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The Status of Sericulture in Ghana

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Abstract
Sericulture involves the rearing of silk-producing insects in captivity or collecting their silk cocoons in the field for production of fabrics. The majority of the world's silk is mulberry obtained from the domesticated silkworm, *Bombyx mori* L. (Lepidoptera: Bombycidae). Sericulture was formally introduced into Ghana in 1992 leading to the establishment of the Silk Farmers Association, and later a silk factory in 2002 with support from the FAO. This boost led to an increase in raw cocoon production, but is now dwindling due to numerous challenges facing the silk industry. A survey was carried out in the Eastern, Brong Ahafo and Northern Regions of Ghana to establish the current status of sericulture. The survey revealed that farmers are mostly engaged in mulberry sericulture with wild silk being minimal, restricted to the rearing of the Eri silkworm, *Philosamia ricini* (Donovan) (Lepidoptera: Saturniidae) on castor oil and cassava leaves. Another important wild silkmoth, *Gonometa* sp. (Lepidoptera: Lasiocampidae) was found on *Acacia* sp. in northern Ghana. Brong-Ahafo region had the highest number of silk farmers. Farmers' participation in sericulture has decreased over the years as a result of many setbacks. The prospects and challenges confronting the sericulture industry in Ghana are discussed.

Keywords
Bombyx mori — mulberry silk — *Philosamia ricini* — Sericulture — wild silk

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Introduction

Sericulture is the process of rearing silk-producing insects in captivity or collecting their silk cocoons in the field for human use, mainly leading to the production of fabrics [1]. Silk can be broadly classified into two, namely domesticated (mulberry) and wild (non-mulberry) silk [1, 2]. The majority of the world's silk, about 95-99%, is obtained from the domesticated silkworm, *Bombyx mori* L. (Lepidoptera: Bombycidae) [1, 3, 4], whereas the wild silk forms a small percentage [5, 6, 2]. Sericulture is composed of activities such as breeding and maintenance of silkworm races, mulberry breeding and cultivation, silkworm egg production, silkworm rearing and mounting, cocoon drying, silk reeling, testing of raw silk quality, the production of silk products by manufacturing and weaving, as well as the silk thread and fabric production [7, 8].

Silk farming is an eco-friendly, agro-based venture with a great potential for environmental amelioration, employment and income generation, artisan's development, diversification of agriculture, and expansion of export earnings [9, 7]. Sericulture can be undertaken as a rural micro-enterprise initiative by resource-poor farming communities which depend on the forest for their livelihoods [10, 11, 4]. This will reduce the pressure on the natural forest and conserve biodiversity [2, 4].

In the past, *Kente* cloth in Ghana was made from silk yarn imported from abroad [12]. However, mulberry sericulture was formally introduced in Ghana in 1992 by P.K. Ntaanu which led to the establishment of the Silk Farmers Association, and later a silk factory in 2002 with support from Food and Agriculture Organisation (FAO) [7]. There was an increase in cocoon production and farmers participation when sericulture started in Ghana. However, this interest dwindled with time due to certain challenges. Among the problems facing the silk industry in Ghana are lack of seeds (certified eggs), functional production centres and locally adapted silkworm strains and mulberry varieties that offer high yielding cocoons of good quality. Thus, silkworm eggs and mulberry stem cuttings were

imported from abroad (China, India, Kenya, and Bulgaria). Furthermore, production of raw cocoons in Ghana has been low and inconsistent, with most of them being of inferior quality and not reelable. This has led to a reduction in the number of silk farmers and land area for mulberry cultivation. The young industry has the potential to reduce rural poverty, increase employment and reduce dependence on the depleting forest if the necessary interventions are put in place.

Wild sericulture has been very minimal in Ghana. The first record on the successful rearing of wild silk, mainly the Eri silkworm, *Philosamia ricini* (Donovan) (Lepidoptera: Saturniidae), on cassava, *Manihot esculenta* Crantz (Euphorbiaceae) and castor oil, *Ricinus communis* L. (Euphorbiaceae) leaves was undertaken in 2007 by P. K. Ntaanu from eggs imported from Andra Pradesh, India. Recently, some individuals are also involved in small scale rearing of Eri silkworm. In addition, a recent study by Agyeiwaa (2013) has documented the African wild silkmoth, *Gonometa* sp. (Lepidoptera: Lasiocampidae) which feeds on some species of *Acacia* in the Guinea Savanna zone of Ghana. Wild silkmoths belonging to this genus *Gonometa* is known to produce cocoons of good quality for commercial silk production [11, 13].

This paper sought to establish the status of sericulture in Ghana by offering information about the current farmer participation and land area under cultivation in the three regions where sericulture is mostly practiced. The prospects and challenges confronting the sericulture industry in Ghana and the interventions for future improvements in this agro-industry so as to offer income to farmers and to promote forest and biodiversity conservation are discussed.

1. Materials and Methods

1.1 Description of the study areas

The study was carried out in Northern, Brong Ahafo and Eastern Regions of Ghana. One District in each region, where sericulture is mostly practiced, was selected. The Tolon-Kumbungu District in the Northern Region lies between latitude 9^o 25' N and 9^o 35' N and longitude 0^o 55' W and 1^o 05'W. The District covers an area of about 2,741 square kilometres. The Sunyani West District in the Brong Ahafo Region lies between latitude 7^o 19'N and 7^o 35' N and longitudes 2^o 08' W and 2^o 31' W. Sunyani West District has a total land area of 1,658.7 square kilometers. The district enjoys two rainy seasons in the year and this offers the district a favourable climate for agricultural production. The Akuapim-South District covers a land area of 403 square kilometres. The total arable land under cultivation is about 20,000 hectares. About 60% of the population is engaged in subsistence and commercial farming. The district enjoys bimodal rainfall which creates favourable climatic conditions for agricultural activities. Figure 1 shows the study areas where the survey was conducted.

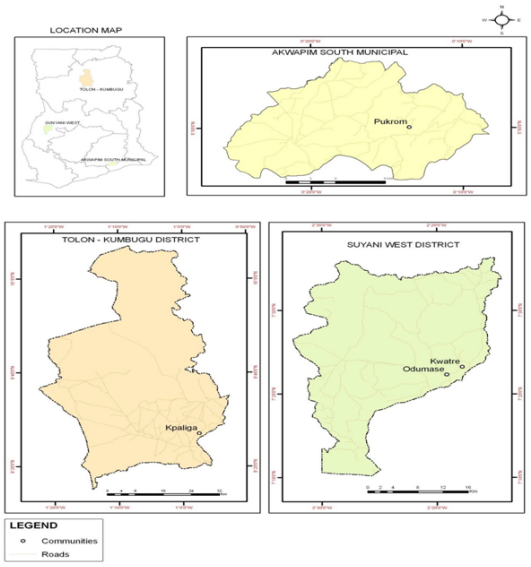

Figure 1. A map of Ghana showing districts and communities selected for the survey on sericulture.

1.2 Survey on sericulture

A survey was conducted during the off-season of 2012 (January to March) which started with identification of regions and districts in which sericulture is practiced in Ghana. It was observed that sericulture was practiced in the Eastern, Western, Ashanti, Central, Volta, Brong-Ahafo, Greater Accra and Northern regions. However, in the process of identification, it was revealed that most farmers have abandoned their mulberry farms and others have replanted the farms with other crops. Based on the criterion that places where farmers have mulberry farms and are actively involved in silkworm rearing, four communities were selected for in-depth study. These were Kpaliga, in the Tolon-Kumbungu District in the Northern Region, Odumase and Kwatre in the Sunyani West District in the Brong–Ahafo Region, and Pukrom in the Akuapim South District of the Eastern Region. Sixty five sericulture farmers were interviewed in this study and sixteen of them were actively involved in silkworm rearing. The issues discussed centered on the varieties of mulberry cultivated, land area under mulberry cultivation, strains of silkworm reared, rearing techniques used, source of silkworm eggs supply and constraints associated with rearing and marketing of cocoons in Ghana. The silk factory located at the Council for Scientific and Industrial Research (CSIR), Industrial Research Institute (IRI) in Accra was also visited and informal interviews and discussions were held with staff of the factory to assess the status of the factory in terms of production levels and constraints. Semi-structured questionnaires were administered and also interviews and focus group discussions were held with farmers and the Sericulture Associations in the various communities. Some of the farmers interviewed were beneficiaries of the Community Based Rural Development Project on Sericulture at Kwatre and Kpaliga Tree Growers Association.

2. Results

2.1 Silk farming (sericulture)

On the distribution of sericulture farmers, the results showed that 46.2%, 38.5% and 15.3% of the farmers were found in Brong-Ahafo, Eastern and Northern Regions, respectively. It was observed that the number of farmers engaged in sericulture has reduced over the years. The total land area under mulberry cultivation in the three regions was 56.0 hectares (Table 1) with Brong-Ahafo Region having the largest. Most farmers, unlike their counterparts in other regions, still kept their mulberry farms. The farmers cultivated their farmlands to other crops and were engaged in sericulture as a subsidiary occupation.It was revealed that Eastern region used to have the highest number of farmers and mulberry farms as Mampong –Akwapim, the seat of the Sericulture Association, was in this region. However, currently most of these farms have been converted into other crop farming activities as a result of dwindled interest in sericulture (Per. Comm. P. K. Ntaanu).

The mulberry variety commonly cultivated in the Brong-Ahafo region was Kanva-2, and Mysore local was mostly grown in the Northern region. In the Eastern region, the farmers grow the mulberry varieties S-36, Kanva-2 and Mysore local. Farmers' choice for a particular variety was based on its availability.

Table 1. Land area under mulberry cultivation by farmers in the Brong-Ahafo, Eastern and Northern Regions of Ghana, during the off-season(January - March) 2012.

Region	Land area (ha)
Brong-Ahafo	43.2
Eastern	12
Northern	0.8

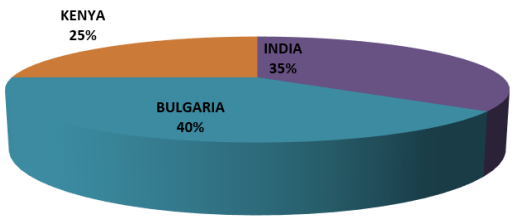

Figure 2. Sources of silkworm egg supply into Ghana

The survey revealed that very few farmers were acquainted with the varieties of mulberry they grow, even though they seem to understand the good characteristics of mulberry leaves needed for feeding silkworm larvae in anticipation for the production of good quality cocoons. The Sericulture Promotion and Development Association (SPDA) and other farmers import silkworm eggs mainly from Bulgaria and sometimes from India and Kenya (Fig. 2).

2.2 Constraints to cocoon production and marketing

According to the survey and interactions with farmers, the major constraints are lack of local market for the raw cocoons produced, and also inadequate reeling centres to add value to the cocoons produced apart from the FAO sponsored silk factory located in CSIR- IRI, Accra (Fig. 3). Farmers also lack adequate technical knowledge required for silk production. Staff at the silk factory at CSIR-IRI also complained about the low quality cocoons provided by farmers which are mostly not reelable and the few that could be reeled often resulted in silk yarns of poor quality.

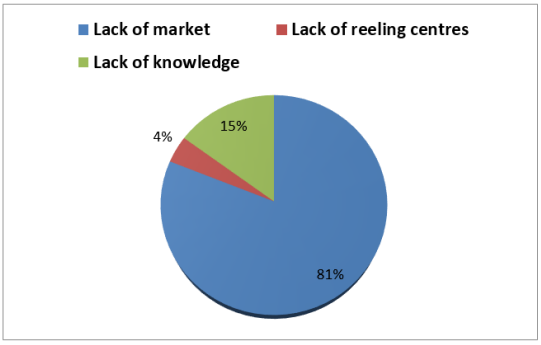

Figure 3. Constraints to cocoon production and marketing in Ghana

3. Discussion

Among the reasons for low quality cocoons could be due to the unavailability of silkworm strains and mulberry varieties that are well adapted to our local climatic conditions. A recent study has identified silkworm strains Z/Y, G2xV2xH1xKK and ICIPE 1 reared on mulberry variety S-36 as having great potential for cocoon and silk production in the Coastal Savanna Agro- ecological zone of Ghana [14]. Farmers must also fertilize their mulberry plants and maintain them properly to ensure that healthy and nutritious leaves are always available for feeding the silkworms. This is because there is a relationship between the quality of the leaves on which the silkworm feeds and silk yield, as well as its quality [15]. It was also evident that the technical staff at CSIR-IRI involved in post-cocoon processing of silk needs refresher courses and further training in order to improve upon their skills in post-cocoon handling and processing into silk yarns as well as weaving of the silk yarns into fabrics.

The silkworm eggs imported from Kenya (i.e. ICIPE 1 and 2) were well adapted to the environmental conditions of Ghana due to similarities in climate in the two countries [14]. Cocoon production in Ghana is low with current production of about 100 kg in 2012 by farmers in Brong-Ahafo and Eastern regions (Personal Comm. Amoah, J). This is far below the daily production capacity of the silk factory, about 2.4 tonnes of fresh cocoons per day. There is therefore the need to improve upon

silk cocoon production in order to make the silk factory fully operational.

It is obvious that the numerous challenges confronting the silk industry is a contributing factor to the low patronage of sericulture and low production of cocoons in Ghana. It is expected that farmers will be trained in adding more value to cocoons by processing them into yarns for the textile industry. This could be achieved through the provision of spinning and reeling machines and weaving centres. Farmer groups and individuals can also establish reeling centres at production sites to reel the cocoons. The value addition to raw cocoons, by further processing them into yarns and possibly fabrics, will earn the farmers more income which in effect will boost their interest in cocoon production. The potential for local market is enormous, as silk yarns could be utilized by *Kente* and *Smock* weavers for weaving and making designs and patterns. On the international scene, we can take advantage of the African Growth and Opportunity Act (AGOA) to export Ghanaian textiles to the US market with tax exemption [12] and also export to other African countries like Egypt where silk is adored. Farmers and stakeholders' education, e.g. training of Agriculture Extension Agents (AEAs) in silkworm rearing and post-cocoon technology, strengthening the link between researchers and the sericulture industry in Ghana will help revamp the dwindling industry.

For example, researchers must develop and/or identify silkworm strains and mulberry varieties that are well suited and adapted to our local climate for high yielding and quality cocoon production. The growth and yield of mulberry varieties in the different ecological zones may not be the same. We therefore need to identify the varieties that do well in the different ecological zones of Ghana. Farmers must be given refresher courses in good agronomic practices in mulberry cultivation and protection, as well as silkworm rearing to produce high quality leaves and cocoons. The native or African mulberry species, *Morus mesozygia* Stapf can be explored and/or improved upon to offer high yielding qualities. Awareness creation among farmers and the general public should be intensified. This will boost interest and increase the number of sericulture farmers and also trigger the interest of stakeholders.

The first record on successful rearing of wild silk, mainly the Eri silkworm, *P. ricini* on cassava and castor oil leaves was undertaken in 2007 by P. K. Ntaanu from eggs imported from Andra Pradesh, India. Recently, some individuals are also involved in small scale rearing of Eri silkworm. In addition, a recent study by Agyeiwaa (2013) has documented the African wild silkmoth, *Gonometa* sp. which feeds on species of *Acacia* in the Guinea Savanna zone of Ghana. Wild silkmoths belonging to this genus *Gonometa* is known to produce cocoons of good quality for commercial silk production [11, 13]. Thus, we can promote sericulture (both domesticated and wild) in Ghana as an incentive for forest-adjacent communities to participate in forest conservation as these silkmoth species live on either indigenous or exotic (mulberry) host plants. Silk farmers could plant these host plants for silkworm rearing and collection of cocoons along the farmlands and buffer zones so as to reduce the pressure on the core forest.

4. Conclusion

The silk industry in Ghana is relatively young and has great prospects due to the favourable environmental conditions that promote the growth of mulberry plants and rearing of silkworms as well as access to cheap labour. However, pragmatic measures must be put in place, supported by effective research and dissemination of findings, to offer solutions to the numerous challenges confronting the silk industry in Ghana. Once sericulture is fully harnessed, it can be used as a tool for poverty alleviation and women empowerment, promote forest and biodiversity conservation, employment generation and artisan's development. There is also the need to increase the awareness of communities and national institutions of the ecological and economic importance of insects, such as silkmoths, and their forest habitats.

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