworm to produce cocoons and laying production. Reeling, twisting, dyeing, printing, finishing, knitting and felting form the industry sector. Sericulture is much valued in creating mainly rural and marginally urban employment (Chandrappa et al., 2013).

India is the second largest producer of silk in the world with four varieties of silk namely Mulberry, Tasar, Eri and Muga. It is also the largest consumer of silk and contributes 17.5% of the total world silk production. The production of silk in India during 2011-12 was recorded to the tune of 23,060 metric tonnes, out of which the mulberry silk production was 18,272 metric tonnes, apart from this, 4,788 metric tonnes of non-mulberry silks is also produced namely Tasar, Eri and Muga which accounts to 1,590, 3,072 and 126 metric tonnes respectively (Fig. 3).

Sericulture has been identified as an occupation of low investments, employment creating and income generating. It is very well established that sericulture is highly profitable when compared to many other horticultural and agricultural crops. Sericulture involves simple technologies, easy to understand and adopt even by
illiterate farmers and it gives returns in quick succession yielding income in every months. Sericulture does not involve hard labour and rearing of silkworm is generally attended by women and old people. In this context sericulture is a better option because it is labour intensive industry and provides direct or indirect employment to about 7.56 million persons in rural and semi-urban areas in India. It requires low investment and offers high profit. It also provides regular income to farmers throughout the year unlike most other agricultural crops. It plays a vital role in the flow of income from the urban rich sections of the society to the rural poor (Dewangan et al., 2013).

Silk is the most elegant textile in the world with unparalleled grandeur, natural sheen, and inherent affinity for dyes, high absorbance, light weight, soft touch, high durability and known as the “Queen of Textiles”. On the other hand, it stands for livelihood opportunity for millions owing to high employment oriented, low capital intensive and remunerative nature of its production. Silk constitutes world’s 3 percent textile trade and India’s share in the world trade is 9 percent and which is growing in recent years.

There are more than 58 countries practicing sericulture in the world. India is the unique country in the world to produce all the four known varieties of silk namely Mulberry, Eri, Tasar and Muga. There are two important sectors in sericulture industry viz., i) Mulberry sericulture- comprising rearing of silkworm, Bombyx mori, L. and ii) Non-Mulberry sericulture involving the rearing of wild silkworms such as Tasar silkworm (Antheraea mylitta), Muga silkworm (Antheraea assamensis) and Eri silkworm (Philosamia ricini) (Ahmed et al., 2012). Mulberry silk is produced throughout the country. Tropical Tasar silk is produced by tribals inhabiting
Central India and Sub Himalayan region. Muga - Golden silk is produced only in Brahmaputra valley of Assam province of North Eastern region and Eri Silk (spun silk) is produced mainly in North Eastern region, now practiced in many other states (Fig. 1).

The North-eastern region of India is one of the ten biogeographic regions harboring varied flora and fauna including silk producing insects (Unni et al., 2009). The climate is subtropical. The congenial atmosphere in particular season has made the region the natural home of many varieties of sericicous insect’s *viz.*, Mulberry, Eri, Muga and Tasar silkworm as well as their corresponding host plants. Eri Silkworm is reported to have originated in the Brahmaputra valley of Assam and Meghalaya. The border area of Assam and Meghalaya is considered to be the ‘Home of Eri’ (Utpal Kumar & Manjit Das, 2010; Sarmah et al., 2012; Romesh Kr. Kakoti; 2012). Eri silkworms are utilized for production of silk with unique thermal properties. However, ericulture in many parts of North East India is for the eri pupae, which is a delicacy among tribal folk of that region. Eriiculture has been traditionally practiced in north eastern states contributing more than 98% of the total eri raw silk produced in the country. Of late, ericulture has been expanding in the states of Orissa, West Bengal, Andhra Pradesh, Madhya Pradesh, Uttar Pradesh and Chhattisgarh due to its existing potential of exploiting castor and tapioca leaves for eri silkworm rearing (Fig. 4).

The non-mulberry silks (Tasar, Muga and Eri) are now being popularized as *Vanya* silk. Unlike mulberry silk, *vanya* silk is wild in nature, tasar and muga are reared in open fields on trees in natural forests and perennial plantations except eri silk, which is completely domesticated and reared in indoor conditions. India has
the unique distinction of producing the commercial varieties of vanya silk. These varieties of silk fetch premium in the international markets. Therefore, adequate thrust is laid for development of this segment of the silk industry. Vanya silk is promoted as Eco silk by providing support for eco friendly production by giving subsidy/incentives, and also by convergence with other developmental programmes (Ahmed and Rajan, 2011).

The advent of Ericulture in India is lost in the antiquity but, the fact remains that Assam was the original home of Eri silk from time immemorial. In the historical records Eri was identified as Assam silk and British people called it as “PALMA CHRISTI” silk. Eri silkworm is usually reared on palmate leaves of castor oil plant or palma christae (means Hand of Christ) and it pronounced in Sanskrit as ENDI or ERANDI. The earliest available reference to Ericulture in India has been documented in 1779 according to which vast quantity of Eri silk was produced in the country in the areas of Ghorghat within the undivided Bengal. East India Company played a mega role in stepping up its production (Bandana Mahan, 2012).

Ericulture has attracted maximum attention of the rural people in northeastern region of India and it is practiced as spare time occupation by the women folk. It can generate employment for a large number of unemployed people especially females partially or fully in its various stages of activities like sowing of seeds, plantation of host plants, maintenance of plants, plucking of leaves from the planted and wildly grown trees, rearing of silkworm, spinning of yarn, weaving of fabrics, marketing of cocoons and fabric manufacturing. The women play a major role in decision making for most of the activities of eri culture and contribute
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substantially to the rural economy through eri culture (Mech et al., 2010).


The food plants of eri are abundantly found in natural forests in plains and hilly areas and leaves of these plants are available in one or the other season for eri silk production. Eri host plants are interchangeable at rearing during scarcity of one host. These plant species are distributed all over India in both natural as well as in cultivated forms and are generally perennial.

Among the non-mulberry silkworm species only eri silkworm is completely domesticated and reared indoor. It is a multivoltine insect completing atleast six to seven generations in a year. It is
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generally hardy and not susceptible to diseases. It belongs to the family Saturnidae and species *ricini*.

The genus *Samia* contains 19 species from all over the world. *S. canningi* (wild) and *S. ricini* (cultivated) are found in North Eastern region of India. The commercially exploited *S. ricini* is multivoltine and has several eco races like, Borduar, Titbar, Khanpara, Nangpoh, Mendipathar, Dhanubhanga, Chuchuyimlang, Lahing, Barpathar, Diphu, Adokgri, Lakhmipur, Dhemaji, Kokrajhar, Imphal, Cachar, Dhakuakhana, Genung, Jonai, Dhansiripar, Sadiya, Tura, Jona Kachari, Barpeta, Ambagaon, Rongpipi. The ecoraces were named based on the location of collection. Further, Six homozygous strains have been isolated on the basis of larval colour and markings, yellow plain, yellow spotted, yellow zebra, greenish blue plain, greenish blue spotted, greenish blue zebra (Table – 2, Figs. 6-11), (Sarmah *et al.*, 2012).

Eri silkworm completes its life cycle in four different metamorphosing phases’ egg, larva, pupa and moth. Out of four stages the egg encompasses the embryonic development, which lasts for about 9 – 10 days, a healthy moth lays up to 300 eggs. The larval stage has five instars and total larval duration is about 18 to 25 days. Pupal stage remains for a period of 12 to 18 days, followed by emergence of adult moths. The male and female moths copulate and reproduce (Fig. 5).

The Eri cocoons are spindle in shape and their colour is white, grey yellow, cream-coloured or red brown (Figs. 12 &13). Length and width of cocoon are 3.5-4.5 cm and 1.5-1.8 cm respectively. The whole cocoon weight, cocoon shell weight, filament length and filament size are 2.3-3.2 g, 0.35-0.49 g, 300-567 m and
2.35 - 2.36 denier, respectively. The Eri cocoons cannot be reeled as they are made up of entangled layers, and are therefore spun like cotton. Eri silk is often referred as Ahimsa silk and the fabric as ‘Fabric of Peace’ because the process does not involve the killing of Pupae. The rearers can easily preserve the cocoons till a reasonable price is offered and it is advantageous to producers. The fibre is usually spun and woven by the reelers (Sarkar, 1988).

Eri silk is widely used for preparing warm clothing like chadars, quilts and scarves (Fig. 14), which are generally used by the poor rural folk and therefore silk is referred as poorman’s silk. Eri silk fibre has wool like finish with a look of cotton and is as soft as other kinds of silk and can be blended with other fibres like wool and polyester for both durability and decoration (Siddiqui et al., 1993). Eri fabrics are more durable than mulberry silk and far more resistant to perspiration, dust, etc. Further, the texture improves by use and wash and the colour also becomes brighter.

“Vanya Resham Utpadan” (Non Mulberry Sericulture) holds great promise for promotion of forestry in India as a supplementary as well as complementary activity. On one hand it can arrest forest destruction, and on the other hand it permits gainful utilization of the vast natural resources or wealth in a sustainable way. The food plants of Eri silkworms play an important role in pharmaceutical, timber, horticulture, paper, match, leather, tannin, dying industry, petroleum industries and some food plants also serves as fodder for farm animals. The history of “Vanya Resham Utpadan” (Non Mulberry Sericulture) is much older than mulberry sericulture in India.
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The Government of India established the Central Muga and Eri Research Training Institute at Jorhat under administrative control of Central Silk Board. It is the only institute for providing research and developmental support for the growth of Muga and Eri industry. The Government of India under Forest (Conservation) Act, 1980 has issued notification in respect of vanya silk cultivation. Under this Act, the State/UT Forest Department should encourage silk cultivation in forests areas by tribals and non tribals who live in and around the forest and are dependent on such forest for their livelihood.

The eri silkworm is used not only as a source of silk, but also for a number of its by-products. Pupae oil of eri silkworm is safe and nutritionally equivalent to commonly used vegetable oils. Eri pupae provide by-products in the form of supplementary protein in the diet of the tribal peoples of North Eastern India, and silkworm litter, which forms a valuable material in the preparation of organic manure (Reddy and Suryanarayan, 2008; Sarmah, 2011; Thingnganing Longvah et al., 2012).

Eri culture is more unique and it produces a wide variety of by-products that have enormous potential for the development of traditional, multipurpose consumer products. These by-products, including waste, are commonly used in a variety of research applications and regularly find their way into the manufacturing process of popular consumer products. Many of the by-products could be put to better use transforming cottage industries into more profitable and economically viable enterprise. Eri pupae are called “poor man’s meat”. Hence, ericulture can play a vital role in polyculture production systems with additional production
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capabilities like poultry, piggery, pisciculture, renewable energy (biogas) production, efficient waste utilization, vermicompost, etc.

Srimungkararat et al., (2002) developed various eri food recipes using late fifth instar larvae, prepupae and pupae as the principal raw material, combined with herbs, vegetables and spices. These recipes are crispy basil flavor, herb flavor, spicy salad flavor, traditional spicy flavor, tom yam crispy flavor, chili paste flavor, original flavor and classic flavor. These recipes have been registered as intellectual property in the form of a patent.

Biosystematics is defined as ‘taxonomy of living populations’. It involves thorough sampling analysis of the taxonomic species under study. Its population, cultivation, geographical range, cytology, anatomy, palynology, phytochemistry, chromosomal number and behavior are keenly observed. Biosystematic study in the contemporary and modern taxonomy plays a vital role in separating and solving some of the problems that may develop in the identification of living organism at the level of species. Bioassay involves testing the abilities or to estimate the strength of living organisms. It may be qualitative or quantitative.

Although, several investigators have made attempts to understand the influence of host plants on the development of eri silkworm, the information available is inadequate to draw any valid inference for expanding ericulture industry. Similarly, fecundity of eri moths in relation to food habit, seasonal variations and using alternate host plants for feeding of eri silkworm have not been worked out systematically.
Considering the importance of ericulture and also keeping the lacunae the present study has been initiated to work out the following aspects:

**Objectives of the present study:**

- to survey distribution pattern of different host plants of eri silkworm in Southern Plateau of Karnataka.
- to collect the food plants from different localities for Biosystematics and Bio-assay studies.
- to study the detailed exo-morphic and micro-morphological features for authentic identification.
- to characterize the pollen morphological information for genotype tagging.
- to analyse the Phytochemical constituents like protein, phenols, sugars, chlorophyll and moisture contents in order to evaluate the feeding efficiency.
- to undertake Rearing trials on promising food plants to asses their commercial utilization.
- to adjudicate marketing issues related to sale of eri cocoons.