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SILK:

ITS ENTOMOLOGY, HISTORY, AND MANUFACTURE,

AS EXEMPLIFIED AT THE

ROYAL JUBILEE EXHIBITION,

MANCHESTER, 1887.

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SILK,

ITS ENTOMOLOGY, HISTORY, & MANUFACTURE,

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THE ROYAL JUBILEE EXHIBITION.

MANCHESTER, 1887.

The design of this cover is taken from a Kinkhab Tablecloth, in gold, silver, and silk. From Ahmedabad, India. For description, see page 47, No. 51.

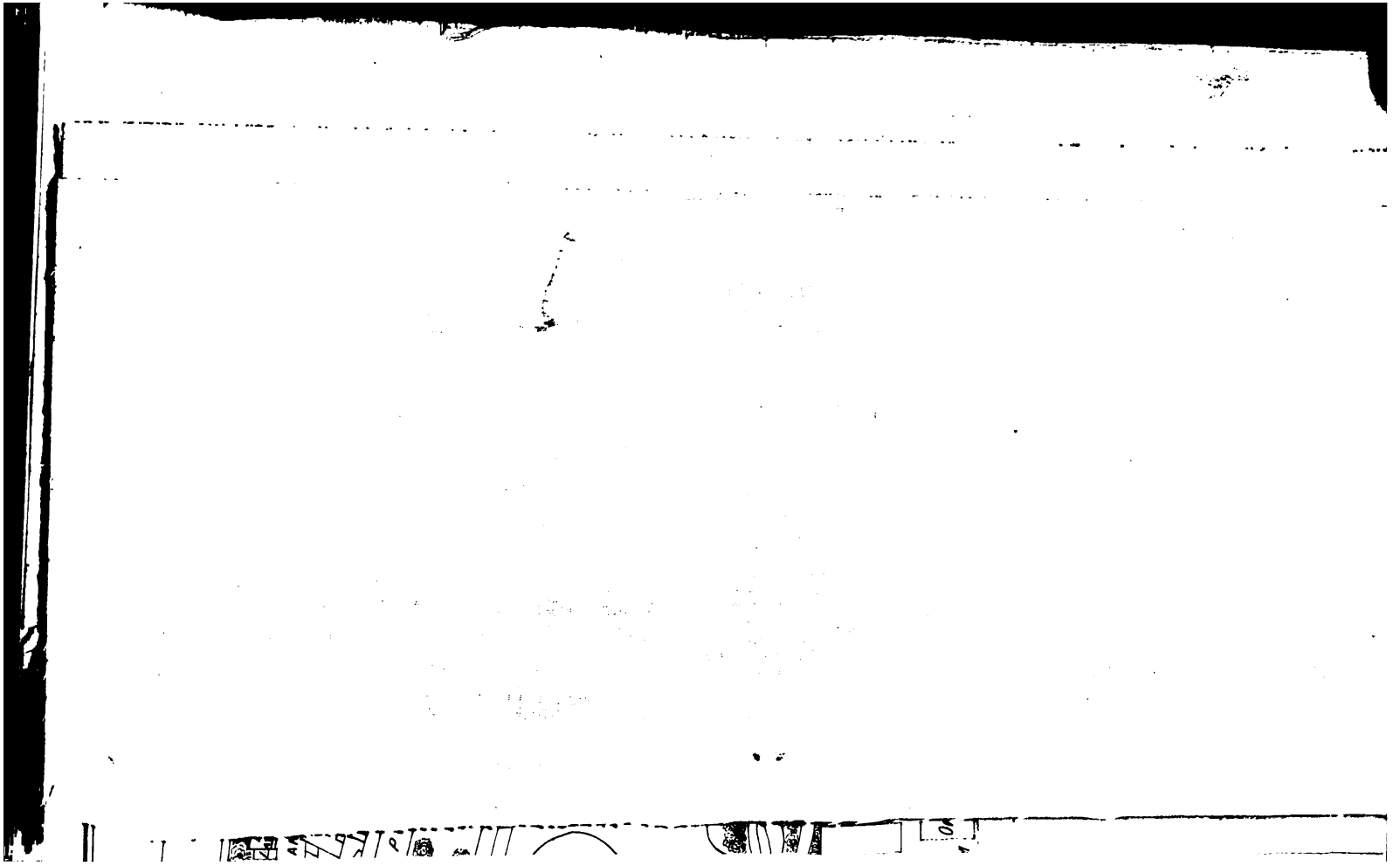
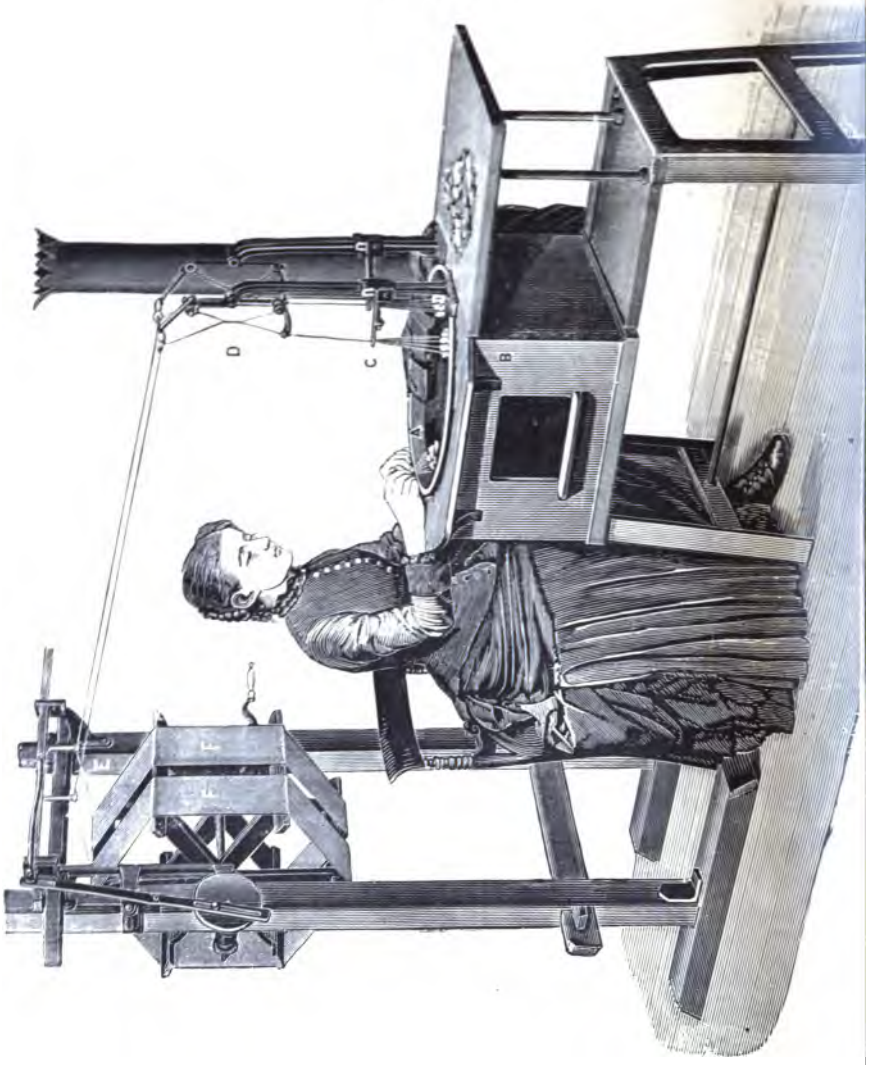


PLATE I.



Cocoon-reeling machine simplified and arranged for cottage use.

A Basin for hot water, from which the cocoons are reeled.
B Cast-iron furnace for fire or gas to keep the water heated.
C Filière through which the threads of several cocoons unite to make one thread of raw silk.
D Two Tavelettes-Keller, erroneously called Consono, showing the croissure or crossing of the silken threads on one another.
E Frame of wood holding reel and guider motion.
F [illegible] silk on the reel, after having been drawn off or unwound from the cocoons.

[*Frontispiece.*

SILK:

TS ENTOMOLOGY, HISTORY, & MANUFACTURE,

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MANCHESTER, 1887.

BY

THOMAS WARDLE,

Fellow of the Chemical Society; Fellow of the Geological Society; Fellow of the Royal Statistical Society; Chevalier de la Légion d'Honneur of France; Officer d'Académie of France; Membre du Jury de l'Industrie de la Soie à l'Exposition Universelle à Paris, 1878; Honorary Superintendent of the Indian Silk Culture Court of the Colonial and Indian Exhibition, London, 1886; Chairman of the Silk Section of the Royal Jubilee Exhibition, Manchester, 1887.

JOHN HEYWOOD,

DEANSGATE AND RIDGEFIELD, MANCHESTER; AND 11, PATERNOSTER BUILDINGS, LONDON.

Document Control Stamp

Royal Jubilee Exhibition, Manchester,

1887.

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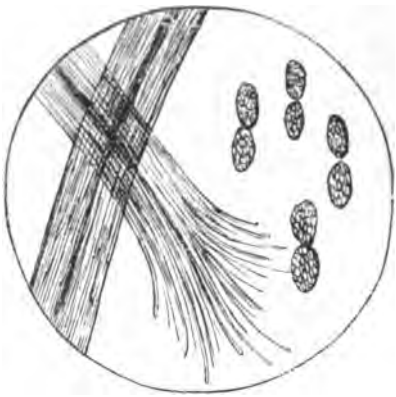


CONTENTS.

LIST OF ILLUSTRATIONS.

The larvæ, cocoons, and moths are shown of the actual size.

ROYAL JUBILEE EXHIBITION, MANCHESTER, 1887.

SILK SECTION.

INTRODUCTION.

The history of silk is so well known that it does not require from me more than the most passing notice, merely that which is sufficient to show that while we are indebted to the sunny East for this industry, it surely travelled westward, although slowly, until we ourselves have long ceased to be the most westwardly country which has claimed a right to and shown a qualification for the possession of a share of working in this wonderful product of nature. It has followed our kinsmen across the Atlantic, until it almost joins hands with its mother country, which gave it birth in ages so remotely past; for, on first leaving China, it found its way through India, Persia, and Asia Minor, to Europe; and in the sixth century it attracted the attention of Justinian, who soon after gave it its first and sure start at Constantinople. We find it afterwards localised in Greece for a long period before the twelfth century, when it was known and practised in Sicily. It reached Italy in the thirteenth century, from whence it spread into France and Spain. We are indebted to the Huguenot persecution for its establishment, if not its introduction into England, where it has met with varying fortunes for the past 200 years. On the whole it was never so bad with us, and, as some think, never so unpromising as now.

We can claim as much right, although not such an ancient one, to the manufacture of silk in England as any other European country, but we may not say the same of silk growing or sericulture proper

James I. tried to encourage silkworm rearing, and had many mulberry trees planted in various parts of the country, but the experiment was not successful, owing to the mulberry leaves not being ready soon enough for the silkworms. No success could ensue in a climate where the silkworms were hatched from their eggs before the mulberry leaves were ready to feed them with.

The silkworm only thrives where the climate is more congenial then it is here. There is not much hope or future for the production of cocoons in England, but there is a good hope of a good future for the retention, development, and extension of the making of silk yarns and fabrics. Why not? England possesses a splendid silk manufacturing climate, more humid, or rather less dry, than perhaps any other country, good conditions for winding and weaving silk; brain power not less than other nations; and opportunities of study and technical training gradually, although slowly, developing. It has examples of ancient and modern art of the best as well as the worst types; and these should give the best incentives to make beautiful work with either the needle or the loom, by lessons of guidance or avoidance.

Why should we not resume our fair share in the production of all that silk is capable of in applied use and beauty? I am not one who takes a gloomy view of that which seems to some an impossibility or a hopeless effort. There is much, it cannot be denied, in the revival of this pursuit to attract those who wish to realise happiness of occupation and useful aims, although, perhaps, not speedily to those who are in search of fortunes above all other considerations.

In England we have done nothing which may be considered to be strictly scientific in silk work. We do not know enough yet about the chemical composition of silk and its gum, or about its properties of combining with other substances, whether as dyes, mordants, or adulterants. The whole subject wants lifting into the sphere of methodical and scientific work, and no one can then doubt of its ultimate usefulness to the silk indtusry and its

entourage, coupled, as it no doubt soon will be, with well-directed technical education.

The importance of these suggestions, which I desire so much to press at this opportune moment, I may well further emphasise by mentioning that I have lately received from the Lyons Chamber of Commerce the report for the year 1885 of the Administrative Commission of the Laboratory for the study of silk lately founded by this Chamber. It contains three plates of silkworms, their cocoons and moths, two of them new. Amongst other things I am pleased to observe the prominence given to my examinations for this Chamber of Commerce of the strength, elasticity, and thickness of a large number of silk fibres, which, with the results of their own laboratory, occupy no less than thirty-six pages of the report. I only mention this to show the high importance the Chamber attaches to all that relates to fibre construction. The expenses of this laboratory work have not exceeded £200, which was the estimated sum voted. Besides this important and influential Chamber, Lyons has its Syndicat de l'Union des Marchands de Soie and Chambre Syndicats de la Fabrique Lyonnaise as well as its important Silk Journals.

Is it not time we did something in this direction? America, without any real sericiculture, but with a rapidly-extending silk manufacture, boasts of a splendidly-conducted Silk Journal, whilst England remains without one. I feel sure the only way to recover a leading position is to commence original research and collective action and effort.

We have trusted too much to individual enterprise and effort. This, without collective action, will never get us into the front, or even into a respectable position as compared with France, and the silken products of England will continue to suffer in comparison with those which are perfectioned by the leaven of applied scientific research and technical instruction.

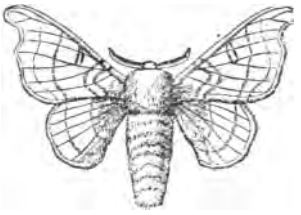
I would draw attention to the official statistics in the Appendices. They show the collective care given in other countries to the various branches of the

silk industry, a care which is nothing short of nurture and great watchfulness, two desirable elements that we would do well to emulate.

It has been a leading motive with the Committee of the Silk Section of the Exhibition to make an effort to revive the English Silk Industry and to call the attention of the public, and especially ladies, to the fact that silk fabrics can be made in England not inferior to those of other countries, both in workmanship, taste, and durability, and to show by the examples brought together in the Section that the preferences which have been accorded to the production of our more fortunate foreign rivals have not always been well founded.

If I, having the honour of being Chairman of this Section, in writing the descriptive catalogue of this very large and varied collection, shall in any degree have contributed to a more successful future for our silk manufacturing towns, the labour will have been well spent.

THOMAS WARDLE.



SILK SECTION.

Introductory Notes to the Indian Collection of Moths, Cocoons, Raw and Thrown Silks, and Fabrics.

THE collection of Indian silk fabrics is exhibited in the upright wall cases which encircle the inner part of the Silk Section. It consists of examples of Eastern fabrics collected in India by the chairman of the section in the winter of 1885-6, added to by more recent arrivals from India for this Exhibition, as well as by some loan specimens, the lenders' names being stated on the labels of the pieces themselves.

This collection evidently possesses a high value both in an artistic and pecuniary sense, and it is to be hoped that its dispersion may not be permitted at the close of the Exhibition, but that an effort will be made to secure it for some central technical museum, there to aid and stimulate the textile student.

One very noticeable feature which pervades this series of "silk attire" is the wonderful variety and beauty of the borders which surround almost every piece of stuff. For richness and harmony of colouring, for originality and positive wealth of designing power, these borders alone stand out as triumphs of the designer's art.

Many, if not all, of them possess meaning, and have a *raison d'être*, social or religious, and from the narrow-figured sacred tape woven in the singularly original little Benares loom to the magnificent sari or brocade with patterned edge, they furnish no small incentive to the pattern designer to go to work with similar motives.

The object of the collection is (1) To illustrate the power and skill of the native silk-weaver in India, and (2) To illustrate the love of patterns which prevails throughout this great dependency, and it may therefore be justly considered a representative one.

The collection in itself may be considered a typical one in design and colouring, and it gives an accurate idea of almost all kind of fabrics of which silk forms the whole or part. It comprises the Corah silks of Bengal, rudely produced by looms that would raise the smile and wonder of Europeans, the coarse Tussur fabrics woven in the same and other districts,

the magnificent kinkhabs of Benares, Ahmedabad and Surat, in which gold and silver form such important decorative features, the plainer silks of Delhi, the delicate and beautiful silks of Thana (a very ancient Christian settlement), the rich fabrics of Yeola, situated not very far from Thana, the lovely brocades of Surat, incomparable for living beauty and Arabian grace of design, the ruder though not less interesting silks of Peshawur and the surrounding country, the satins of Asimgarh, Ahmedabad, Surat, Dhranghra and Kathiawar, the wonderfully constructed patterns of the *patolo* weaving with "tie and dye" warp and woof, the silks of Berhampur, Cambay, Cutch, Indore, Kathiawar and Bombay, all testify not only to the skill achieved by Indian dyers and weavers during many ages, but also for the fascinations which have held these people spellbound in the production of their fabrics of mystery and beauty.

The printed silks of India, too, are by a long way not the least of the interesting decorative work. It is a great pity that anything should have superseded the permanent and striking prints of the old-fashioned pocket handkerchiefs. I have seen them being printed on the squat tables of the Calcutta printers, with indescribable interest, who use their prettily-sculptured little blocks with a dexterity and exactness marvellous to see, requiring no pin points to guide them in their repeats of patterns.

The Indians, like the Chinese and Japanese, have never cared so much for what in Europe is termed excellence of quality, which means, for the most part, mechanical regularity in texture and pattern, and although they have had to weave with threads often much varying in regularity and thickness, yet they have down to to-day managed somehow or other, if they have had a pattern to weave, to put, so to speak, soul into it, and to raise it above the commonplace fabrics so often produced in modern Europe.

For ages, and so long as they continued to use the natural colours which they obtained from their own beautiful dyestuffs, coupled with an ingenuous and traditional taste, they never could go very far wrong in colour. It is now impossible to observe without regret, in passing through India, how the love of the modern brilliant European dyes has affected, to a serious degree, the products of the native loom of to-day.

This is also to be observed as much in another part of silk decoration in India which is as extensive, if not more so, than weaving, viz., the ornamentation of fabrics of cotton, wool, and silk by embroidering with a silk floss or thread. Embroidery in India is on a great scale, much of it unknown because unseen. The natives of Assam, for example, embroider most beautifully, not for sale, but for domestic uses and for marriage and other presents. It is purely carried on as an art, and not for commerce, and it is principally done with a

silk that will one day, I feel sure, be in considerable demand in Europe—I mean the silk produced by the worm of the *Antheræa Assama*, or the Muga silkworm. It was not known to the English until recently that any of this silk was exported. It has often been stated by observers in Assam and India that it was only produced for home consumption, but when I was in Calcutta, making inquiries about this silk, which has engaged my attention now for several years, Sir E. C. Buck, Secretary of State, Revenue and Agricultural Department, and Mr. H. Z. Darrah, Officiating Director, Department of Agriculture, Assam, discovered, whilst on a tour of inspection and search in the native bazaars of Calcutta, that the embroidered turbans made in Dacca were worked upon a cloth of cotton and Muga silk, wholly embroidered with undyed silk of the same kind. This embroidery, which had been very well known as having been sent down to Calcutta and largely worn there by the natives, and also exported into Arabia and other parts of Western Asia, but kept, and still kept, in the hands of a very few merchants, was previously thought to be worked with Tussur silk, the fawn-like colour of which it closely resembled.

At the cocoon reeling frame in the Silk Section may be seen being reeled cocoons of the Muga silkworm, which have been sent from Assam by Mr. H. Z. Darrah, on behalf of the Government. The silk which they yield has a beautiful and clear fibre, and is well worthy of the examination of manufacturers. In colour it resembles Tussur silk, but its fibre is somewhat finer. The silkworm which produces these cocoons is semi-domesticated, and feeds on the leaves of *Machilus odoratissima*, a sweet-scented laurel. It is also found in the extreme north-eastern corner of Bengal. Examples of these Dacca-made Muga silk turbans are in the collection of Indian silks, Nos. 145, 146, and 161.

Too little regard has been paid in recent times to the Indian raw silk of commerce. Its merits have been overlooked and almost forgotton in the incrustations of defects arising from not keeping pace with the more active thought of the West, and its continually developing appliances for amelioration and improvement of quality by better reeling, as well as from other but minor causes.

India sends to Europe but very little raw silk now. It was only 457,600lb. in 1885, in 1874 it was 2¼ million lb., and in 1870 2½ million lb., against an annual export from China to Europe, in 1883, of 7,000,000lb., and from Japan of 3,000,000lb. Just a hundred years ago, Indian silk was so good in quality as to drive out all competitors from the European market, save China and Italy. In 1884 it was so bad that European manufacturers could not buy it. It had gradually lost its reputation, from want of quality. But the silk itself,

that is its fibre, as it rested in the cocoon, had not altered in these hundred years. The method of manipulation (I mean the reeling of it from the cocoon), had not kept pace with that of other countries; it had in fact fallen back, gone worse, until Indian silk almost found no place in the world's market; and worse still, the manufacturing people of India would not buy it. In a few of the Bengal districts, such as Murshidabad and others, it is used for weaving Corah silks, but generally over India it is not to be found.

The manufacturers of Poonah told me they bought China silk because Bengal silk was of such defective quality. From the Deccan to Calcutta, and from Calcutta to Benares, and on to Peshawur, I found either China or Bokhara silk; and so down Rajputana to Ahmedabad, Baroda, Surat, Yeola, and Thana, everywhere the native silk avoided, and everywhere the same reason given, its want of thread regularity.

India only wants the application of progressive operations, and the immediate adoption of whatever method the progress of science and mechanical art may bring, to keep pace with and to produce the better results of Europe. That there is ample scope may be inferred from the fact that for the ten years ending 1883 we in England have been purchasing manufactured silks from countries in Europe to the extent of more than £11,000,000 annually. I extract the following interesting statement from Mr. J. E. O'Conor's "Review of the Trade of India in 1884-5:"—

"Silk was imported to a much smaller extent than in the last two previous years, only 1,831,702lb., which was 17 per cent less than in 1883-4, though still a very large quantity for a country which is held to be a great silk-producing country. Whatever may be the capacity of the country for producing silk in large quantities, it is clear that while India imports more silk than it exports (the bulk of the exports being, moreover, only waste or chassam), the country must more properly be called an importer and consumer rather than a present producer of silk. Most of the imported silk comes from China and Siam, via the Straits of Bombay mainly, and Burmah in smaller degree. Even Bengal, however, the great silk-producing province, imported 212,349lb. of silk last year."

Having convinced myself, by lengthened microscopical study of the structure of Bengal and other cocoons, of the wonderful regularity in which the silkworm deposits its silken thread, I felt that the fault did not lie with the worm, but in the earliest stage of manufacture, that of reeling or unwinding the silk from the cocoon.

I have had many opportunities of observing silk reeling in both France and Italy for many years past, and I felt that if the same care and appliances were used in India as in these countries, silk of proper quality could be obtained.

In that I perfectly succeeded, and in no case in India was it told me that an improved thread was not the result—in every case it was admitted

I found by using exactly the same appliances as those of Italy that there was no difficulty in unwinding or reeling the cocoon with almost perfect regularity, and in order that this possibility may be exemplified to those who may have before doubted it, the Silk Section Committee have decided not only to have this system in daily practical operation but also two of the best French methods. A large quantity of Bengal cocoons have been sent from the Bengal filatures of Messrs. Robert Watson and Co., of Rajshaye, and a French *fileuse* is reeling them into raw silk daily during the time the Exhibition is open. At the other end of the reeling stand is the Italian method in operation, and cocoons from Cyprus, Adrianople and elsewhere are also being reeled. Tussur and Muga cocoons are also occasionally being reeled, and on short notice being given any person can see the reeling of Tussur or Muga cocoons in operation.

One thing has been proved, and I have been permitted to bring it home to the minds of impartial and unprejudiced manufacturers in England and on the Continent, that the Bengal cocoon has not the inherent imperfections which it was thought pertained to it, and that there is a prospect of a greatly enlarged output of silk from Bengal for several important purposes in the silk trade of Europe and America.

First, Sewing Silk.

Several of the best manufacturers of silks for sewing purposes in Leek have assured me, after full examination and trial, that this silk is peculiarly applicable to their trade.

Mr. S. Gibson, a Leek manufacturer, writes:—

"I am very pleased with the five bales of Bengal silk I have just bought; they work very freely, almost running from beginning to end of the skein without breaking down, which means winding without loss. The strand is of nice even size, suitable for the Leek trade, free from rough or slubby places, so much so as to render one important process in the manufacturing unnecessary, viz., cleaning. I am working these new Bengals in both the bright and washed state, and they are coming out at about one-half the cost of original Bengals. If this improved reeling is maintained it must have a serious influence on the China and Canton raws."

Mr. S. Goodwin, another silk manufacturer, and President of the Leek Silk Association, writes:—

"I have worked the sample skein of Bengal raw silk, and am pleased to say that it is simply perfection. As to reeling, I may say that it wound almost without a break from end to end."

This skein was reeled by me in Bengal with the Tavelette Keller, also erroneously called Consono.

The silk of the Bengal worm, by its greater elasticity, is much better adapted for sewing silk than any other. I have estimated, in experiments conducted during the last few days, the tension of the bave, or double fibre, deposited by the silkworm, of the Bengal Madrassee or hot weather cocoons, the Bengal Desi or November bund cocoons, and of Italian cocoons. The results are shown in the following table, each figure being the average of numerous determinations, and representing the number of centimetres which three decimetres of the bave is capable of stretching before it breaks :—

Cocoons.	Tension at the end of the cocoon bave which is at the surface of the cocoon immediately beneath the superficial loose fibres or waste.	Tension at the middle of the cocoon bave.	Tension at the end of the cocoon bave which is nearest the telette or inner envelope.
Madrassee Cocoon	5·5	9·0	5·0
Desi Cocoon	7·0	7·2	5·9
Italian Cocoon	4·5	6·1	4·4

Second, Organzine and Tram for Weaving.

Mr. Nicholson, silk manufacturer, Macclesfield, in a letter to me, writes the following :—

"In answer to your inquiry, I consider that good Surdah raw, when well reeled with plenty of spin upon it, will work well. It will then be a good substitute for Italian, its cheapness being the reason for its use."

In addition to this, I may say that Mr. Nicholson is speaking of a Bengal silk that was not reeled by the Italian method. I contend that there would be no greater evenness of thread in the Italian silk over that of Bengal if the Italian method of reeling were used.

Messrs. G. Davenport and Co., of Leek, to whom I sent a portion of the 10 to 12 deniers, which I saw reeled by the Tavelette Keller in Bengal, have thrown it into organzine and tram, and send me the following report: "The slip winds beautifully. Enclosed are samples of two threads tram and a 500 yards skein of organzine. The silk is very clean. We consider it equal to ordinary Italian. It was running for an hour and only broke down once."

Now it is necessary to say that, even with every improvement, Bengal silk may not be expected to rival or supersede the *finest* qualities of silk in the market. A reason or two from me may suffice. It will never be as white as China silk, because one is from a yellow cocoon and the other from a white one. It will not "boil-off" or condition as well as the silks of Italy, China, or

Japan, because it contains more gum or grès than these, and this brings me to an entomological point, namely, it is probably not of the same species; but of this further on.

I must guard myself against being thought slack in acknowledging the claims which at least three Bengal firms have on the consideration of European manufacturers for careful reeling. The excellence of the silk produced at Surdah and its allied factories in the district of Rajshahi and other parts of Bengal, that of the Bengal Silk Company's factories, the chief of which is at Berhampur, and that of the well-known firm of Messrs. Louis Payen & Cie., are too well known to need mention. I acknowledge with much pleasure the kindness I received from these firms, and they are well deserving of the confidence of all interested in silk.

But apart from the efficiency of these well-known firms, there remains the much larger native industry, the reeling that is carried on in the numerous villages under the shade of banyan, palm and mango groves. I visited many of these and found the appliances very rough and rude, the reeling by them varying from 10 to 20 cocoons in almost as many seconds.

In the Rajshahi district alone, out of 97 filatures, 63 are native and the remaining 34 European, eleven to twelve thousand natives being employed in silk reeling in this district alone, 150 square miles of which exist under mulberry cultivation.

If these village native filatures can be induced to improve their reeling, a largely extended industry lies waiting for them in their own country; for it goes without saying that the resources of China and Bokhara would not be drawn upon if Bengal silks were of the required quality. Many native manufacturers assured me they would much prefer to buy Indian silk if only the quality were good enough. The consumption of silk for native uses alone is enormous. All Hindoos wear it at meals and worship. The Mahommedans wear *mashru*, or cloth of cotton-warp and silk weft, the wearing of pure silk fabrics being forbidden by the Koran.

Since I was in India another silk-reeling machine has been brought to my notice by the Under Secretary of State for India. Its inventor, Mr. Serrell, of New York, claims for it that unskilled labour can be used with its aid in reeling cocoons. This machine is automatic, and by means of a feeble electric current which controls the feed, takes up another cocoon thread when one breaks, so that a new cocoon is added whenever required to keep up the size of the thread. It is stated to do two and a half times as much work as the present system, at a saving of 2s. 9½d. per lb. in wages, and one reeler can attend to six bassines.

I am sorry it has not been possible to have this machine at work in the Exhibition, side by side with the other three, but I have lately seen it working in London, and have been very much struck with its automatic action. It was reeling Bengal cocoons without any difficulty, and it seems to me to be an appliance particularly suited to silk-producing countries where labour is dear, such as in our Colonies.

By this apparatus the cocoons are softened in a few seconds, and the reelable ends found without brushing the cocoons. They are then transferred to the machine, and placed singly in slots on a revolving disc. The thread is taken automatically from each cocoon by a self-acting hook immediately it is needed at the tavelette, and this want is indicated by tension drums, in electrical connection with the hook, whenever the combined thread of raw silk becomes less than its normal strength.

Explanatory notes and printed particulars are published, and may be had, as well as all information respecting this interesting invention, from Mr. F. B. Forbes, 5, St. James's Place, London, S.W.

It appears to be able to do what Mr. Serrell claims for it, and it promises fair to be a valuable addition to the Bengal silk industry, and I commend it to those interested for a thorough investigation of its capabilities.

Indian sericiculture has received a new impetus in a scientific direction. When in Calcutta, I suggested to Sir E. C. Buck the desirability of a scientific investigation of the silkworm being commenced with a view of inquiry into and amelioration of disease, the breeding of the worms, the growth of the mulberry food, the exorbitant rental of the mulberry lands, and all that relates to the production of good cocoons.

Mr. Buck acceded, and at once set about organising the means. He charged the Indian museum at Calcutta with this inquiry, and Mr. Wood-Mason, the assisting superintendent, immediately began it methodically. The firstfruits of it were for the first time to be seen last year in the Indian Silk Culture Court of the Colonies and India Exhibition, in a series of cases of moths and cocoons of extreme interest. Hitherto the entomologist has alone occupied this field of research, but now the zoologist takes part with him in the study, and we may confidently anticipate that, when biological and morphological attention has been directed to the subject, we shall be in possession of much valuable information, which, in my opinion, Bengal sericiculture has for a long time greatly needed. Thus the absolutely entomological phase merges into the zoological one, and the morphological study of egg, larva, and moth becomes an important adjunct to this industrial pursuit which cannot fail to be greatly strengthened thereby. A sericicultural

laboratory has been constructed at the Indian Museum, Calcutta, and life studies of various species of silkworms are being daily conducted.

When in Bengal I learned from Mr. Morey, of Surdah, that about 60 per cent of the Bengal silkworms died in their larval state, and I memorialised the Government of India for an inquiry to be made into the causes. Immediate action was taken. Mr. Wood-Mason, whom I have before mentioned, was commissioned to make inquiries on the spot, and, conjointly with Mr. Nitya Gopal Mukharji, who was summoned from his agricultural studies at Cirencester College, England, to assist Mr. Wood Mason in the silk districts, they have issued most important pathological and nosological reports, revealing the fact that the worms are ravaged by diseases of four kinds, which they designate *Kata*, *Kala shira*, *Rasa*, and *Chuna*. The first is the *pebrine* of Europe, which, beginning in Spain about 1854, spread over France, Italy, Greece, Broussa, and other sericicultural districts of Southern Europe, devastating and threatening to annihilate the silk-growing industry, until, thanks to the researches of Monsieur Pasteur, means were discovered to check its ravages, if not to extirpate the formidable disease. Measures are now being taken by the Government of India to eradicate these diseases. I have received from Mr. Nitya Gopal Mukharji a pathological collection of eggs, larvæ, moths, and cocoons of high interest. It is placed on the entomological collection in that part of the Silk Section which is in the Gallery of Approach, and a seriatim description will be found at the end of Part 1 (Indian Silk Entomology) of this catalogue.

In the published catalogue of the Indian Museum collection the Desi, or indigenous cold weather moth, is stated to be *Bombyx fortunatus*, and the Nistry or Madrassee one *Bombyx cræsi*. The Eria silkworm is named *Philosamia ricini* instead of *Attacus ricini* as heretofore, and *Antheræa Assama* is changed into *Antheræopsis Assama*.

It would be wrong if I did not here mention the great service to the entomology of Indian silk-producing Lepidoptera rendered by Mr. F. Moore, to whom is accorded by European consent the highest authority on this subject. For many years Europe has been indebted to him for much patient and laborious investigation, and it is to be hoped that his researches will before long be published.

In the French report of the Lyons Silk Laboratoire for 1885, which I have already alluded to, is the drawing of a new Chinese bivoltine wild silk-moth, which feeds on the mulberry leaf. Mr. Moore has named it *Rondotia Menciana*. This genus is a new one, and is so named by him as a souvenir of the important works on silk of my old friend and former president, Monsieur Rondot. The specific name is to recall to recollection the old Chinese philosopher Mencius.

It may turn out that the term "Mori" may have more of a generic significance than specific, indicating simply the mulberry feeders. In fact there is some doubt as to whether we really know what *Bombyx mori* means, or whether it exists at all as a correctly defined species.

I feel certain that there is a great difference between the mulberry-feeding silkworms of Bengal and the so-called *Bombyx mori* worm of China and Japan, which is the kind now being acclimatised in North India. The extraordinary difference seen in the respective cocoons shows this plainly enough.

The Bengal worm I consider to be best suited to the Bengal climate.

I do not believe it can be acclimatised in Cashmere, the Punjab, the N.W. Provinces, or in Assam, but without doubt the *Bombyx mori* can, and it is the proper worm to try there. Whether they have structural differences sufficient to be *specific* I must leave to entomology and biology to determine. If they are not *specifically* different, there is sufficient divergence to group them as distinct varieties of the Mori, and I repeat they are exactly suited to those parts of Bengal where they are found, and through which for the most part the Ganges flows. I believe also they are indigenous to this part of India.

It may be useful here to state that the Bengal silkworm of the rainy and hot weather bund or season is called locally the Nistry-poloo and Madrassee worm; that of the November or cold weather bund or season is called the Desi or Chota-poloo worm. They are designated by Mr. Wood-Mason respectively *Bombyx cræsi* and *Bombyx fortunatus*, though perhaps only provisionally. It is these worms which produce the raw silk of commerce.

Concurrently with this branch of inquiry I most strongly advocate the commencement of a structural one, such as has been started in Lyons, and that the fibres of all kinds of cocoons should undergo systematic examination and the results recorded. In this way one inquiry will help and strengthen the other. To be of practical and industrial use, both should be conducted simultaneously; for silk manufacturers would, I am sure, agree with me that it is of the first importance that the strength, elasticity, and thickness of fibres should be known, as well as their varying states in health, disease, and changing climatic conditions.

The importance of this would soon be seen in the comparison of Bengal silks with those of Cashmere, the North-West Provinces and the Punjab, and valuable information as to climatic conditions obtained.

From these comparisons with the better known silks of both East and West would be made, and important data established.

That there is a great future in store for sericiculture in India is beyond doubt, and if only the same energy were applied as that brought to bear on

the production of Indian wheat and Indian tea, the day would not be far distant when the silk centres of Europe would desire the silks of Bengal as much as they now do those of China and Japan.

That India should take a fair position in the supply of the world's demand for silk is not for Englishmen to gainsay. On the contrary, India, with a greatly increasing population, the natural result of a great continent at peace with itself, and a growing security from depopulation by famine, an improved sanitary administration and more scientific medical enlightenment and instruction, it goes without saying that Englishmen, of all others, should feel the greatest possible interest in the material welfare of India, and especially in everything which tends to the organisation and stimulus in her varied industries, particularly one which is so capable of being so widely spread as sericiculture.

Tussur silk, too, as adapted for export, has been, during the last ten years, very slow in taking root in India, and large supplies have had to be obtained from China to meet the gradually growing European demand. At the Paris Exhibition of 1878, Sir Philip Cunliffe-Owen determined, with my assistance, to give this silk an opportunity of asserting itself, and afterwards, in the Indian Museum, at South Kensington, he took care that its capabilities and uses should be conspicuously displayed. Not a little of the industrial growth of this useful though wild silk is due to his encouragement, and now in this Exhibition can be seen the fruits of all the care which has been bestowed upon it in various ways, and I am more than pleased to state that India now has an enormous and yearly increasing demand.

I am indebted to my friend Mr. Gupti, of Bombay, for the translation of several Hindoo quotations, and for the explanation and description of those Indian fabrics having local meaning and interest, notably those which contain decorative treatment symbolical of the religious faiths of the peoples of India.

A number of gentlemen in India are vieing with each other to improve the methods of reeling, and with singular success. In the exhibits of Tussur raw silk are shown results which a few years ago would have been thought to be impossible. Already this silk is capable of far more extended uses than ever before, and although it cannot be expected, on account of its structure and properties, to take the place of the more beautiful silk of the *Bombycidæ*, it has its uses, and those in a much higher degree than it was ever thought susceptible of.

Besides the silks already mentioned, there are others, such as the Eria silk, obtained from the *Attacus ricini* silkworm, which will gradually find extended utility; and great lessons may be learnt by those who care to

observe, in these varied exhibits, both as to the reeling of the cocoons, the spinning of the waste fibres, and the dyeing and weaving of the silks.

On both sides of the Ganges, Bengal is capable of producing silk to a vastly extended degree, not only enough for all the requirements of India, which are really very great, both for weaving, embroidery, and minor purposes, but for a greatly increased export trade. Under European careful supervision the native Indian works beautifully. He cares more for patient manual labour and real handicraft traditional work than he does for progressive thought or invention, and it is not to be wondered at that it has been left to the quicker brain and the desire for development that characterises the people of the West to produce results which find a readier market than his own unaided and unguided efforts can secure.

In connection with India one is naturally led to think of mutual interests in two ways. (1) Silk manufacturing, which we too, in England, can share with our Indian fellow-subjects, and silk growing, a field for India, in which we cannot hope to share, but which ought to occupy more of our care and countenance than it does.

The happiness and prosperity of India is, or ought to be, involved in the happiness and prosperity of England, and contrariwise if Imperial Federation has any meaning, and because of our grave and Christian responsibilities there.

How Lyons cherishes her Gard, Drome, and Vaucluse departments, which send to her dyehouses and looms such carefully-reared silk! How these silk-worm-rearing districts endeavour, by the most careful attention to all the minutiæ of breeding and feeding, to furnish Lyons with silken fibre of such beautiful quality that the cultured taste gives a ready preference to fabrics produced under such conditions! And so with Italy in both ancient and modern days! Why should it not be so with us, having the beautiful silk Paradise of India committed to our charge and responsibility?

We are, in our sericicultural wealth, through having India, more than equal to France, Italy, or any other country in the world, being in some respects even better off than China, for we are not confined to one species of silk nor to two. India can boast of the greatest silk-producing fauna in the world. She has her varieties of Bombycidæ, which feed on the mulberry leaf, both wild and domesticated; she has her jungle broods of worms of many sorts, more or less useful or to become useful by-and-by; her Tussur silk is now an established and well-rooted industry, a few years ago in export non-existing; her Assamese women are clad in silks of the Eri and Muga worms, of which as yet we know practically nothing, and silken stuffs are handed down from matron to spinster but little the worse for the wear of a generation.

Having been sent out to India in the winter of 1885-6 to obtain accurate information of the silk industries, I returned much impressed with the necessity devolving upon us to cherish and develop them, so that we may have reason to know that our interests there are not wholly selfish, and that her immense and struggling populations may participate in our comforts and success.

PART 1.

INDIAN MUSEUM, CALCUTTA.

A PRELIMINARY LIST OF

ENTOMOLOGICAL SPECIMENS

First collected and arranged for the Silk Court of the Colonial and Indian Exhibition, London, 1886, and afterwards transferred, by permission of the Government of India, to this Exhibition. By J. Wood Mason, Esq., Officiating Superintendent of the Indian Museum, Calcutta.

No. of Tray.	No. of Specimen.	Name and Nature of Specimen.	Locality.	Remarks.
I.	1, *a—j*	*Bombyx mori*, Linn. Cocoons from Indian eggs.	Lahore, Panjáb.	
	2, *a—j*	*Bombyx mori*, Linn. Cocoons from Japanese eggs.	Ditto.	
	3, *a—e*	*Bombyx* sp. Cocoons.	Kotnaina, Gurdaspur, Panjáb.	Rearer Subhan.
	4, *a—h*	*Bombyx* sp. Cocoons.	Ditto.	Ditto.
	5, *a—e*	*Bombyx textor*, Hutton. "Bara Poloo." Cocoons.	Gonatea.	
	6, *a—c*	Ditto Moths, 2 ♂ 1 ♀.	Ditto.	Bred in Museum.
	7, *a—f*	Ditto Cocoons.	Serampore, Hughli District.	
II.	8, *a—h*	*Bombyx meridionalis*. Cocoons.	Cuddapah District Madras.	
	9, *a—h*	Ditto ditto	Induradi village, Kollegal Taluk, Koimbatore District.	
	10, *a—j*	*Bombyx* sp. Cocoons.	Serampore, Hughli District.	
	11, *a—c*	*Bombyx fortunatus*, Hutton. "Desi silkworm." Moths, 2 ♂ 1 ♀.	Sadah, Rajshaye.	Bred in Museum.
	12, *a—h*	Ditto Cocoons.	Ditto.	

No. of Tray.	No. of Specimen.	Name and Nature of Specimen.	Locality.	Remarks.
II.	13, *a—i*	*Bombyx cræsi*, Hutton. "Madrassee silkworm." Cocoons.	Sardah, Rajshahye.	
	14, *a—c*	Ditto Moths, 2 ♂, 1 ♀.	Ditto.	Bred in Museum.
	15, *a—b*	*Bombyx* sp. Cocoons.	Rungpore.	
III.	16, *a—c*	*Bombyx* sp. "Pat silkworm." Cocoons.	Assam.	? = Bara Poloo.
	17, *a.*	*Theophila huttoni*, West w. ♂ ♀ Moths.	?	From Hutton's collection.
	18, *a—b*	*Theophila huttoni*, West w. Cocoons.	Pokaria, Govindpore.	From wild mulberry.
	19, *a—e*	*Philosamia ricini*, Jones. Wild Cocoons.	Lakhimpore, Assam.	
	20, *a.*	Ditto Moth, ♂.	Assam.	Bred in Museum.
	21, *a—h*	*Philosamia ricini*, Jones. Cocoons.	Kamrup, Assam.	
	22, *a—f*	Ditto ditto	Sylhet, Assam.	
IV.	23, *a—h*	Ditto ditto	Dinagepore.	
	24, *a—b*	Ditto Moths, ♂, ♀.	Ditto.	Bred in Museum.
	25, *a.*	Ditto Mass of Cocoons.	Ditto.	Bred in Museum.
	26, *a—b*	Ditto Moths, ♂, ♀.	Burma.	Var. *a.*
	27, *a—b*	Ditto Cocoons.	Assam.	
	28, *a—b*	Ditto Moths, 2 ♂.	Burma.	Var. *b.*
V.	29, *a—f*	*P. cynthia*, Drury. Cocoons.	Near Almora.	
	30, *a—b*	Ditto Moths, ♂, ♀.	Sikkim.	
	31, *a—b*	*Attacus atlas*, Linn. Moths, ♂, ♀.	Burma.	Var. *a.*
	32, *a—b*	*A. atlas*, Linn. Moths, ♂ ♀	Burma.	Var. *b.*
VI.	33, *a—c*	Ditto Cocoons.	Aligarh.	
	34, *a—b*	Ditto Moths, ♂ ♀	Sikkim.	
VII.	35, *a*	*A. edwardsii*, White Cocoon.	Lakhimpur, Assam.	"Bun Muga."
	36, *a—b*	Ditto Moths, 2 ♀	Sikkim.	
VIII.	37, *a*	*Actias selene*, McLeay, Cocoon.	Sylhet.	
	38, *a—b*	Ditto Moths, ♂, ♀.	Sikkim.	

No. of Tray.	No. of Specimen.	Name and Nature of Specimen.	Locality.	Remarks.
VIII.	39, *a—b*	*A. leto*, Doubleday, Moths, ♂, ♀.	Ditto	*A. mamas* is the opposite sex of this species.
IX.	40, *a—e*	*Antheræopsis assama*, Helfer. Cocoons.	Sibsagar and Kamrup, Assam.	Three pale ones = "Mezankoori Muga."
	41, *a—d*	Ditto ditto Cocoons.	Lakhimpur, Assam.	On "Hingari" leaves.
	42, *a—b*	Ditto ditto Moths, ♂, ♀.	Mungaldai, Assam.	Bred in Museum.
	43, *a*	*Cricula trifenestrata*, Helfer. Bunch of Cocoons.	Ranchi.	! Winter Cocoons.
	44, *a—d*	Ditto Moths, 1 ♂, 3 ♀	Ditto	Bred in Museum.
X.	45, *a—c*	*Antheræa mylitta*, Drury. Cocoons.	Singbhoom.	
	46, *a—b*	Ditto ditto Cocoons.	Phillour, Panjáb.	
	47, *a—c*	*A. mylitta*, Drury. Cocoons.	Burdwan.	
	48, *a*	*A. mylitta*, Drury, var. Cocoon.	Calcutta.	Showing mode of attachment to shoot of *Terminalia catappa.*
	49, *a*	*Antheræa mylitta*, Drury, var. Cocoon.	Calcutta.	To show mode of attachment to petiole and midrib of leaf of *T. catappa.*
	50, *a*	Ditto ditto	Ditto	Showing four successive annular attachments below the pulvinus of as many leaves of a shoot of *Terminalia arjuna.*
	51, *a—b*	Ditto Moths, ♂, ♀	Ditto	Bred in Museum from wild cocoons found on *T. catappa* ("Badám.")
XI.	52, *a—g*	*Antheræa mylitta*, var. *nebulosa* Hutton, 1 ♂ 6 ♀ Moths.	Maunbhum.	Differing greatly on the upper surface in the shade of the ground colour, they are all alike below in both sexes. Bred in Museum.
	53, *a—b*	*Antheræa frithii* Moore, ♂ Moths.	Sikkim.	Cocoon unknown.

No. of Tray.	No. of Specimen.	Name and Nature of Specimen.	Locality.	Remarks.
XII.	54, *a*—*b*	*Antheræa helferi*, Moore, ♂ & ♀ Moths.	Sikkim	Cocoon unknown.
	55, *a*—*b*	*Caligula simla* Westwood, ♂ & ♀ Moths.	N.-W. Himalayas.	♂ from Mussoorie; ♀ from Kumaon from the Hutton collection.
	56, *a*	*Neoris huttoni*, Moore, ♀ Moth.	Ditto.	From the Hutton collection.
	57, *a*—*b*	*Rinaca zuleika*, Hope, ♂ Moth and Cocoon.	Sikkim.	Silk of no practical value.
	58, *a*	*Salassa lola*, Westwood, ♀ Moth.	Ditto.	Cocoon unknown.

Pathological and Nosological Collection of Indian Larvæ, Cocoons, Moths, Eggs, &c., sent and described by Mr. Nitya Gopal Mukharji.

LARVÆ.

Bottle containing in spirit Larvæ of *Philosamia ricini*, reared at the Berhampur Experimental Nursery, April, 1887, showing the disease known as pebrine.

Bottle containing Larvæ of *Bombyx crœsi*, reared at the Berhampur Experimental Nursery, May, 1887, showing the disease known as muscardine.

Bottle containing Larvæ and Imagos of *Bombyx crœsi*, reared in the Berhampur Experimental Nursery, showing the disease known as flacherie.

Bottle containing Larvæ of *Bombyx crœsi*, reared in the Berhampur Experimental Nursery, showing the disease known as sarcina bombycis.

Bottle containing Larvæ of *Bombyx fortunatus*, reared in the Berhampur Experimental Nursery, fly-blown and pebrinous, April, 1887.

Bottle containing dipterous flies, parasitic, which deposit eggs on the larvæ of the *Bombycidæ*. Berhampur Experimental Laboratory.

The cuts show the various forms of the Bacteria, magnified 500 times :—

Pebrine.

Flacherie.

Muscardine.

COCOONS.

Cocoons of *Bombyx crœsi*, containing chrysalides, infected by muscardine. The diseases muscardine and sarcina do not probably go beyond the pupal stage.

Sun-dried cocoons of *Bombyx fortunatus* (the *Desi* or *Chota polu*), considered indigenous. It is the cold weather or November bund species, *Bombyx crœsi* being the hot weather bund species. It is next in quality to *Bombyx textor*. Period of life about 40 days. *Bombyx fortunatus* is distinguished from *Bombyx crœsi* by (1) the absence of black marks on head and back which characterise the *Bombyx crœsi* larvæ; (2) by the smaller size of moths and of larvæ; (3) by the more cylindrical shape of the cocoons, *Bombyx crœsi* being of almost almond shape; (4) by possessing a larger quantity of finer silk as compared with *Bombyx crœsi*.

Bombyx crœsi cocoons sun-dried, white variety. There are generally a few white cocoons in a lot of yellow ones. These were picked out and reared separately at the head experimental nursery, at Berhampur. These may prove a very valuable crop. The white cocoons from the *Bombyx fortunatus* will be similarly picked out for rearing in the cold weather, and the seed distributed.

Cocoons of *Bombyx mori*.—French cocoons reared at Berhampur. The worms get very much diseased, particularly with pebrine. The eggs continued hatching from the middle of December to the middle of April. The last lot of worms all died. I do not consider these at all suited to this climate. (Note.—Probably the food difference may have had a deleterious influence, the French worms being fed on the leaves of mulberry trees, whilst those of Bengal are leaves grown on the mulberry as a shrub.—T. W.)

Bulla Cocoons.—I am not quite sure what these are. They are confined to Midnapur and Hoogly. Probably they are produced by selection of white cocoons from China. They are a monthly species, and, being white, are more appreciated than the yellow.

Cocoons of *Bombyx sinensis* (China palm).—These are confined to Midnapur at present. These specimens may be particularly bad, but the whole stock is said to be degenerating. They are a monthly crop.

Cocoons of *Philosamia ricini* (Eri cocoons) from Assam ; larvæ fed on castor-oil leaves.—These are very much pebrinised.

Cocoons of *Cricula trifenestrata*, from Ranchi.—I do not consider these cocoons of much commercial value, unless they can be domesticated and improved. (Note.—It is, perhaps, premature to decide. I am having experiments made by spinners, two of whom are operating upon 1,000lb. each, which I have obtained for them from Ranchi, and for which they have paid 1s. 6d. per lb. in the dried state.—T. W.)

Four kinds of Tussur cocoons, labelled respectively Mugas, Largos, Pabahs, and Burgoys. The systematic position of these cocoons (so divided and named) has not been satisfactorily ascertained. They are probably only a native filature classification according to size.

The Mugas are the largest Tussur cocoons produced. The largest measures 2½in. in length, and 1½in. in breadth.

MOTHS AND EGGS.

A number of male moths of *Bombyx cræsi* (after separation). Male moths are smaller than the female.

Series of papers containing diseased moths, eggs, and larvæ of *Bombyx cræsi*, all afflicted with pebrine, and showing method of rearing for microscopic selection ; and rejected moths and eggs after microscopic examination.

Flacherie in *Bombyx cræsi*, showing method of rearing for microscopic selection, and with moths and eggs rejected after microscopic examination.

Eggs and moths in which bacteria were found. Evidence of disease not yet reported, and as yet noticed only in three moths. Although fatal, this disease is not important.

Live eggs of *Bombyx textor* laid on thin silk. To hatch in November.

PART 2.

Indian Sericiculture. Collection of Various Kinds of Cocoons, lent by the Government of India.

This list will be found of especial usefulness to those who wish to ascertain the localities where the various kinds of Cocoons mentioned are produced.

1 Cocoons of the mulberry-fed silkworm. Rangpur, Bengal.

2 Cocoons of the-mulberry fed silkworm. Bogra District, Bengal.

3 Cocoons of the mulberry-fed silkworm. Pierced by the exit of the moth. Bogra District, Bengal.

4 Cocoons of the mulberry-fed silkworm. Pierced by the exit of the moth. Serampur, Bengal.

5 Cocoons of the mulberry-fed silkworm. Unovened, *i.e.*, sun-dried. Serampur, Bengal.

6 White cocoons of the mulberry-fed silkworm, *boro polu morahkoah.* Murshidabad, Bengal.

7 White cocoons of the mulberry-fed silkworm, *boro polu kachi koah* Murshidabad, Bengal.

8 White cocoons of the mulberry-fed silkworm, *boro polur lat.* Pierced by the exit of the moth. Murshidabad, Bengal.

9 Red cocoons of the mulberry-fed silkworm, *chhoto polur lat.* Pierced by the exit of the moth. Murshidabad, Bengal.

10 Red cocoons of the mulberry-fed silkworm, *chhoto polu morah koah.* Murshidabad, Bengal.

11 Red cocoons of the mulberry-fed silkworm, "*chhoto polu kachi koah.*" Murshidabad, Bengal.

12 Cocoons of the mulberry-fed silkworm. Pierced by the exit of the moth. Birbhum, Bengal.

13 Cocoons of the mulberry-fed silkworm. Birbhum, Bengal.

14 Cocoons, *(kôa)* of the mulberry-fed silkworm which obtained a bronze medal at the Doom ran Exhibition, 1885. Dinapur, Bengal.

15 Cocoons of the mulberry-fed silkworm. Gaya, Bengal.

16 Cocoons of the mulberry-fed silkworm, reared in the Sudder Subdivision, Howrah, Bengal.

17 Cocoons of the mulberry-fed silkworm. Dhantala, Bengal.

18 Cocoons of the mulberry-fed silkworm. Prescribed in medicine at Cawnpore as an aphrodisiac or nervine tonic. Sent by E. C. Ozanne, Esq., Director of Agriculture, Bombay Presidency.

19 White and yellow cocoons of the mulberry-fed silkworm, reared from Japanese eggs. Lahore, Punjab.

20 Cocoons of the mulberry-fed silkworm. Eggs received from Dehra Dun. Saharanpur, North-Western Provinces.

21 Cocoons of the mulberry-fed silkworm. Eggs raised in Saharanpur. North-Western Provinces. Saharanpur.

22 Cocoons of the mulberry-fed silkworm. Dehra Dun, North-Western Provinces.

22A Buff cocoons of the *Bombyx mori*, from French eggs. Reared at the "Lister Grant," Dehra Dun, North-Western Provinces.

23 Yellow-buff cocoons of the mulberry-fed silkworm, *Bombyx meridionalis*. Cuddapah, Madras. (These cocoons probably were wrongly labelled at Madras, and it is more likely they are those of *Bombyx mori*.)

24 Cocoons of the mulberry-fed silkworm. Pierced by the exit of the moth. Reared on the Retreat Estate, Yerkad, Madras, from Mysore silkworms. Exhibited by Deputy-Surgeon-General J. Shortt, M.D., F.L.S., F.Z.S., Yerkad, Shevaroys.

25 Cocoons of the mulberry-fed silkworm, *Bombyx meridionalis*. Kanara, Madras.

26 White cocoons of the mulberry-fed silkworm. South Australia. Exhibited by Sir Samuel Davenport. (For silk woven therefrom see p. 114.)

27 Tussur silk cocoons, "*Muga*." Singbhum, Bengal.

28 Tussur silk cocoons, "*Daba*." Singbhum, Bengal.

29 Tussur silk cocoons, "*Laria*." Singbhum, Bengal.

30 Tussur silk cocoons, "*Bogai*." Singbhum, Bengal.

31 Pierced Tussur silk cocoons, "*Bugoy*." Singbhum, Bengal.

32 Pierced Tussur silk cocoons, "*Daba*." Chaibasa, Singbhum district, Bengal.

33 Pierced Tussur silk cocoons, "*Laria*." Chaibasa, Singbhum district, Bengal.

34 Tussur silk cocoons. Ranchi, Chutia Nagpur, Bengal.

35 Tussur silk cocoons. Santal Jungles, Manbhum, Bengal.

36 Pierced Tussur silk cocoons. Santal Jungles, Manbhum, Bengal.

37 Tussur silk cocoons. Birbhum, Bengal.

38 Tussur silk cocoons. Bardwan, Bengal.

39 Pierced Tussur silk cocoons. Bardwan, Bengal.

40 Tussur silk cocoons. Darjiling, Bengal.

41 Tussur silk cocoons. Ganjam district, Madras.

42 Tussur silk cocoons. North Arcot, Madras.

43 Tussur silk cocoons. Dudhi, Madras.

44 Pierced Tussur silk cocoons. Retreat Estate, Yerkad, Madras.

45 Tussur silk cocoons. Madras.

46 Tussur silk cocoons. Cuddapah, Madras.

47 Tussur silk cocoons. Phillaur, Punjab.

48 Tussur silk cocoons. Beas, Punjab.

49 Tussur silk cocoons. Gaya, Bengal.

50 Tussur silk cocoons of very pale colour. Royal Gardens, Baroda, Bombay Presidency.

51 Tussur silk cocoons. Chaibasa, Singbhum.

52 Pedicles of Tussur silk cocoons, prepared for spinning. Lent by T. F. Peppé, Esq., Arrah, Bengal.

53 Cocoons of the Eria silkworm, *Attacus ricini.* Kamrup, Assam.

54 Cocoons of the Eria silkworm, *Attacus ricini.* Assam.

55 Cocoons of the Eria silkworm, *Attacus ricini.* Rangpur, Bengal.

56 Cocoons of the Eria silkworm, *Attacus ricini.* Lakimpur, Assam.

57 Red and white cocoons of the Eria silkworm, *Attacus ricini.* Sylhet, Assam.

57A Eria cocoons of high quality, reared for export by Mr. Mackenzie, of Sylhet, who is at present able to produce about 2,000lb. per month. The remarkable whiteness is obtained by proper and systematic feeding, &c., of the worms.

58 Cocoons of the Eria silkworm, *Attacus ricini.* Jalpaiguri, Bengal.

59 Red cocoons of the Eria silkworm, *Attacus ricini.* Dinajpur, Bengal.

60 Cocoons of the Eria silkworm, *Attacus ricini* prepared for carding, as sold for manufacturing purposes. Nowgong. Assam

61 and 62 Cocoons of the Muga silkworm, *Antheræa Assama.* Sibsagar, Assam.

63 Cocoons of *Cricula trifenestrata.* Exhibited by Deputy-Surgeon-General J. Shortt, M.D., F.L.S., F.Z.S., Yerkad, Shevaroys.

PART 3.

Collection of the Various Silk Fibres and Threads Produced and Used in India, lent by the Government of India.

1 Raw silk reeled from the cocoons of the mulberry-fed silkworm by the ordinary method. 12 to 14 cocoons reeled together, size 25/30 deniers. Surdah, Rajshahi, Bengal.

2 Raw silk reeled from the cocoons of the mulberry-fed silkworm with Italian appliances. 12 to 14 cocoons reeled together, size 25/30 deniers. Surdah, Rajshahi, Bengal.

2A Thrown silk, Organzine and Tram, a portion undyed and the rest dyed a number of colours by Joshua Wardle & Sons, of Leek. This exhibit is intended to illustrate the excellent quality of Bengal silk when properly reeled. It was manufactured by Messrs. J. & T. Brocklehurst & Sons, of Macclesfield, from raw silk supplied from the filature of Messrs. Robt. Watson & Co., of Surdah, Rajshahi, Bengal. It will easily be observed how beautiful and lustrous the silk is after being dyed, and how even and excellent is the quality.

2B Crefeld undyed satin woven "in gum," with Bengal silk face (Surdah Organzine) and cotton back.

2C Two Crefeld coloured satins, piece dyed and finished, made of Bengal silk (Surdah Organzine) with cotton back.

2D Two Crefeld satins made of Bengal silk (Surdah Organzine(yarn dyed.

3 Raw silk reeled from the cocoons of the mulberry-fed silkworm by the ordinary method. Rangpur, Bengal.

4 Fine raw sik reeled from the cocoons of the mulberry-fed silkworm. Bogra, Bengal.

5 Coarse raw silk reeled from the cocoons of the mulberry-fed silkworm, Bogra, Bengal.

6 Raw silk reeled from the cocoons of the mulberry-fed silkworm. Lowest quality, Rs. 8 per seer. Maldah, Bengal.

7 Raw silk reeled from the cocoons of the mulberry-fed silkworm, middle quality, Rs. 10.8 per seer. Maldah, Bengal.

8 Raw silk reeled from the cocoons of the mulberry-fed silkworm, Rs. 11 per seer. Maldah, Bengal.

9 Raw silk reeled from the cocoons of the mulberry-fed silkworm, best quality, Rs. 12 per seer. Maldah, Bengal.

10 Tram for weaving, made from the silk of the mulberry-fed silkworm of Bengal. Jehanabad, Hugli District, Bengal.

11 Raw silk reeled from the cocoons of the mulberry-fed silkworm of Bengal. Jangipur, Murshidabad District.

12 and 13 Raw silk reeled from the cocoons of the mulberry-fed silkworm of Bengal. Birbhum, Bengal.

14 Coarse waste silk of the mulberry-fed silkworm of Bengal. Canpore.

15 Tram *(bharua)* thrown from raw silk reeled from the cocoons of the mulberry-fed silkworm of Bengal. Dhantala, Bengal.

16 Warp *(tana)* thrown from raw silk reeled from the cocoons of the mulberry-fed silkworm of Bengal. Dhantala, Bengal.

17 Raw silk reeled from the cocoons of the mulberry-fed silkworm of Bengal. Dhantala, Bengal.

18 Raw silk reeled from the cocoons of the mulberry-fed silkworm. Dehra Dun, North-Western Provinces.

19 White raw silk, reeled from the cocoons of the mulberry-fed silkworm. Dehra Dun, North-Western Provinces. The seed from which the cocoons were reared was received through the Madras Government. Exhibited by Deputy-Surg.-Genl. J. Shortt, M.D., F.L.S., F.Z.S., Yerkad, Shevaroys.

20 Yellow raw silk, reeled from the cocoons of the mulberry-fed silkworm. Dehra Dun, North-Western Provinces. The seed from which the cocoons were reared was received through the Madras Government. Exhibited by Deputy-Surg.-Genl. J. Shortt, M.D., F.L.S., F.Z.S., Yerkad, Shevaroys.

21 Straw-coloured raw silk reeled from the cocoons of the mulberry-fed silkworm. Dehra Dun, North-Western Provinces. The seed from which the cocoons were reared was received through the Madras Government. Exhibited by Deputy-Surg.-Genl. J. Shortt, M.D., F.L.S., F.Z.S., Yerkad, Shevaroys.

22 Native Indian hand reel. Madras. (See plate II., p. 39).

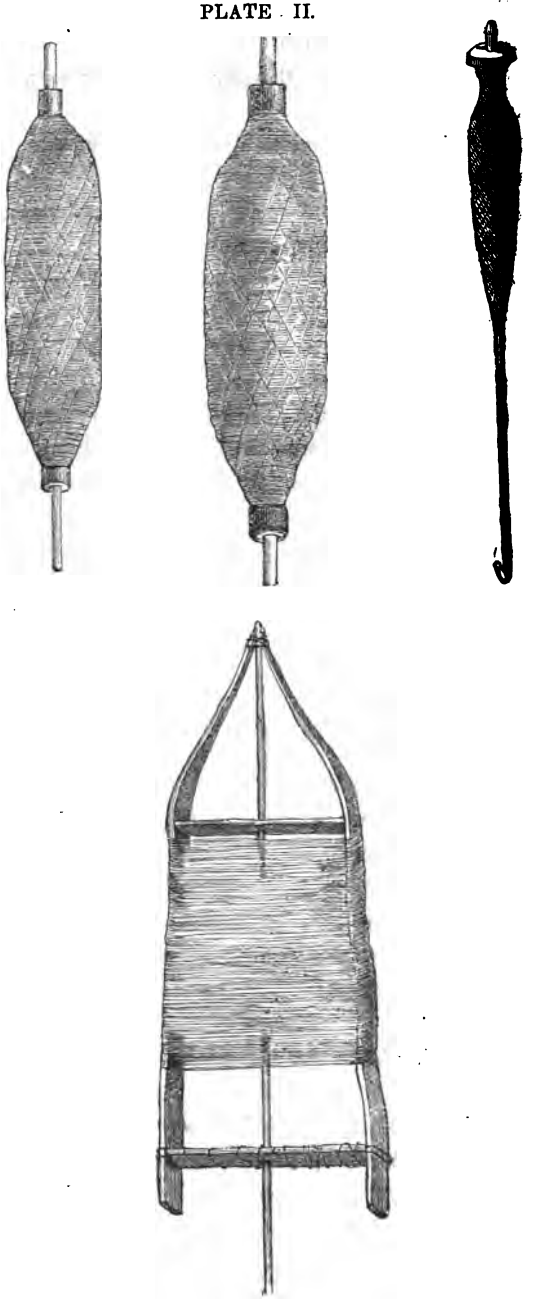
23 Dyed floss silk *(phalian)* in different colours. Rs. 11 ann. 12 per seer. Davee Sahai, Merchant, Chumba Mull, Amritsar, Punjab.

24 Floss silk *(katha)*, imported from Yerkad, Madras. Rs. 10 ann. 4 per seer. Davee Sahai, Chumba Mull, Amritsar, Punjab.

25 *Tani* silk from Cabul, cleaned. Rs. 16 per seer. Davee Sahai, Chumba Mull, Amritsar, Punjab.

26 Silk *(phalian)* imported from Cabul. Rs. 8 ann. 4 per seer. Davee Sahai, Chumba Mull, Amritsar, Punjab.

PLATE II.



Native winding, twisting, and reeling implements; scale $\frac{1}{3}$ of the real size.
See No. 22, p. 38, and No. 76, p. 42.

27 Silk (*vardham*) imported from Bokhara. Rs. 12 per seer. Davee Sahai Chumba Mull, Amritsar, Punjab.

28 Silk (*chappi*) imported from Bengal. Rs. 10 per seer. Davee Sahai Chumba Mull, Amritsar, Punjab.

29 Silk (*makhtul*) imported from Bengal. Rs. 6 per seer. Davee Sahai Chumba Mull, Amritsar, Punjab.

30 Silk (*sheesh mehal*) imported from China. Rs. 5 ann. 12 per seer. Davee Sahai Chumba Mull, Amritsar, Punjab.

31 Silk (*phul*) imported from China. Rs. 11 per seer. Davee Sahai Chumba Mull, Amritsar, Punjab.

32 Silk warp (*tani*) imported from Yerkad, Madras. Rs. 12 per seer. Davee Sahai Chumba Mull, Amritsar, Punjab.

33 Silk (*vardham*) native-dyed in different colours with aniline dyes. Rs. 18 per seer. Davee Sahai Chumba Mull, Amritsar, Punjab.

34 Boiled-off silk warp, from Koreyal, undyed. Sent by the Collector of Coimbatore, Madras.

35 Raw mulberry silk from Koreyal. Sent by the Collector of Coimbatore, Madras.

36 Boiled-off silk warp from Koreyal, native-dyed orange colour. Sent by the Collector of Coimbatore, Madras.

37 Boiled-off silk warp from Koreyal, native-dyed crimson. Sent by the Collector of Coimbatore, Madras.

38 Boiled-off silk warp from Koreyal, native-dyed yellow. Sent by the Collector of Coimbatore, Madras.

39 Boiled-off silk warp, from Koreyal, native-dyed orange. Sent by the Collector of Coimbatore, Madras.

40 Boiled-off silk warp, from Koreyal, native-dyed red. Sent by the Collector of Coimbatore, Madras.

41 Boiled-off silk warp, from Koreyal, native-dyed black with the seeds of *semecarpus anacardium*. Sent by the Collector of Coimbatore, Madras.

42 and 43 Raw silk of the mulberry-fed silkworm. Kanara, Bombay Presidency.

44 Coarse raw silk of the mulberry-fed silkworm. Mysore.

45 Raw silk of the mulberry-fed silkworm, reeled from cocoons raised from seed obtained locally. Mysore. Exhibited by Deputy-Surgeon-General J. Shortt, M.D., F.L.S., F.Z.S., Yerkad, Shevaroys.

46 Rough silk of the mulberry-fed silkworm used for weaving bathing clothes. Cuddapah, Madras.

47 Raw silk reeled from the cocoons of the mulberry-fed silkworm. Cuddapah, Madras.

48 Raw silk reeled from the cocoons of the mulberry-fed silkworm. Tinnevelli, Madras.

49 Fine silk of the cocoons of the mulberry-fed silkworm. Cuddapah, Madras.

50 Raw silk of the cocoons of the mulberry-fed silkworm. Cuddapah, Madras.

51 Raw silk of the cocoons of the mulberry-fed silkworm after first cleaning. Cuddapah, Madras.

52 Raw silk of the cocoons of the mulberry-fed silkworm. Dinapur, Bengal.

53 Waste silk of the cocoons of the mulberry-fed silkworm. Stuffing of the bed of the Queen of Burma. Brought from Mandalay.

54 Tussur silk, native dyed, crimson, yellow, and violet.

55 Tussur silk waste (*a*) undyed, (*b*) dyed with magenta. Ranchi, Chutia Nagpur, Bengal.

56 Tussur silk thread. From the twenty-four Parganas, Bengal.

57 and 58 Tussur raw silk, native reeling. Birbhum, Bengal.

59 Tussur raw silk, native reeling. Fatwa, Bengal.

60 Tussur silk thread. Bardwan, Bengal.

61 Tussur raw silk reeled from *dhaba* Tussur silk cocoons. Singbhum, Bengal.

62 Tussur raw silk reeled from *bogura* Tussur silk cocoons. Singbhum Bengal.

63 Tussur silk waste. No. 1. Manbhum, Bengal. Sent by T. F. Peppé, Esq.

64 Tussur silk waste. No. 2. Manbhum, Bengal. Sent by T. F. Peppé, Esq.,

65 Tussur raw silk reeled from *bogoi* Tussur silk cocoons. Singbhum, Bengal.

66 Tussur raw silk reeled from *laria* Tussur silk cocoons. Singbhum, Bengal.

67 Tussur raw silk. Anandpur, Midnapur, Bengal.

68 Tussur silk waste. Anandpur, Midnapur, Bengal.

69 Tussur raw silk. Baramba State, Orissa.

70 and 71 Tussur raw silk. Rajgram, Bankura.

72 Tussur raw silk. Midnapur, Bengal.

73 Tussur silk of native reeling from Ramdera, near Debri, Shahabad, Bengal, in the reeling of which castor oil and the alkaline earth, *saji matti*, are used. Sent by T. F. Peppé, Esq.

74 Tussur raw silk. Gaya, Bengal.

75 Tussur silk cord dyed with magenta. Ranchi, Chutia Nagpur, Bengal,

76 Weavers quills containing Tussur silk weft. Murshidabad, Bengal. (Plate ii., p. 39.)

77 Silk of the Eria silkworm, *Attacus ricini*, hand-spun for weaving into cloth, not reeled. Lakhimpur, Assam.

78 Native-made Eria silk cloth. Dinajpur, Bengal.

79 Native-made Eria silk cloth. Nowgong, Assam.

80 Silk of the Eria silkworm, *Attacus ricini*, spun for weaving into cloth, not reeled. Lakhimpur, Assam.

81 and 82 Silk of the Eria silkworm, *Attacus ricini*, spun for weaving into cloth, not reeled. Sylhet, Assam.

83 Silk of the Eria silkworm, *Attacus ricini*, spun for weaving into cloth, not reeled. Dinajpur, Assam.

84 Silk of the Eria silkworm, *Attacus ricini*, spun for weaving into cloth, not reeled. Kamrup, Assam.

85 Silk of the Eria silkworm, *Attacus ricini*, spun for weaving into cloth, not reeled. Jalpaiguri, Bengal.

86 Silk of the Endi or Eria silkworm, *Attacus ricini*, spun for weaving into cloth, not reeled. Rangpur, Bengal.

87 Warp and weft spun threads of Eria silk, *Attacus ricini*. Nowgong, Assam.

88 Silk of the Muga silkworm, *Antheræa Assama*. Lakhimpur, Assam.

89 Silk of the Muga silkworm, *Antheræa Assama*. Kamrup, Assam.

90 Silk of the Muga silkworm, *Antheræa Assama*, spun from pierced cocoons for reeling into cloth, not reeled. Assam.

91 Silk of the Muga silkworm, *Antheræa Assama*. Sibsagar, Assam.

92 Stages in the manufacture of Indian gold thread for embroidery and weaving. Sent by E. C. Ozanne, Esq., Director of Agriculture, Bombay Presidency.

a Silver bar covered with gold leaf.

b Thin wire drawn out from the gold leaf covered bar.

c Finer drawn wire of gold on silver.

d The finer wire flattened by the hammer.

e China silk thread, dyed orange, to be covered with the flattened gold and silver wire.

f Gold thread, consisting of *d* and *e* wound together. Its completed state.

93 Tussur raw silk of improved reeling. Lent by Mr. A. Gallois, of Messrs. Louis Payen & Co.'s Filature at Berhampur, Bengal.

PART 4.

Collection of Indian Silk Fabrics

1 *Patolo.* A bride's garment, given as a present to a bride, generally by her maternal uncle, during the marriage. It is woven with warp and weft which have been separately tied and dyed by the bandhana process. The dyer takes a small bundle of warp which has been dyed in the lightest colour found on the warp in the finished piece, and draws in pencil across it some lines at measured distances according to the design to be produced. His wife then ties the silk, along the spaces marked, tightly round with cotton thread, through which the dye will not penetrate. It is then dyed with the next darker colour found upon the warp, and the process is repeated until the darkest colour is reached. The weft is then treated in the same way, being so tied and dyed that, in the loom, when it crosses the warp, each of its colours may exactly come in contact with the same colour in the warp. The little bundles of warp have next to be arranged in the loom by the weaver, who then takes the little bundles of weft one at a time, using each in its own place throughout the design. The *Patolo* is a speciality of a province which includes the territory of H.H. the Gáekwár of Baroda, H.H. the Nabob of Bombay, and the silk weaving districts of Ahmedabad, Surat, and Broach. From Surat, Bombay Presidency.

2 Silk brocade *(himro)*, white, red and yellow on black ground. A small native shield-like pattern. From Surat, Bombay Presidency.

3 *Patolo* to which the description of No. 1 is equally applicable. Woven in Surat, Bombay Presidency.

4 Silk and gold loin cloth. This fabric is curiously woven, yellow on both sides, and its borders of gold on red silk ground are very dignified. The joining of red and yellow weft at the border lines is interesting as the yellow weft does not extend across the borders, but is united to them in the loom at the point of junction. Silk loin cloths are worn during the performance of religious ceremonies and during meals, when cotton cloth is considered impure. It is called *pitámbar* in Sanskrit as well as in modern languages. The word *pitámbar* merely means a yellow cloth, and the probability is that this fabric was always yellow when it was first introduced, and although it is now dyed red, green, purple, orange, or black, it still retains its first name, derived in all probability from the natural yellow colour of the *Bombyx mori* silk. Vishnu is called "*Pitámbar-dhári*" in mythological books. This name literally means "one who bears a yellow cloth." From Poona, Bombay Presidency.

PLATE III.

FIG. 1.

FIG. 2.

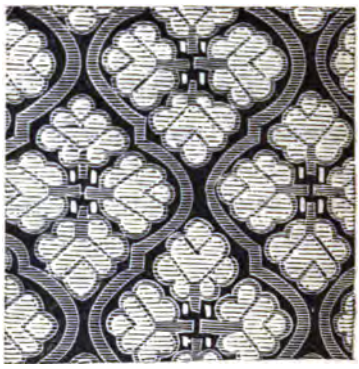


FIG. 3.

FIG. 4.

FIG. 5.

FIG. 6.

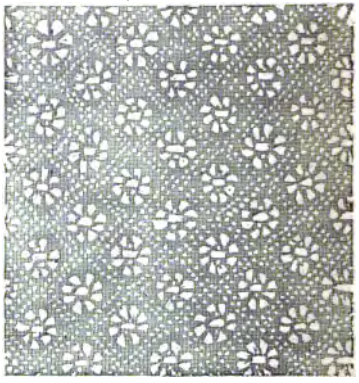


Fig. 1. Chasum Phul. Silver and Gold Kinkhab, on Silk, from Surat, Bombay Presidency. See No. 10 Indian Fabrics, p. 45.

Figs. 2, 3, 4. Silk Brocades "Himro," woven at Surat, Bombay Presidency. See Nos. 13, &c., Collection of India Silk Fabrics, p. 45.

Fig. 5. Specimen of Patterned Silk, woven at Thana, Bombay Presidency, fully described under No. 99, Collection of Indian Silk Fabrics, p. 51.

Fig. 6. Silk Fabric, typical of the style of weaving in Bijapur, Bombay Presidency, red and gold shot silk. See No. 185, Collection of Indian Silk Fabrics, p. 57.

5 Silk brocade *(himro)*, yellow and white on black ground. This is a curious diaper pattern with a conventional eight-petalled flower in the centre of each diaper. Woven in Surat, Bombay Presidency.

6 Silk brocade (*himro*), yellow, white and red, on dark purple ground. Woven in Surat, Bombay Presidency.

7 Silk brocade (*himro*), white and yellow, on black ground. The design is called *Char Khonama chár dáni*, or squares with flowers having four petals. The squares of which this design is composed are set diamond-ways in an exceedingly neat diaper on dark purple ground. Woven in Surat, Bombay Presidency.

8 and 9 Two exceedingly interesting borders, with conventional elephants, woven in gold and silver on silk. Surat, Bombay Presidency.

10 Gold, silver, and black silk kinkhab. This is a most effective treatment of gold and silver weaving on black silk ground. The design is called *Chasam phul*, from a flower of that name. The flower, of eight petals, is in gold, and is in the centre of diamond-shaped lattice work, with silver four-petalled smaller flowers at each intersection. In this as in all the kinkhabs the gold and silver are of the purest description. The method of the manufacture of gold thread for weaving in India is shown in the case containing Indian silk and gold threads in the gallery approach. Surat, Bombay Presidency. Fig. 1, plate iii.

11 Silk brocade (*himro*), white and yellow with green spots on a red ground. This design is composed of triangular wedge-shaped characters, the bases of which are in an upright position. Woven in Surat, Bombay Presidency.

12 Silk brocade (*himro*), white and yellow, with red spots on a purple ground. A geometrical diaper. Woven in Surat, Bombay Presidency.

13, 14, and 15 Three typical silk brocades (*himro*), of great beauty and interest, as is all this series of brocades. Woven in Surat, Bombay Presidency. They are much worn by rich Arabs, who import them from Surat. The colourings are of great delicacy, and the designs very characteristic. Much taste is shown in the use of the various colours, not only in their disposition in the designs, but in their respective tones, in which there is thorough harmony. They are all studies and are exquisite stuffs. With regard to the designs they may be described as of Arab or Mahommedan forms, chiefly geometrical, for even in those of the more floriated treatment there is more or less of geometrical spacing. Nearly all of them may be considered to be in or from the diaper manner of design so universal in India. Figs. 2, 3, 4, plate iii.

16 Silk and cotton sari, with an exquisite and elaborately-designed border.

The central portion of the cloth is in minute red squares with black centres. Bombay.

17 to 20 Four kinkhab *kharita* bags from the Foreign Office. *Kharita*, means a letter from a prince, and these bags are used as envelopes by the princes of India. They are beautifully woven in silk, gold, and silver.

21 Gold, silver, and silk brocade with elaborately woven borders. Bombay.

22 Gold and silk brocade with conventional Indian pine pattern and herring-bone borders.

23 Kinkhab of leaf and scroll pattern, in gold and silver, on black silk Surat, Bombay Presidency.

24 Black silk and gold brocade, with gold border, for petticoats. The design is called *Keri ne Chardani*, which means "mangoes and flowers with four petals." The border of gold is masterly and most effective. Surat. Bombay Presidency.

25 Gold and silk kinkhab table cover. This is a most beautiful specimen of weaving. It has a handsome border with red silk in lines and herring-bone work, which separate gold and silver ornamentation. The centre piece is filled with gold lozenges, on which are woven, in red silk, words in Hindi characters. Bombay. This piece is well represented on the outside cover of this catalogue.

26 Gold on black and red silks, kinkhab Sarong, with elaborate border. Bombay.

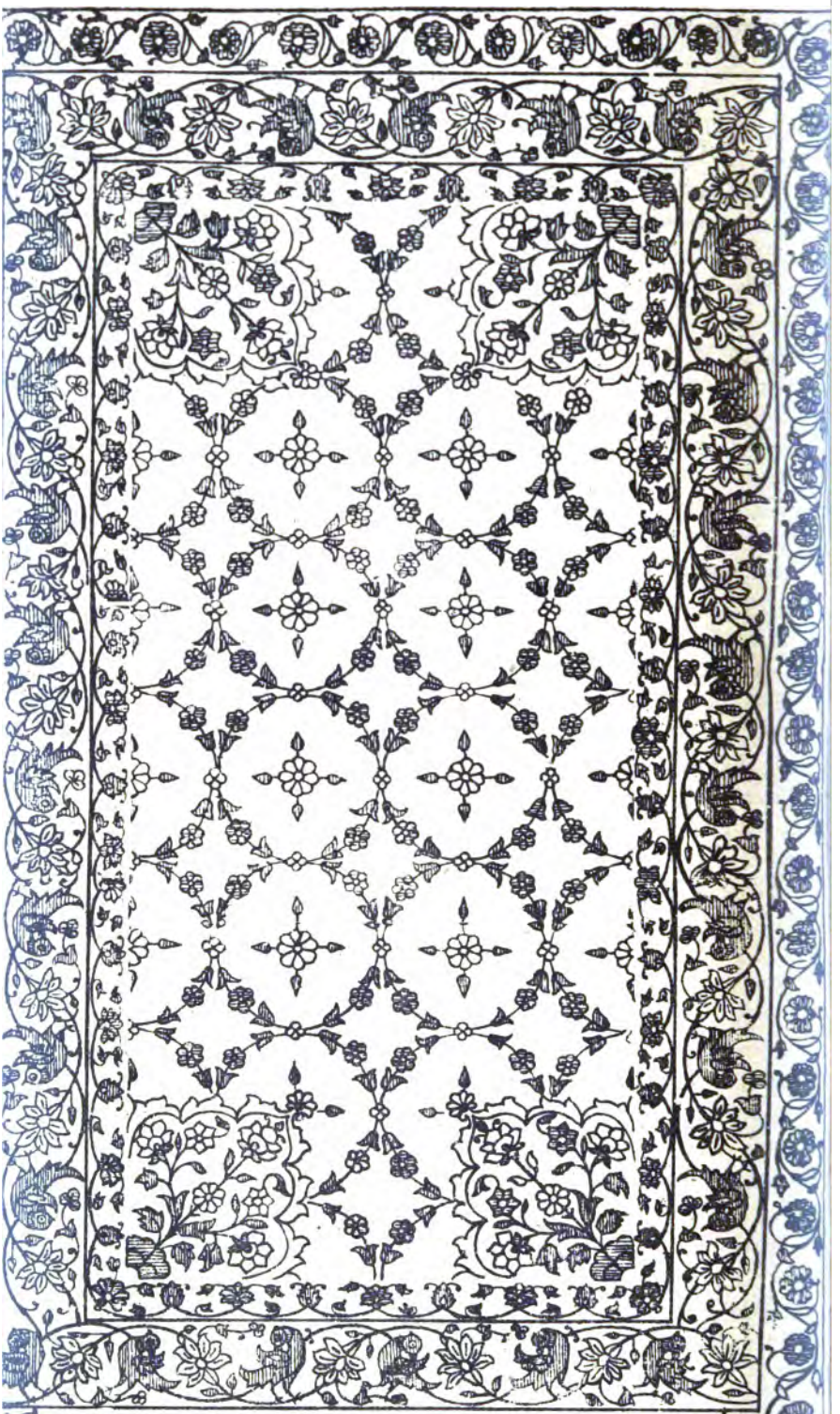
30 Cloth of gold kinkhab, with beautiful floral border. This is a very effective example of weaving in gold and coloured silk. The surface of the cloth is entirely covered with brilliant gold thread woven in a conventional cone or pine pattern, which is really a leaf form with a kind of prolonged spiral apex. Bombay.

31 Silk Sarong, with gold and silver brocades, used by the Siamese princes. In this Sarong fine peacocks are woven in gold on each side of the comb ornament characteristic of Sarongs. Green silk is used in the borders. The fabric is dark crimson silk with gold and silver flower-bosses, the gold ones of two sizes, large and small, and the silver ones all small. They are arranged in diagonal order. From Surat, Bombay Presidency.

32 and 33 Black silk caps embroidered with gold, worn by Mahommedans. Surat, Bombay Presidency.

34 Gold and silk brocade, crimson ground, with elaborate borders upon crimson, green, and scarlet silk. Bombay.

35 Gold and silk brocade. The pattern is a diaper formed of four lions, with an eight-petalled flower in the centre. The border consists of tigers and conventional foliage between herring-bone work in gold. Bombay.



Kinkhab Tablecloth, in gold, silver, and silk. From Ahmedabad, India.
For description, see page 47, No. 51.

36 Silk brocade (*himro*), similar in its triangular wedge-shaped design to No. 11, but upon a black ground with red spots.

37 and 38 Embroidered sari borders, chiefly used by Parsi women and sometimes by the Gujerath women. This variety of embroidery is called *reshami Bharat Kam*, or work done in hand stitches as opposed to the *Karchobi*, or work done on the frame. Surat, Bombay Presidency.

39 *Ilaicha*, or satin, with yellow and red dotted lines, and yellow and purple streaks, producing a herring-bone effect. This cloth is only used for the *burkhas* or outer garbs, with which the *Parda* or zenana women cover themselves from head to foot, having only a couple of small holes, covered with gauze, for the eyes. This is one of the most curiously woven fabrics in the Section. The lines are in narrow vertical stripes of half an inch purple and half an inch gold colour, so arranged as to produce diagonal bars of purple and the same of gold alternating across the piece. Each narrow band is bordered with alternating white and red dots. Surat, Bombay Presidency.

40 Gold, silver, and silk kinkhab table-cover. This is another beautiful example of weaving in gold and silver. The middle of the table-cloth is of lozenges of gold, each with a many-petalled flower of silver in the centre. Each quatrefoil is enclosed in an effective diaper which runs all over the piece. The border is of gold and silver, and red silk, with similar herring-bone work to that which is so characteristic in fourteenth century Gothic ornament. Bombay.

41 Gold, silver, and red silk kinkhab. A beautiful treatment of gold and silver in double diaper on crimson silk. The geometric flower is spotted in the centre with green silk. Surat, Bombay Presidency.

42 Cloth of gold and crimson silk sari border. Surat, Bombay Presidency.

43 to 46 Gold and silver on silk kharita bags, from the Foreign Office. See Nos. 17 to 20.

47, 48, and 49 Silk fabrics dyed by the bandhana or tie-and-dye process. Cutch, Bombay Presidency.

50 Gold, silver, and red silk scarf. The filling of the design of this fabric is a floriated scroll of gold, filled in with large eight-petalled flowers with a central green spot. The borders at the ends are most elaborate and very fine. Lent by A. L. Liberty, Esq.

51 Kinkhab table-cloth in gold and silver, interspersed with purple, green, and red silk, on a black back. It is an adaptation of a design, used for saddle-cloths, of great beauty, made in Ahmedabad, to the European drawing-room. The parrot, which is the chief figure in the design of the border, is a favourite bird in India. The design in the body of the fabric is called *tara mandal*, or

constellation of stars. The border, in five-fold bands, is known in India by the name of *popatvela*, which means a creeper, with parrots worked in. In this design the parrots' heads are turned back; the Hindoos draw their parrots both ways, the Mahommedans only with the heads turned backwards. This fabric is a gorgeous and most artistic treatment of gold, silver, and silk. Ahmedabad, Bombay Presidency. Lent by A. L. Liberty, Esq.

52 Gold and silk brocade on crimson silk ground. The gold is woven in small two-inch squares in the centre of which is a large gold star or twelve, petalled flower. The crimson is of course of native dye, and its tone is very effective in contrast with the gold. Bombay.

53 Silk brocade (*Himro*), white and yellow on red ground. Beautifully designed. One of the series of brocades described under Nos. 13, 14, and 15. Woven in Surat, Bombay Presidency.

54 Gold on coral-coloured silk kinkhab. *Mohor* or gold coin pattern Benares.

55 Kinkhab in transverse bands of gold and silver alternating, in elaborate pattern work on dark blue silk. From Benares, North-Western Provinces.

56 Gold and silk brocade, dark blue ground, with gold flowers in large spots. Bombay.

52 Crimson silk sari with *Mohor*, or gold coin, spots and narrow border. Bombay. Lent by A. L. Liberty, Esq.

58 Silk fabric dyed by the bandhana or "tie-and-dye" process. Cutch-Bombay Presidency. This is an elaborate design with dancing girls and birds in the border; the pattern is composed of spots of white, yellow, and green, on red ground. In dyeing by the bandhana method, in order to produce designs such as this, the white silk fabric is folded into two, four, eight, or sixteen folds, like folding a letter, corresponding with the number of repetitions of the design required. If two "repeats" are wanted, the fabric is folded once; for four repeats twice; for eight repeats three times, &c. On the uppermost of these folds the design is printed in lines, with blocks, in red ochre mixed with gum arabic, and then knots are tightly tied at intervals along the lines with cotton thread in such a way that when the fabric enters the dye-beck the dye will not penetrate to the small portion or spot on the cloth around which the thread is tied. The fabric is then "mordanted" with alum and dyed orange. Then another design is printed upon it in the interspaces of the first which remains tied; knots are tied on the lines of the second design, and the fabric dyed red. All the knots are then untied, the fabric spread on a small raised platform, and some of the orange spots touched with indigo to make them green. *Bandhani* is the name of this process in Gujrat, but in

Rajputana and Ulwar, where Hindi is spoken, it is *bandhana*. This word is derived from the Hindi verb *bandh*, to tie.

59 Interesting piece of red satin, ornamented with white minute bandhana spots. Surat, Bombay Presidency.

60 and 61. Examples of bandhana or "tie-and-dye" work, Bombay.

62 Bandhana, or "tie-and-dye" silk fabric, green ground, with red spots. Jamnupur, Bombay Presidency.

63 Gold and silk brocade. Bombay.

64 Gold and silk brocade, with interesting gold border on red silk. Bombay.

65 Black silk fabric, with beautiful border of gold on red silk. Used for bodices. Poona, Bombay Presidency.

66 Gold and silk fabric. Bombay.

67 Violet silk fabric, with design of white spots obtained by the bandhana, or "tie-and-dye" method. Bombay.

68 Silk fabric, red ground, with large square, white, green, and yellow bandhana spots. Cutch, Bombay Presidency.

69 Striped silk sari of peculiar patterning, consisting, in fact, of bordering entirely across the piece. Bombay.

70 and 71 Silk and cotton fabrics, Bijapur, Bombay Presidency. In these fabrics the peculiarity of style characteristic of Bijapur weaving is worthy of notice. The patterning is all in many-petalled flowers, either distributed diagonally, close together, or divided by horizontal and vertical lines.

72 Silk fabric, the design of which is an exceedingly chaste example of producing a small diaper with simply four eight-petalled flowers placed diamond ways, with a small spotted diamond filling in the centre, making in reality a series of bands down the piece, giving both diagonal, diaper, and horizontal effects with very much play of lively colouring. This piece is quite a study. Bijapur, Bombay Presidency.

73 Silk and cotton fabric. Another treatment, but on the same lines as the foregoing. Bijapur, Bombay Presidency.

74 and 75 Silk fabrics in parti-coloured vertical stripes, with horizontal rows of flowers interwoven. Karachi, Bombay Presidency.

76 Silk and cotton fabric. Bijapur, Bombay Presidency.

77 Orange-coloured silk scarf, with white horizontal and vertical lines forming an effective plaid. The border of this piece is exceedingly artistic and refined. Baroda State.

78 Silk and cotton fabric. Bijapur, Bombay Presidency.

79 to 82 Figured silk fabrics. These pieces are characteristic of the

interesting weaving and patterning of Baroda State, and are well worthy of study. Baroda State.

83 Yellow scarf with printed border and filling. Brought from India about 1803. The colours appear to have stood perfectly. Lent by Mrs. S. E. Haworth, Manchester.

84 An interesting shot silk, gold on crimson, with a pretty border. The border across the ends is very deep and chaste in colouring. Bombay.

85 Silk scarf in transverse bands of sky blue and orange, with gold border. Baroda State.

86 Silk sari, yellow and black plaid, with red and green border. Bombay.

87 Silk plaid sari. In the border of this sari occurs the arrow-head ornament which is so characteristic a treatment of Indian borders. The arrow-heads are of alternating red and yellow. The herring-bone borders are a simpler treatment of the same idea. Baroda State.

88 Very large bi-coloured silk sari or loin cloth, with gold border. Woven in Yeola, Bombay Presidency. See No. 4, the description of which applies to this fabric also, except that No. 88 is yellow on one side and crimson on the other. The yellow dye withstood the sun perfectly throughout the whole of the summer of last year at the Colonial and Indian Exhibition, and the crimson is also beautifully dyed.

89 Crimson and green shot silk scarf or sari. Bombay.

90 Striped satin sari, in crimson, violet, pink, and gold. Bombay.

91 Yellow silk sari, with crimson border. Bombay.

92 Orange and lavender sari, with herring-bone and saw-edge pattern in gold, in the border, on crimson silk. Bombay.

93 Crimson silk shawl, with green border, embroidered all over with white and gold flowers alternating, arranged diagonally. An interesting specimen of needlework. Bombay.

94 Odhani, or silk shawl, beautifully embroidered and ornamented with small circular mirrors. The ground is deep blue—indigo dye. An old piece. Cutch, Bombay Presidency.

95 Odhani, or silk shawl, embroidered with silk, with numerous small circular mirrors inserted and fastened into the fabric by broad bordering of circular stitches of orange and gold silk, giving the appearance of the eye of a carrier pigeon and its broad circular surrounding. The embroidery of this fabric is all done on a printed silk. The ground is dark purple and the print crimson. This is perhaps the most artistic piece of embroidery in the collection. It has also a very effective embroidered border. It was worked at Cutch, in the Bombay Presidency, a place famed for its embroideries.

96 Claret-coloured satin fabric with a stem of leaves and flowers in yellow, green, white, and red, repeated upon it diagonally. Bombay.

97 Embroidered border from Cutch, Bombay Presidency. Hung on the chief entrance of the house of the Indian merchant or *bania*, the worshipper of the goddess of wealth, Lakshmi, whose lotus-shaped throne is worked in the design, interspersed with bits of silvered glass, producing a pleasing effect. The great *divali* holidays of India, which extend over four to six days, begin with the worship of Lakshmi, when the whole town is illuminated, and when the merchants and bankers invite their customers, friends, relations, and acquaintances to their shops, especially decorated with pictures and carpets, and copiously lighted to receive them. After the customary worship of the goddess, and the dedication of the new account books for the year, which commences the next morning, *pan supari*, or betel leaves and nuts, sweetmeats, nosegays, and perfumes are distributed among the guests, who pour in one after another till midnight, visiting the shops they have been invited to honour with their presence. It is on this day that this specimen is tied to the doorway and its old predecessor removed.

98 Coat of green satin, beautifully embroidered with gold. Bombay Presidency.

99 Figured silk dress piece, in black and white. Chaste geometrical design. Woven at Thana, Bombay Presidency. The silk industry of Thana, a small town twenty-one miles north-east of Bombay, is entirely confined to the Christian community, who number about 1,100 souls. The native Christian church of Thana has a long and eventful history, running back to the early years of the sixth century. The Nestorians of the sixth century were succeeded in the fourteenth by a Latin church, and in the sixteenth by the missionary churches of the Franciscans and Jesuits, under the auspices of the Portuguese conquerors of Western India. The Mahrattas conquered Thana at the end of the seventeenth century, and proscribed Christianity The Christian church dwindled to a poor and despised sect, most of whom lived by silk weaving, and in this state they were found by the British in 1774. At one time 4,000 weavers were employed, but there are now only fourteen looms. Their pretty silks have much individuality, and are unlike any other Indian productions. Fig. 5, plate iii.

100 Series of twelve small patterns of silks woven at Thana, characteristic of their patterning. These patterns are exceedingly small and delicate, and bespeak great taste.

101 Pretty piece of grey silk for dresses of the same geometrical pattern as No. 99, but made of white and drab coloured silk. Woven at Thana, near Bombay.

102 Cotton shawl embroidered with silk and cotton, and ornamented with circular mirrors. Cutch, Bombay Presidency.

103 Green silk embroidered scarf or shawl, with crimson border, worn by women. The flowers, with sprigs, are similar in design to those of No. 93. This is, in fact, another colouring of the same idea, probably by the same workmen. From Cutch, Bombay Presidency.

104 to 108 Gold and silver on silk *kharita* bags, two of them with large wax seals of the princes who use them. See Nos. 17 to 20.

109 Silk bodice piece, white, with squares in red dotted lines, and a handsome gold border on red silk. Poona, Bombay Presidency.

110 Silk scarf. Lent by W. Sinclair, Esq., C.S., Alibag, Bombay Presidency.

111 Shot silk handkerchief. Lent by W. Sinclair, Esq., C.S., Alibag, Bombay Presidency.

112 Bodice piece. A very interesting example of decoration. The border has a deep crimson ground, with double rows or bars of white flowers between green and gold coloured lines. The middle part of the cloth is an example of spots arranged in diamond shapes, enclosed in yellow squares. Belgaum, Bombay Presidency.

113 Dacca muslin shawl, embroidered with scarlet and green silk. Bombay.

114 to 118 Gold and silver on silk kinkhab *kharita* bags, two of them with large wax seals of the princes who use them. See Nos. 17 to 20. The circular seal is that of H.H. Tukoji Rao Holkar, the late Maharaja of Indore, engraved by Shekh Nisar Mahommed, of Delhi, with the following inscription :—

"Shri
Mhálsákánt
Charani-tatpara,
Yashvantráv-sut
Tukoji Holkar."

The explanation of this inscription is as follows: Tukoji Holkar, the son of Yashvantrav, and the devotee of (*lit.* one who is absorbed in the meditation of the feet of) the Beautiful Husband of the Goddess Mhalsa, viz., Khanderav, the deified hero, who has a temple at Jejuri, near Poona, annually visited by a large number of pilgrims.

119 Silk embroidered *sozni*. Probably a prayer carpet, as it is embroidered only on the sides, having plain centre. On a very large scale, like No. 123, the description of which will also apply to this. From Peshawur, Punjab.

120 Baluchar sari, white and red silk brocade on purple ground. Berhampur, Bengal.

121 Embroidered sheepskin overcoat. This sheepskin is richly embroidered all over in a good design with gold-coloured floss. The wool has not been removed, but forms the interior of the coat. It is worn by military Afghans and others, and is called a *postin*. It was probably embroidered in Kabul, though bought in Peshawur, Punjab.

122 Baluchar sari, white and red silk brocade on blue ground. Berhampur, Bengal.

123 *Sozni* embroidered with silk upon cotton. This remarkably fine piece of embroidery was probably worked away from Peshawur, possibly in Bokhara, although such examples are now made there. The bold treatment of masses of reds, blues, greens, and yellows is effective, and the design generally denotes a breadth of conception not usual in embroidery. Crimson and scarlet are freely introduced side by side.

124 Baluchar sari, orange, red, and white, on a purple ground, with a remarkably interesting and well-designed border. Berhampur, Bengal.

125 Deep indigo silk scarf, with gold and white cotton stripes. Peshawur, Punjab.

126 Black and white striped fabric. Lahore, Punjab.

127 *Charkhona* cloth, with white and black squares in the design (*Chár* means four, and *khona*, angles). Berhampur, Bengal.

128 Black and white check silk fabric. Lahore, Punjab.

129 A very handsome green, yellow, red, and purple plaid silk rumal. Peshawur, Punjab.

130 Striped silk scarf (sari). Peshawur, Punjab.

131 Embroidered silk on cotton phulcari or flower work, ornamented with small pieces of looking-glass. Made and worn at Amritzar and the neighbouring villages. The etymology of the word phulcari is *phul*, a flower, and *cari*, embroidery or work. Amritsar, Punjab.

132 A costly coat of silk cloth, richly embroidered with gold. Benares, North-West Provinces.

133 Embroidered silk on cotton phulcari petticoat. Made and worn at Amritsar and the neighbouring villages. See No. 131. Amritsar, Punjab.

134 Very interesting and ancient Indo-Persian figure weaving. This fabric is woven in the following manner: A main warp forms the black satin ground and rises to allow the weft to come to the face to make the pattern. A binder warp works simply to fasten the weft figure on the face, and the coloured weft on the back of the cloth. This is almost the oldest method of figure weaving, and not confined to any particular country. It occurs in Japanese and Chinese work, and in many of the Palermitan and Lucca fabrics,

162 Cloth woven from the silk of the Muga silkworm (*Antheræa Assama*). Assam.

163 Silk gauze scarf (*sari*), made of silk in its natural state, but with a dyed border. Coimbatore, Madras.

164 Printed silk handkerchief in red, yellow, gold, and black. Calcutta.

165 and 166 Yellow Corah silks *chadars*, with red and black borders. Giridi, Bengal.

167 Undyed Corah silk cloth, with neat purple border. Calcutta.

168 Shot purple Corah silk, with orange and white border (*begoona dhoti*). Kagra, Bengal.

169 Orange Corah silk *dhoti*. Kagra, Bengal.

170 Undyed Tussur silk *chadar*, with red border. Giridi, Bengal.

171 Undyed Tussur silk *dhoti*, with red border. Giridi, Bengal.

172 Undyed Tussur silk *chadar*, with red border. Giridi, Bengal.

173 Undyed Tussur silk *dhoti*, with red border. Giridi, Bengal.

174 Piece of undyed Tussur silk cloth. Surdah, Rajshahi, Bengal.

175 Crimson Corah silk scarf (*sari*). Giridi, Bengal.

176 Piece of Corah silk from which the natural gum or *grès* has not been discharged. Native weaving at Berhampur, Bengal.

177 Piece of Corah silk from which the natural gum or *grès* has been discharged. ("Boiled off"). Native weaving at Berhampur, Bengal.

178 Shot blue and orange Corah silk (*begoona dhoti*). Kagra, Bengal.

179 White Corah silk *dhoti*. Kagra, Bengal.

180 Silk bodice piece. A charming gold and red admixture of colour in repetitions of a narrow pretty border pattern. Mysore.

181 Piece of old Indian brocade woven in gold and coloured silk. Lent by the Hon. Mrs. Percy Mitford.

182 Embroidered Indian white satin coverlet, 200 years old. Lent by Miss F. Hermann Glass.

183 Valuable Indian Cashmere shawl, embroidered with gold, silver, silk, and real pearls. Lent by Lady Poltimore.

184 Silk and cotton fabric. Bijapur, Bombay Presidency.

185 Beautifully patterned diaper silk fabric, crimson and gold, with interesting border. Bijapur, Bombay Presidency. Fig. 6, plate iii.

186 Blue, red, and white bandana silk. Calcutta.

187 Dress of printed Chinese silk crape, worn on the day of the Queen's coronation. Lent by Mrs. Riley, Richmond House, Salford.

188 Printed Chinese silk crape, 50 years old. Lent by Mrs. Riley, Richmond House, Salford.

189 Elaborate specimen of "tie-and-dye," or bandana work. Given to Mr. Wardle by the late Dewan Sree Ram, late Prime Minister of Ulwar. This remarkable example of bandana work required two months to tie. Its value n Ulwar was only Rs. 15 (about 22s. 6d.) Plate iv., page 58.

190 Specimens illustrating the different stages of bandana or "tie-and-dye" work from Sumarang, Java. (1) Piece of silk folded in four parts, on which the design is sketched, and sewn through with thread. (2) The threads round the spots drawn up and firmly tied. (3) The spots covered with pieces of banana leaf, ready for dyeing. (4) The white end of the fabric has been tied in a banana leaf whilst the other end was dyed red. (5) The white end of the fabric has been dyed yellow. (6) The yellow end of the fabric has been dipped into blue dye and made green. (7) The spots untied and blue painted in. (8) Primitive instrument with which the blue is painted in. (9) Indigo and Amballo. The dyestuffs from which the blue and red are obtained. (10, 11, and 12) A different combination of colours from the preceding example. Sent by Felix Driessen, Esq., Leyden, Holland.

191 Unique bi-coloured net. A marriage robe, most curiously and skilfully dyed, red on one side and green on the other. Ornamented with crescents of alternate red and green, set off in gold thread, embroidered bordering. (Ulwar).

192 Turban produced in Ulwar by the bandana or "tie-and-dye" process, in diagonal pink stripes with square red spots.

193 Turban produced in Ulwar by the bandana process, showing the method in which the cloth is tied ready for dyeing. Since the dyeing process it has been untied and partially unrolled, showing the effect produced.

194 Turban from Ulwar, partially tied and dyed by the bandana process. Since the dyeing it has been untied and partially unrolled, showing the colours already obtained.

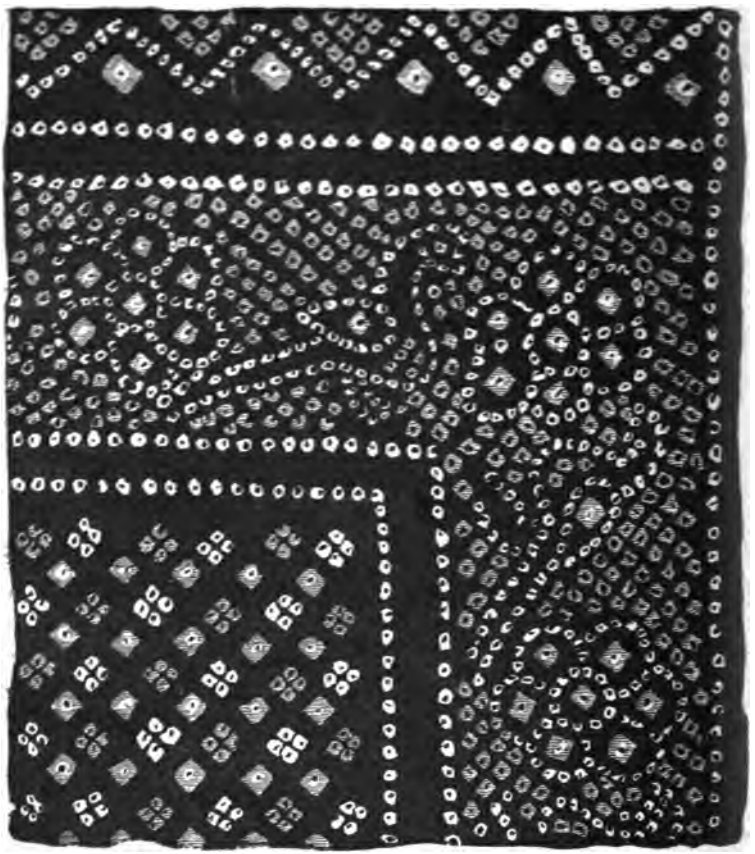
195 Turban produced in Ulwar, by the bandana or "tie-and-dye" process, in many-coloured diagonal stripes and spots. An elaborate example of this beautiful and artistic style of work.

196 Turban produced in Ulwar, by the bandana or "tie-and-dye" process, in red, white, yellow, and blue diagonal stripes, separated by chocolate-coloured lines.

197 Manchester machine-printed and cheap imitation of Ulwar bandana work.

198 Bandana or "tie-and-dye" satin fabric, with deep purple *ground and* square red spots with white centres. A scroll border with *red ground and* yellow and white bandana spots. Cutch, Bombay *Presidency.*

PLATE IV.



Bandana work (knot-dyeing or tie-and-dye work). Given by Dewan Sree Ram, late Prime Minister of Ulwar. (See No. 189.)

199 Bandana or "tie-and-dye" satin fabric. Green, with red and yellow diamond-shaped spots. Bombay.

200 Bandana or "tie-and-dye" satin fabric. Dark indigo, with white spots. Bombay.

201 to 204 Silk brocades (*himro*), yellow, white, and red on purple ground. Woven in Surat, Bombay Presidency. See Nos. 13, 14, and 15, which are similar fabrics.

205 Shawl, 50 years old, embroidered at Delhi, in the Punjab, with Indian silk floss. Lent by Mrs. Brockbank, Brockhurst, Didsbury.

206 Embroidered Cashmere shawl, 50 years old. Lent by Mrs. Brockbank, Brockhurst, Didsbury.

The foregoing collection of silk fabrics, representing the art of embroidery and silk weaving in India in its various centres, and for the most part collected in and ordered from that country by myself, possesses a high artistic and educational value. It would be well, instead of dispersing it at the close of the Exhibition, to purchase it for one or more museums connected with the weaving schools of the country, and to thoroughly incorporate it with Technical and Art Education, so greatly needed at this period of our history.

European Utilisation of Tussur Silk.

1, 2, 3 and 4 Summer curtain stuffs, after the manner of Madras muslin, the woven patterns of which are Tussur silk variously coloured. Lent by Messrs. Alexander Jamieson and Co., Glasgow.

5 Tussur silk rug designed, made by William Morris, Esq. Lent by the Chairman of the Section.

6 Large Tussur silk rug dyed in permanent Indian dyes. Lent by the Chairman of the Section.

7 and 8 Fichus or shawls of Leicester manufacture, made of undyed Tussur silk.

9 Chenille Tussur silk shawl of German manufacture. Lent by the Chairman of the Section. The small chenille monkeys sold in the streets of London are made of Tussur silk.

10 Card containing three patterns of Tussur silk fabrics of Lyons manufacture.

11 and 12 Seal cloth of Yorkshire manufacture made of Tussur silk waste. This fabric has a deep plush pile very much resembling seal skin, but much healthier to wear.

13 Seal cloth, like Nos. 11 and 12, but with an ornamentation of white hairs interspersed throughout the plush.

14 Reversible Tussur silk plush. Lent by Messrs. Barbour and Anderson, Glasgow.

15 Series of Tussur silk utilisations, consisting of pompons, tram on bobbins and raw silk, dyed in a variety of colours. Lent by Mr. A. W. Metcalf, London.

16 Example of elastic braid of French manufacture in which Tussur silk has successfully replaced the ordinary silk.

17 Tussur silk of superior throw, manufactured by Messrs. J. and T. Brocklehurst and Sons, of Macclesfield, and dyed into a variety of shades by Joshua Wardle and Sons, Tussur Silk Dyers, Leek.

COLONIAL SILK.

anada—New South Wales—Victoria—South Australia—Queensland—West Australia—New Zealand—Fiji—Cape of Good Hope—Natal—Ceylon—Straits Settlements—Hong-Kong—British North Borneo—British Guiana—West Indies—West Africa Settlements—Cyprus. With Reports of Examinations of the Structure and Physical Properties of Cocoons produced in these Colonies.

UNDERTOOK, at the request of H.R.H. the Prince of Wales, the task of describing the exhibits of Colonial Silks at the Colonial and Indian Exhibition with much pleasure, and I entered thoroughly into the subject from a conviction that several of our Colonies may be made in time and under auspicious circumstances to rival other silk-producing parts of the world. At the present time it is estimated that the total production of raw silk annually is 20,000,000lb., and no doubt this quantity, large as it is, would be materially increased, could the product be cheapened and its maximum and minimum prices be brought within less varying limits, which would undoubtedly be the case with increased supplies and a more widely-spread area of production. No doubt this increase of production could be accomplished, the climate of some of our principal Colonies being exactly suited to both the growth of the mulberry tree and to the healthy rearing of the silkworm. It seems worth an effort to show that every encouragement should be given to this important and beautiful industry.

Although at the present time labour is so costly in the Colonies that silk-reeling cannot be profitably practised, it may be useful to give a description of the appliances which are deemed the simplest, and at the same time the best, and which are used where the most perfected reeling of cocoons is conducted, namely, in France and Italy. I have so modified these appliances, without in any way impairing their utility, as to bring them within the reach of any cottager in price and portability, in order that cottage reeling may be carried on as a domestic industry, in houses where there is a family, without necessarily interfering with other industries.

The following are the reeling appliances required:—

A cast-iron furnace for heating the reeling basin. B, plate i.

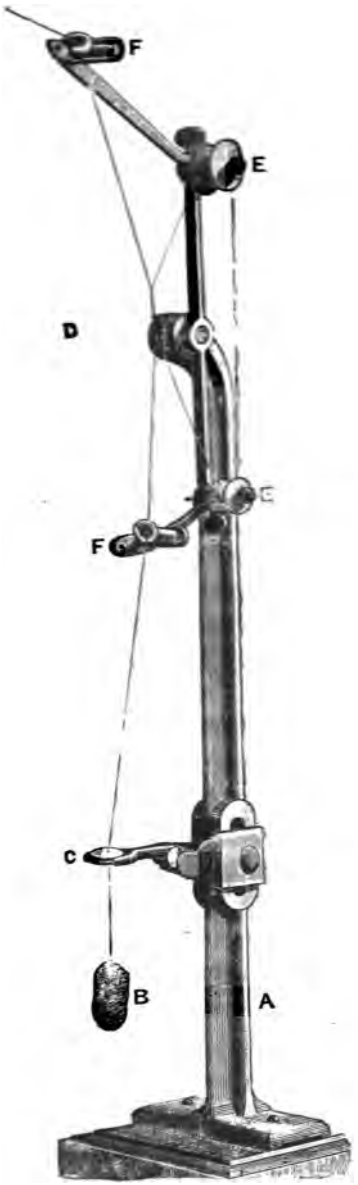
A reeling basin which contains water and the cocoons to be reeled. A, plate i.

A tavelette. D, plate v., page 62.

A reel upon which the silk is drawn off from the cocoons. F, plate i.

See frontispiece for references to lettering.

PLATE V.



A An iron stand 12 inches high.

B Cocoon and its thread placed so as to show the position of the silk on the instrument.

C Filière, a porcelain disc, pierced in the centre and concave on the lower side. The threads of four or more cocoons pass through it and form a compound thread of "raw silk."

D Croisure or crossing of the raw silk thread, six or more times round itself. The object of this is to straighten and remove kinks and irregularities in the thread.

E E Pulleys, the drums of which are formed of thin glass rods.

F F Porcelain eyelets or guiders attached to a brass frame which also supports the pulleys.

Tavelette-Keller, sometimes, but erroneously, attributed to Consono. The Italian system of reeling cocoons. See p. 61.

The tavelette is supported on a rod of cast iron fixed in front of the reeling basin. The filiere is a perforated porcelain button through which the multiple thread from the cocoons passes to the tavelette. An eyelet guider conducts the thread to two small pulleys, from which, after being twisted round itself from six to twelve times, it passes through an upper eyelet guider, and is carried to the reel.

I am having several of these machines constructed for the Government of India, and for several native Indian States and other places, as working models. The importance of having the best method of reeling cannot be over-estimated. I am introducing some modifications to simplify the reeling, so as to enable it to be used in the cottage as well as the factory. I shall be happy to order duplicates to be made and sent out to any person wishing to have them. The cost will not exceed £8 and with needful appliances £3 or £4 extra.

The method of working this new machine is as follows (the letters of reference will be found to correspond with those on plate i.) :—

The reeling basin A is partly filled with water, and is heated by means of the oven B underneath it, which contains a coke or charcoal fire, or a Bunsen gas burner may be placed in it.

The cocoons are placed in the hot water 150° F. to 170° F. in the reeling basin, and the waste, which always exists in greater or less quantity on the outside of the cocoons, is removed with the small brush as soon as the cocoons become sufficiently softened. The reelable ends will be found attached to the brush.

For softening the cocoons of the mulberry-feeding silkworm, it is only necessary to employ hot water; but for Tussur cocoons a little *saji mati*, or carbonate of soda, must be used in boiling water, and the cocoons boiled until soft enough, or about three hours.

When the reelable ends of the fibres of a number of cocoons have been found, the ends of a number of fibres, varying according to the size of the raw silk required—say 4, 5, 6, to 12 fibres—are passed together through the filiere C, or perforated button, over the basin, from whence they proceed to the tavelette D (plate v.) where they pass, first, through the lowest porcelain eye or guider C, then over the top pulley, then under the bottom pulley (both pulleys moving from left to right), then they are twisted from six to twelve times round and upon themselves, as shown in plate v., at D, and next passed through the upper porcelain eye, through the reel guider, and on to the reel F (plate i.), which is turned by another person than the one who minds the cocoon basin.

In the following tables of notes of my laboratory examinations of cocoons, where the percentage of silk reeled from the cocoon is stated, it must be understood that the cocoon when weighed contained the *dried* chrysalis.

It is quite possible that all the results of experiments on the properties of the silken fibre of the cocoons examined are not absolutely free from error, although the experiments have been most carefully made. I intend traversing again the whole series during the next twelve months, and if any errors are found, their corrections will be notified. But I believe they may, as they stand, be taken on the whole to be scientifically and practically accurate.

All the cocoons mentioned as exhibits in this chapter will be found in the case labelled "Aids to Sericicultural Study," see also page 85.

CANADA.

Neither cocoons nor raw silk are produced in the Canadian Dominion. The silk of commerce, being produced by the mulberry-fed worm (*Bombyx mori*), can find no prospect of a future here, owing to the climatic conditions being unfavourable to the growth of the mulberry tree.

I noticed, at the Colonial and Indian Exhibition, there were splendid collections of Canadian Lepidoptera, amongst which were several species of wild silk-producers of great interest.

Professor William Saunders, F.R.C.S., President of the Entomological Society of Ontario, exhibited two cases of Samia, Telea, Actias, Collosamia, Hypercheria, and Eacles, which strongly suggested that greater attention, from a sericicultural point of view, should be paid to these cocoon producers.

I strongly suggest and urge the Canadian authorities to send over to England a complete list of indigenous silk-producers, as well as examples of eggs, larvæ, and moths, in all cases accompanied by their cocoons. For sericultural work this is, of course, absolutely essential.

The great success which has attended my efforts for the utilisation of the wild silks of India greatly encourages and warrants this suggestion.

I am engaged in the examination of all fibres of silk, whether at present brought into utility or not, with a view of reporting upon their adaptability for reeling or spinning, their power of tinctorial absorption, their strength, thickness, and elasticity, and in every way which is likely to tend to their ultimate use commercially, and I should be glad to receive from time to time any specimens which may be collected, whether of known or hitherto unknown species, and still more so if the Executive Commission of this great Dominion would aid me in this work.

There are no doubt many entomologists in Canada who would be glad to forward specimens if only requested.

NEW SOUTH WALES.

Sericiculture has not made much progress in this Colony, although it seems to have a suitable climate, stated to be approximate to that of Southern Europe. With a population close upon a million, there is room to suppose that families might be found to attend to the rearing of silkworms and to the collection of cocoons.

No. 24 Buff-coloured cocoons, partially sun-dried, exhibited by Mr. Charles Anthony Brady, of Tumbulgum, Tweed River. The source from which the eggs were obtained was not stated, but it was probably Italian or French.

Nos. 22 and 23 Cream-coloured cocoons, exhibited by Mr. George Thorne, of Castle Hill, Paramatta district.

Cocoons, No. I.

Species of cocoon, with name and address of producer and exhibitor.—Mulberry-fed silkworm cocoon *(Bombyx mori)*. Produced by G. Thorne, Castle Hill, Paramatta District, New South Wales.

Description of the cocoon and its silk fibres.—Form: elliptical-oblong, with slight medial depression. Colour: light buff outside, but yellow inside. Texture: rather loose, the silky walls of the cocoon being composed of successive layers. The reelable cocoon thread or *bave* is composed of two cylindrical fibres or *brins*, consisting of homogeneous matter (*fibroïn*, Schorlemmer) surrounded and cemented together by a substance resembling gelatine (*sericin* or silk-gelatine, Schorlemmer). This latter is called "gum" in England and "grès" in France. As with other mulberry silks, the two *brins* polarise light very beautifully when the *bave* is examined with the microscope and polariscope, but the surrounding silk-gelatine, which forms about 33 per cent of the total weight of the *bave* has no polarising power.

Weight of cocoon.—0·727 gramme.

Dimensions of cocoon.—35 × 19 millimetres.

Length of bave reeled.—615 metres.

Weight of bave reeled.—0·190 gramme.

Titre of bave, milligrammes per 500 metres.—154 milligrammes.

Titre of bave in deniers.—2·89.

Mean diameter of bave.—00·336 millimetre.

Mean elasticity of bave.—20·77 per cent.

Mean tenacity or strength of bave.—8·53 grammes.

Percentage of silk reeled from the cocoon.

Diameter, elasticity, and tenacity of the bave—(I.) 10 metres from the end at the outside of the cocoon; (II.) at the middle of the cocoon; and (III.) 10 metres from the end at the inside of the cocoon.

	I.	II.	III.
Diameter of bave in ten thousandths of a millimetre	* 322 irregular	345	340
Percentage of elasticity. Average of six estimations	† 13·3	24·3	24·7
Tenacity or breaking strength in grammes. Average of six estimations	‡ 6·25	10·27	9·07

	I.	II.	III.	IV.	V.	VI.	VII.
Weight in milligrammes of each 100 metres of bave reeled from the cocoon, commencing at the end of the bave which is at the outside of the cocoon	31	35	34	32	32	26	15 metres remained.

Cocoons No. II.

Species of cocoon, with name and address of producer and exhibitor.—Mulberry-fed silkworm cocoon (*Bombyx mori*). Produced by G. Thorne, Castle Hill, Paramatta district, New South Wales.

Description of cocoon.—Form: elliptical-oblong, without any medial depression, ends rather pointed. Colour: very light greenish-yellow outside, creamy-white inside. Texture: fairly compact, though the silken walls of the cocoon are separable into successive layers. Reeling: good. The description of the bave of Cocoon No. I. applies equally to Cocoon No. II.

Weight of cocoon.—0·693 gramme.

Dimensions of cocoon.—35 × 18 millimetres.

Length of bave reeled.—418 metres.

Weight of bave reeled.—0·146 gramme.

Titre of bave, milligrammes per 500 *metres.*—175 milligrammes.

Titre of bave, in deniers.—3·27.

Mean diameter of bave.—0·0355 millimetre.

Mean elasticity of bave.—20·8 per cent.

Mean tenacity or strength of bave.—9·67 grammes.

Percentage of silk reeled from the cocoon.—21·07 per cent.

Diameter, elasticity, and tenacity of the bave—(I.) 10 metres from the end at the outside of the cocoon; (II.) at the middle of the cocoon; and (III.) 10 metres from the end at the inside of the cocoon.

* 322 ten thousandths of a millimetre equal $\frac{322}{10000}$ inch, as will be seen from the following calculation:—$\frac{1}{10000}$ millimetre = 0·000003937 inch ∴ $\frac{322}{10000}$ millimetre = 0·001267714 inch, or $\frac{1267}{1000}$ inch.

† *i.e.* 100 inches of *bave* will stretch or extend before breaking to 113·3 inches.

‡ 6·25 grammes = 0·2204375oz. avoirdupois, by the following calculation: 1 gramme = 0·03527oz., an 0·03527 × 6·25 = 0·2204375.

The diameter and strength of the *bave*, or natural pair of fibres, are, of course, double those of the single fibre or *brin*.

	I.	II.	III.
Diameter of bave in ten thousandths of a millimetre	372	397	295
Percentage of elasticity. Average of six estimations	17·8	26·7	17·9
Tenacity or breaking strength in grammes. Average of six estimations	10·3	13·2	5·5

	I.	II.	III.	IV.	V.
Weight in milligrammes of each 100 metres of bave reeled from the cocoon, commencing at the end of the bave which is at the outside of the cocoon	45	41	34	24	18 metres remained.

Cocoons No. III.

Species of cocoon, with name and address of producer and exhibitor.—Mulberry-fed silk-worm cocoon (*Bombyx mori*). Produced by C. A. Brady, Tumbulgum, Tweed River, New South Wales.

Description of cocoon.—Form: elliptical-oblong, with slight medial depression. Colour: creamy-white inside and outside. Texture: fairly compact. Reeling: good. The description of the bave of Cocoon No. I. applies equally to Cocoon No. III.

Weight of cocoon.—0·634 gramme.

Dimensions of cocoon.—32 × 16 millimetres.

Length of bave reeled.—554 metres.

Weight of bave reeled.—0·159 gramme.

Titre of bave, milligrammes per 500 metres.—144 milligrammes.

Titre of bave, in deniers.—2·70.

Mean diameter of bave.—0·0328 millimetre.

Mean elasticity of bave.—18·1 per cent.

Mean tenacity or strength of bave.—6·7 grammes.

Percentage of silk reeled from the cocoon.—25·08 per cent.

Diameter, elasticity, and tenacity of the bave—(I.) 10 metres from the end at the outside of the cocoon; (II.) at the middle of the cocoon; and (III.) 10 metres from the end at the inside of the cocoon.

	I.	II.	III.
Diameter of bave in ten thousandths of a millimetre	345	345	294
Percentage of elasticity. Average of six estimations	16·7	22·8	14·9
Tenacity or breaking strength in grammes. Average of six estimations	7·7	8·5	3·9

	I.	II.	III.	IV.	V.	VI.
Weight in milligrammes of each 100 metres of bave reeled from the cocoon, commencing at the end of the bave which is at the outside of the cocoon.....	41	37	33	28	15	54 metres remained, weighing 5 milligrammes.

VICTORIA.

No. 25 Cocoons and raw silk have been sent to England by the Superioress of the Convent of the Good Shepherd (Sister Mary C. Curtain), Abbotsford.

No. 25A Cocoons from Mrs. Timbrell's silk farm in Victoria, formerly exhibited at the Amsterdam Exhibition by Mrs. Bladon Neale. This exhibit was sent on to the Colonial and Indian Exhibition, but was not exhibited owing to the damaged condition of its contents. It was however, sent to my office, and after careful examination and rearrangement I found it to contain really good cocoons, quite of equal commercial value to those of any country.

The following are notes of my laboratory examinations of these cocoons. Their silk fibre will be seen to be somewhat deficient in strength, the reason of this being, that owing to the cocoons having been sent over for exhibition in the Amsterdam Exhibition of 1883, and having been kept in the case since that time, they have suffered in some way, probably from dampness. I have no doubt originally the strength of their silk fibre was quite equal to that of the fibre of any of the other cocoons examined:—

Species of cocoon.—Mulberry-fed silkworm cocoon (*Bombyx mori*).

Description of the cocoon and its silk fibres.—Form: elliptical-oblong, with slight medial depression. Colour: creamy-white. Texture: compact. Reeling: fairly good. See the remarks about the bave under the head Cocoon No. I., New South Wales Report, which are are applicable here also.

Weight of cocoon.—0·221 gramme.

Dimensions of cocoon.—28 × 12 millimetres.

Length of bave reeled.—377 metres.

Weight of bave reeled.—0·070 gramme.

Titre of bave, milligrammes per 500 metres.—93 milligrammes.

Titre of bave, in deniers.—1·75.

Mean diameter of bave.—0·0202 millimetre.

Mean elasticity of bave.—21·73 per cent.

Mean tenacity or strength of bave.—6·57 grammes.

Percentage of silk reeled from the cocoon.—31·67 per cent.

Diameter, elasticity, and tenacity of the bave—(I.) 10 metres from the end **the outside** of the cocoon; (II.) at the middle of the cocoon; and (III.) 10 **etres** from the end at the inside of the cocoon.

	I.	II.	III.
iameter of bave in ten thousandths of a millimetre	205	218	184
ercentage of elasticity. Average of six estimations	24·8	22·9	17·5
'enacity or breaking strength in grammes. Average of six estimations	7·5	7·7	4·5

	I.	II.	III.	IV.
Weight in milligrammes of each 100 metres of bave reeled from the cocoon, commencing at the end of the bave which is at the outside of the cocoon.	21	25	16	77 metres 8

I have no doubt several species of the wild or semi-domesticated silkworms of India might be found capable of acclimatisation in Victoria, and I would recommend eggs to be obtained from India and China. Particulars of all the known species will be found in my "Handbook of the Wild Silks of India," published by the Lords of the Committee of Council on Education, and also in the Descriptive Catalogue of the Indian Silk Culture Court of the Colonial and Indian Exhibition, to which I would refer persons intending to experiment in sericulture.

SOUTH AUSTRALIA.

This Colony extends from north to south, directly through the centre of Australia.

A good deal of encouragement is being given here to sericiculture by Sir Samuel Davenport, K.C.M.G., Assistant-Executive Commissioner in London for South Australia at the Colonial and Indian Exhibition, and President of the Chamber of Manufactures in Adelaide, and by Lady Davenport, who was the first to introduce silkworm culture into this Colony.

No. 27 An excellent exhibit of white cocoons is made by Dr. W. Lennox Cheland, Resident Medical Officer of the Parkside Lunatic Asylum. These cocoons have been sent over in considerable quantity, and, at the request of Sir Samuel Davenport, I have had them reeled, and the resulting raw silk made into silk fabrics. I obtained from these cocoons 3lb. 14oz. of raw silk, and Messrs. J. Birchenough and Sons, of Macclesfield, have thrown

and manufactured it into a beautiful piece of brocaded and patterned satin dress silk or white Broché (see plate xi.), and have sent me the following report of it: "The silk reeled at Leek from Australian cocoons is on the whole very satisfactory. As a winding silk it is superior to China silk, and about equal to a good Japan or Italian. Its elasticity is not so good as the last two classes of silk, and in places the thread has a tendency to split, and where this occurs the result is disappointing. There seems to be an absence of gum, which will account in some degree for this slight fault. The silk is clean, and would be passed as a good silk for a throwster, there being an absence of slubs, knibs, and dirt, which is greatly in its favour. The general sizes seem to be 16 to 20 deniers, but it will range from about 10 to 24 deniers, single thread. As to its value, at the present low value of China silk, it should be worth about 16s. per lb." The cocoons were reeled by the French reeler who was sent over to the Colonial and Indian Exhibition, and who is now working in the Silk Section Court of this Exhibition, by the kindness of the Chamber of Commerce at Lyons, through the instrumentality of Monsieur J. Dusuzeau, Directeur of the Laboratoire de Sériculture of Lyons. After the close of the Colonial and Indian Exhibition the reeler came down to Leek and reeled the cocoons in the adjoining house to my own, where I had daily opportunities of observing the work. The reeling machine used was similar to that employed at the Exhibition, but of a more simple and economical construction. I have had it made to send out to India as a Government pattern, and would strongly recommend its adoption to those in Australia who wish to reel cocoons. It contains all the elements of the best appliances of Italy, the use of which I have studied, but so simplified as to be capable of cottage use, for which purpose in India I have designed it in order to give so agreeable an occupation to the women there whose caste customs of almost perpetual indoor life are well known.

No. 27A Two cocoons or larva cases, species unknown; from St. Kilda, near Melbourne. Sent by Mr. M. S. Smith, Manchester.

The following is the result of my laboratory examinations of the cocoons before mentioned, exhibited in the avenue of approach:—

Species of cocoon and Colony in which it is produced.—Mulberry-fed silkworm cocoon (*Bombyx mori*), South Australia.

Description of cocoon.—Form: elliptical-oblong with slight medial depression. Colour: white. Texture: compact. Reeling: good. Bave composed of two cylindrical structureless brins.

Weight of cocoon.—0·366 gramme.

Dimensions of cocoon.—35 × 16 millimetres.

Length of bave reeled.—497 metres.

Weight of bave reeled.—0·162 gramme.
Titre of bave, milligrammes per 500 metres.—163 milligrammes.
Titre of bave, in deniers.—3·06.
Mean diameter of bave.—0·0473 millimetre.
Mean elasticity.—24·07 per cent.
Mean tenacity.—13·43 grammes.
Percentage of silk reeled from the cocoon.—44·26 per cent.

Trials of the bave—(I.) 10 metres from the end at the outside of the cocoon; (II.) at the middle of the cocoon; and (III.) 10 metres from the end at the inside of the cocoon.

	I.	II.	III.
Diameter of bave in ten-thousandths of a millimetre	483	508	427
Percentage of elasticity. Average of six estimations	25	27·5	19·7
Tenacity of breaking strength in grammes. Average of six estimations	13·6	15·4	11·3

	I.	II.	III.	IV.	V.	VI.
Weight in milligrammes of each 100 metres of bave reeled from the cocoon, commencing at the end of the bave, which is at the outside of the cocoon	30	32	36	37	97 metres remained, weighing 27 milligrammes.	—

Whether all the circumstances which are favourable to such a consummation offer sufficient inducements to emigrants acquainted with sericiculture I am unable to decide, but I think the subject well worth consideration, especially as the objection which I heard put forward so frequently in 1878, at Paris, I have fortunately been able to meet. It was then said that although the climate and country were quite favourable to the culture of the silkworm, labour was scarce and too dear for its application to cocoon-reeling to be thought of. This objection also held good with regard to other parts of Australia.

Feeling this obstacle in itself to be insuperable, I set about casting for a remedy, and my visit to India supplied one, which was as follows: Australia need not trouble itself with cocoon-reeling at all, but should export the cocoons as raw produce to the reeling districts of Bengal, where they can either be reeled by commission, or, what is better, bought outright. I found in Bengal a non-continuous state of silk-reeling owing to the bunds or cocoon harvests having their respective reeling seasons immediately following them, notably after the July or rainy bund, and the November or cold-weather bund.

Briefly, the natives are only occupied six months in the year, and they would gladly welcome arrivals of cocoons from Australia, or other sources, to give them continuous employment.

I have it on the authority of the extensive firm of Messrs. Robert Watson and Co., through their agent and director Mr. Morey, who has the management and control of their numerous filatures in the Rajshahi district, where a considerable proportion of the population is employed in cocoon-reeling, that it would be a very great help indeed if they could be supplied with cocoons to keep their factories or filatures going all the year round, instead of about six months only out of the twelve as at present.

Mr. Morey informed me that importing cocoons from China could be made to pay, and that their factories could take *all the cocoons which the Colonies could produce for some time*, as the very best qualities of silk could be reeled from them.

As regards the value of cocoons reared in the Colonies, at the present prices of raw silk—Italian 18s. to 18s. 6d. per lb., China 14s. per lb., Bengal 16s. per lb., French 22s. per lb., Japan 15s. 6d. per lb.—it would not be less than 16s. per lb. in the dried state.

The best arrangement would probably be to pay so much per lb. for the silk, allowing the reelers a fair profit; but, at any rate, there would always be a market for the cocoons, the chrysalides having been first killed, and the cocoons well dried before packing.

For two parcels of cocoons, which I had to buy from Marseilles for the Royal Commission of the Colonial and Indian Exhibition, for the unbroken continuance of the cocoon-reeling in the Indian Silk Culture Court, I had to pay 5s. per lb. This year, for two parcels of Adrianople and Cyprus cocoons, for the Silk Section Court of this Exhibition, I had to pay 5s. per lb.

Silkworm eggs can be easily obtained from any of the countries the price of whose raw silk is above quoted.

The yield of raw silk from 1lb. of cocoons is about 1oz. to $1\frac{1}{3}$oz. This means green, not dry cocoons. One seer of green or undried good cocoons will yield about one chittak of silk. One seer equals about 2lb., and one chittak about 2oz. avoirdupois.

The reelers of the Serrell machine inform me that they could obtain 1lb. of raw silk from $4\frac{1}{2}$lb. of dry Bengal cocoons, and that from $3\frac{1}{2}$ to 5 and even 6lb. of dry French cocoons they obtained 1lb. of silk, whereas it took 12 to 16lb. of fresh or undried cocoons to yield 1lb. of raw silk.

QUEENSLAND.

No. 28 Cocoons and skeins of raw silk have been sent to England by Miss Gibson, of Stanmore, Yatala.

No. 28A Cocoons and raw silk from the Bengal variety of silkworm, reared in Upper Coomera; have been also sent to England by Mr. Edward Carrington.

I had some of these cocoons reeled in the Colonial and Indian Exhibition by the Lyons woman who was brought over to illustrate the improved method of reeling Bengal and Tussur cocoons, and I reported as follows:—

"September 24th, 1886.

"1. The cocoons reeled very well, and the silk is of very good quality. Cocoons yellow and green.

"2. These cocoons did not reel so well as the former, being much too weak. The worms were either weak or badly fed, and the cocoons, though fit for spinning, were not so for reeling.

"3. These cocoons reeled very well and the raw silk has a pleasant silky touch and is not hairy, but has a nice clean thread, and is about the same as No. 117."

It is evident from this trial that Queensland is capable of sericiculture.

The climate of Queensland is stated to be hot and dry. I infer that the mulberry can grow, although it is not included in the list at page 12 of the Handbook on the Resources and Institutions of Queensland, amongst the plants that have become naturalised.

WEST AUSTRALIA.

There are no exhibits of cocoons from this Colony.

NEW ZEALAND.

There are no exhibits of cocoons from this Colony.

FIJI.

There are two or three species of mulberry-trees in this island, and several species of silk-producing moths and spiders, but sericiculture has been abandoned owing to the ravages of ants and cockroaches.

CAPE OF GOOD HOPE.

The exhibits of silk produced in this Colony I consider to be of very great interest and promise.

The cocoons appear to be good, and if native labour is obtainable at a sufficiently low rate, I do not see why the reeling of them could not be efficiently done. All depends on the price of such labour. If it is dear it is hopeless to attempt to compete with Italy, where the silk-reelers earn about 6d. per day, or with India, where such labour can be had abundantly at 2d. to 4d. per day.

Three series of samples of raw silk have been sent to England by Mr. Barrington of the Knysna district. He was also an exhibitor at the Paris Exhibition of 1878, and, I believe, obtained an award. I remember his exhibit, as I was on the Silk Jury of that Exhibition.

I hope Mr. R. Trimen, Curator of the Museum, Cape Town, will give me the advantage of his co-operation in obtaining examples of all the South African species of larvæ, cocoons, and moths of silk-producers.

Probably no part of the world is richer in wild silk-producers, from the gregarious ones which feed and form their cocoons together in colonies, some of which are upwards of a foot in length, and consist of more than a hundred cocoons enclosed in a silken bag, to those species which seriposit separately and alone.

It would be well if the Cape Town Museum were made a centre of collections of all the African silk-producers, accompanied in all possible cases with the cocoons they form, and so be made an aid, by supplying material to the structural and other examinations of all kinds of silk fibre which I am conducting.

NATAL.

I have not been able to obtain much information about sericiculture in Natal.

From what I have read of the climate, I think it is a highly suitable one for mulberry cultivation, and the rearing of mulberry-fed silkworms. The mean temperature of the summer at Pietermaritzburg is stated to be about 69°, and that of the winter 60°, that of the year being 64·7°. The temperature seldom descends to freezing point.

No. 26 The cocoons and small discs or plaques made from them sent by Mrs. H. J. Dodswell, of Pietermaritzburg, of which the following are notes of my laboratory examinations:—

Species of cocoon.—Mulberry-fed silkworm cocoon (*Bombyx mori*).

Description of cocoon and its silk fibres.—Form: elliptical, but rather pointed at each end. Colour: bright yellow outside, pale yellow inside. Texture: not compact; the cocoon is easily separated into layers, and the outside is covered with a dense coating of very loose bright yellow fibre. Reeling: good, except that there was an excessive quantity of waste fibres on the surface of the cocoon. See the remarks about the bave under the head Cocoon No. I., New South Wales Report, which are applicable here also.

Weight of cocoon.—0·264 gramme.
Dimensions of cocoon.—37 × 14 millimetres.
Length of bave reeled.—236 metres.
Weight of bave reeled.—0·063 gramme.
Titre of bave, milligrammes per 500 *metres.*—133 milligrammes.
Titre of bave, in deniers.—2·50.
Mean diameter of bave.—0·0389 millimetre.
Mean elasticity of bave.—25·07 per cent.
[illegible] strength of bave.—13·97 grammes.
[illegible] reeled from the cocoon.—23·86 per cent.

Diameter, elasticity, and tenacity of the bave—(I.) 10 metres from the end the outside of the cocoon; (II.) at the middle of the cocoon; and (III.) 10 etres from the end at the inside of the cocoon.

	I.	II.	III.
iameter of bave in ten-thousandths of a millimetre	405	390	372
ercentage of elasticity. Average of six estimations	28·8	28·7	17·7
enacity or breaking strength in grammes. Average of six estimations	15·6	14·4	11·9

	I.	II.	III.
Weight in milligrammes of each 100 metres of bave reeled from the cocoon, commencing at the end of the bave which is at the outside of the cocoon	33	23	36 metres remained, weighing 7 milligrammes.

CEYLON.

Silk culture has been introduced into Ceylon by Mr. A. Ross, of Matale, and I cannot do better than quote part of the description given at page 70 of the Official Handbook and Catalogue of the Ceylon Court, at the Colonial and Indian Exhibition, by way of prefacing my own observations. It is as follows: "The white and yellowish-green cocoons shown are exhibited by Mr. Ross, who first imported 'seed' of the *Bombyx mori* from Japan, and endeavoured to rear the worms on his estate in the Matale district, a warm (average temperature about 75° Fahr.) and rather dry locality, about 1,200 feet above sea-level. After a number of disappointments, the experiments gave some promise of success, and the silk pioneer, finding that in Matale *six* crops of silkworms could be reared within the year, *i.e.*, during the hot months of January, February, March, April, and part of May and August and September, set about planting mulberry cuttings along the roads and boundaries, with the view of taking up the industry. Four millions of eggs were obtained from Japan. The cocoons now exhibited are part of the result of this last attempt, and some of these have been favourably commended and valued both in Marseilles and Lyons. The mulberry cultivated is the common *Morus indica*, grown throughout Ceylon. On this the worms feed readily and thrive. It is grown in hedges and propagated by cuttings. The cultivation of the mulberry in the warmer parts of Ceylon, such as Matale Valley, at about 1,200 feet altitude above sea-level, requires no attention beyond the putting down of the cuttings, and keeping them clear of jungle

and weeds. The work of sericiculture is interesting and light; it could easily be managed by families of natives, many of whom have the mulberry growing about their homes and gardens, so that, with some inducement, which they always need in the introduction of new industries, there should be no reason why Ceylon, producing six crops of silk per annum, should not with this 'product,' as with others, take the lead as to quantity and quality, and so tend to the raising of many natives of these dry districts from a state of indolence and want to one of comparative activity and well-being."

Nos. 29 and 29A Mulberry-fed silkworm cocoons (*Bombyx mori*), exhibited by Mr. Ross, of Matale. The following are notes of my laboratory examinations of the two varieties of these cocoons:—

Cocoon No. I.

Species of cocoons, and district in which they were produced.—Mulberry-fed silkworm cocoons (*Bombyx mori*). From North Matale, Ceylon.

Description of cocoon and its silken fibre.—Form: elliptical-oblong, with medial depression. Colour: light yellowish-green. Texture: compact, but silken walls of cocoon thin. Reeling: good. See remarks about the bave under the head of Cocoon No. I., New South Wales Report, which are applicable here also.

Weight of cocoon.—0·436 gramme.

Dimensions of cocoon.—28 × 16 millimetres.

Length of bave reeled.—472 metres.

Weight of bave reeled.—0·117 gramme.

Titre of bave, milligrammes per 500 metres.—124 milligrammes.

Titre of bave, in deniers.—2·33.

Mean diameter of bave.—0·0359 millimetre.

Mean elasticity of bave.—18·77 per cent.

Mean tenacity or strength of bave.—9·17 grammes.

Percentage of silk reeled from the cocoon.—26·84 per cent.

Diameter, elasticity, and tenacity of the bave—(I.) 10 metres from the end at the outside of the cocoon; (II.) at the middle of the cocoon; and (III.) 10 metres from the end at the inside of the cocoon.

	I.	II.	III.
Diameter of the bave in ten thousandths of a millimetre	385	395	298
Percentage of elasticity. Average of six estimations	22·3	24·0	10·0
Tenacity or breaking strength in grammes. Average of six estimations	8·3	13·5	5·7

	I.	II.	III.	IV.	V.
Weight in milligrammes of each 100 metres of bave reeled from the cocoon, commencing at the end of the bave which is at the ouside of the cocoon	27	28	23	22	72 metres remained, weighing 17 milligrammes.

Cocoon No. II.

Species of cocoons, and district in which they were produced.—Mulberry-fed silkworm cocoons (*Bombyx mori*). From North Matale, Ceylon.

Description of cocoon and its silken fibre.—Form: elliptical-oblong, with medial depression. Colour: white inside and outside. Texture: fairly compact, but silken walls of cocoon separable into successive layers. Reeling: good. See the remarks about the bave under the head of Cocoon No. I., New South Wales report, which are applicable here also.

Weight of cocoon.—0·397 gramme.

Dimensions of cocoon.—29 × 14 millimetres.

Length of bave reeled.—490 metres.

Weight of bave reeled.—0·145 gramme.

Titre of bave, milligrammes per 500 metres.—148 milligrammes.

Titre of bave in deniers.—2·78.

Mean diameter of bave.—0·0364 millimetre.

Mean elasticity of bave.—20·00 per cent.

Mean tenacity or strength of bave.—10·5 grammes.

Percentage of silk reeled from the cocoon.—36·37 per cent.

Diameter, elasticity, and tenacity of the bave—(I.) 10 metres from the end at the outside of the cocoon; (II.) at the middle of the cocoon; and (III.) 10 metres from the end at the inside of the cocoon.

	I.	II.	III.
Diameter of the bave in ten thousandths of a millimetre	385	398	308
Percentage of elasticity. Average of six estimations	21·0	23·3	15·7
Tenacity or breaking strength in grammes. Average of six estimations	8·6	12·2	10·7

	I.	II.	III.	IV.	V.
Weight in milligrammes of each 100 metres of bave reeled from the cocoon, commencing at the end of the bave which is at the outside of the cocoons	37	34	30	24	90 metres remained, weighing 20 milligrammes.

There is no silk weaving in Ceylon.

THE STRAITS SETTLEMENTS.

I can find no trace of the existence of any sericicultural industry in this colony.

HONG-KONG.

The exhibits from Hong-Kong may be said to illustrate the wealth of China in silk rather than of the small Colony of Hong-Kong, where silk culture is hardly practised, although much of China's silk is shipped from there. The exhibits thus represent the merchandise in silks and not their production,

nevertheless it would be a serious omission if a description of them were not given.

No. 31 A series of silks in the early stages of manipulation is contributed by Messrs. Arnhold, Karberg & Co., of Hong-Kong, Canton, and of London. They comprise specimens of waste silk under the head of "Punjam," and a most interesting series of raw silks such as the European and other markets are supplied with. The following is the list of them in its completeness, which forms a most desirable addition to the published nomenclatures of silk :—

No.	——	——	Size in Deniers.	How produced from the Cocoon.
1	Punjam }			
2	„ } waste silk for			
3	„ } spinners.			
4	„ }			
50	Canton Tsatlee Curio ...	Loonkong.		
51	„ „ No. 1 ...	„		
52	„ „ Curio ...	Loongshan.		
53	„ „ No. 1 ...	„		
54	„ „ „ 2 ...	„		
55	„ „ „ 1 ...	Kodngon.		
56	„ „ „ 2 ...	„		
57	„ „ „ 2 ...	Soeytang.		
58	„ „ „ 3 ...	„		
59	„ „ „ 4 ...	„		
60	„ Long Reels	Lacklow.		
61	„ „ „	Mahang.		
62	„ „ „	Kowkong.		
100	Kwong Shun Cheong ...	....	13/15	Canton Steam.
101	Min King Lun	....	14/16	Filature Silk.
102	Ü Han Cheong.....	....	10/12	„
103	Kai Cheong Loong	....	10/12	„
104	Yee Wo Cheong	....	13/15	„
105	„ „ „	....	14/16	„
106	Hing Loong Cheong ...	....	10/12	„
108	Chong Kee	....	13/15	„
109	Kwong Hing Lun	....	10/12	„
110	„ „ „	....	10/12	Canton Steam.
111	Kam Lun Cheong	....	13/15	Filature Silk.
112	Poo Cheong Woo.....	....	13/15	„
113	How King Cheong	....	10/12	„
120	Wing Wo Lun	....	12/14	„
118	King Wo Cheong.....	....	18/22	„
114	Wing Kee.....	....	10/12	„
115	„ „	....	14/16	„
116	Shun Po On	....	13/15	„
117	Lee Han Sang	....	10/12	„
119	Ko King Lun	....	10/12	„
121	Ohn Ching	....	10/12	„
122	Sin Lun Cheong	....	10/12	„
123	King Cheong Loong ...	....	10/12	„
124	Lee Ching Cheong	....	11/13	„
125	Yaen Hang Lee	....	10/12	„
126	Lun Kee	....	10/12	„

This collection has been transferred to this Exhibition from the Colonial and Indian Exhibition of last year by consent of Sir P. Cunliffe-Owen, K.C.B., K.C.M.G., C.I.E., Director of the South Kensington Museum, Commissioner of Hong Kong.

BRITISH NORTH BORNEO.

There is no silk culture in this tropical colony.

BRITISH GUIANA.

I am indebted to G. H. Hawtayne, Esq., C.M.G., for the following information :—

Nothing is known of any silk produced by indigenous or imported Lepidoptera, and no silk industry is carried on in this colony, but there are moths much like the Atlas moth of India, but smaller. Mr. G. H. Hawtayne has kindly obtained for me, from Demerara, a specimen of a moth of the genus *Attacus*, resembling *Attacus Atlas* in appearance, but smaller, also a specimen of the cocoon of this species, and of raw silk reeled from it. These are exhibited in the Entomological collection.

THE WEST INDIES.

The West Indies and British Honduras, comprising Jamaica, Trinidad, Barbados, Grenada, St. Vincent, Tobago, St. Lucia, Antigua, St. Christopher, Dominica, Montserrat, Virgin Islands, British Honduras, and the Bahamas, furnish but little of sericicultural interest.

In the cases of Lepidoptera exhibited at the Colonial and Indian Exhibition I noticed several species of silk-producers, from which I infer that a proper search made throughout these islands and districts might result in a good addition to our sericicultural and lepidopterous knowledge.

In the British Honduras Court, Sir Augustus Adderley drew my attention to a bunch of fawn-coloured substance of fibrous structure, $5\frac{3}{4}$ inches long, $3\frac{1}{4}$ inches wide, and $1\frac{1}{2}$ inches thick, which, on closer examination, I found to be a cluster of silk cocoons containing living chrysalides, and during the summer (1886) a moth emerged from each of four of the cocoons. Each cocoon is about $1\frac{3}{8}$ inch in length, $\frac{5}{8}$ inch in width.

This is most probably a new species, and belongs to the family Lasiocampidæ; genus Hyleora.

The four moths which emerged from these cocoons were all females. The fore wings mottled pale brown, without very distinctive markings or eye-spots. The hind wings were like the fore wings in appearance. Measurement across the wings $2\frac{9}{16}$ inches.

The silk differs from most wild silks, inasmuch as the fibre is round, and resembles in structure and form that of the cocoons of the mulberry-feeding

species, which produce the ordinary silk of commerce. Its diameter, however, is less, that of the double fibre being only $\frac{1}{1870}$inch, and of the single fibre $\frac{1}{3740}$inch. The fibres are deposited in pairs in cocoons by the silkworm, like those of all other silks, and are very uniform in diameter.

This new silk is very interesting both to sericiculture and to science, and I would suggest that further investigations should be made in Honduras, and the cocoons, if they should be found in quantity, sent over to England for spinning purposes.

The cocoons are bound together in a cluster or bunch by silk fibre, and are enclosed in a thin transparent bag, which is a web or tissue of the same material.

WEST AFRICA SETTLEMENTS.

Captain Moloney, C.M.G., late Governor of Gambia, exhibited at the Colonial and Indian Exhibition a beautifully arranged series of insect cases, amongst which were fourteen cases of moths, containing, with others, several species of silk-producers.

There is no silk industry in these colonies as far as I can learn.

CYPRUS.

Cyprus has for a long period been a silk-producing island. The climate is on the whole salubrious, especially in the higher plateaux, being hot in the summer and moderate in winter.

The cocoons produced here are the largest I have seen. The silk of those of Baffo (the ancient Paphos, where Elymas the sorcerer was struck blind by St. Paul, and where it is said, mythologically, Venus rose out of the sea) has the reputation of being stronger than the silks of Asia Minor or Western Europe, and has been for many years used in France in the manufacture of gold and silver lace.

Many of the cocoons are much pointed at one end and rounded broadly at at the other. The largest measure 2 inches in length and $\frac{7}{8}$ inch in breadth; 6 to 6½lb. of them are stated to produce 1lb. of silk, which is a large yield.

Disease of the silkworm has injured this industry, but no doubt careful attention to its causes and nature would show it to be preventable, or at any rate curable; and I would especially recommend the encouragement of silk culture to those in authority.

There is no need to provide for reeling the cocoons, because the filatures of Italy and France are so near, and there is no difficulty in disposing of the silk in the cocoon state. This ought to be made a very important industry

and it would, as formerly, be a profitable means of subsistence to the Cyprian women.

There are three species of cocoons, one being from Cypriote eggs, one from Japanese, and one from French eggs. The yield in Cyprus from the two latter has been stated to me to be 1lb. of silk from 12 to 13lb. of cocoons.

No. 30 Mulberry-fed silkworm cocoons (*Bombyx mori*), Cyprus, Paphos, exhibited by the Cyprus Commission.

The following are notes of my laboratory examinations of the above:—

Description of the cocoon and its silk fibre.—Form: elliptical-oblong, but pointed at one end, and with a slight medial depression. Colour: light buff outside and inside. Texture: compact, but silken walls of cocoon thin. Reeling: good. See the remarks about the bave under the head Cocoon No. I., New South Wales Report, which are applicable here also.

Weight of cocoon.—0·653 gramme.
Dimensions of cocoon.—47 × 20 millimetres.
Length of bave reeled.—787 metres.
Weight of bave reeled.—0·234 gramme.
Titre of bave, milligrammes per 500 metres.—149 milligrammes.
Titre of bave, in deniers.—2·80.
Mean diameter of bave.—0·0375 millimetre.
Mean elasticity of bave.—23·2 per cent.
Mean tenacity or strength of bave.—14·1 grammes.
Percentage of silk reeled from the cocoon.—35·83 per cent.

Diameter, elasticity, and tenacity of the bave—(I.) 10 metres from the end at the outside of the cocoon; (II.) at the middle of the cocoon; and (III.) 10 metres from the end at the inside of the cocoon.

	I.	II.	III.
Diameter of bave in ten thousandths of a millimetre	310	479	335
Percentage of elasticity. Average of six estimations	16·1	29·4	24·1
Tenacity or breaking strength in grammes. Average of six estimations	11·1	17·2	14·1

	I.	II.	III.	IV.	V.	VI.	VII.	VIII.
Weight in milligrammes of each 100 metres of bave reeled from the cocoon, commencing at the end of the bave which is at the outside of the cocoon	41	41	37	34	29	25	19	87 metres remained, weighing 8 milligrammes.

In order to make the value of the estimations of thickness, elasticity, and tenacity, or strength, of the several specimens of silk examined in the foregoing pages more apparent, it is necessary to compare them with silks of known commercial worth; and I therefore add the results of similar examina-

tions of typical cocoons from France, Japan, and Bengal, at the same time stating their respective present values in the market as raw silk, which are as follows: French, 22s. per lb.; Japanese, 15s. 6d. per lb.; Bengal, 16s. per lb.; and Italian, 18s. to 18s. 6d. per lb.

French Cocoon.

Description of the cocoon and its silk fibre.—Form: elliptical-oblong, with slight medial depression. Colour: light buff outside, yellow inside. Texture: compact, but silken walls of cocoon separable into successive layers. Reeling: good. See the remarks about the bave under the head Cocoon No. I., New South Wales Report, which are applicable here also.

Weight of cocoon.—0·565 gramme.

Dimensions of cocoon.—31 × 17 millimetres.

Length of bave reeled.—705 metres.

Weight of bave reeled.—0·197 gramme.

Titre of bave, milligrammes per 500 metres.—140 milligrammes.

Titre of bave, in deniers.—2·63.

Mean diameter of bave.—0·0334 millimetre.

Mean elasticity of bave.—19·30 per cent.

Mean tenacity or strength of bave.—9·50 gramme.

Percentage of silk reeled from the cocoon.—34·87 per cent.

Diameter, elasticity, and tenacity of the bave—(I.) 10 metres from the end at the outside of the cocoon; (II.) at the middle of the cocoon; and (III.) 10 metres from the end at the inside of the cocoon.

	I.	II.	III.
Diameter of bave in ten thousandths of a millimetre	330	347	325
Percentage of elasticity. Average of six estimations	14·4	23·8	19·7
Tenacity or breaking strength in grammes. Average of six estimations	7·9	12·4	2·8

	I.	II.	III.	IV.	V.	VI.	VII.
Weight in milligrammes of each 100 metres of bave reeled from the cocoon, commencing at the end of the bave which is at the outside of the cocoon	28	34	33	32	27	24	18

The following particulars regarding a French cocoon will show the relative proportions in weight of the bave, the waste fibres, and the chrysalis. The different parts of the cocoon were, of course, weighed in a dry state:—

Weight of cocoon	0·711	gramme.
„ chrysalis	0·432	„
„ bave	0·246	„
„ waste fibres, including the superficial waste and the unreelable fibres surrounding the chrysalis, which form an envelope called in France the "telette"	0·033	„

Bengal Cocoon.

Description of the cocoon and of its silk fibre.—Form: elliptical-oblong, without medial depression. Colour: Deep golden yellow outside and lighter yellow inside. Texture: not very compact, the silken wall of the cocoon being separable into successive layers, and its surface being covered by many loose waste fibres. Reeling: good. See the remarks about the bave under the head Cocoon No. I., New South Wales Report, which are applicable here also.

Weight of cocoon.—0·184 gramme.
Dimensions of cocoon.—26 × 14 millimetres.
Length of bave reeled—104 metres.
Weight of bave reeled.—0·022 gramme.
Titre of bave, milligrammes per 500 metres.—105 milligrammes.
Titre of bave, in deniers.—1·97.
Mean diameter of bave.—0·202 millimetre.
Mean elasticity of bave.—17·87 per cent.
Mean tenacity or strength of bave.—9·33 grammes.
Percentage of silk reeled from the cocoon.—11·95.

Diameter, elasticity, and tenacity of the bave—(I.) 10 metres from the end at the outside of the cocoon; (II.) at the middle of the cocoon; and (III.) 10 metres from the end at the inside of the cocoon.

	I.	II.	III.
Diameter of bave in ten thousandths of a millimetre	205	212	190
Percentage of elasticity Average of six estimations.....	20·7	20·5	12·4
Tenacity or breaking strength in grammes. Average of six estimations	10·2	10·7	7·1

Japanese Cocoon (*Ao Jiku*).

Description of the cocoon and its silk fibre—Form: elliptical-oblong, with medial depression Colour: white inside and outside. Texture: compact, but silken walls of cocoon separable into successive layers. Reeling: good. See the remarks about the bave under the head Cocoon No. I., New South Wales Report, which are applicable here also.

Weight of cocoon.—0·730 gramme.
Dimensions of cocoon.—33 × 16 millimetres.
Length of bave reeled.—642 metres.
Weight of bave reeled.—0·276 gramme.
Titre of bave, milligrammes per 500 metres.—215 milligrammes.
Titre of bave, in deniers.—4·00.
Mean diameter of bave.—0·0393 millimetre.
Mean elasticity of bave.—14·33 per cent.
Mean tenacity or strength of bave.—9·50 per cent.
Percentage of silk reeled from the cocoon.—37·81 per cent.

Diameter, elasticity, and tenacity of the bave—(I.) 10 metres from the end at the outside of the cocoon; (II.) at the middle of the cocoon; and (III.) 10 metres from the end at the inside of the cocoon.

	I.	II.	III.
Diameter of bave in ten thousandths of a millimetre	375	412	392
Percentage of elasticity. Average of six estimations	11·7	18·9	12·4
Tenacity or breaking strength in grammes. Average of six estimations	7·9	12·4	8·2

	I.	II.	III.	IV.	V.	VI.	VII.
Weight in milligrammes of each 100 metres of bave reeled from the cocoon, commencing at the end of the bave which is at the outside of cocoon	34	42	44	48	46	44	42 metres remained, weighing 18 milligrammes.

ids to Sericicultural Study.* Cocoons from Italy, France, Greece, China, Japan, India, and British Colonies.

1 Tussur silk cocoons. Bardwan, Bengal. Exhibited by the Government f India.

2 Cocoons of the Eria silkworm, *Attacus ricini*. Kamrup, Assam. Exhibited by the Government of India.

3 Cocoons of the Eria silkworm, *Attacus ricini*, prepared for carding, as old for manufacturing purposes. Nowgong, Assam. Exhibited by the Government of India.

4. Cocoons of the Eria silkworm, *Attacus ricini*. Jalpaiguri, Bengal. Exhibited by the Government of India.

5 Cocoons of the mulberry-fed silkworm of Bengal, as being reeled at the cocoon-reeling frame in this Section.

6 Pierced cocoons of the Japanese silkworm, *Antheræa yama-mai*.

7 Three drafts of the silk of the pierced cocoons of the Japanese silkworm *Antheræa yama-mai*, dressed ready for spinning by Messrs. Clayton, Marsdens, & Co., Halifax.

8 Italian cocoons of the mulberry-fed silkworm, *Bombyx mori*. Lent by H. T. Gaddum, Esq., of Manchester. The cocoons comprising this series are distinguished as follows:—

Incrocio giallo verde.
Bianchi riprodotti Giappone.
„ Adrianopoli calcinati.
Verdi a bozzolo piccolo.
Verdi-scarto di rugginosi (rouillés).
From Romagna.
Doppi gialli.
Bozzoli Pirenei.
Verdi vellutati inferiori.
Gialli calcinati (muscardinés).
Doppi verdi.
Verdi a bozzolo grotto.
Incrocio bianco-giallo.

9 Cocoons from Madagascar. Sent by Messrs. Pare and Arthur, London.

* See also list of Cocoons lent by the Government of India, p. 96, and the Colonial Cocoons, pp. 65, 68, 69, 70, 73, 74, 76.

10 Three drafts of the silk of the cocoons of the Eria silkworm of Assam, *Attacus ricini*, dressed ready for spinning, by Messrs. Clayton, Marsdens, and Co., Halifax.

11 Races or varieties of cocoons of the mulberry-fed silkworm, *Bombyx mori*. Lent by myself:—

a. Japanese cocoons, Aka-Tiku.
b. „ „ Ao-Jiku.
c. „ „ Ko-ischi-Maru.
d. „ „ Mata-Mukashi.
e. „ „ Oui-tchi-Zimi.
f. „ „ Timé-San.
g. „ „ Kin Sei.
h. „ „ Ki mai san.
i. „ „ Nikiva San.
j. „ „ Shi-Kiva-San.
p. French cocoons, large variety.
q. „ „ Bione variety.
r. „ „ Vallerangue.
s. „ „ des Cevennes.
t. „ „ Alpes Maritimes.
u. „ „ de Provence.
v. „ „ de Sina.
cc. White cocoons of Corea, raised in France.
w. Italian cocoons, Sardinia.
x. „ „ Tuscany.
y. „ „ Pestellini.
n Cocoons from Kalamata, Greece.
aa „ Andros, Greece, Vitaliste.
bb „ Bagdad, Turkey in Asia.
z Bulgarian cocoons, Roustchouk.
ee White cocoons, Cochin-China.

12 Cocoons of the mulberry-fed silkworm, *Bombyx mori*, Italy. Lent by Mr. H. T. Gaddum, Manchester:—

1 Yellow, from Romagna or Ascoli, reared in Piedmont.
2 Yellow, from Pyrenees, reared in Piedment.
3 Yellow, from Var, reared in Piedmont.
4 Yellow, from Istria, reared in Friouli.
5 Yellow, from France, reared in Syria.
6 Yellow satinés (oozy), inferior, reared in Piedmont.

7 Yellow muscardinés (chrysalis dried up), reared in Piedmont.
8 Yellow, double, reared in Piedmont.
9 White, from Adrianople, reared in Piedment.
10 White, from Adrianople, muscardinés, reared in Piedmont.
11 White, from Japan, reared in Piedmont.
12 White, from Japan, seed laid in Italy, reared in Piedmont.
13 Green small cocoons, reared in Piedmont.
14 Green large cocoons, reared in Piedmont.
15 Green inferior satinés, reared in Piedmont.
16 Green inferior rusted (Rouillés), reared in Piedmont.
17 Green, doubie, reared in Piedmont.
18 Green, white cross, reared in Friouli.
19 Yellow, white cross, reared in Friouli.
20 Yellow, green cross, reared in Friouli.
21 Yellow and white-pierced cocoons, reared in Friouli.
22 Good cocoons, from Romagna.
23 Double cocoons, from Romagna.

13 Silk formed by the Spider, Nephilengys malabarensis, Walck, found at the Lake of Bhim Tál, in Kumáun District, North-western Provinces, by J. F. Duthie, Esq., of the Botanical Gardens, Saharanpur, showing the way in which it was collected on sticks.

14 The same spider silk as No. 13, but removed from the sticks. For information on this silk, see the report of "Researches on Silk Fibre," by the chairman of the section, published by the Government of India, July 9th, 1885.

15 Spider silk. Lent by J. Wood Mason, Esq., Economic Museum, Calcutta.

15A Spider silk from nest of Uroctea Durandii (Walck), Palestine.

15B Spider silk; egg cocoons of an Epeirida sp.

15C Spider silk; egg cocoons of Voconia Maculatas, N. Corrientes, La Plata.

15D Spider silk; egg cocoons of Meta Menardi, Devonshire.

15E Supposed spider silk. From South America.

15F Spider silk; Nephila Plumipes, Koch. From United States, America.

15G Spider silk; Nephilengys Malabarensis (Walck). From Bhim Tal, Kuman, India.

15H Two spider cocoons from Staffordshire. Lent by Mr. Chappell.

15I Web made by *Acari* (*tetranchus tetanus*). Found by Dr. Stolterfoth, of Chester, on the hill above Barmouth, on August 25th, 1886. These insects had covered the gorse with a fine web over a space of at least one hundred

square feet. The appearance presented was if a flock of sheep had run down the hills and left part of their wool on the thick gorse. Lent by Mr. R. Newstead, Curator, Grosvenor, Museum, Chester.

No. 15J Spider's nest (France). Lent by Mr. R. Newstead, Curator of the Grosvenor Museum, Chester.

No. 15K Very large and curious silk bag (32 inches long), said to be made by spiders, but more probably by lepidopterous larvæ. From Africa. Lent by Mr. R. Newstead, Curator of the Grosvenor Museum, Chester.

15L Flask-shaped cocoon spider. Sent by Mr. P. Elliott, Queensland.

16 Indian Tussur, silk cocoon (*Antheræa mylitta*), showing the method by which the silk worm attaches it to the branches of the trees on the leaves of which it feeds. The cocoon is cut open to show the chrysalis.

17 Cocoons of an unknown species of silkworm. Gambia, West Africa. Sent by Sir James Marshall.

18 Silk cocoons, produced by an unknown species of silkworm, which feeds and forms its cocoons in colonies. The colony of cocoons is enclosed in a silken bag. Probably Hylesia canitiæ. British Honduras.

19 Boro poloo silk of *Bombyx mori*, 23 deniers. The cocoons from which this silk was reeled are univoltine, and yield beautiful silk. Exhibited by the Government of India.

20 Eria silk cocoons, *Attacus ricini*, attached in bunches. Nowgong, Assam.

21 Light-coloured Tussur silk cocoons from larvæ which feed on the eaves of *Zizyphus jujuba*. Exhibited by the Government of India.

22 Raw silk, reeled from the cocoons of the Muga silkworm (*Antheræa Assama*) in the Silk Section by the French method of cocoon reeling. The cocoons were sent from Assam by Mr. H. Z. Darrah, Officiating Director of Agriculture, in three boxes. This silk is of excellent quality, and it is the first that has ever been reeled in Europe.

23 Hank of raw silk of 10 to 12 deniers reeled from the cocoons of the mulberry-feeding silkworm of Bengal by the Serrell Automatic Cocoon-reeling Machine. Quality excellent.

23A Thrown silk, Organzine and Tram, a portion undyed and the rest dyed into a series of colours by Joshua Wardle and Sons, of Leek. This exhibit is to illustrate the excellent quality of Bengal silk when properly reeled. These examples were manufactured by Messrs. J. and T. Brocklehurst and Sons, of Macclesfield, from raw silk supplied by the Rajshahi Filature of Messrs. Robert Watson and Co., of Surdah, Bengal. It will easily be observed how beautiful and lustrous the silk is after dyeing, and how even and excellent is the quality.

Silk Cocoon Reeling.

Three Cocoon Reeling Machines at work. Two French ones exemplifying two principal methods of reeling employed in the south of France, and an lian one showing the system of reeling in which the Tavelette Keller, oneously called Consono, is used. One of the French machines is worked by French fileuse, or cocoon reeler, from Lyons, who is engaged in reeling ngal cocoons. The other is reeling Tussur and Muga cocoons, and by it is own the practicability of producing Tussur and Muga raw silk in continuous id even threads.

Two Small Models of Cocoon Reeling Machines, showing the method actised by the Chinese. One of them is automatic, and by winding up a pring is set at work. Lent by Messrs. Arnhold, Karberg & Co., London.

Specimen of a tavelette such as is used in the Indo-European filatures of engal, and which is also the system which, in a rougher degree, obtains in he villages where native reeling of cocoons is carried on.

STAND No.

A List of the Entomological Collection in Cases of the Silk Section placed in the Gallery of Approach.

This collection is intended to illustrate as far as has been possible the silk-producing insects of the world, and to show what a large number of larvæ do actually secrete a silken fibre. It is partly a loan collection and partly purchased.

Both the living and dead collections have been placed under the able care of Mr. Chappell, of Manchester, who is instructed to give any information about them to any persons applying at the Silk Section Office.

Family.	Genus and Species.	Locality.
Nycteolidæ	Hylophila prasinana	Britain
Arctiidæ	sp.	South Africa
Nocturni	Limacodes asellus	Britain
,,	,, testudo	,,
,,	Procris statices	,,
,,	,, geryon	,,
,,	,, globulariæ	,,
,,	Zygæna minos	,,
,,	,, exulans	,,
,,	,, trifolii	,,
,,	,, meliloti	,,
,,	,, loniceræ	,,
,,	,, filipendulæ	,,
,,	Nola cucullatella	,,
,,	,, cristulalis	,,
,,	,, strigula	,,
,,	,, albulalis	,,
,,	,, centonalis	,,
,,	Setina irrorella	,,
,,	Lithosia mesomella	,,
,,	,, muscerda	,,
,,	,, aureola	,,
,,	,, pygmæola	,,
,,	,, caniola	,,
,,	,, helveola	,,
,,	,, complanula	,,
,,	,, complana	,,
,,	,, griseola	,,
,,	,, stramineola	,,
,,	,, quadra	,,
,,	,, rubricollis	,,
,,	Eulepia grammica	,,
,,	,, cribrum	,,
,,	Callimorpha dominula	,,
,,	,, hera	Jersey
,,	Euthemonia russula	Britain
,,	Chelonia plantaginis	,,
,,	,, caja	,,
,,	,, villica	,,
,,	Arctia fuliginosa	,,
,,	Spilosoma menthrasti	,,
,,	Arctia mendica	,,
,,	,, urticæ	,,
,,	Liparis chrysorrhœa	Britain
,,	,, auriflua	,,
,,	,, salicis	,,
,,	,, dispar	,,

Family.	Genus and Species.	Locality.
Nocturni	Liparis monacha	Britain
,,	Demas coryli	,,
,,	Pœcilocampa populi	
Psychidæ	sp.	Senegal
,,	sp.	India
Liparidæ	Orgyia antiqua	,,
,,	,, gonostigma	,,
,,	,, leucostigma	Europe
,,	Dasychira confusa	,,
,,	,, selenitica	,,
,,	,, pudibunda	,,
,,	Dicallomera fascelina	,,
,,	Calliteara abietis	,,
,,	Darala ocellata	,,
,,	Murlida citrina	Indo-Australasia
,,	,, undata	,,
,,	,, mutans	,,
Bombycidæ	Gastropackæ sp.	,,
,,	Bombyx mori	Lahore, Punjab
,,	,, ,,	Japan
,,	,, ,,	Milan
,,	,, ,,	China
,,	,, ,,	South of France
,,	,, ,,	Bengal
,,	,, ,,	South Africa
,,	,, sp.	Kotnaina, Gurdaspur
,,	,, sp.	,,
,,	,, textor	Gonatea
,,	,, meridionalis	Buddapah, Madras
,,	,, sp.	Serampore
,,	,, fortunatus	Surdah, Rajshahi
,,	,, cræsi	,,
,,	,, sp.	Rungpore
,,	,, sp.	Assam
,,	Cocoons mori	Cyprus
,,	,, ,,	Adrianople, Greece
,,	Fertile cocoons	Milan
,,	Trichiura cratægi	Britain
,,	Malacosoma franconica	Europe
,,	Nemeophila alpicola	,,
,,	Clisiocampa castrensis	Britain
,,	,, neustria	,,
,,	,, americana	North America
,,	,, innocens	South America
,,	,, henckei	Europe
,,	,, ursula	Africa
,,	Eriogaster lanestris	Britain
,,	Dasysoma catax	Europe
,,	Lasiocampa ? eversmanni	,,
,,	Dasysoma rimicola-catax	,,
,,	Pachygastria trifolii	Britain
,,	,, serrula	Europe
,,	Lasiocampa quercus	Britain
,,	,, rubi	,,
,,	Theophila huttoni	Pokhuria Gobindpore, India
,,	Hylesia sp. ? canitiæ	Honduras
,,	Eriogaster proxima	South America
,,	Titya undulosa	,,
,,	Macromphalia chilensis	,,
,,	Crateronyx dumi	Europe
,,	Odonestis potatoria	Britain

Family.	Genus and Species.	Locality.
Bombycidæ	Odonestis albomaculata	Europe
,,	,, laeta	,,
,,	Chrostogastria pruni	,,
,,	,, sumatrensis	Indo-Australasia
,,	Gastropacha quercifolia	Britain
,,	,, populifolia	Central Europe
,,	,, tremulifolia	Europe
,,	,, betulifolia	,,
,,	,, ilicifolia	Britain
,,	,, suberifolia	France and Spain
,,	Antarctia sordida	Europe
,,	Eutricha pini	Central Europe
,,	Boroceras postica	,,
Lasiocampidæ	Limacodes bufo	Europe and Siberia
,,	Cosmotriche lunigera	South Germany
,,	Pachypasa otus	Europe and Siberia
,,	Lebeda pithyocampa crameis	Africa
,,	Megosoma repandum	Europe
,,	Dryocampa senatoria	North America
,,	,, alba	North America
,,	Nemeresa trimacula	South America
,,	Gonometa postica	South Africa
,,	Palustra burmeisteri	South America
Endromidæ	Endromis versicolora	Britain
,,	Cricula trifenestrata	India

Hymenoptera, (Ichneumon flies and their tiny silken cocoons of white silk, of their larvæ which fed in the interior of a larva of arctia caja).

Ditto	ditto	another species with yellow cocoons.
Saturniidæ	Attacus atlas	India and China
,,	,, edwardsii	Lakhimpur Assam
,,	,, cynthia	India
,,	,, ricini	India
,,	,, insularis	India
,,	,, aurota	South America
,,	,, jacobæa	South America
,,	,, hesperus	South America
,,	,, maurus	South America
,,	,, speculum	South America
,,	,, ,,	Demerara
,,	,, ,,	,,
,,	,, ,,	Malacca
,,	Platysamia cecropia	North America
,,	,, ceonothi	California
,,	,, columbia	North America
,,	Callosamia promethea	North America
,,	,, angulifera	North America
,,	Telea polyphemus	North America
,,	Bunæa alcinæ	Africa
,,	,, caffaria	South Africa
,,	Antheræa assama	Assam
,,	,, mylitta	India
,,	,, frithii	Sikkim
,,	,, cytherœa	South Africa
,,	,, wahlbergi	South Africa
,,	,, helferi	Sikkim
,,	,, menippe	India
,,	,, roylei	India
,,	,, pernyi	China
,,	,, feltoni	China
,,	,, yama-mai	Japan
,,	,, tyrrhea	South Africa

Family.	Genus and Species.	Locality.
Saturniidæ	Antheræa belina	Indo-Australasia
,,	,, eucalypti	Indo-Australasia
,,	,, sp.	
,,	Caligula simla	India
,,	Loepa katinka	India
,,	,, miranda	India
,,	Actias selene	Sikkim, India
,,	,, leto	Sikkim, India
,,	,, mimosa	South Africa
,,	,, luna	North America
,,	,, artemis	Siberia
,,	,, isabella	Spain
,,	Rinaca zuleika	Sikkim
,,	Salassa lola	Sikkim
,,	Gynanisa isis	Africa
,,	Brahmæa ledereri	Europe
,,	Saturnia pyri	South Europe
,,	,, boisduvalii	Europe
,,	,, schenckii	Europe
,,	,, spini	S. E. Europe, W. Asia
,,	,, carpini	Britain
,,	,, attacus	South Africa
,,	,, hœgei	South America
,,	Perisomena cæcigena	Europe, W. Asia
,,	Saturnia jankowskii	Siberia
,,	,, mendocina	North America
,,	Polythysana rubrecsens	South America
,,	,, andromeda	,,
,,	Endelia rufescens	,,
,,	Hyperchiriaio	North America
,,	,, pamina	,,
,,	,, metzlii	South America
,,	,, euryopa	,,
,,	,, coresus	,,
,,	,, viridescens	,,
,,	,, aspersa	,,
,,	,, myops	,,
,,	Aglia tau	Central Europe
,,	Hemileuca maja	North America
,,	Urota sinope	Africa
,,	Micrattacus dissimile	South America
,,	Dirphia	South Africa
,,	Calepteryx collesi	Indo-Australasia
,,	Neoris huttoni	N. W. Himalayas
,,	sp.	,,
,,	Gangarides rosea	Indo-Australasia
,,	Syntherata janetta	,,
Cuspidatæ	Platypteryx lacertula	,,
,,	,, sicula	,,
,,	,, falcula	,,
,,	,, hamula	,,
,,	,, unguicula	,,
,,	Cilix spinula	,,
,,	Stauropus fagi	,,
,,	Petasia cassinea	,,
,,	,, nubeculosa	,,
,,	Pygæra bucephala	,,
,,	Clostera curtula	,,
,,	,, anachoreta	,,
,,	,, reclusa	,,
,,	Gluphisia crenata	,,
,,	Ptilophora plumigera	,,

Family.	Genus and Species.	Locality.
Cuspidatæ	Ptilodontis palpina	Indo-Australasia
,,	Notodonta camelina	,,
,,	,, cucullina	,,
,,	,, carmelita	,,
,,	,, bicolor	,,
,,	,, dictæa	,,
,,	,, dictæoides	,,
,,	,, dromedarius	,,
,,	,, ziczac	,,
,,	,, trepida	,,
,,	,, chaonia	,,
,,	,, dodonæa	,,
,,	Dilobia cæruleocephala	,,
Notodontidæ	Heterocampa subrotata	North America
,,	,, amazonica	South America
,,	,, quadrata	,,
,,	Edema albifrons	North America
,,	Cnethocampa processionea	Central Europe
,,	,, pityocampa	North Germany
,,	Natural silken envelope and colony of cocoons	Tepic, Mexico
Noctuæ	Diphthera Orion	,,
,,	Acronycta auricoma	,,
,,	,, menyanthidis	,,
,,	Simyra venosa	,,
,,	Catocola sponsi	,,
Crambites	Cocoons in colonies	Madagascar
,,	Yponomeuta padi (the pale spotted ermine moth)	Britain

The larvæ of this species, which are to be seen feeding and making their cocoons in the Exhibition, feed, in colonies or clusters, on the leaves of the bird cherry (*Prunus padus*), which tree they cover with webs, extending from branch to branch and supporting both larvæ and the small white cocoons. The moths are also to be seen emerging from the cocoons in large numbers. Three or four species of parasitic ichneumons are feeding inside the larvæ and becoming metamorphosised into perfected flies. The specimens exhibited were found in Mr. Argle's woods, near Haergate and Fowlchurch, Leek. This species also feeds on the spindle (*Euonymus Europæus*).

Tineidæ	Yponmeuta plumbella	Britain
,,	,, padella	,,
,,	,, cognatella	,,
,,	Plutella xylostella	,,
,,	Harpipteryx harpella	,,
Tineæ	,, ,,	,,
,,	Galleria cerella, Linnæus (this is the honeycomb or wax moth)	,,

In two stocks of Ligurian bees received from Switzerland, in old long pine boxes, it was found, upon transferring the bees and combs into a bar-frame hive, that the bottom of the cells in many of the combs was tunnelled by the caterpillars of this moth. The tunnels were made at the bottom of the cells near the division by the insect eating a hole through the side of the cell, and occasionally through the centre division of the comb, spinning as it proceeded a silken casing or tunnel from cell to cell. It was astonishing how quickly the caterpillar could run in this tube or tunnel from one end of the comb to the other, and in perfect safety, as the bees were powerless to destroy the silken tunnel or the caterpillar, and each caterpillar had its own tunnel. Numbers of them soon destroy all the cells for either honey or brood and the stock perishes. The caterpillar is cylindrically spindle-shaped, and when fully grown from ten to twelve lines long, and two lines thick, dirty white, with scarcely visible brown tubercles, emitting slender hairs. The head is chestnut brown, the back of the following segment rather darker, divided lengthwise by a whitish line, which line is sometimes continued indistinctly along the back; the belly and sixteen feet are bone-coloured. Three hundred caterpillars have been found in a hive. They attain their full size within three

weeks and are then ready for entering the pupa state. When this is is the case they make for themselves a firmer and entirely closed web, either in the above mentioned tunnels or in a concealed corner of the hive. In this web the caterpillar lives from ten to twenty-eight days unchanged, but is finally transformed into a brown pupa, out of which the moth appears in fourteen days. Those which become pupæ in the autumn lie the whole winter in that state. There are two generations in a year, the moths appearing in the spring and again in early July. The only method of clearing bee-hives of this insect consists in looking for and destroying larvæ and pupæ, the hives being examined at least once a week. According to Morris, localities for this species are Stowmarket and Tenterden. It is distinct from the honey moth.

Vegetable caterpillar (*Hepialus virescens*), changed into vegetable matter by the fungus *Sphœria robertsi*, whose spores germinate in the soft parts behind the head, and find nourishment in the parts which would form the future imago, and throw out slender processes which soon bear numerous spores, which in turn are shaken off by the caterpillar aa it moves. Lent from New Zealand by Mr. Charles Sidey.

See plates at the end of the catalogue for illustrations of the silk, larvæ, imagos, microscopic appearance of the scales of many of the species, the food-plants, &c.

The following is a list of those who have kindly contributed specimens to the Entomological collection :—

Rev. A. Campbell, Pokhuria, Manbhum, Bengal, India; Mr. Wm. Carr, Mr. J. Chappell, Mr. H. T. Gaddum, Mr. W. Gollam, Mussoorie, India; Government of India, Mr. John Hardy, Mr. J. H. Hawtayne, Messrs. E. Meyer and Co., Mr. N. G. Mukharji, Agricultural Officer on special Government sericicultural duty, Berhampur, Bengal, India; Mr. R. Newstead, Chester; Mr. V. Roberts, Uitenhage, South Africa; Mr. C. A. Schoch, Auckland, New Zealand; Mr. Charles Sidey, New Zealand; Mr. J. Sidebotham, M.P.; Mr. John Thorpe, Mr. T. Wardle, Mr. John White.

Collection of Larvæ feeding, Larvæ making their Cocoons, and Moths, emerging from their Cocoons, to be seen in the Silk Section.

Species of Larvæ feeding in the Exhibition :—

Species.	Habitat.	Food.
Bombyx mori	China	Mulberry
Bombyx rubi	China	Mulberry
Attacus cynthia	India	——
Actias luna	North America	Walnut
Telea polyphemus	North America	Oak
Antheræa pernyi	China and New Zealand	Oak
Samia cecropia	North America	——
Saturnia pyri	South Europe	Hawthorn
Saturnia carpini	Britain	Hawthorn
Bombyx quercus	Britain	Heather
Bombyx neustria	Britain	Hawthorn
Harpyia vinula	Britain	Poplar
Cricula trifenestrata	India	——
Drepana lasertula	India	——
Notodonta camelina	Britain	Birch
Notodonta dromedarius	Britain	Birch
Notodonta dictæoides	Britain	Birch
Yponomeuta padi	Britain	Bird cherry (Prunus padus)

Moths emerging from their Cocoons in the Exhibition :—

Species.	Habitat.
Bombyx mori	China
Bombyx neustria	Britain
Antheræa mylitta	India
Actias selene	India
Attacus atlas	India
Callosamia promethea	North America
Attacus cynthia	India
Samia cecropia	North America
Antheræa pernyi	New Zealand
Yponomeuta padi	Britain

The larvæ of this moth feed on the bird cherry (*Prunus padi*), not an uncommon tree in the woods in the neighbourhood of Leek, Staffordshire, and this year seems to have been very favourable for the development of the moth *Yponomeuta padi*, for wherever this tree has occurred it has been found to be covered with the silken webs of this moth, inside which have been found nests of cocoons more or less numerous. They form a very attractive feature in one of the live moth cases, hundreds of moths having emerged, as well as several species of parasitic ichneumon flies, the result of the eggs of this fly having been laid in the caterpillars of this species of moth.

Cricula trifenestrata	India
Boroceras postica	Africa

Larvæ making Cocoons in the Exhibition :—

Species.	Habitat.
Bombyx mori	Italy
Bombyx neustria .	Britain
Harpyia vinula	Britain

Various Races of Fertile Cocoons from which Moths have emerged in the Exhibition, sent by Messrs. Enrico Meyer et Cie., Milan, collected in the following districts of Italy :—

White Cocoons.	Buff Cocoons.
Giapponesa	Giallo uid Gaie Giappo
Bianca piviæ	Vuse iol masipio Gialla
Saliti il 4 Ginquo	Pura Sant il 5 Ginquo
Arcola	Saliti at baxoil 3 Ginquo
Giallo Pura	

Also consignment of Japanese green and buff cocoons whose moths emerged and died during transit.

Good collections of Eria and Muga cocoons, sent for this Exhibition by Mr. Darrah, from Assam, in tube cases made of split bamboo. Unfortunately, the moths had emerged and died during transit, as had also splendid collections of Tussur and Cricula Trifenestrata cocoons, sent by Mr. Binnings from Ranchi, Chutia Maypur.

Early Christian Coptic Fabrics, and their Uses and History.

It was owing to the labours of St. Mark that Christianity was spread in Egypt among the Coptic people. He was sent there, probably by St. Paul, and fixed his residence at Alexandria. He is said to have made a multitude of converts during his first mission, and on his second sojourn he was martyred, after a most successful ministry.

The history of Christianity in Egypt will one day find elucidation: at the present moment it is at its starting point, and may be said to be the new archæological and ecclesiological subject. Mr. Butler, in his preface to his Ancient Coptic Churches, informs us "that we have yet to learn how the cold worship, the tranquil life, and the mummified customs of that immemorial people dissolved in the fervour of a new faith; how faces like those sculptured on the monuments of the Pharaohs became the faces of anchorites, saints, and martyrs."

Mr. Butler informs us that "Christian doctrines spread and Christian churches sprang up through all the land of Egypt. The Delta was covered with them; singly or in clusters they were dotted along the banks of the Nile for at least a thousand miles south towards the sister churches of Ethiopia; and even the silence of the desert was broken by hymn and chant from chapels built upon scenes that were hallowed by the life and death of holy anchorites. For monasticism began in Egypt, as pious or frail believers were driven by the vanities or persecutions of the world into the dreary solitudes where neither the fear of the sword nor the allurements of the flesh could follow them. To trace the history of these churches, to show how Christianity, at first driven into holes and caves, came forth from the dim catacombs of Alexandria, stood in the light, and in spite of fierce opposition won its way from the Mediterranean to the tropics—this would be a work for which time and material alike fail. The houses, piled at random about a Coptic church, had two purposes, monastic and defensive; but it is obvious that they made anything like exterior ornamentation impossible, and one may say roughly that an Egyptian church has neither outline nor exterior architecture. The outside is a rude, shapeless congeries of brickwork intended rather to escape notice than to attract admiration; it was meant that there should be nothing to delight the eye of the Moslem enemy prowling without, while architectural and liturgical splendours alike were reserved for the believer within."

Of the numerous churches built in these early times very few remain. All the churches of Alexandria are destroyed, but "fortunately some of the most

interesting in point of history and of structure are at once the best preserved and the most accessible," and are situate in Old Cairo, and date as far back as the 3rd century. Their prevailing type is Basilican, with a vaulted apsidal dome over the altars, generally three in number, always placed eastwise, unlike the Basilicas of Italy, which had no regard for orientation, but had eastern doorway and western altars.

Mr. Alfred J. Butler, to whose charming and excellent work on ancient Coptic churches I am much indebted for the information I am giving, and from which I freely quote, thinks the orientation of our European churches to have been derived from Egypt. These Basilicas were lighted only with skylights. It was a necessity of existence, after the Moslem conquest, for the Copts to fortify their churches, and most of them possessed only one entrance, at the west, which generally aligned the street.

Mr. Butler says it is rare to find a church with a single altar: three always were built wherever space could be devised for placing them side by side, standing detached in the middle of its haikal or sanctuary, each having its own dedication, and being used on dedication anniversaries, the centre one being the high altar.

There was the iconostasis or altar screen, with its pictures above of the Virgin and three apostles on each side of her.

The choir screen of Abu-s-Sofain of the 10th century, Mr. Butler tells us, is worth a journey to Egypt to see. It contains numerous pictures of Scriptural subjects, and has blocks of solid ivory carved in relief more or less in the interlacing manner of that period of both eastern and western ornament. I found this moulding beautifully and gorgeously exemplified in the ancient Buddhist temple on Mount Aboo, in Rajputana. It prevails in Coptic, Scandinavian, and Irish ornamentation, as may be seen in the Runes of England (notably in the three Runic crosses of the Parish Church of Leek), also in Norway, Scotland, Isle of Man, and in the early manuscripts in Ireland, of which the celebrated Durrow Bible is perhaps the best example.

Monasticism, as I have already quoted, commenced in Egypt, and it is not a little singular that the earliest monastic buildings in Ireland correspond in their arrangements with those of Egypt, both using alike the wagon-vault for the roofs of nave and chancel. Mr. Butler thinks this is not a coincidence, and quotes a statement in Ledwick's "Antiquities of Ireland" that seven Egyptian monks were buried at Disert Ulidh, in Ireland, and are invoked in the Litany of Oengus, and states further that a colony of Egyptians settled in the Isle of Lerins, off the south coast of France, and adds that the Egyptian plan was followed at Glastonbury.

"The monks of Bangor, St. Columba, Congel, &c., adopted the rule of St. Basil, and the distiuguished antiquaries, Sir R. Cotton, Sir H. Spelman, W. Camden, and J. Selden, when appealed to on the subject, 'drew up a certificate, wherein they declared that previous to the coming of St. Augustine in 597 the Egyptian rule (of monastic life) was only in use.'"

No Coptic church has tower or spire—they were forbidden by the Moslems.

Space will not allow me to say much about the arrangements of the interior of the ancient Coptic churches. I must refer my readers to Mr. Butler's book for particulars of the division of the nave into the women's and men's sections—a practice dating from the 10th century till to-day, the Epiphany tank for feet washing and the mandatum.

The Coptic people never built their churches on a cruciform plan: this western idea seems never to have occurred to them. The interiors generally presented the following features: An apsidal end with a tribune in the apse curve on steps, on which were seats for twelve elders of the church, with the bishop's throne in the middle, all facing westward to give the occupants of these seats opportunity to see the celebration of the mysteries. For apsidal decorations it was the practice always to have paintings of the twelve apostles with the Saviour in the centre in the attitude of blessing.

The altar followed, standing apart in the haikal or sanctuary; then the iconostasis or screen, then the choir and nave.

No Byzantine features are found in the ancient Coptic churches of Egypt; and Anthemius, the architect of St. Sophia, at Constantinople, cannot be said to have been influnenced in his great design for this, perhaps, the grandest of churches by Coptic precedent.

The Copts now bury their dead in cemeteries, but some of the ancient churches, such as Mâri Mîna, have separate churchyards. Sometimes great people and patriarchs were buried inside the church, but "There is no single instance of any inscription or monument to mark the resting-place of great men buried within the church. So, too, when a rich man has given a vessel to the altar, it is inscribed as a gift, and a short prayer is lettered upon it, but the donor's name is almost invariably unrecorded. This is the silence that is golden and full of golden lessons. To the same right oblivion are consigned the bodies of such as were honoured with burial within the inclosure about the church, as at Auba Shanûdah. In vaults beneath the dark rooms which adjoin the western end of that church many great worthies are buried without a line to perpetuate any remembrance beyond that which is graven in the minds of men. Still within the precincts of the church, but somewhat farther removed from the building, are the curious

early sepulchres at K. Burbârah, under the Roman wall. There also the dead rest, nameless and forgotten. It is only in modern graveyards and cemeteries, such as that at Kasr-ash-Shamm'ah, that the Copts have begun to cumber the ground with sculptured monuments recording worthless names, forgetting the truth their forefathers well understood, that none deserve to live or can live after death save those whose works have made them remembered. But the old tradition lingers still in the solitude of the Natrun Valley, where nothing is more remarkable than to find that the monks, with all their multitude of churches, have not one single graveyard. With them, God's Acre is the boundless desert, and though they retain the bones of some few saints as relics, yet for all the countless dead who have passed away during the space of full fifteen centuries, they cannot show one single tomb."

Embalming, Mr. Butler tells us, was common as late as the middle of the fourth century, but the translation from Egyptian to Christian rites waits investigation. His accounts of vesting the dead are very interesting, and give force and meaning to the description of the fabrics which are now exhibited in the Silk Section Court.

"The Mohammedan custom, as described to me by a native, and as I have witnessed it, is to lay the body on a white shroud, which is then loosely folded over it. Round this a winding sheet is wrapped, of a material varying with the wealth of the deceased's family; rich people use silk, and red silk for a maiden. Three loose bands are then tied round the sheet—one at the neck, one at the waist, and one at the knees or feet. When the body is placed in the tomb these bands are further loosened or removed. The present Coptic custom is to dress the deceased in his best dress, and to lay over this a sheet of cloth, silk, or cashmere. They do not swathe the body in bands, and they use a coffin."

It is of such graves as these that I now come to speak, or rather of the fabrics which have been recently removed from them, and which are just now causing so much stir and attention in the archæological world. Those exhibited as ancient Coptic fabrics, Catalogue Nos. 1 to 4 in the Silk Section, are specimens. Modern curiosity and the desire for historical novelty and evidence are too strong to allow the peaceful rest of the bodies of the great majority gone before.

I believe three of these examples were collected by the Rev. Dr. Bock, the well-known antiquarian and collector from Aix-la-Chapelle, and with the others were purchased from his collection by my friend, Mr. C. P. Scott, Editor of the *Manchester Guardian*, and Honorary Secretary of the Royal Jubilee Exhibition, for whom I have mounted and exhibited them. They consist for

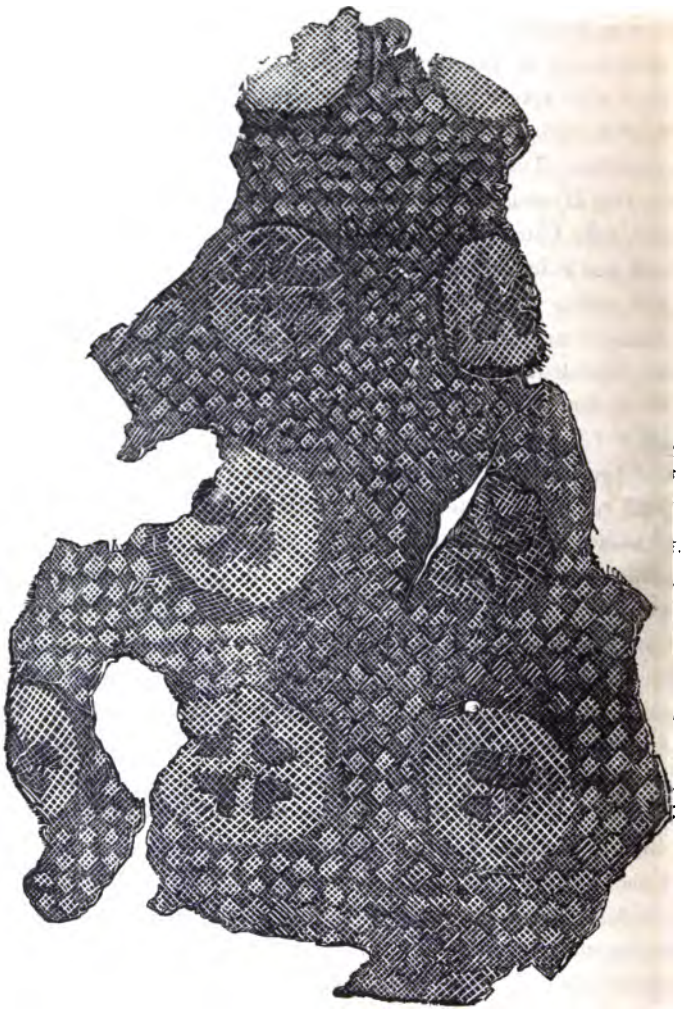
the most part of burial and other garments and fabrics, both cleric and lay. Most probably the lay portions are those used at the burial of well-to-do persons, for one of them, No. 44 (See p. 102, plate vi.), is a beautifully-woven silk with a pretty diaper ground, with two forms of crosses at intervals of half an inch. The colour was probably red and white, now brown and grey. It was brought from Cairo by Mr. C. Purdon Clarke a few weeks ago. He was sent there by the South Kensington Museum authorities to collect has returned with a very interesting series, but of no greater interest or these ancient fabrics, and variety, if as much, as those of which Mr. Scott is the happy possessor. This piece of silk, No. 44, is of the 4th century, and is probably a rich layman's or woman's burial robe. It was removed from a tomb at Echmine, near Cairo, a few months ago. I am reproducing the pattern of this ancient and valuable relic on silk by printing.

You will notice the delicate and artistic cruciform pattern work. There are two forms of small crosses which form the larger patterning, and are not unlike the ornamentation which forms the centre of the Coptic isbodikon or Eucharistic wafer. The ground is of diaper in tiny squares, and one would almost think it had suggested the similar diapering, on a larger scale, of the Irish linen tablecloths. Under the microscope the silken fibres are very distinct, and retain their silken lustre, although they are so decayed that a slight rub makes dust of them.

The other specimens, Nos. 1 to 43, are of linen, cotton, and wool, designed and coloured with skill and meaning. The ritual of the Coptic church remains almost unchanged from its earliest times. The priestly garments and ornaments used by the Coptic branch of the Eastern church are the dalmatic, amice, girdle, stole (the patrashil is a kind of stole), pall, the sleeves or armlets (not the maniple), the phelonion or outer garment, crown, crozier, pectoral and processional crosses, sandals, benedictional cross, and rosary. These articles are in a small degree represented in Mr. Scott's collection along with sepulchral cloths, each having its deep significance in teaching their sevenfold sacramental doctrines of Baptism, Confirmation, the Eucharist, Penance, Orders, Matrimony, and Anointing of the Sick. No. 6, Haut-lisse Pallium mortuorum, very curious and rare, representing a horseman ("les lapides en baccentaur") in the Greco-Roman style, and of the time of the Ptolemys of Egypt. Found in a Coptic Christian tomb near Luxor. 5th century.

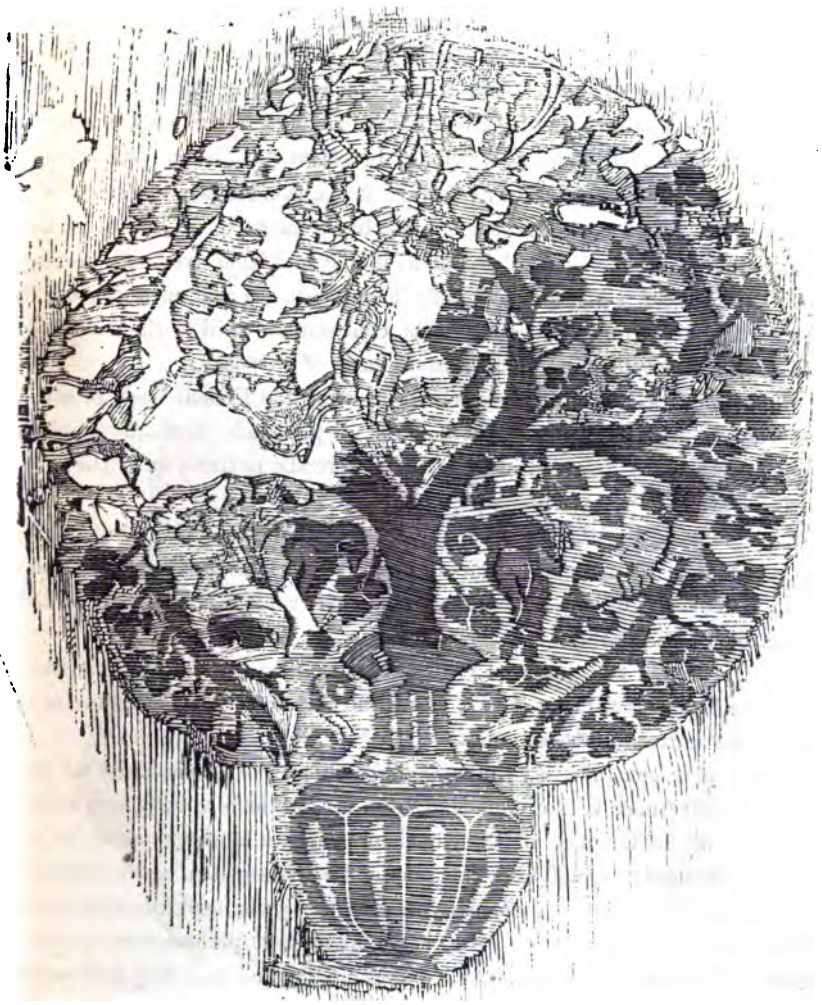
I would point out the exceeding interest which attaches to the patterning of these cloths. No. 43 (See p. 107, plate ix.) is a floral diaper border with ornament typical of Eastern art—the diaper enclosing the pomegranate, fig, and lotus, which alternate round the border. The colouring is most

PLATE VI.



Fragment of ilk fabric, 4th century (Coptic.) See No. 44, p. 101.

PLATE VII.



Ancient Coptic fabric, 5th century to 8th century. See No. 41, p. 104.

interesting, consisting of blue, two greens, orange, gold, reds and blacks, wonderfully preserved, and really of artistic tones.

A pair of armlets at Abu Kîr, figured in Mr. Butler's book, are of crimson velvet, richly embroidered with stars and crosses wrought in massive thread of silver. Round either end runs a double border enclosing designs, and while one sleeve is ornamented with a representation of the Virgin Mary and her Son, the other has a figure of an angel with outspread wings. Nothing can exceed the fineness of the needlework and the delicacy of the colours in which these figures are embroidered. The extreme richness of the work denotes that this pair of sleeves belonged to a bishop, doubtless the Bishop of Babylon.

What is as noteworthy as any feature is the wonderful permanence of the dyeing of these fabrics. The reds, greens, blue, orange, gold, and black are as bright after thirteen centuries of time as if they had been dyed only yesterday. They have, indeed, stood unchanged for more centuries than most modern dyes can stand months, and point alike to the consummate skill of the ancient dyer as well as to his genuineness and thoroughness of purpose.

These fabrics, I take it, were woven in what the French used to call the *haut lisse* or upright loom, which had its warp threads vertically fixed in a frame and the woof threaded in by hand to form the pattern, as is the way in the fashioning of the Gobelins tapestry.

No. 42 (See p. 105, plate viii.) On this narrow fabric there may be observed, which is apparently a part of a stole or perhaps girdle, figures of men, one on horseback and one unmounted, with some conventional beast, probably the emblem of S. Mark.

No. 41 (See p. 103, plate vii.) On one specimen is a conventional tree in dark chocolate colour, in a red pot, beautifully drawn. The acanthus is also a favourite pattern in these ancient cloths.

I will now conclude my imperfect sketch of the Christianity of these remote Coptic times with a quotation from Mr. Butler's work, which tells us beautifully of the language of these ancient people, a language which he says is "to-day no doubt virtually the same tongue that was spoken by the builders of the Pyramids; and it still retains many words scarcely changed from that epoch."

The Copts can boast of no great poets, historians, philosophers, or men of science. Their only literature is religious; and the fact that they have neither witchery of speech nor treasures of knowledge to offer, has caused their language to be treated with a strangely undeserved indifference. For there is no language with a higher antiquity, a more abnormal structure, or a more curious history. The records of five thousand years ago chiselled on the monuments of Egypt still remain sculptured, though standing in everlasting

PLATE VIII.

Ancient Coptic fabric, 5th to 8th century. See No. 42, p. 104.

silence; the very words uttered by the great men of Hellas are still heard sounding, though no longer written in the ancient manner of writing, yet these two, the lost utterance of the old Egyptian speech, and the lost character of the old Greek writing, are united and preserved in the Coptic of to-day. The romance of language could go no further than to join the speech of Pharaoh and the writing of Homer in the service book of an Egyptian Christian.

There are upwards of forty examples at the lower end of the Gallery of Approach of ancient Coptic fabrics of the fifth to the eighth centuries, in a variety of interesting designs characteristic of those periods, and which are fully explained in the foregoing introduction.

Collection, chiefly English, of Ancient and Modern Silk Fabrics and Embroideries.

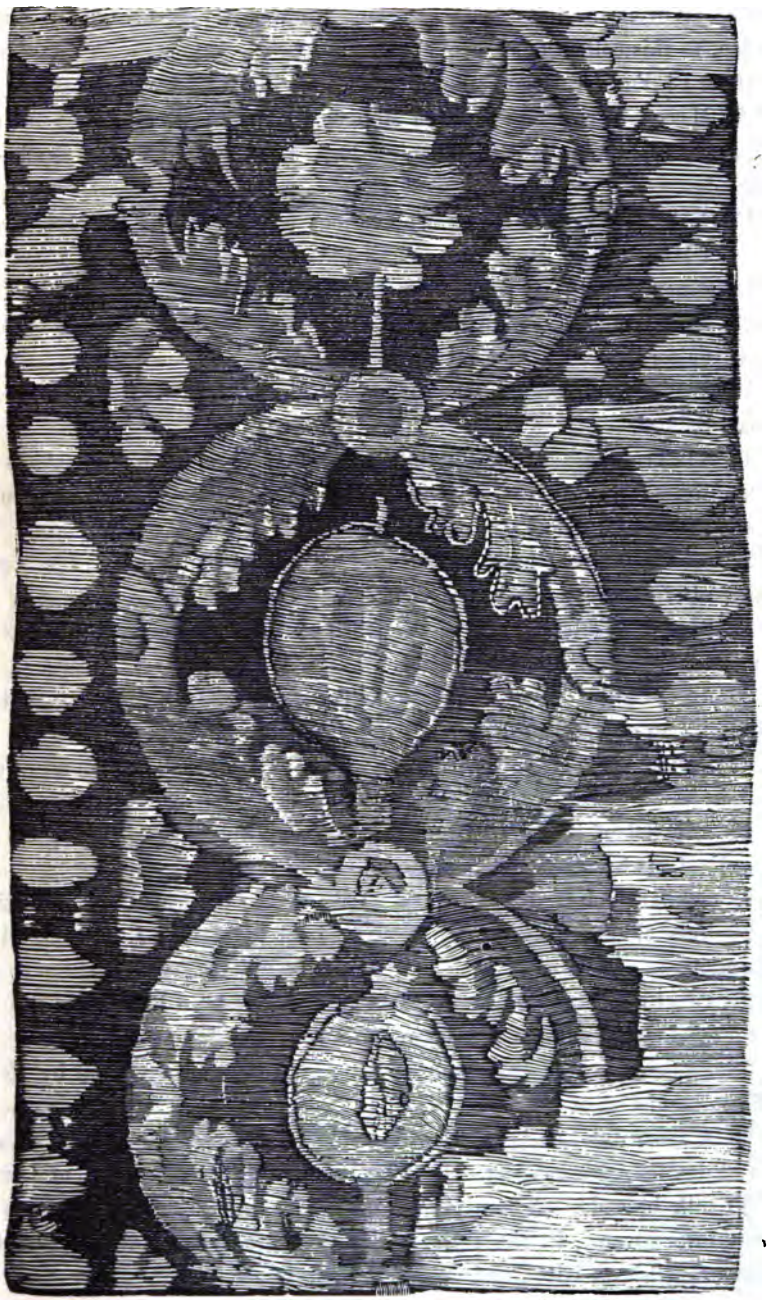
THE object of this collection is to show visitors to the Exhibition, especially ladies, the excellence of manufacture, of design, and of colouring of English-made fabrics, both old and new.

There can be no more worthy object connected with the exhibition of Silk than to endeavour to revive an industry which, thirty years ago, was in a flourishing state, and extensively practised in Spitalfields, Manchester, Middleton, and that neighbourhood, Coventry, Congleton, Macclesfield, Leek, Derby, Dublin, Norwich, and other places.

The last few years have unhappily witnessed a great decadence in all these places in silk textiles, and it may be well to consider whether the time has not arrived for an endeavour to alter a state of things like the present, in which we find we are purchasing manufactured silks from the Continent to the extent of between eleven and twelve millions sterling per annum, whilst our own silk manufacturing towns are annually decreasing their output. There is no need for this sad state of things to obtain. Both technical and art instruction can be as well administered in England as in any part of the Continent, and it is to be hoped that we shall soon find that with the advantages of a thorough technical and art training our manufactures in silk may be so improved that ladies will prefer to wear silks of English manufacture, not only from patriotic motives but from inherent values, purity and genuineness having always been characteristics of these silks.

The Silk Section is indebted to several ladies, as well as English silk manufacturing firms and others for examples of silk fabrics of a more or less artistic nature.

PLATE IX.



Ancient Coptic fabric, 5th to 8th century. See No. 43, p. 101.

1 to 9 Large specimens of beautifully-designed and woven silk upholstery fabrics. Woven in Spitalfields and lent by Messrs. Warner and Ramm, of London, to this collection.

10 to 13 Figured woven silk manufactured in Middleton, Lancashire, and lent by Messrs. Parker and Lord, of Manchester.

14 Old brocade quilt with plush border. Lent by H.R.H. the Duchess of Cambridge.

15 Cushion of velvet and satin in various colours. Lent by Mrs. Hedley Jones, of Manchester.

16 Fancy mats, hand painted on silk. Lent by Miss Nelly Wardle, Leek.

17 Woven ribbon. Date about 1830. Lent by Mrs. Riley, Richmond House, Salford.

18 Chene woven ribbon, 50 years old. Lent by Mrs. Riley, Richmond House, Salford.

19 Silk brocade. A floral design on pink ground with gold stems and leaves interwoven. In the style of the time of Louis Quatorze. Lent by Messrs. Cowlishaw, Nicol, and Co., Manchester.

20 Broussa velvet, 16th century, of characteristic design. Lent by the Chairman of the Section.

21 Persian cushion or table cover, 18th century, very beautifully coloured. Lent by the Chairman of the Section.

22 An old piece of Aurora Genovese Terry velvet, 16th century. Lent by the Chairman of the Section.

23 Italian Brocade, 16th century. Lent by Messrs. J. Sasson and Co., of London.

24 A panel of beautifully-designed Genovese velvet, dark green on gold ground. Lent by Messrs. J. Sasson and Co., of London.

25 Bokhara velvet, 16th century. Lent by the Chairman of the Section.

26 Very old silk prayer rug. Persian. Lent by Messrs. J. Sasson and Co., of London.

27 Panel of crimson velvet on plain ground. Made in Broussa in the 16th century. Lent by Messrs. J. Sasson and Co., of London.

28 French brocatelle of effective colouring, 18th century. Lent by Messrs. J. Sasson and Co., of London.

29 A beautifully-designed Cyprus table cover, very Persian in its ornamental details, 16th century. Lent by Messrs. J. Sasson and Co., of London.

30 Silk brocade. A floral design on cream ground, with gold stems and leaves interwoven. In the style of the time of Louis Quatorze. Lent by Messrs. Cowlishaw, Nicol, and Co., of Manchester.

31 A most interesting piece of silk embroidery of the 16th century. Worked by Mary Queen of Scots or by the ladies of her Court. The principal flowers are chrysanthemums, roses, violets and auriculas. Lent by Mrs. Hart, of Londonderry.

32 A Damascus silk woven bridle, six yards long, inscribed with blessings to the horse and owner, 16th century. Lent by Messrs. J. Sasson and Co., of London.

33 Bokhara silk velvet bridle, 16th century. A very scarce specimen. Woven like silk carpet, but faced on both sides with six figure warps for face and back, and one or two binder warps of silk. This is a most interesting and instructive product of the loom. Lent by Messrs. J. Sasson and Co., of London.

34 Embroidered silk brocade. Date, about 1830. Lent by Messrs. Cowlishaw, Nicol, and Co., of Manchester.

35 Crimson silk brocade. Date, about 1830. Lent by Messrs. Cowlishaw, Nichol, and Co., of Manchester.

36 Embroidered silk brocade. Date, about 1830. Lent by Messrs. Cowlishaw, Nicol, and Co., of Manchester.

37 Old tartan scarf of Warwick manufacture. Lent by Mrs. S. E. Haworth, of Manchester.

38 Damask, made by Mr. Louis Schwabe, as an experiment, with green silk warp. The weft is white spun glass. Lent by Messrs. Cowlishaw, Nicol, and Co., of Manchester.

39 Old Lancashire weaver's "picking peg," worn by the hand by long usage. Lent by Mrs. Brockbank, Brockhurst, Didsbury.

40 Yellow brocade, bouquet pattern, made in the early years of Her Majesty's reign. The design is used in Windsor Castle. Lent by Messrs. Cowlishaw, Nicol, and Co., of Manchester.

41 Parliamentary brocatelle. This design was specially prepared for hangings, to be used in the decoration of the private apartments in the Houses of Parliament, 1858. Lent by Messrs. Cowlishaw, Nicol, and Co., of Manchester.

42 Green and gold silk brocade, made in the early years of Her Majesty's reign. Lent by Messrs. Cowlishaw, Nicol, and Co., of Manchester.

43, 44 The Queen's dress and train, manufactured at the old mill in Portland Street, by Mr. Louis Schwabe shortly before Her Majesty's marriage, and understood at the time to be Her Majesty's "wedding" dress. The following is an extract from a letter written by Mr. Louis Schwabe to the British Association on June 22nd, 1842, on the occasion of their meeting in

Manchester: "The dress executed by the gracious command of Her Majesty in 1839 is by far the most costly work ever done at my establishment, and thereby has Her Majesty's distinguished patronage given me the opportunity of producing a specimen which may be considered unique of its kind." The embroidery was done by patent machinery constructed under the direction of the late Mr. Henry Houldsworth, of Manchester, who was at the time associated with Mr. Schwabe in business. The design is reported to be Her Majesty's own work.

45 Old silk embroidery. Lent by Charles E. Smith, Esq.

46 Silk damask. "Apple blossom." Made in the early years of Her Majesty's reign. Lent by Messrs. Cowlishaw, Nicol, and Co., of Manchester.

47 "Gordon" silk damask. Made in the early years of Her Majesty's reign. Lent by Messrs. Cowlishaw, Nicol, and Co., of Manchester.

48 Silk patchwork quilt. Lent by Miss L. Glover.

49 Chene woven shawl, 40 to 50 years old. Lent by Mr. Riley, Salford.

50 Silk brocatelle, designed by Pugin. A beautiful specimen both in design and texture. Abney Hall, the residence of Sir James Watts, was hung with this fabric when he entertained Prince Albert on the occasion of his visit to Manchester to open the Art Treasures Exhibition in 1857. Lent by Messrs. Cowlishaw, Nicol, and Co., of Manchester.

51 Blue silk brocade, made in the early years of Her Majesty's reign. Lent by Messrs. Cowlishaw, Nicol, and Co., of Manchester.

52 Silk damask, Etruscan pattern. Made in the early years of Her Majesty's reign. Lent by Messrs. Cowlishaw, Nicol, and Co., of Manchester.

53 Silk brocade in blue and gold pattern with embroidered flowers in panels. Made in the early years of Her Majesty's reign. Lent by Messrs. Cowlishaw, Nicol, and Co., of Manchester.

54 Silk embroidered work bag. Lent by Mrs. Hellawell.

55 Richly-embroidered coat—about 1770. Lent by Lady de Tabley.

56 Ancient white silk vest, ornamented with embroidery and crystals. Lent by Lady de Tabley.

57 Silk embroidered skirt, worn at a Court Presentation in the reign of George III. Lent by Mr. S. E. Haworth.

58 Silk scarf. Lent by Mr. Joseph Cottam.

59 Valuable and antique embroidery. Lent by the Honourable Mrs. Percy Mitford.

60 Antique embroidered coat. Lent by Mr. T. G. Litchfield, Bruton Street, London.

61 Ancient and costly embroidery, on crimson satin. Lent by the Honourable Mrs. Percy Mitford.

62 (See Plate x.) Richly-embroidered coat of the time of Sheridan—about 1770. Worn by a former Lord de Tabley. This is a beautiful example of lace border enriched with silk embroidery. The coat itself is made of silk velvet in dark purple ribs upon pale blue satin. Lent by Lady de Tabley.

63 Ancient cream satin vest, richly embroidered with coloured silks. Lent by Lady de Tabley.

64 Ancient gold embroidery on satin. Lent by the Honourable Mrs. Percy Mitford.

65 Shot silk mantle and lady's cap of the period. Made about 1830. Lent by Mrs. Bradbury.

66 Old silk embroidered opera cloak of last century. Lent by Mrs. Hellawell.

67 Old silk fabric bought at Madrid by Lord Wharncliffe in 1872. Lent by Lady Wharncliffe.

68 Ancient needlework quilt, with crest and monogram of the Legh family. Lent by Mrs. Legh, Lyme Park, Disley, Cheshire.

69 Old embroidered bed valance. Lent by Mr. T. G. Litchfield, Bruto Street, London.

70 Silk apron embroidered in the silkworm design, Brussels, 1815. Lent by Mr. S. E. Haworth.

71 Silk embroidered mantilla, 1731. Lent by Mrs. Moll, Crumpsall.

72 Old tambour work, violet silk, supposed to be French, 17th century. Lent by Mrs. Legh, Lyme Park, Disley, Cheshire.

73 Antique embroidered altar front, 16th century. Lent by Mr. T. G. Litchfield, Bruton Street, London.

74 Ancient brocade with fine pattern, probably Italian. Bought by Lord Wharncliffe in Florence. Lent by Lady Wharncliffe.

75 Old embroidered quilt on white silk, stitched by hand, 16th century. Lent by Mrs. Legh, Lyme Park, Disley, Cheshire.

76 Louis XIV. embroidery (Lambrequin). Lent by Mr. T. G. Litchfield, Bruton Street, London.

77 Ancient and valuable embroidery in gold on silk. Lent by the Honourable Mrs. Percy Mitford.

78 Old silk embroidery. Lent by the Honourable Mrs. Percy Mitford.

79 Old Italian silk fabric. Lent by Lady Wharncliffe.

80 Chinese silk fabric with gold thread on black. Lent by Lady Wharncliffe.

PLATE X.

Example of lace border, enriched with silk embroidery, on a Geo. III. coat of silk velvet - De Tabley. (No. 62, p. 111, Ancient and Modern Collection.)

81 Silk brocade. Lady Clive's wedding dress. 1700 to 1750. Lent by Mrs. Brockbank, Brockhurst, Didsbury.

82 Three small pieces of a Chinese embroidered robe. Lent by Mrs. Brockbank, Brockhurst, Didsbury.

83 Embroidery which belonged to Mrs. Metcalf, wife of the Governor of Dominica, 120 years ago, in the old slave days. Lent by Mrs. Brockbank, Brockhurst, Didsbury.

84 Silk for dresses, English manufacture. Lent by Messrs. Wardle & Co., London.

85 Series of sixteen examples of modern English weaving in satin, merveilleux, plain gros grains, and various patterned silks, for dresses. Lent by Messrs. C. Hilton and Son, Manchester.

86 Eleven very fine examples of modern brocades for trains and dresses, in a variety of beautiful designs and colours. Woven in Spitalfields. Lent by Messrs. Warner and Ramm, London.

87 Six examples of modern English dress silks of Manchester manufacture. Lent by Messrs. C. Hilton & Son, Manchester.

88 Four specimens of silk hat plush, a kind of fabric not manufactured in Great Britain. It is manufactured on the Continent by Messrs. Emile Huber and Co.

Tarreguemines, Lorraine.
Tarare, Rhone.
Gersheim, Palatinat.

And Mr. J. B. Martin,

Tarare, Metz, Pont-a-Mousson.
,, Meyzieux, Roanne.

89 Brocade, more than 200 years old. It had formerly a cream moire ground. Lent by Mrs. Crossley, Accrington.

90 Old French brocade, green. Lent by the Misses De Bertodano, London

91 Yellow brocade, 200 years old. Lent by Mrs. Edwards, 35, Bromley College, Kent.

92 Old silk brocade skirt, red, gold, and grey. Lent by Miss Patteson, London.

93 Red silk brocade, front of an old court dress, red, gold, and green. Lent by Miss Higgin, Westbourne Park, London.

94 Shawl, embroidered with red silk floss on black gauze ground. Very elaborate. Probably old Indian. (Delhi) Lent by Mr. G. Freemantle, Manchester.

95 Red silk brocade. Lent by Mr G. Freemantle, Manchester.

PLATE XI.

Silk fabric, white broché, woven from the silk reeled from cocoons produced in South Australia. See No. 99, p. 115; and No. 27, pp. 69, 70.

96 Black and white figured woven silk. Lent by Mr. G. Freemantle, Manchester.

97 Two small embroidered mats of Japanese design. Lent by Mr. G. Freemantle, Manchester.

98 Specimens of Irish embroidery, about fifty years old. Lent by Miss Chambré, Mispel House, Dublin.

99 Silk fabric, woven from the silk reeled from cocoons reared in South Australia, and exhibited by Sir Samuel Davenport, under No. 27, in the "Aids to Sericicultural Study."

100 Glass case containing fifteen specimens of variously coloured Japanese silk fabrics, manufactured with the silk of the mulberry feeding silkworm (*Bombyx mori*), or silk of commerce, the patterned part being of a species peculiar to Japan (*Antheræa yama-mai*). The latter silk was at one time a silk confined to the use of royalty alone. The colours of these fabrics are very delicate, and the effect of the two silks very interesting.

The Royal Institution Collection of Ancient Fabrics, chiefly Silk.

THE Silk Section is indebted to the kindness of the Council of the Royal Institution of Manchester for this very interesting collection of olden time and skill, owing to the suggestion of Mr. C. P. Scott, our honorary secretary, who thought that by the transference of the principal part of the somewhat large collection of the Royal Institution to the Silk Section of the Exhibition an opportunity would be afforded to a much larger number of people to see and examine so interesting a series of the art in the weaving and printing of former times.

The collection is almost European, being chiefly French, Italian, and Spanish, with a few examples of early block printing. They form part of a large series bought by the Lords of the Committee of the Council on Education at South Kensington from that indefatigable collector the Rev. Dr. Bock, of Aix-la-Chapelle, the author of "Liturgische Gewänder," and other works on ancient art.

A portion of the collection was offered to Manchester, and finds its destination in one of the rooms of the Royal Institution in Mosley Street.

No doubt the Council recognised the high artistic and educational value of this collection, which chronologically illustrates the design and fabrication of silks of the best historic European periods. It is much to be regretted that

their exposition in the Royal Institution is far from satisfactory. The room which has been assigned to them is inconvenient for such a display. It is lighted only on two sides, and is not sufficiently spacious for displaying the fabrics in an attractive and conspicuous way. It may be well hoped that at some not far distant date the collection may form the basis of a more extended collection, like that, for instance, in the important weaving school museum at Crefeld, in Germany. It would form an excellent nucleus for a museum of a similar nature in Manchester, and now that a Bill has been introduced into Parliament to enable industrial centres to rate themselves, and to obtain grants from Government for technical instruction, such a technical museum will doubtless be a necessity for the numerous students who will be trained under the provisions of this Bill, brought in by men so earnest in advocating a better technical training as Sir W. Hart-Dyke and Sir Henry Roscoe, the latter being well known for his valuable services in the great cause of education in the city of Manchester.

Collection of Ancient Fabrics lent by the Royal Institution, Manchester.

49 Satin, dark violet, with rich gold brocade. Manufactured by Saracen weavers in the so-called "Hotel de Tirraz," a State manufactory, in connection with the palace of the Saracen Caliphs, in Palermo. In this institution all the robes of State and those intended as gifts to foreign potentates were produced in the days of the Saracen domination in Sicily. It continued to be patronised by the Norman Kings of Sicily, and also by the Emperors of the House of Hohenstaufen, who succeeded these. A description of these rich fabrics of the Hotel de Tirraz in the days of the Hohenstaufens may be found in the contemporary list compiled by Bishop Otto of Freisingen, a relation of the Hohenstaufen Emperors. A strikingly similar fabric is one in the form of a Dalmatic, in the South Kensington Museum.—Middle of the 13th century, Sicily (Palermo).

50, 51 Silks. Cyprus gold brocade on red satin ground. Both pieces represent the Announcing Angel appearing to the Virgin. The representations are executed in coloured silks, not by means of embroidery, but by the loom. After designs by a pupil of the school of Fra Angelico.—Early 14th century, Italy (Florence).

68 Satin. According to the opinion of Professor Karabazek, of Vienna, this piece may be recorded among the rare figured silks, whose Hispano-Arabic

inscriptions afford ample proof of their manufacture by the Moors of Southern Spain (Almeria or Granada), during the 12th and 13th centuries. This piece is also woven in bands in accordance with the preference evinced by Oriental designers for such striped fabrics. This specimen, which was originally probably three times its present width, contains the oft-repeated inscription in Hispano-Arabic: "Honour to our Lord the Sultan," surrounded by a narrow band of arabesques. A similar piece to this is illustrated and described in Bock's "Geschichte der Liturgischen Gewänder des Mittelalters." It was probably manufactured in Almeria, as may be gathered from the Moorish geometrical combinations of moon and stars, which occur in strikingly similar forms in the decoration of the Palace of the Alhambra.—Latter half of the 13th century, Hispano-Moresque.

93 Satin, formerly light violet in colour, with rich brocade in Cyprus gold thread. The design contains conventional floral ornament and fanciful animals in so-called arabesque forms, termed by ancient writers of the 13th and 14th centuries, *eum bestiulis, flosculis, lunulis* (with small animals, flowers and moons). This splendid design, which may be reckoned as one of the finest productions of Sicilian weaving, is in the form of cartouches arranged in a zig-zag pattern, and bearing Arabic (Neski) inscriptions, surrounded by eight-leaved rosettes. If the inscriptions are legible, that is, give a meaning on translation, the fabric was woven in Palermo, but if they are illegible, then it was probably manufactured by the weavers of Lucca in imitation of Palermitan work. It is probably, however, to be ascribed to the former manufactures.—Latter half of the 13th century, Sicily (Palermo?).

120, 121 Velvet, red, on white satin ground. The design is of the period of highest development of the Renaissance. The inner portions of the ornament are of cut velvet, whilst the outlines are uncut (*velours frisé*).—16th century, Italy (Florence or Venice).

122 Velvet, green, ground yellow silk repp shot with gold. The design is in the form of "S's," arranged in squares.—Late 16th century, Italy (Florence).

123 Velvet, ground of white silk, formerly shot with silver. Serpentine, intertwining pattern.—Late 16th century, Italy (Florence).

126 Velvet, blue, with crimson ground. Splendid design, dating from the best period of the Florentine velvet industry.—Middle of the 16th century, Italy (Florence).

127 Velvet, green, silk repp ground. The pattern is composed of the capital "S," arranged in squares, each containing a floral ornament.—Close of the 16th century, Northern Italy.

128 Velvet, figured. Unfortunately the pattern of this interesting material has suffered much from age and long use. Enough, however, of this hexagonal design still remains to enable the pattern to be distinguished and copied. Middle of the 16th century, Italy.

129 Velvet, green; design in cut velvet, with uncut outlines on red satin ground.—Middle of the 16th century, Italy (Florence).

133 Brocade. As in the case of most fabrics dating from the days of the Medici, the warp of which the pattern is formed is composed of fine spun silk, while the weft is of coarse linen. The patterns of these immensely durable brocades of the cinquecento period all show similar designs filled in with small squares and triangles.—Middle of the 16th century, Northern Italy.

134 Brocade; yellow ground with crimson pattern. At the time when damasks and figured velvets of the stereotyped flowered pattern were worn in the manufacturing towns of Northern Italy, the weavers of Milan, Genoa, and Florence were occupied in producing heavy brocades similar to this, which were used as hangings for walls and for the decoration of rooms generally.—Middle of the 16th century, Italian.

135 Velvet, greenish yellow, with rich design in cut velvet with uncut outlines, somewhat similar to the pomegranate pattern, on yellow satin ground. Middle of the 16th century, Italy (Venice).

136 Satin, red, with rich design, somewhat resembling the pomegranate pattern of the middle ages, and shot with gold.—Middle of 16th century, Italy (Milan).

186 Satin, dark violet, with yellow designs. The design is that of the so-called flower vase (*pot-au-fleurs*), and is characteristic of Venetian manufactures.—End of 16th and beginning of 17th century, Italy (Venice).

200 Velvet, black, on gold ground. This curiously prepared gold thread is especially remarkable, as it still preserves its lustre and brightness.—Middle of the 16th century, Italy (Venice).

201 Cloth of silver, with star pattern, woven in gold. The pattern may be interesting to manufacturers from the fact that the weft is not formed by a single thread, but is composed each time of two gold threads twisted together and forming the pattern. In consequence of this the latter stands out in considerable relief from the rest of the material. Comparatively few such cloths of silver or gold, worked in this curious and costly style, are now to be found.—End of the 16th and beginning of the 17th century, Northern Italy (Florence or Venice).

202 Satin, red ground. The design dates from the best period of the Renaissance. It is also met with in similar forms in the Florentine velvets.—

he 16th century, Northern Italy.

203 Silk, black satin ground, with powdered pattern of twigs arranged in rows.—Close of the 16th century, Northern Italy.

250, 251, 252, 253 Mixed fabrics; warp linen, weft silk. All these pieces owe their origin to the same (but unknown) place of manufacture. In distinction to the mixed fabrics whose warp is of silk and whose weft is of linen, these are to be reckoned amongst those whose warp is of linen and weft of silk. Nos. 250 and 251 are denoted as productions of the Renaissance period by their conventional decoration, but more especially by the two-handled vases of flowers. No. 252 was probably originally intended not for articles of dress but for wall hangings. As Italy, owing to the richness and durability of its silks, had complete control of the market of the world, and was a great producer of silk, it was not under the necessity of providing for the production of mixed fabrics. It is, indeed, much more probable that these mixed fabrics were produced in large quantities for the market of the world in one of the larger manufacturing towns of Flanders. Some believe that this material, which recurs so often in ecclesiastical vestments, was manufactured at Zurich or at Bâle.—Late 16th, early 17th, century.

278, 279, 280, 281, 282, 283, 284, 285, 286 Silks, figured, with small patterns. 279 and 281 are Italian, the rest French. The small pattern indicates that the various materials, with the exception of 279 and 281, were intended for lay purposes. The patterns are all more or less the same, and such as were prevalent from the beginning of the 17th to the end of the 18th century. 279 and 281 were formerly used for ecclesiastical purposes, and these fabrics are still frequently to be found in Northern Italy. The remainder are probably French.—17th and 18th centuries, Italy and France.

287 Silk, damask, crimson; with powdered pattern of pinks.—Early half of the 17th century, Northern Italy.

288 Velvet, cut, green; with zigzag pattern, with designs borrowed from those of linen damasks.—17th century, Northern Italy.

289 Satin, red; with powdered pattern in gold brocade.—First half of the 17th century, Northern Italy.

312 Brocatelle, crimson. Large design for wall-hangings, with pattern of crowns, &c.—Latter half of the 17th century, Italy (Venice).

317 Velvet, with large design on white ground, shot with silver stripes.—17th century, Italy (Genoa or Venice).

400 Satin, damask, red; with richly composed design.—End of the 17th century, Italy (Milan).

401 Brocade, rich gold, with magnificent lace-work pattern.—Latter half of the 17th century, Italy (probably Milan).

415 Silk, repp, white; with large naturalistic floral pattern.—End of the 17th century, Italy (Milan).

419 Brocatelle; with large pattern of palms and crowns. End of the 17th century, Northern Italy.

484 Silk, with gold brocade. The design is a characteristic one of the Venetian manufacture. Latter half of the 17th century, Italy (Venice).

485 Silk, damask, brown, with design in various colours.—Latter half of the 17th century, Northern Italy.

489 Embroidery on canvas in coloured silks, with serpentine flame-striped design. Favourite style of work during the early half of the 18th century, used for covering furniture, etc.—18th century, Germany.

506 Silk, violet, satin ground; with large floral design in the style of the Louis XIV. period.—17th century, France (Lyons).

516 Silk, repp; with naturalistic floral pattern, and shot with silver.—Beginning of the 17th century, France (Lyons).

517 Silk; design in imitation of lacework. Characteristic manufacture of Lyons of the time of Louis XIV.—17th century, France (Lyons).

520 Satin, dark yellow. Large floral zigzag pattern, borrowed from contemporary lace designs. Dating from the most flourishing period of French production in the time of Louis XIV.—17th century, France.

522 Satin; with large floral pattern in imitation of lacework.—17th century, France (Lyons).

523 Silk, damask, white; with design in gold.—End of the 17th century, France (Lyons).

529 Silk; with ground in heavy yellow satin. The pattern in imitation of the lace designs of the 17th century.—End of the 17th century, France (Lyons).

530 Brocade, silver; richly woven, with designs resembling those of the French manufacture of the period of Louis XIV. Once forming part of the back of an ecclesiastical vestment.—Latter half of the 17th century, France.

532 Satin, red; with rich floral ornament, in imitation of lace designs.—End of the 17th century, France (Lyons).

534 Silk, with rare pattern. The design points to the period of the higher development of the silk industry of Lyons at the close of the reign of Louis XIV.—Latter half of the 17th century, France (Lyons).

539 Mixed fabric, dark violet wool, with pattern in silk.—Late 17th century, probably France.

540 Silk, with richly-composed lace pattern.—Close of the 17th century, France.

541 Velvet, green, on ground interwoven with silver, with designs from the time of Louis XV.—Latter half of the 17th century, France or Northern Italy.

549 Satin, light red, with pattern imitated from the laces of the 17th century.—End of the 17th century, France (Lyons).

558 Silk, damask, heavy green, with naturalistic floral ornament in colours, and silver and gold brocade.—Latter half of the 17th century, France (Lyons).

594 Silk, heavy repp (*gros de Naples*); with serpentine pattern of squares, containing floral ornaments.—Beginning of the 18th century, Northern Italy.

621 Satin, green ground, with dark-green and yellow pattern. The design is similar to those used in lacework.—Early 18th century, France (Lyons).

622 Silk, green, with design of squares containing floral ornaments; stereotyped French pattern of the early 18th century.—Beginning of the 18th century, France (Lyons).

626 Silk, violet damask; with broad yellow design, dating from the period of decadence in the art of weaving. Hood of a cape. Excellent in texture and colouring.—Beginning of the 18th century, France (Lyons).

627 Satin, red; with design in colours.—Beginning of the 18th century, France (Lyons).

631 Silk, rose coloured repp, shot with silver; naturalistic floral pattern. Beginning of the 18th century, France (Lyons).

632 Brocade, rich gold; with large floral design in the style of the period of Louis XV.—Beginning of the 18th century, France (Lyons).

633 Silk, heavy, white repp; with wave-like pattern, interwoven with silver and gold.—Beginning of the 18th century, France.

634 Cloth of silver; woven in stripes with gold, and with naturalistic bouquets of flowers.—First half of the 18th century, France (Lyons).

638 Silk, damask, white; woven with gold.—Beginning of the 18th century.—France or Italy (Lyons or Milan).

639 Silk, heavy repp (*gros de Naples*); with serpentine pattern, and in part woven with silver.—First half of the 18th century, France or Italy (Lyons or Milan).

640 Velvet, crimson, on satin ground. The design is arranged in squares in cut velvet, each enclosing ornament in uncut velvet.—First half of the 18th century, France (Lyons).

648 Brocatelle, green; with large floral design.—First half of the 18th century, France (Lyons).

664 Cloth of silver; ornamented at intervals with bouquets of naturalistic flowers.—18th century, probably France (Lyons).

665 Silk, repp; with large zigzag floral design, shot with silver.—18th century, France (Lyons).

666 Silk, heavy "gros de Tours." The pattern is a naturalistic one with architectural designs in imitation of the Chinese. Similar architectural designs of ruins, houses &c., were much in fashion in France shortly after the discoveries in Pompeii and Herculaneum had been made.—18th century, France (Lyons).

667 Satin, heavy, black; with naturalistic design. This design indicates the decadence of the French silk manufactures.—18th century, France.

686 Satin, red. The pattern contains pastoral figures, and dates from the period when the Court of Louis XVI. used to dress themselves as shepherds and shepherdesses.—Late 18th century, France (Lyons).

687, 687A Velvet, on satin ground. Formerly used as bed-hangings during that period of Louis XVI.'s reign when designs with pastoral subjects were the fashion.—Close of the 18th century, France.

688 Satin, splendidly woven; red ground, with white pattern. Dating from the period at which pastoral designs were in fashion in France.—Latter half of the 18th century, France (Lyons).

689 Velvet, with cut velvet pattern, outlined in uncut velvet, on a white satin ground. This velvet is intended to imitate a leopard's skin, and was used as a material for hunting costumes.—Close of the 18th, beginning of the 19th century, France.

690 Velvet. Pattern of small squares on spotted ground. Masterpiece of Lyons manufacture.—Latter half of the 18th century, France (Lyons).

693 Silk, red satin ground, with patterns of garlands, wreaths, and doves.—End of the 18th century, France (Lyons).

694 Satin, red, with floral ornament and amorini. Dating from the period at which pastoral subjects were much in vogue in France.—End of the 18th century, France (Lyons).

735 Satin, dark blue, with pattern of animals, etc., in beautiful colours. The pattern is composed of oval medallions in bands, and appears to have been designed with a view of being cut into lengths. The grey strips with which the fabric is interwoven consist of gilt paper, much damaged by age and use.—17th century, China.

743 Satin, with powdered pattern in gold brocade.—18th or 19th century, India or Persia.

744 Silk, white, with gold brocade. Part of a chasuble. Honeycomb-like ground, with star pattern in gold.—Beginning of the 18th century, probably Oriental.

745 Velvet forming the border of a velvet texture, of distinctly Persian design and colouring—18th century, Persia.

746 Silk, with designs in gold, formed by strips of paper gilt.—19th century, China.

747 Silk, with original pattern, characteristic of Chinese manufacture.—19th century, China.

748 Silk, damask, of beautiful dark blue colour, with characteristic Chinese design. Excellent texture.—19th century, China.

755 Embroidery; cross, from the back of a vestment. The work of the Cologne Guild of Embroiderers. In Rhenish churches a number of vestments dating from the most flourishing period of the Cologne Guild of Embroiderers and Chasuble Makers (*breudatores et factrices casularum*), who formed part of the guild of Armorial Embroiderers of that city. The ground of these orfreys, which are ornamented with figures executed in the finest broad-stitch, is worked in the ancient gold thread (*aurum Cypreum*), or, as a Florentine author of the 14th century terms it, the *mysterium auri filati*. The threads, composed of a gilt membrane, wound round a linen core, are so laid upon a ground of coarse linen, and fastened down with stitches in red silk, as to form a very regular pattern. The cross, embroidered with gold thread, as also the figure of the Saviour extremely delicately executed in broad-stitch, were sewn on to the linen ground at a later date. In spite of its greatly damaged condition, the execution of the embroidered figure of our Lord testifies to the great perfection attained by the Guild of Cologne Embroiderers towards the close of the middle ages, with the aid of the painters of the time.—Latter half of the 15th century, Germany (Cologne).

756 Embroidery; part of the orfrey of a vestment in Cologne, ornamented with an embroidered coat of arms belonging to a patrician family. The embroidered gold ground is composed, as in the case of all orfreys executed by the Guild of Embroiderers of Cologne, of Cyprus gold thread. One half of the coat of arms is worked in Cyprus silver thread.—Latter half of the 15th century, Germany (Cologne).

757 Embroidery, in gold thread. Coat of arms embroidered in Cyprus gold thread, executed by the Guild of Embroiderers of Cologne. It must be left to the student of Heraldry to decide to which noble Rhenish family this coat of arms belongs. Both the shape of the casque and its decoration terminating in Gothic foliage are typical of the last thirty years of the 15th century, the period at which the renowned "Grünberger Wappenbuch" was compiled. The ground is of old green velvet, and together with the old gold lace, has been added in modern times.—Latter half of the 15th century, Germany (Cologne).

758 Embroidery in metallic gold, *brodé en or battu*. The design contains figures of saints under canopies. The original ground has been replaced at a later date by the green velvet.—First half of the 15th century, Cologne.

759 Embroidery, silk on canvas. The work of Swiss nuns. Executed in plaited-stitch on canvas. Owing to the general circulation in the 16th century of Italian, German, and French pattern books, printed with wood blocks, open work embroidery on linen, as also work executed in the plaited-stitch on canvas, was much practised. The characteristic design, as also the execution of this particular specimen, denote plainly that this was produced in the convent, under the influence of these pattern books, towards the close of the 16th century.—Late 16th century, Switzerland.

760 Embroidery; silk, on coarse canvas, in plaited-stitch. The interesting pattern, with its beautiful design, reminds us of the embroideries (point compté) of the Italian and German pattern-books, as they may be observed in the books by Vincolo and Siebmacher. This fragment of an old border was found in a convent in Switzerland. (NOTE.—The design may be more plainly seen if the material be held against the light.)—Middle of the 16th century, Germany.

761 Embroidery; silk on cloth. The work of North German nuns. In the chapels or churches of North German monasteries and convents, dating from the latter half of the 16th and the beginning of the 17th century, richly-embroidered covers for the backs of the choir stalls may still be found. The outlines of the pattern are marked by thin strips of gilt leather. These covers, as may be seen from this specimen, are composed of large square compartments, in the middle of each of which is generally a coat of arms. This piece, also, in an excellent state of preservation, being one square of such a cover, has in the middle a fanciful coat of arms, on which is a bust with two faces, male and female, which are turned in opposite directions, perhaps to represent the past and the future. The late Gothic armorial shield is surrounded by an elegant wreath of foliage from the four corners of which spreads more foliage worked in double cross-stitch, and the outlines of which are also marked by gilt strips of leather. In spite of its age, 100 years, the strong and durable ground of black is still intact, without having suffered in the least from the moth.—Early 16th century, Germany.

792 Border, silk. Similar woven borders, in white and red, and excellently executed, are still to be found in quantities in Italy, and somewhat more rarely in Germany. They were probably used as edgings to hangings or table covers. The same pattern is to be found also in the old net-work (point compté) of Venice and Florence, which flourished in Italian convents during the 16th century.—Middle of the 16th century, Italy.

793 Embroidery. Plaited-stitch in silk, on canvas. This border shows an interesting pattern recurring in two variations, after designs in Italian pattern-books, and similar to those of the figured velvets and damasks, in two colours, dating from the same period. Nearly the whole surface is covered in plaited-stitch, the pattern being formed by the canvas ground, which is left out.—Middle of the 16th century, Italian.

794 Embroidery, in silk on linen. This embroidery, the pattern of which is unfortunately not very well preserved, was probably originally intended to form part of a bed hanging, or was employed to decorate a chimney-piece. The pattern, in plaited-stitch on linen, is hardly distinguishable. The fringe is also interesting, and is plainly Italian work of the 16th century.—Middle of the 16th century, Italy.

795 Embroidery; appliqué work in white and yellow; satin on black silk repp. Probably part of an antependium, used in the church at funeral services.—Late 16th, early 17th century, Spain.

812 Embroidery, on red velvet. The embroidery represents the Eucharist supported by two adoring angels. The lower border is composed of appliqué work on white satin. The upper border contains the following quotation, embroidered in Roman capitals: "Qui manducat hunc panem vivet in æternum I. O. N. G. G." Purchased in Toledo. It was probably used to cover the Eucharist during the service.—17th century, Spain.

815 Embroidery, in coloured silks, on repp. The work of Rhenish nuns. Once formed part of the dress of a wooden image of the Virgin.—17th century, Germany.

817 Embroidery in gold bullion, on white satin. Probably part of the bandolier of a colour bearer.—17th century, probably Spain.

818 Embroidery, in gold, on green silk damask. Made in a Rhenish convent. The embroidery is in Rococo style, and is perfect in execution. Part of the orfrey of an antependium. The letters I.H.S. are embroidered in the middle.—End of the 17th and beginning of the 18th century, Germany.

819 Embroidery, in gold bullion in relief, in Spanish style.—17th century, South Germany.

826 Sampler, interesting; embroidered in coloured silk on linen canvas, and with the date of 1704. An interesting specimen. Probably embroidered by a lady of high rank, after ancient ancestral designs. In the middle of the sampler is a coat of arms, with two finely conventionalised heraldic lions on either side, and surrounded by a wreath of flowers.—1704, South Germany.

827 Sampler; elegant embroidery in coloured silks on canvas.—Early 18th century, South Germany.

828 Sampler, with embroidery, in silk, showing the various stitches, and with representations of the instruments of the Passion, and the "Agnus Dei." Worked in a convent. Purchased in Nürnberg.—1696, South Germany.

829 Embroidery, silk on linen. Such samplers were worked as school tasks in the convents, and were handed down in the family from mother to daughter. They were carefully preserved as heirlooms, even as late as the 18th century, at which date the art of embroidery in silk on linen was still universally practised in German families, in which the traditional designs were still preserved. With the commencement of the 19th century both taste and execution in domestic embroidery began to deteriorate, and since the year 1820 to 1830 the senseless and unsightly embroidery on canvas in cross-stitch has been introduced, to the almost total extinction of all artistic embroidery.—End of the 17th century, South Germany.

830 Sampler; showing in excellent execution, the various styles of embroidery in silks on canvas. These samplers, which are still preserved in considerable numbers, date from a period when German married women and girls were accustomed to occupy their spare time in sitting by the hearth and executing all kinds of artistic work, with which they decorated their churches and houses. Ladies of the present day are also desirous of excelling in the art of needlework with as little trouble as possible, and without devoting much time to its pursuits. Perseverance, devotion, and a true appreciation of art are, however, wanting.—A.D. 1684, South Germany.

834 Embroidery, in coloured silks on coarse canvas; showing different patterns executed in the same stitch. The designs and colourings in excellent imitation of old traditional patterns.

835 Sampler; showing various methods of embroidery in silk on linen, with the date, 1727. Purchased in Nürnberg.—1727, South Germany.

848 Embroidery in silk, in tambour stitch.—18th century, Germany.

849 Embroidery in gold on white silk. A chalice cover, *Palla calicis*. The design indicates the decadence of the art of embroidery.—Middle of the 18th century, Rhenish.

850 Embroidery in gold on red satin ground, in the typical *barocque* style. This rich piece is worked by the Guild of Rhenish Embroiderers in gold. A chalice cover, *Palla calicis*.—18th century.

851 Embroidery in tambour stitch on black satin. Characteristic work of the "Brodeurs de l'Empereur," in the days of the first Empire.—Beginning of the 19th century, France (Paris).

PRINTS.

871 Cotton white, printed with design in red and green. Once formed the cross on the back of an ecclesiastical vestment.—17th century, probably Holland.

873 Cotton, printed in curious colours.—18th century, Holland.

874 Linen; printed in four colours by means of wood blocks.—End of 17th century, Rhenish Germany.

875 Linen; printed in three colours, with pattern of squares containing floral ornaments.—Beginning of the 18th century, Holland.

876 Linen; printed with powdered pattern of the 18th century.—Beginning of the 18th century, Holland.

903 Cotton; white, printed with diaper pattern in gold and design of foliage in four colours, with outlines in gold.—Beginning of the 18th century, Oriental (Broussa, Smyrna, or Damascus).

904, 905, 906 Linens; printed in different patterns in red and black.—Beginning of the 18th century, Holland.

907 Cotton; white, printed with pattern in red.—18th century, Holland.

908 Satin, printed, probably accomplished by means of a copper or steel plate.—End of the 18th century, France.

909 Linen, printed with pattern; borrowed from the lace-work of the 18th century, South Germany.

910, 911 Cotton, white; printed with powdered pattern in black.—18th century, Holland.

912 Print, serpentine pattern with flowers. The material is somewhat difficult to determine.—19th century, place of manufacture difficult to name.

913 Linen, white, printed with serpentine pattern in blue.—18th century, Rhenish Germany.

SILK EXHIBITORS' CATALOGUE.

310 ROBERT WATSON & Co., Surdah, Rajshahi, Bengal; the Calcutta agents of this firm are Messrs. Jardine, Skinner & Co.; the London agents, Messrs. Matheson & Co., 3, Lombard-street.

Raw Silk reeled at the Surdah Filature with the Tavelette Consono, 25/30 deniers. Surdah is the name of the head filature of this extensive company, which embraces other filatures in the district. The filatures of Radnagore, of which the factory at Ghátál is the head, also belong to this company. Ghátál, writes Dr. Hunter, is a municipal town in the Midnapur District, situated on the Silai River, near its junction with the Rúpnáráyan, containing a population of about sixteen thousand, nearly all of whom are Hindus. It is an important commercial town, trading in rice, silk, sugar, cotton cloth, &c. Raw Silk reeled by the best Indian method, 10/11 deniers. Raw Silk reeled with the Tavelette Keller, 10/11 deniers. Improved reeling of Tussur Silk. Cocoons from Surdah, Rajshahi, Bengal. (*a*) Cocoons of *Cricula trifenestrata*. (*b*) Cocoons of the Tussur silkworm. (*c*) Yellow and white Cocoons of the mulberry-fed silkworm. Burma. (*d*) Desi pierced Cocoons of the mulberry-fed silkworm. November bund. (*e*) Madrassee or hot weather Cocoons of the mulberry-fed silkworm, unovened, *i.e.* sun-dried. (*f*) Madrassee or hot weather Cocoons of the mulberry-fed silkworm, ovened, *i.e.* artificially dried. (*g*) Desi or November bund Cocoons of the mulberry-fed silkworm, unovened, *i.e.* sun-dried. (*h*) Desi or November bund Cocoons of the mulberry-fed silkworm, ovened, *i.e.* artificially dried. Bengal silk waste. Tussur silk waste.

311 PIZZIE AND CRAMP, 34, Earl-street, Coventry.

Ribbons and Dress and Mantle Trimmings.

313 BENGAL SILK COMPANY, Behrempore, Bengal; the manager of this company is Mr. J. W. Stocks, of Berhampur, and the Calcutta agents, Messrs. Lyall, Marshall & Co. The London agents are Messrs. Anderson Brothers, 16, Philpot-lane, E.C.

Raw Silks reeled in the usual Bengal method. (*a*) A series of hanks of raw Silk, 10 to 13 deniers. Gonatea. (*b*) A series of hanks of raw Silk, 26 to 30 deniers. Cossimbazaar. (*c*) A series of hanks of raw Silk, 11 to 13 deniers. Rangamati. (*d*) A series of hanks of raw Silk, 16 to 20 deniers. Benjeti.

314 THOMAS WARDLE, Dyer and Printer, Leek, Staffordshire,

"Contributions to Decorative Art, by the Chairman of the Silk Section, in silk, silk and Tussur silk plushes, cotton, and woollen printing and dyeing, for dress and upholstering purposes."

315 LES PETITS FILS DE C. J. BONNET & Co., 8, Rue du Griffon, Lyon.

Silk Cocoons. Raw Silk. Reeled Silk. Dyed Silk. Silk Stuffs, comprising Faille, Satin, Faille Française, Merveilleux, and various new armures, in all silk, silk and wool, and silk grenadine, in over fifty qualities.

316 J. VANNER & SONS, 1, Coleman-street, London.

Spitalfields Silk for umbrellas.

317 LEWIS AND ALLENBY, Regent-street and Conduit-street, London.

Reversible Surat. Coloured and Black Dress Silks. Rich Jacquard-loom Broché Silks. Silk Long Cloth.

318 TOM BRADWELL & Co., Dane Mills, Congleton, Cheshire.

Sewing Silks for Hand and Machine Use. Knitting, Crewel, Filoselle, and Embroidery Silks. Tailors' Twists. Bootmakers' Closing Twists, &c.

319 J. MILLIGAN & SON Buxton, Derbyshire.

Derbyshire Hand-wrought Silk Hosiery.

320 JOHN HADWEN & SONS, Kehroyde Mills, near Halifax.

Waste Silk in the Raw and Stages of Manufacture. Spun Silk for Laces. Velvet Plush Hosiery and Mixed Goods. Sewing and Filoselle Silks.

321 HENRY TUCKER & Co., Castleton Silk Mills, Rochdale; and Pendleton Silk Mill, Manchester.

Waste Silk, and Waste Silk Yarns, and products from same, and products from raw silk.

322 JOHN MASON, Park Green Mill, Macclesfield.

English-made Silk Plush Handkerchiefs, Mufflers, Squares, and Sashes.

323 ENRICO MEYER & Co., Via Andegari, Milan, Italy.

Raw and Thrown Silks.

324 P. WILD & Co., The Forge Mills, Congleton.

Spun Silk, Machine Twists, Filoselles, Embroideries, and other Yarns.

325 CLAYTON MARSDENS & Co. LIMITED, Wellington Mills, Halifax.

Waste Silk and Spun Silk Yarns.

326 JAMES PEARSALL & Co., 155 and 156, Cheapside, London, E.C.

Embroidering Silks and Filoselles, in unfading and washing colours. Knitting Silks. Machine Sewing Silks, for the leather trade and for general purposes. Upholstery Covering and Fringeing Silks. Tussur Silks. Upholstery Satins, in unfading colours.

327 HENRY HOGG & SON, Congleton, Cheshire; and JOHN GODWIN, Macclesfield.

Specially Thrown Organzine. Specially Thrown Tram. Silk Handkerchiefs, Cut-ups, Mufflers.

328 FRANCIS BAGLEY, Bailey-lane; J. & T. P. CALDICOTT, 28, Much Park-street; J. and J. CASH, Hertford-street; DALTON, BARTON, & Co., Earl-street; F. W. FRANKLIN, Bailey-lane; G. CAREY FRANKLIN, Earl-street; GEORGE STATHAM, 25, Much Park-street; THOS. STEVENS, Stevengraph Works; and A. S. TOMSON, Grey Friars Works.

Combined Exhibit of All-silk Ribbons and Mixed Goods manufactured by the above in Coventry, with the exception of A. S. Tomson, waterer and finisher of all goods shown.

329 WILLIAM HAMMERSLEY & Co., Mill-street, Abbey Green-road; and Bridge End, Leek, Staffordshire.

Dyed Silks (Bombyx Mori) in Tailor's Twist. Machine Twists, Sewings, Embroideries. Filoselles, Crewels, Washing Colours, Knitting Silks, unfading colours for art and upholstery. Organzines and Trams, weighted and unweighted. Softs and Souples in black and colours, including the noted fast French and Desange blacks, suitable for ribbons, velvets, chenilles, umbrellas, and all weaving purposes. Indian and China Tussurs in dyed, raw, and manufactured state.

330 KERSHAW AND SWINDELLS, Paradise Mills, Macclesfield; 28, Cheapside, London, E.C.

Silk Manufactures for neck and pocket wear. Plain and Fancy Chenille.

331 WILLIAM CHORLTON & Co., 29, High-street, Manchester; Silk Mill, Droylsden, near Manchester; Silk Mill, Cheadle, Staffordshire.

Black Silk Crapes, various qualities.

332 THE PURE SILK MANUFACTURING CO. OF VICENZA, Italy, Stabilimento Serico, Vicenza, Italy.

Loom in work, making the silk of the olden time. Show Case at end of loom containing Specimens of the Silk of the Olden Time, in black and colours.

333 & 334 JOSHUA WARDLE & SONS, Silk Dyers, Leek, Staffordshire; Works, Leek Brook, Churnet, and Hencroft.

Italian and China Organzine and Tram, dyed in whites, colours, and black, for Failles, Moires-antique, Satins, Velvets, Plushes, Umbrella Silks, Poplins, Ribbons, Elastic Webs, Braids, Bindings, Tassels, Laces, Sewings, Twists, Sewing-machine Twists, Fringes, Cordonnets, Trimmings, Embroidery Silks, Tapestries, Floss, Filoselle, &c. Sewings, Tailor's Twist, and Sewing-machine Twist, dyed in whites, colours, black and the celebrated Raven dye (first dyed by Mr. J. Badnall, a former Leek silk dyer, 1820). Embroidery Floss, Filo Floss, Knitting Silk, Fringe Silk in Indian vegetable unfading dyes. Spun Silk, two-fold Spun Yarn for weaving purposes, Embroidery and Sewing-machine Twist, dyed in whites, colours, black and Raven. Pure and fast blacks for Velvets, Dress Silks, Serges, and all other necessary purposes—gradations of shades in colour dyeing. Tussur Silk—written also Tussore, Tussah, Tusser, and Tasar, and other wild silks—Raw, Organzine, and Tram, bleached and dyed in whites, colours, and black. Tussur Piece Silks bleached and dyed. Muga Embroidery Silk, dyed in colours. Examples of "Wardle's" Fast Blacks for pure dress silks, &c.

336 MICHAEL BORG, Silk Lace Manufacturer, 263 and 269, Strada Reale, Valetta, Malta; and 7, Wool Exchange, Coleman-street, London, E.C.

Black and Cream Silk Square Shawls, Scarfs, Fichus, Flounces, Trimmings, and Mittens. Cream Silk Handkerchiefs. Collars and Cuffs. Cream and Black Mantillas. Malta Mule Cloth Curtains and Antimacassars.

336A JAMES HAYWARD, 2, Argyll Place, Regent-street, London, W.

Case of gems. This gentleman is connected with the sapphire mines of Ceylon, and this case contains a beautiful collection of mounted and unmounted precious stones found in Ceylon, amongst which are beautiful specimens of sapphires, blue, straw-coloured, and colourless; moonstones, polished and carved; starstones, rubies, spinel rubies, peridots, amethysts, chrisoberyl of various colours, and tourmalines. The gems are faceted and in cabuchon.

337 THOMAS FRASER PEPPÉ, Arrah, Bengal, India; London agents, Tongue & Birkbeck, 34, Southampton Buildings, Chancery-lane, London, E.C.

Stall of exhibits showing the improved reeling of Tussur silk and its appliances, consisting of Tussur cocoons with pedicles, pierced Tussur cocoons, pedicles of Tussur cocoons softened and prepared for carding, Tussur cocoons prepared for reeling, Tussur raw silk, Tussur silk waste, woven Tussur silk fabrics, waist bands, fichus, embroidery, yarns for sewing and stocking-knitting, singlets, socks, &c.

338 COWLISHAW, NICOL, & Co., LIMITED, 16, Princess-street, Manchester.

Upholstering Fabrics, Satin Damasks, Satins, Silk Tapestries, Silk and Wool Tapestries, Silk Brocatelles, Silk and Chenille Tapestries, Curtains and Covers, Silk Brocades, Silk Plush, Cotelines, Silk and Cotton and Silk and Wool Cashmeres, Bouretta Tapestries, Curtains and Covers. Embroidery for Dress and Upholstering Purposes in Silk and Chenille. Duplicate samples of Silk Damask made for Windsor Castle, Marlborough House, and the House of Lords; and duplicate samples of Embroidered Dress made for Her Majesty the Queen in the year 1839. The following quotation from "The Cabinetmaker" gives an accurate idea of the excellent exhibit of this firm :—

Taking first fabrics having specially to do with furnishing, Messrs. Cowlishaw, Nicol & Co.'s exhibit will fully prove that statement, for it would be impossible to conceive anything more varied, artistic, or technically excellent than the splendid array of materials which they unfold. The four pairs of portière curtains at archway to dome, and those to the wrought-iron screen at entrance to music room and to the art galleries, show what they can do in a large and grand way, but furnishers will be not less interested in the upholstering fabrics, such as satin damasks, satins, silk and wool tapestries, silk brocatelles, silk and chenille tapestries, curtains and covers, silk brocades and plush, cotelines, cashmeres, bouretta tapestries, curtains and covers which are exhibited by this firm. The requirements of our upholsterers have been specially studied, and it would be difficult to find an all-round selection to equal this. We were so pleased with one of the designs that we shall illustrate it next month. It possesses a fine Renaissance feeling which is quite up to date. Did space permit we should be glad to illustrate in like manner some of the silk and chenille embroidery for dress and upholstering purposes, and the samples of silk damask made for Windsor Castle, Marlborough House, and the House of Lords. The duplicate sample of the embroidered dress made for Her Majesty the Queen in the year 1839 is also very interesting, and *a propos* of the Jubilee.

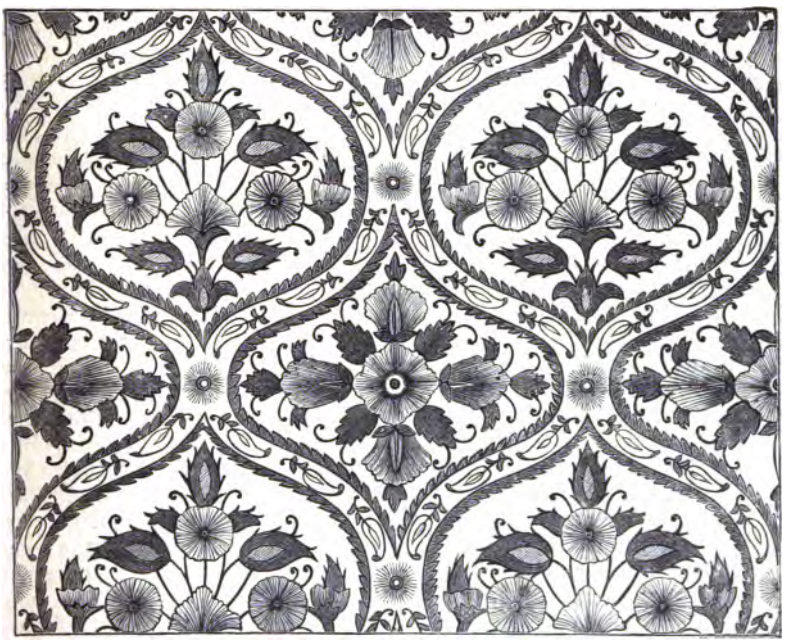
339 BRIGGS & Co., 8, Church-street, Manchester.

Transferring Designs for Embroidery. Embroidery Silks from the raw state to finished needlework.

340 LEEK EMBROIDERY SOCIETY; Address, Leek, Staffordshire.

Curtain in Tussur Silk and Gold Thread; ground challet. Designed by C. Purdon Clarke, Esq., C.I.E. Curtain in Tussur Silk and Gold Thread; ground Tussur. Designed by William Morris, Esq. Curtain in Tussur Silk and Gold Thread. Curtain in Tussur Silk with Tussur Silk Embroidery. Copy of Printed Tussur, end of 17th century; ground Tussur. The Leek Church Carpets, worked by ' on meshes cut in pile (communicants' kneelers for All Saints',

PLATE XII.



Two examples of Tussur on Tussur silk embroidery.
Leek Embroidery Society Exhibit No. 340.

Leek). A specimen of the reproduction of the old Tambour work for curtains. Case of small pieces of Embroidery on Tussur Silk; Blotters, Chair Backs, Work-bags, Handkerchief Cases, Glove Cases, Brackets. (See Plate xii).

341 J. O. NICHOLSON, Macclesfield Embroidery School, and Furniture Silks Manufacturing Company, Hope Mills, Macclesfield.

Thrown Silks. Silk Damasks and Brocades. Furniture Fabrics in spun silk, Tussur silk, and cotton. Dress Silks, plain and brocaded. Hand Embroideries—Portières, Curtains, Table Covers, and Borders, upon silks, satins, plushes, and Tussah silks. Bed Coverlets, Table Cloths, Chair Backs, &c., upon cotton, linen, and woollen cloths.

346 SILK SECTION COMMITTEE.

Curious and ingenious Indian Loom, for weaving Sacred Tape, brought from Benares and lent by Mr. Wardle. This loom is intended for weaving double warp fabrics only, in which the ground is made by one warp and the figure by another, the two warps being united in one in this loom, as their separation is not necessary. In such fabrics it is necessary, when raising a figured thread, to depress the corresponding ground thread, and this loom is so contrived as to take the two motions in one. The effect of this contrivance is excellent, as diminishing the possible number of defects in the work. This loom is worked with an opening of only seven-eighths of an inch between the warp threads raised and those depressed—one-third of the opening requisite in the Jacquard loom. With a smaller opening there is less strain upon the threads. Further, the weaver can work any pattern at will without alteration of loom or "passing in," and without any preliminary expenditure, such as draughting the pattern, and perforating cards. The warp threads are stretched between two pillars, being passed in fours between the teeth of a deep wooden comb which acts as a back reed, and also passed separately through the holes in the square pieces of horn. The pieces of horn form the arrangement for shedding—that is, separating the threads to make room for the weft—and in their arrangement all the interest of the loom is centred. The horns are square, with corners slightly rounded to avoid catching the threads, and there are four holes in each one at each corner. Where the Sanscrit characters are woven upon the tape there is a crimson warp for the ground and a white one for the figure. The two upper holes in the horns have each a thread of crimson passed through them, and the two lower ones each a thread of white. By turning a horn a quarter of a turn forward or backward the weaver can bring one of the crimson threads down, and one of the white threads up; by giving the horn a half turn he would have the two crimson threads down and the two white ones up. Thus he commands the threads so as to form his pattern. He has also a method of twisting the thread by a movement of the horns to get peculiar effects. The horns are 48 in number and

graduated in size, the largest being furthest from the weaver. There are 192 ends of silk in the warp, 96 for the face and 96 for the back. The stripes are mingled gold, green, white, and orange. The figure threads are finer than the ground threads. The weft is crimson throughout. The width of the sacred tape is three-quarters to seven-eighths of an inch. To judge of the quality, the tape as well as the loom should be examined. It is exceedingly well made, and shows to greatest advantage under the magnifying-glass. It is 4ft. 10in. long, and has 48 picks per inch. If woven in the Jacquard loom, a set of 2,750 cards would be required, and these cards alone would cost twelve times as much as the total cost of constructing a loom such as the one in which this sacred tape is woven. The dexterity and memory of the weaver, whose manipulations of the horns would exceed one hundred thousand in the weaving of one pattern, is remarkable. Of course the process of weaving would be slow, but considering the weaver's want of capital and the low rate at which time is valued in India, this contrivance must rank as one of the most singular instances of ingenuity in the history of weaving. There are exhibited with the loom two kinds of tape woven in it. Both are sacred ribbons worn by the Hindoos at worship in their temples or at home. The first one contains, in ornamental borders, twenty-nine names of Vishnu in Sanscrit, some of them having Gujrati terminations, and all except one being prefixed by the word "shri," which means "the beautiful," whilst the one not so prefixed also contains this word. The other tape is intended for worshippers of Shiva and contains only a repetition of Om Namha Shivaya—"I bow to Shiva."—(Mr. T. G. Lomas of the Silk Section Committee, has kindly furnished the above interesting description of this loom).

347 SILK SECTION COMMITTEE.

Model of Primitive Loom, showing manner of weaving in earliest period of the world's history. Constructed and lent by T. P. Lomas, Esq., of Manchester. From this form of loom, through many successive inventions, all our elaborate machinery is derived.

348 R. NORMAN SHAW, ESQ., R.A.

Triptych or Reredos for All Saints' Church, Compton, Leek. Painted by F. Hamilton Jackson; frame designed by W. R. Lethaby.

349 MR. WALTER SCOTT.

Designs for Silks and other fabrics. Students' drawings, Macclesfield School of Art.

Two Working Models of Chinese Cocoon Reeling Machines. One is worked by clockwork.

SILK EXHIBITS

IN THE

MACHINERY SECTION

368 NIGHTINGALE BROS., Paterson, New Jersey, U.S.A.

A Machine to Wind Quills for Looms, either silk or cotton. The machine doubles any number of ends together on the empty quills. It has 40 spindles. The quills are wound upright, requiring no former. An Attachment to Looms designed to let off silk from the beam of the loom automatically while in motion.

370 THOMAS STEVENS, Stevengraph Works, Coventry.

Improved Jacquard Loom which weaves twenty ribbons and has an eight-tier batton. It is for weaving all kinds of fancy silk goods, and all similar goods are woven with this kind of loom. On an Improved Jacquard Loom, of 20 spaces, 8 tier batton, 900 Jacquard Machine, weaving silk-woven pictures of Royal Mail Coach, &c. The various goods exhibited, such as bookmarkers, silk-woven portraits, pictures, braces, &c., &c., are all manufactured in looms of the same class.

373 WILLIAM CROSSLEY, Chapel Works, Wrigley Head, Failsworth, near Manchester.

Power Loom, weaving silk handkerchiefs with cross border. Double-lift Jacquard Machine. Loom made by George Hattersley and Son, North Brook Works, Keighley. Plate xiii.

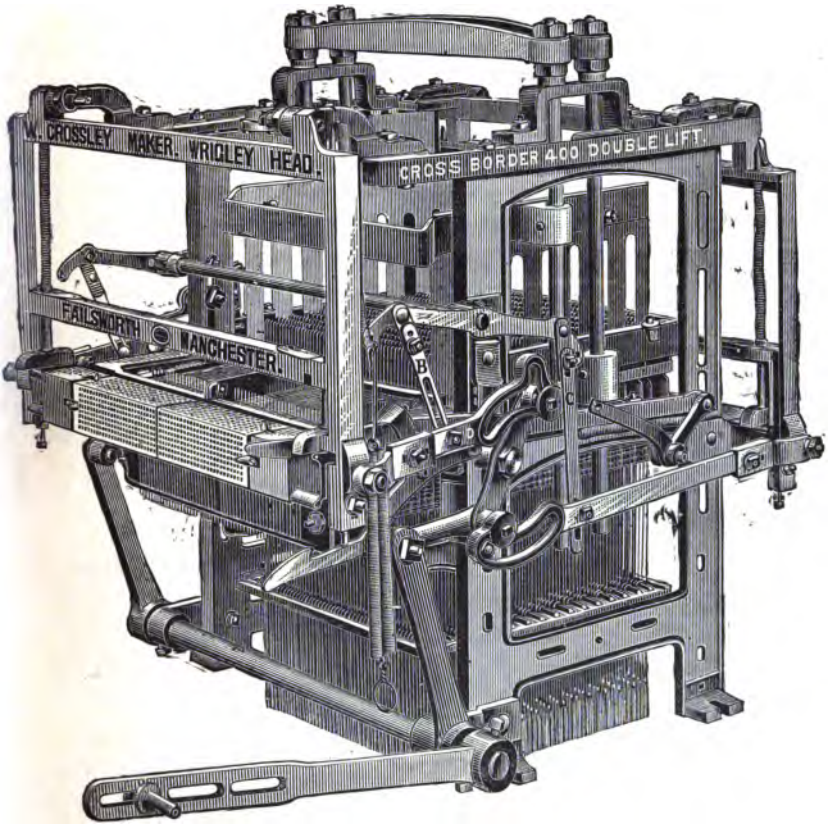
389 THE BRADFORD MANUFACTURING Co., 29, Canal-road, Bradford, Yorkshire.

Jacquard Loom, weaving a silk handkerchief containing portraits of Her Majesty, the Prince of Wales, and Prince Albert Victor, and pictures representing important events in Her Majesty's life.

443 SAMUEL BROOKS, Union Iron Works, West Gorton, Manchester, along with his Machinery Exhibits.

A specimen of the new Tube Spooled Sewing Machine Silk. A method which preserves the roundness of thread and tension. Can be ·oled in lengths as much as 4,000 yards. There is a freedom from The system is by Mr. Gallimore, silk manufacturer, Leek

PLATE XIII.



Wm. Crossley's Double-lift Jacquard. No. 373, p. 136.

B. Boyer, of St. Etienne.

French loom. This loom has a 400 Jacquard, with a four-tier batton, with all the latest improvements, and makes six fancy silk ribbons. Various Models of Handlooms for weaving figured silk fabrics, in which the warp threads are lifted by hand to allow the shuttle to pass. Half-size reproduction of Egypto-Greek loom, of a type model belonging to the Museum of Art and Industry, Lyons. Cylinder of a loom for weaving figured stuffs, with keys arranged to work the healds. Executed after the model of Dresden.

Various Models of Handlooms for weaving figured silk fabrics, in which the warp threads are lifted by hand to allow the shuttle to pass.

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1. Half-size reproduction of an Egypto-Greek loom of a type-model belonging to the Museum of Art and Industry, Lyons.

2. Cylinder of a Loom for weaving figured stuffs, with keys arranged to work the healds. Executed after the model at Dresden, &c.

EXHIBITS OF SILK

IN THE

IRISH SECTION.

The following interesting account of the history and state of the poplin trade, copied from the Official Handbook of the Irish Section, will be interesting in this place :—

Poplins, no less than linens, have come to be considered distinctively Irish, but the trade has always lacked stability. The trade was introduced into Dublin as early as 1693. It was due, in the first place, to an overflow of labour in the Huguenot colony at Spitalfields, but seemed to find at first an excellent footing in Dublin. Silk damasks and lusterings were also made, but poplin or tabinet has always been the mainstay of the manufacture. In recent years these have been its only outlet, until the revival lately of a handkerchief and piece silk business. Until 1781 there was no export of silks from Dublin, and then only some 460lb. were sent out, but two years later the quantity had increased to 6,216lb. There were at this time some 1,500 workmen engaged in the trade, and these are said to have increased to 2,500 in 1800. That happier results did not follow on conditions so promising is due to the senseless action of the workers, in attempting to dictate impossible terms to their employers, under which English competition could not be profitably met. For many years the Royal Dublin Society subsidised the industry, until abuse of the premiums became so flagrant that its support was withdrawn. What vitality remained to the trade was injured by the cruel kindness of laws so restrictive that the fabrics were so enhanced in value as almost to be unsaleable. Special Acts, fixed wages, and, according to prevailing notions of expediency, every endeavour was used to bolster up the decaying trade, which only woke to healthy activity when these hindrances were removed in 1826. From then there might have been as prosperous and progressive a future as may still be wished for Irish silks, if it had not been that the Dublin workmen combined to resist a reduction in the tariff of wages

which had been found imperative in England and accepted there. Many weavers, during the dispute, went over to Manchester, and there worked at wages which they had refused in Dublin. Another attempt to enforce a higher scale than that current in England was successfully resisted in 1849, at which time there was a partial revival of trade. Since then the industry in general has made headway alike in poplins, Court lace, and upholstery goods, having had at intervals the direct support and patronage of Royal Courts, home and foreign, and on more than one occasion the personal example of Her Majesty. There are not now more than about 150 poplin weavers in Dublin, but the number of operatives engaged in the several branches of silk production is considerably larger. The cheapness of labour in Ireland led at one time to an endeavour to establish sericiculture and the reeling of silk in the country, and the same condition should offer every hope for enterprise in extension of the manufacture.

Special commendation must be given to the beautiful exhibits of poplin fabrics of Messrs. Pim Bros., of Dublin, and Messrs. O'Reilly, Dunne, & Co., of Dublin. Messrs. Pim's case is decidedly one of the very finest in the Exhibition, and contains beautiful examples of poplin fabrics for dress and furniture purposes, which lay great claim to artistic excellence in designing and colouring. Messrs. O'Reilley, Dunne, & Co. exhibit an ancient Dublin poplin loom at work weaving patterned black poplins, as well as an excellent collection of poplins in many colours.

1168 WOMEN'S INDUSTRIES.

(8) PRESENTATION CONVENT, Killarney.—Yellow Silk Lace. Reticella Lace. Pocket Handkerchief. Reticella Squares. Nettled Lace Specimen. Nettled Black Lace (silk). D'Oyleys.

1179 PIM BROTHERS & Co., 22, William-street, Dublin; and 3 and 4, Milk-street, London, E.C.

Silk Poplins for Ladies' Dresses. Silk Handkerchiefs. Brocaded Silk Terries for furniture purposes. The display of Poplins and Silks of this firm is one of the finest in the Exhibition, and contains a collection of Poplins for both dress and furnishing purposes of great artistic merit, the colours and their combination and arrangement being well chosen, and the designs and patterning successful art efforts, and are in every way worthy of a people with such artistic instinct as the Irish.

1180 O'REILLY, DUNNE, & Co., 30, College Green, Dublin.

Irish Poplin, black and coloured. Empress Poplin. Imperial Fine Poplin. Brocaded Poplin. Double Poplin. Demie Poplin. Single Poplin. Irish Black Silk.

The following is an extract from the *Manchester City News*:—

Next to the linens, as a special Irish industry, we may take the poplins. These beautiful goods are nowhere made in such perfection as in Ireland, and much of their beauty—their rich and liquid lustre—is attributed to the peculiar properties of the water used in the dyeing processes. All poplins are made of silk and wool, the warp being of the finest and purest silk, the weft of the very best Australian wool. The firm of O'Reilly, Dunne, and Co., College Green, Dublin, is reputed to be the oldest in the trade; and so far back as the days of William the Fourth, the Princess Victoria, now Her Most Gracious Majesty, was a customer of the house. Poplins are said to be alike on both sides, and to look bright to the last hour of their wear; that, in fact, they wear too well, and outlast every other material. The silk used in the manufacture is imported mainly, we believe, from China. O'Reilly, Dunne, and Co. have a capital show of these exquisite stuffs, plain, figured and brocaded, black, white, and coloured. Some of the patterns have been specially designed for the Exhibition; and they exhibit a hand loom, at which a weaver is regularly employed at work upon the production of a very excellent specimen.

1181 O'REILLY, DUNNE, & Co., 30, College Green, Dublin.

Hand Loom in motion, weaving Brocaded Poplin, Jubilee Pattern.

SILK EXHIBITS

IN THE

INDUSTRIAL DESIGN SECTION.

12 HERMANN J. HAHLO, 41, Faulkner-street, Manchester.

Grass, Cotton, Linen, India Tapes, Silk, Cotton, China Ribbons and Flosses.

38 TOOTAL, BROADHURST, LEE, & Co., 56 to 62, Mosley-street, and 2, Charlotte-street, Manchester; Sunnyside Mills, Bolton; Ten Acres Mill, Manchester; Black Lane Mill, Radcliffe; and Dan Lane Mills, Atherton.

Plain and Fancy Muslins and White Dress Goods. Plain and Fancy Skirtings. All and Mixed Silk, Woollen, and Cotton Dress Goods. Piqués. Fancy Printed Calicoes and Muslins. Velveteens. Handkerchiefs. Sateens and Linings. Yarns and Sewing Cottons.

42 ROBT. FIELDING & SON; works, Sycamore-street, Oldham-road, Manchester; office, 15A, York-street, Manchester.

Large design of a figured-silk handkerchief, for weaving portrait of Her Majesty Queen Victoria, and other portraits, and illustrations of various incidents which have occurred during the Queen's lifetime. A handkerchief woven from the above design is exhibited. Can be seen weaving in the loom of the Bradford Manufacturing Co., in the Machinery Annexe East, Stand No. 389. Two designs for silk dress cloths, with samples of silk cloths woven from them. Design for cotton dress fabric, with sample of cloth woven from it. This design can be seen weaving in the loom of Devoge & Co., Jacquard machinists, Stand No. 372, in Machinery Annexe East. Sketches for various styles of cloth, in which the design is to be woven by the Jacquard machine.

59 HOLROYD AND SCOTT, Parkside Mills, Bradford.

Silk Plush.

62 WILLIAM COOKE & Co., Grove Works, Claypit-lane, Leeds.

Golden Lustre Silk.

157 BRIGGS PRIESTLEY & SONS, Albion Mills, Laister Dyke, and Dole Mills, Thornton, Yorkshire.

Silk and Wool Dress Fabrics for Gentlewomen.

169 SMITH BROTHERS & Co., 1, Forbes-place, Paisley.

Fine quality of Silk and Wool Shawls, also Figured Velvet Shawls.

171 BUSER AND KEISER, Laufenbourg and Liestàl, Switzerlaad. Depôt and Shipping Office: E. Buser, 8, York-street, Manchester.

Elastic Knit Ribbed Underclothing in silk, wool, and Lisle.

205 JOHN AND RICHARD SHELDON, Leek, Staffordshire.

Silk and Mohair Braids for Military, Gentlemen's, and Ladies' Wear.

206 ANTHONY WARD & Co., Albion Mills, Leek, Staffordshire.

Braids of Mohair and Silk Mixed with Mohair, suitable for Military Clothiers, Clothing Manufacturers, &c. Laces of Silk, Mohair, and Cotton.

222 H. SCOTT RICHMOND & Co., 30 and 31, Paternoster Square, and 13, Roser-street, London, E.C.; 127, Fifth Avenue, New York; Temple Court, Collins-street West, Melbourne; 1747, Notre Dame-street, Montreal, Canada.

Wall Papers, Silks, Brocatelles, Brocades, Printed Stuffs, Muslins, Velvets, and other fabrics for house furnishing and decoration.

257 MORRIS & Co., 449, Oxford-street, London, W.; works, Merton Abbey, Surrey; Manchester agents, Kendal, Milne, & Co.

Arras Tapestry. Hand-made Carpets. Brussels and Wilton Carpets. Wall Papers. Printed Furniture Cottons. Curtain Materials. Silk Damasks. Cabinet Work. Embroideries.

APPENDIX.

(1.) ITALY AND FRANCE.

STATISTICS OF CONSUMPTION AND PRODUCTION OF SILK.

(From "The Moniteur des Soies," Lyons.)

THE following table will serve to show the silk producing parts of Italy, the official prices of cocoons on the 1st and 2nd of July of the present year, as well as the quantities sold on those days:—

	Prices Francs per Kilogramme. Yellow.	Green.	Quantities in Kilogrammes.		Prices. Francs per Kilogramme. Yellow.	Green.	Quantities in Kilogrammes.
PIEDMONT.							
Acqui	3.89	—	6.040	Doglani	3.87	—	10.440
„	3.97	—	9.040	Mondovi	3.93	—	13.000
Alba	4.13	—	6.760	„	3.95	—	8.000
Alexandrie ...	3.98	3.28	8.720	Novare.....	3.72	3.27	37.430
„ ...	3.91	3.24	9.270	Novi-Ligure...	3.80	—	1.850
Asti.....	4.0	—	37.780	„ ...	3.87	—	2.540
Bra	4.01	2.67	14.750	Fossano	3.78	2.70	32.000
„	3.99	2.77	16.800	„	3.71	2.68	40.000
Carmagnole..	3.99	3.10	15.000	Pignerole	4.07	3.09	23.170
„ ...	3.93	—	2.500	„	3.96	3.09	16.220
Cavour	3.80	2.92	27.900	Racconis	3.93	2.80	15.900
„	3.91	2.96	9.800	„	3.93	2.86	11.900
Chivasso.....	3.44	—	4.000	Saluces	4.05	3.09	19.350
„	3.47	—	4.600	„	4.09	3.12	19.090
Casale.....	3.86	2.69	8.700	Savigliano.....	3.16	2.30	12.000
„	3.85	—	6.340	„	3.57	2.58	14.000
Cuneo.....	3.86	3.04	17.850	Turin.....	3.88	2.45	40.090
„	4·02	3.0	30.420	„	3.83	2.47	19.950
Dogliani... ..	3.99	—	12.260	Villafranca ...	3.88	3.01	1.600
LOMBARDIE.							
Brescia	—	3.0	14.350	Milan.....	3.89	—	480
„	—	3.02	18.550	Plaisance	3.53	—	—
Crème	3.60	2.90	3.360	„	3.55	—	—
Crèmone ...	3.61	2.88	6.600	Vigevano	3.79	3.17	2.770
„ ...	—	—	2.790	Voghera.....	3.89	3.0	1.711
Milan.....	3.86	—	1.430	„	3.96	2.83	9.970
DUCHÉS, ROMAGNES, EMILIE.							
Bologne.....	3.67	—	31.600	Macerata	3.48	—	3.830
Cesena	3.46	—	2.700	Meldola	3.92	—	4.120
„	3.44	—	2.910	„	3.94	—	3.500
Faenza	3.55	—	1.540	Modène	3.49	—	2.470
Fano...	3.27	—	1.350	„	3.70	—	2.690
Forli	3.66	—	3.470	Parme.....	3.90	3.42	21.930
„	3.68	—	3.260	„	3 95	3.09	18.220
Fossombrone	3.57	—	6.630	Pesaro.....	3.58	—	8.450
„ ...	3.54	—	8.310	„	3.62	—	4.010
Guastalla ...	3.50	—	1.400	Reggio	3.84	2.43	9.490
Iesi	3.48	—	2.280	„	3.77	3.05	9.000
„	3.64	—	7.520	Rimini	3.41	—	2.280
Imola	3.60	—	4.670	„	3.44	—	2.090
Lugo.....	3.46	—	12.900	Savignano	3.41	—	1.000
„	3.49	—	12.860	„	3.06	—	846
acerata ...	3.41	—	1.830				

The following table will serve to show the silk producing parts of France and the prices of cocoons from June 16th to 22nd of the present year :—

PRIX DES COCONS FRANÇAIS.

	Juin.	Francs per Kilogramme.
ARDÈCHE.		
Aubenas	18	3.50 et le cours
„	22	3.50 —
Bourg-Saint-Andéol	17	3.30 à 3.40
Joyeuse	20	3.50 3.60 et la plus-value
Viviers	16	3.25 à 3.30
„	21	3.40 3.50
DRÔME.		
Bouchet	19	3.15 à 3.30
„	22	3.55 —
Livron	20	3.50 — et la plus-value
Nyons	22	3.25 à 3.50
GARD.		
Alais	18	3.75 —
„	20	3.75 à 3.80 net
Bagnols-sur-Cèze	19	3.55 3.65
Pont-Saint-Esprit..	18 et 19	3.50 3.55
„ „	21	3.60 —
Saint-Ambroix	21	3.75 3.80
Tavel	16	3.25 3.30
„	19	3.45 3.50
Uzès	16	3.35 3.40
„	21	3.60 —
HÉRAULT.		
Ganges	22	3.75 à 3.80
VAR.		
Trans	17	3.30 à 3.40
Vidauban	16	3.55 av. doubl.
„	18	3.35 à 3.40

	Juin.	Francs per Kilogramme.
VAUCLUSE.		
Avignon	16	3.50 —
„	17	3.40 à 3.45
Bollène	17	3.30 avec la plus-value
„	17	3.30 à 3.35
„	18	3.35 3.40
„	21	3.45 3.50
„	22	3.50 —
Caromb	16	3.10 3.20
„	18	3.20 3.25
„	20	3.20 3.25
„	21	3.25 3.35
„	22	3.30 3.35
Carpentras	17	3.25 3.30
Cavaillon	17	3.45 av. doubl.
„	20	3.35 à 3.45
„	22	3.35 3.45
L'Isle-sur-Sorgue	22	3.25 3.30
Orange	16	3.25 3.30
„	19	3.35 —
Piolenc	16	3.25 —
„	20	3.35 3.40
Rochegude	16	3.25 —
„	20	3.45 3.50
Sainte-Cécile	16	3.25 —
„	17	3.30 3.35
„	20	3.45 3.50
Sablet-Violès	21	3.35 3.40
Sérignan	20	3.35 3.45
Sorgues	17	3.30 3.50
Visan	21	3.25 3.30

STATISTICS OF THE PRODUCTION OF SILK IN FRANCE.

Harvest of 1886.

In spite of the diminution of the number of ounces of eggs reserved for rearing, this harvest has been superior by 1,651,695 kilos. of cocoons to that of the preceding year, on account of the better yield of the eggs. According to the figures of the Minister of Agriculture the quantity of cocoons gathered increased to 8,269,862 kilos. against 6,678,167 kilos. in 1885.

Departments.	Harvest of 1885. Kil.	Harvest of 1886. Kil.
Gard	1,850,300	2,304,449
Ardèche	1,406,484	1,810,683
Drôme	1,387,333	1,654,091
Vaucluse	846,176	1,036,922
Bouches-du-Rhône	135,153	177,501
Var	336,214	347,771
Isère	267,135	306,564
Hérault	116,375	152,085
Lozère	39,653	98,331
Basses-Alpes	102,277	229,412
Alpes-Maritimes	13,590	15,998
Savoie	19,825	35,328
Tarn	2,341	3,066
Pyrénées-Orientales	25,505	20,419
Tarn-et-Garonne	9,215	10,555
Loire	4,710	5,775
Hautes-Alpes	15,839	18,163
Ain	9,049	9,800
Aveyron	2,996	3,743
Rhône	1,757	1,191
Haute-Garonne	2,410	2,185
Lot	201	50
Aude	129	237
Corse	23,500	25,533
Totals	6,618,167	8,269,862

These two totals are distributed in the following manner amongst the different varieties :—

	1885.		1886.
Original green variety	170,905	...	135,363
Reproduced do.	185,243	...	241,378
Other foreign varieties	302,505	...	295,975
Indigenous	5,959,514	...	7,595,146
Totals	6,618,167	...	8,269,862

Of this supply, 168,344 kilos. of cocoons have been laid aside for rearing purposes, producing 429,383 oz. of eggs. That part of the harvest reserved for manufacture will be about 7,429,000 kilos. of yellow cocoons ; 673,000 kilos. of green ; together, 8,102,000 kilos.

The quality of the cocoons was satisfactory. Estimating the average yield at the basin at 12 for every 1 which could not be reeled for the yellow cocoons, and 13 for 1 of the green cocoons, the produce of raw silk for the 1886 harvest may be estimated at 619,000 kilos. of yellow raw ; 58,000 kilos. of green raw ; together, 677,000 kilos., against 535,000 kilos. in 1885, 483,000 kilos. in 1884, 611,000 kilos. in 1883, and 772,000 kilos. in 1882.

Thus the silk production of France for 1886 has surpassed that of 1885 by 142,000 kilos., or 21 per cent., and that of the mean of the four preceding years, which is 600,000 kilos., by 77,000 kilos., or 11 per cent.

The following table gives the quantities of the different varieties of eggs reserved for breeding in each of the sericicultural departments of France during the year 1886:—

Name of Department.	Indigenous. Ounces.	Japanese. Eggs direct from Japan on Cards.	Japanese. Eggs Reproduced in France. Ounces.	Other Foreign Eggs. Ounces.	Total. Ounces and Cards.
Gard	61·916	·045	·261	·501	62·723
Ardèche	49·459	1·847	1·957	3·013	56·276
Drôme	38·843	2·910	3·619	4·273	49·645
Vaucluse	33·031	·035	·036	·339	33·441
Bouches du Rhône	5·561	.....	·152	·156	5·869
Var	8·353	.....	·116	·118	8·587
Isère	7·545	·044	1·201	·626	9·416
Hèrault	4·240	.....	·092	·030	4·362
Lozère	3·780	·010	·047	.....	3·837
Basses-Alpes	5·303	.....	.....	.....	5·303
Alpes-Maritimes	·506	.....	.....	.....	·506
Savoie	·934	.....	.....	.....	·934
Tarn	·082	.....	·012	...	·094
Pyrénées Orientales	·380	.....	·003	·003	·386
Tarn-et-Garonne	·282	.....	·007	.....	·289
Loire	·183	.....	·006	.....	·189
Hautes-Alpes	·349	.....	.....	.....	·349
Ain	·292	.....	·007	.....	·299
Aveyron	·105	·002	·002	·001	·110
Rhône	·038	.....	.....	.....	·038
Haute Garonne	·103	.....	.....	.....	·103
Lot	·001	.....	.....	.....	·001
Aude	·004	.....	.....	.....	·004
Corse	·559	...	·005	·007	·571
Totals	221·849	4·892	7·[illegible]		243·332

As compared with the preceding years:—

	1883.	1884.	1885.	1886.
Japanese on Cards	5·118	3·237	5·718	4·892
„ Reproduced	6·212	5·312	7·332	7·523
Other Foreign Eggs	13·195	10 898	11·025	6·066
Indigenous	294·120	260·166	232·876	221·849
Totals	318·745	279·613	256·951	243·333

(2.) FRANCE.

STATISTICS of the SILK TRADE of FRANCE extracted from the "Essai sur le Commerce de la Soie en France," par Monsieur Albert Rondot,*

With some notes by myself.

COMMERCIAL DISPOSALS of RAW SILK in 1881.

WESTERN EUROPE.	Lb.
France	1,650,000
Corsica and Algeria	6,182
Italy	6,523,000
Austrian Hungary	324,632
Spain and Portugal	184,800
	8,688,614

THE LEVANT.	Lb.
Turkey: Anatolia	158,400
„ Salonica, bolo } „ Adrianople }	264,000
Syria	365,200
Greece	28,600
Persia and Georgia	550,000
	1,366,200

EXTREME EAST.	Lb.
China: Exports from Shanghai	6,204,000
„ „ Canton	2,272,600
Japan: Exports from Yokohama	2,640,000
India: Exports from Calcutta	840,400
	11,957,000
Total in the whole world	22,011,814

It is seen that the country which is the greatest producer in the world is China; after China comes Italy, then Japan, and France ranks fourth.

Of the total commercial disposals—

China furnishes	38·53 per cent.
Italy furnishes	29·65 „
Japan furnishes	12·00 „
France furnishes	7·52 „
The Levant furnishes	6·21 „
India furnishes	3·82 „
The other countries furnish	2·27 „

* Lyon, Imprimerie Pittat Aîné, 4, Rue Gentil, 1883.

Thus there are annually about 22 millions of pounds' weight of silk which are disposable for fabrics in the manufacturing countries of Europe and America. The production is really much greater, as the Asiatic peoples, who are great consumers of silk, preserve for their own wants a considerable part of their production.

France absorbs upwards of 8,800,000lb. Germany comes next. The manufacturing of Crefeld alone consumed, in 1881, 1,430,000lb. of silk, that is to say, 946,000lb. of silk properly so called, and 484,000lb. of schappe. Returning to the accounts given by the Chamber of Commerce of Crefeld, always replete with facts and very exact, it is found that from 946,000lb. in 1877 the consumption has mounted to 1,430,000lb. in 1881, with an increase of fifty-two per cent for the schappe. This progression is remarkable. I am not able to give the statistics for the whole of Germany, but it must not be forgotten that besides Crefeld there are the important silk centres at Elberfeld, Barmen, and Müheim besides silk manufactures carried on at Berlin, Langenberg, Viersen, &c.

After Germany must be mentioned Switzerland and the United States.

The United States received, in 1882, 2,800 bales of silk from Europe and 19,100 bales of silk from China and Japan.

Switzerland consumes about 2,640,000lb.

Italy consumes about 1,100,000lb.

THROWN SILK conditioned in FRANCE, GERMANY, SWITZERLAND, AUSTRIA, ITALY, and ENGLAND, during each year from 1870 to 1881.

Years.	Weight of Silk in Lbs.					
	France.	Germany.	Switzerland.	Austria.	Italy.	England.
1870	4,448,400	1,038,400	1,218,800	288,200	...	...
1873	5,847,600	1,243,000	1,353,000	228,800	5,390,000	239,800
1876	9,950,600	1,507,000	2,178,000	224,400	6,740,800	167,200
1881	8,038,800	1,742,400	2,545,400	266,200	6,219,400	92,400

It must be observed that the total amount of thrown silk conditioned in Germany is much less than the amount of silk which is there appropriated to manufacturing, for the greatest part of this silk is conditioned in Italy. The same applies to Austria.

It is in the United States that the consumption has increased with the greatest rapidity.

IMPORTATION of SILKS to the UNITED STATES.

Years.	Quantities.	Values.	
	Bales.	Dollars.	£
1876	11,293	5,626,299	1,160,424
1882	21,889	14,040,808	2,895,917

The following table shows the production of cocoons in France in 1881 for each Department:—

	Lbs.
Gard	5,118,113
Ardèche	4,579,848
Drôme	3,582,033
Vaucluse	3,477,599
Var	993,355
Mouths of the Rhone	768,858
Isère	694,564
Hérault	355,689
Lower Alps	250,252
Lozère	160,573
Maritime Alps	81,980
Eastern Pyrenees	68,131
Other Departments	231,184
Total	20,362,179

Before the epidemic this production was, on the average, more than 55,000,000lb. of cocoons; it fell, in 1876, down to 5,280,000lb., and it attained, in 1881, as has just been seen, almost 20,500,000lb.

TOTAL PRODUCTION of RAW SILK in FRANCE,

Years.	Lbs.
1875	1,608,200
1876	341,000
1877	1,918,400
1878	1,337,600
1879	825,000
1880	1,156,540
1881	1,650,000

IMPORTATIONS into FRANCE in 1881.

	Quantities.	Values.
	Lb.	£
Cocoons	4,314,200	980,720
Raw Silks	9,781,200	8,180,640
Thrown Silks	2,204,400	2,206,560
Total Sik Waste of kinds	10,841,600	3,153,920

The total amount of 10,841,600lb. of silk waste is worthy of attention. The use of waste has increased much in late years owing to the great demand for low-priced fabrics. The following little table is, in this respect, very significant, and illustrates forcibly the sure and gradual expansion of the spun silk industry.

IMPORTATION into FRANCE of SILK WASTE for the Manufacture of Spun Silk.

	Lb.
1876 and 1877 (on the average)	5,995,000
1878	7,073,000
1879	7,979,400
1880	9,000,200
1881	10,841,600
1882	10,643,600

PRODUCTION in FRANCE of SILK TEXTILES.

It is estimated that in 1874, in France the production of *tissus de soie étoffes, rubans, tulles, passementerie, &c.*, amounted to about £28,000,000.

For the year 1881 the production of the Lyons manufactures, according to the estimations of the *Chambre Syndicale des fabricants de soieries de Lyon*, amounted to £15,968,800.

The following are the different branches this production includes :—

Plain silks, inclusive of those made of spun silk in blacks and colours : Failles, taffetas, satins, velvets in blacks and colours, serges, foulards printed or dyed, moires antiques, furniture silks, armures for dress silks, &c., £6,424,000.

Figured silks, consisting of damasks, armures, droguets, lampas, satins, moires antiques, velvets, taffetas, gros de tours, cravat silks, &c., £1,040,000.

Mixed goods, silk and cotton, silk and wool, &c. : satins, velvets, plushes, poplins, armures, carriage and furniture silks, serges, failles, doublures, cravats, shawls, fichus, umbrella fabrics, &c., £6,220,000.

Silk stuffs mixed with gold or silver ; also cotton and silk stuffs mixed with gold and silver, £400,000.

Crêpes in blacks and colours, £392,000.

Gauzes and grenadines, £472,000.

Tulles, plain, patterned or embroidered, £240,000.

Lace, guipures, lamas, £120,800.

Ornamental silk for churches, upholstery and military silks, £200,000.

Upholstery silks mixed with wool, cotton or pearls, £460,000.

Total, £15,968,800.

M. Natalis Rondot says there is not generally sufficient importance assigned to the other manufactures ; to those of Calais and of Saint-Pierre-lès-Calais ; of Paris, of Nîmes, of Tours, of Avignon, of Roubaix ; to those of the Departments of Aisne, of the North, of Oise, of Somme, of Gard, and of Herault. In his report of 1882 to the *Commission des Valeurs*, M. N. Rondot has given three estimations which ought to be signalised; he has estimated the production of *tulles*, of *rubans*, and of *passementerie* of silk at £8,000,000.

	£
Tulles de Saint-Pierre-lès-Calais et de Lyon	3,280,000
Passementerie de soie	2,800,000
Rubans de soie pure ou mélangée	1,920,000
	£8,000,000

The following statistics and *remarks* extracted from the *Moniteur des Soies*, of Lyons, will be read with interest, and will serve to compare the degree of debasement the silk industry of this country has arrived at, with its prosperity in the hands of our more energetic neighbours the French. An o[illegible] of comparing the silk trade of England with that of its [illegible] fforded at the same time.

Average weekly quantities of Silks conditioned in Lyons, from April 16th to July 16th, 1887 (a quarter of a year).

Nature of Silk.	Organzine Bales.	Tram Bales.	Raw Bales.
France	56	17	63
Spain	6	—	1
Piedmont	36	6	13
Italy	52	25	70
Brousse	2	1	22
Syria	14	—	23
Tussur	8	17	84
Bengal	6	1	14
China	16	58	259
Canton	25	33	210
Japan	26	29	175

Average weekly conditioning from 18th June to 16th July, 1887 (one month).

Nature of Silk.	Organzine Bales.	Tram Bales.	Raw Bales.
France	49	14	63
Spain	5	—	—
Piedmont	43	6	16
Italy	53	19	70
Brousse	1	2	28
Syria	21	—	21
Tussur	8	19	43
Bengal	4	1	18
China	14	56	232
Canton	26	30	319
Japan	27	25	243

For the week ending July 23rd it is curious to notice that the quantity of Tussur raw silk conditioned in Lyons was greater than that of any other kind, except Canton silk, the figures being—France, 36 bales; Italy, 83 bales; Tussur, 121 bales; China, 98 bales Canton, 330 bales; Japan, 89 bales.

SILK AND SILK CENTRES.

(Remarks from the *Moniteur des Soies.*)

With perhaps a few exceptions the price of silk has been continually diminishing for 15 years. M. Natalis Rondot estimates the fall in price to be at least 45%, which is confirmed by the statistics published by *The Bulletin des Soies*, 31 December, 1886. Thus :—

	Price in 1872.	In 1884.	1886.
Organsine (French)	124-126fr.	..... 63fr.	66-67fr.
„ (Piedmont).....	116-124fr.	..... —	66-67fr.
Raw (Italy)	92-106fr.	... .. —	57-58fr.

With some articles the decline has not been so severe, as—

	1872.	1886.
Raws (Bengal)	64-73fr.	50-52fr.

The fall is chiefly to be attributed to the increasingly energetic competition between silk-producing nations, and also to the series of bad or moderate corn, wine, sugar, and oil harvests which have occurred in Europe for several consecutive years, and which by contracting the consumption have obliged manufacturers to reduce their prices to find customers. But prices have begun to rise again, thus :—

	31 Dec., 1884.	31 Dec., 1886.
Organsine (French) cost.....	63-65fr.	66-67fr.
Tram (Italy).....	55fr.	61fr.
Raw (Italy)	50fr.	57fr.
„ (Bengal)	33fr.	51fr.*

The production is continually satisfactory. Cocoons gathered in Europe in 1885, 6,678,167kilos.; in 1886, 8,269,862kilos., an increase of 11% on the last four years. Cocoons gathered in Italy alone, in 1885, 3,220,617kilos.; in 1886, 4,397,323kilos., an increase of 22%.

Raw silk has increased in production 29% more than in 1885, and 15% more than the mean of the six former years.

In Austria-Hungary the figures give—

Cocoons, 1884, 1,275,000 ; 1885, 1,500,000 ; 1886, 1,800,000.

In the Levant there is an increase of 20-25% over the last year, and in the East (India, China, and Japan), as far as can be ascertained in the absence of official documents, the total in 1885 was 5,478,000, and in 1886, 5,819,000.

Silk industry in Germany is concentrated close by the Rhine. The principal centres are Crefeld, Elberfeld, Barmen and Versen. The development has been recent, dating from the war of 1870. Number of looms in 1865, 42,000 ; 1873, 68,000 ; 1881 upwards 87,000, at one time 90,000, Crefeld itself claiming 37,605. Since then the total of looms has decreased. M. Rondot estimates the diminutions to amount to 10,000. In 1883 the production of Crefeld totalled 86,584,069 marks, but in 1886 it fell to 77,801,863 marks. Judging from the total German exports the year 1886 has given no more favourable results. Thus for the 1st quarter of 1883 the German manufacturers exported 80,100 kilos. of pure silk, and for the same period in 1884 83,000 kilos., which fell in 1886 to 55,400 kilos.

This was, however, partly compensated for by an increased export of mixed silk, which rose from 646,500 kilos. in 1883 to 956,500 kilos. in 1886, considering the first quarter year in each case.

German exports into France have decreased to a noticeable extent—thus, in 1883 7,642,549 marks worth of silk were exported, in 1884 5,856,737, and in 1885 4,711,223, a result due to the enterprise of French manufacturers of mixed silks, who have not only regained ground but have competed with the Germans in English and American markets with a great amount of success.

*, unfortunately, was not maintained. Prices at 13 June were : French Organzines, 61-63fr. ; 58-59fr. ; Italian Raws, 53-54fr. ; Bengal Raws, 47fr.

The silk production in England is estimated at 100 to 120 million francs per annumn, of which the greater part is consumed at home, and the remainder is distributed in the East (especially Burmah), the United States, and France. But, speaking generally, English competition is little to be feared by the French. *Macclesfield products are too dear and too inferior in quality to suit French markets.**

France exported to England £4,504,442 in 1884, £3,736,658 in 1885, and £3,459,375 in 1886, excluding £625,225 for silk and satin ribands.

The United States give a powerful example of a competition of speedy growth, and one which is spreading gradually in every direction. Silk industry only became an important feature there during the last thirteen years. During that period the consumption has almost quadrupled, rising from 400,000 kilos. to 1,553,000 kilos.

The Americans have preserved their silk industry by maintaining an import duty on silk stuffs of more than 5 per cent. Consumption from 1871 to 1883 increased rapidly, then for two years it was checked by industrial and financial crises, especially in the year 1885. Thus, in round figures, imports in 1882 were 38½ million dollars; in 1883, 32 millions; in 1884, 31 millions; and in 1885 the imports fell to 23 million dollars, rising again in 1886 to about 28 millions.

Thus, French silks prosper there, in spite of the prohibitive duty, better than in England where no duty is imposed—a phenomenon to be accounted for by the increased activity of French manufacturers in that direction, and also by the preference for German goods shown by English buyers.

A great development has lately taken place in Austria, goods being turned out equal to Lyons articles. Production reaches 35·40 million francs, all for home consumption. Sericiculture in Hungary has greatly progressed, and judging from the very rapid advance made, that country must soon become an important centre of silk production. In 1880 there were 1,050 silk rearers, giving 10,135 kilos. of silk; in 1883, 6,260 rearers, giving 72,143 kilos.; and in 1886, 17,783 rearers, giving 257,660 kilos. of silk.

The industry is assisted by Government—and two model establishments have been completed, the first, erected in 1882, at Panesowa, with 60 basins, the other, in 1885, at Neusatz, with 140, the two together having produced about 33,000 kilos. of silk, of which 28,500 has been sold at Lyons, and 4,500 at Vienna. Rearers are furnished gratis with leaves and eggs of the best quality, which are selected at Szegzard with the aid of the microscope. This establishment distributed 11,700 ounces of eggs in 1886.

The manufacture of woven silk goods has developed rapidly in Russia during the last few years, being concentrated almost entirely within the jurisdiction of Moscow, where, in 1884, there were 148 factories, 8,874 looms, 10,845 hands producing stuff to the value of 7,625,000 roubles; and there were also 72 small factories whose annual production does not reach 1,000 roubles per factory. In the jurisdiction of Vladimir there are 14 factories, 862 looms, 1,050 hands, producing to the value of 789,000 roubles. In that of St. Petersburg 10 factories, giving a value of 350,000 roubles; and in the government of Grodno 1 factory producing to the value of 156,000 roubles. Add to these 112 factories of woven silks, ornamented with silver or gold embroidery, employing 2,625 hands, and producing to the value of 2,680,000 roubles, 13 riband factories producing to the value of 600,000 roubles, and 590 dye-houses employing 29,750 hands.

Italy, the greatest silk producer of Europe, takes second place as manufacturer. The official documents give these results: Importations in 1886, 91,435,501fr.; exports in 1886, 276,696,805fr., of which last item raws amounted to 229,586,500fr. French silks exported for Italy vary between 9,000,000 and 11,000,000fr. Zurich and Bale are the centres of the silk industry in Switzerland, possessing 35,000 or 36,000 looms (4,120 machine), producing about 80,000,000fr. Two years ago the industry suffered a severe check. The mean total

* If this reproach be true should it not speedily be made a thing of the past?—T. W.

from 1880 to 1884 was 3,600,000 kilos. of exported goods, falling to 2,384,100 kilos. in 1885.

The production of Spain, Holland, Belgium, and Portugal is too slight to deserve consideration.

The production of Eastern countries can only be conjectured. M. Rondot estimates that China employs 350,000 looms, with production to the value of 300,000,000fr., about 25,000,000fr. being exported.

Japan is estimated by M. Permezel to employ 200,000 looms, nearly all for home consumption.

The production of Syria, Asia Minor, and India is approximated at from 20,000,000fr. to 21,000,000fr.

The increase in the number of silk-producing districts causing protective tariffs to be imposed, seriously affected the export trade of France. Statistics relating to the industry of Lyons alone may be taken as a good criterion of the whole of that country. The exports amounting in 1881 to 556,549 kilos. fell in 1883 to 218,622 kilos. Gradually recovering, however, to some extent, they reached in 1885 the total of 271,208 kilos., and though statistics for 1886 are not yet published, it is supposed that a slight advance has been made.

(3.) GERMANY.

THE following statistics, which will further prove the immense development of the silk trade on the Continent, are extracted from the * *Jahres-Bericht der Handels Kammer zu Crefeld für 1881.* They may be taken as fairly averaging the results of the subsequent years.

The total production of Italian cocoons in 1881 was 39,300 tons, and in 1880 40,930 tons.

The silks conditioned in Crefeld in 1881 and 1880 were as follows:—

Silk.	1881.		1880.	
	Lb.	Quantities per cent for each Country.	Lb.	Quantities per cent for each Country.
Lombardy	783,220	65	642,771	67
Piedmont	120,601	10	97,477	10
French	8,927	1	5,973	1
China	174,435	14	82,583	9
Japan	45,315	4	45,141	5
Bengal	46,409	4	59,954	6
Syrian	21,753	2	19,285	2
Raw	5,555	—	112	—
Various	4,527	—	1,700	—
Total	1,210,742	100	954,996	100

STATE of the CREFIELD VELVET and SILK TRADE.

The trade with Germany increased during 1881 more than £200,000. It was £1,550,000 in the year 1872. The trade with England, which was in the years 1878 and 1879 more than a third of the total amount done, has diminished more than £150,000. Crefeld pays a duty on cotton yarns of 39s. per 220lb. These are chiefly imported from Manchester. There is

* Crefeld, 1882. Druck von Kriner and Baum.

no duty on the silk imported. The silk trade of Crefeld consists in a manufacture of sa failles, cravat silks, damasks, umbrella silks, button silks, velvets, velvet ribbons, sa ribbons, faille ribbons. Most velvet finishers are also velvet cutters. The number of wor people employed in Crefeld in finishing and cutting is about 650.

A.—Average Number of Looms Occupied.

	1879.	1880.	1881.
Velvets and Velvet Cloths	16,546	17,464	15,716
Velvet Ribbo s	250	242	240
Failles, Satins and other Stuffs than Velvets	15,842	15,196	16,125
Ribbons other than Velvet Ribbons	88	106	45

B.—The Amount of the Trade with each of the following Countries; or the total of the Crefeld manufactures sold.

	1879.	1880.	1881.
	£	£	£
Germany	1,170,670	1,191,585	1,419,397
Austria	60,422	52,811	52,962
England	1,251,218	1,186,581	1,048,046
France	182,217	195,301	240,022
Other European Countries	143,895	141,771	178,821
Countries not European	710,102	956,037	887,180
Total	3,518,524	3,724,086	3,826,428

C.—Raw Material Used.

	1879.	1880.	1881.
	Lb.	Lb.	Lb.
Thrown silk	806,315	786,638	949,414
Schappe	388,234	463,392	474,221
Cotton	1,862,702	1,811,796	2,068,030

D.—Wages Paid.

	1879.	1880.	1881.
	£	£	£
Weaving	767,089	828,796	799,453
Winding	89,215	84,158	99,463
Warping	34,720	36,322	42,574
Dyeing	199,152	197,005	223,982
Finishing	91,583	94,260	106,159

Note.—The above tables only include work done for the Crefeld manufacturers, and not that done for themselves.

STATE of the CREFELD VELVET AND SILK DYEHOUSES.

	1879.	1880.	1881.
A.—Average number of workpeople employed in Crefeld in the dyeing of silk schappe and cotton	1,330	1,406	1,539
B.—Quantity of raw material dyed.			
1. For Crefeld manufacturers.	Lb.	Lb.	Lb.
a. Silk	797,192	865,895	941,952
b. Schappe	400,004	463,474	527,560
c. Cotton	1,892,037	1,791,097	1,770,120
2. For other countries.			
a. Silk	428,128	500,541	637,331
b. Schaffe	238,090	247,500	232,760
c. Cotton	297,327	404,624	424,685
	£	£	£
C.—Amount of wages paid	62,535	66,343	70,819

(4.) AMERICA.

CONSUMPTION AND MANUFACTURE OF SILK IN THE UNITED STATES OF AMERICA.—IMPORTATIONS FOR THE FISCAL YEAR ENDING JUNE 30, 1887.

(From the American Silk Journal.)

WE present, elsewhere in this issue, the annual statistics prepared by the Secretary of the Silk Association of America, showing the amount of importations, invoice value, of silk manufactured goods into the port of New York during the fiscal year ending June 30, 1887, and for the six years preceding, together with the imports of raw silk and waste silk and pierced cocoons at New York and San Francisco, for the fiscal year ending June 30, 1887, and and in the five years preceding.

As will be perceived by a reference thereto, the total importations of silk manufactured goods, during the year, amounted in value to $29,366,924, they exceeding those of the preceding year in the sum of $3,219,289, and those of 1884-5 in the sum of $3,258,734. They were, however, $4,672,773 less than in 1883-4, $4,600,247 less than in 1882-3, $7,065,782 less than in 1881-2, and $1,134,927 less than in 1880-1.

The goods, the value of importation of which decreased in 1886-7, as compared with 1885-6, are herewith shown:—

	1886-7.	1885-6.	Decrease	
	$	$	$	Per ct.
Silk piece goods	11,263,296	11,431,840	168,544	01·47
Crapes	247,174	432,789	185,615	42·88
Pongees	16,624	82,374	65,750	79·81
Ribbons	1,240,846	1,253,717	12.871	01·02
Gloves	478,153	503,823	25,670	05·09
Handkerchiefs	163,851	169,948	6,097	03·58

An increase, as compared with 1885-6, is shown in the following articles :—

	1886-7.	1885-6.	Increase	
	$	$	$	Per ct.
Satins	534,051	432,789	101,262	23·39
Plushes	2,153,209	1,414,727	738,482	52·19
Velvets	3,527,953	2,747,736	780,217	28·39
Laces	2,135,393	1,820,692	314,701	17·28
Shawls	184,606	106,590	78,016	73·19
Cravats	62,971	33,015	29,956	90·70
Hose	350,169	270,735	79,434	29·33
Threads and yarns	190,445	159,189	31,256	19·63
Braids and bindings	1,350,336	697,938	652,398	93·47
Silk and worsted	727,423	357,800	369,623	103·30
Silk and cotton	4,731,877	4,259,052	472,825	11·07
Silk and linen	8,547	1,907	6,640	347·66

The imports of raw silk, amounting to 31,974 bales, of a value of $22,126,890, were larger, so far as *value* was concerned, than in any preceding fiscal or calendar year, they exceeding those of the previous fiscal year in the sum of $2,443,990, and those of the calendar year, 1886, in the sum of $150,480, but 1,023 less *bales* were imported in the last fiscal year than in the preceding one, and 1,486 less bales than in the last calendar year. The average value, per bale of the importation, in the last fiscal year, was $692.65 ; in the preceding year, $596.51 ; and in 1884-5, $582.59. Of the year's importation, 15,927 bales, of a value of $11,065,911, were brought in, in the six months ending December 31, 1886, against 15,464 bales, valued at $8,764,491, imported in the corresponding period of 1885, and 16,047 bales, of a value of $11,060,979, in the six months ending June 30, 1887, against 17,533 bales, valued at $10,910,499, in the first six months of 1886.

The following tables show the increase or decrease in bales, valuation, and percentage of each, in the different classes of raw silk, in the last fiscal year, as compared with the preceding one :—

Increase.

	Bales.	Per cent.	Value. $	Per ct.
European	680	13·29	993,226	19·90
Japan	—	—	1,151,455	12·05
China	—	—	334,348	06·87

Decrease.

	Bales.	Per cent.	Value. $	Per ct.
Asiatic, reshipped from Europe	147	30·88	35,129	14·37
Japan	843	05·58	—	—
China	613	05·30	—	—

The imports of waste silk, pierced cocoons and noils, at the ports of New York and San Francisco, in the fiscal year just closed, amounted to 5,054 packages, valued at $929,192, an increase over the preceding year of 78 packages and $97,115 in value.

The final table gives the importation of all kinds of raw stock, at all ports of entry, in the last fiscal year, in pounds avoirdupois, and the value thereof, from which it appears that of the total importation of $23,082,675, but $955,785, or 04·14 per cent of the whole, was brought in at ports other than New York and San Francisco.

(5.) INDIA.

INDIAN SILK CULTURE.

In the Santal Jungles the leaves of *Terminalia tomentosa* (Pl. xxxix.) form the food of those Tussur silkworms whose cocoons are intended to be utilised industrially. The worms whose cocoons are intended for breeding are fed on the leaves of *Shorea robusta* (Pl. xlii.).

The prices of Tussur cocoons in Fatwa, Manbhum, Gaya, and Chutia Nagpur are shown in the following table (January, 1886) :—

Fatwa	120 cocoons per rupee	...	Best cocoons
	160 „ „		Common cocoons
Manbhum.....	5 to 7 rupees for 800	...	
Gaya	10 rupees for 1000	...	
Chutia Nagpur..... ..	320 cocoons per rupee	...	Formerly
	240 „ „	...	Recently
	160 to 200 „ „	...	Price which the natives are now demanding

At the beginning of the year the contract price for Indian Tussur waste silk was in France 1s. 6d. per lb., the highest rate yet obtained, and for Tussur raw silk of the improved reeling 7s. 3d. per lb, as against 4s. 8½d. per lb. for Chinese Tussur raw silk.

The collector of Vizagapatam informed me that immense tracts of country in his district produced Tussur cocoons.

A few particulars of the value of Muga and Eria silks may be useful in this catalogue.

1. Muga. The silk of the Muga cocoon is reeled, not spun. The two principal trees upon which the Muga silkworm feeds are the *Soom* (*Machilus odoratissima*), and the *Sud.* (*Tetranthera monopetala*). The price for cocoons for reeling is 500 to 800 cocoons for Rs. 1. The price for waste cocoons for reeling is Rs. 2 per seer containing nearly 3,000 cocoons, or 1s. 6d. per lb. The price of Muga raw silk is from Rs. 8 to Rs. 12 per seer, or 6s. to 9s. per lb. Muga spun yarn can be bought for Rs. 4 per seer, or 3s. per lb. The priceof Muga cloth in Assam varies from Rs. 1·8 to Rs. 2 (2s. 3d. to 3s.) per square yard.

2. Eria.—Eria cocoons are sold at Rs. 2·8 to Rs. 3 per seer, containing about 3,600 cocoons, or 1s. 10½d. to 2s. 3d per lb. Pierced Eria cocoons sell in Calcutta at Rs. 60 to Rs. 70 per maund of 82lb., or 1s. 1d. to 1s. 3d. per lb. Cocoons containing the dessicated chrysalis sell at the rate of 1,200 to 1,500 per rupee or at about 9 annas per seer, containing 700 cocoons (5d. per lb). The prices, however, vary much. The value of the thread varies from Rs. 4 to Rs. 7 per seer, or 3s. to 5s. 3d. per lb. Eria thread, I should mention, is made of silk spun from the cocoon and not reeled, as is not practicable to reel this cocoon. The value of Eria cloth woven with this spun thread varies from Rs. 7 to Rs. 20 for 6 to 7 yards according to quality, or 1s. 6d. to 5s. per yard.

3. The *Philosamia* or *Attacus cynthia* (Pl. xxiii., Figs. 1 and 2) is found wild in the Terai.

4. The *Philosamia* or *Attacus ricini* of Assam (Pl. xxii., Figs. 1 and 2) is said to owe its difference from *A. cynthia* to domestication.

A few short particulars about Indian sericiculture will not be out of place here, and should be useful hereafter to India.

5. The *Desi* or *Chota poloo* silkworm of Bengal (*Bombyx fortunatus*), No. 11, p. 28, &c., is said to have been imported from China, in 1771, by the East India Company, but the pure variety is now only to be found in Bogree, Midnapur.

6. The *Madrassee* or *Nistri poloo* silkworm (*Bombyx cræsi*), No. 13, p. 29, &c., is found throughout the silk districts of Bengal. It is characterised by having round and not crescent marks.

7. The *Boro poloo* silkworm, the only univoltine variety, is found only in parts of Murshidabad, Hugli, Midnapur, and Birbhum districts. It is said to have been introduced in 1710, but is gradually being neglected by rearers as precarious and uncertain.

Another variety of the mulberry silkworm, known as *Chini*, is found only in Midnapur, Bengal. This silkworm, as well as the *Boro poloo*, has crescent marks.

Cocoons of mulberry silkworms for seed, purchased in different districts, are called *Sunchoo*.

The mulberry-feeding silkworms of Bengal have four moultings, being in the first stage black, the second blackish-grey, the third grey, and the fourth greenish-white or grey. The leaves are given to the worms at first chopped up, after the third moulting detached from the twigs, and after the fourth moulting attached to the twigs. Thirty or forty pounds of cocoons are obtained from an English ounce of eggs. A *bigha** of land gives four crops of leaf in the year, and the produce of cocoons reared per *bigha* in the year is *three maunds*.†

In the Punjaub experiments from eggs of French, Italian, and Japanese origin yielded 401b. of cocoons per ounce of eggs, and that 161b. of fresh cocoons yielded 11b. of raw silk. In Europe 12lb. to 14lb. of cocoons yield 11b. of silk.

In Italy and in France sericiculturists obtain 40 to 60 kilogrammes of cocoons per ounce of eggs, but the yields vary with locality and climate. This larger yield is the result of studying the worms, in selection of eggs, in crossing the numerous varieties of the silkworms.

The mulberry in Bengal (*Morus Indica*), *Tût*, is grown in clayey or sandy soils as a perennial shrub. It is cut down seven to eight times a year. It is planted once and remains in the soil until it wears itself out, or the ryot finds other crops more profitable. New earth is generally put on to renew the soil. The roots belong to the ryot and not to the zamindar.

No. 447. The silks which bear the mark G. G. McP. are from the Bengal Silk Company. This mark is a contraction of G. G. McPherson, who was one of the founders of this industry.

From the 11th to the 16th of January, 1886, an exhibition of silk cocoons was held at Rampore Beauleah, Rajshahi District, Bengal. It was opened and actively supported by Lord H. Ulick Browne, Commissioner of the Rajshahi Division, who believes that it has undoubtedly fostered a spirit of emulation among the cocoon rearers by bringing together the cocoons of various silk-producing tracts, and says that there are grounds for hoping that similar exhibitions held in the different silk-producing districts, in different years, may lead to good results.

A prize of Rs. 50 was awarded to Baboo Roma Nath Sen, the author of the best Bengali essay on the method of rearing silk cocoons. This essay is intended to be printed, and copies distributed among the exhibitors. The money for the prizes was raised by subscriptions in the neighbourhood, to which Government added an equal sum.

The number of exhibits were as under:—

Rajshahi	141
Murshidabad	83
Birbhum	5
Naidya	1
Total	230

* There are three *bighas* in an English acre.

† A *maunds* is about 82lb.

The following are the silk districts of Bengal :—

Bardwan.	Jessoor.
Bankura.	Murshidabad.
Birbhum.	Rajshahi.
Midnapur.	Rangpur.
Hugli with Howrah and Serampur	Bogra.
Parganas.	Maldah.
Nadiya.	

I am informed that the French Government has lately sent out forty reeling machines to Madras for reeling Tussur cocoons.

The *Bombyx mori* cocoons, No. 382*a*, have been sent by Mr. S. Cunliffe Lister, of Manningham, Yorkshire, who informs me they are from the "Lister Grant" at Dehra Dun, and reared from French eggs sent out last autumn, and that he has 2,000 acres there now under mulberry cultivation, and is planting several hundred acres per annum. It takes five years by his system for the mulberry plants to be of the proper age. These cocoons resemble in size, form, and colour the race cultivated in Provence. I have reeled excellent silk from them in the Silk Culture Court here of 10-12 deniers with the Tavelette-Keller. *See* Raw Silk, No. 272*a*.

TABLE of the Diameter, Strength, and Tension of a single Cocoon Thread or Bave, and Dimensions of Cocoons of the chief Mulberry and Indian Wild Silks.

Name of Worm or Silk.	Country.	Diameter of single Fibre in fractions of an inch.		Tension or limit of stretch before breaking in inches of single Fibre one foot long.		Strength of single Fibre in drams avoirdupois.		Dimensions of Cocoons in inches.
		Outside of Cocoon.	Inner part of Cocoon.	Outside of Cocoon.	Inner part of Cocoon.	Outside of Cocoon.	Inner part of Cocoon.	
Bombyx mori, or mulberry silk	China...	1/1950	1/1400	1·3	1·9	1 1/8	2 5/8	1 1/8 × 1/2
	Italy ...	1/1900	1/1480	1·2	1·9	1 1/8	2 5/8	1 1/4 × 5/8
	Japan..	1/1740	1/1420	1·2	1·4	2	3 1/8	1 1/8 × 5/8
Bombyx fortunatus	Bengal..	1/2200	1/1950	1·8	2·3	1 5/8	2 3/4	1 1/4 × 1/2
Bombyx textor	India ...	1/2400	1/2100	1·5	1·9	1 3/8	2 5/8	1 1/4 × 1 1/2
Antheræa mylitta, or Tussur silk	,, ...	1/630	1/530	1·9	2·7	6 5/8	7 3/4	1 1/2 × 7/8
Attacus ricini, or Eria silk..	,, ...	1/1170	1/1070	1·7	2·0	1 1/2	3	1 1/2 × 3/4
Attacus Cynthia, or Ailanthus silk	,, ...	1/1200	1/1030	2·6	2·9	2 3/8	3 1/2	1 3/4 × 3/4
Antheræa Assama, or Muga silk	,, ...	1/730	1/810	2·4	2·9	2 7/8	4 7/8	1 3/4 × 1
Actias selene	,, ..	1/1000	1/930	2·0	2·8	2 3/8	4	3 × 1 1/4
Attacus atlas	,, ...	1/850	1/900	1·9	2·8	2 1/8	4 1/8	3 1/2 × 1
Antheræa yama-mai	Japan...	1/1130	1/1040	2·0	4·0	6 3/4	7 1/2	1 1/2 × 1
Cricula trifenestrata	India ...	—	1/810	—	—	—	—	2 × 1
Antheræa pernyi	China ...	1/730	1/710	2·0	2·7	3 1/4	5 7/8	1 5/8 × 3/4

(6.) ENGLAND.

IMPORTS of MANUFACTURED SILK into ENGLAND, from 1854 to 1883 inclusive, from Countries in Europe.

Year.	Raw Silk.	Knubs or Husks of Silk and Waste.	Thrown Silk.	Silk Manufactures.
	Lb.	Cwt.	Lb.	£
1854	7,535,407	19,480	1,021,832	2,365,415
1855	6,618,862	12,106	929,896	2,217,107
1856	7,383,672	17,993	853,015	2,669,172
1857	12,077,931	20,680	640,936	2,077,616
1858	6,277,576	16,765	358,269	2,187,061
1859	9,920,891	20,808	327,462	2,763,379
1860	9,178,647	17,435	244,335	3,343,761
1861	8,710,681	29,627	124,574	5,906,029
1862	10,372,123	28,142	62,227	6,618,501
1863	9,221,145	31,940	59,383	6,639,155
1864	5,655,401	24,876	73,160	7,620,432
1865	7,732,450	33,432	60,130	8,496,825
1866	5,453,864	25,417	66,850	9,434,936
1867	5,849,648	23,031	196,188	9,094,612
1868	7,036,177	30,550	326,574	10,950,784
1869	5,573,366	29,198	209,509	11,908,814
1870	6,307,575	31,360	283,723	15,244,919
1871	8,253,335	38,984	177,386	8,397,938
1872	7,302,083	33,886	63,001	9,429,121
1873	6,445,213	31,815	108,794	10,065,378
1874	5,911,831	35,141	114,601	11,979,459
1875	4,487,837	33,787	110,010	12,264,532
1876	6,016,927	29,663	164,040	11,815,740
1877	4,441,891	24,282	114,417	12,860,988
1878	4,170,606	32,887	40,039	12,755,988
1879	3,886,422	38,268	116,741	12,841,918
1880	3,673,949	55,002	203,567	13,324,935
1881	2,904,580	54,119	131,836	11,727,397
1882	3,377,119	44,277	294,207	11,174,573
1883	3,178,593	62,064	292,433	10,523,920

With regard to the column headed "Silk Manufactures," manufactured silks are imported chiefly from countries on the continent of Europe, those imported from other countries having, from 1854 to 1880, an average value of £242,449 per year.

The manufactured silks from the continent of Europe are classified in the Board of Trade Returns, thus:—

Broad Stuffs: Silk and Satin.—Broad Stuffs: Velvet.—Ribbons: Silk and Satin.—Ribbons: Other kinds.—Plush for making hats.—Manufactures of Silk or of Silk mixed with other materials, unenumerated.

In calling attention to the tables of statistics respecting the English silk industry, it may be well to notice more particularly the table on this page, in which it is shown that the average annual value of manufactured silks which England has bought from countries in Europe, for the decade 1874 to 1883, is £11,831,057, whilst the sum for the year 1854 was only £2,365,415. There is no doubt that this large increase of imports of manufactured silk goods is in ratio to the decline of the silk industry in England and to its corresponding increase on the continent of Europe, and that very much less than the whole of this sum turned over in the decayed English silk districts, would make them very prosperous indeed

Silk and Silk Goods (net and spun) exported from the United Kingdom during the years 1854 to 1883 inclusive.

Years.	Raw Silk.	Knubs or Husks of Silk and Waste.	Thrown Silk.		Silk Manufactures.	
			British.	Foreign and Colonial.	British.	Foreign and Colonial.
	Lb.	Cwt.	£	Lb.	£	£
1854	1,096,303	832	465,816	524,817	1,226,564	410,506
1855	2,185,555	1,070	441,751	402,264	1,082,592	366,616
1856	1,438,598	562	1,203,399	282,705	1,758,657	420,001
1857	1,706,625	939	1,082,505	238,529	1,807,324	370,414
1858	2,314,519	2,429	790,960	364,680	1,305,899	264,453
1859	2,152,327	1,505	790,401	254,297	1,562,152	386,036
1860	2,153,993	1,506	826,105	426,866	1,587,303	224,366
1861	4,096,992	835	918,342	82,780	1,395,582	242,329
1862	5,205,861	4,228	1,096,453	137,095	1,264,074	267,900
1863	3,852,919	1,087	811,045	216,903	1,421,261	260,477
1864	3,922,130	844	854,407	334,065	1,460,160	188,736
1865	3,137,292	1,212	767,058	306,701	1,404,381	166,936
1866	1,965,093	12,452	629,610	71,882	1,318,066	311,454
1867	1,902,014	4,625	754,145	16,126	1,024,515	305,605
1868	2,930,295	1,076	1,229,126	58,448	1,083,060	207,727
1869	3,049,151	7,252	1,150,037	36,014	1,110,118	137,570
1870	2,644 402	4,165	1,154,364	39,771	1,450,397	166,25[illegible]
1871	3,269,775	5,322	1,269,812	41,156	2,053,086	683,06[illegible]
1872	3,213,057	3,527	1,894,595	41,189	2,190,869	362,156
1873	2,786,305	2,833	1,667,545	20,905	1,878,600	324,603
1874	2,741,842	4,078	1,032,643	21,860	2,101,419	341,673
1875	2,551,417	1,779	880,923	87,924	1,734,519	328,426
1876	3,064,725	4,210	1,080,678	50,202	1,794,565	303,954
1877	1,652,935	7,450	570,999	17,910	1,705,153	229,130
1878	1,841,505	8,012	565,266	40,470	1,922,953	222,133
1879	1,375,608	5,029	694,735	24,461	1,697,209	248,495
1880	947,165	9,241	683,591	7,553	2,030,659	259,023
1881	903,997	4,528	1,008,272	5,561	2,564,730	263,826
1882	915,773	6,941	825,572	6,281	2,692,275	...
1883	524,182	5,216	705,825	5,596	2,426,299	...

With regard to the column giving the exports of foreign and colonial silk manufactures, the average total value of silk manufactures, the produce of countries out of Europe, exported during the years 1854 to 1863, was £233,391 per annum, whilst during the years 1864 to 1881 it was £45,740 per annum. The exports of silk manufactures, the produce of countries out of Europe, have steadily decreased from £292,442 in 1854 to £24,085 in 1881. The decrease in 1864 was unusually great, the value of these exports being £134,410 in 1863, and £80,360 in 1864. From the years 1854 to 1863 the values of the exports of silk manufactures, the produce of countries out of Europe, were more than half the total exports of foreign and colonial silk manufactures; whilst during the years 1864 to 1881 the exports of foreign silk manufactures, the produce of countries in Europe, composed more than half the total exports of foreign and colonial silk manufactures.

The values of the exports of both British and foreign and colonial silk manufactures also include the exports of manufactured silks, of which spun silk forms the whole or part, which are very large and increasing, and also manufactures of silk mixed with other

A CURIOUS CONTRIBUTION TO SILK LITERATURE.

(From the American Silk Journal.)

We reproduce herewith one of the most curious contributions to the literature of silk that probably was ever made, and one containing such extraordinary ideas as to methods of raising silkworms, and the medicinal virtues of their product, that it cannot fail to have much amusing interest to our readers. The old book, from which we reproduce it, with its accompanying illustration, was, as will be observed, published in London in 1725, and is now very rare, the copy to which we are indebted being owned by Mr. John Dean, of Brooklyn. This copy, which is a book seven by nine inches in size, and of over four hundred pages, is in an excellent state of preservation, and a most creditable piece of work as regards paper, typography, and binding for the age in which it was done. We reproduce its title-page and the portion of the work relating to silkworms, in the quaint orthography in use at the time the book was published, so far as is possible with type of the present age :—

A Compleat

HISTORY

of

DRUGGS,

Written in *French* by Monsieur *POMET*,

Chief Druggist to the late *French* King *LEWIS* XIV.

To which is added

What is further observable on the same SUBJECT,

from

Mess. *LEMERT* and *TOURNEFORT*,

Divided into Three CLASSES,

Vegetable, Animal and Mineral;

With their USE

In PHYSICK, CHYMISTRY, PHARMACY,

And several other ARTS.

ILLUSTRATED

With above Four Hundred Copper CUTTS, curiously done from the Life; and an EXPLANATION of their different Names, Places of Growth, and Countries from whence they are brought; the way to know the True from the False; their Virtues, *&c.* A WORK of very great Use and Curiosity.

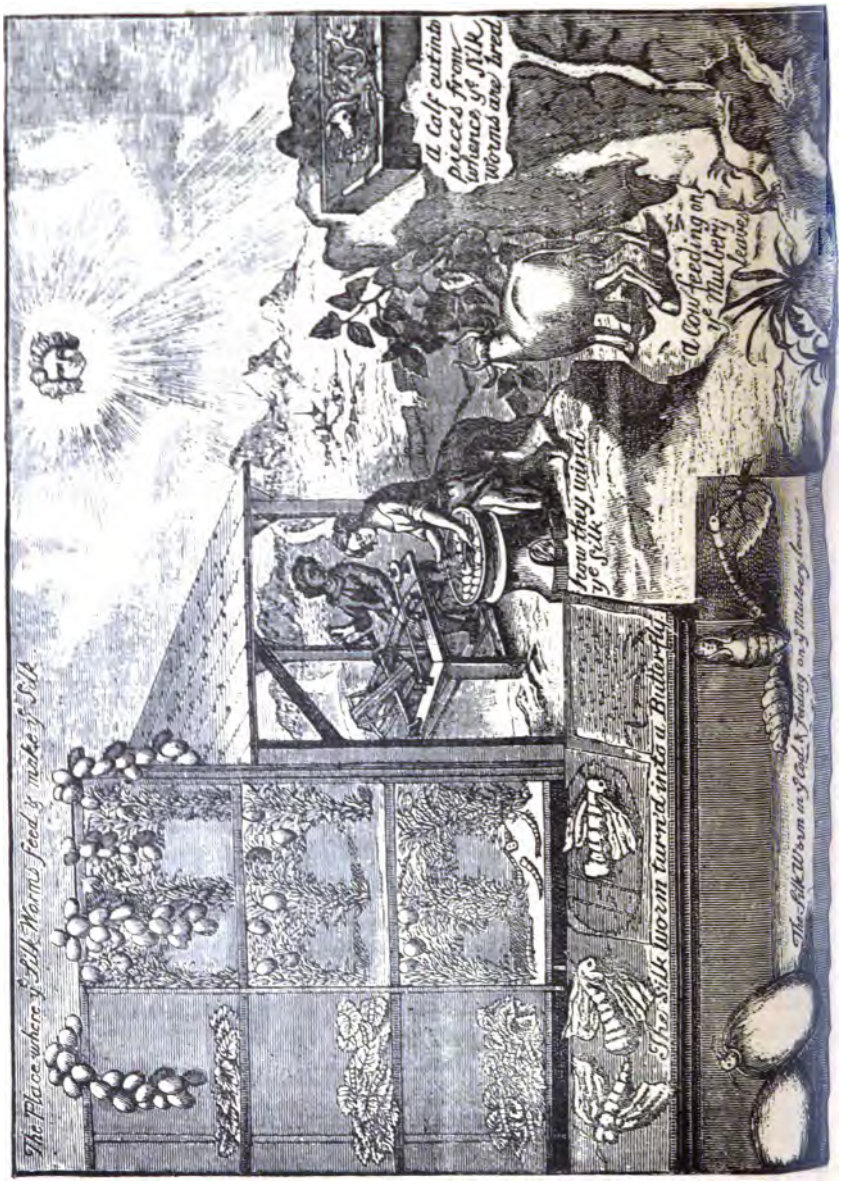
Done into *English* from the ORIGINALS.

The SECOND EDITION.

LONDON:

Printed for *R.* and *J. Bonwicke*, and *R. Wilkin*, in St. *Paul's Church-yard; John Walthoe* and *Tho. Ward* in the Temple. MDCCXXV.

PLATE XIV.



The place where ye silkworms feed and make ye silk.

Of Silkworms.

THE *Silkworms* are little Insects, whose Origin is altogether surprising, as well as the various Shapes and Changes they undergo. Several Authors have writ of them; and amongst the rest Mr. *Isnard*, in a little Treatise of his, at the 254th *Page*, accounts for their Original, thus: *Pomet.*

"At the Time when the Mulberry-Leaves are ready to gather, which should be five Days after their budding, in the beginning of the Spring, they take a Cow, which is almost at Calving, and feed her wholly with Mulberry-Leaves, without giving her any Thing else to eat, of Herbs, Hay, or the like, till she has calv'd; and this they continue for eight Days longer; after which, they let the Cow and Calf both feed upon this some Days together, without any other Mixture as before: They kill the Calf after it has been fill'd or satiated with the Mulberry-Leaves and the Cow's Milk; then chop it to Pieces to the very Feet, and without throwing anything away, put all together, the Flesh, Blood, Bones, Skin and Guts, into a wooden Trough, and set it a top of the House in a Granary, or Garret, 'till it is corrupted; and from this will proceed little Worms, which they lay together on a Heap, with Mulberry-Leaves, to raise 'em afterwards, just as they do those which are produced from the Eggs; and these Silk-worms are abundantly more fruitful than those from the Eggs; so that those who deal considerably in them, never fail every ten or twelve Years to raise them this Way."

There are so many Particulars relating to the Management and Breeding of these little Creatures, that it would be troublesome to dwell upon this Subject; besides, it has no Relation to my present Purpose; and since Mr. *Isnard* has writ an intire Book upon it, I shall refer those to it who would know further. These little Animals supply us with a Commodity so valuable, that formerly only those of the best Quality were clothed with it. There are several Colours of Silk; as white, yellow, and the like; These different Silks are found upon little *Clues*, of the Size and Shape of a Pigeon's Egg; and by the Means of warm Water, and certain *Windles*, they wind it into Skains, and then dye it of what Colour they please.

I shall not detain you with a Description of all the different Silks that we have brought us from several Parts, contenting myself only to say, that what is us'd in Physick is the Natural; that is to say, the *Ball*, or what is wound up naturally, and without passing thro' hot Water, to which the Ancients gave the Name of Raw-Silk, or rough as it comes from the *Silk-worm*. This Silk, after it is reduced to Powder, which is not very easy to do, is brought into several Compositions, as Confections of *Alkermes*, *Hyacinth*, &c. They use likewise Silk dyed Scarlet, to give to Women in Child-Bed instead of *Alkermes*. Several authors say, that Silk has the Virtue of making the Heart pleasant, and the Spirits brisk, and to cleanse the Blood. Those who use the Balls of Silk ought to take Care, before they reduce it into Powder, to cut it asunder, and take away the Worm that is within, sometimes fresh, and sometimes rotten, with the first Skin that wraps it about, as not fitting to be taken inwardly; and those who would have the best, use nothing except the Raw Silk, because the rest is nothing but Dross, or refuse Stuff: It may be reduc'd to Powder, by cutting it very fine, so that it will pass thro' a Sieve; for to beat it, 'twill be a tedious Work, besides it will lose half. As to the Confections of *Alkermes* and *Hyacinth*, the scarlet Silk ought to be prefer'd to all other, tho' almost all Authors recommend the Raw Silk, which is that that is White, or of a Gold Colour, and which has not been dy'd.

Bombyx, sife Vermis lanificius, the *Silk worm*, is a Kind of Caterpillar, or a Worm as long and thick as one's little Finger, divided from one part to another in a sort of Rings; having under them usually fourteen Feet, six in the fore Part, which are very small, and eight on the hinder Part, which begin after the third Ring: The two last are much larger than the rest; the Shape of 'em are ugly to look upon; their Substance ver *Lemery.*

moist and viscous. They are cloath'd with a very thin tender Skin: easy to break and wast away, of a brown or whitish Colour, with some Spots. It is produced in the Spring, from a little round Egg, that is like a Poppy Seed, is fed with Mulberry-Leaves fresh gather'd; for if they are decay'd, they kill the Silk worms. When they are grown to their full Size they eat no longer, but spue out of their Mouths a Kind of thick, gluey, or viscous Slaver or Foam, which they stretch, extend, and work to a Silk web, and then wind into a *Clue*, that is sometimes white, and sometimes yellowish, wherein it is wrap'd, and lies several Days still working 'till it dies; but if you do not throw this *Clue* into Water to draw off the Silk, it will quit this thick Cloathing, pierce thro' the *Clue*, and arise a fine, white, gawdy, active Butterfly; and if you leave after this Manner a Number of them, you will have a diverting Sight, to see the Male and Female Butterflies caressing, and making Love; from whence, afterwards, you have Eggs when the Animal is dead.

The Silk worms yield Abundance of Flegm and Oil, but little volatile Salt. They are reckon'd very good to cure a *Vertigo*, if after they are dry'd and powder'd you apply the Powder upon the Head, being first shav'd. The Silk upon the *Clue*, before it is cast into the Water, is called *Sericum crudum*, or Raw Silk. It ought to be cut asunder to uncover the Worm within it. This yields a little Flegm, a good deal of Oil, but very little volatile Salt and Earth. It is thought proper to recruit the Spirits, and Purify the Blood, being taken in Powder. Some People hold, that if you feed a Calf with Mulberry-Leaves, then kill and cut it to Pieces, and expose it to the Air, Upon a House, it will produce Silk worms; but this Thought wants Confirmation. In the Parts where they trade in Silk, as *Savoy*, *Languedoc*, and *Provence*, they put their Silk worms in Chambers, where they are dispos'd in Repositories or Niches, where they make their *Clues;* good Quantities of which they preserve on Purpose to have Eggs, and they throw the rest into warm Water, wherein the Worms die.

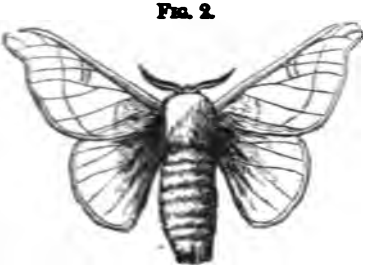
The Clichés for the majority of the following Plates have been lent by the Lords of the Committee of Council on Education. They form the Illustrations of my "Wild Silks of India" published as a South Kensington Museum Handbook, in 1881. Copyright.

PLATE XV.

Fig. 1.

Bombyx mori, or mulberry-feeding silkworm (Male).

Fig. 2.



Bombyx mori (Female).

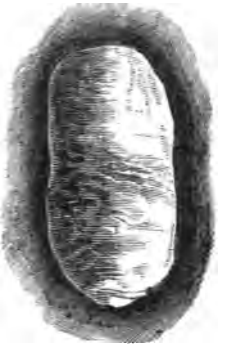
Fig. 3.

Larva of Bombyx mori.

Fig. 4.

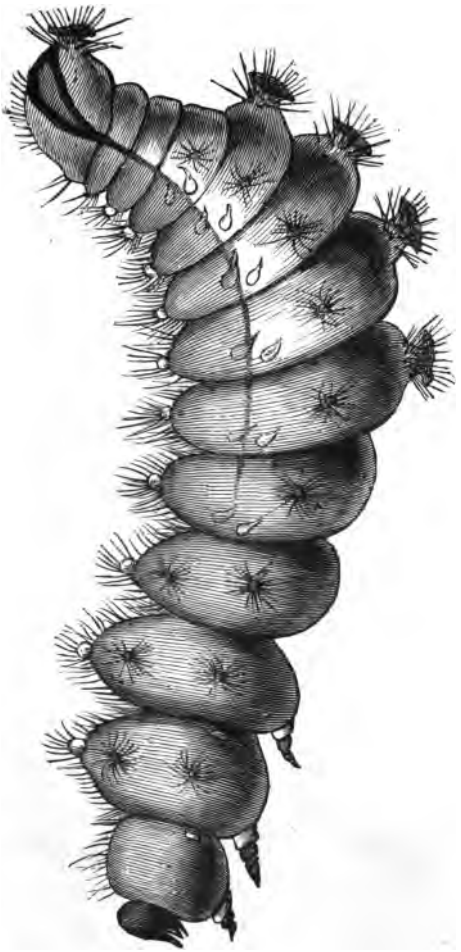
Coccon of Bombyx fortunatus from Bengal.

Fig. 5.



Cocoon of Bombyx mori reared in Italy from Japan seed.

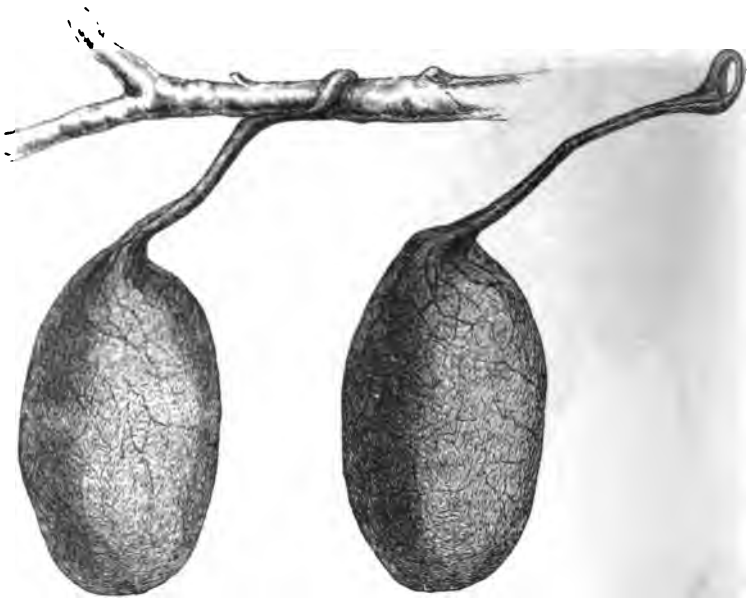
PLATE XVI.



Larva of Antheræa Mylitta or Tussur silkworm.

PLATE XVII.

FIG. 1.



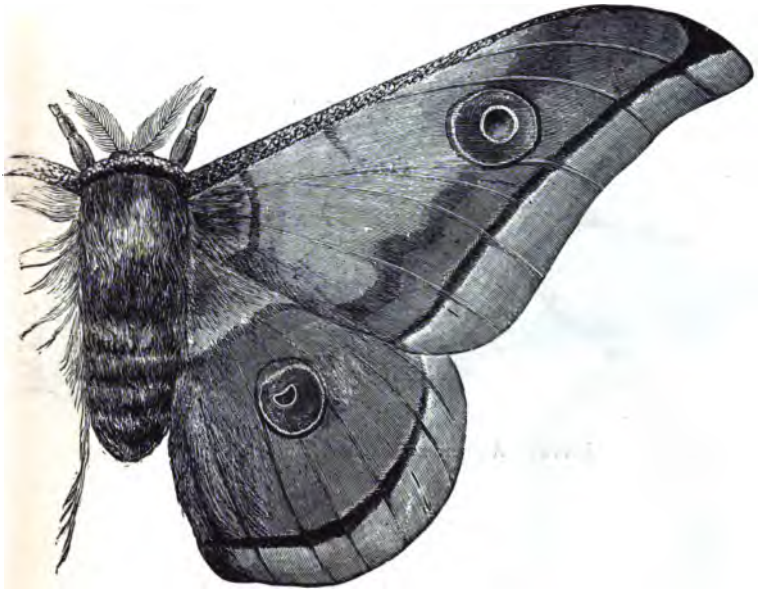
Tussur Cocoons with their pedicles, showing natural attachment to boughs.

FIG. 2.

Tussur cocoon cut open to show the chrysalis inside.

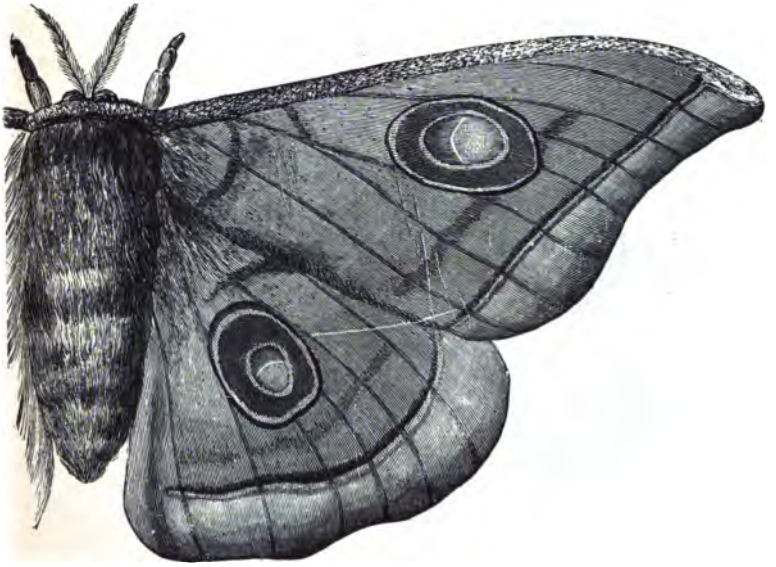
PLATE XVIII.

FIG. 1.



Antheræa mylitta or Tussur moth (Male).

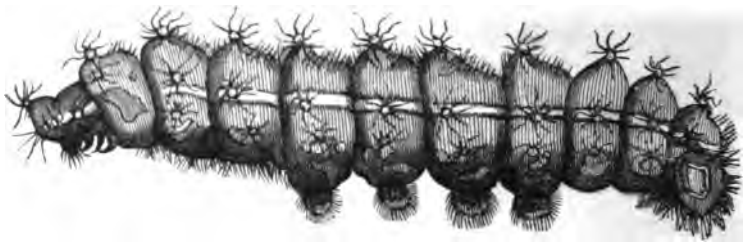
FIG. 2.



Antheræa mylitta or Tussur moth (Female).

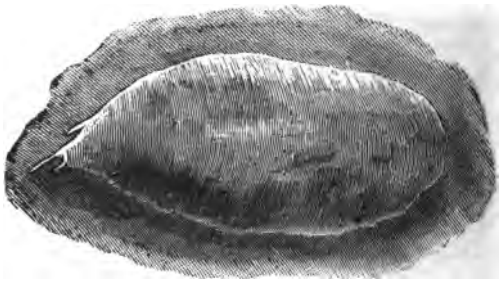
PLATE XIX.

Fig. 1.



Larva of Antheræa Assama or Muga silkworm.

Fig. 2.



Muga cocoon.

PLATE XX.

FIG. 1.

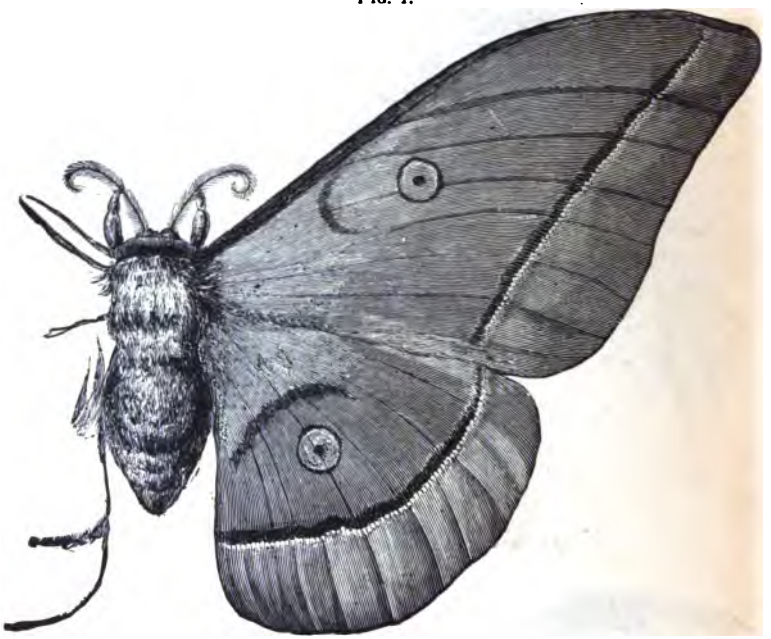
Antheræa Assama or Muga moth (Male).

FIG. 2.

Antheræa Assama or Muga moth (Female).

PLATE XXI.

FIG. 1.



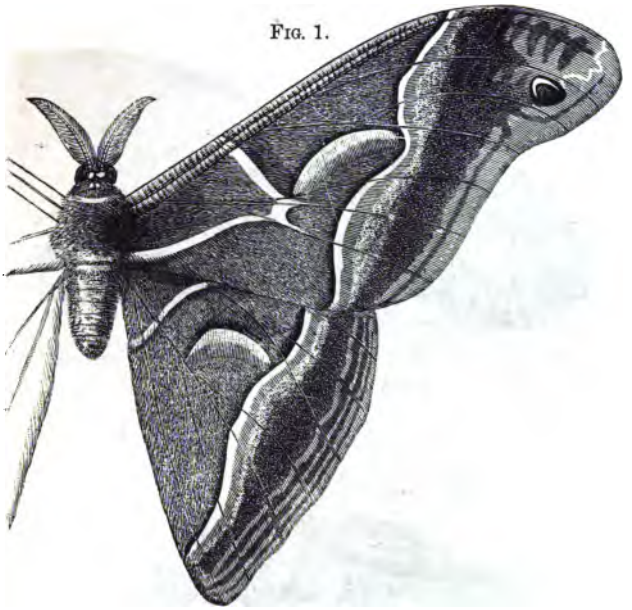
Antheræa Roylei (Female).

FIG. 2.

Antheræa Frithii (Male).

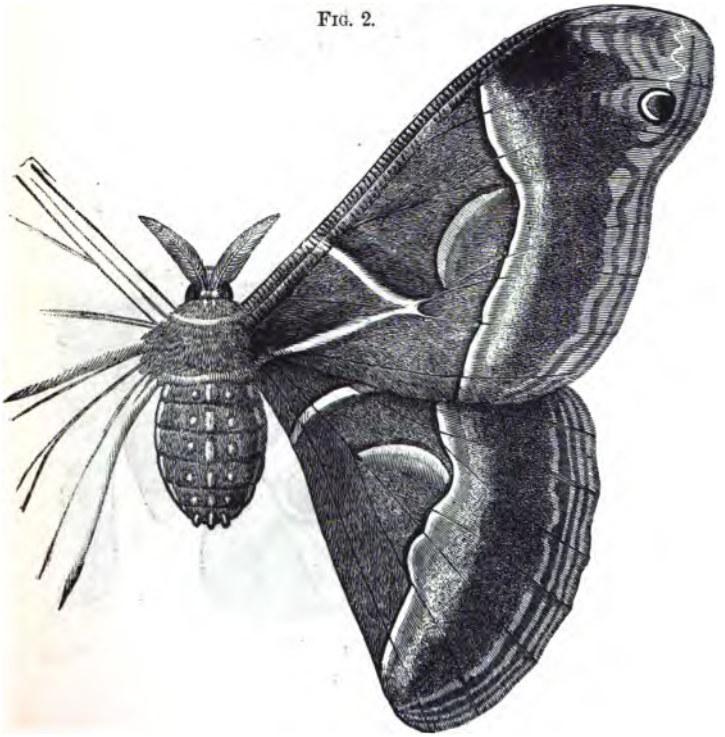
PLATE XXII.

FIG. 1.



Eri moth, Attacus ricini (Male).

FIG. 2.



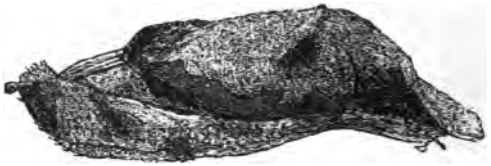
Eri moth, Attacus ricini (Female). For Eri cocoon see Plate XXXIII.

PLATE XXIII.

FIG. 1.

Larva of Attacus cynthia.

FIG. 2.



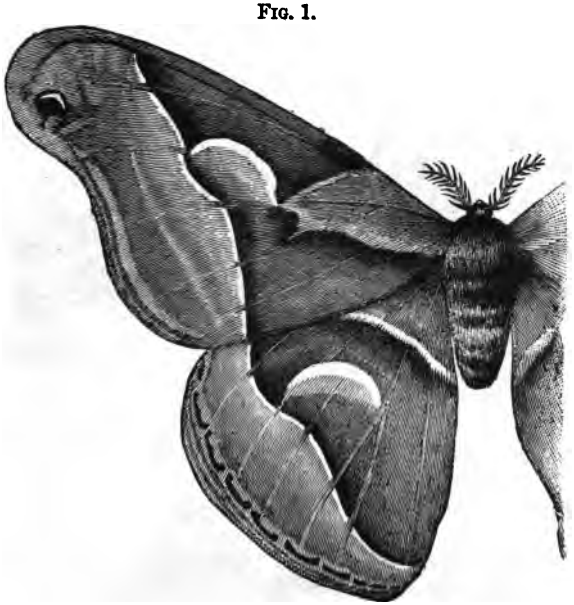
Cocoon of Attacus cynthia.

FIG. 3.

Neoris Huttoni.

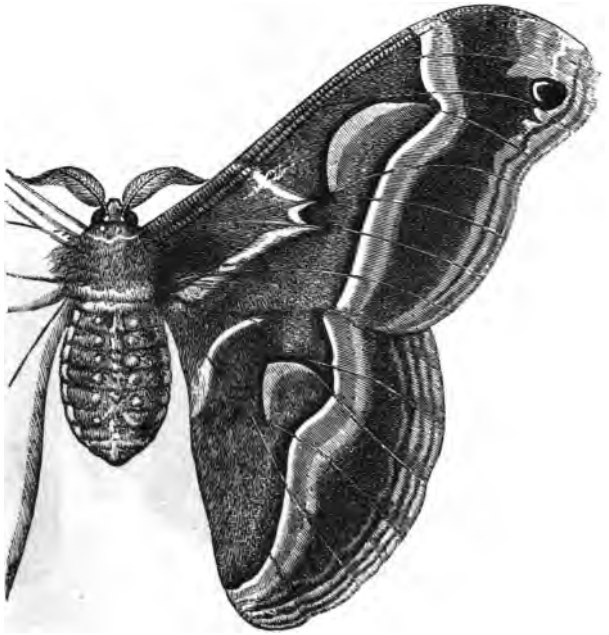
PLATE XXIV

FIG. 1.



Attacus cynthia (Male).

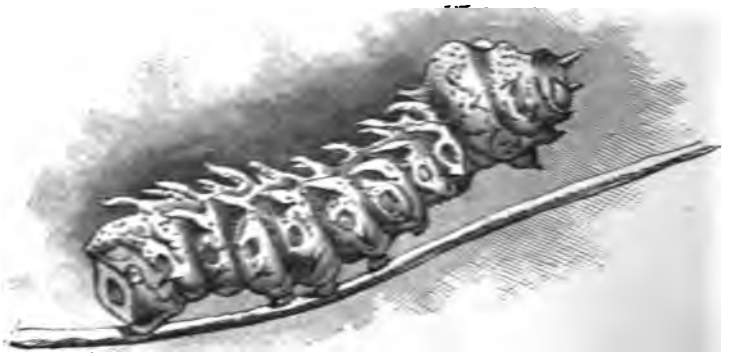
FIG. 2.



Attacus cynthia (Female).

PLATE XXV.

Fig. 1.

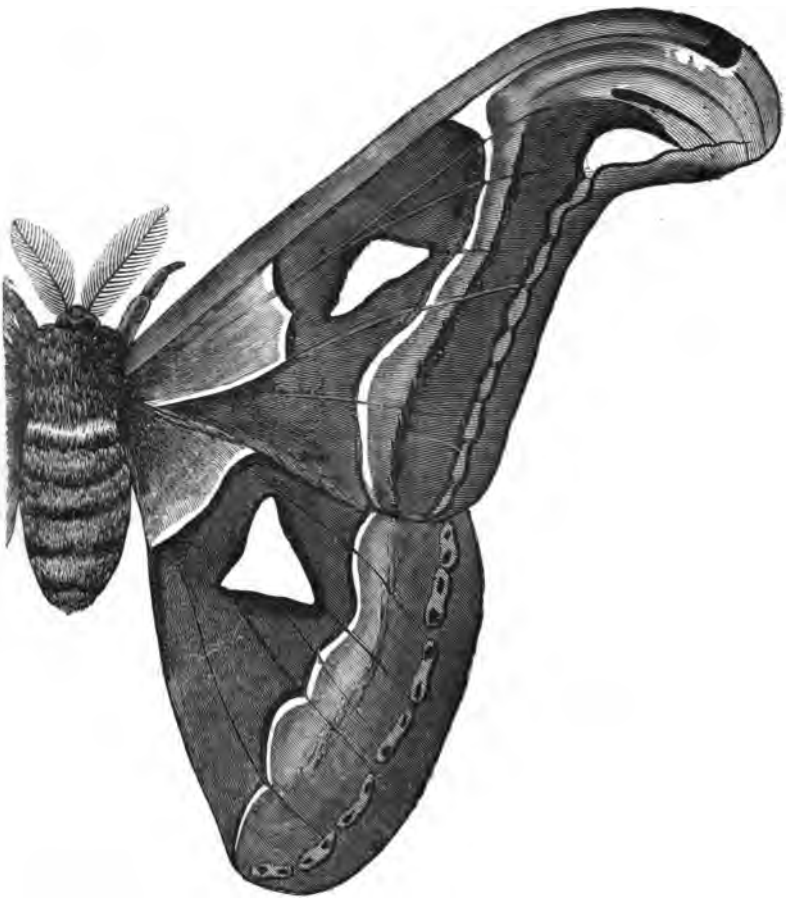


Larva of Attacus Atlas or Atlas silkworm.

Fig. 2.

Cocoon of Attacus Atlas.

PLATE XXVI.



Attacus Atlas (Male).

PLATE XXVII.

Attacus Atlas (Female).

PLATE XXVIII.

FIG. 1.

Cricula trifenestrata (Male).

FIG. 2.

Cricula trifenestrata (Female).

FIG. 3.

Larva of Cricula trifenestrata.

FIG. 4.

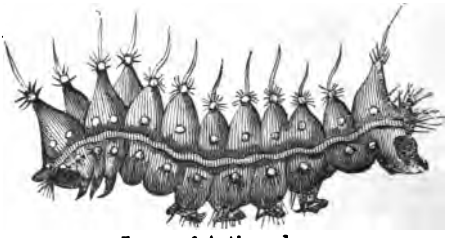
Cocoon of Cricula trifenestrata.

PLATE XXIX.

FIG. 1.

Actias selene (Male).

FIG. 2.

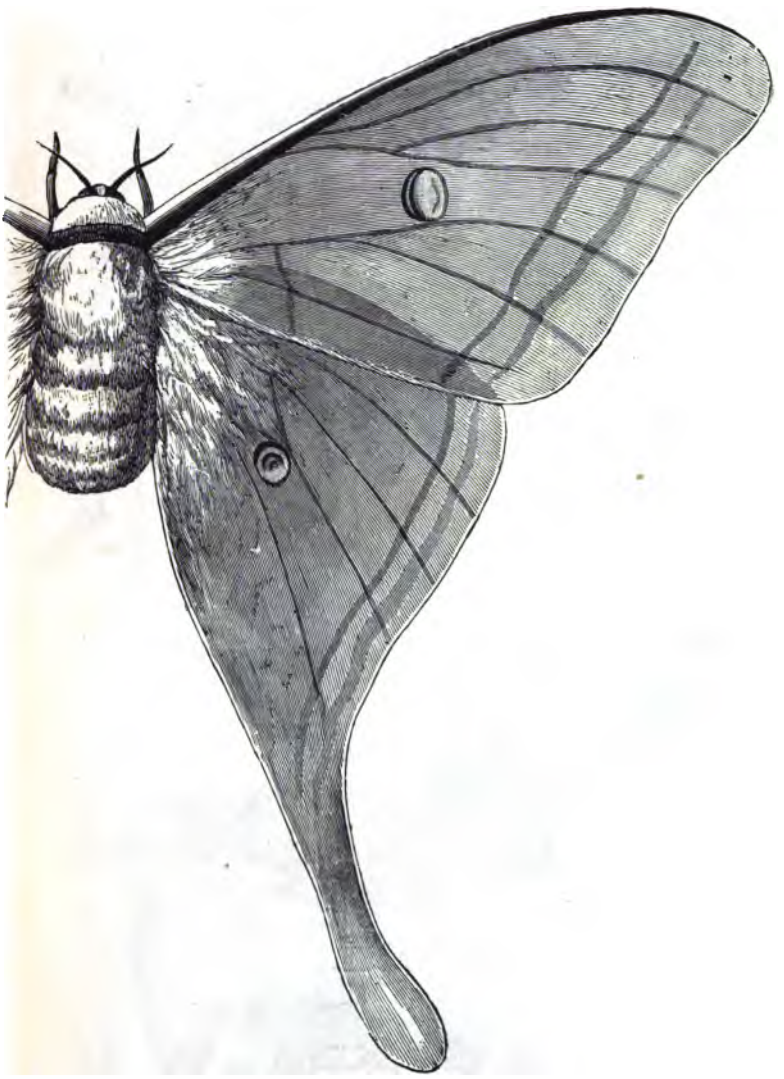


Larva of Actias selene.

FIG. 3.

Cocoon of Selene inside a leafy envelope.

PLATE XXX.



Actias selene (Female)

PLATE XXXI.

FIG. 1.

Antheræa Helferi (Male).

FIG. 2.

Caligula Simla (Female).

PLATE XXXII.

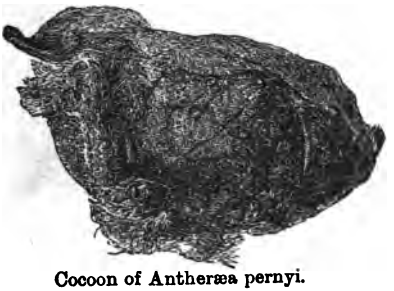
FIG. 1.

Antheræa pernyi (Male).

FIG. 2.

Antheræa pernyi (Female).

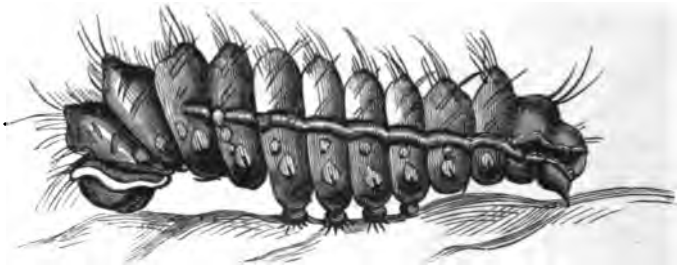
FIG. 3.



Cocoon of Antheræa pernyi.

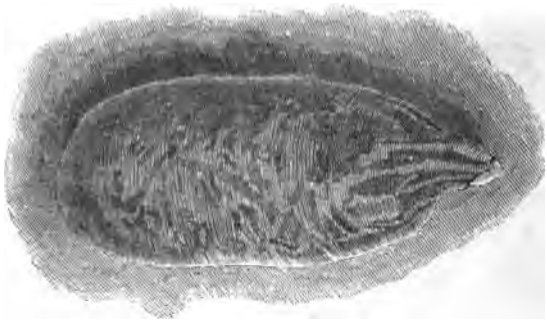
PLATE XXXIII.

FIG. 1.



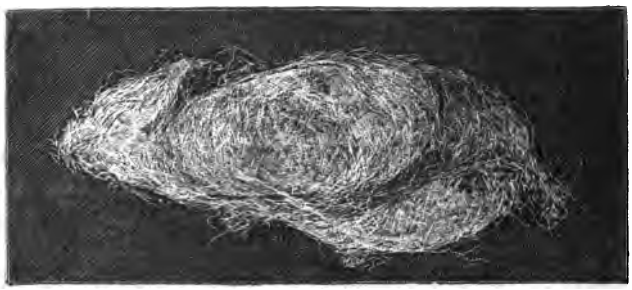
Larva of Antheræa yama-mai.

FIG. 2.



Cocoon of Antheræa yama-mai.

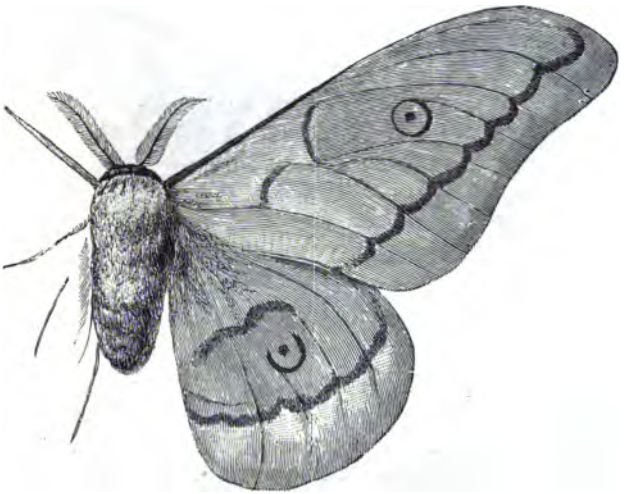
FIG. 3.



Cocoon of Attacus ricini.

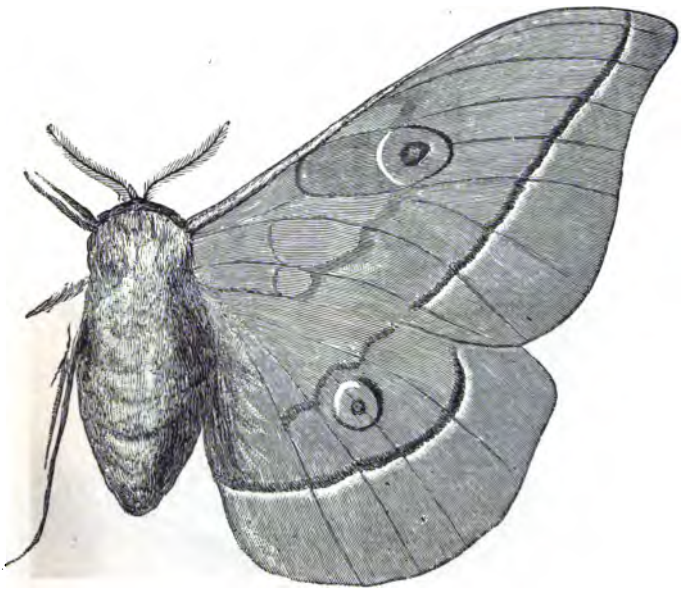
PLATE XXXIV.

FIG. 1.



Antheræa yama-mai (Male).

FIG. 2.



Antheræa yama-mai (Female).

PLATE XXXV.

FIG. 1

Saturnia carpini (Male).

FIG 2.

Saturnia carpini (Female).

FIG. 3.

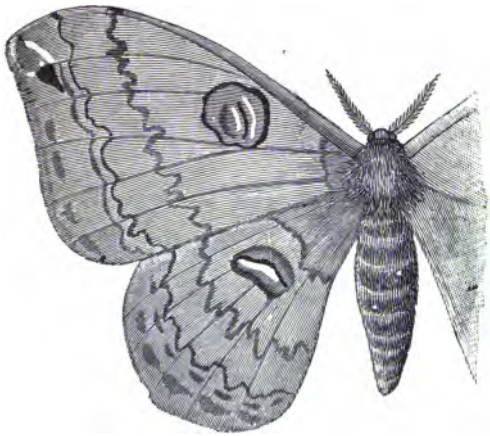
Saturnia Grotei (Female).

PLATE XXXVI.

FIG. 1.

Loepa katinka (Male).

FIG. 2.



Loepa katinka (Female).

FIG. 3.

Larva of Loepa katinka.

PLATE XXXVII.

FIG. 1.

Loepa miranda (Male).

FIG. 2.

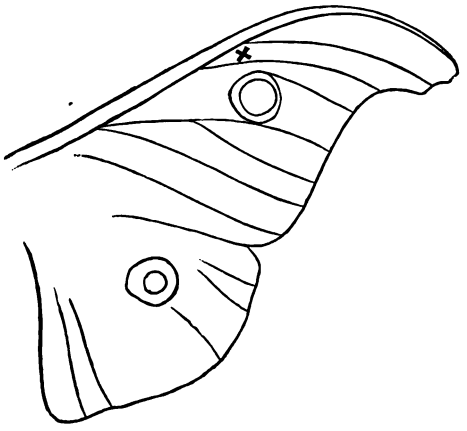


Diagram showing the point (x) on wing from which the scales have been taken for microscopic examinations. (*See* Plates lviii. to lxiii.)

PLATE XXXVIII.

Morus alba (the Mulberry-leaf), the food of the Bombyx mori silkworm ; the leaves of Morus indica form the food of Bombyx fortunatus, Bombyx cræsi, Bombyx textor, Bombyx meridionalis, Bombyx sinensis, &c.

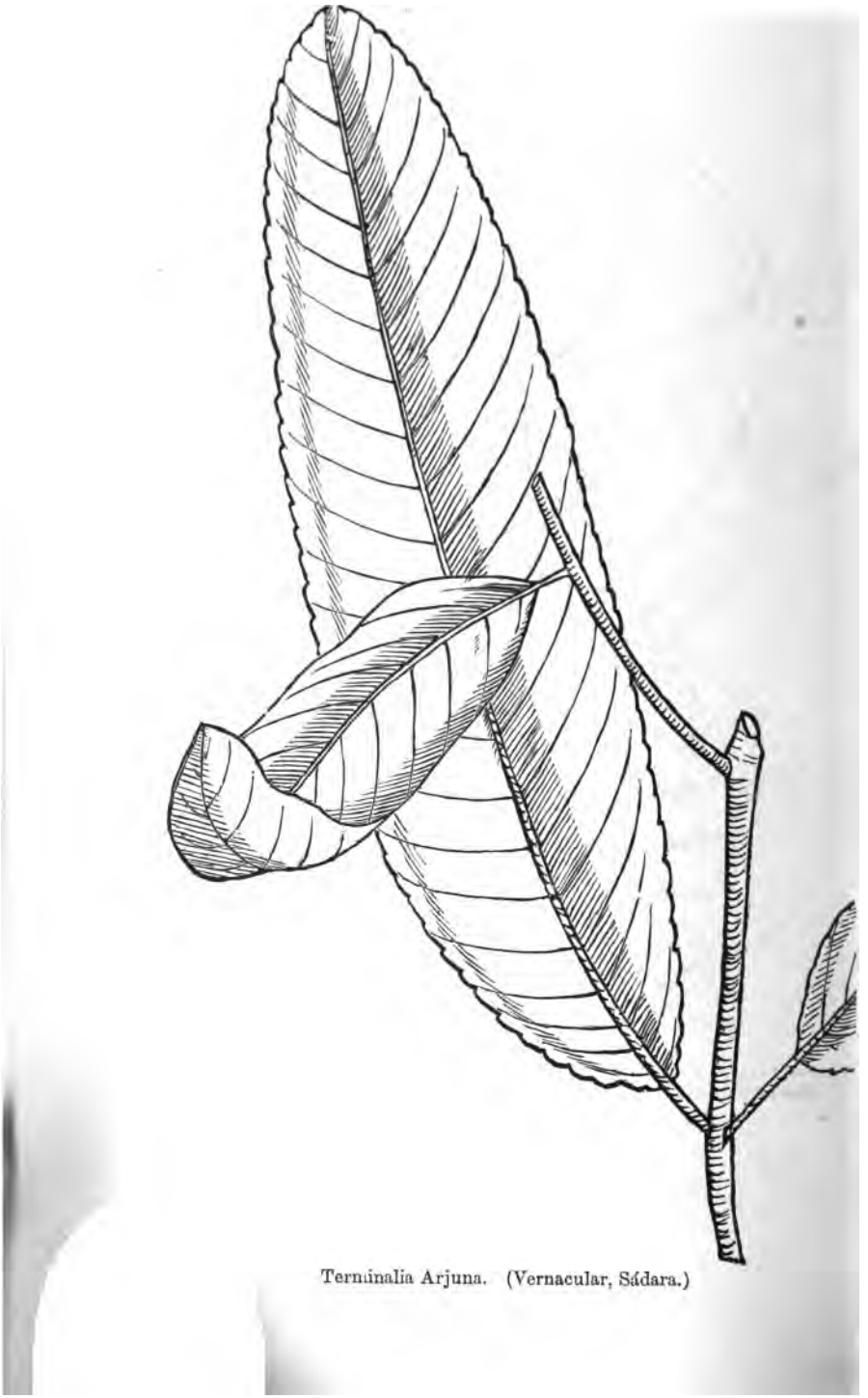
PLATE XXXIX.

entosa (*saj* tree), on the leaves of which the Tussur silkworm chiefly feeds.

PLATE XL.

Terminalia Catappa (Country Almond Tree).
Tussur silkworm will feed also on this tree and on those figured in the following 13 plates.

PLATE XLI.

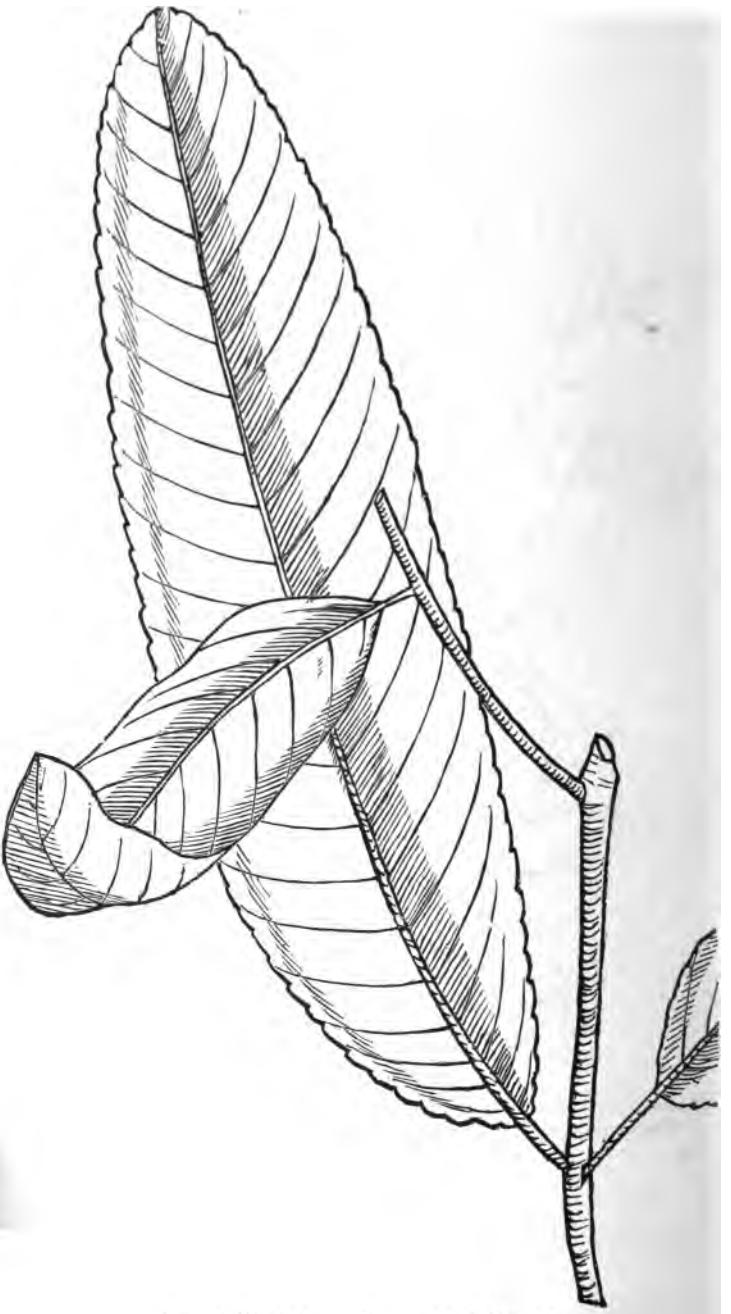


Terminalia Arjuna. (Vernacular, Sádara.)

PLATE XLII.

Shorea robusta (*sal* tree), on the leaves of which the Tussur silkworm feeds. The Santals select the worms which have fed on this tree for breeding.

PLATE XLI.

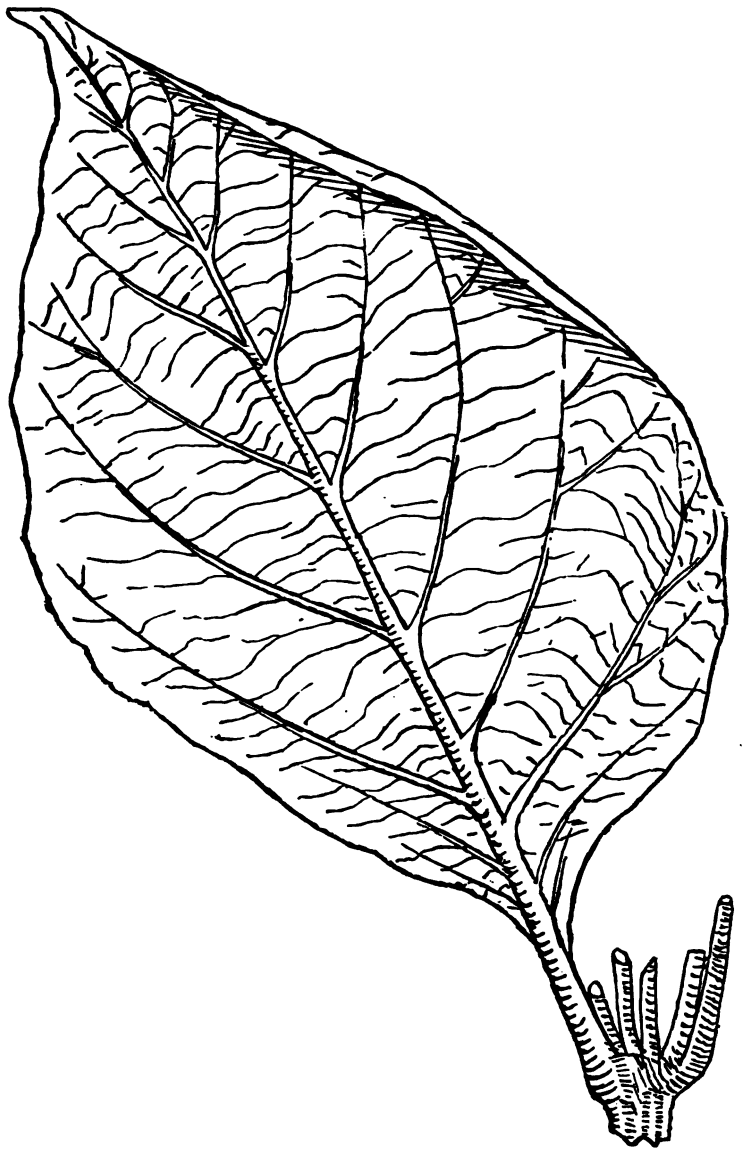


Terminalia Arjuna. (Vernacular, Sádara.)

PLATE XLII.

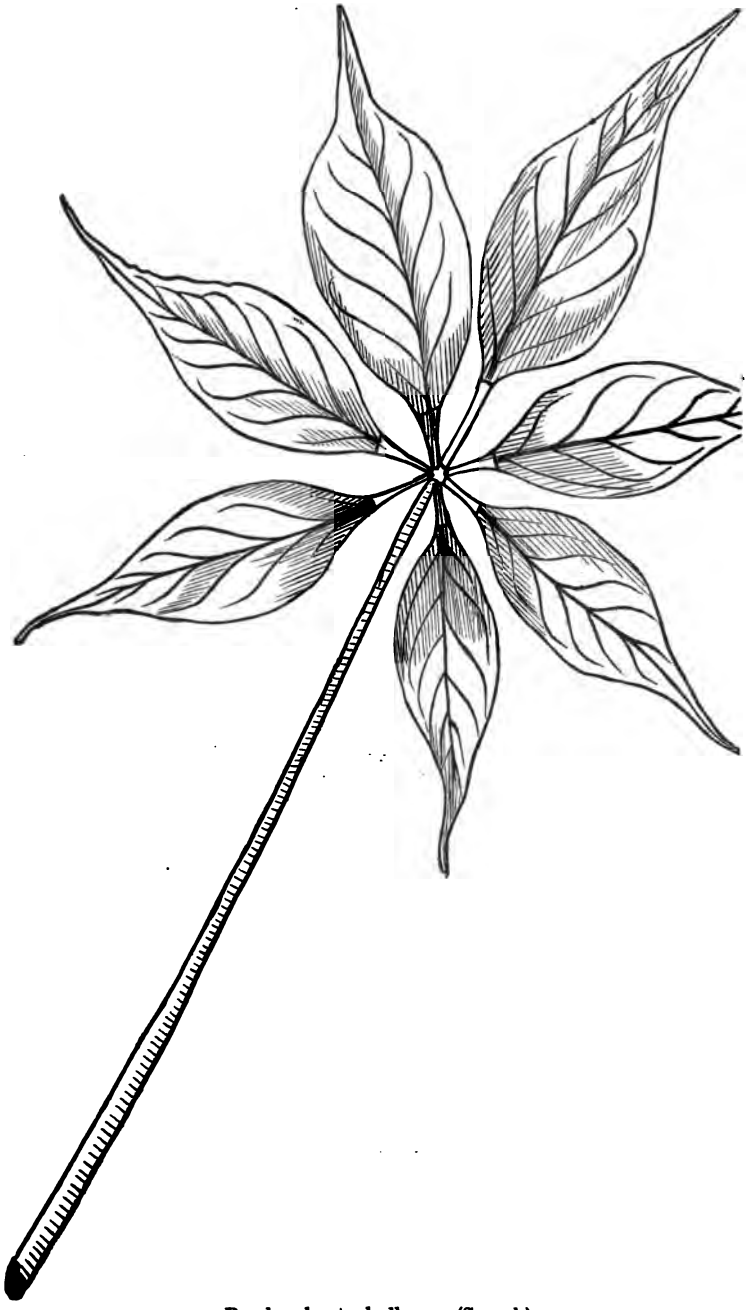
Shorea robusta 'sal tree', on the leaves of which the Tussur silkworm feeds.
The Santals collect the worms which have fed on this tree for weaving.

PLATE XLIII.



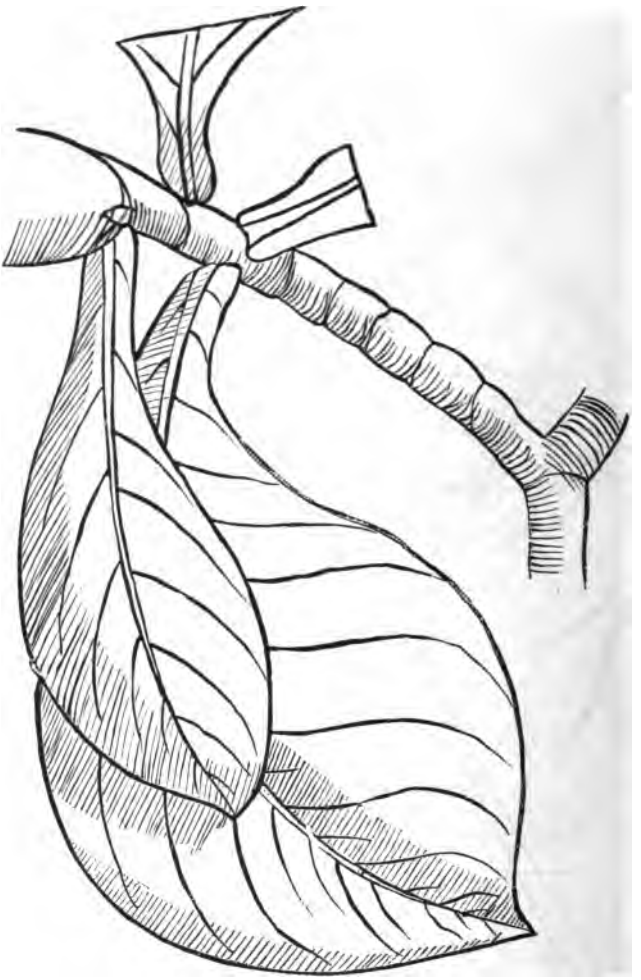
Tectona grandis (teak tree.)

PLATE XLIV.



Bombax heptaphyllum. (Semul.)

PLATE XLV.

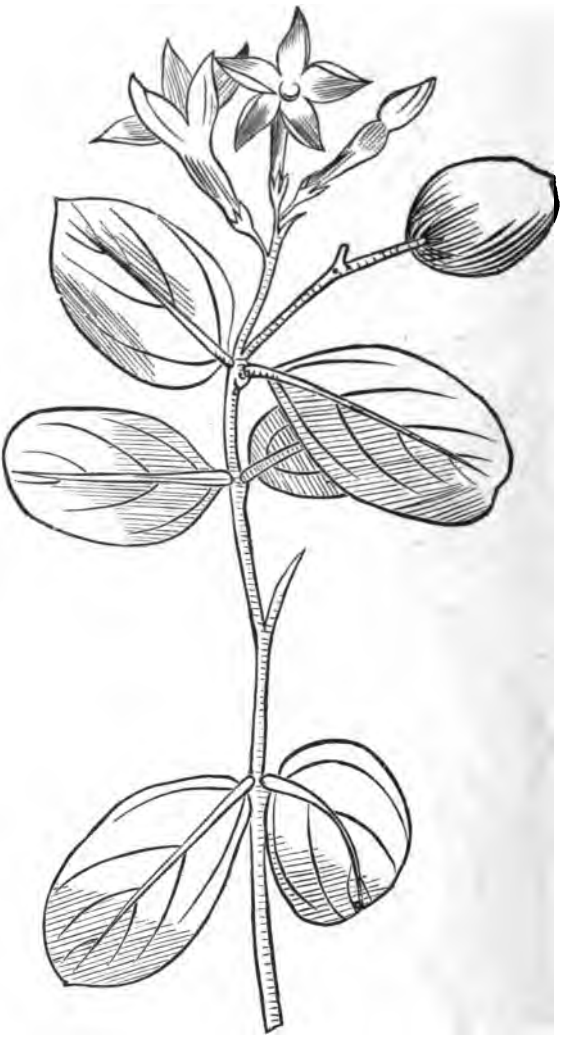


Careya sphærica.

PLATE XLVI.

Lagerstræmia Indica. Vernacular, Daiyeti.
Major Coussmaker used the leaves of this tree to feed the Tussur silkworm in his experiments at Poona.

PLATE XLVII.



Carissa Carandas. Vernacular, Karinda.

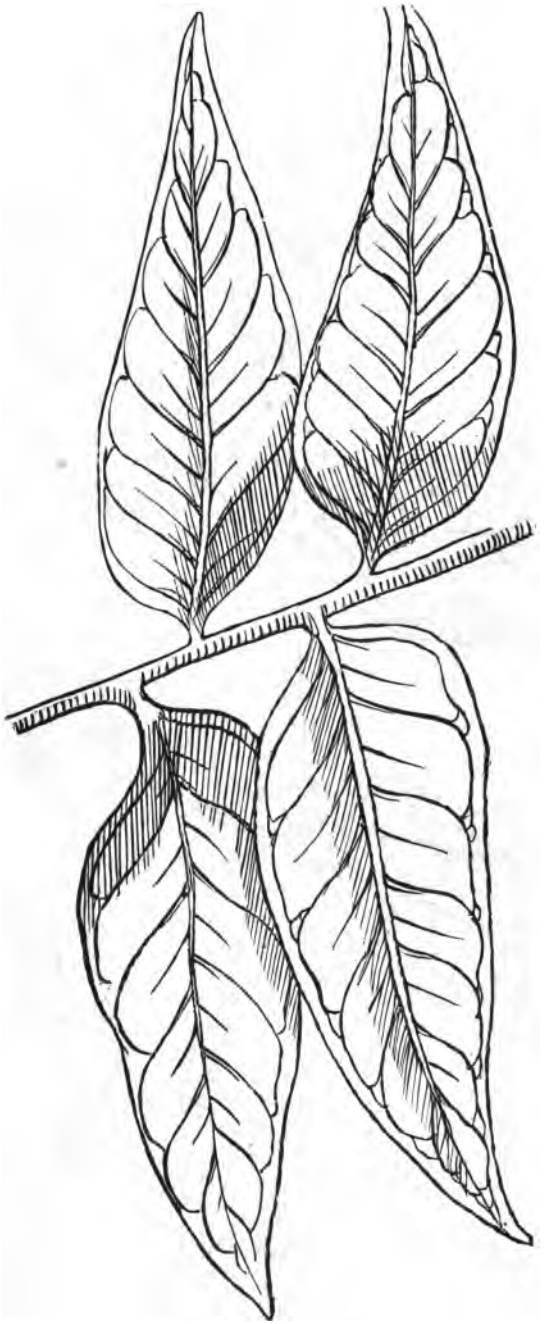
PLATE XLVIII.

Ficus Benjaminia. Vernacular, Nándruk.

PLATE XLIX.

Odina wodier.

PLATE I.

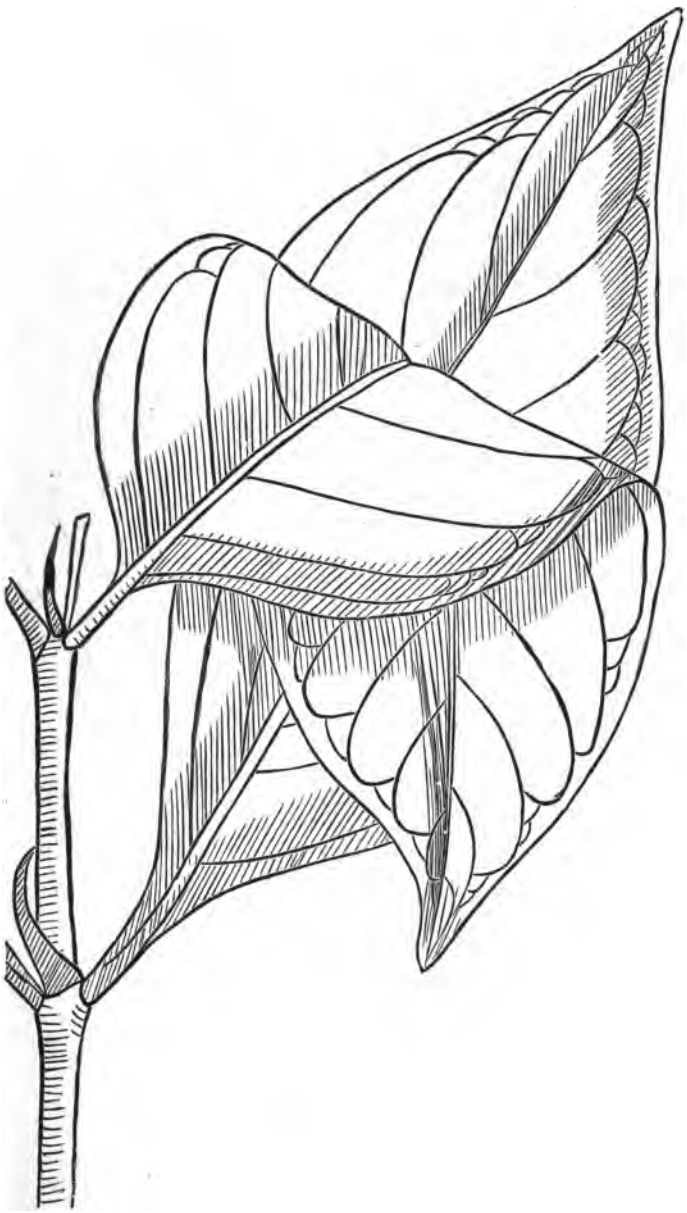


Cedrela Toona (*toon* tree).

PLATE LI.

Coriaria nipalensis.

PLATE LII.



Nauclea Cadamba.

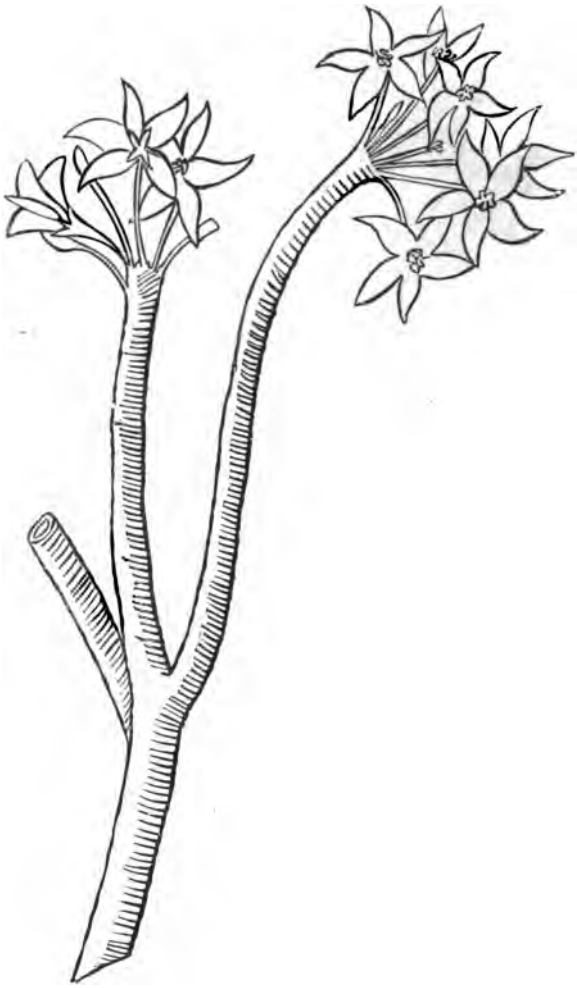
PLATE LIII.

Artimisia Indica.

PLATE LIV.

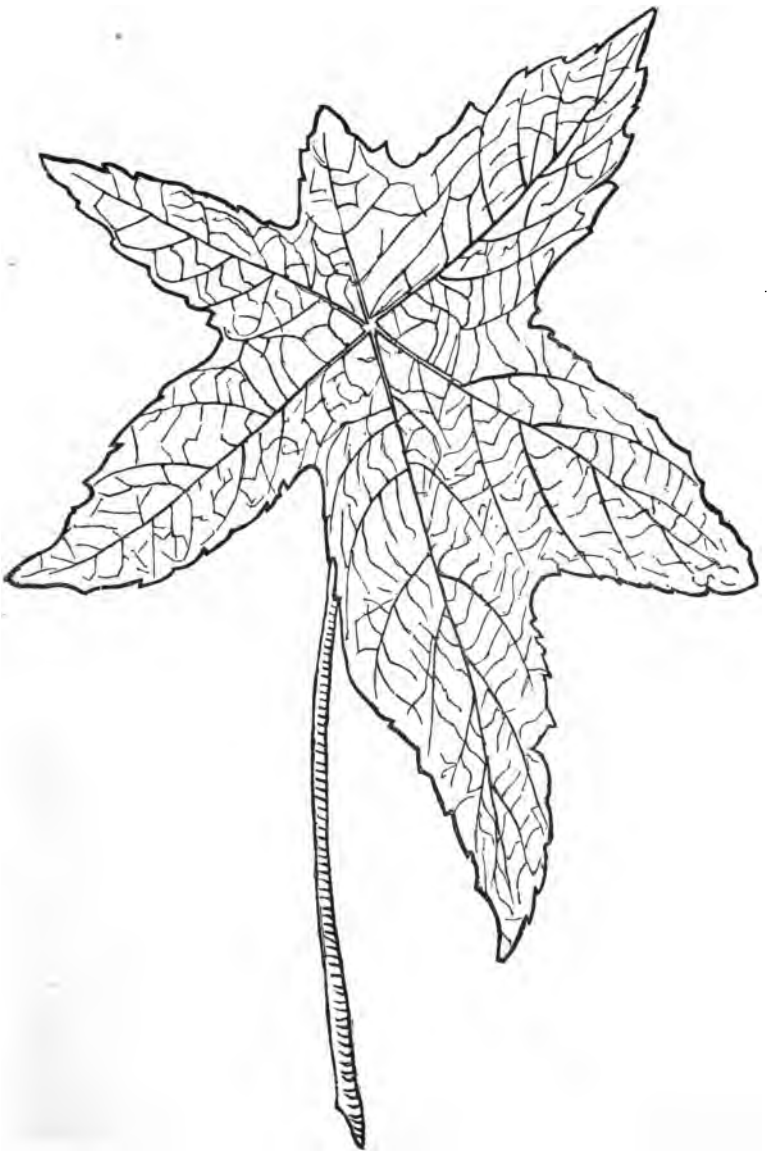
Machilus odoratissima (*soom* tree), on the leaves of which the Muga silkworm feeds.

PLATE LV.



Sarcostemma brevistigma (*soom* tree), on which the Muga silkworm also feeds.

PLATE LVI.

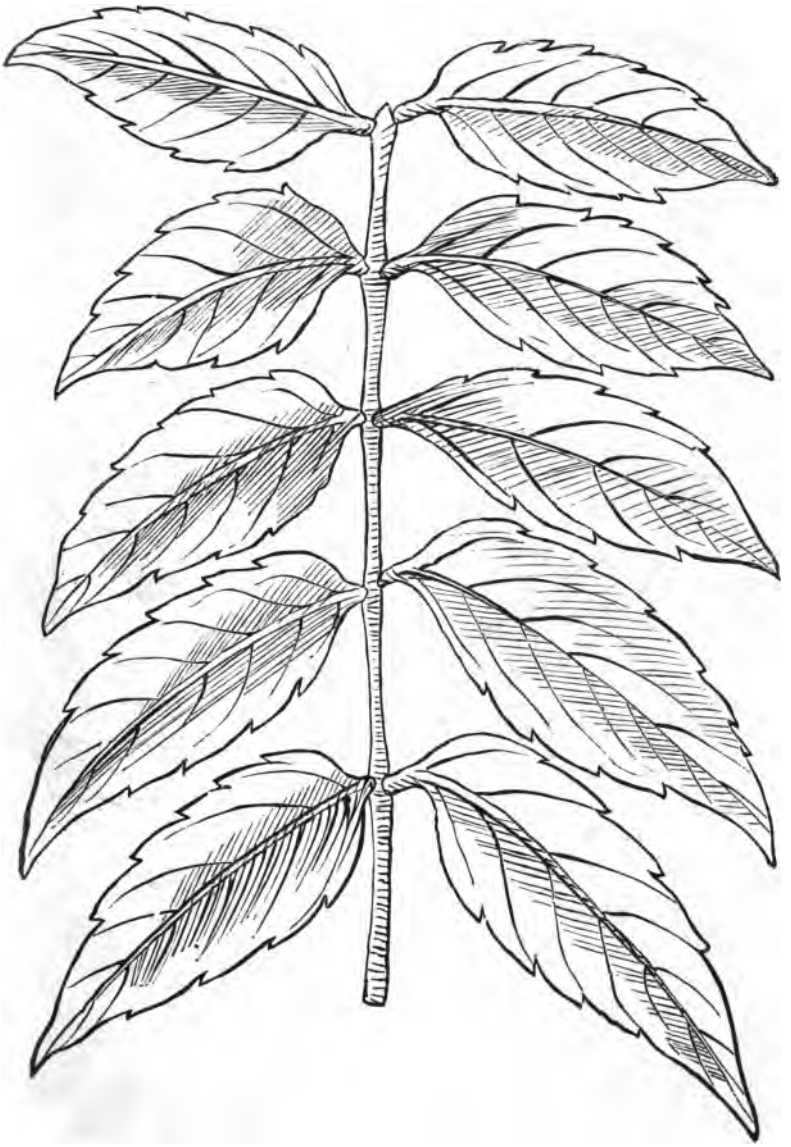


Ricinus communis (castor-oil plant), the food of the Eri worm (Attacus ricini).

PLATE LVII.

Ailanthus glandulosa, the food of the Ailanthus worm (Attacus cynthia).

PLATE LVIII.



Ailanthus excelsa, the food also of the Ailanthus worm (Attacus cynthia).

PLATE LIX.

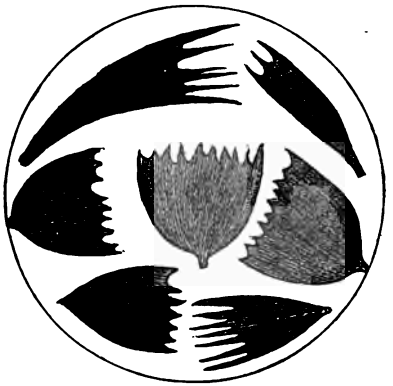
Fig. 1.

Bombyx mori (Male).

Fig. 2.

Antheræa mylitta (Male).

Fig. 3.



Antheræa mylitta (Female)

Fig. 4.

Attacus ricini (Male).

Fig. 5.

Attacus cynthia (Male).

Fig. 6.

Attacus Atlas (Male).

Scales from Wings magnified 140 diameters.

Microscopic appearances of the Wing Scales of various species of Moths

PLATE LX.

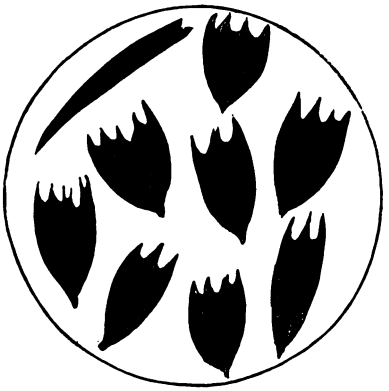
FIG. 1.

Attacus Atlas (Female).

FIG. 2.

Antheræa pernyi (Male).

FIG. 3.



Cricula trifenestrata (Male).

FIG. 4.

Actias selene (Male

FIG. 5.

Antheræa yama-mai (Male).

FIG. 6.

Antheræa yama-mai (Female).

Scales from Wings magnified 140 diameters.

Microscopic appearances of the Wing Scales of various species of Moths.

PLATE LXI.

FIG. 1.

Caligula Simla (Male).

FIG. 2.

Neoris Huttoni (Male).

FIG. 3.

Bombyx mori (Male).

FIG. 4.

Antheræa mylitta (Male).

Taken from different parts of Wing.

FIG. 5.

Antheræa yama-mai (Male).

FIG 6.

Actias selene (Male).

Taken from different parts of Wing.

Scales from Wings magnified 140 diameters.

c appearances of the Wing Scales of various species of Moths.

PLATE LXII.

FIG. 1.

Saturnia carpini (Male).

FIG. 2

Saturnia carpini (Female).

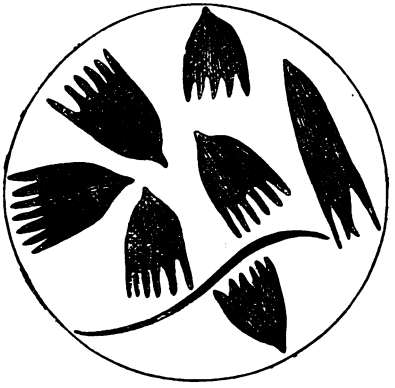
FIG. 3.

Antheræa Roylei (Male).

FIG. 4.

Antheræa Helferi (Male).

FIG. 5.



Loepa katinka (Male).

FIG. 6.

Loepa miranda (Male).

Scales from Wings magnified 140 diameters.

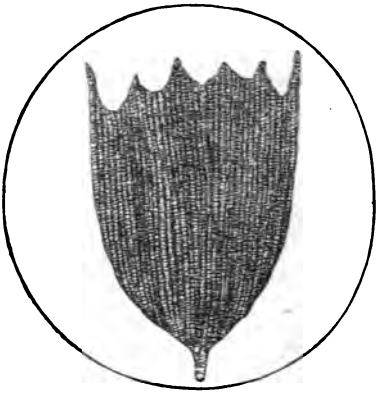
Microscopic appearances of the Wing Scales of various species of Moths.

PLATE LXIII.

FIG. 1.

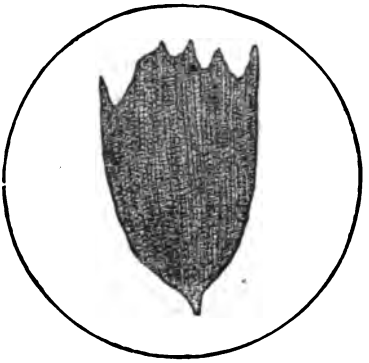
Bombyx mori (Male).

FIG. 2.



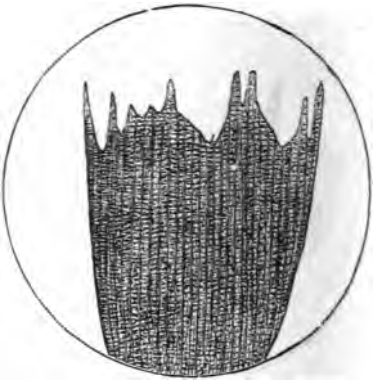
Antheræa mylitta (Male).

FIG. 3.



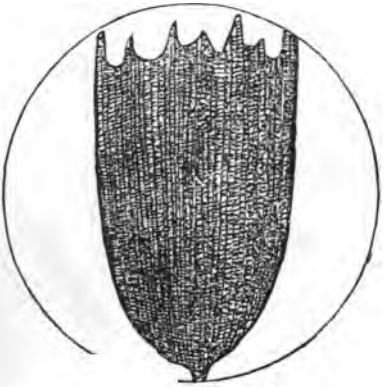
Antheræa pernyi (Male).

FIG. 4.



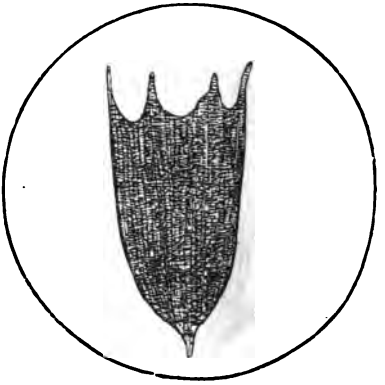
Antheræa Roylei (Male).

FIG. 5.



yama-mai.

FIG. 6.



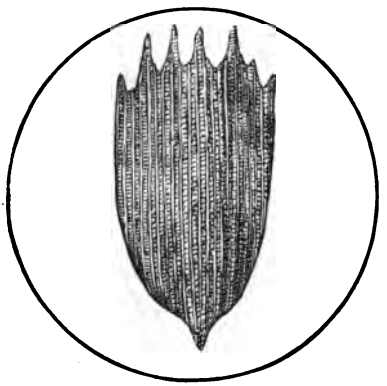
Attacus ricini (Male).

Scales from Wings magnified 500 diameters.

ppearances of the Wing Scales of various species of Moths.

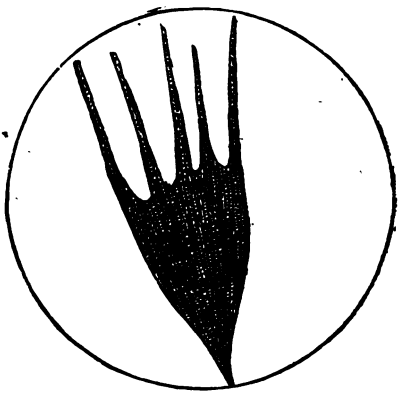
PLATE LXIV.

FIG. 1.



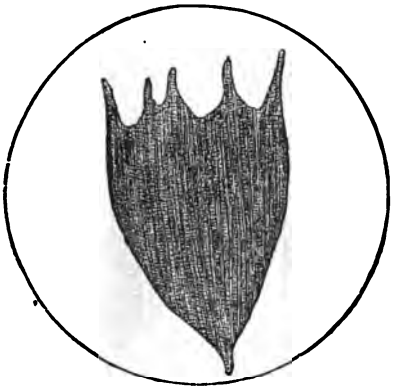
Attacus Atlas (Male).

FIG. 2.



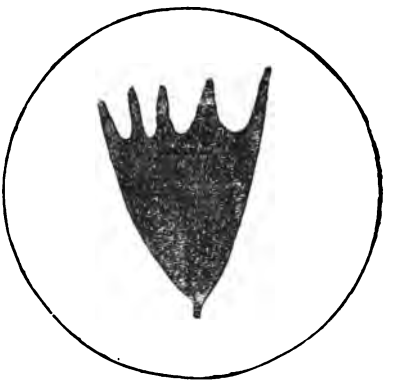
Actias selene (Male).

FIG. 3.



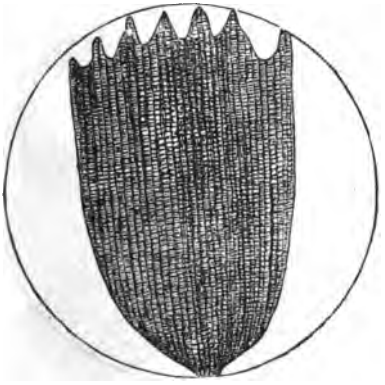
Cricula trifenestrata (Male).

FIG. 4.



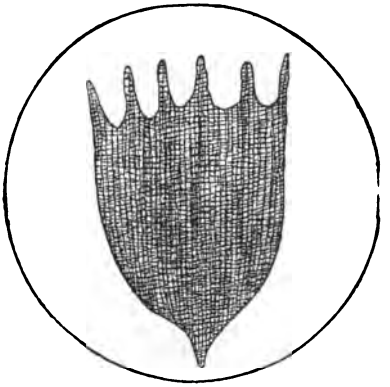
Saturnia carpini (Male).

FIG. 5.



Loepa miranda (Male).

FIG. 6.



Neoris Huttoni (Male).

Scales from Wings magnified 500 diameters.

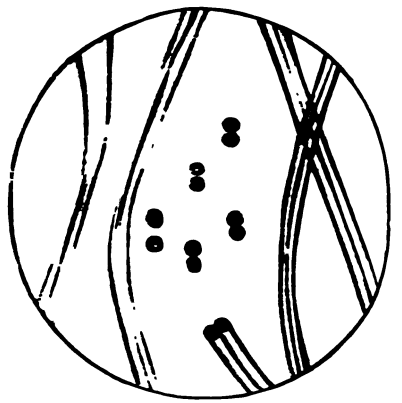
Microscopic appearances of the Wing Scales of various species of Moths.

PLATE LXV.

FIG. 1.

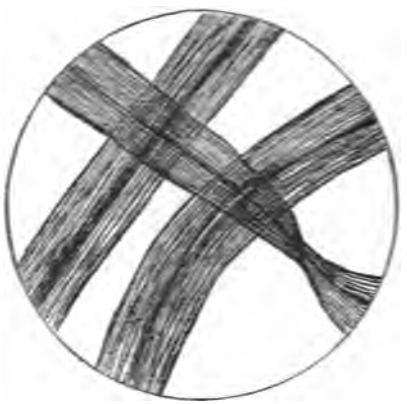
Silk of Bombyx mori, or silk of commerce.

FIG. 2.



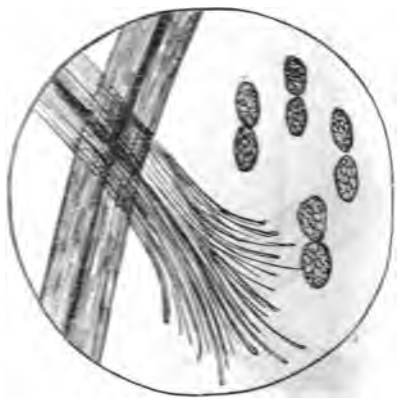
Silk of Bombyx mori, showing transverse sections.

FIG. 3.



Silk of Antheræa mylitta or Tussur silk.

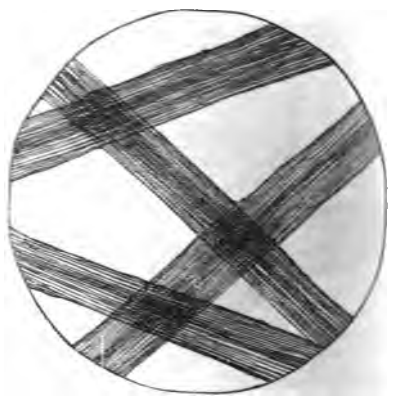
FIG. 4.



Silk of Antheræa mylitta or Tussur silk, showing fibrets and transverse sections.

FIG. 5.

FIG. 6.



Silk of Antheræa pernyi.

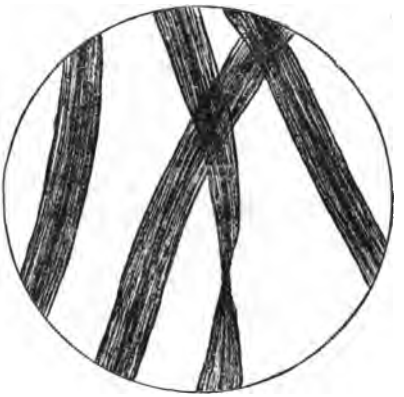
M[illegible] na or Muga silk.
various species of silk fibres in pairs as seriposited by the worms.
ir is bave, and for the single fibre brin. Magnified 500 diameters.

PLATE LXVI.

FIG. 1.

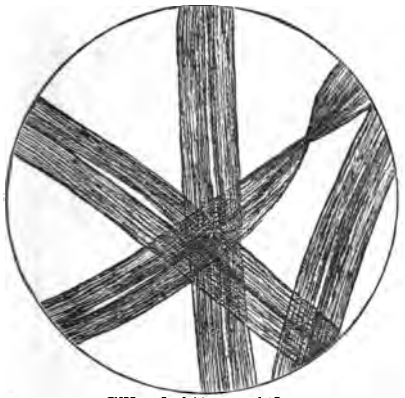
Silk of Actias selene.

FIG. 2.



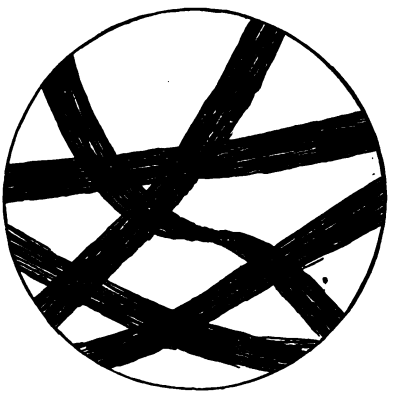
Silk of Attacus ricini or Eria silk.

FIG. 3.



Silk of Attacus Atlas.

FIG. 4.

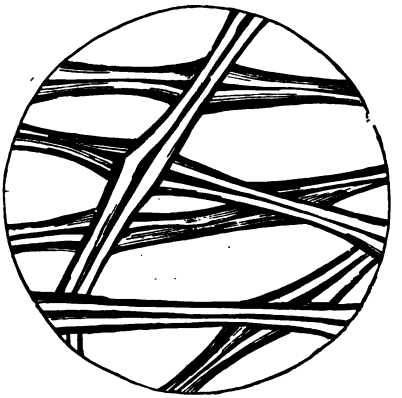


Silk of Cricula trifenestrata.

FIG. 5.

Silk of Antheræa yama-mai.

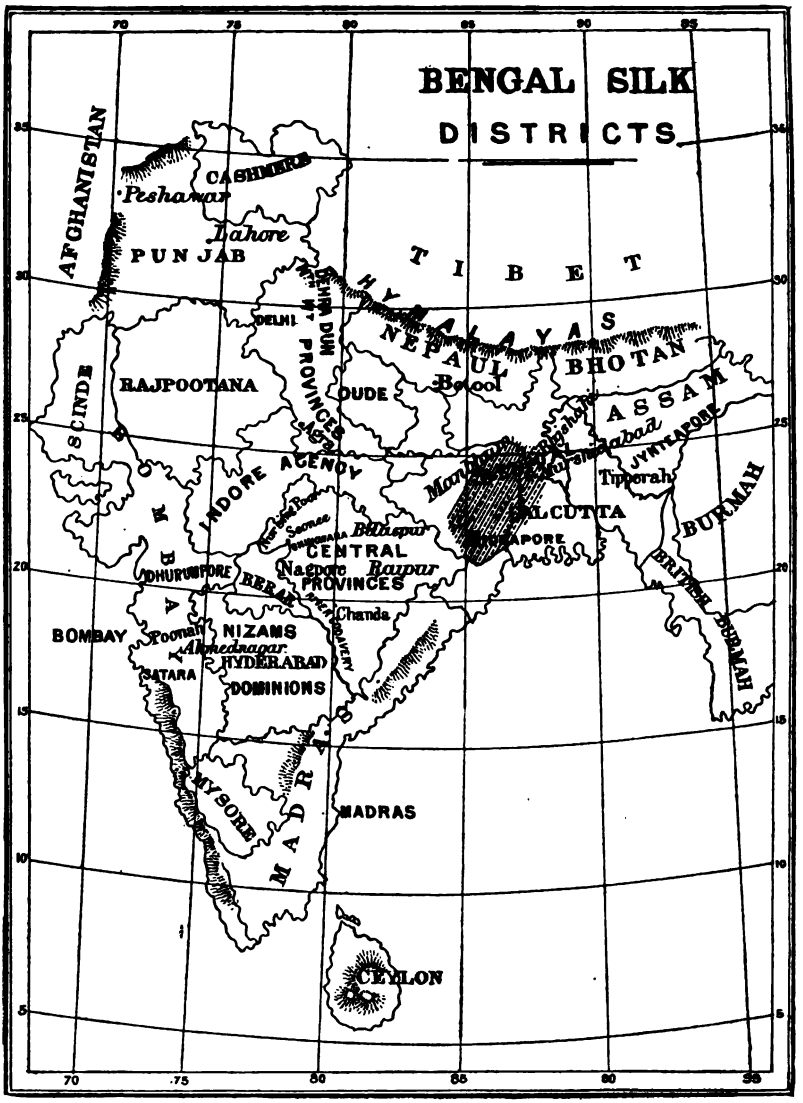
FIG. 6.



Silk of Saturnia carpini.

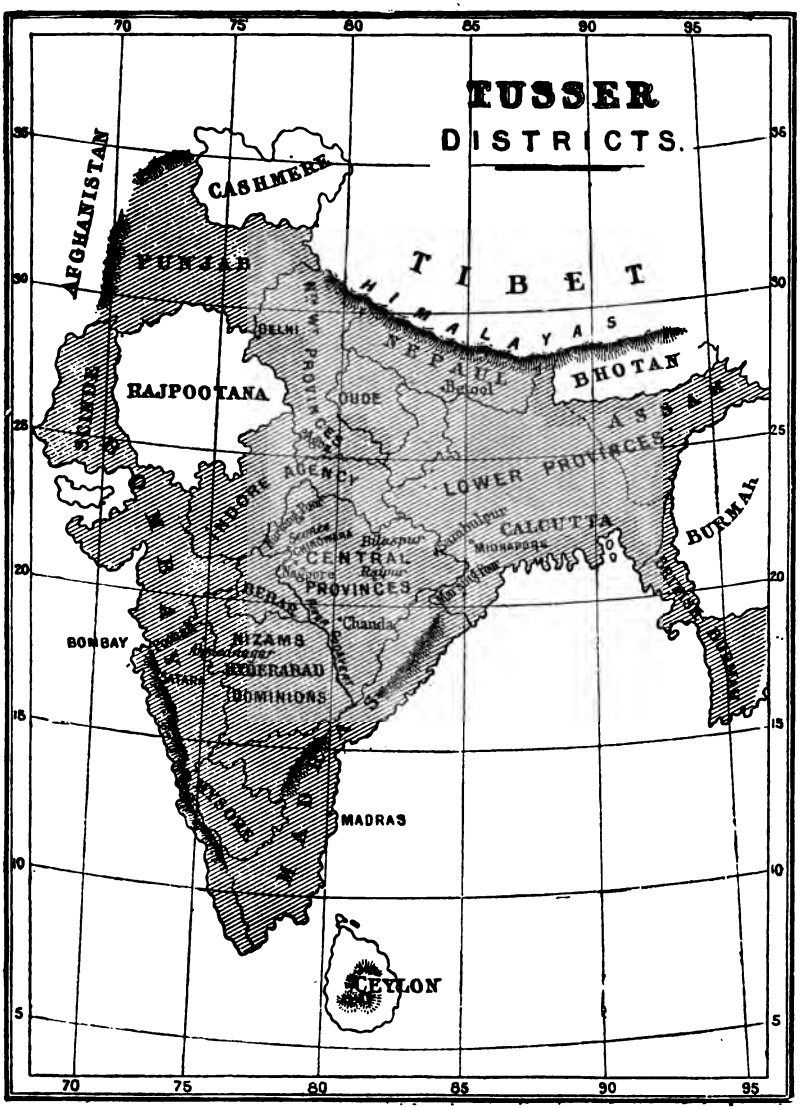
Microscopic appearances of various species of silk fibres in pairs as seriposited by the worms.
In France the pair of fibres is termed bave, and for the single fibre brin.
Magnified 500 diameters.

PLATE LXVII.



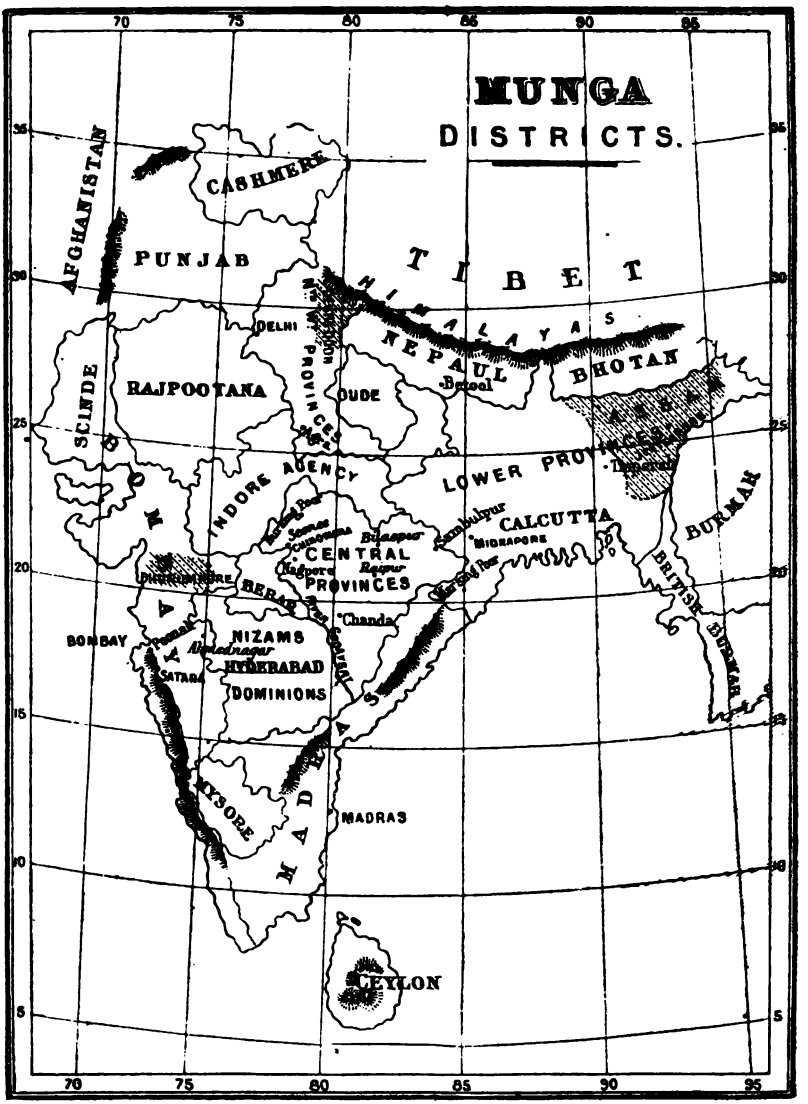
The shaded part of Bengal shows the Bengal silk (Bombyx fortunatus and cræsi) districts.

PLATE LXVIII.



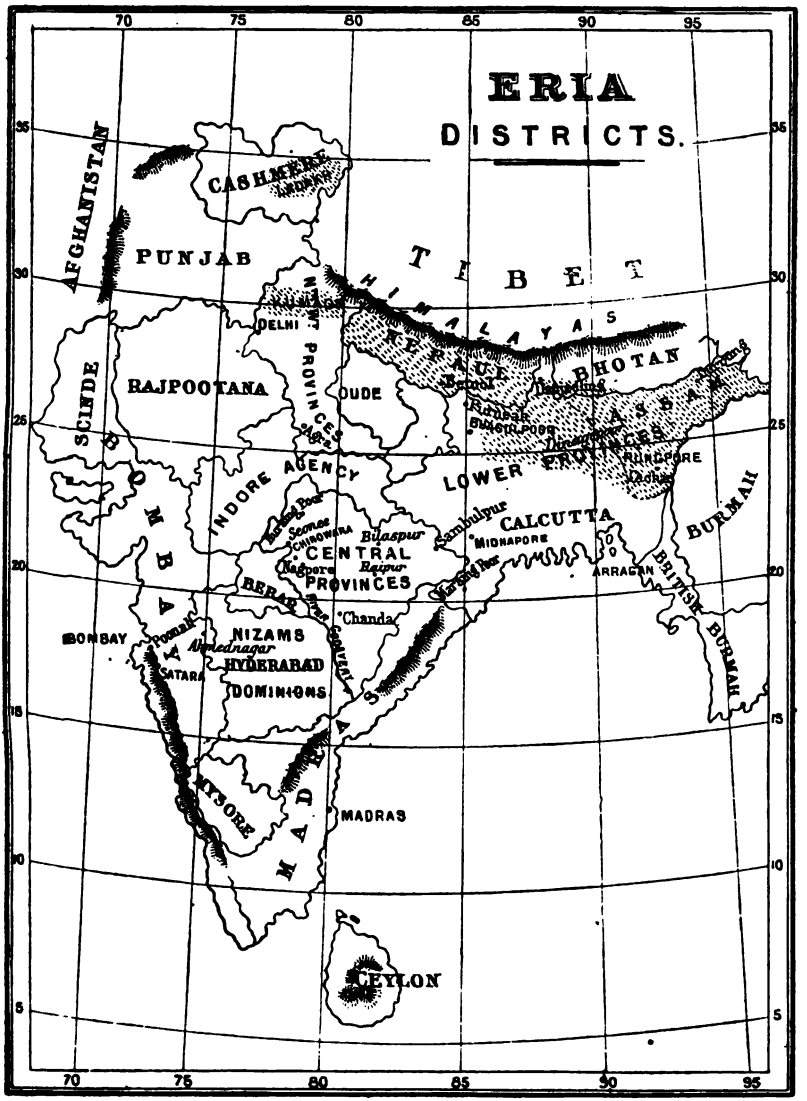
The shaded parts show the districts in which the Tussur moth has been found. It is no doubt also present in Rajpootana.

PLATE LXIX.



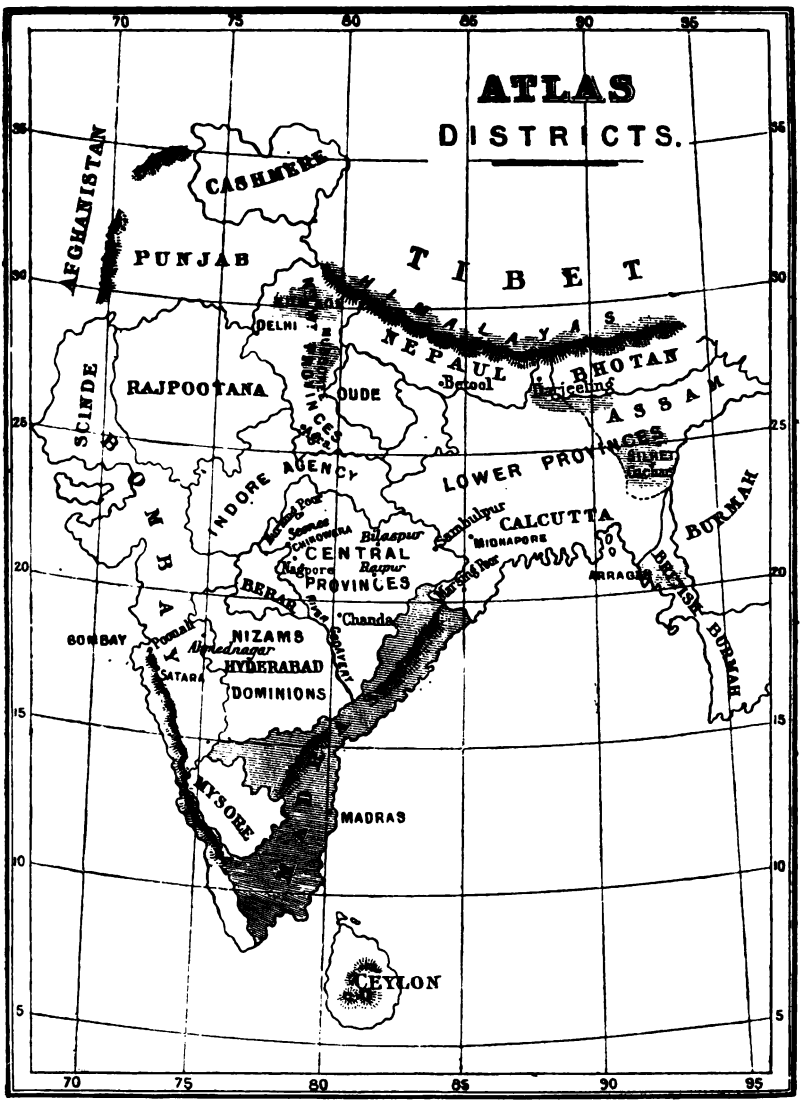
The shaded parts show the districts in which the Munga or Muga moth *(Antheræa assama*—now called *Antheræaopsis assama)* has been found.

PLATE LXX.

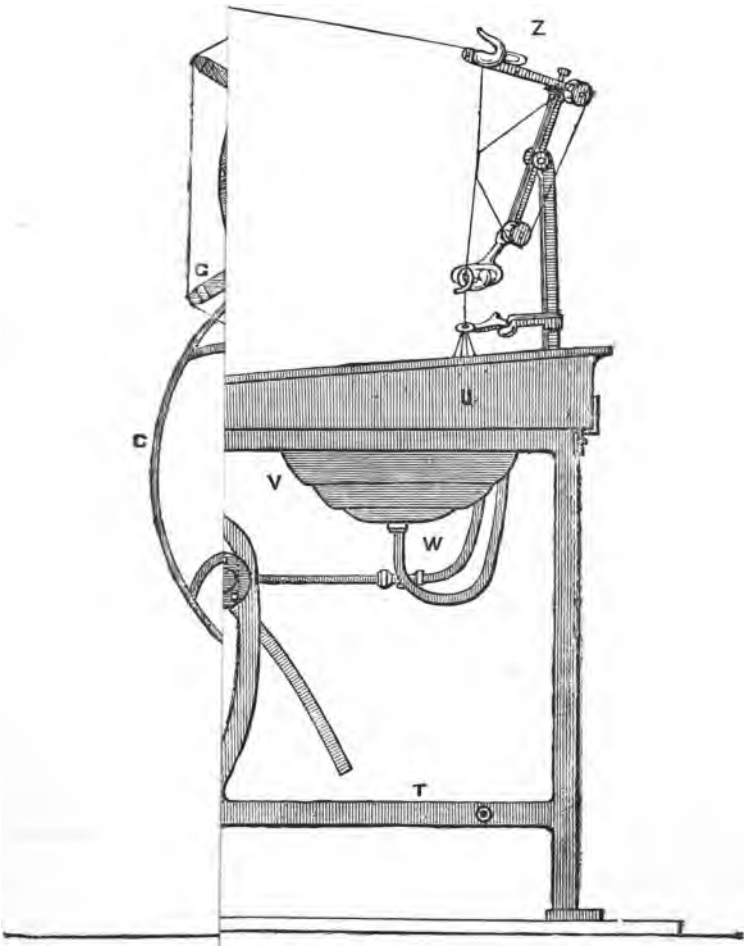


The shaded parts show the districts in which the Eria moth *(Attacus ricini*—now called *Philosamia ricini)* has been found.

PLATE LXXI.

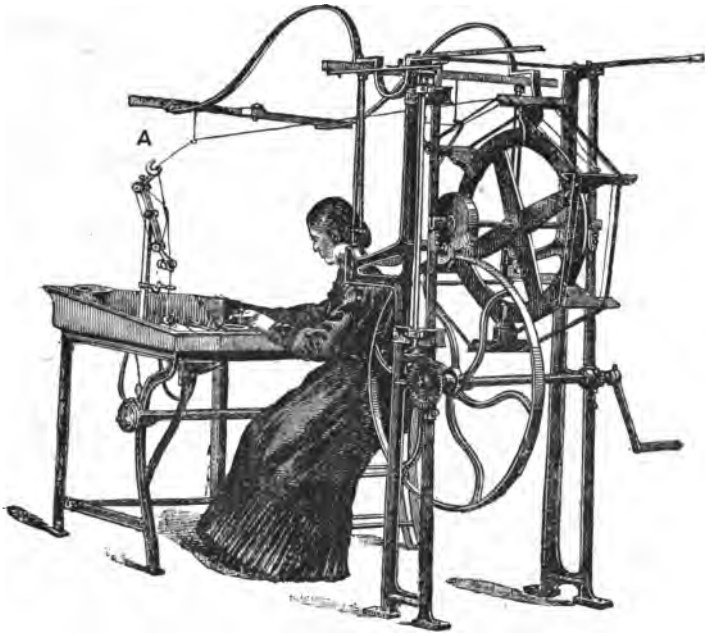


The shaded parts show the districts in which the Atlas moth *(Attacus Atlas)* has been found. It is found also in Ceylon and the Straits Settlements in abundance. No doubt also it exists in other parts of India than those indicated on the map.



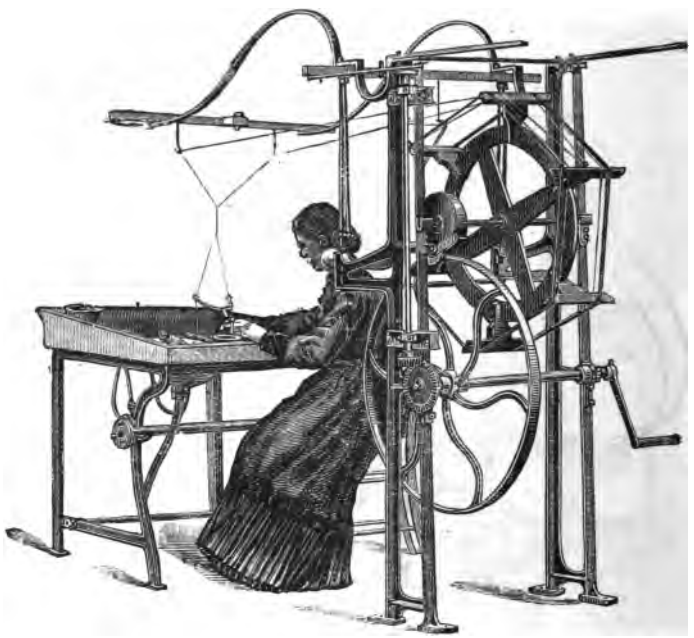
inch to the foot.

PLATE LXXIII.



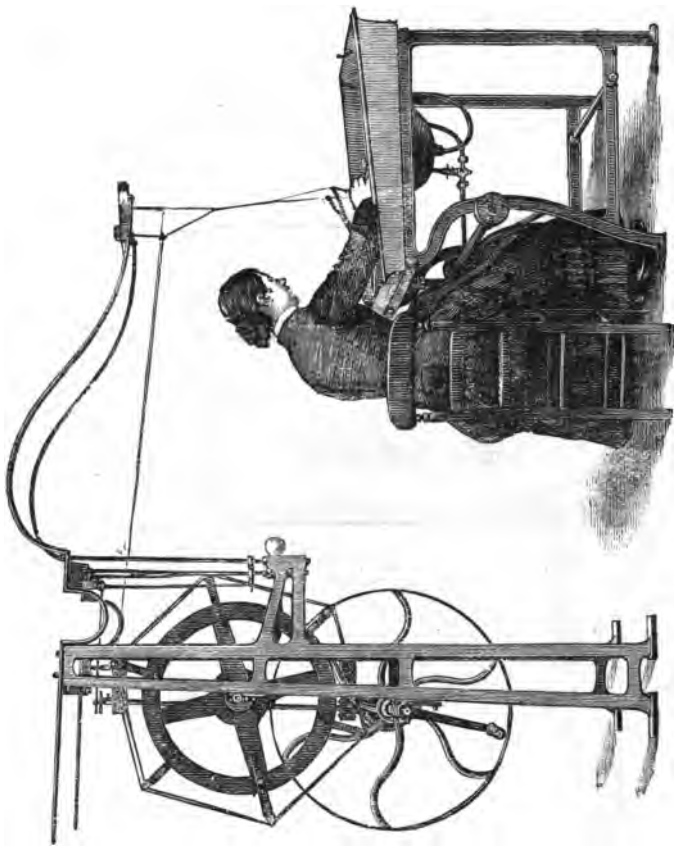
European Cocoon-reeling machine, diagonal view, showing **A**, Tavelette-Keller, sometimes, but erroneously, called Consono.

PLATE LXXIV.



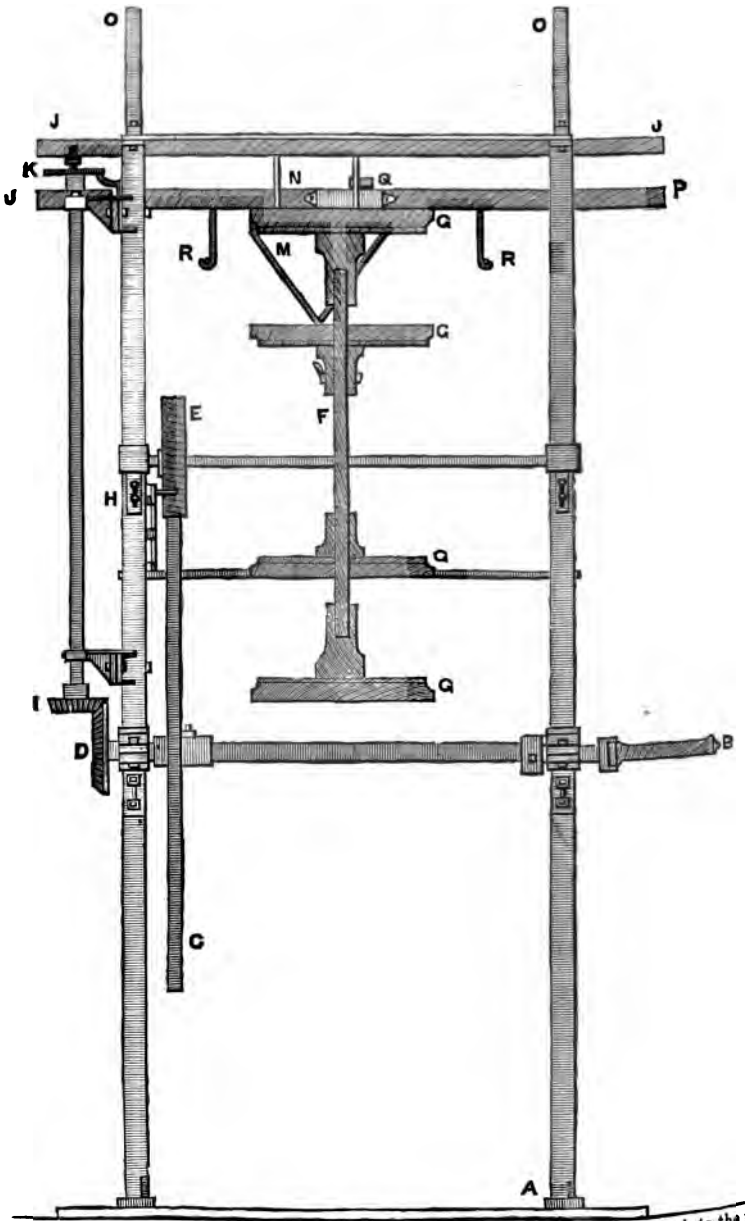
European Cocoon-reeling machine, diagonal view, System Chambon (French).

PLATE LXXV.



European Cocoon-reeling machine, side view, System Chambon (French).

PLATE LXXVI.



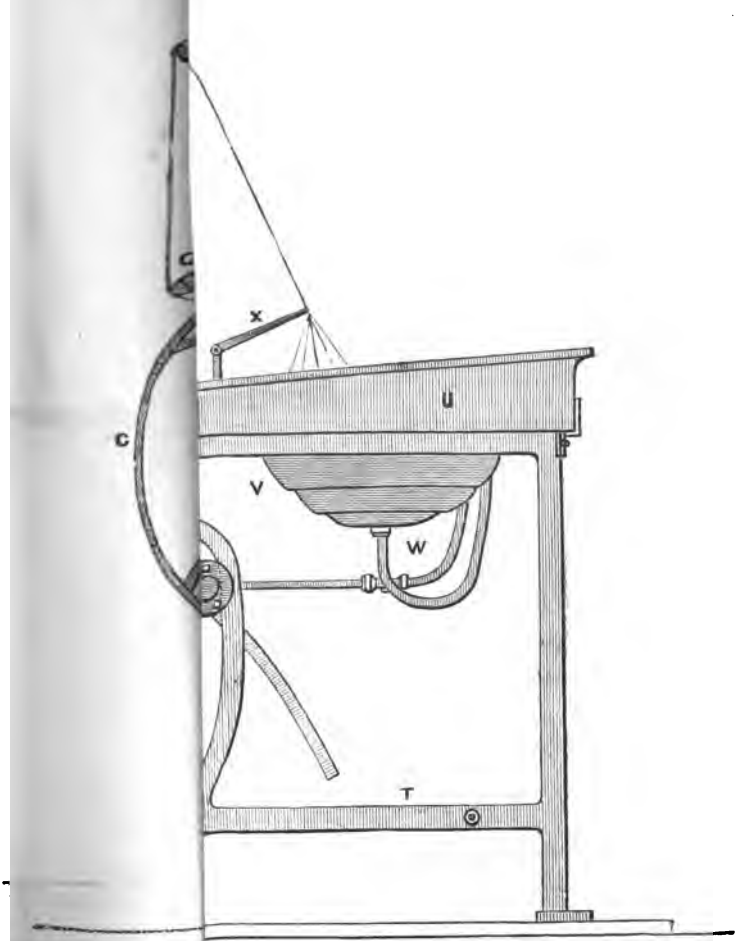
European Cocoon-reeling machine ; mechanical drawing, end view, scale 1 inch to the foot.

SYSTEM CHAMBON. FRENCH.

A Light iron frame.
to turn the reel.
driving wheel.
heel to turn guider motion.
increasing speed of reel.

on which the silk is reeled.

I Bench cog wheel, giving vertical motion from D
JKL Guider bar and motion.
M Glass triangle guider to guide the silk from R to G
N Bar with agate guider.
O Iron straps to fix the machine to beam or ceiling.
P Guider motion-bar of wood.
Q Spring instrument with hooks to cause croisseur
R Iron hook, with agate guider discs.



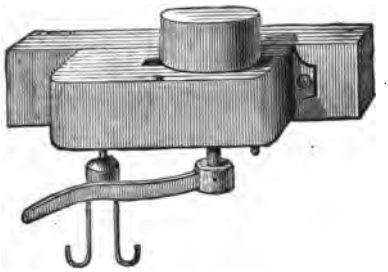
hambon (French).

PLATE LXXVIII.

FIG. 1.

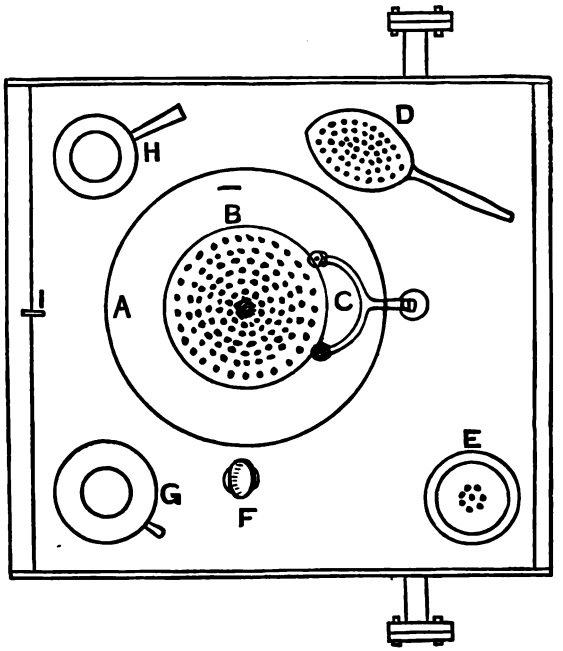
Champignon ; scale ½ natural size, to connect drain pipe to bottom of bassine.

FIG. 2.



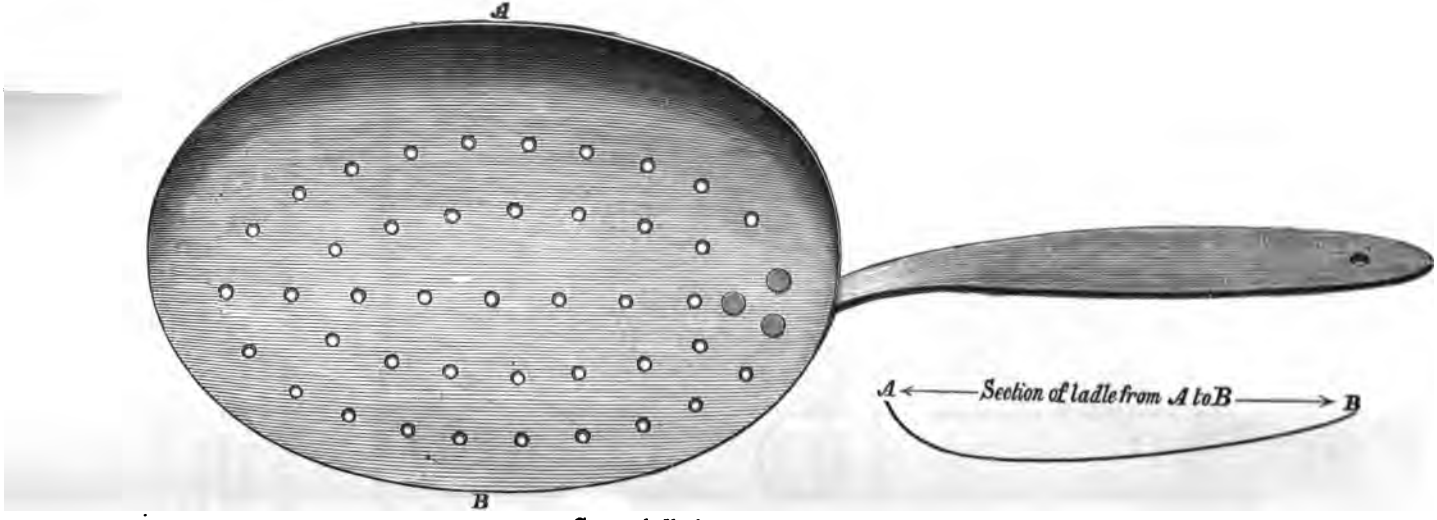
Instrument for causing croisseur, scale ½ natural size ; not now used, twisting-in the croisseur by hand preferred.

FIG. 3.



Tray and utensils of cocoon reeling frame ; mechanical drawing, scale 1 inch to the foot.

A Basin for water and cocoons.
B Perforated dish used when water is heated by steam.
C Double filiére.
D Cocoon ladle. (See also Plate LXXIX.)
E Sunk pot for holding refuse cocoons.
F Knob to turn on steam.
G Brass vessel.
H Brass vessel for cold water.



Cocoon ladle for basin ; scale ½ of the real size.

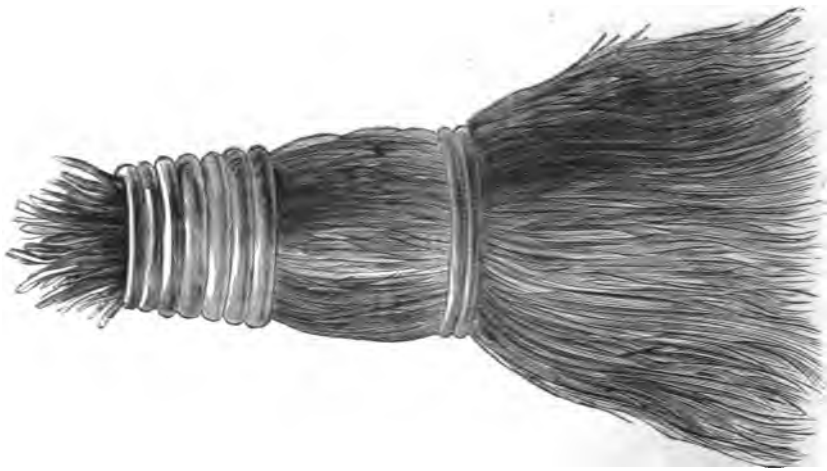
COCOON REELING.

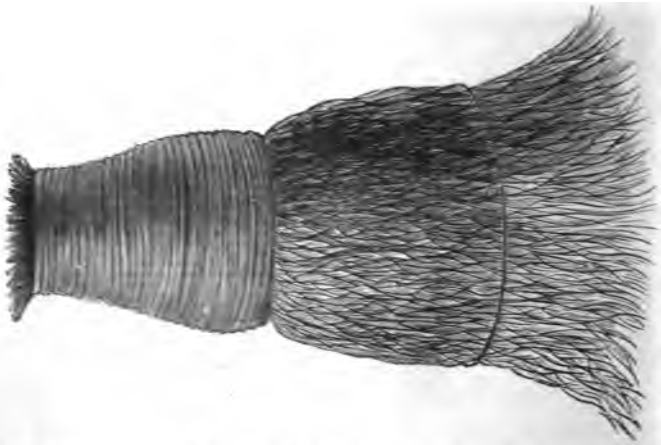
PLATE LXXX.

Brass vessels belonging to tray of cocoon reeling machine ; scale ½ of the real size.

COCOON REELING.

PLATE LXXXI.



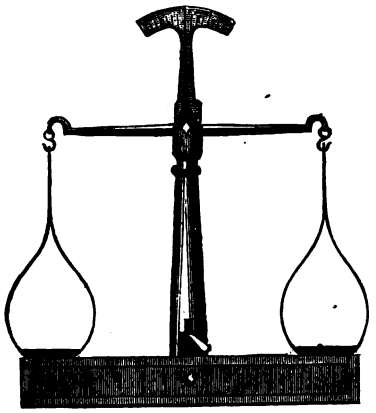


Brushes for the battage; scale ½ of the real size. Used for finding the reelable ends of the cocoons.

COCOON REELING.

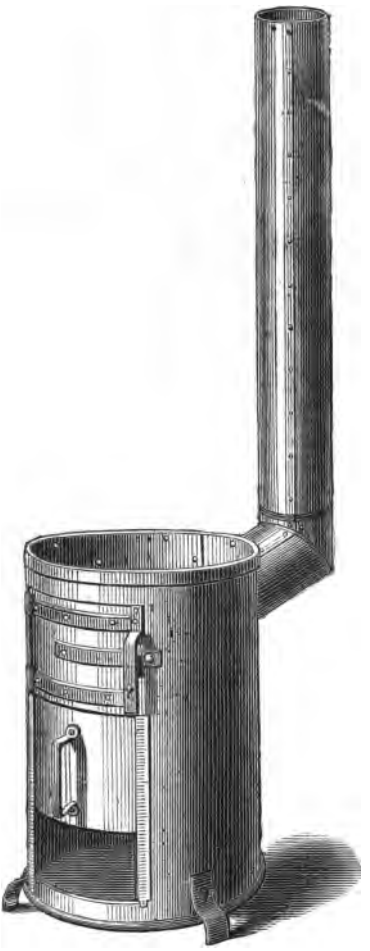
PLATE LXXXII.

FIG. 1.



Fine balance for deniering; scale $\frac{1}{5}$ of real size.

FIG. 2.



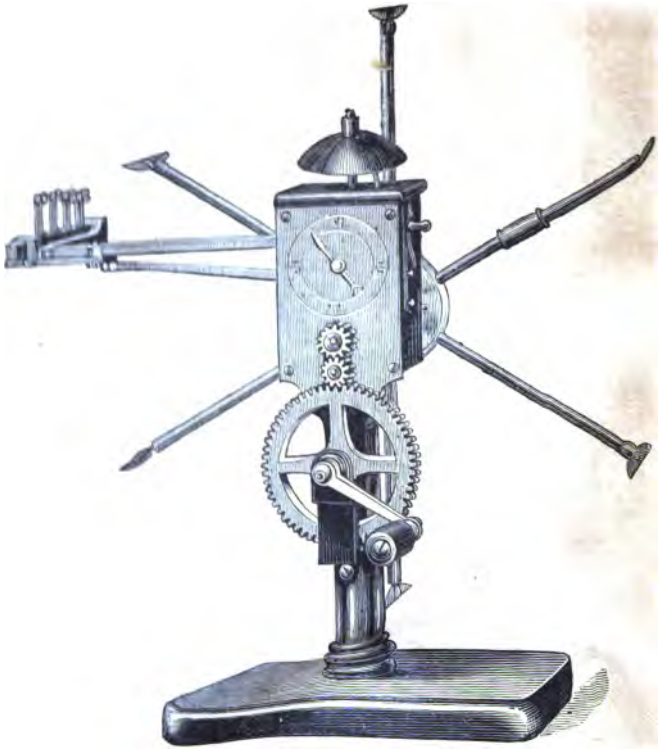
Stove for heating basin; scale 1 inch to the foot.

COCOON REELING.

Denierіng and measuring reel; scale $\frac{1}{6}$ of the real size.

COCOON REELING.

PLATE LXXXIII.



Deniering and measuring reel ; scale $\frac{1}{5}$ of the real size.

COCOON REELING.

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