**Right:** Semi-captive rearing technology. A farmer demonstrates how the semi-captive rearing technology protects young silk larvae for cocoon production, which involves using a mechanical barrier (net sleeves) to protect larvae from predators, parasites or predators.

## Constraints and mitigation

Food plants for rearing wild silkworms such as *Argema mimosae* are getting depleted due to increase in population, urban development, and destruction of natural forest (through charcoal burning, firewood, and timber harvests). Cutting down these food plants has reduced the silkmoth populations, leading to low cocoon output. Eventually, this will affect silk production, since cocoons are the raw materials for silk fabric. For this reason, farmers are advised to avoid cutting trees, but instead conserve them and plant more trees.

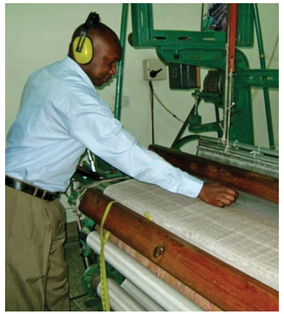
Farmers should also establish nurseries of the food plants to earn income from the sale of seedlings, which will also support production of silk cocoons and reforestation efforts.

Natural enemies (including ants, birds, wasps, spiders, and others), attack *A. mimosae* silk larvae; but locally available net sleeves are providing the mechanical barrier needed to protect the larvae during rearing. The net sleeves bear a resemblance to mosquito nets, and the farmers can have them locally made.

Although *A. mimosae* moths are part of our habitat, living in our farms, homesteads or forests, many people are unaware of their economic importance, and continue destroying these habitats. *icipe* has introduced research and training on wild silk farming, and farmers can seek advice on how to rear silkworms, and produce and process silk cocoons to earn extra income.



**Right:** Weaving of forest silk fabric on a powerloom.



## Economics

In Mwingi area of eastern Kenya, a tree with a canopy of 8–10 feet wide could support up to 200 larvae. One thousand trees on one hectare, each supporting 200 cocoons, could therefore, yield a total of 200,000 cocoons. Assuming a 50% survival rate, this translates to 100,000 cocoons per hectare, which can produce 280 metres of silk fabric. This is estimated to provide an income of US$ 7560 if sold at the current price of US$ 27 per metre.

*Forest Silk Technology of Argema mimosae in Kenya*

## *icipe* – Working in Africa for Africa…

*icipe* – African Insect Science for Food and Health – was established in 1970 in direct response to the need for alternative and environmentally-friendly pest and vector management strategies. Headquartered in Nairobi, Kenya, *icipe* is mandated to conduct research and develop methods that are effective, selective, non-polluting, non-resistance inducing, and which are affordable to resource-limited rural and urban communities. *icipe*'s mandate further extends to conserving and utilising the rich insect biodiversity found in Africa.

*icipe* contributes to sustainable food security in Africa through establishment of insect-based enterprises, such as sericulture, that are sustainable, eco-friendly and synergistic, and that provide quick economic rewards to communities living in these forest areas. The underlying principle is to assist rural resource-poor communities to improve their livelihood, and to protect the natural environment, thus increasing the productivity and resilience of their farming systems and the natural resources, through uptake of these techniques.

### COVER PHOTOS

**Top left:** A newly emerged *Argema mimosae* moth.

**Top right:** Hand spinning of *A. mimosae* floss into yarn for weaving fabric. The cocoons are deflossed and spun when semi dry.

**Bottom left:** The ultimate sign of harvesting silk from the forest – A farmer at a silkworm rearing site in Arabuko-Sokoke Forest.

**Bottom right:** Freshly harvested *A. mimosae* cocoons.

**Donors:** European Union, IFAD, WTO-Enhanced Integrated Framework (EIF), UNDP-GEF, Biovision, AusAID, CordAid, USAID, CEPF

**Collaborators (including communities):** AU-IBAR, Ministries of Agriculture, Animal Industry, Fisheries and Environment, NARS, NGOs, Kenya Organic Agriculture Network (KOAN), Farmers' Federations, and local community groups.

*Photos: icipe*

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# Forest Silk Technology

*of Argema mimosae in Kenya*

*icipe*
*African Insect Science for Food and Health*

The wingspan of an adult *Argema mimosa* moth can measure up to 13 cm across and 13 cm from tip to tip (it has an elongated tail-like structure). The shape of the wings gives the appearance of a piece of dried out foliage, and the moth uses this for camouflage.

## Background

Several African countries, including Kenya, have undertaken remedial actions towards sustainably exploiting forest resources, but few actions have involved the use of forest resources, such as insects, for commercial purposes. Many people consider insects as pests; however, forest insects have the potential to be exploited for commercial purposes, to alleviate poverty. The forest insect industry (FII) neither requires capital nor landownership, and is suitable for communities, especially women, living in forest fringe areas and in buffer zones around protected forests. Several tree-inhabiting insect products (such as silk) are linked to forest conservation activities, as they provide livelihood services at different economic scales to forest-dependent people. In Kenya, development of the forest silk technology (FST) as a rural cottage industry is long overdue, as it could enhance the income potential of resource-poor rural communities, and ensure the rich biological diversity is conserved.

*Argema mimosae,* commonly known as the African moon moth is a forest insect of the family Saturniidae that produces wild silk. This moth is found in eastern and South Africa. In Kenya, it is found in Makueni County in eastern Kenya, and in the Arabuko-



Sokoke Forest, along the coast. It is brilliantly-coloured, and is found in many exhibitions and institutions (such as museums), where it is displayed for educational purposes and for research. Scientists, educators, animal keepers, and volunteers, collaborate to share knowledge and highlight the importance of these insects, and to develop a better understanding of the roles they play in the natural world. The significant economic importance of the African moon moth is due to its high quality silk fibres, which form an important component of the forest sericulture industry. The Commercial Insects Programme at *icipe* has developed forest silk technologies with full participation of communities, to utilise the full potential of this silkmoth for producing cocoons and conserving the biodiversity in the Arabuko-Sokoke Forest.

## Common moon moth food plants

A survey in East Africa has shown that *A. mimosae* larvae feed on various food plants, such as *Spirostachys venenifera, Lannea schweinfurthii, Sclerocarya birrea* and *Ozoroa obovata*. These food plants provide a wider food choice for the *A. mimosae* caterpillars to eat, and for the wild silk farmers to rear the silkworms. These plants are found in different ecological zones in Kenya, and are identified by different local names.

*Lannea schweinfurthii* is a deciduous, irregularly branched tree with a spreading rather than open crown, as well as drooping branches. It can grow up to 22 metres tall.



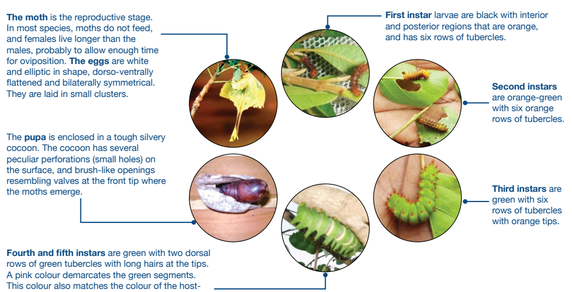
## Local names for *Argema mimosae* food plants in Kenya

| Scientific name | Common names | Local names |
|---|---|---|
| *Lannea schweinfurthii* | - | Munyumbu-maji (Swa, Gir), Ile, Tile (Bor), Muraci (Emb), Muasi (Kam), Chepchai, Goinyet (Kip), Moino (Pokot), Den (Som) Oropando (Maa). |
| *Ozoroa obovata* | - | Mwaalika (Swa), Mkayukayu (Gir), Kedula, Bangoe (Boni), Msalasanga (Dig) |
| *Sclerocarya birrea* | Marula tree | Mgongo (Swa, Dig), Muua (Kam), Didissa (Bor), Mura (Mer), Ol-Mangwai (Maa), Orulo (Pokot), Tololokwo (Tug) |
| *Spirostachys venenifera* | - | Siricho (Bor), Haiyah-badad, Ayabedeo (Som), Mtolo (Pkm), Mtanga (Dur), Wolkon (Orm). |

**Table Key:**
*Bor – Borana; Dig – Digo; Emb – Embu; Gab – Gabbra; Gir– Giriama; Kam – Kamba; Kik – Kikuyu; Kip – Kipsigis; Luh – Luhya; Maa – Maasai; Mer – Meru; Nan – Nandi; Orm – Orama; Pkm – Pokomo; Som – Somali; Swa – Swahili; Tug – Turgen; Tur – Turkana.*

## The life cycle of *Argema mimosae* (African moon moth)

Farmers require basic knowledge of wild silkmoth phenology, which entails knowing the seasons and cycles of the silkmoths' development.






## *Argema mimosae* farming

Forest-based silk requires the farmer to follow a planned calendar in order to succeed. This calendar of activities is based on the seasons and the availability of the host plants with foliage in a locality.

*Step I: Selection and preparation of the rearing site*

To initiate rearing of *A. mimosae* larvae, a farmer requires at least 200 host plants, each with a canopy, to rear at least 200 silk larvae from 1st instar to cocoon stage.

*Step II: Grainage set-up for egg production*

One must select well-formed healthy cocoons for use as seeds for egg production. Nearer the start of a rearing season, a breeding cage is prepared for moth emergence and mating. A moth lays between 300–400 eggs.

*Step III: Eggs incubation and young age rearing*

Eggs should be collected on a daily basis and incubated at room temperature in clean plastic containers covered with net material for air circulation. Eggs take 8–10 days to hatch, after which the newly hatched larvae are transferred to tender leaves within 12 hours. Young age larvae are susceptible to natural enemies (such as predators, parasites and parasitoids); and therefore, require protection using net sleeves.

*Step IV: Late age rearing*

Larvae in the late age stage adopt a solitary life and feed on mature leaves till they form cocoons. Feeding is intensive in the last instar, and the entire larval period is 28–30 days.

*Step V: Cocoon formation*

At the end of the larval stage, the larvae spin silk cocoons in 24 hours and metamorphose into pupae. Cocoons are harvested after seven days using a sharp knife to detach them from the branch, and stored in well-ventilated rooms, away from predators such as lizards and rats.