

**THE WILD SILKS OF  
INDIA, PRINCIPALLY  
TUSSER**

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**THOMAS WARDLE**

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BY  
THOMAS WARDLE, F.C.S., F.G.S., &c.

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ON

# THE WILD SILKS OF INDIA,

## PRINCIPALLY TUSSER.

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### INTRODUCTION.

This interesting and important subject has received so much learned attention during the last fifty years, from both entomologists and sericulturalists, that it is impossible now to treat of it in a lecture without saying much that is not absolutely new.

Whilst, therefore, abstract research may have but a narrow field left, I hope that what I have to say may be useful in stimulating a greater utilisation of these products, which are as beautiful as they are curious, and in calling the attention of manufacturers, printers, dyers, and users to some most important improvements and developments in each of their several departments, the result of a lengthened study of the exact nature of the fibres, and of new and improved modes of manufacturing and decorating them.

Amongst the many names of persons in various countries interested in the cultivation of wild silkworms, the utilisation of their products, and in the entomology of the subject, I venture to give the following list, which will be found interesting by many, and will serve to show more forcibly to what a large extent this important subject has been made a matter for study and investigation:—

#### *English.*

Dr. Roxburgh, Captain Hutton, Mr. Hugon, Dr. Birdwood, Mr. F. Moore, Mr. P. H. Gosse, Captain Mitchell, Mr. Butler, Major Coussmaker, Lady D. Neville, Lady Gilbert, Mr. Calvert, Mr. Geoghegan, Dr. Alex. Wallace, Dr. Mackenzie, and others.

#### *Continental.*

M. Guérin Méneville, M. Personnat, M. Robert, M. Camille Mayne, M. W. Reed, M. Braine, M. Maurice Girard, M. Wailly, Wilhelm Carl Berg, M. Costa, M. Matthieu Bonagous, Mich. Judizky, Roo Van Westmas, N. H. de Graaf, Dr. Chavaunes, and many others. My friend, M. Rondot, member of the Chamber of Commerce, Lyons, and President of the Jury, Class 34, Silks, at the Paris Exhibition last year, author of several important works on silk and Eastern dyes, is at the present time giving much economic attention to this question, for the purpose of considering supply for the increasing demand of the French silk trade in wild silks.

Amongst those who have interested themselves especially in the utilisation of these wild silks must be mentioned Dr. Birdwood, who was one of the first, if not the first, to call public attention to the importance of Tusser silk, in a lengthy report to Government in 1858, which I regret I have not time to read.

Lady Dorothy Neville is well known by her efforts in trying to acclimatise the *ailanthus* worm, and in utilising its silk during a long series of observations of a practical nature.

Mr. Geoghegan is the author and compiler of a valuable report to the Government of India on the silk industry of India, which is indispensable to a study of the subject.

Major Coussmaker is pursuing with a praiseworthy determination, at Poonah, his culture of Tusser silkworms, with a view of making Tusser silk as systematic an industry as that produced by *Bombyx mori* and the other mulberry silks.

Besides many others, the enthusiastic labours of the French, aided by their Société d'Acclimatation, set us a great example. They have succeeded in domesticating, if not in almost naturalising, several eastern species of wild silk producers, and in obtaining from them silk of industrial value.

*Classification.*

The silk-producing *Lepidopterous* insects are of many species, possessing, as is here shown, very marked structural differences, whilst the variety and quiet beauty of their colours and, with the exception of the mulberry feeders, their large size, contribute greatly to the charm of studying this branch of natural history, and they make a collection, apart from their great usefulness, worthy of being placed in the first rank.

They belong, as I have stated, to the order *Lepidoptera*, and are all members of but two families, *Bombycidae* and *Saturniida*.

All the *Saturniida* are silk spinners, but not all the *Bombycida*.

The British Museum catalogue contains the names of 294 species of *Saturniida*. Mr. Butler, of the British Museum, informs me there have been 100 more species added since the publication of the catalogue.

The following table shows the position of these two families in the great system of classification of the animal kingdom, and the known number of Indian genera in each :—

DIVISION III.		
Articulata.		
SUB-DIVISION II.		
Anthropoda (or true articulata).		
CLASS VIII.		
Insecta.		
SUB-CLASS III.		
Metabola.		
ORDER X.		
Lepidoptera.		
SUB-ORDER I.		
Heterocera (Moths—8 groups or tribes).		
GROUP.		
Bombycina.		
FAMILY 10.		
<i>Genera.—Bombycidae.</i>		
Bombyx, Theophila,		Ocinara, Trilocha.
FAMILY 8.		
<i>Genera.—Saturniida.</i>		
Attacus, Antheraea, Actias, Salassa, Rinsca, Rhodia,		Caligula, Neoris, Saturnia, Loepa, Cricula.

Mr. Frederic Moore, curator of the India Museum, the acknowledged authority on Indian wild silk moths, has kindly furnished me with a list of all the silk-producing *Lepidoptera* of India known at the present time.

The new India Museum contains a collection of the principal wild silk moths, with specimens of the cocoons and the silk of their larvæ, arranged by Mr. Moore, a description of which will be found in the second volume of the catalogue on Indian *Lepidoptera*, published in 1858-9.



To illustrate my lecture, I have here to-night a very interesting collection of the moths of the greatest industrial importance, as well as the cocoons of their larvae, and examples of their silk in most, if not all, the various stages of industrial development.

The following is Mr. Moore's list of all the known species of silk producers in India. It is the most valuable list yet published, and shows how rich India is in silk-producing insects :—

#### MULBERRY-FEEDING SILKWORMS—DOMESTICATED.

*Bombyx mori* (Linnæus).—The common silkworm, domesticated in China, Japan, Bokhara, Afghanistan, Cashmere, Persia, S. Russia, Turkey, Egypt and Algeria, Italy, France, and Spain, in all which countries it produces but one crop annually, spinning the largest cocoon and the best silk, of a golden yellow or white.

*Bombyx textor* (Hutton).—The *Boro pooloo* of Bengal, domesticated in S. China and Bengal; an annual only, producing a white (sometimes yellow) cocoon, of a different texture and more flossy than *B. mori*.

*Bombyx sinensis* (Hutton).—The *Sina*, *Chcena*, or small Chinese monthly worm of Bengal, partially domesticated in Bengal, where it was introduced from China; produces several broods in the year; cocoon white and yellow.

*Bombyx craei* (The *Nistry* or *Madrassee* of Bengal, introduced from China; domesticated in Bengal; yielding seven or eight broods of golden yellow cocoons in the year, of larger size than *B. sinensis*.

*Bombyx fortunatus* (Hutton).—The *Dasee* of Bengal yields several broods annually, spinning the smallest cocoon, of a golden yellow colour.

*Bombyx arracaneensis* (Hutton).—The Burmese silkworm, domesticated in Arracan, said to have been introduced from China through Burmah; yields several broods annually; cocoons larger than the Bengal monthly species.

#### MULBERRY-FEEDING SILKWORMS—WILD.

*Theophila Huttoni* (Westwood).—The wild silkworm of the N. W. Himalayas. A wild species, the worms being found abundantly feeding on the indigenous mulberry in the mountain forests of the N. W. Himalayas.

*Theophila shervillii* (Moore).—The wild silkworm of the S. E. Himalayas.

*Theophila Bengalensis* (Hutton).—The wild silkworm of Lower Bengal. Discovered in the neighbourhood of Calcutta feeding on *Artocarpus lacucha*. Found also at Ranchee in Chota Nagpore.

*Theophila religiosa* (Helfer).—The *Jorce* of Assam and *Deo-mooga* of Cachar. Feeds on the bur tree (*Ficus indica*) and the pipul (*F. religiosa*).

*Theophila mandarina* (Moore).—The wild silkworm of Chekiang, N. China. Worms stated to feed on wild mulberry trees, spinning a white cocoon.

*Ocinara lactea* (Hutton).—Mussooree, N. W. Himalaya. Feeds on *Ficus venosa*, spinning a small yellow cocoon, yielding several broods during the summer.

*Ocinara Moorei* (Hutton).—Mussooree, N. W. Himalaya. Also feeds on *Ficus venosa*, as well as on the wild fig, spinning a small white cocoon. It is a multivoltine.

*Ocinara diaphana* (Moore).—Khasia hills.

*Trilocha varians* (Walker).—N. and S. India.

#### ATLAS AND ERIA GROUP.

*Attacus atlas* (Linnæus).—China, Burmah, India, Ceylon, Java. This appears to be almost omnivorous, feeding in different districts upon the shrubs and trees peculiar to it. At Mussooree it is found upon *Bradleya ovata*, *Falconeria insignis*, and several other trees; at Almorah the yellow flowering barberry is said to be its favourite food. In Cachar it feeds on various other trees. Cocoon well stored with a fine silk.

*Attacus silhetica* (Helfer).—Silhet.

*Attacus Edwardsia* (White).—Sikkim, Cherra, and Khasia hills.

*Attacus cynthia* (Drury).—China. Domesticated in the provinces of Shantung and Honan. Feeds on the varnish tree (*Ailanthus glandulosa*).

*Attacus Ricini* (Jones).—The *Eria* of Assam, and *Arindi* of Dinajpore. Domesticated in the Northern parts of Bengal (Bogra, Rungpore, and Dinajpore), in Assam and Cachar, feeding on the castor-oil plant (*Ricinus communis*), yielding

seven or more crops annually. Cocoons somewhat loose and flossy, orange red, sometimes white. The so-called "Ailanthus silkworm" of Europe—the result of a fertile hybrid between the Chinese and the Bengal species—was produced some years ago in France, by Monsieur Guérin-Méneville, and subsequently reared, from whence it was introduced into various parts of the world.

*Attacus Canningi* (Hutton).—N. W. Himalayas. Common in a wild state, feeding on the leaves of *Coriaria nipalensis* and *Xanthophyllum hostile*. Cocoons hard and compactly woven, rusty orange or grey. An annual.

*Attacus lunula* (Walker).—Silhet.

*Attacus obscurus* (Butler).—Cachar. Not very common. Stated to feed on a plant called *Lood*.

*Attacus Guerini* (Moore).—Eastern Bengal.

#### ACTIAS GROUP.

*Actias Selene* (McLeay).—Mussooree, Sikkim, and Khasia hills; Madras. The worms feed upon *Andromeda ovalifolia*, *Coriaria nipalensis*, wild cherry, and walnut, at Mussooree, and on *Odina woderi* in Madras.

*Actias Sinensis* (Walker).—N. China.

*Actias Leto* (Doubleday).—Sikkim and Khasia hills.

*Actias Menas* (Doubleday).—Sikkim and Khasia hills.

*Actias ignescens* (Moore).—Andaman Isles.

#### TUSSER AND MOONGA GROUP.

*Antheraea mylitta* (Drury); *Antheraea paphia* of authors; the *Tusser*, *Tussar*, or *Tussah* silkworm.—These well-known and valuable insects (of various undetermined species) are widely distributed over India, from east to west and north to south, on the coast, and in the Central Provinces. They feed in a wild state upon the ber (*Zizyphus jujuba*), the asun (*Terminalia alata*), the seemul (*Bombax heptaphyllum*), &c.

*Antheraea mezankooria* (Moore); the *Mezankooree* silkworm of the Assamese.—The worms which produce the mezankooree silk are stated to feed on the addakoory (? *Tetranthera* sp.), which is abundant in Upper and Lower Assam. The silk is nearly white, its value being fifty per cent. above that of the moonga.

*Antheraea nebulosa* (Hutton).—This is the *Tusser* of the Sonthal jungles of Colong. It is also found in Singbhoom, Chota Nagpore.

*Antheraea Perrotteti* (Guér. Mén.).—Described as being found in the districts of Pondicherry, feeding upon a species of *Zizyphus*, the jamboul (*Syzygium jambolanum*), &c. Stated to produce four broods in a year.

*Antheraea Andamana* (Moore).—An allied species to the tusser. Inhabits the S. Andamans.

*Antheraea Frithi* (Moore).—Sikkim, Himalayas. A common species, inhabiting the hot sub-tropical valleys below 2,000 ft. Known only as a wild species. The cocoon is stated to be similar to that of the tusser in form, but of finer silk.

*Antheraea Helferi* (Moore).—Sikkim, Himalayas. This is a common species found in the hot valleys of Sikkim.

*Antheraea Assama* (Helfer).—The *Moonga* or *Mooga* of the Assamese. The moonga silkworm feeds upon the trees known in Assam as the champa (*Michelia* sp.), the soom, kontoolva, digluttee (*Tetranthera diglottica*), the pattee shoonda (*Laurus obtusifolia*), and the Sonhalloo (*Tet. macrophylla*). It is extensively cultivated by the natives, and can be reared in houses, but is fed and thrives best in the open air and upon the trees. The silk forms an article of export from Assam, and leaves the country generally in the shape of thread.

*Antheraea Roylei* (Moore).—The oak-feeding silkworm of the N. W. Himalayas. A common species, feeding on the hill oak (*Quercus incana*) of the N. W. Himalayas (Simla, Masuri, Almora). The cocoon is large and very tough, the silk being pronounced as promising, and worth cultivating. They can be reared easily in the house.

#### MISCELLANEOUS GROUP.

*Salassa Lola* (Westwood).—Sikkim, Himalayas.

*Rinaca Zuleika* (Hope).—Sikkim.

*Rhodia Newara* (Moore).—Nepal (Kathmandoo). Worms feed upon a species of weeping willow. Spins a brilliant green cocoon, pendant from the twigs.

*Caligula Thibeta* (Westwood).—Mussooree, N. W. Himalayas, 7,000 ft. Common, the worms feeding on *Andromeda ovalifolia*, wild pear, and the cultivated quince, forming a light, open, net-like cocoon.

*Caligula Simla* (Westwood).—Simla, N. W. Himalayas, 5,000 ft. Feeds on the walnut, *Salix babylonica*, wild pear, &c.; forms an open, net-like cocoon.

*Caligula Cachara* (Moore).—Cachar.

*Neoris Huttoni* (Moore).—Mussooree, N. W. Himalaya, 6,500 feet. The worms appear in April, feeding upon a species of wild pear tree; spins a thin silken cocoon.

*Neoris Shadulla* (Moore).—Yarkund.

*Neoris Stoliczkana* (Felder).—Ladak.

*Saturnia Cidosa* (Moore).—Hot valleys of the Sikkim, Himalayas.

*Saturnia Grolei* (Moore).—Sikkim, Himalayas.

*Saturnia Lindia* (Moore).—Sikkim, Himalayas.

*Saturnia Anna* (Moore).—Sikkim, Himalayas.

*Loepa katinka* (Westwood).—Sikkim, 5,000 to 7,000 feet. Assam.

*Loepa sikkima* (Moore).—Hot valleys of Sikkim.

*Loepa sivalica* (Hutton).—Mussooree, 5,000 feet. Spins a long cocoon, pointed at each end, and of a dark greenish-grey colour.

*Loepa miranda* (Moore).—Sikkim, Himalayas.

*Cricula trifenestrata* (Helfer); the *Haumpottonce* of the Assamese.—Noted as being very common in Assam, the worms feeding on the soom tree, forming an open net-like cocoon of a beautiful yellow colour and of a rich lustre, the silk being spun in the same manner as the *Eria* cocoon. Occurs also in Moulmein, where the worms are stated to feed upon the cashew-nut tree (*Anacardium orientale*).

*Cricula drepanoides* (Moore).—Sikkim.

To this number may be added a few others which, although not of India, are well worth the attention of the Government of India for the purpose of acclimatisation there.

*Antheraea Pernyi* (Guér. Mén.).—The oak-feeding silkworm of Mantchouria, N. China. This is described as having been long known to the Mantchour Tartars, very large quantities of the silk being used among the Chinese. The worms feed on various species of oak (*Quercus mongolica*), &c., the cocoon differing from the tusser in form and texture. The silk is represented as strong, but with little lustre. Two crops of silk are produced in the year—a spring and autumn crop.

*Antheraea Confucii* (Moore).—A species allied to *A. pernyi*, inhabiting the hills in the neighbourhood of Shanghai, N. China.

*Antheraea Yama-mai* (Guérin Méneville).—The *Yama-mai* silkworm of Japan.

An oak-feeding species, forming a cocoon of a pale yellowish-green colour. This worm feeds on the oak, and produces excellent silk of considerable commercial value in Japan. I should strongly recommend its introduction into India. It has been acclimatised in Europe, and crossed with *Bombyx Attacus Pernyi*, is successfully reared in France, the eggs hatching at almost freezing point. The silk is much cultivated and used in Japan. Its fibre is oval, and 950th of an inch thick.

*Saturnia pyretorum*, from South China.—The worm feeds upon the *Liquidamber formosanu* in Canton, Amoy, where the silk is stated to be woven into a coarse fabric.

*Neoris shadulla* (Moore).—Yarkund.

*Theophila mandarina* (Moore).—N. China.

#### HISTORY OF SILK.

A few words on the silk of commerce and its history may form a fit preface in introducing to your notice those wild silks which it is my object to describe to-night.

The name silk is derived from the name of the people of Eastern Asia whom the ancient Greeks called Σίρες, Seres, and who, no doubt, were the Chinese, and who were then, as now, celebrated for silken fabrics or seric stuff.

From seres comes the Latin *sericum*, the French *soie*, the German *seiden*, the Anglo-Saxon *seole*, the Icelandic *silki*, and the English *silk*.

We are informed by Hawae-nan-tze, in a Chinese work called the "Silkworm