



Introduction

Silk, “The queen of textiles” is a natural protein fibre secreted by arthropods especially lepidopteran silkworms. 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 being used as a wear in some form or the other. Silk is the undisputed queen of textiles over the centuries. Silk provides much needed work in several developing and labour rich countries. Sericulture refers to the conscious mass scale rearing of silk producing organisms in order to obtain silk from them. Silkworms are broadly classified as mulberry and wild or non-mulberry silkworms. Among non-mulberry silks, eri silk production is in increasing trend. Eri culture is a viable agro-based industry, plays a significant role in rural livelihood security especially among the marginalized and weaker sections of the society. Eri culture though relatively a less remunerative occupation but it has many advantages. Several socio-economic studies have affirmed that the benefit-cost ratio in eri culture is higher among comparable agricultural crops. This chapter discusses in detail about the different types of silks available in India, how it has been introduced, the global scenario of silk marketing, position of eri culture in silk industry, its significance as Ahimsa silk and trends of growth in eri silk industry in different states of India.

If fashion is a fine art, then silk is its biggest canvas, and if silk is the canvas, then all its weavers, dyers, designers, embroiderers are the greatest artists. Silk is nature’s gift to mankind and a commercial fibre of animal origin other than wool. Being an eco-friendly, biodegradable and self-sustaining material, silk has assumed special relevance in present age. Silk is a natural protein fibre secreted by arthropods especially lepidopteran silkworms (Chowdhary, 2006). Sericulture refers to the conscious mass scale rearing of silk producing organisms in order to obtain silk from them (Ganga and Chetty, 1997). The word sericulture has been derived from the Greek word “Sericos” means silk and the English word culture means ‘rearing’. Sericulture is both an art and science of raising silk worms for silk production. Silk is the most elegant textile in the world with

unparalleled grandeur, natural sheen, and inherent affinity for dyes with high absorbance, light weight, soft touch, smooth, strong and highly durable than any natural or artificial fibre. Hence silk is known as “The Queen of Textiles”. The insects that produce silk of economic value are termed as sericigenous insects. The natural silk producing insects are broadly classified as mulberry and wild or non-mulberry silkworms. The mulberry silk moths are represented by domesticated *Bombyx mori* Linnaeus. Non-mulberry sericulture is universally known as forest or wild sericulture that provides an important source of employment for the native population in forest areas.

Sericulture includes raising of host plants, rearing of silkworm, production of silk yarn. Sericulture requires low investment, gives quick returns, provides employment opportunities and earns foreign exchange. Sericulture suits both for marginal and small land holders because of its high returns, short gestation period, and it creates opportunity for own family employment round the year. Sericulture serves as an important tool for rural reconstruction, benefiting the weaker sections of the society (Lakshmanan *et al.*, 1997 and Goswami *et al.*, 2015).

Types of Silks

Sericulture was introduced in India about 2000 years ago and the silkworm producing yellow silk was known since the ancient time (Reddy, 2000). India is a home to a vast variety of silk secreting fauna which also includes an amazing diversity of silk moths. This has enabled India to achieve the unique distinction of being a producer of all the five commercially traded varieties of natural silks namely, Mulberry, Tropical Tasar, Oak Tasar, Eri and Muga. Silk obtained from sources other than mulberry are generally termed as non-mulberry or vanya silks. The term ‘Vanya’ is of Sanskrit origin, meaning untamed, wild or forest based. The bulk of the commercial silk produced in the world is mulberry silk that comes from the domesticated silkworm, *Bombyx mori* L. which feeds solely on the leaves of the mulberry (*Morus alba*) plant. In India, mulberry silk is produced mainly in the states of Karnataka, Andhra Pradesh, Tamil Nadu, Jammu & Kashmir and West Bengal, while the non-mulberry silks are produced in Jharkhand, Chattisgarh, Orissa and North-Eastern states. Tasar silk is copperish in colour, coarse in nature and is mainly used for furnishing and interiors. It is secreted by the Tropical Tasar silkworm, *Antheraea mylitta* which thrives on plants like Asan and Arjun (*Terminalia* sp.). Tasar silkworm can be reared on naturally growing trees in the forests and is the main stay for many tribal communities in the

states of Jharkhand, Chhattisgarh, Orissa, Maharashtra, West Bengal and Andhra Pradesh. Oak Tasar is a finer variety of Tasar produced by the temperate tasar silkworm, *Antheraea proylei* which feeds on natural oak plants (*Quercus* sp.) and is found in abundance in the sub-Himalayan belt. Eri silk is a silk spun from open-ended cocoons and secreted by the domesticated silkworm, *Samia cynthia ricini* Boisduval that feeds mainly on castor (*Ricinus communis* Linn) leaves. Muga silk is golden yellow in colour and is preferred mainly in the state of Assam during festivities. Muga silk is secreted by *Antheraea assama* that feeds on aromatic leaves of naturally growing Som (*Persia bombycina*) and Soalu (*Litsea polyantha*) plants. Among the four varieties of silks produced, mulberry accounted for 71.8% (20,434 MT), tasar's share was 9.9% (2,818 MT), eri accounted for 17.8% (5,054 MT) and muga silk accounted for 0.6% i.e. 166 MT of the total raw silk production of 28,472 MT during 2015-16 (Fig. 1.1).

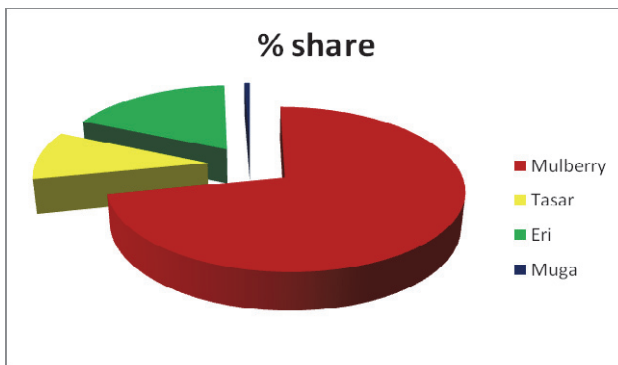


Figure 1.1 Variety wise raw silk production in India (2015-16)
Source : Central Silk Board, Bangalore

Different Versions about History of Sericulture

Silk production has a long history. Silk, the weavable fiber was first discovered during 2640 BC by the Chinese Empress Xi Ling Shi, the 14 year old bride of the China's 3rd Emperor, Huang Ti, also called "Yellow Emperor". One day she was sitting under mulberry tree, drinking a cup of tea into which a silkworm cocoon fell from above. She found that the delicate fibres started to unravel in the hot liquid and could be twisted together to make a thread that was strong enough to be woven into cloth. Thereafter, Xi Ling Shi discovered not only the means of raising

silkworms, but also the manners of reeling the silk and of employing it to make garments. Silk was profitable trade commodity in China. The Chinese kept the secret of the beautiful and value-added material that they were producing, from the rest of the world for more than 30 centuries. Traders from ancient Persia (now, Iran) used to bring richly coloured and fine textured silks from Chinese merchants through hazardous routes interspersed with dangerous mountainous terrains, difficult passes, dry deserts and thick forests. Commodities like amber, glass, spices and tea were also traded along with silk which indeed rapidly became one of the principal elements of the Chinese economy and hence, the trade route got the name “Silk Route”.

After 1200 B.C. Chinese immigrants who had settled in Korea helped in the emergence of silk industry in Korea. During the third century B.C. Semiramus, a general of the army of Empress Singh-Kongo, invaded and conquered Korea. In 550 A.D. silk moth eggs and mulberry seeds were smuggled from China by two Nestorian monks, sent by Emperor, Justinian-1 and silk production began in Byzantium. The technique of sericulture spread throughout the Mediterranean countries during the 7th century A.D. and then to Africa, Spain and Sicily. Later, it was introduced into Europe and Japan as well. During later part of the 19th century, modern machinery, improved techniques and intensive research helped the growth of sericulture industry in Japan. The industrial and commercial uses of silk contributed to the silkworm promotion all over the world especially in developing nations. This opens ways for integrating agricultural practices with silk production as with animal husbandry, dairying, fisheries and horticulture, which will improve the overall productivity of the societies (Sahay *et al.*, 1997; Lamelu, 1998; Hiwar, 2001, Tzenov, 2007 and Kedir Shifa *et al.*, 2014). The silkworms are very important economic insect which contributes substantially to the national economy and Gross Domestic Production (GDP) of many countries like China, India, Thailand etc. (Chen, 2003; Chen and Gu, 2006). In Ethiopia, rearing of eri and mulberry silkworm is practiced sparsely (Metaferia *et al.*, 2007). Geographically, Asia is the main producer of silk in the world and manufactures over 95 % of the total global output. At present, China is the major producer of silk followed by India. Other countries like Korea, Italy, Soviet Union, France, Brazil Japan also contribute to silk production in the world.

Table 1.1: Global Silk production (In Metric Tonnes) from 2010-11 to 2015-16

Country	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	% Share
China	115000	104000	126000	130000	146000	170000	84.12
India	21005	23060	23679	26480	28708	28523	14.11
Uzbekistan	940	940	940	980	1100	1200	0.59
Thailand	655	655	655	680	692	698	0.34
Brazil	770	558	614	550	560	600	0.29
Vietnam	550	500	450	475	420	450	0.22
North Korea	-	300	300	300	320	350	0.17
Iran	75	120	123	123	110	120	0.05
Bangladesh	40	38	42.50	43	44.5	44	0.02
Japan	54	42	30	30	30	30	0.01
Turkey	18	22	22	25	32	30	0.01
Indonesia	20	20	20	16	10	8	0.003
Bulgaria	9.4	6	8.5	8.5	8	8	0.003
Madagascar	16	16	18	18	15	5	0.002
Tunisia	0.12	3	3.95	4	4	3	0.001
Philippines	1	1	0.89	1	1.1	1.2	-
South Korea	3	3	1.5	1.6	1.2	1	-
Egypt	0.3	0.7	0.7	0.7	0.82	0.83	-
Colombia	0.6	0.6	0.6	0.6	0.5	0.5	-
Syria	0.6	0.5	0.5	0.7	0.5	0.3	-
Total	139100.02	129661.80	152845.64	159737.10	178057.62	202072.83	100.00

Introduction of Silk Industry in India

A story is that a Chinese princess married an Indian prince. She carried silkworm eggs/ mulberry cocoons in her elaborate head dress. She disclosed the secret of raising silkworms thus, silk production spread in India. According to Western historians, mulberry-tree cultivation spread to India through Tibet during 140 BC and cultivation of mulberry trees, rearing of silkworms began in the areas flanking the Brahmaputra and Ganges rivers. According to some Indian scholars silkworms (*Bombyx mori*) were first domesticated in the foothills of the Himalayas. Evidences in ancient Sanskrit literature reveal that certain kind of wild silks were cultivated in India since time immemorial. When British came to India, the flourishing silk trade was exploited and they developed silk centres in many parts of the country. The Company exported large quantities of silk produced in West Bengal to England. The Company's monopoly was abolished in 1836 and the entire trade turned over to private enterprise.

Slowly, due to improper organized system, the silk industry in West Bengal declined. By the time other silk producing states in the country viz., Jammu & Kashmir, Mysore have developed the industry. According to reports available, sericulture industry flourished in India as an agro-industry till 1857, with an annual production of two million pounds of silk fibre. The industry survived the attack of the Pebrine disease during the period from 1857 to 1895. However, after 1928, the sericulture industry showed a decline in its production owing to the fierce competition from advanced sericulture countries, such as Japan, China and European countries. After Independence in India, the industry again started flourishing as an agro-industry, giving employment to rural population in the Country (Anitha, 2011).

Sericulture in India

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 being used as a wear in some form or the other. Silk is the undisputed queen of textiles over the centuries. Silk provides much needed work in several developing and labour rich countries. Sericulture is one of the most labour intensive sectors of the Indian economy combining both agriculture and industry, which provides means of livelihood to a large section of the population i.e. crop cultivator, co-operative rearer, silkworm seed producer, farmer-cum-rearer, reeler, twister, weaver, hand spinners of silk waste, trade etc. It is the only one cash crop in agriculture sector that gives returns within 30 days. The silk industry has a distinctive position in India, and plays a significant role in textile industry and export. This industry provides employment nearly to 35 million people in our country. Out of which, 60% of the people are women respondents. Thus, in contrast to any other agro-based profession the role of women in sericulture industry is dominating which will be helpful for improving the status of women in family enterprises. In the light of women welfare through sericulture industry, the Central Silk Board, a statutory organization, under the Ministry of Textiles, Government of India has established a special component of assistance to women and NGO's in the National Sericulture Project.

Sericulture is cultivated in Karnataka, Bengal, Tamil Nadu, Telangana, Andhra Pradesh, Jammu & Kashmir, Gujarat, Kerala, Maharashtra, Uttar Pradesh, Rajasthan, Bihar, Orissa etc. Though India is the second largest silk producer in the World after China, it accounts for just 5% of the global silk market, since the bulk of Indian silk thread and silk cloth are

consumed domestically. The Central Silk Board, Ministry of Textiles, Govt. of India has been acting as a facilitator for planning, development and monitoring of sericulture industry between the States and Central Govt. The silk production, which is 16,500 MT during 2004-05, has increased to 28,523 MT in 2015-16, contributes to 14% of the total world raw silk production (Fig. 1.2). The state wise raw silk production during the 12th plan period is shown in the table 1.2.

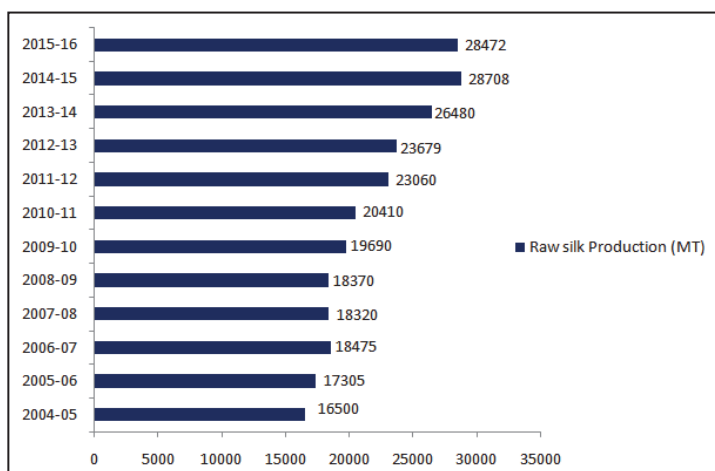


Fig. 1.2 Raw silk production in India (MT)

Table 1.2: State wise raw silk production during the XII Plan period (2012-13 to 2015-16)

S.No	State	Raw silk production (MTs)			
		2012-13	2013-14	2014-15	2015-16 (P)
1	Karnataka	8219	8574	9645	9823
2	Andhra Pradesh	6550	6912	6485	5086
3	Telangana	--	--	100	116
4	Tamil Nadu	1185	1120	1602	1898
5	Kerala	6	4	7	9
6	Maharashtra	97	122	222	274
7	Uttar Pradesh	157	188	236	249
8	Madhya Pradesh	190	195	177	214
9	Chhattisgarh	391	391	200	261
10	West Bengal	2070	2079	2500	2391
11	Bihar	22	52	53	67
12	Jharkhand	1090	2003	1946	2284

Table 1.2 Contd...

S.No	State	Raw silk production (MTs)			
		2012-13	2013-14	2014-15	2015-16 (P)
13	Orissa	104	53	98	117
14	Jammu & Kashmir	145	136	147	127
15	Himachal Pradesh	23	25	30	32
16	Uttarakhand	17	22	29	30
17	Haryana	0.13	0.13	0.3	0.6
18	Punjab	5	4	4	0.8
19	Assam & Bodoland	2068	2766	3222	3325
20	Arunachal Pradesh	22	15	28	37
21	Manipur	418	487	369	522
22	Meghalaya	517	644	655	857
23	Mizoram	40	44	50	64
24	Nagaland	324	606	619	631
25	Sikkim	3	0.20	8	6
26	Tripura	15	40	36	52
	Total	23679	26480	28467	28472

P=Provisional (Source: Central Silk Board, Bangalore)

Export potential of India

Indian silk industry has registered an impressive growth, both horizontally and vertically over the last six decades because of the favourable climate (Virk *et al.*, 2009). Plans and schemes implemented by central and state agencies and relentless efforts of thousands of dedicated persons in the fields of research and extension have helped in this context. The sericulture industry has witnessed a quantum jump in raw silk productivity. As a result, the export potential of India, which is 1422.85 crores in 1997-98, has reached to 4351.23 crores during 2015-16. The Indian silk goods are being exported to the traditional major markets like USA, European countries and small markets of Asia region. For instance, the age old univoltine hybrids have been replaced by bivoltine and multivoltine hybrids. The new technology besides doubling yields has also led to qualitative improvements in cocoon production with considerably reduced renditta and has also helped to break the climate barrier. The average yield of 25 kgs of cocoons/100 dfls in the recent past has increased and currently the average yields are in the range of 60-65 kgs/100 dfls.

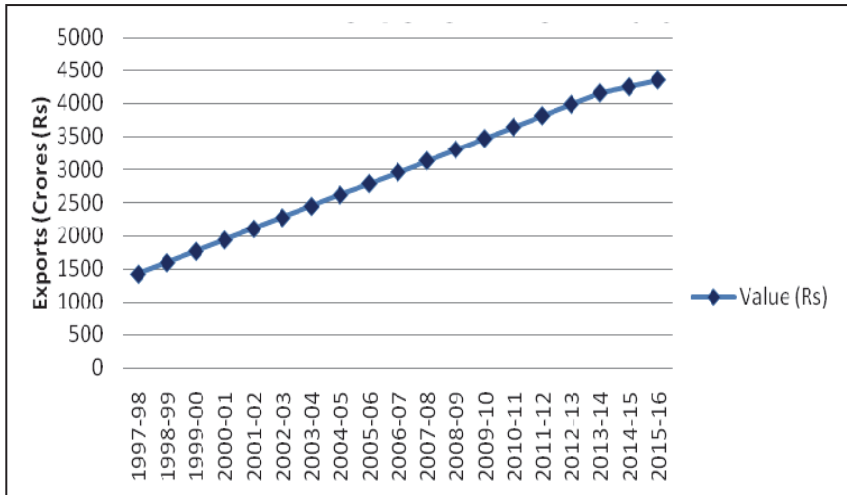


Fig. 1.3 Export of silk from India

Trends in Indian Sericulture in recent years

As we have already seen, in the global scenario, India is the world leader in tropical sericulture and stands second in raw silk production in the world next to China. It has a strong tradition and culture bound domestic market of silk. India produces 20,434 MT of mulberry raw silk along with 8,038 MT of non-mulberry silk (2015-16). Total annual consumption of silk in the country is around 29,300 MT. The additional requirement of silk is imported mainly from China. Therefore, there is scope for production of additional quantity of silk in the country to meet the domestic demand. Among non-mulberry silk, eri silk production is increasing very fast.

Position of Ericulture in silk industry

Ericulture plays significant role in rural livelihood security especially among marginalized and weaker section of the society covering more than 0.18 million families of the country (Ahmed *et al.*, 2015) with an annual production of 4236 metric tonnes. It is a viable agro-based industry, which was first introduced into India about 400 years back. Since then the industry is flourishing as an agro-based industry. Compared with the other non-mulberry silkworms, eri silkworm has a very rich harvest. Among the commercially exploited non-mulberry silkworms, the eri silkworm, *Samia cynthia ricini* (Boisduval) is the only species domesticated completely and adopted to indoor rearing all through the year (Reddy *et al.*, 2000 and

Debaraj *et al.*, 2002). Apart from the benefits of indoor rearing, silkworm itself is extremely hardy and less susceptible to diseases. Eri silk is commonly considered as poor man's silk and its production in India is limited to backyard venture. However, it offers tremendous scope and opportunities for developing the same into an industry with immense potentialities for self-employment and can play a vital role in poverty alleviation, besides generating additional income to the farmers (Siddiqui *et al.*, 1993). The silk produced by the eri silkworm is considered economically the third most important silk in the world after mulberry silk and Chinese tasar.

The word 'Eri' is derived from the Sanskrit term "Erranda", which refers to the castor plant, *Ricinus communis* Linnaeus (Euphorbiaceae), which is the primary host plant of eri silkworm (Patil and Savanurmah, 1994 and Saratchandra, 2003). Eri silk is also known as endi or errandi in India. Ericulture involves rearing of eri silkworm and production of eri silk. Eri silk is popular in some Indian states because of its qualities like texture, lustre, tensile qualities, comfort, adaptability to all climatic conditions, royal look, natural shine, soft, inherent affinities for dyes and vibrant colours with high absorbance and light weight (Ganga and Sulochana Chetty, 1995; Anonymous 1984, 1994, 2004). Further, the castor can be grown on semi-arable and degraded soil. It can also be grown on waste lands and in rain fed conditions. Castor plant does not attract either cattle or wild animals. This makes cultivation of castor more suitable for tribal areas, adjacent to the forests.

Ericulture is prevalent mainly amongst the tribal women in hill districts of North Eastern region. Apart from North-Eastern region ericulture is also practiced in the States of West Bengal, Bihar, Orissa, Jharkhand, Andhra Pradesh, and Telangana. Recently its culture has been spread to Uttarakhand, Chhattisgarh, Maharashtra, Gujarat, UP etc. Ericulture though relatively a less remunerative occupation but it has its own advantages. Just like castor plant eri silkworm is also considered as hardier, and it is highly nutritious. It does not make annoying sound or odours. It also does not need water to drink and has less mortality rate than other silkworms. Eri silkworms require comparatively minimum care as they are easy to handle. With feeding on the castor leaves, it is possible to obtain 75-85% effective yield. In India ericulture is essentially village-based industry providing employment to a sizable activity falling under the cottage and small scale sector. The cocoon of eri silkworm cannot be

reeled but are being spun into thread like cotton and the weaving can be done on hand looms under cottage industry. It particularly suits rural based farmers, entrepreneurs and artisans, as it requires low investment but have potential for relative higher return. It provides income and employment to the rural poor specially farmers with small land holding and marginalized weaker section of the society. Several socio-economic studies have affirmed that the benefit-cost ratio in ericulture is higher among comparable agricultural crops.

Origin and History of Eri silkworm with Special Reference to Indian Conditions

Eri silkworm is biologically named as *Ailanthus* silk moth. This silkworm is known as a caterpillar and is prominently found in the South Asian regions especially in China and Japan. These silk moths are predominantly found over the wild trees and shrubs of *Shorea robusta* and *Terminalia*. Eri silk being the most textured silk needs a huge amount of preservation and care strategy. It has shorter fibers' than the usual cultured silks. The eri silk is so popular because texture of the fabric is coarse, fine and dense. It is very strong, durable and has elasticity, darker, heavier than other silks. It blends well with wool and cotton. Hence it is widely used in home furnishing. It is indeed one of the softest and purest forms of silk which is fancied by almost all the silk lovers and is a staple in every fashionists' wardrobe. The eri silkworms give the silk with a dull yellow or gold like sheen. Eri Silk has become the face of Indian silk. India is the largest producer of eri silk in the world as 96% of eri silk is produced in India of the total eri silk produced in the world (Rajesh Kumar and Gangwar, 2010). Eri silk production in India in the year 2007-08 was 1530 tones this made up 73% of the total vanya silk production of 2075 tonnes. Around forty per cent of eri silk is produced in Nagaland, Meghalaya, Manipur, Bihar, Orissa, Karnataka, Assam, Andhra Pradesh, Telangana, and Jharkhand. The bulk of Eri Silk production gives Assam the name of eri silk state. In North eastern region eri silk production is 1714.0 MT in Assam, 222.0 MT in Manipur, 480 MT in Meghalaya, 280 MT in Nagaland, 16 MT in Arunachal Pradesh, 6.50 MT in Mizoram. Ericulture production in other states is 5.0 MT in Andhra Pradesh, 9.0 MT in west Bengal, 5 MT in Bihar, 3.0 MT in Chhattisgarh, 4.5 MT in Madhya Pradesh, 5.0 MT in Orissa. The details are presented in the Table 1.3.

Table 1.3: State wise Eri raw silk production in India

State	Raw silk in MT			
	2007-08	2008-09	2009-10	2010-11
Andhra Pradesh	5.00	7.00	8.00	5.00
West Bengal	10.00	11.23	13.00	9.00
Assam	837.00	1141.00	1410.00	1714.00
Arunachal Pradesh	11.00	14.00	15.00	16.00
Bihar	2.00	2.00	2.50	5.00
Chhattisgarh	2.00	1.50	2.00	3.00
Jharkhand	1.30	0.10	0.50	0.00
Madhya Pradesh	6.50	4.00	4.00	4.50
Manipur	213.00	240.00	280.00	222.00
Mizoram	3.00	6.00	6.00	6.50
Meghalaya	303.00	435.00	450.00	480.00
Nagaland	124.00	160.00	250.00	280.00
Orissa	5.00	8.50	9.00	5.00
Sikkim	0.20	0.50	2.00	1.00
Punjab	0.00	0.00	0.00	0.50
Uttarakhand	1.00	1.40	2.00	0.50
Uttar Pradesh	6.00	5.78	6.00	8.00
Total	1530	2038	2460	2760

(Source: Central Silk Board, Bangalore)

Eri silk is believed to have originated in India and its history dates back to 1600 B.C. in vedic literature. Eri silk was traded from Assam to Northern India as early as 600-650 B.C. during the period of King Bhaskar Burman. The great Ahom king of Sibsagar patronized silk industry in Assam during 1492-1520 A.D. Ericulture is one of the oldest professions adopted by the people of North Eastern region of India for production of eri silk as well as use of eri pupa as food material which is highly nutritive. Ericulture is purely traditional and a leisure time occupation limited to meet sericulture family's clothing and food needs. Sarkar (1980) mentioned that 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 environs of Ghoraghat within the then undivided Bengal and since then, a few British agents recorded

various references about eri silk in their diaries from time to time. Sankardev named it as “Vrindavania Vastra”. During the British rule, Bengal and Myanmar were important consumers of silk fabrics produced in Assam. Indeed, eri silk has been known more to the people of the North-Eastern region of India than others for many centuries. Many communities in Assam, especially the Bodos considered eri silk as a part of their heritage and culture. Yet, the fact remains that the use of eri silk over the centuries is confined to only a few pockets in India, Tibet, Bhutan and Myanmar. For years, it has remained a locally available substitute for wool in North-East India for making winter clothing. Primitive techniques of spinning, crude ways of processing and production of fabric on very basis looms, all lead to eri becoming almost a synonym for chaddar. The popularity of eri pupae as a tasty and nutritious food item also ensured that silk was relegated more as a by-product in ericulture.

The eri silk production of 85,000lb during the early decades of 19th century is increased tremendously to 5,054 MT during 2015-16 in India (Table 1.4). Captain Jenkins and Mr. Michael Atkinson of Jangipur, Murshidabad (1771) remarked that eri silk, though inferior to muga silk, was of incredible durability. Attempts were made to introduce ericulture, on large scale during the turn of the 19th century by the planters in Assam. However, it did not succeed as they found it uneconomical due to high labour cost involved in it. Since then ericulture hardly made any headway as an industry and remained confined to Assam. Ministry of Textiles, Government of India has established a national organization in the year 1949 to look after the overall development of ericulture and silk industry in India. Central Silk Board studied the feasibility of ericulture as an additional income and employment generating opportunity to castor growers of all states in India. The increasing demand for eri silk products outmatches the production and to match this central silk board, of late has planned development of ericulture units in several states like Andhra Pradesh, Bihar, Jharkhand, West Bengal, Orissa, Madhya Pradesh, Chhatisgarh, Uttar Pradesh, Punjab, Tamil Nadu, Pondicherry and Kerala under various schemes of central silk board and Ministry of Rural Development, Government of India. Limited efforts were taken to introduce ericulture in Rajasthan and Gujarat as a subsidiary to castor or cassava cultivation aiming at some additional income. Recently, ericulture is being introduced in Madhya Pradesh, Delhi, Punjab, Karnataka and Maharashtra (Kshama Giridhar *et al.*, 2007).

Table 1.4: Trend of growth in Eri raw silk production in India (1951-52 to 2015-16)

Year	Production of raw silk (MT)	Year	Production of raw silk (MT)
1951-52	100	1984-85	279
1952-53	102	1985-86	352
1953-54	99	1986-87	392
1954-55	104	1987-88	522
1955-56	127	1988-89	565
1956-57	130	1989-90	589
1957-58	143	1990-91	624
1958-59	143	1991-92	704
1959-60	112	1992-93	-
1960-61	110	1993-94	-
1961-62	132	1994-95	-
1962-63	137	1995-96	745
1963-64	194	1996-97	745
1964-65	204	1997-98	814
1965-66	201	1998-99	970
1966-67	208	1999-00	974
1967-68	200	2000-01	1089
1968-69	213	2001-02	1160
1969-70	218	2002-03	1316
1970-71	161	2003-04	1352
1971-72	168	2004-05	1448
1972-73	143	2005-06	1442
1973-74	141	2006-07	1485
1974-75	115	2007-08	1530
1975-76	123	2008-09	2038
1976-77	106	2009-10	2460
1977-78	56	2010-11	2645
1978-79	120	2011-12	3072
1979-80	183	2012-13	3116
1980-81	135	2013-14	4237
1981-82	147	2014-15	4726
1982-83	213	2015-16	5054
1983-84	270		

The recent advances in ericulture technologies and their dissemination have increased the quality and productivity levels in all stages of production including host plant cultivation with high yielding varieties. Added to this, the prospects of intercropping of eri host plants with grams, pulses, oilseeds and vegetables increase the return from unit area. Castor, primary host of eri silkworm can be exploited both for seed and cocoon production. The technologies developed by research and development institutes of CSB have been popularized among the farmers to maximize yield and returns which in turn resulted in bringing out vertical growth of the industry. The constant efforts made by CSB and state sericulture department have resulted in the overall increase in the silk production and quality. Dissemination of advanced technologies supplemented by the quality seed supply, extension programmes, training, technical assistance etc. have resulted in improvement of production, productivity and quality of eri cocoons in the field. There has been considerable impact on increase in uptake of silkworm seed and enhancement of raw silk production per unit area. There has been up gradation of infrastructure of farmers, improvement of skills and knowledge of the farmers that paved way for strict discipline in sericulture practices. This has been made possible through technology demonstration programmes, adoption of new technologies in host plant cultivation, silkworm rearing and disease management. Besides this other extension activities *viz.*, kisan melas/ field days/ farmers days/ exhibitions/ training programmes/ audio visual/ vichar gosthi/ work shop/ film shows are undertaken to reach more number of beneficiaries and keep abreast of the latest methodologies among the farmers. The growth and development of ericulture depends on the rapidity with which the new technologies and practices are developed. Indian scientists have significantly contributed to the development of technologies for silkworm rearing practices. Ericulture provides livelihood to 1.83 lakh farm families. The increasing production is due to the horizontal expansion of plantation and not due to the increase in productivity. Development of improved breeds along with adoption of available improved technologies is the important tools for enhancement of productivity and employment generation among rural poor.

Eri silkworm being multivoltine, about 5-6 crops can be reared in a year and the worms can be fed on various food plants by virtue of its polyphagous nature. Although ericulture has been closely associated with the tradition and culture of North East, the overall productivity of the region is poor mainly due to lack of systematic plantation, small scale rearing and plasticising of the culture in conventional manner. The whole gamut of ericulture activities right from plantation, rearing, seed

production to post cocoon are being carried out in unorganized manner there by affecting the overall production and productivity of the sector. Eri silk shares about 73% of the total vanya or non-mulberry raw silk produced in the country and offers vast scope for its development and expansion in traditional as well as non-traditional states by virtue of its thermal property and blending abilities with other natural and synthetic fibres. Though North East India contributes more than 96% of the total raw silk produced in the country, it has been steadily expanding in the states of Orissa, West Bengal, Andhra Pradesh, Madhya Pradesh, Uttar Pradesh, and Chhattisgarh also due to the existing potential for its development. Ericulture can be easily practiced with less investment and the crops are more assured as compared to other vanya silks such as muga and tasar due to their outdoor nature of rearing coupled with severe attack by pests and predators. Evaluation on rearing and grainage performance of eri silkworm in non-traditional states revealed encouraging results and adoption of improved rearing package has increased the quality and productivity of cocoons substantially. By products in the form of protein rich eri pupae, silkworm litters and excreta also form integral and important economic components of the culture. The introduction of new and improved spinning devices has also enabled to produce finer yarn and paved the way to multiplicity of design and value added products with ample marketing avenues. Exploitation of eri pupa as protein rich food enhances the income level of rural poor from Rs. 2500 to Rs. 14,500, out of 100 disease free layings (Ahmed and Rajan, 2011).

In order to cater research and development needs of eri silk industry, studies on various aspects pertaining to improvement of host plants, effect of host plants on rearing performance and economic traits of eri silkworm, rearing methods, inter-changeability of food plants, crop improvement including breeding studies of eri silk moths were initiated by the erstwhile Central Muga & Eri Research Station (CMERS), Titabar, Central Eri Research & Training Institute (CER&TI), Mendipathar, Meghalaya. Of late Central Silk Board established Central Muga & Eri Research & Training Institute (CMER&TI), Lahdoigarh, Jorhat to carry out studies on various aspects of host plants and silkworm crop improvement. The institute was mandated to serve as the apex research institute for eri development *viz.*, to collect and conserve eri germplasm host plants and eco races of silkworms, to evolve suitable package of practices for eri silkworm rearing for its geographical area and to improve various seed technological aspects connected with ericulture.

Eri silkworm rearing is being practiced traditionally in rural areas of India. It contributes to approximately 14% of the total raw silk production in India. Of late eri silk production is increasing steadily and there was remarkable growth during the X to XII plan period. Eri silk industry gained a new dimension due to systematic and scientific interventions, introduction of high yielding plantation, replacement of traditional spinning devices with improved ones and development of diversified products having potential markets in India and abroad. Farmers adopted new technologies and modern practices as they yield better returns. The main contribution to increase the production is attributed to the production of eri silk in main land states of the country. During XII plan period as against the target of 4.10 lakh dfl rearing, we have achieved 5.69 lakh dfl rearings.

While rearing mulberry silkworm *Bombyx mori*, exclusively for silk, it is always essential to kill the pupae to extract the silk from the cocoons, whereas the rearing of eri silkworm (*Samia cynthia ricini*) is just opposite because its cocoons are used for processing spun silk wherefrom moths have already emerged. Therefore, culturing eri silkworm has been favoured by the people whose religious practices forbid the taking of silkworm life such as Buddhists in Sri Lanka (Suryanarayana and Choaba Singh, 2003; Choaba Singh and Suryanarayana, 2003). Hence the eri silk can be called “Ahimsa silk”.

Significance of Eri silk and why it is called as ‘Ahimsa silk’ or fabric of peace

Eri silk is known as poor person’s silk (As it is not so enormously priced compared to other silk types and its cost of production is very less than other silks) (Sarkar, 1988). It is also known as non-violence silk (There is no need to kill the pupae inside the cocoon as in the case of other silk because eri silk is spun into thread like cotton) and cocoon of eri silkworm is open mouthed at one end. Texture of eri fabric is coarse, fine and dense. It is very strong and durable and has elasticity, darker, heavier than other silk. It blends well with wool and cotton. The thermal property (warm in winter and cool in summers) of eri silk makes it a suitable fabric for shawls, jackets and blankets. Eri silk is valued for the strong, supple fabric it produces. The fibre is woven into chaddars or wraps and used as a substitute for woollens. Baby dresses are also made from eri silk because of its soft texture and moisture absorbent qualities (Vaidya and Yadav, 2014). However, the British called it as “Palma Christi” or “Divine silk” as it is obtained without killing the insect. Eri silk is one of the purest forms of silk that is a true and genuine product of the *Samia cynthia ricini*

worm. Eri silk is called the father of all forms of cultured and textured silks. It is the only domesticated silk produced in India, as the process doesn't involve any killing of the silk worm, also naming Eri silk as 'Ahimsa silk' or fabric of peace. Eri silkworms are relatively cheap and easy to maintain and their cultivation forms a small scale, cottage industry in Assam and Meghalaya that produce around 95% of the world's Eri silk. Here are some reasons why Eri silk earned its moniker 'ahimsa silk' and why it is one of the most sustainable fabrics in the world.

1. It is a free gift from *Samia c. ricini*

The Eri Silk moth spins open-ended cocoons as it transitions into beautiful moths. Because these cocoons are open-ended, allowing the moth to leave and enter the cocoon through the opening. It also means that the worm does not need to be killed in order to obtain the silk threads and that it can complete the process of metamorphosing into a moth, hatch and breed. Unlike other silks, the moth is allowed to leave the cocoon before the Eri silk is extracted earning the fabric many names like ahimsa, non-violence, peace or vegan silk. These are yellowish-white or golden in colour and have an almost divine sheen to them.

2. Its cultivation is sustainable

The *Samia cynthia ricini* worms feed off castor leaves (*era* in Assamese). Unlike mulberry silkworm rearing which is known to be land intensive, cultivation of castor is easier, possible in drought-prone regions on small plots of land alongside other crops, thus providing small and marginal farmers an alternative economic activity and income source.

3. It has a small water footprint and produces zero waste

Most plant based natural fibres like cotton and linen require a lot of water during the growing stage and need very good irrigation infrastructure. Since the eri silk fibre is technically a waste in itself (after the worm becomes a moth), no additional resources are spent by nature in its making, apart from helping a life transition into another version of itself. Hundred % of the cocoon can be used to make yarns and, in turn, fabrics. It is in fact nature's very way of teaching us up cycling.

4. Its production empowers small and marginal tribal farmers

Almost all eri silk is produced in North Eastern part of our country. The communities rearing the eri silkworms, mostly indigenous tribal communities, are incentivized by Eri culture as they get good profits for

this valuable material. The Central Silk Board runs many clusters in the region to ensure that the activity serves as a sustainable alternate source of income for small and marginal farmers in the region.

Summary and Conclusions

- Silk is a natural protein fibre secreted by arthropods especially lepidopteran silkworms.
- The word sericulture has been derived from the Greek word “Sericos” means silk and the English word culture means ‘rearing’.
- Silk is the most elegant textile in the world with unparalleled grandeur, natural sheen, and inherent affinity for dyes with high absorbance, light weight, soft touch, smooth, strong and high durable than any natural or artificial fibre. Hence silk is known as “The Queen of Textiles”.
- The insects that produce silk of economic value are termed as sericigenous insects. The natural silk producing insects are broadly classified as mulberry and wild or non-mulberry silkworms.
- The mulberry silk moths are represented by domesticated *Bombyx mori* Linnaeus. Non-mulberry sericulture is universally known as forest or vanya or wild sericulture. The term ‘Vanya’ is of Sanskrit origin, meaning untamed, wild or forest based.
- Sericulture includes raising of host plants, rearing of silkworm, production of silk yarn. Sericulture requires low investment, gives quick return, provides employment opportunities and earns foreign exchange.
- India is a home to a vast variety of silk secreting fauna which also includes an amazing diversity of silk moths.
- India is the producer of all the five commercially traded varieties of natural silks namely, Mulberry, Tropical Tasar, Oak Tasar, Eri and Muga.
- Tasar silk is copperish in colour, coarse in nature and is secreted by the Tropical Tasar silkworm, *Antheraea mylitta* which thrives on plants like Asan and Arjun (*Terminalia* sp.).
- Oak Tasar is a finer variety of Tasar produced by the temperate tasar silkworm, *Antheraea proylei* which feeds on natural oak plants (*Quercus* sp.) and is found in abundance in the sub-Himalayan belt.
- Eri silk is a silk spun from open-ended cocoons and secreted by the domesticated silkworm, *Samia cynthia ricini* Boisduval that feeds mainly on castor (*Ricinus communis* Linn) leaves.

- Muga silk is golden yellow in colour and is preferred mainly in the state of Assam during festivities. Muga silk is secreted by *Antheraea assama* that feeds on aromatic leaves of naturally growing Som (*Persia bombycina*) and Soalu (*Litsea polyantha*) plants.
- Silk was first discovered during 2640 BC by the Chinese Empress Xi Ling Shi, the 14 year old bride of the China's 3rd Emperor, Huang Ti, also called "Yellow Emperor".
- The Chinese kept the secret of the beautiful and value added material from the rest of the world that they were producing, for more than 30 centuries.
- After 1200 B.C. Chinese immigrants who had settled in Korea helped in the emergence of silk industry in Korea. From there onwards the silk industry spread to Africa, Spain and Sicily. Later, it was introduced into Europe and Japan as well by 7th century AD.
- The Chinese princess married to Indian prince disclosed the secret of raising silkworms thus, silk production spread in India.
- According to Western historians, mulberry-tree cultivation spread to India through Tibet during 140 BC.
- According to some Indian scholars silkworms (*Bombyx mori*) were first domesticated in the foothills of the Himalayas.
- The flourishing Indian silk trade was exploited by the British people and they exported large quantities of silk produced in West Bengal to England.
- After Independence in India, the industry again started flourishing as an agro-industry, giving employment to 35 million people in the country.
- The silk production, which is 16,500 MT during 2004-05, has increased to 28,523 MT in 2015-16, contributes to 14% of the total world raw silk production.
- Indian silk industry has registered an impressive growth, both horizontally and vertically over the last six decades because of the favourable climate.
- As a result, the export potential of India, which is 1422.85 crores in 1997-98, has reached to 4351.23 crores during 2015-16.
- The average yield of 25 kgs of cocoons/100 dfls in the recent past has increased to 60-65 kgs/100 dfls because of the improved practices in the field of sericulture.

- Among the commercially exploited non-mulberry silkworms, the eri silkworm, *Samia cynthia ricini* (Boisduval) is the only species domesticated completely and adopted to indoor rearing all through the year.
- Eri silk is commonly considered as poor man's silk and its production in India is limited to backyard venture. However, it offers tremendous scope and opportunities for developing the same into an industry with immense potentialities for self-employment and can play a vital role in poverty alleviation, besides generating additional income to the farmers.
- The word 'Eri' is derived from the Sanskrit term "Erranda", which refers to the castor plant, the primary host of eri silkworm.
- Eri culture though relatively a less remunerative occupation but it has its own advantages. It is highly nutritious, does not make annoying sound or odours. It also does not need water to drink and has less mortality rate than other silkworms.
- The cocoon of eri silkworm cannot be reeled but are being spun into thread like cotton and the weaving can be done on hand looms under cottage industry.
- The eri silk is so popular because texture of the fabric is coarse, fine and dense. It is very strong, durable and has elasticity, darker, heavier than other silks. It blends well with wool and cotton. Hence it is widely used in home furnishing.
- Eri Silk has become the face of Indian silk. India is the largest producer of eri silk in the world as 96% of eri silk is produced in India.
- Eri culture is one of the oldest professions adopted by the people of North Eastern region of India for production of eri silk as well as use of eri pupa as food material which is highly nutritive.
- Eri culture is purely traditional and a leisure time occupation limited to meet sericulture family's clothing and food need.
- The eri silk production of 85,000lb during the early decades of 19th century is increased tremendously to 5,054 MT during 2015-16 in India.
- Eri silk industry gained a new dimension due to systematic and scientific interventions, introduction of high yielding plantation, replacement of traditional spinning devices with improved ones and development of diversified products having potential markets in India and abroad.

- During XII plan period as against the target of 4.10 lakh dfl rearing, we have achieved 5.69 lakh dfl rearings.
- While rearing mulberry silkworm, exclusively for silk, it is always essential to kill the pupae to extract the silk from the cocoons, whereas the rearing of eri silkworm is just opposite because its cocoons are used for processing spun silk wherefrom moths have already emerged.
- Hence eri silk is also known as non-violence silk or ahimsa silk or fabric of peace or vegan silk.

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