



Figure 1. A-E. Stages in silk spinning and weaving, F. Final undyed native silk fabric. Antsirabe, Madagascar.

Madagascan 'wild' silk

Sericulture is the ancient and well-established manufacture of a natural product (silk, la soie (Fr.)) processed from cocoons of moths cultivated for high value fabrics. To a close approximation all modern silk derives from the domesticated silkworm, *Bombyx mori* (Bombycidae), reared on mulberry (*Morus* spp.). This moth is no longer found in the wild and all aspects of production is human-assisted. Silk fabrics actually provide a very small proportion of global fabric production, comprising less than 0.2% (International Sericulture Commission, 2013-16), with the market dominated by China and India where 98% of all silk is produced. African, including Madagascan (Malagasy), silk production is modest even among the remaining few producer countries, yet in some areas it is a locally important source of income. Native silk moth production is mentioned at most as a footnote to *B. mori* sericulture in entomological textbooks including Gullan & Cranston (2014).

Earlier this year I travelled through central Madagascar on a 'national parks' trip, largely to watch birds, lemurs and chameleons (in that order), and with culture and entomology as asides only. However, as we progressed it became evident that natural silk production in this country may be a sustainable and conservation-sensitive means of poverty alleviation. Combined with a fascinating historical background, the sociological implications continue to the present day.

My first silk encounter was in Antsirabe, a large town lying in the central highlands at an elevation of 1500 m., some 500 km south of the capital Antananarivo on the sole north-south asphalt road. In a typically children-dominated encounter, there was a sign advertising '*La Soie Sauvage*' – Malagasy people have French as their second (educated) language. My rusty French eventually helped me very much, but early on I had forgotten that

'sauvage' meant 'wild', not necessarily 'savage', silk. Our tour guide Didier Ramilison had organised a demonstration of silk production in what was essentially a backyard artisanal enterprise. All stages were performed with power only from human muscles (foot pedals) and fine motor skills. We saw cocoons being heated in an alkaline liquid (Figs. 1A, B), fired by fuel derived from the plentiful eucalypt plantations, silk spinning and weaving on a loom (Figs 1C-E). As our group watched the show, a tale emerged, mostly in Malagasy incorporating French for concepts new to the traditional Indonesian-based language, and simultaneously translated to current French with some English. The enterprise usually used cultivated *B. mori* cocoons for their silk, via contracts to local producers growing mulberries, to meet demand for this 'whiter' silk for some customers. However what we were seeing was the artisanal production of a native silk from indigenous gatherers, collected from native trees, to produce a less refined final product that naturally was a pleasant shade of beige (Fig. 1F, 4). We gleaned that 'la soie sauvage' was sought for particular uses, notably in making the traditional shrouds in which the deceased, especially if wealthy and of high status, were wrapped prior to burial ceremonies. More of this later.

My interest was piqued by the 'sauvage' silkworms: after all, this was the trivially mentioned 'and other African moths' from which silk could be produced commercially. Traveling south through the highlands, introduced pines and eucalypts had dominated, but some savannah-like areas had clumps of native trees, although no forest. These trees, with vernacular name *tapia*, scientifically are *Uapaca bojeri* Baill., once treated as Euphorbiaceae, but the lack of toxic sap and spines has had them removed to the Phyllanthaceae. In appropriate

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Figure 2. Immature stages of “landibe”, *Borocera cajani* (Vinson), Isalo National Park, Madagascar. A-B, larvae (caterpillars), C. evacuated pupal cocoon; on ‘tapia’, *Uapaca bojeri* Baill., (Phyllanthaceae).

areas these tapia trees can dominate, giving rise to the ecosystem-defining tapia woodlands. Close-up, to a naïve observer they look like cork oaks because of the thick insulating bark, and this is key – the trees are fire resistant. The grasslands in which they grow are burnt annually to force the tough Emperor grasses to generate fresh growth for the all-important zebu cattle (= male wealth). This tree and a few other species are the preferred host for the moths that provides the cocoons for wild silk. In Isalo National Park, as we climbed upwards through sandstone bluffs into the tapia ‘forest’ distraction was provided by ring-tailed lemurs rising from their overnight repose in caves for fossa avoidance. Despite warning from our local guide Naina that it was not the season for the moths, almost the first tapia tree examined had a 10 cm long

multicoloured larva actively feeding in full view (Fig. 2A). This was the penultimate (of five) larval instars of *Borocera cajani* (Vinson) (confused previously with more lowland, coastal *B. madagascarensis* (Boisduval)). These lasiocampid moths known as “landibe” in the local vernacular, are the major source of wild-collected silk. The final instar is more cryptically coloured and can reach a length of over 12 cm. The species is endemic to Madagascar, has high sexual dimorphism with the female adult up to three times the size of the male, and with high variability in colour and patterning. Oviposition is not assisted by humans although some suggestions for intervention are being made by charities associated with alleviation of rural poverty. Soon we found larvae showing colour variation (Fig. 2B) and some empty cocoons (Fig. 2C). Major differences between the

cocoons and those of *B. mori* are evident: the silken cocoon is off-white to brownish, impregnated with spines and hairs (‘dirty’) and, above all, when harvested after the adult has emerged, has larval and pupal cuticle within the cocoon. This explained what we had heard earlier in Antsirabe, that handling of ‘soie sauvage’ is much more difficult, including the need for special cleaning and other preparation, and with fibre length shortened by the emergence of the adult creating an exit hole. Add to this the dispersed nature of the ‘crop’ scattered amongst many hectares of forest, and the lack of local processing facilities makes one wonders how this can be an economic harvest.

Although it is suggested that wild silk has been in decline, it still amounts to a national crop of some 40–50 tonnes per year. Some indications are positive



Figure 3. A. Giraffe weevils (*Trachelophorus giraffa*) on *Melostoma* leaf, B. phasmid, *Achrioptera gracilis*, on dead branches of 'tapia'.

for the future. In drier regions of the country with only one crop of rice possible per year, there is substantial labour down-time and men head to cities to seek cash employment. Cocoon collection is dominated by women, and payment for cocoons from wild harvest in impoverished rural areas generates cash that may cover school fees, for example. Misuse of tapia for firewood or charcoal, even felling for cocoon harvest and other unsustainable uses is said to have reduced the availability of trees for local harvest of cocoons, but conservation and replanting projects do exist. According to Naina, our local guide in Isola National Park, people from the nearby commune of Ranohira can obtain a free permit to collect cocoons, with the proviso that they damage no trees and collect only post-emergence cocoons. While it is a decent hike from the commune and hard work harvesting the cocoons: surely this is a sustainable and sensible use of a local resource. Community 'ownership' and management of natural resources such as silk, and tourist access under local guidance to 'non-National Park' areas seem to work well to augment local income and enhance conservation in areas that I saw in rainforest, highland and arid areas.

Above all, what is the demand for this difficult-to-handle 'sauvage' silk that encourages the producers in Antsirabe to travel each year over 1000 km return to and from Isalo on a bad road to this southernmost Tapia forest? The answer lies in funerary customs (Famadihana, the turning of the bones) involving the burial and reburial of the dead, in an ancestor worship ceremonial uncannily reminiscent of those of the Tana Toraja in south Sulawesi. In traditions that long predate the arrival of 'Chinese' silkworms (in c. 1830), funerary shrouds of native silk have been *de rigueur* for wrapping the recently deceased corpse and again for subsequent exhumations.

I still can't get my head around the sustainability of acquisition of zebu (Asian humped cattle) as a sign of wealth, much sought after by males by working otherwise in menial jobs. The herds, which graze widely across fire-managed grasslands, are not 'redeemed' until death, at which time they are slaughtered to pay for the first burial and subsequent re-burial ceremonies, including much feasting, the purchase and wrapping of the corpse and bones



Figure 4. Penny Gullan, modelling her shroud of native silk.

in expensive natural silk and in the construction and maintenance of impressive tombs. Fortunately, wealthy Malagasy have used native silk for fashion and the demonstration of the wealth of the living. Now tourists are the new wealthy purchasers, and there are encouraging signs that awareness of native silks is catching on as a fashionable 'new' insect-derived product with a 'story', as I have recounted above. But there is more to it: the sustainable collection of cocoons may provide little more than pin-money, but several charities recently have recognised that the 'lost skill' of preparing, dyeing, spinning and hand-loomed of fabrics from wild silks can be revived and provide real jobs in a rural economy. Furthermore, colours as seen in the fabric in Fig. 1E, come from natural dyes from native plants such as *Labourdonnaisia madagascariensis* Pierre ex Baill.. This is known in the vernacular as 'nato', a species of Sapotaceae whose bark gives a characteristic red (not a cochineal ...) and provides good reason to conserve such resources.

Since returning I found that David Attenborough had fronted a project to support this cultural revival via a recent BBC television series (in UK). Links to some charities and some videos are provided below. However, a word of caution – your partner may be less than impressed with a funerary shroud, so presentation as a soft, light, native silk shawl or scarf may be more acceptable (Fig. 4).

Although I travelled with entomology as a low priority, I became aware of many giraffe weevils (*Trachelophorus giraffa*) actively interacting on native *Melastoma* leaves (Fig. 3A) and dozens of species of stick insects were everywhere, near invisible as was this 25 cm long *Achrioptera gracilis* (Fig. 3B). The heavy-weight Madagascan hissing cockroaches (*Gromphadorhina portentosa*) were seen around rotting timber and in leaf litter, and the insect-collecting tongues of chameleons clean up by day and night. The weirdest plants abound - baobabs are but one example of the many 'bottle plants/trees' - and xerophytes and succulents dominate. I

won't mention the 100+ species of birds and 14 lemurs that I saw. All biologists should visit, but do avoid the wine.

We thank Didier Ramilison of Wild Madagascar, who masterfully guided a group of eight around Madagascar on behalf of Australia-based International Park Tours. Randrianantenaina Charles Edmond (Naina) led us into the sandstone country of Isola and discussed the harvest of silkworms and its local sustainability. Gavin Svenson kindly provided a provisional identification of the phasmid from photographs.

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