

SILK AND SILK PRODUCERS.

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[*Read November 12th, 1877.*]

The employment of insects for the special purposes of mankind may be placed under three principal heads, viz., Medicine, Food, and Clothing. With regard to the two first, one may almost write, as did old Herrebow, the author of a Natural History of Iceland, the 72nd chapter of whose work runs thus—"Concerning snakes. There are *no* snakes in Iceland." For it is quite astounding—when we consider their number (not less than 150,000 species), and the varied properties they possess—how few insects are pressed into man's service either for curative or culinary purposes. In the present day, Hygeia entrusts her reputation and the safety of invalids almost entirely to vegetable and mineral substances; while, as for the cookery book, we may search in vain for the name of an insect among the myriad of delicacies, which pamper modern appetites.

But, if Science is reserved in the employment of insects in the pharmacopœia, ignorance and credulity have given full flight to their fancy.

"Fools have rushed in, where angels feared to tread."

Had one of our ancestors a distressing toothache? There were ready at hand the weevil and the ladybird, either of which could be crushed and applied to the afflicted part. Nay, did he wish to get rid of the offending organ altogether, he had but to touch it with the ashes of burnt "emnets or pismires," and straightway the tooth would drop from the gum. Had he the misfortune to sprain his leg or bruise his foot? Two at least of the beetles, which dwell in excrementitious matter, *Geotrupes* and *Aphodius*, were specifics held in high estimation. The yellow matter which exudes from the joints of the bilbeetle, was held to be as efficacious in dropsy or rheumatism, as in hydrophobia—and no doubt was so. Another infallible remedy against the bite of a mad dog consisted of the fat white maggots generated in the putrid carcase of the dog itself—truly a case of Homœopathy run mad!

That foul disease leprosy could not stand before the bruised body of a meal worm. The great jaws of the stag beetle when powdered proved a certain cure in most of the maladies incidental to childhood. The different tree bugs were good against ague; the male cricket taken internally could drive away a cold. Was the cold accompanied by headache? There were plenty of remedies at hand, such as earwigs and cockroaches. This last insect was specially valuable; for according to Dioscorides (whose receipt is unhesitatingly reproduced by Mouffet in the 17th century), the fat of the cockroach pounded with oil of roses is singularly efficacious in earache, and the same insect boiled in oil removes warts. Lastly, snake-poison was rendered perfectly harmless, if the patient could be induced to swallow one or two bed-bugs!

Civilised peoples have never been much in the habit of utilising insects as food. The only example I know of is that of the Romans,

who were partial to a large grub ; though it is doubtful what the particular insect was. We know that it bore the name of "Cossus"; * but naturalists are much divided on the knotty question of what is the true Cossus of the ancients. It was certainly not the animal to which Linnæus gave the title. Again in Leviticus xi. 22, "The beetle after his kind" is mentioned among the articles of food which the Jews might eat ; but there is no doubt that the original word (*chargol*) is incorrectly translated.†

If, however, insects cannot be said to hold an important position in regard to medicine and food, there is no doubt, that in arts and manufactures they play a distinguished part. The number of species employed may be small, but certainly a considerable void would be created, were all the insects to be blotted out, which contribute to our necessities or luxuries in this respect.

To insects we are indebted for one of the principal articles of clothing. Silk—to which I propose to devote the remainder of this paper—the produce of an insignificant moth has in the course of ages become one of the most important manufactures which the world has witnessed.

The education of the insect and the manufacture of the article have alike come to us from the Northern Provinces of China, where sericulture has been established from a very early period. Chinese annalists carry it back to the 27th century before Christ ; and they attribute its establishment to the foresight and care of Si-ling-chi, wife of the emperor Hoang-ti. Setting aside trade tradition, the mention of silk as an article of manufacture occurs for the first time in the writings of Ezekiel, the prophet, about 550 B. C., who speaks of its use among the Jews as an indication of wealth and glory.‡ It is well to mention that there are two earlier allusions in our version of the Bible to the employment of silk. The first is in Genesis xii. 42, where "Pharaoh," it is said, "arrayed Joseph in vestures of *fine linen* ; the last two words are given in the margin as "silk." Again, in the Book of Proverbs,§ the clothing of the virtuous wife is described as of "silk and purple." The original word in both cases is "Shesh," of which "fine linen" appears to be the more equivalent.

We next read of silk in the Sacred Writings of the Book of Revelation,|| where it is enumerated among the luxuries for which Babylon was celebrated.

But although the ancients were acquainted with the article, they were entirely ignorant of its origin ; as we may gather from the poet Virgil, who speaks of

"Ethiop forests hoar with fluttering fleece,
And downy foliage carded by Chinese."¶

By Ethiopia, I may mention, is intended the modern Abyssinia ; and it is curious, that Pliny speaks also of Ethiopia as the home of cotton ; for he says that that country "possesses scarcely any trees of importance, *except* those which bear wool."

Two centuries later the celebrated Roman physician, Galen, employed silk as threads for securing blood-vessels in surgical operations.

* Pliny, Hist. Nat. xvii. 24.

‡ Ezekiel xvi., 10, 13.

|| Revel. xviii. 12.

† Smith, Dict. of the Bible.

§ Proverbs xxxi., 22.

¶ Second Georgic. Blackmore's translation.

Up to this period and for some time after, the little silk which reached Europe, was imported from Persia and India. The Emperor, Heliogabalus, about the year 220 B.C. was the first Roman, and therefore I presume the first European, who wore a garment of pure silk. It was not until the sixth century after Christ, when Justinian occupied the throne of Constantinople, that the real origin of silk became known to the world. About the year 550, two Persian monks, at the risk of their lives brought a few eggs from China in the hollow of a walking stick, and from that hour the mystery was solved. For a long period the breeding of the silk-worm was confined to the Greeks of the Lower Empire. Manufactories were established in Athens, Thebes and Corinth; from whence the Venetians, who were then what England is now, the carrying nation of the world, supplied Europe with silk goods. About the middle of the twelfth century Roger, King of Sicily, introduced the worm into Italy;* and from this period sericulture became an established institution in Europe. It was not until the commencement of the eleventh century, that the mulberry was planted for the first time in France. At the present day the breeding of the worm, and the preparation and manufacture of the silk afford employment to thousands of the French population. In the year 1870 the value of the eggs and cocoons imported for home use amounted to the enormous sum of £2,053,000.

In England the manufacture of silk commenced in the 15th century, but made little progress until the Revocation of the Edict of Nantes in 1685 drove 50,000 fugitives from the shores of France, many of whom settled in Spitalfields, in the neighbourhood of London. Efforts have been made, from time to time, to rear the moth itself in England on a large scale. In 1609 James I. took the matter up with much earnestness, and mulberries were planted in large quantities on the spot where the royal residence of Buckingham Palace now stands.† The attempt however, met with no success, and the spot soon became a mere place of fashionable resort. Evelyn, in his well-known diary, makes an amusing allusion to it, under date May 10, 1654. "My Lady Gerrard treated us at Mulberry Garden, now the only place of refreshment about the town for persons of the best quality to be exceedingly treated at; Cromwell and his partisans having shut up and seized on Spring Garden, which till now had been the usual rendezvous for the ladies and gallants at this season."

Nothing whatever is known of the Silk-worm in its wild condition. It seems to be assumed by all biological writers, that the insect came originally from Northern China; but beyond this, all is a blank in the life-history of this important insect.

As a captive, domesticated for thousands of years, we see in the Silkworm (*Bombyx* or *Sericaria mori*) a moderately large moth of a dirty white hue, with ill-formed wings—so ill-formed indeed, that the creature is quite incapable of flight. The antennæ, which are much darker in colour than the rest of the body, are very beautiful in the male insect, being deeply pectinated, or cut into narrow divisions, like a comb, with a double set of teeth placed back to back. Beyond its pretty antennæ, *Sericaria* has nothing to commend

* Gibbon, Decline etc. LII.

† C. Knight, London, S. James' Park.

it, thus justifying Taschenberg's remark, in his *Wirbellose Thiére* : "The most useful of all insects, like the loveliest songsters among birds, is clothed in the soberest garments."

The larva (or "worm" *par excellence*) is a stout thick-bodied grub, of nearly the same tint as the moth, with a small head and naked body, of which the first segment is much swollen, and the last but one bears an upright horn. The worm feeds by preference on the mulberry—not the common sort with the luscious fruit, known to botanists as *Morus nigra*, but another species, *Morus alba*, of which the fruit is worthless as food. The insect can also support itself on lettuce, and some other juicy plants ; but the silk is said in such case to be much inferior.

The Cocoon enclosing the chrysalis is egg-shaped, and is composed of the much-coveted silk, varying in colour from pure white to golden yellow ; occasionally it assumes an apple green tint. Leunis, the learned author of the *Synopsis der Thierreich*, tells us, that blue cocoons can be obtained by sprinkling the food with indigo ; and that a pink hue is communicated, if the powdered leaves of a South American plant, *Bignonia chica*, are employed.

The threads issue from two glands situated near the mouth, aggluminated together and covered with a glossy varnish—each thread measuring about the 2,000th of an inch in diameter.

A cocoon contains from 700 to 1,100 feet of thread ; and it takes some 2,000 of these indefatigable spinners to procure one lb. weight of the raw material.

The outer covering of the cocoon is made up of loose broken fibres, well-known as Floss or Bourre, which is carded and spun like cotton.

Besides the Floss, three forms of raw silk are recognised in commerce.

1. Singles : Formed of a single thread to give it firmness.
2. Train : Formed of two or more threads slightly twisted together. It is generally used for the shoot or weft.
3. Organzine, which is, in fact, Thrown Silk, is made up of several threads twisted firmly together in a direction contrary to that of the individual threads. It serves for the warp of the best stuffs.

I may mention, in passing, that the Throwing machine has been so much improved of late years that the extraordinary speed of 5000 revolutions per minute is given to the spindles.

Silk-worms, owing no doubt to their purely artificial condition, are subject to various diseases, many of which are as destructive to them, as are cholera or yellow fever to their owners. Among them are conspicuous muscardine, pebrine, jaunisse, and others much dreaded by the silk-farmers of Italy and France. The devastation caused by these epidemics has interfered seriously with the supply of silk ; as the infected "grains" or eggs have been transported from one country to another, and have spread disease far and wide. Even China, the cradle of silk culture, has not been spared. It is principally from Japan, that growers are now supplied with grain, as that country has hitherto escaped the plagues that have devastated other lands. At the same time, this immunity will be of short duration, if, as reported, the Japanese, with short-sighted policy, are actually importing infected eggs for the purpose of adulterating healthy ova for the foreign market.

Under these adverse circumstances efforts have been made from time to time to domesticate other species of silk-producing moths, and utilise their cocoons. Among those, which have been experimented on of late years, the Ailanthus worm (*Attacus cynthia*) must be placed at the head. It is a native of Japan, and has its common name in consequence of its feeding on a hardy tree, named *Ailanthus glandulosus*. Japan also supplies us with another valuable worm, *Antheraea yama-mai*, which in its native country subsists on the leaves of two kinds of oak, *Quercus dentata* and *serrata*.

India and its immediate neighbourhood are rich in silk producers. The most important is the Tusseh worm (*Antheraea paphia*), which feeds on various species of Bombax, Terminalia, and some other trees. The cocoon is as large as a hen's egg, and the silk, which is remarkably strong, has been manufactured for centuries and supplies clothing to multitudes of the natives under the name of Tusseh cloth. The head-quarters of Paphia are in Bengal; but efforts are being made to establish it in other Presidencies. Some months ago this Society received, through the Colonial Secretary's office, a despatch dated from Poona, Bombay, the writer of which, Capt. G. Coussmaker, details the various methods he employed to introduce the Tusseh worm (or "Tasar silk worm," as he names it) into that neighbourhood. Nearly allied to paphia is the Bughy worm (*Antheraea mylitta*) indeed by some authors the two species are held to be identical. Its cocoon, as is the case with some others, is attached to a twig by a long stiff stalk composed of a gummy matter, which is in fact immature silk.* This gives me the opportunity of stating, that even immature silk is not altogether worthless; for from it is made the "gut," so indispensable to the fisherman, combining, as it does in the highest degree, the qualities of flexibility, toughness, and indestructibility in water. The best is said to be imported from China and Spain, where it is made by soaking the caterpillar in strong acid, then pulling the body asunder, and winding the gummy matter, exposed to view, round pins placed some distance apart on a board. This substance is the embryo silk utilised before it has been exposed to the air."†

The Bughy worm feeds on the castor oil plant. The same plant supports the Eria or Arrindy worm (*Attacus ricini*), which produces a coarse but very durable material much in favour with the poorer classes of India. On the other hand the silk of the Joree worm (*Saturnia religiosæ*) is exceedingly fine and lustrous; it chooses the Pipul (*Ficus indica*) as its food plant. Assam is the native home of the Joree worm, as it is also of the Moongha (*Antheraea assamensis*). It is found on *Zizyphus jujuba*, and produces a cocoon which is sometimes fawn coloured, at others nearly white; the latter is considered the most valuable variety. Another moth of the same family and country is *Antheraea roylæ*, which supports itself on the leaves of some species of oak.

Towards the close of 1864 the discovery was made in Senegal on the coast of Africa, of a moth, to which M. Guérin Meneville gave the name of *Faidherbia bauhinicæ* in honour of General Faidherbe, whose name afterwards became prominent in the Franco-German War. Like the whole of those already mentioned,

* Linnean Soc. Trans. Vol. VII.

† American Naturalist, 1870.

Faidherbia belongs to the Bombycid Division of the moths. It is partial to the species of *Zizyphus*, especially the Siddeem (*Zizyphus orthacantha*); and it is thought, that it will be exceedingly valuable, when established in Algeria, as the silk, though of a bad colour, a pale grey, winds off with ease, and is produced in very large quantities. Whereas the mean weight of a single cocoon of the common silk-worm is 290 millegrammes, and of an *Ailantus* worm 255, that of *Faidherbia* attains to no less than 633 millegrammes.*

North America possesses numerous large Bombycid moths, more than one of which might probably be domesticated with profit.

The pretty pale green *Tropœa lina* chooses the sycamore and the oak for its food plants. *Callosamia promethea* supports itself on two species of the bay, *Saurus sassafras* and *benzoin*. *Callosamia cecropia* occurs on the wild plum (*Prunus pennsylvanica*).† The cocoon of the last-named insect is of a yellowish brown and larger than a pigeon's egg; the silk has been carded and converted into stockings. Another species of *Callosamia*, named *Angulifera*, is partial to the cherry, whilst *Telea polyphemus*, the larvæ of which feeds on the oak and elm, may some day prove of economic value. It has been reared on a large scale at Boston, by a Mr. Troubelet, who speaks highly of the quality of the silk produced by the "Polyphemus Worm."‡

It will be observed that the foregoing moths belong without exception to the same subdivision of the order *Lepidoptera*—that of the *Bombycids*; in fact, the members of this group appear to enjoy a monopoly of the art of spinning a serviceable silk.

The only moths outside this subdivision, whose threads have been put under contribution—and that only on a limited scale—are the *Ermines*, as they are named, from the fact of their snowy wings being studded with velvety black spots. They constitute the genus *Hyponomeuta*, of the sub-order *Tineids*.

Though individually small these insects are capable of producing a large amount of silk, and (it may be added) of working an enormous amount of mischief; because the larvæ are gregarious in their habits; in other words, the caterpillars, on leaving the eggs, instead of separating and going each its own way, all keep together, and spin, in common, a large silken web, wherein they congregate, when not feeding.

In Great Britain, and in most of the temperate parts of Europe, they infest orchards, and in years when they are abundant, often commit sad havoc, not merely by devouring the leaves, but by enveloping the branches in a silken covering, thus excluding the air and spoiling the fruit. In the year 1841, they appeared in vast numbers in the heart of London; in many of the squares not a hawthorn tree was to be seen, whose branches were not enveloped in a web, giving the tree the appearance of being covered by a fine cloth. § A year or two previously the cider makers of Normandy—and this title includes nearly every family in that fertile province of France—were almost driven to despair by the ravages of one of these Ermine-moths, *Hyponomeuta cognatella*. It was hopeless to attempt to destroy them, and the unfortunate

* Comptes Rendus, 1865.

‡ American Naturalist, 1870.

† Duncan. Nat. Library, xxxvii.

§ E. Lankester. Entomologist, 1841.

farmers could only gaze with folded arms on the tiny persecutors, as they hung suspended from their boughs in silken bags, many of which were more than three feet long and nearly as wide. Not unfrequently, too, the trunks themselves were enveloped in the thick silky tissue woven by these never-tiring grubs. That the British Ermine can work as heartily as his French relative is clear, from the fact, that webs of this species were exhibited at a meeting of the Entomological Society in February, 1871, which measured "over a yard long."

With such wonderful silk-producing power constantly in view, it is scarcely a matter of surprise, that persons have endeavoured to take advantage of the little animal's instinct, and turn it to some practical purpose. With this object, frames or models have been constructed, upon which the caterpillars were compelled to work. So long ago as 1815, a certain Lieutenant Hebenstreit, living in the vicinity of Munich, produced in this way a number of bags of remarkably fine tissue. And the French zoologist Auton Desmarest states that a material has been obtained by the labour of the common ermine (*Hyponomeuta padella*) so strong and light as to have been actually worn as a lady's neckerchief. However, the manufacture was more curious than useful, and the experiments have ceased to be carried on.

From time to time attempts have been made to supplement the produce of the silkworm by that of other insects. Some persons were sanguine enough to hope, that something might be done with the spider's web, more especially that of the common house spider of Europe (*Tegenaria domestica*). Stockings and gloves have in consequence been manufactured from the silken bags, within which the female spider encloses its ova. But the difficulty of collecting these egg-bags, and the still greater difficulty, or rather impossibility, of inducing the fierce little spinners to live together in harmony, soon put a stop to all efforts in that direction.

Attention has also been turned to the thread (technically termed *Byssus*), by which many of the *Mollusca*, or shellfish, moor themselves to the rocks. This is especially the habit of the family *Heteromya*, to which the mussels belong. Two of these (*Pinna squamosa* and *Pinna nobilis*), inhabiting the Mediterranean Sea, develop threads from 9 inches to a foot long, and from these threads purses, gloves, and such things have long been woven.

About the middle of the last century, "A pair of gloves of this silk was presented to the then Pope, Benedict XIV."* A pair of gloves of the same material is also deposited in the Oxford Museum.

Until lately there was a regular manufactory at Naples, where the *Byssus* was worked up into articles of dress and ornament, which were presented on state occasions by the King of the two Sicilies to those whom His Majesty desired to honour. I believe, however, that the manufactory has come to an end since the expulsion of the Bourbons.

Indeed, in spite of all attempts in other directions, the silkworm interest has shown itself to be too strong to be materially

* Gibbon Decline, etc., 4.

interfered with, and still is (and is likely long to remain) master of the situation.

Whether any of the silk producers, whose names I have brought before you, will ever be introduced with profit into this colony, is a question, which cannot at present be answered. There is certainly nothing in the geographical position of the island or in its climatic relations, to prevent the attempt from being made with prospect of success, when the proper time arrives. The North American, if not the Indian, moths are perfectly hardy, and would undoubtedly thrive in this dry and sunny climate. Indeed there is no reason why the true silkworm should not do well here. Dr. A. Wallace, no mean authority on the subject, has given his opinion that it might be cultivated with success in Great Britain.* And if it would do well in the damp foggy climate of the old country, we may safely predicate that it would prosper in our more favoured zone.

Of course, at present skilled labour commands too high a price to hope for commercial success from sericulture. But the day may come, I have little doubt, when, if the popular energies are turned in that direction, Tasmanian silk or Tasmanian Tusseh cloths will be able to compete with the fabrics of Japan and China.

* Entom. Annual, 1871.