



Wild SILK Development in the North Rift Region of Kenya



2009



Cabesi Project Report

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Cabesi Market Place in Kapenguria: Honey is the main-business



1. Foreword



The North Rift of Kenya is a marginalized region where natural resources are under-utilized due to lack of technologies, market access and transportation. The Cabesi Project (from Camels, Bees and Silk) started in 2004 under Icipe's Commercial Insect Program.

The camel program offered courses in camel husbandry and –health, and trainings for using camels for transportation. And in connection with ASAL Cabesi was able to increase the camel population by 30 animals.

Cabesi provides since 2008 the complete infrastructure from beekeeping to production and sales of various bee-products. The system includes six honey collection centers in Pokot Central, West Pokot, North Pokot and Turkana Districts, and one Market Place in Kapenguria, where final processing, packaging and marketing are done. The value added products are offered to customers or traders. Beside the main business of honey other products from bee's wax and Propolis have been developed and find their national and international market.

Part of Cabesi Program is the introduction of technologies of Wild Silk farming and -production. Being a new venture in the North Rift, it took a bit time to be accepted as a income generating activity. But also the rearing system for the worms had to be developed in order to meet the local conditions. In Icipe several people had been trained and specialized in silk rearing and postproduction, and Cabesi is able to produce the cloth right up from the cocoons.- For better understanding of the Biology of *Epiphora bauhiniae* a PhD-student was offered the studies from the sponsor.

This small booklet with its guide for silk rearing hopefully will enhance the production of cocoons in the North Rift, to the benefit of the local community.

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2. Introduction

The history of silk is as long as that of civilization. The luxurious look and lusture of silk fabric are unquestionably unique. From its origin in China about 2200 B.C., the silk industry has had an adventurous course of evolution, becoming established with time in other parts of the world. Sericulture is the practice of raising silkworms to produce raw silk. The most known commercial silkworm is the domesticated mulberry silkworm, *Bombyx mori*.



Domesticated silkworms on a papyrus mountage, Mbita Point, Icipe.



Fabric from *Bombyx* sp., produced in Icipe Nairobi.



Cocoon and butterfly from *Gonometa* sp.

Other types of moths produce wild silk of commercial value. Silk moths grown in wild conditions are known as wild silkmooths. Most of the wild silkmooths belong to the families *Saturniidae*, *Lasiocampidae*, and *Thaumetopoeidae*. In East Africa there are over 60 wild silkmooth species. Some examples of Wild silkmooths in Kenya include; *Gonometa postica* in Mwingi Uasin Gishu and Arabuko Sokoke, *Argema mimosae*, in Makueni and Arabuko Sokoke and *Anaphe panda* from Kakamega forest. In the North Rift Region is the species *Epiphora bauhinae*, whose description is here presented. (1)



POKOT WILD SILK MOTH

| | |
|------------------|---------------------------|
| Order | Lepidoptera |
| Family | Saturniidae |
| Subfamily | Attacinae |
| Genus | <i>Epiphora</i> |
| Species | <i>bauhinae</i> , Guer |

3. Host Plants



Wild silkmths require food plants on which the silkworms live in and feed on. Food plants play an important role in wild silk production and most non-mulberry silkworms are polyphagous. Larval plants play an important role in the live of the lepidopterans and have a role to play in their conservation. Eight primary food plants and several secondary food plants for different wild silkmths have been so far identified and documented. They include several *Acacia* species, *Brachystegia speciformis*, *Lannea schweinfurthii*, among other.

The food plant for *Epiphora bauhineae* is from two different *Zizyphus* species:

A. *Zizyphus mucronata* (Tirokwo)

This is a wickedly armed scrambler, shrub or small tree to 7m with dropping tangled branches and thorny. Widely distributed in drier tropical Africa and grows in a variety of soils. It grows both in temperate and tropical climates but most common in dry areas and often riverine. Used for; Firewood, charcoal, building poles, medicine (roots, leaves), fodder (fruit), and live fence. The strong sharp thorns are in pairs, one straight to 2m, the other smaller curved with the leaves arising between the thorns ("thumb-pointer" thorn). Bark: grey to dark grey, smooth at bush becoming rough and fissured with age. Leaves: Shiny and thin, the same green both sides, 3-6cm long, base rounded, often very unequal sided, the edge with regular rounded teeth, a pointed tip, 3 main veins clear below.

Flowers are very small, yellowish, in heads about 1.5cm across. Fruit is rounded, dark reddish- brown when ripe, the pulp very acid and scarcely edible, in stalked bundles. Propagation is by seedlings, direct sowing, root suckers; Number of seeds per kg (500-2000) pre treatment is by removing the flesh and soaked in cold water for 6 hours. The seed can be stored for up to 12 months (2).

The tree is fast growing for dry areas; lopping, pollarding, coppicing the species is difficult to handle due to its hooked species or thorns. It is an important species in dry areas and widely liked for medicine used for



boils, skin infections, and stomach and chest pains. The yellow pink wood is tough and bends well (bows), livestock and wild animals eat the fruit (3).



B. *Zizyphus mauritania* (Tlomwo)

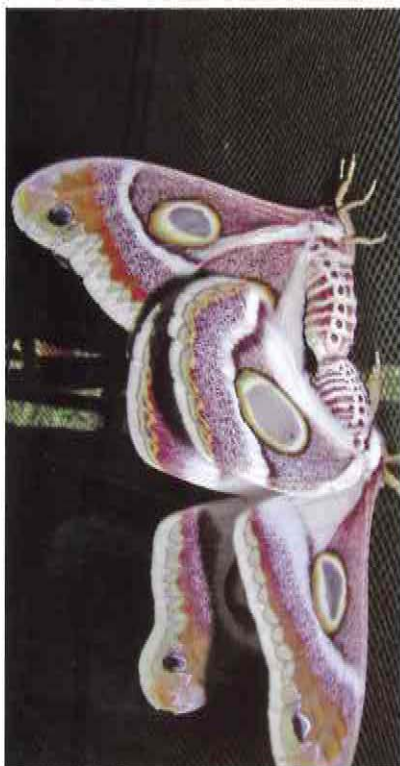
This also is a wickedly armed scambler shrubs or small tree, very thorny species, often thicket found, widespread at the coast and inland Up to 1,400 m. often is distributed on cultivated land, also found in the Middle East and India, but widely naturalized in the tropics. Leaves are thin, soft, shinny mid-green above , oval to almost round to 3-8 cm long , apex blunt or notched , base almost symmetrical , under surface densely covered with very short silvery-grey hairs. Fruit is round to oval, up to 2 cm long, yellow to black, edible when ripe.

This species is fast growing and drought resistant making good fodder and an excellent hedge, with hard, heavy wood used at the Coast for beds and dhows. When ripe, the fruit pulp can be made into a thirst quenching drink and also into a potent spirit. Distributed from the coast to Nyanza Province and often riparian. The strong sharp thorns are in pairs, one straight to 2 cm, and the other smaller and recurved with the leaves arising between the two pair of thorns. The leaves are thin and hairless, the same colour on both surfaces, 3 to 6cm long, base rounded, markedly asymmetric apex tapping to a point, margin with regular rounded teeth. Only the main veins from the base are provided on the underside. The flowers are very small, yellowish in heads about 1.5 cm across. The fruit is clear reddish-brown, very acid and scarcely edible. (4).

4 The Life Cycle of *Epiphora bauhinae*



In order to undertake successful wild silkmoth farming, life cycle information of the species involved in ones locality is very important. By understanding the life cycle, the species and its food plants can be conserved and the people empowered to utilize it for income generation. The behavior of the moths before and after mating varies significantly. After emergence the females remains at one point within the net cage while the males fly around to trace the females . Mating begins around seven thirty in the evening and continued till seven thirty evening the following day that is twenty-four hours. After separating the male immediately having moved away to a point within the net exhausted weakens out and dies within three to four days later. After mating the female immediately flies around to look for a suitable point to lay eggs. After laying her eggs a period lasting between three to four days the adult female moth out of exhaustion weakens and dies too.



The duration of each stage and factors affecting the development can be understood by undertaking field studies. The development of the Pokot silkmoths passes through four main stages, i.e. egg, larva (caterpillar), pupa (enclosed in a silken cocoon), and adult (imago), a process known as complete metamorphosis. Generally, the developmental time for the different stages is influenced by the nutritional quality of the host plant leaves during larval feeding as well as climatic conditions (e.g. rainfall, temperature, relative humidity).

There are two seasons for the Pokot silkmoth in the field. Season one and the most pronounced is between March to June while season two falls in October to December depending on rainfall patterns. The *Epiphora bauhinae* silkmoth takes approximately 35 days (as per preliminary findings) to complete its cycle. Instar one lasts for 6 days, instar two 4 days, instar three 5 days, instar four 5 days, instar five 4 days and instar six lasted 3days. The eggs take 7 days to hatch.

The life cycle of the *Epiphora bauhiniæ* silkmoth
(Central Pokot 2008)



Adult *Epiphora* moth



Cocoon/pupa stage



Egg stage



Larval stage

5. Rearing of *Epiphora bauhiniae*



For wild silk farming to be sustainable, farming as opposed to wild harvesting is encouraged. Care of the silkworms (using net sleeves at early stages) and preservation of seed will ensure a continued population as opposed to depletion of the populations in the wild. Without rearing it would be very difficult to reach the (big) number of cocoons needed for the post-production, without disturbing the ecological balance of a region.

One female lays around 300 eggs. The rearing system will care for as many as possible of those eggs to reach the stage of the cocoon, mainly with the help of net sleeves in order to keep the birds away from prey on the larvae during the development. The cocoons are used for producing seed for the next rearing season and are the raw material for silk.

For protection against predators, use of net sleeves is recommended. Due to the different shape and structure of the two host plants, also two options of rearing with sleeves have been used.

5.1 Net sleeve option for *Zizyphus mucronata*

In Cabesi, the production of the eggs is done in a traditional hut inside a closed net to avoid predators (especially lizards). The cocoons are tight on a tread and hanged inside the net. After emerging of the moths, they mate and lay the eggs anywhere inside the net. These



In-house-rearing of eggs or caterpillars.



Third Instar worm.

eggs are then carefully collected.

Cabesi experienced the best results by eggs direct on the trees, enclosed a net sleeve. Depending on the size of the branch, about 50 to 100 eggs can be seeded. The worms will

find their way into the preferred leaves as they crawl around. Supervise after every three or four days to monitor the growth progress. Any dead worms must be removed and as soon as the leaves have been exhaustively eaten the net and the worms are transferred to a nearby branch. The worms are easy to handle and are not hairy or irritating on handling.

Instead of eggs, it is also possible to feed the first instars of caterpillars under captivity and to release the 3rd Instar worms to the tree.

This method has the advantage, that it is quite cheap, but the disadvantage, that it is work-intensive: transferring the nets and the cocoons need great care and close monitoring.

The net sleeves measure 1mx1mx1m and they have to be tied tightly to ensure that worms don't escape along the branch.



Handling a net sleeve on a branch.

5.2 The cage method for *Zizyphus mauritania*

This method, where the whole tree is enclosed is ideal for the very thorny *Zizyphus mauritania*. Here, male and female cocoons are tied on to the tree in the ratio of one to two depending on the canopy of the tree. The cocoons are left on to the tree for the moths to emerge, mate and lay eggs. The moths will lay eggs randomly on the branches from where they will hatch and start feeding on the leaves. Monitoring will be needed as the worms develop till spinning. In case of overpopulation of the caterpillars on the tree, additional branches for food might have to be brought in. To avoid black ants from feasting on the eggs, putting ashes around the cage has shown success.



Different materials have been tried.

In this method the investment is a bit high. We used about 2,5 roles of mosquito-wire-mesh for one tree, amounting to 3750 KSh plus some nails and posts. The big advantage is the fact that almost no interference has to be done, the rearing is under maximum natural circumstances, and the silkworms don't have to be disturbed. The metal wire mesh-though rusty, can be used for many seasons.

5.3 A different Approach

Cabesi is planning to set up some 1-acre-plots for cultivation of the food crops. After trees reach a reasonable size, cocoons will be placed on them and the rearing will be done without any nets. Through the big number of caterpillars probably the damage from birds and lizards can then be neglected.

The problem with any netting is the limited durability and therefore the relatively high cost.



Cage is prepared.



A tree after season: it recovers fast!



Cocoons are tight on the branches in the ration males to females 1:2



Hundreds of 3-instar caterpillars on the search of food: Additional feeding was needed.



Male cocoon (left) and female cocoon.

6. Harvesting

After instar six the grown up worms will spin a silvery cocoon into which they will pupate as they transform to moths. The cocoons are left on the tree at least a week then harvest by chopping it nicely at the point of attachment on the branch being careful of the thorns. Or in places with hard accessibility brake small branches with many cocoons and bring them down for removal of the cocoons.



Cocoons ready for harvest.



In some cases it is easier to remove the cocoons after cutting the branches.



Cocoons ready for post production.

7. Post production



After cleaning the cocoons, they are boiled for more than 2 hours in a solution with water and Magadi-soda. After rinsing they are deflossed when they are semi-dry. The floss (like wool) is spun still before drying up. Then the fabric can be weaved.



Floss,



Thread after spinning.



100% Pokot Silk: still a bit rough, but with more experience we shall produce a fine fabric!

Due to our limited amount of Cocoons received from the field partners, we weave on small hand looms. Trials with a mixture of domesticated- and wild silk gave a softer cloth than pure wild silk.

Within Cabesi are several women trained in the postproduction of silk. Our goal is (like with other products from the project) to add value to the raw material up to a final product.



Work on the spinning wheel.



Weaving with hand loom.

8. Wild Silk farming in the North Rift

In various meetings with Icipe scientists the idea of Wild Silk Farming in the North Rift has been introduced through Cabesi project since 2004. In 2005 the Seito Silk Center in Chesta was opened with the idea of rearing wild silk.

Since then, some more people started rearing wild silk in Marakwet Distrikt, others are interested from Turkana. The Cabesi Market Place in Kapenguria has been constructed and several women have been trained in Icipe in post-production of wild silk. The Market Place is interested to buy *Epiphora* cocoons and pays 2 KSh per cocoon. To receive a good income, a rearer has to be very serious with rearing. For 1 m (ca 400g) silk about 800 cocoons are needed!

From the wild cocoons are only accepted which are empty or emerged to encourage wild population survival.



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