

The Current Status of Sericulture in Ethiopia: A Review

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Abstract: This review intended to focus on current status of sericulture in Ethiopia. Sericulture is an agro-based industry involving food-plant cultivation to feed the silkworms, silkworm rearing, cocoon reeling to acquire silk thread and weaving to convert the yarn to garments. Silk production in Ethiopia is an agro-based industry and has a strong attraction to the people of Ethiopia starting from ancient period of country's civilization. Until the 1930's, there were no known records of silk being produced in Ethiopia. Silk production from eri silkworm is practiced in different parts of the country especially by poor farmers as an additional income source through efficient use of family labor. The most important benefit of sericulture is that it can be practiced on small to medium sized land holdings in rural areas, either as a subsidiary or main occupation. Ethiopia has huge investment potentials for sericulture investment and government looks to expand the textile industry in different parts of the country; it is poised to grow even more. Currently, in the country some area (regions) are under sericulture investment which have incredible employments potential by, Collection and processing of cocoon; Silk based textile production; Silkworm seed production; and Production of cocoon processing (yarn production) equipment. Amhara, Central Ethiopia Region Oromia, Sidama, South Ethiopia and southwestern Ethiopia were identified as potential areas. Currently, these areas (regions) are at different stages of sericulture (silk) production. Since the sector was new, it was not distributed or adopted equally, hence, in some areas, there was only cocoon production and in other areas, row silk was processed by smallholder farmers. To strengthen and uniformly adapt to the sericulture industry stockholders should be equally aware.

Key words: Current Status • Sericulture

INTRODUCTION

Sericulture is an agro-based industry. It is the process of obtaining the natural silk fiber through silkworm rearing, which can be practiced in varying agro-climatic conditions and is suited to different production systems. The major activities of sericulture comprises of food-plant cultivation to feed the silkworms which spin silk cocoons and reeling the cocoons for unwinding the silk filament for value added benefits such as processing and weaving[1]. Many studies indicated that sericulture industry has enormous advantages for sustainable developments of any country. The industrial and commercial uses of silk contributed to the silkworm promotion all over the world especially in developing nations [2].

Silkworm is one of the most valuable domesticated insects where the growth and development is greatly influenced by weather conditions. Although there are

several commercial species of silkworms, *Bombyx mori* is the most widely used and intensively studied. Success of silkworm breeds largely depends on their adaptability to the environment in which it is intended to be cultured.

Historically, sericulture was introduced for the first time, into China by Hoshomin, the Queen of China. Later, it was introduced to rest of the world. Today, the top five silk producing countries in the world are China, India, Japan, Brazil and Thailand [3]. In Africa, silk has been used for textiles for about thousands of years [4] and sericulture has a history of more than 30 years in East Africa. The potential of the African indigenous silk moth species for wild silk production has been well documented in Nigeria [5] Uganda [6] and Kenya [7] and other central and southern African countries. Currently, International Centre of Insect Physiology and Ecology (ICIPE, Nairobi, Kenya) is playing a central role in sericulture development in Africa including Ethiopia [8].

Silk played an important role in the social and religious life of Ethiopia from the earliest days of the Kingdom of Axum. The silk was imported in large quantities from India, Arabia and China and stored in vast grottos in the central highlands of Ethiopia [9]. However, after long time of history introduction of mulberry silkworm into Ethiopia early in 1930s by Italian and its activities went into recession shortly. Sericulture is new agro business technology for Ethiopia that had been targeted as a tool for poverty reduction. That is why, in most of the region the sector is at infant stage that requires focusing on both biological and physiological aspects. Since the sector has been untapped and lagged behind, research will be thoroughly conducted and hence fill the gaps existed.

Even though, realized the suitability of climatic condition for rearing of silk worm and availability of necessary resource in Ethiopia for mulberry and castor plant production and allowed to spread all over the country and mulberry plant is seen growing in altitude of 1500m to 2, 500m in the country. Early 1970's some Ethiopian scientists were getting interested in mulberry silkworm and they conducted some research works until 1980s. Since then, very few research works have been made due to low priority given by Ethiopian Government [10].

The viability of sericulture sectors depends upon several factors such as the impact of the environmental factors like biotic and abiotic factors is of vital importance. Among the abiotic factors, temperature due to poikilothermic insect and biotic factors like management for rearing ability and silk quality plays a major role on growth and productivity of silkworm [11]. As a result, failure of timely introduction of adequate technologies, a poor capacity building, lack of integrated and effective extension services and lack of parent stock of silkworm eggs contributed a lot for the less impact around stakeholders. Also, in case no parent stock of silkworm eggs is domestically produced and as far as it relies on external supply sources, not only a high-quality silkworm egg is hard to be ensured but also it is difficult to meet consumer's requirement in terms of timely delivery. Thus the goal of this review was to know present stage of sericulture in Ethiopia.

Sericulture in East Africa: Although cotton, coffee and tea have been exported traditionally, agriculture in the countries of East Africa mainly consists of subsistence farming. However horticulture products, such as flowers and ornamental plants and vegetables, have rapidly

increased in recent years as non-traditional export products. Expectations are also high for sericulture as a new non-traditional export product which can contribute to the improvement in the income of farmers, including small-scale farmers and farmers in frontier areas. The sericulture industry entails everything from cocoon and raw silk production and business transactions by various processes, such as breeding and maintenance of silkworm races, mulberry breeding and cultivation, silkworm egg production, silkworm rearing and mounting, cocoon drying, silk reeling, raw silk testing, to the production of silk products by manufacturing and weaving, as well as the silk thread and silk industry.

As defined by the African Development Bank, 11 countries constitute East Africa- Comoros, Djibouti, Eritrea, Federal Democratic Republic of Ethiopia, Republic of Kenya, Republic of Madagascar, Mauritius, Republic of Seychelles, Somalia Democratic Republic, United Republic of Tanzania and Republic of Uganda. Among these countries, production of cocoons and silk thread from silkworms occurs in Ethiopia, Kenya, Madagascar and Uganda and production of cocoons and silk using wild a silk insect (wild silkworms) is also performed.

However, their operations are in the extremely immature phase and cocoons and silk as materials for traditional handcrafts are poorly supplied to the local market. Although a small amount of wild cocoons or silk thread was exported from Uganda to India and Japan in the past, exports to the overseas market have ceased Wild silkworms have been traditionally used for many years. However, productivity and product quality is low and the market is limited, so such production has not grown even as local industry. Ethiopia is the only country to export wild silk products to the overseas market [9].

Sericulture in Ethiopia: Agricultural production in Ethiopia is a subsistence nature of activities. Poverty and unemployment are the main challenges to the country. Poverty alleviation and employment creation, therefore, requires additional on farm and off farm income generation activities like rearing of silkworms [9]. Silk has played an important role in social and religious life of Ethiopia back earliest days of the Kingdom of Axum. However, the silk yarns and silkworms (both Eric & Mulberry) used for silk productions were imported in large quantities from India, Arabia and China and stored in huge caverns in the central highlands of Ethiopia [10].

Silk production in Ethiopia is an agro-based industry and silk has strong attraction to the people of Ethiopia starting from ancient period of country's civilization.

Until 1930's, there were no known records of silk being produced in Ethiopia. Later on Belli [12] realized that Ethiopia has suitable climatic condition and necessary resource available for the rearing of silk worm. Again, in early 2000's Ethiopian Institute of Agricultural Research and Ministry of Science and Technology confirmed the immense potential of the country for silk production [10]. Then, the SNNPR Bureau of Agriculture and Rural Development become the first to promote sericulture technology to the rural poor farmers among all the regions. Subsequently related sectors and interested individuals in and around urban areas of Awassa, Adama, Addis Ababa, Debrezeit and Bahir Dar were involved in the development of silk production program [13].

Importance of Sericulture in Ethiopia: Sericulture industry is ideally suited to all developing countries in the tropical belt where poverty, unemployment and under employment continue to be a serious problem. For any country silk production has important roles in economic development, poverty reduction & income generation, providing employment for youth, environmental conservation, adoption of technologies, offer medicinal, ecological, social and religious value, contribute to livelihood, rural development & women empowerment, provides biomolecules and easily integrated with other agricultural activities.

Creation of Job and Income Generation: Sericulture can play a very crucial role by providing the job opportunities & generate income [14]. Female labors engaged in sericulture activities are more as compared to male labors. The business holds a greater hope at village level for Ethiopian citizen migrating to cities searching for jobs. Silk production from eri silkworm is practiced in different parts of the country especially by poor farmers as an additional income source through efficient use of family labor [15, 16]. Sericulture can be an excellent job opportunity and income generating activities for rural women, jobless youth and university graduates of Ethiopia [16]. It provides income & employment to the rural poor especially farmers with small land-holding & marginalized & weaker sections of the society. In Ethiopia, sericulture or silkworm rearing is a new agro-business technology that had been targeted as a tool for employment creation [17]. Because, the country is the second most populated country in Africa continent and as result there is migration of citizens to cities, large numbers of unemployment and poverty in the country. Thus, silk production from eri silkworm is practiced in different parts

of the country especially by poor farmers as an additional income source through efficient use of family labor [10]. Further, silk production can be regarded as best tools for solving the problem of unemployment and underemployment of many youth in country.

Sericulture for Rural Development & Women Empowerment:

Sericulture is advantageous for women, to control their own earnings, helps them to learn, to deal with people outside, to develop their own personality, they can do it their home, etc. Silk production in particular, provides women with economic opportunities. Female labors engaged in sericulture activities are more as compared to male labors. The most important benefit of sericulture is that it can be practiced on small to medium sized land holdings in rural areas, either as a subsidiary or main occupation. In this regard, sericulture can be one of the income generating activities for rural communities [18].

The business holds a greater hope of hope at village level for Ethiopian citizen migrating to cities searching for jobs [2]. Sericulture is very beneficial to young people, particularly women, in terms of providing a variety of employment options and viable income without affecting their regular agricultural activities or the existing sociocultural equilibrium [19].

Integrated with Other Farming Practices, Provides Ecological and Environmental Values:

Silk production can be integrated with other farming activities like fish farming (aquaculture), beekeeping (apiculture), vegetable production and poultry farming. For instances; after reeling, silkworm pupae from cut cocoons are found to be useful to feed poultry and fish and the waste of silkworm larvae will be used as farmyard manure. In addition to feeding silkworms, mulberry leaves can serve as animal feed and provide fruit. Farmer also integrate silkworm production with poultry production in that, they feed dead and over produced worms (rich in protein) for poultry. Mulberry leaf is also found along road shoulders and fences as well as intercropped with other crops [20].

From ecological points of view, the plantations used as a feed of the silkworms are useful in natural resources conservation [21]. Silk farming is an eco-friendly, agro-based venture with a great potential for environmental amelioration. Apart from supporting livelihoods and providing employment, sericulture waste (mulberry waste and silkworm excreta) improves soil health through nutrient recycling and reduces the use of chemical fertilizers. Nutrient recycling along with changes in agronomic practices and water saving measures proved to

Table 1: Potential area of sericulture production in Ethiopia

Regions	Districts	Types of silk worm	Current status	Source
Amhara	Bahi Dar	Eri silk worm	unknown	[18, 24]
	D/brihan	Eri silk worm	Active	
Oromia	A/malkassa	Eri and mulbary	Under production	[24]
	Bishoftu	Eri silk worm	Active	
	Dodota	Eri silk worm	Active	
	Jimma	Both	Active	
	Nekemt	Both	unknown	
	Woliso	Both	Active	
	Adis abeba city	Eri	Under processing	
Sidama	Shebadino	Eri	Under production	[24, 25]
	Tula	Eri	Under production	
	Hawassa	Both	Active	
	Wondo genet	Both	Under production	
Southern Ethiopia	Arba mich	Both	Under production	
	Arba minchi zuria	Eri	Under production	
	Mierab abaya	Eri	Under production	
South western	Tep	Both	Active	
Central Ethiopia	Alage TVET College	mulbary	under production	
Tigray	Ade gret	Both	Unknown	[26]
	hawzen	Both	Unknown	
	wokuro	Both	Unknown	

Active: Represent or shows areas only maintaining silk worm and few cocoon

Under production: Shows both maintaining of silk worm, cocoon production and row silk yarn and supplies to silk industry

be effective in controlling soil degradation and reducing the use of precious water. Silkworm larvae plays an important roles in the ecosystem, example; many birds rely on caterpillars for food, especially for feeding their young. Unique features of the sericulture sector are its rural nature, ecologically and economically sustainable activity for the poor, small and marginal farmers and women in particular [22]

Current Status and Potential Area under Production of Sericulture in the Country: Sericulture or silk production is a growing industry in Ethiopia. In the past decade, several research and development efforts were conducted on silkworms in Ethiopia including mulberry silkworms (*Bombyx mori*) and as a result silk production from mulberry silkworms is practiced in some parts of the country recently [10].

According to Gamble [23], the country has huge investment potentials for sericulture investment and government looks to expand the textile industry into different parts of the country; it is poised to grow even more. While production of cocoons from both mulberry and castor is growing fast, the development of the technology to process the cocoon is currently in progress. The interest of the rural population, which is often under employed, to consider cocoon production as a livelihood alternative is very high because the community well understood the benefit gained from

silkworm rearing or silk production. This indicates that there would be a sustainable high demand for silkworm seed (egg).

Currently, in the country some area (regions) under sericulture investment which have incredible employments potential by, Collection and processing of cocoon; Silk based textile production; Silkworm seed production; and Production of cocoon processing (yarn production) equipment.

According to MARC (Malkassa Agricultural Research Center) some regions of the country under sericulture potential are: Amhara, Central Ethiopia Region Oromia, Sidama, South Ethiopia and south western Ethiopian were identified. Districts of potential region were summarized under Table 1 blow.

Currently these areas (regions) were at different stages of sericulture (silk) production. According to Assemu *et al.* [19] In Amhara region silk production is at infant stage and was started in middle of 2004, to assure food security in rain scarcity areas /district/ of the region. The researchers farther revealed that, sericulture production in the region practiced by elders, women and youth at urban and per-urban areas, Amhara TEVT colleges and NGOs like Jerusalem Children and Community Development Organization (JeCCDO). Sericulture in the region was started mainly by Eri types which were highly dependent on caster plantation as feed source. In addition Debra brhan University also started

maintaining of Eri silk worm and castor seed and starting producing of cocoon in the region. Sericulture marketing in the region had almost the characteristics of monopsony market situation; means there was only one purchaser in the market which makes producers to be price taker. Still, there is no competition in the market which reveals poor performance of cocoon market [27].

In Oromia region there are some zones known in silk production. Wolliso town is located in the southwest Shewa zone, Oromia region, Ethiopia. This town has a large scale silk production or sericulture factory. The farmers living around this town raise silkworms and sell the cocoon to a factory in the town. Dodota district, Arsi zone, Oromia, Ethiopia, is also one of the common areas to raise silkworms and farmers sell the cocoon to factory exist in Wolliso town and others companies in Addis Ababa as a raw products. Silk production in this district is practiced by rural women living in Dodota town. Dodota is one of drought-affected district, hence engaging in silk production work is the best alternative way for women to make income source and support and feed their family members. The Castor Oil plant, or Gulo (local name), is a plant that is drought tolerant, prefers disturbed ground and is prevalent in and around Dodota. The rural women living in this area could produce silk cocoons in their homes then process the cocoons into a final silk product i.e. clothing [28].

In Jimma zone, south west, Ethiopia: there is the growth of mulberry plant in the garden and silkworm rearing experiment in rearing house at Jimma Agricultural Research Center (JARC), Jimma, Oromia, Ethiopia.

In sidama region Huwassa, Shebadino, Wondo genet and other districts were starting sericulture activity. Wondo genet Agricultural research was responsible to the region by maintaining and multiplying of silk worm seed and feed plan for silk worm. The center can maintain more than 4 Eri sub race silk worm and bivoltin and multivoltine of mulberry silk worm on station. Depending on the demands center can multiply and supply to silk producers in the region. Improved variety of castor and mulberry plants for feeding of silk worms also distributed to farmers from the center. In wondo genet district more than 20 womens started rearing of eri silk worm and producing cocoon. In this district they only produce cocoon and sell to processors at Hawassa and arba minch. Tula is one of sub city of hawassa town farmers producing cocoon. Shabadino districts one of the Sidama regional state which sericulture production was widely started and under good condition. In the district some women produce only cocoon and others started processing cocoon to row silk yarn by manual reeling

machine which made by Malkassa agricultural research. Concern market of sericulture product it is better next to Arba mich [24].

In southern Ethiopian people's region Arba Minch town, Arbaminch zuria district and Mirab Abaya district was hot spots for sericulture. Mira Abaya district has a smallholder silkworm rearing enterprise (known as Young Entrepreneurs in Silk and Honey). It is a silkworm farming and honey production youth enterprise. This project was established in 2016, by International Centre of Insect Physiology and Ecology (ICIPE) in collaboration with the Ministry of Agriculture and Mastercard Foundation, which gave chance for many youths to fully engage in the rearing of silkworms using castor seed leaves. Both material input and technical input were supplied by different bodies in the case of sericulture business operation in the study area. According to sericulture producer enterprises, land, house to rear and keep worms from enemies and sun strike, silkworm eggs, rearing kits and technical inputs (knowledge) were required to start silkworm rearing. Land is supplied by local government administration while all other technical and material inputs were supplied by Youth Entrepreneurship in Silk and Honey (YESH) project and Bere sericulture PLC.

Arba Minch is another area of the region which known by producing silk from silk worms, which exists near Arba Minch Airport. This silk farm is the first in Ethiopia. The people with more than 10 years' experience had engaged in the production are smallholders' farmers. This silk producing sector is known as Bere Sericulture Production Private Limited Company (Bere PLC) and it was established in 2009. The company involves an innovation and adoption of sericulture production and processing in Ethiopia and generates income to ensure food security [28]. Sericulture production and silkworm rearing in the case of Bere sericulture PLC was well-organized and relatively owned modern sericulture rearing and processing equipment. The company has been contributing the local communities by creating job opportunity, sharing experiences and providing trainings for farmers and out-growers, distributing and supplying castor oil and mulberry seed, selected silkworm eggs, cocoon and larvae to farmers [16]. Concurrently, it is also introducing sericulture technology (new machines) to the local community by providing the expertise to the community through training, providing new plant cultivator, new silkworm seeds and the overall production scheme. Today, this private limited company has introduced new machines for Boiling, Steaming, drying, Reeling, Re-reeling and Twisting.

In Tigray region, the practice of silk production is highly well known in Eastern part of Tigray, especially in areas such as Hawzen, Adigrati & Wukro [26]. According to the author, both eri and mulberry silkworms were practiced in the areas, however, mulberry silkworm adapted more and produces more kilograms of silk and income per year than eri silkworm. Mulberry and Castor oil plant leaves were commonly used as main food for silkworms in the areas. The author further stated that the areas have high potential for silk production, despite several limiting factors or constraints exist [25, 27; 28].

CONCLUSION AND RECOMMENDATION

Sericulture is an agro-based industry involving food-plant cultivation to feed the silkworms, silkworm rearing, cocoon reeling to acquire silk thread and weaving to convert the yarn to garments.

Ethiopia is the only country to export wild silk products to the overseas market. Ethiopia has necessary resources, favorable environmental and climatic condition for this sector. There are good attempts regarding sericulture activity in some parts of Ethiopia like Amahara, Oromia, Sidama, Southern peoples, South western and Tgray regions. Currently the result obtained from these areas are also implied the existence of huge sericulture potential areas and condition in the country. Currently these areas (regions) were at different stages of sericulture (silk) production. Since the sector was new it was not distributed or adopted equally, hence, in some area there was only cocoon production and in other area row silk was processed by small holder farmers. This is due to lack of capital, lack of necessary facilities and inputs, lack of skill and knowledge, attitude of the farmer, absence of necessary support from government and others, lack of various linkages, etc. On the other hand, even though various challenges exist, currently sericulture plays enormous beneficial roles from individual income generation to country development via job creation, biodiversity conservation and others. Therefore, the sector requires due attention via proper management practices, continuous follow-up and holistic support as needed in order to enhance the quality and production scales for better future on citizens livelihood.

Based on above review conclusion the following recommendation was set:

- To strengthen and uniformly adapt the sericulture industry stock holders should be equally aware.

- Strengthening sericulture industry linkage with experienced professionals from Research institutes, Universities of the country, private companies different project groups, NGO's & others.
- Apart from research facilities, every concerned entity, such as the district and zonal agricultural offices, should focus on enhancing the provision of extension services to silk producers and consumers of sericulture technology
- Invest in research and development projects to tackle issues including silk processing value addition, disease management and modernizing sericulture methods.
- Work together with agricultural research centres to provide creative solutions that are adapted to regional circumstances.

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