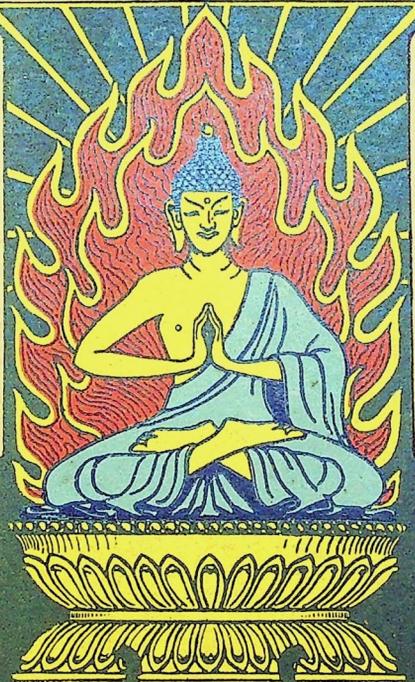


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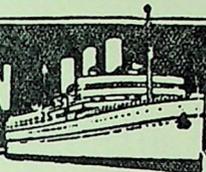
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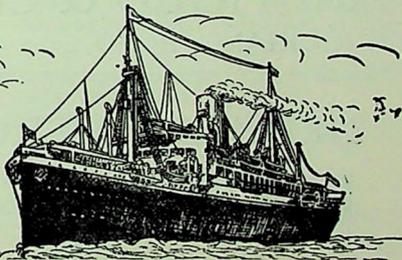
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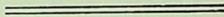
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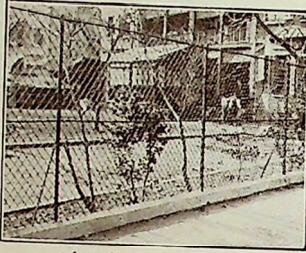
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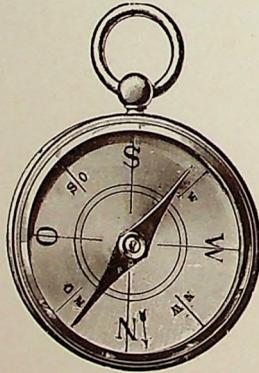
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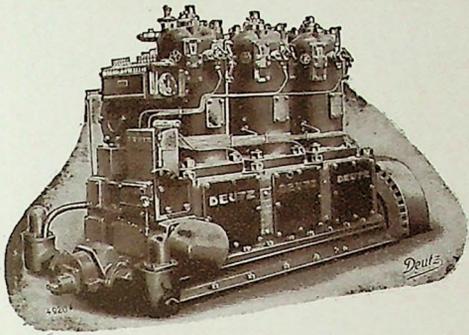


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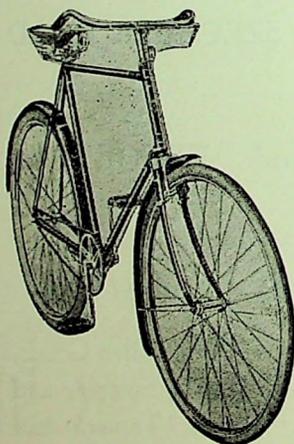
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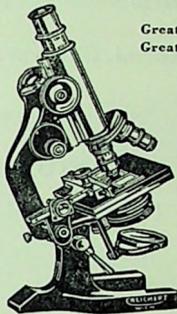
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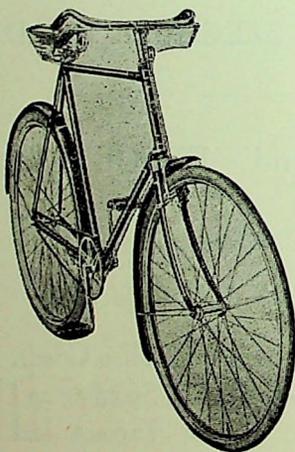
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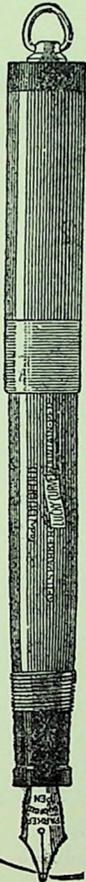
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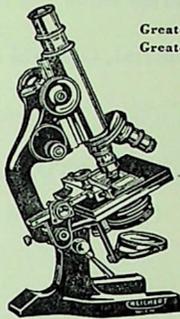
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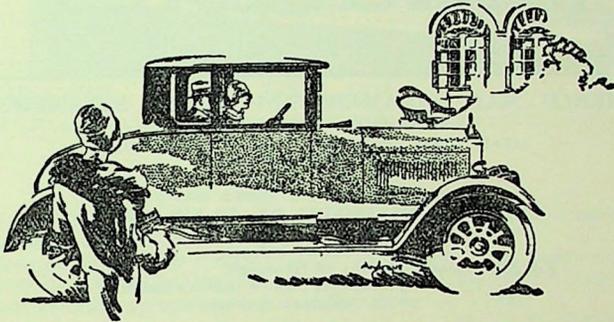
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No. 5

CONTENTS

	PAGE
WHAT SILK MEANS TO SHANGHAI BY ARTHUR DE C. SOWERBY	221
ARTIFICIAL SILK	224
HISTORY OF SILK IN CHINA	225
HOW SILK CAME TO EUROPE	226
THE POTENTIALITIES OF THE SILK INDUSTRY OF CHINA	
BY C. J. HUBER	227
A COMPARATIVE STUDY OF COCOONS.. .. .	233
BY R. E. BUCHANAN	233
WILD SILK IN MANCHURIA	238
BY Y. MORISE	238
EDITORIAL COMMENTS	247
THROUGH THE SILK PRODUCING DISTRICTS OF CENTRAL CHINA	
BY ARTHUR DE C. SOWERBY	248
REPORTS FROM SILK IMPROVEMENT AND EXPERIMENT STATIONS	
IN CHINA FOR 1927	251
THE LIFE OF THE SILKWORM	256
BY CLAUDE R. KELLOGG	256
DISEASES OF THE SILKWORM	263
BY CLAUDE R. KELLOGG	263
SCIENTIFIC NOTES AND REVIEWS	275
SHOOTING AND FISHING NOTES	279
THE KENNEL	282
THE GARDEN	285
PUBLICATIONS RECEIVED	286

Contributions of a suitable nature are invited and all M.M.S. not accepted for publication will be returned.

Books for review should be sent to the Editor as early as possible.

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THE CHINA JOURNAL

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Classified Index of Advertisers

ART AND CURIO DEALERS:

Jade Store	XLIX
Jade Temple, The	Cover 3
Toyo Murakami	III

AUTOMOBILES:

The Auto Palace Co. (Morris Cars)	XXXIX
---	-------

BANKS:

National City Bank of New York	VI
--	----

BOOKS, BOOKSELLERS AND AGENTS, ETC.:

Oxford University Press	LVIII
---------------------------------	-------

BUILDING MATERIALS:

Calatroni, Hsieh & Co. (Raoul Bigazzi Marbles, etc.)	LXI
Crittall Manufacturing Co. (Metal Windows)	IV
Kailan Mining Administration	XXXIV
Stanislas Zeng Weida (Fontaine & Co. Iron Fence)	XXVIII

CHEMICAL IMPORTERS, DRUGGISTS, ETC.:

Brunner, Mond & Co. (China), Ltd. (Crescent Fertilisers)	XVI
Burroughs Wellcome & Co. (Cod Liver Oil & Malt Extract)	XLVIII
China Export, Import and Bank Co. (Bayer Aspirin)	VIII
National Aniline and Chemical Co. U. S. A. (Dyestuffs)	XLIII
Schmidt & Co.	XI

DEPARTMENT STORES:

Hall & Holtz, Ltd.	LXII
Squires, Bingham Co. (Sporting Supplies)	XLI
Weeks & Co. (Voiles)	X

DYES AND CHEMICALS:

National Aniline and Chemical Co., Inc.	XLIII
---	-------

ELECTRICAL ENGINEERS AND CONTRACTORS:

General Electric Co. (of China) Ltd.	IV
Hugo Reiss & Co. Federal, Inc., (Westinghouse)	Cover 3
Oriental Electric Protective Association, Inc.	II

ENGINEERS, MACHINERY MERCHANTS, SHIP-BUILDERS, ETC.:

Andersen, Meyer & Co., Ltd. (Silk Weaving & Spinning Machinery)	XLV
Arnhold & Co., Ltd.	X
Carlowitz & Co. (Bicycles)	XXXVI
Chien Hsin Engineering Co., Ltd. (Deutz Engines)	XXIX
Gordon & Co., Ltd.	XL
Jensen, G. S. (Bollinder's Engines)	LIV
Oliveira & Son, H.	XXV
Rose, Downs & Thompson (Far East) Ltd.	VI
Scott, Harding & Co., Ltd.	LIV

FOOD PRODUCTS:

Allenburys' Milk Food	I
Bianchi	XXXVII
McBain, George, Import Department (Rouyer Guillet & Co. Brandy)	XLII
James Nell's Scotch Bakery (Bermaline Bread)	XLII
Nestlé and Anglo-Swiss Condensed Milk Co. (Lactogen)	Cover 4
Shanghai Ice and Cold Storage Co. (Clover Brand Butter)	XLII
Whitsons, Ltd. (Gillard Condiments)	LX

FOUNTAIN PENS:

Parker Duofold, Jr. (Dodge and Seymour)	XXXVII
---	--------

FURNITURE MANUFACTURERS:

Arts & Crafts, Ltd.	Cover 2
-----------------------------	---------

HOTELS:

Astor House Hotel, Ltd., Tientsin	XLII
Court Hotel, Tientsin	XI
Imperial Hotel, Ltd., The, Tientsin	XLII

IMPORTERS AND EXPORTERS, ETC.:

Mitsui Bussan Kaisha, Ltd.	XXXV
Mustard & Co. (Safes, etc.)	LIX

INSURANCE COMPANIES:

Andersen, Meyer & Co., Ltd.	IV
Cornhill Insurance Co., Ltd.	XXXI
Cumline & Co., Ltd.	XXXI
Emile Essig (Balaise Marine & Fire)	XXXII
Gibb, Livingston & Co.	XVII
Jardine, Matheson & Co.	VIII
L. Moore & Co., Ltd.	LXII
Manufacturers Life Insurance Co.	XXVI
Palatine Insurance Co., Ltd.	XXXII
Scott, Harding & Co., Ltd.	LIV

JEWELLERS:

Hirsbrunner & Co.	XXVIII
Jade Store	XLIX
Tuck Chang & Co.	LV

MERCHANTS AND COMMISSION AGENTS:

Burkill & Sons, A. R.	VI
Wattie & Co., Ltd., J. A.	XXXVIII

OIL COMPANIES:

Asiatic Petroleum Co. (North China), Ltd.	LVI
Standard Oil Co., of New York	LXI

OPTICAL GOODS, ETC.:

American Drug Co. (Microscopes)	XXXVII
Schmidt & Co.	XI

PHOTOGRAPHY:

Agfa Photo-Materials	XLIX
Sanzetti Studio	XLVIII

(Continued on next page).

Classified Index of Advertisers (Contd.)

PUBLISHERS, PRINTERS, NEWSPAPERS, ETC.:

China Journal (The Naturalist in Manchuria, etc.) ..	XLVII, L & LXI
China Mail	LI
Discovery	LVIII
Hongkong Sunday Herald ..	LI
North-China Daily News & Herald, Ltd. (Hong List, 1923)	LI
Oxford University Press ..	LVIII
Tientsin Press, Ltd. (P. & T. Times)	XXXVI

REAL ESTATE AGENTS:

Shanghai Land Investment Company	XXXIV
---	-------

RUBBER ESTATES AND RUBBER PRODUCTS:

Burkhill & Sons, A. R. ..	VI
Scott, Harding & Co., Ltd. ..	LIV
Wattie & Co., Ltd., J. A. ..	XXXVIII

SCIENTIFIC INSTRUMENTS:

American Drug Co. (Micro- scopes)	XXXVII
--	--------

SILKS, LACES, EMBROI- DERIES AND SHAWLS:

An Kone Silk Co., The ..	XXXII
Arnhold & Co., Ltd. (Raw Silk)	XIII
Burkhardt, Amidani & Co. ..	XLIII
China Export Co., Ltd. ..	XXIV
China Silk Co., Ltd. ..	XIX
Clerici Bedoni & Co. ..	LVII
Courtaulds Ltd. (Artificial Silk)	VII
Dyce & Co.	XXV
Eagle & Co., Inc., C. K. ..	LVIII
Etablissement A. Chapeaux ..	LVII
Foo, Glanzmann	XX
Foot Ease Hosiery	LIII
General Silk Importing Co., Inc.	XXI
Gibb, Livingston & Co. ..	XVII
Hall & Holtz, Ltd.	LXII
Heffer & Co., F. C.	XLIV
Huber & Co., S. A., E. ..	XVIII
Jardine, Matheson & Co., Ltd.	XV
Kunst & Albers	XLV
Lachard, Follet et Cie. ..	XXIII
La Generale Soles	XIX
Laou Kiu Luen & Co. ..	XXIV

Little & Co., William ..	XLIV
Madier Ribert et Cie ..	XXVIII
Marthoud & Cie	XXIII
Puthod, A.	XXV
Reiss, Massey & Co., Ltd. ..	XXIX
Righini, S. A.	XLVII
Rudolph & Co., Charles ..	XX
Schwyzler, F.	XXXIII
Shanghai Lyons Silk Co., Ltd.	XXII
Siber Hegner & Co.	XXVI
Soy Lun Silk Filature (Arnhold & Co., Ltd.)	XII
Tai, C. T.	XXV
Toyo Murakami	II
Waibel & Co. (Agfa Silk) ..	XLVI
Wai Tzun Silk Co.	XIV
Weber, C. A.	XXII
Pagoda Hosiery	II

STEAMSHIP AND RAILWAY COMPANIES:

American Mail Line ..	Cover 2
Canadian Pacific Steamships, Limited	IX
Dollar Steamship Line ..	Cover 2
Gibb, Livingston & Co. ..	VIII
Jardine, Matheson & Co., Ltd.	VIII
MacKinnon, Mackenzie & Co.	Cover 3
Messageries Maritimes ..	XL
Norddeutscher Lloyd, Bremen	IX

TOBACCO:

British-American Tobacco Co. (China), Ltd. (Capstain Cigarettes)	V
--	---

TRANSPORTATION:

Aronovsky, D. G. M. ..	LVI
------------------------	-----

TRAVEL AGENCIES:

Hawaii Tourist Bureau ..	L
--------------------------	---

TYPEWRITERS:

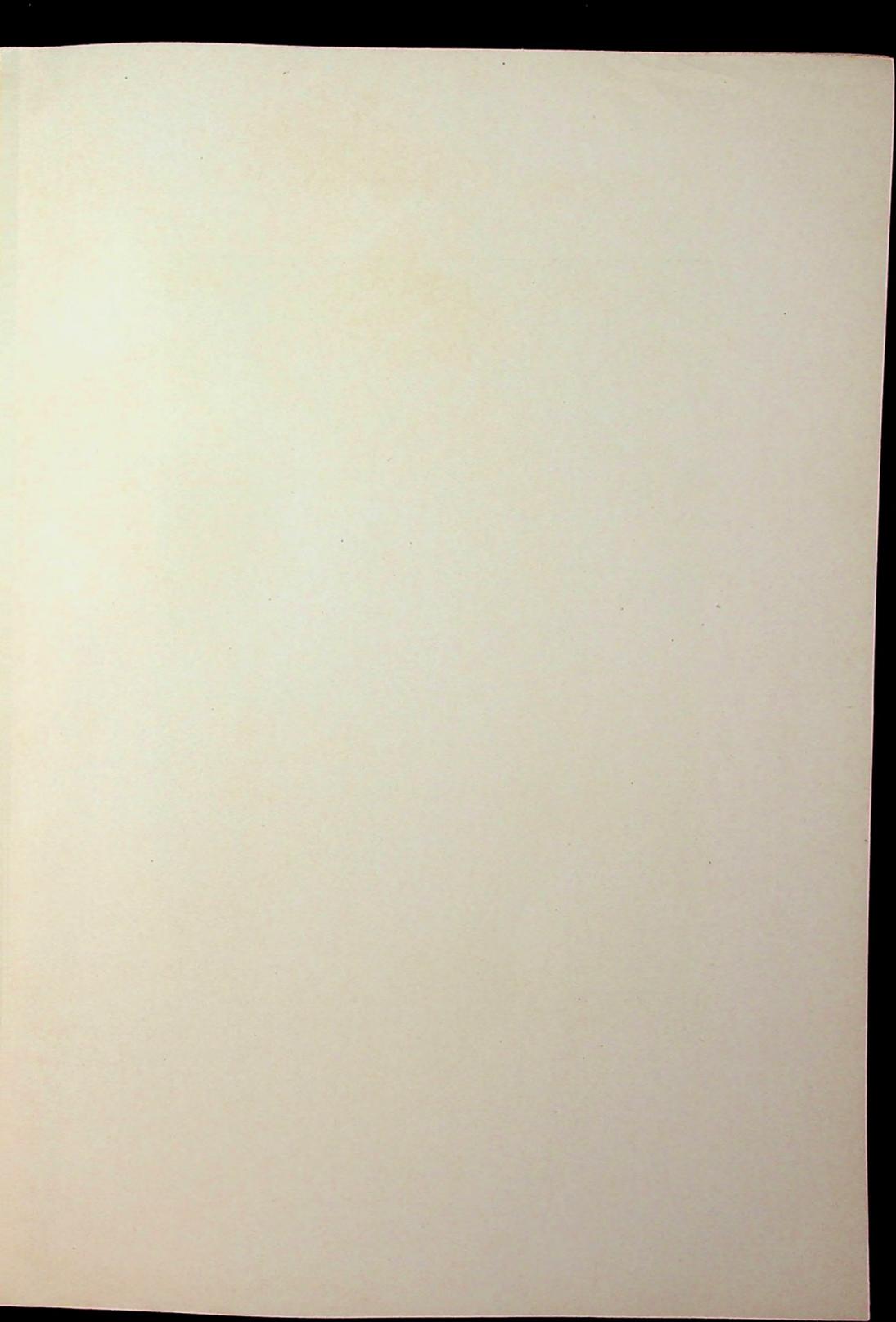
Dodge & Seymour (China) Ltd. (Corona)	LV
Dodwell & Co., Ltd. (Under- wood Portable)	I

WINE MERCHANTS:

McBain, George, Import Dept. (Rouyer Guillet & Co. Brandy)	XLI
Union Brewery, Shanghai (U. B. Beer)	XXXIII

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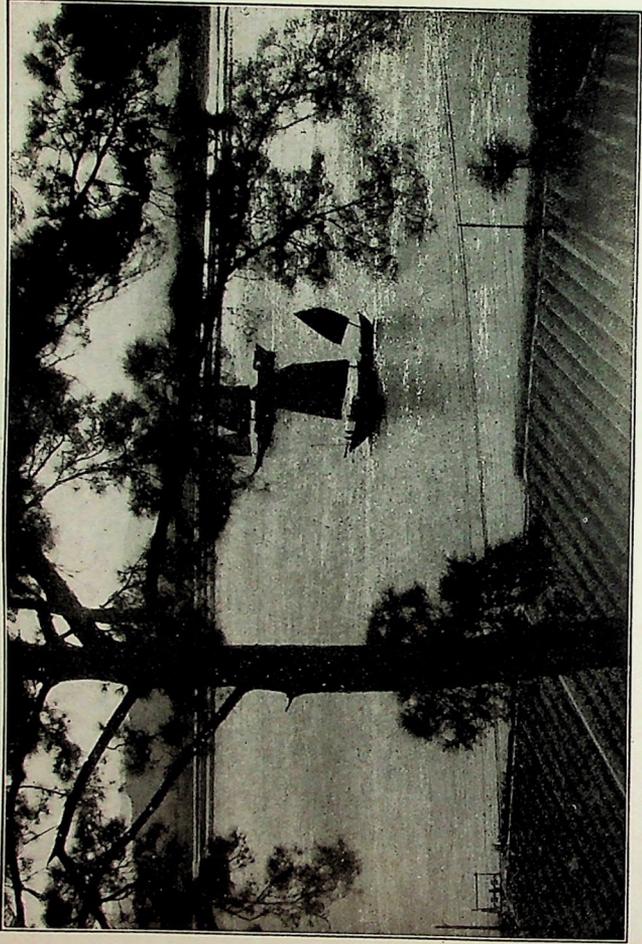
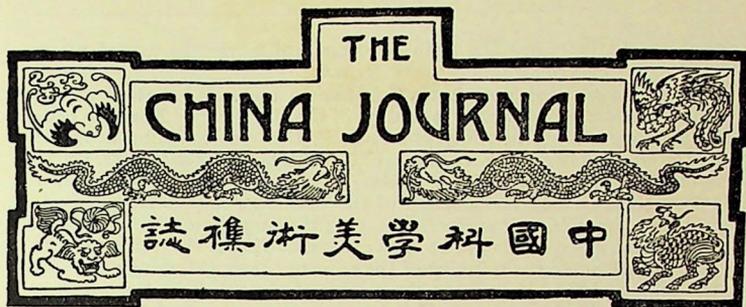


Photo by C. R. Kellogg
A view of the Min River through Pine Tree branches from the Fukien Christian University,
Foochow, Fukien.



VOL. VIII

MAY 1928

No. 5

WHAT SILK MEANS TO SHANGHAI

BY

ARTHUR DE C. SOWERBY

The romance of industry is a theme that might well occupy the pens of our ablest writers to a far greater extent than it does at present. For all we are living in the age of industry, trade and commerce, the public at large is inclined to look upon these things as dull and uninteresting, necessary concomitants of the comfort and luxury prevalent throughout the world to-day, but humdrum and lacking in excitement beyond the sordid facts that in dingy offices fortunes are sometimes made or lost or that fluctuations in the ratio between demand and supply of various commodities provide the means of speculation in stocks, shares and exchange.

Yet, often, if we take the trouble to look behind the scenes or delve into the history of a given industry, we may find lurking there romance as poignant as anything that has appeared in novel, drama or verse. This is particularly true of the silk industry.

One of our modern writers has had enough vision to appreciate this: Samuel Merwin, whose book "Silk" is woven round the story of a Persian princess who with her Wazir, or Prime Minister, intrigued to discover the secret of silk production from China as a sop to Rome. It tells of the immense caravan trade in silk passing through Chinese Turkestan to the countries of the West, and the huge profit and wealth derived therefrom by the Chinese. But this is only a legend. The truth, if it were only known, of the wresting from the Chinese of the secret of sericulture, whereby they supplied diaphanous material of untold loveliness and stupendous cost to delight the beauties of ancient Greece and the stately ladies of Rome, would probably prove to be infinitely

more romantic. How the Chinese came to discover the use of silk is lost in the mists of antiquity, but discover it they did, thereby conferring an ineffable blessing upon the whole human race. What shall we say of the production, as we see it to-day, of the silk itself? First the carefully preserved egg in the peasant's hut; then the hatching in spring by the warmth of a woman's bosom of the tiny black threads, that, placed upon the tender shoots of the mulberry, soon grow into the well-known worms; the feeding and tending of the worms as they develop in size and pass through their successive stages; the preparation of the mounts upon which the cocoons will be spun; the scattering of the "ripe" worms over the mounts; the spinning of the cocoons; their gathering and sale; the killing of the chrysalises; the reeling of the silk from the white or golden balls bobbing in pans of hot water; the weaving of the silk into costly fabrics; the selection of cocoons for breeding; the mating of the moths; the laying of the eggs, and their careful conservation; the cultivation of the mulberry bushes—surely there is romance in all this, just as there is romance in the hunt conducted in the laboratory for the disease-producing germs that infect the silkworms and moths and for the means of eradicating these pests.

Again, is there no romance in the buying and selling of the cocoons, as raw silk? Is there no excitement in the lives of those engaged in what is, perhaps, the most difficult of occupations? Ask the silk merchants of Shanghai and those who insure the cocoons.

From the little round egg deposited by the white moth in her diminutive compartment, to the donning of the gorgeous robe by the lady of fashion in a London or New York *salon*, silk is crowded with romance.

And what does silk mean to Shanghai, this mighty port and industrial centre that has risen in less than a century from a mud-flat? It would not be going too far to say that in a great measure Shanghai owes its present proud position to silk, situated as she is at the very door of one of the greatest silk producing regions in the world.

Annually silk to the value of Tls. 60,000,000, or roughly £8,000,000, is exported from Shanghai. The total value of silk exported from the whole of China is Tls. 125,000,000, so it will be seen that nearly half of China's silk export is taken care of by Shanghai. Since silk represents about a quarter of the total value of China's export each year, it follows that this industry in relation to Shanghai represents an eighth, or twelve per cent., of China's export.

This enormous and valuable production of silk export is taken care of by some 88 steam filatures in Shanghai (the total number of steam filatures in Kiangsu and Chekiang, the main silk producing area of Central China, is 130), employing some 30,000 reeling girls besides other large numbers of natives, both male and female, in various other capacities. This does not take into consideration the large amount of silk reeled by native hand machines, in which thousands more are employed. Besides this there are large quantities of silk manufactured in Shanghai for local consumption, so that the industry, taken as a whole, is of the utmost importance, is, perhaps, the most important in Shanghai, and represents a vast amount of wealth and employment.

WHAT SILK MEANS TO SHANGHAI

For this reason it is imperative that Shanghai residents and those who have the prosperity of this great city at heart should appreciate the importance of developing the Chinese silk industry to its fullest possible extent; and to do this large sums and much effort must be expended in the improvement of the quality and standard of the silk produced in the areas about the Yangtze Delta, where the rich alluvial soil and the genial climate are such favourable factors in the growth of the silk-worm's staple diet, the mulberry.

In this connection it is interesting to note that for several years various organizations have been working on the problem of sericulture improvement. Perhaps the most important of these are the stations established by the Nanking University at Nanking and the Canton Christian University at Canton. In Fukien the Fukien Christian University is also carrying on good work along the same lines, while good work is being done in Chefoo by the Chefoo Silk Improvement Commission—all receiving strong financial support from America.

In Shanghai the International Committee for the Improvement of Sericulture in China, sponsored by the Foreign Silk Association and receiving financial support from the Chinese Government, is working along the same lines, having an experiment station in the French Concession and several other stations scattered throughout the provinces of Kiangsu, Chekiang and Anhwei. Here, too, has been established what is known as The Shanghai International Testing House, supported by money from the United States, and vitally interested in the improvement of Chinese silk, all of which indicates that foreign silk interests are fully alive to the needs of the industry.

But, in order to get the best returns, it is essential that the Chinese themselves, and especially the Chinese authorities, should wake up to the importance of the improvement of Chinese sericulture. It is gratifying to note that the Chinese Government is spending something like \$150,000 a year on the improvement of sericulture in Kiangsu and Chekiang, but this does not compare very favourably with the \$1,000,000 spent by the silk interests of the United States in China for the same purpose during the past few years, and still less favourably with the expenditure by the Japanese Government in Japan of Yen 1,500,000 each year on egg inspection alone.

In fairness to the present controllers of the region tapped by Shanghai, the Nationalist Government, we may state that definite plans for the improvement of sericulture in Central China have been made, but whether these plans will or can be carried out remains to be seen. It is largely a question of money, and with civil war raging throughout China, there seems little likelihood of there being any adequate sums available for the improvement and advancement of the sericulture. But the fact remains that the Chinese authorities realize the importance of the silk industry, which, as already stated, has probably been one of the main factors in bringing Shanghai to its present high state of prosperity and importance.

Under these circumstances it is hardly to be wondered at that a very considerable interest attaches to silk in the minds of Shanghai people,

for which reason we have decided to devote practically the whole of the present issue of *The China Journal* to the industry in its various phases. How large a place silk occupies in our lives may be gathered from the fact that we have been able to assemble material of the greatest interest under our usual sectional headings of Literature, Art, Travel and Science.

ARTIFICIAL SILK

The astounding increase in the production of artificial silk during the past few years, and the enormous profits made by the companies engaged in the development of this industry, read almost like a romance. As pointed out by the founders of one of the most important of the artificial silk producing companies, the world's population is increasing at a faster rate than can be kept pace with by the production of silk and cotton goods for clothing; which simply means that every bit of additional fabric for clothing that can be produced must find a ready consumption. This accounts for the fact that the enormous production of fabrics of artificial silk and artificial wool (for wool, too, now has a very good substitute) has not affected the world's consumption of silk, cotton or woollen goods.

Following is a table kindly supplied by the Chinese Maritime Customs Statistical Department giving statistics of the import of artificial silk, etc. into Shanghai during the past three years.

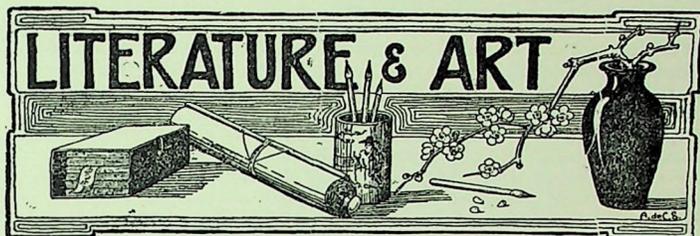
		1925.	1926.	1927.
Artificial Silk Floss and Yarn.	Piculs.	27,233	42,781	82,169
„ „ & Cotton Piece Goods.	Yds.	2,191,090	3,663,698	5,130,123
„ „ & Woollen „ „	„	183,442	368,781	221,473
„ „ Piece Goods.	„	1,114,229	1,151,304	869,193

The silk export trade of Shanghai is as large this year as ever, yet great quantities of artificial silk are being used in Europe and America for the manufacture of fabrics that are finding a ready sale.

In Shanghai, perhaps unknown to the general public, a very big industry in artificial silk and artificial woollen goods has arisen. In fact, fabric of this nature is actually being manufactured in Shanghai on a large scale and shipped to Europe and America, some of the stuff being of such high quality and beautiful design as to compare more than favourably with that of European manufacture.

Strangely enough, this local production is not all used to satisfy local demand, and large quantities of artificial silk fabric are imported.

All of which goes to show how important is the silk industry, with which must be included the production and weaving of artificial silk, to Shanghai and China generally.



HISTORY OF SILK IN CHINA

BY

J. C. FERGUSON.

As far as I know there is no trustworthy record of the time when silk was first used in China or of the place where it originated. We learn but little from the earliest books.

In the "Spring and Autumn Annals" (春秋) there is no record of the use of any character containing the radical "糸" which is used in the sense of silk. This radical is used in the names of persons or places, with the exception of its use in the characters *na* (納) and *chi* (績), neither of which has any reference to silk.

In the Book of Poetry (詩經) there are the characters *pi* (紕) which Legge translates as woven silk bands, *t'o* (紘) for braiding, *tsu* (組) for ribbons, *ssü* (絲) for any materials made of silk, *chin* (綫) for thread, *kao* (縞) for undyed silk, all of which were connected with the use of silk, though probably several of these characters were also used for hemp products. The radical "糸" is used with many other characters in this book which have no relation to the production or use of silk.

In the Book of History (書經) we have, in addition to those used in the Book of Poetry, *hsü* (緒) as the end of silk in a cocoon, *hsün* (繅) for purple silks, *k'uang* (纈) for fine floss silk, *ch'ien* (織) for fine checkered silks.

An examination of the Analects of Confucius and of the Book of Mencius shows an improved knowledge of the value of silk, and an evident increase in its use. Mencius has several new characters such as *hsü* (絮), spoiled or old floss, *ts'ao* (纛) to unwind a cocoon, *lou* (縷) for silk, *hsiu* (繡) for silk embroidered garments.

From this short survey of early records it is reasonable to propound as a working hypothesis the theory that the use of woven silk in China began about the time of Confucius and Mencius and that it originated in Shantung, the homeland of these two Sages. In the Book of History, Pt. III "Tribute of Yü," silk is one of the articles of tribute mentioned as coming from Yen-chou, Shantung (厥貢漆絲). In this same passage

mention is also made of silkworms and mulberry trees (桑土既蠶). It is further said in this paragraph that the wild tribes of Lai (Northeastern Shantung) who had been taught pasturage brought wild mulberry silk in their baskets (萊夷作牧厥筐屨絲). In his learned paper on "The Wild Silkworms of the Province of Shantung," China Review Vol. VI, p. 89, A. A. Fauvel gave detailed information as to the production of silk in that province. He quotes the opinion of Cuvier and other naturalists that the *Bombyx mori*, the silkworm of France and Italy, is a native of the northern provinces of China. From the passages quoted in the preceding paragraphs I have arrived at the opinion that among these northern provinces Shantung must be given the credit for being the first place where silkworms were produced by feeding upon mulberry leaves and where the silk from cocoons was woven into silk cloth.

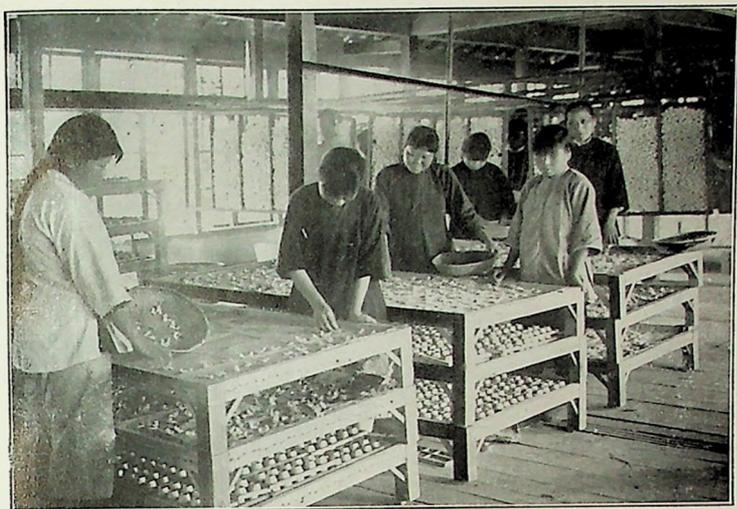
By the time of the Han Dynasty silk was in general use throughout the empire. The earliest piece of silk cloth of which I know is one found in the excavations of Han Dynasty graves undertaken in the northern part of Korea, which was included in the Han Empire, by a joint committee of professors from the Universities of Tokyo and Kyoto. In a grave on the Ta-t'ung River (大同江), east of Pheng-yang (平壤), a piece of silk was found in a lacquer box. It was woven in the same way as modern coarse silk.

HOW SILK CAME TO EUROPE

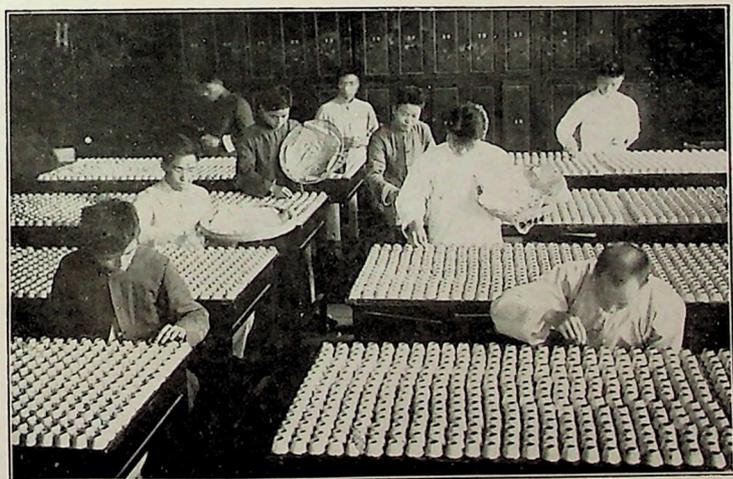
BY

HERBERT CHATLEY, D. SC. (Lond.)

The very name of silk indicates its Chinese origin. The Anglo-Saxon *Seolc* and its Teutonic analogues are corruptions of the Latin *Seric* (—us) which means secondarily "silk garments" and primarily "Chinese," the Greek geographers describing China as *Ser*. Aristotle (B.C. 350) and Pliny refer to the origin of the material from the caterpillar *Bombyx* and the first fabrics were woven in Cos, an island off the coast of Asia Minor. Merwin in his fascinating novel "Silk" has romantically described how the eggs reached Bactria (modern Afghanistan), there being a legend that a Chinese princess circumvented the prohibition as to the export of the eggs by concealing some in her headdress and so



Chinese Girls pairing the Moths.



Photos by Int. Comm. for the Imp. of Ser. in China

Mass Production of Eggs. Each little Cubicle imprisons a Female Moth, which will lay her Eggs upon little Squares of Paper beneath.

HOW SILK CAME TO EUROPE

carrying them to Khotan (Chinese Turkestan). The Stein expedition found several specimens of early silk, indicating that a regular trade in the material passed through the Tarim Valley during the first millenium of the Christian Era. The usual account of the introduction of the *growth* of silk into Europe is that Justinian induced two Persian monks residing in China to bring some eggs to Byzantium (Constantinople) in A. D. 551. From thence the cultivation proceeded to Sicily in 1146 and Spain in 1253. The monks in question are reputed to have been Nestorians. The stela of Chang An (Hsi-an Fu in Shensi) speaks of the introduction of Nestorianism in China in A. D. 635. Nestorius himself became Patriarch of Constantinople in A. D. 428, so that the monks of Justinian's time may have been itinerants rather than actual residents in China.

It is of course conceivable that some silk came by sea routes via Mesopotamia or the Red Sea, but all the evidence tends to show that the export of the material from China to Europe was generally by land and that the eggs certainly came that way. The development of communications between China and Europe which followed upon Alexander's Indian campaigns may be regarded as the direct cause of the imporation of the silkworm into Europe. It is most interesting to observe how the history of this process is mixed up with the first consciousness in Europe of China's existence, the emergence of the Greeks as a world power and the missionary enterprise of Christianity.

THE POTENTIALITIES OF THE SILK INDUSTRY OF CHINA

BY

C. J. HUBER.

(*Director of Technical Research, Chenay Brothers, South Manchester,
Coun., U.S.A.*)

While China has for centuries possessed extensive hand crafts and has produced large quantities of manufactured goods mostly for domestic consumption, she is and will continue to be for many years an agricultural country. The mineral resources, including vast deposits of coal, and the great supply of man-power, constitute the chief essentials for the development of her manufacturing industries.

Even to the casual observer of economics it is evident that China is entering an era of great industrial growth and expansion. This expansion will probably do more than anything else to win for China a place of in-

fluence among the large nations. As her industrial and manufacturing development advances, her dependence upon international trade balance will become more and more important. The principle involved in this assumption was very clearly demonstrated in the industrial development of Great Britain during the past two centuries and is being, at present, further illustrated in the industrial development and expansion of the United States and Japan. China's economic isolation can be maintained only through industrial suppression and handcraft continuation.

The silk industry is probably China's oldest and most important industry. Oldest because it dates back to and is closely interwoven with Chinese mythology, and most important because it is China's largest single item of export, being almost one quarter of her total export trade. Due to its high market value it is the industry which can be most easily improved, so as to help rehabilitate China.

The approximate value of raw silk and silk waste products for 1927 was 144,000,000 taels. Of this amount America purchased a little more than one half. America imports annually 500,000,000 taels worth of raw silk, in as much as she does not produce any raw silk. Of this amount, 80 per cent. or approximately 400,000,000 is purchased from Japan. China, with probably more people engaged in the various branches of the raw silk industry than all other silk producing countries combined, exported from its various provinces only one third of this amount in 1922.

America, the largest purchaser of raw silk in the world, is very anxious to obtain more raw silk from China, but up to the present time it has been impossible to increase the amount to the extent desired. This has been largely due to the lack of progressiveness and co-operation among the Chinese in promoting sericultural development and the deficiency of industrial organization in the various steps of production. By the application of practical scientific methods throughout China's silk industry, the exportation of this commodity should be doubled or trebled, at the same time increasing the quantity for domestic consumption.

The economic value of China's raw silk production, per unit of quantity, or per unit of area and population engaged, is smaller than that of Italy, France, Japan, and the Near East, and probably exceeds only that of some of the most primitive silk producing regions. This low value per unit is due to the following causes which are listed as they occur in the industry and not in the order of their economic importance.

FIRST: Inefficiency in the selection, cultivation, fertilization and protection from disease of the mulberry.

SECOND: Inefficiency in the selection, breeding, feeding and marketing of the cocoons.

THIRD: Lack of economic, rapid and direct transportation, unhampered by cumulative internal taxation.

FOURTH: Inefficient, primitive, country methods of reeling a large portion of the cocoon production and preparing the bye-products into an inferior material of low market value.

THE POTENTIALITIES OF THE SILK INDUSTRY OF CHINA

FIFTH : Basing prices on speculation instead of on cost of production figures.

To remove these causes in a great country like China and in a great industry involving in a complex manner a large number of people seems impossible. However, it must be done if the economic value of China's silk products is to be raised to a level corresponding to those of other countries.

In order to facilitate improvement in the raw silk industry, the first point of attack is the improvement in sericulture, or in the method of raising the silkworms, which is largely that of producing disease free eggs. It has been stated by authorities whose judgment cannot be questioned that, by the elimination of silk-worm diseases, and without increasing the present mulberry production of leaves, China's raw silk production can be increased 400 per cent. The effect on filature operations in producing raw silk from cocoons reared from disease free eggs is still more astounding. The cost of production is lower because the various operations involved, such as sorting, peeling and reeling, are greatly simplified. Again, to produce one picul of raw silk at present requires six to seven piculs of dry cocoons, while with good cocoons this quantity can be reduced to four^c which even then is more than the average required in Japan. In this way China can increase her exportable silk many fold, and at the same time have more silk for local consumption.

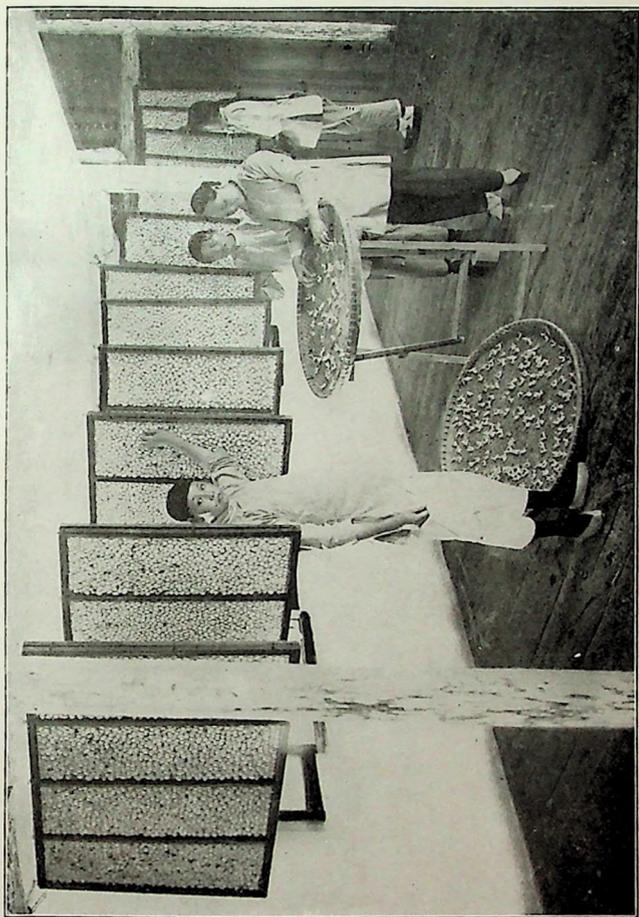
In as much as the disease free eggs play such an important rôle in the improvement work in the silk industry of China, a brief explanation of how they are produced in Central China may be interesting. The disease free egg sheets, which have been stored in a cool dry place since the year before, are put into an incubator at the beginning of April, or as soon as the mulberry leaves begin to sprout. These eggs are incubated for about two weeks, at a temperature of 90 degrees Fahrenheit, when the worms come out, and are gently brushed off with a feather brush on to a carefully weighed paper. This paper, with the worms, is again weighed so as to know accurately the weight of the worms, called "ants." It is estimated that every ounce of "ants" consumes twenty-five piculs of mulberry leaves before spinning the cocoons. The worms are reared by the same method used by the average farmer except that very great care is taken in ventilation and sanitation. Everything must be kept clean and any sign of infection must be treated at once so that only strong healthy worms are raised which produce good strong cocoons. In about seven days, the moth pierces the cocoon, and comes out a whitish-grey in colour. The female is larger than the male, but both are unable to fly. They mate at once, which requires about six hours, after which they are separated, the female being placed on a sheet of paper, and covered with a conical ring, where she deposits her eggs, about four hundred in number. The male dies, and is discarded. After the female has finished her task of laying eggs, she too dies, but is kept with her eggs for examination. Her body is ground up into a fine powder, and mixed with pure water. A drop of this fluid is examined under the microscope, and if any disease germs appear, the eggs produced by this moth are destroyed. The disease free eggs only are kept and prepared for the rearing of the next crop.

There are a number of organizations and schools producing disease free eggs, the most important one being the International Committee for the Improvement of Sericulture in China which has its headquarters at Shanghai with seven producing stations in the Yangtze Valley silk district. This Committee has been producing annually over a million disease free layings. This Committee receives an annual grant from the Peking Government which enables it to carry on and expand its activities. Its work shows a steady improvement in as much as each year the percentage of diseased layings among those hatched by the Committee has steadily decreased as well as the cost of production for a hundred disease free layings. In some of its stations the percentage of bad layings has been reduced to 8 per cent., which is quite remarkable when considering that native eggs show from 75 to 80 per cent. disease. The average net price for a hundred good layings for the last year was M.\$3.45, which compares favourably with the net cost of French and Italian eggs which is M.\$2.46 for the same quality. The Committee is working steadfastly to increase the local supply of disease free eggs by working with the provincial schools and by having farmers raise the crops under the supervision of picked experts.

Nanking University has also been doing fine work in producing disease free eggs on a quantity basis. Last season they raised under one roof enough cocoons to produce 1,000,000 disease free layings. Besides this, they are giving short courses in sericulture and are doing extension work by sending exhibits throughout the silk raising district to instruct the farmers just before the rearing season in not only the good sanitary method of rearing the worms but also their economic value. In using disease free eggs nothing is so convincing to the farmers as to show them by actual demonstration how many more dollars they will have at the end of the season by using the more up-to-date methods in this old industry.

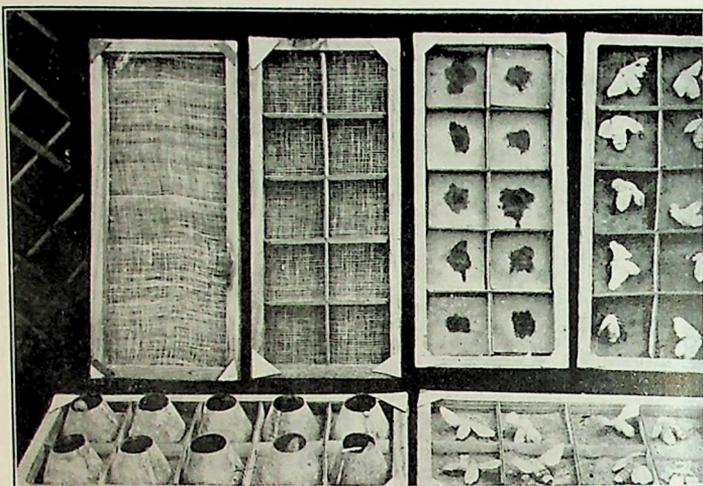
In south China, Canton Christian College is making great progress in eradicating silk worm diseases and assisting the raw silk industry as a whole to increase the quantity and better the quality of the silk produce. Their work is made more effective in as much as the five to eight crops annually means a rapid turnover and allows the elimination of disease, which may require several generations, to be accomplished within a silk season. They produce annually about 1,500,000 disease free layings. Their work is further augmented by the progressive egg merchants who have long ago learned the value of cocoons produced from the examined disease free eggs. As soon as a farmer purchases his seed from the College, the egg merchant contracts with him for his crop of cocoons at a price above the market, to be used for egg production.

The Chefoo Silk Improvement Commission is doing much improvement work along the same lines, but with the wild, or oak-fed, silkworms which produces the tussore, the silk used in manufacturing pongee goods. It is supported by the remission of customs at the port of Chefoo and is fast getting into a position where it can provide the farmers with disease free eggs and acorns from good species of oak.

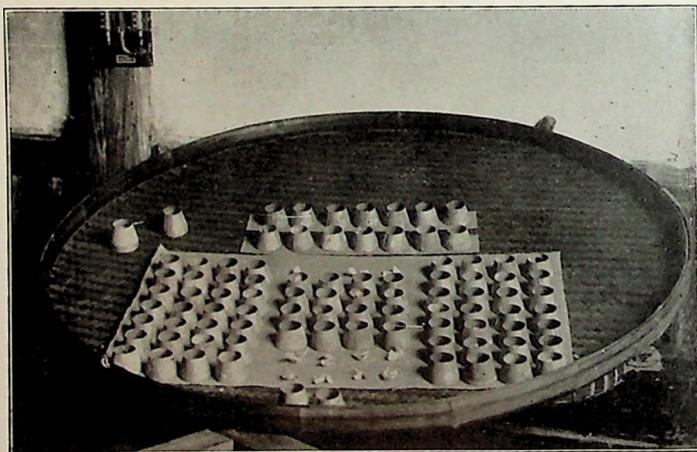


Chinese Girls Taking the Moths as they hatch from the Wire-netting Frames in which Selected Cocoons for Moth-production are kept.

Photo by Int. Comm. for the Imp. of Ser. in China



Trays, Moths and Individual Cubicles, devised by Mr. Chang Ping Ho of the International Committee for the Improvement of Sericulture in China to secure Eggs for Examination.



Photos by Int. Comm. for the Imp. of Ser. in China

In each of these Tin Cup-like Cubicles a female Moth is imprisoned. When she has laid her Eggs upon the little Paper Square underneath, she is placed in a small Paper Bag where she awaits Microscopical Examination for Disease. Bag and Paper Square are Correspondingly numbered. If the Moth is found to be infected with Disease, her Eggs are destroyed.

THE POTENTIALITIES OF THE SILK INDUSTRY OF CHINA

Fukien Christian University at Foochow has just started sericulture work in a field which seems to have wonderful possibilities for silk production.

Yet with all this work for the production of disease free eggs in China and the augmented purchases from outside sources, China has less than one per cent. of the amount required for its annual production. In order to make the work on disease free egg production most effective, it will have to be organized eventually as a distinct unit of the silk industry along commercial lines. These producers will operate under government licenses and the Pasteur method of egg production will be enforced upon all the producers the same as in France, Italy and Japan. In these countries the silk farmers are not permitted to hatch any eggs that have not been secured from these registered and licensed producers.

The improvements in mulberry raising used by the farmer can be accomplished by educational work which will necessarily be slow to yield results, but in as much as it is intensive cultivation, the time element is not as important a factor as it is in the elimination of disease.

The improvement and extension of means of transportation will be correspondingly slow and will not be of great assistance unless internal transit taxation, which places such a great burden upon the movement of merchandise from interior regions, is removed and the remote districts are enabled to compete with the coastal districts upon a cost basis plus transportation expense. The great Chengtu plain of Central Szechuen is a good example. With a population approximately equal to the main islands of Japan and a raw silk production only exceeded in China by Kwangtung and the Eastern Yangtze Valley, its limited and expensive transportation prevents access to the large raw silk consuming markets and the economic value of its raw and finished silk production is relatively very low.

An improvement which will yield the most rapid and effective increase in the economic value of China's raw silk production is the expansion of the steam filature industry. Only a small portion of the cocoon supply is reeled into high valued silk in the steam filatures. The largest portion is reeled by the farmers and village people by very primitive and wasteful methods into a low valued material.

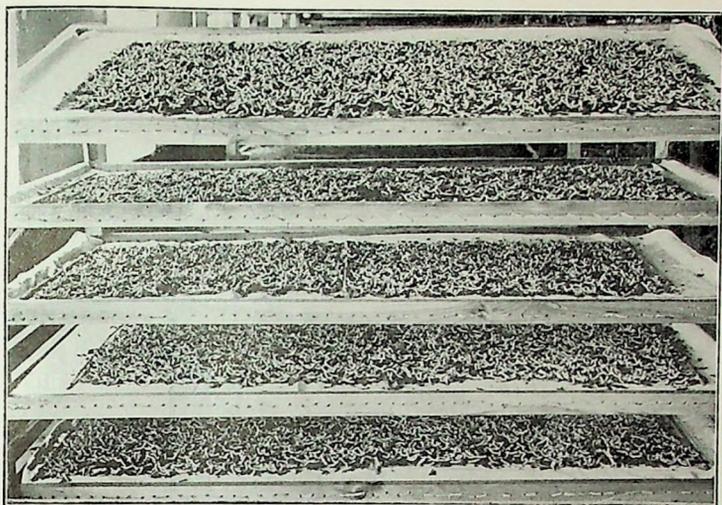
The price difference between steam filature raw silk and the country reeled (Tsatlee) raw silk on the Shanghai market is usually about Tls. 300. per picul and much of the country reeled silk is of such poor quality that it is not saleable on the Shanghai market. Immense quantities of first quality cocoons are thus made into low quality raw silk.

One example of what can be done by the expansion of the filature industry is the city of Nanzing on the Grand Canal between Soochow and Hangchow. It is one of the important country-reeled silk districts. By re-reeling and cleaning the best grades of this silk the silk merchants of Nanzing are able to produce for export an average of 14,000 piculs per year of the "re-reeled Tsatlee." Assuming that only this quantity was reeled into steam filatures and that the resulting raw silk had a value on the Shanghai market \$300 per picul above that which it now has, there would be an economic gain to the district of over \$4,000,000 per

year. The economic loss by country reeling in the great cocoon producing district around Tai Ho (Big Lake) extending as far as Hangchow will probably amount to approximately ten times this amount. This same condition exists in many parts of China. The introduction of steam filatures in the cocoon producing districts, where the country people can be employed to reel the silk into high valued material during the winter months, will add greatly to the economic wealth of those districts and to China. It will not in any way curtail domestic manufacture for the reason that the cocoons must be sorted into grades in the filatures and only high grade cocoons would produce raw silk suitable for export. The medium and low grade cocoons would be used for reeling raw silk for domestic manufacture and would produce for the domestic weavers raw silk at reasonable prices, and of quality superior to that which they are now using. The filature pays the farmers for their cocoons in the districts where cocoons are located more than the farmers receive for their country-reeled silk in the districts where no hong's are located. In addition the farmers are not required to abandon the work in their fields during the most valuable part of the cultivating season, May and June, to reel the cocoons before the moths emerge and ruin them. In every district in China where steam filatures have been established the entire population has been enriched and benefited.

It is therefore highly desirable that the industrial leaders of China should become interested and take a part in the expansion of the steam filature industry into all cocoon producing districts, should encourage and assist the movement for the improvement and extension of the cocoon production and should encourage sericultural education so that modern scientific methods can gradually be introduced in even the remote districts. Investment in filatures and their operation by responsible business men and wealthy families should be encouraged and advocated. The banks should assist, as far as is consistent with good business, by advancing credit and financing investments.

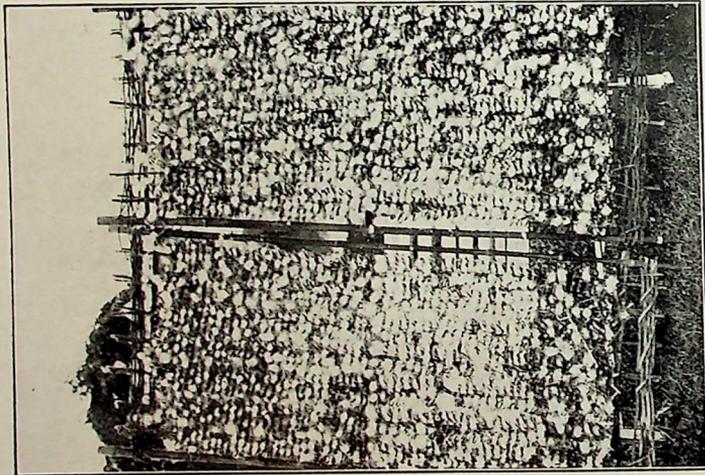
Thus we see that the improvement and expansion of China's raw silk industry will lead to large economic gains for all of the districts where mulberry can be grown, silkworms reared and silk cocoons reeled into raw silk of high market value. It will furnish additional revenue for the government and it will bring to China an increasing amount of foreign money through its sale abroad in larger quantity at higher per unit values. It will assist in balancing China's purchases which she must make abroad to enable her to develop her industries, maintain and expand her railways and develop her extensive natural resources. Raw silk is China's most important means for maintaining a favourable balance of trade with the nations of the world.



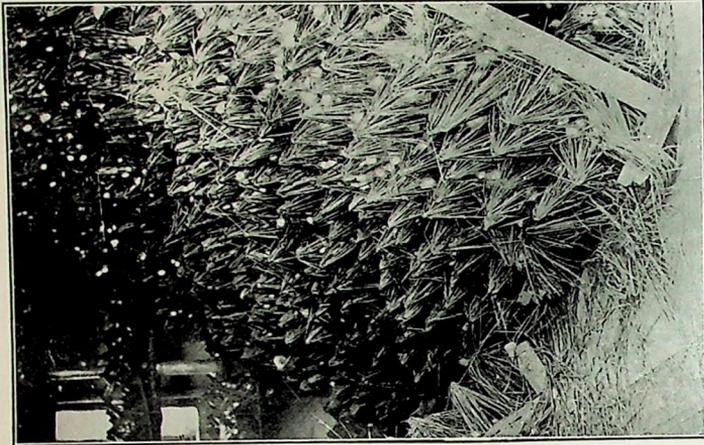
Combined Rectangular Trays and Stands as used by the Experimental Stations.



Photos by Int. Comm. for the Imp. of Ser. in China
Cocoons on Straw Mounts as used in the Kashing District, Chekiang.



Bamboo Wattle Mount for Cocoons as used in Fukien and Other Parts of China.



Photos by Int. Comm. for the Imp. of Ser. in China
Rice Straw Mounts for Cocoons as used in the Huchow District of Northern Chekiang.

A COMPARATIVE STUDY OF COCOONS

BY

R. E. BUCHANAN

(*Manager Shanghai International Testing House*).

As a part of a general plan to encourage and assist the improvement and expansion of Chinese raw silk production, this comparative study of the various qualities and characteristics of disease free and native cocoons of Central China and disease free cocoons of Japan was made to ascertain their comparative values in relation to the manufacture of raw silk in the filatures and to emphasize the necessity for producing high grade cocoons from selected silkworm eggs before any appreciable advance towards a higher economic standard in the raw silk industry of the Yangtze Valley can be made.

Since evenness and uniformity of high grade silk extensively depend upon the uniformity and physical characteristics of cocoons and represent 75 to 80 per cent. of the cost of producing raw silk, it is very evident that the cocoons are the all important factor in the raw silk industry and the one item of investment which must be closely scrutinized at all times so as to prevent a financial disaster in filature management.

The most important single quality of cocoons is the silk content, as shown in the yield, and which is expressed as the number of units of cocoons required to produce one unit of raw silk. The higher the quality of cocoons, the better the yield ratio, that is, the number of units of cocoons per unit of raw silk will be low. This condition indicates that good cocoons are of considerable financial value to the filature.

Another important quality of cocoons is the ease with which the silk can be unwound from the cocoons, and in this study this is referred to as "production per operative per hour." Cocoons that are readily reelable require a minimum amount of time in manufacturing and therefore greatly reduce production expenses. At the same time, they make it possible to produce high grade raw silk with outstanding superior characteristics. Cocoons of poorer quality create a large amount of waste silk in "finding ends" and the filaments when constantly breaking cause, not only loss of time and poor production from a quality standpoint, but also an inferior thread lacking in uniformity. The most experienced and alert reeler cannot produce an even and clean raw silk thread when many breaks occur in reeling cocoons, and the result is always an uneven thread with many defects due to "cast ons." With respect to

evenness, this latter condition is variable in raw silk, depending upon the size of the individual cocoon filaments.

Two main types of tests were made on the cocoons. First, a yield test was made to show the number of units of dry cocoons required to produce one unit of raw silk. This test also gave the percentage of reelable cocoons, raw silk, waste, etc. and produced sufficient raw silk so that the physical characteristics of the various grades could be determined and studied in conjunction with the types of cocoon used.

Second, carefully selected average samples of cocoons were reeled to determine the size of the individual filament and the ease with which the silk could be reeled from the cocoons.

YIELD TEST

Sorting and Peeling: In making the yield test the gross weight of approximately 2,000 grams of dried cocoons was used for each district. The cocoons were first peeled, that is, the outside cover or floss was removed, and then sorted into first grade, second grade, third grade, double, pierced, coloured and refuse cocoons. In grading the cocoons only those that were firm, heavy and free from spots or other imperfections were classed as first grade; second grade cocoons were lighter in weight and less firm, and third grade were the lightest weight and slightly spotted cocoons. The remainder were classified as follows: double cocoons, containing two chrysalises; pierced cocoons, which were pierced by a parasitic worm; coloured cocoons, which were reelable, and refuse cocoons, which could not be reeled.

In the yield table for Japanese cocoons only the net yield is given and several other items common to Chinese cocoons are not reported. The difference is due entirely to the fact that Japanese farmers eliminate refuse, double, coloured cocoons, etc. and remove the cocoon covers or floss before offering them for sale at the buying markets. The yield ratio is on a net basis, while in China, the cocoons are submitted for sale at the markets in the same condition as when taken from the mountings where they have been spun by the silkworms.

REELING

The first, second and third grade cocoons were reeled by lots and the amount of silk obtained from each grade noted. The cocoons were first boiled at a temperature of 212°F. in softened water, transferred to a basin and reeled at a temperature of 160°F. with a six inch crossing. When reeling the first grade cocoons five ends were used by the reeling girl, but because of the poorer quality of the second and third grades, which necessitated greater care in reeling, only four ends were run. The total weight of long waste and the combined chrysalises and pelletes was noted after having been dried to room dryness. The reeling was done by an experienced reeling girl on a power driven reel under good flature control methods.

The variation in the proportion of the different grades of raw silk obtained in the different districts indicates the relative market value



Manufacturing the "Dragon" Mounts for Cocoons as used in the Shanghai and Nanking Districts.



Photos by Int. Comm. for the Imp. of Ser. in China

Scattering fully developed Worms upon "Dragon" Mounts coiled in Baskets. The Worms immediately set about spinning their Cocoons.

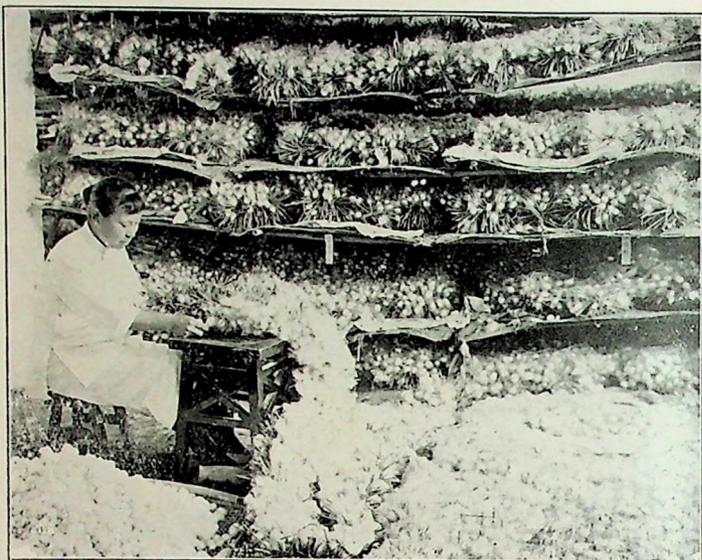


Photo by Int. Comm. for the Imp. of Ser. in China

Taking Cocoons off the "Dragon" Mounts.



Photo by Meri La Voy

A Chinese Farmer selling Cocoons in the Market, Nanking District.

A COMPARATIVE STUDY OF COCOONS

of the cocoons and the superiority of high grade cocoons produced from selected seeds.

SINGLE FILAMENT TEST

A lot of fifty individual cocoons were reeled from each district and only cocoons that were considered average of the sample were used. The cocoons were divided into lots of ten cocoons, peeled, weighed individually and then reeled by a hand reeling equipment. The individual cocoons were boiled at 212°F. in softened water. They were then transferred to another basin and reeled at a temperature of 160°F. The number of meters reeled, number of breaks, weight of the silk reeled, size of filament and yield were recorded for each of the fifty cocoons from which the average results were calculated.

This study confirms the value of high grade cocoons for producing good quality raw silk, not only because of the larger yield of superior fiber and increased quantity of raw silk available therefrom, but because of the increased financial return to the sericulturist, the filaturist and the consumer. Should the time arrive in the not distant future when selected eggs are universally accepted and reared by the farmers according to modern scientific methods, a rapid expansion and improvement of China's raw silk industry can be expected.

STUDY OF 1927

JAPANESE SPRING COCOONS

YIELD TEST

	GUMMA	GIFU	AISHI	NAGANO
Net Yield	3.71	3.76	3.42	3.22
Raw Silk	26.95%	26.51%	29.24%	31.01%
Long Waste	6.80	6.04	6.48	4.74
Chrysalis	58.01	58.34	54.08	53.47
Loss in Reeling	8.24	9.11	10.20	10.78

PROPORTION DIFFERENT GRADES RAW SILK OBTAINED

First Grade	76.3%	86.8%	81.7%	43.80%
Second Grade	23.7	13.2	18.3	56.20

PRODUCTION PER OPERATIVE PER HOUR

First Grade *	59 gms.	57 gms.	60 gms.	66 gms.
Second Grade **	54	45	58	43

SINGLE FILAMENT REELING TEST

Length in Meters	591	606	620	561
Breaks in Reeling	1.6	.8	.9	.1
Breaks per 1000 meters	no	no	no	no
Cocoon Wgt. in grams .. .. .	.768	.724	.800	.646
Wgt. silk reeled in grams .. .. .	.233	.219	.227	.214
Size Filament in Denier	3.57	3.32	3.34	3.32
Net Yield	3.30	3.31	3.52	3.02

Reeling * 5 ends

** 4 ends.

A THREE YEARS' COMPARISON OF CENTRAL CHINA NATIVE COCOONS YIELD TESTS
CHEKIANG PROVINCE

	KIANGSU PROVINCE												CHEKIANG PROVINCE											
	WUSHI				CHANGCHOW				SOOCHOW				HANGCHOW				KASHING				SHAOSHING			
	1927	1926	1925	1924	1927	1926	1925	1924	1927	1926	1925	1924	1927	1926	1925	1924	1927	1926	1925	1924	1927	1926	1925	1924
Net Yield	5.11	4.69	5.40	4.45	4.58	4.92	4.70	4.40	5.70	4.88	4.55	4.41	4.21	4.11	4.54	—	4.83	—	—	—	5.20	—	—	—
Gross Yield	6.27	6.21	6.72	5.70	6.19	6.19	5.23	6.10	5.98	5.82	5.20	4.80	4.81	4.59	5.21	—	5.20	—	—	—	—	—	—	—
Raw Silk	15.96%	16.1%	14.86%	17.55%	16.1%	16.15%	19.19%	16.6%	16.82%	17.2%	19.22%	20.82%	20.5%	21.79%	19.00%	—	19.25%	—	—	—	—	—	—	—
Long Waste	49.77	47.0	53.03	4.50	4.4	4.01	4.58	3.5	6.07	5.5	4.53	6.50	3.7	3.07	4.37	—	4.22	—	—	—	—	—	—	—
Chrysalis	7.5	9.16	10.00	47.6	48.52	55.67	46.0	—	51.60	51.5	51.93	50.47	51.9	53.25	48.90	—	50.45	—	—	—	—	—	—	—
Loss in Reeling	8.55	11.0	9.77	11.52	11.0	10.53	14.49	9.1	15.20	8.5	15.48	13.28	14.7	13.67	5.72	—	10.45	—	—	—	—	—	—	—
Pierced Cocoons	3.94	—	—	3.53	1.9	—	1.49	4.0	1.30	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Coloured Cocoons	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Refuse Cocoons	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cover or Floss	7.13	5.88	6.39	6.1	3.02	6.64	4.20	4.7	6.50	3.4	2.72	3.9	3.9	5.72	7.08	—	—	—	—	—	—	—	—	—
	6.94	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

PERCENTAGE PROPORTION OF DIFFERENT GRADES OF RAW SILK OBTAINED

First Grade	9.7	33.0	29.03	45.8	43.7	40.23	20.7	38.6	20.2	31.2	29.82	38.1	36.9	40.69	19.2
Second Grade	43.5	16.5	16.79	23.5	19.5	41.90	33.3	33.3	33.8	31.0	33.0	36.3	26.1	27.71	38.5
Third Grade	46.3	50.5	—	28.4	37.3	1.60	56.3	53.8	35.0	28.65	36.3	—	26.3	27.71	38.5
Fourth Grade	—	—	—	—	—	10.71	—	—	—	—	—	—	—	—	—

PRODUCTION PER OPERATIVE PER HOUR IN GRAMS

First Grade	85	42	30	29	36	37	31	10	98	42	33	99	37	—
Second Grade	24	22	27	26	16	15	27	30	20	43	21	28	18	—
Third Grade	21	22	27	26	16	15	27	30	20	43	21	28	18	—
Fourth Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—

SINGLE FILAMENT REELING TEST

Length in Meters	395	356	407	394	375	444	449	—	460	458	514	300	468	443	438
Breaks in Reeling	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Breaks per 1000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cocon Wt.	1.79	2.45	1.83	3.75	2.40	1.12	1.91	—	.654	3.83	3.11	2.05	1.54	2.942	.90
Wt. Silk Reeled	.354	.293	.304	.289	.299	.360	.373	—	.399	.425	.518	.496	.372	.431	.431
Size Grams	.093	.079	.07	.083	.078	.079	.02	1.02	—	1.0	1.15	.136	.121	.107	.121
Denier	9.16	1.81	1.84	1.79	1.90	1.90	2.06	—	2.00	2.31	2.43	2.08	2.45	2.19	2.31
Net Yield	3.88	3.93	4.02	3.83	3.79	4.02	3.71	—	4.07	3.85	3.82	4.10	3.54	3.61	4.14

* 5 ends.

** 4 ends.

*** 3 ends.

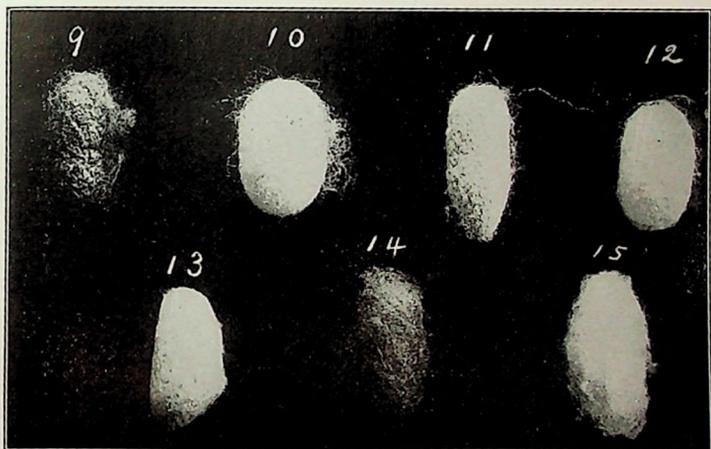
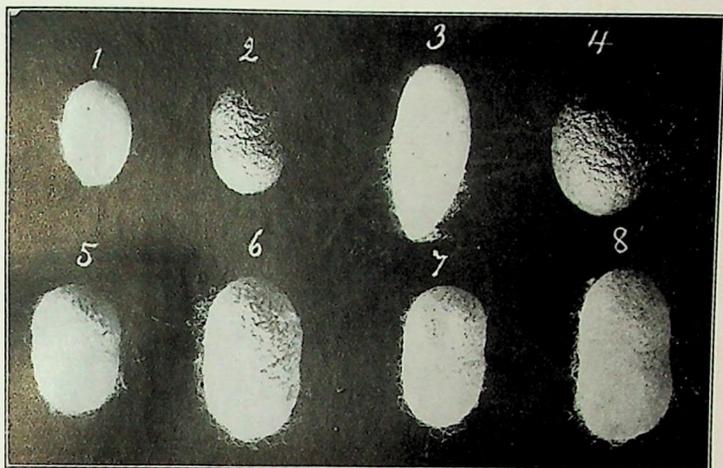


Photo by Int. Comm. for the Imp. of Ser. in China

Various Kinds of Silk Cocoons.

- | | |
|-------------------------|----------------------|
| 1. Wush | 5. Shin Yui |
| 2. Golden (Chinese) | 6. & 7. Chu Kuei |
| 3. Long Pointed (Anhui) | 8. Selected Chu Kuei |
| 4. Yellow (Chinese) | 9. Rose (Chinese). |

13 to 15 Wild (Chinese)

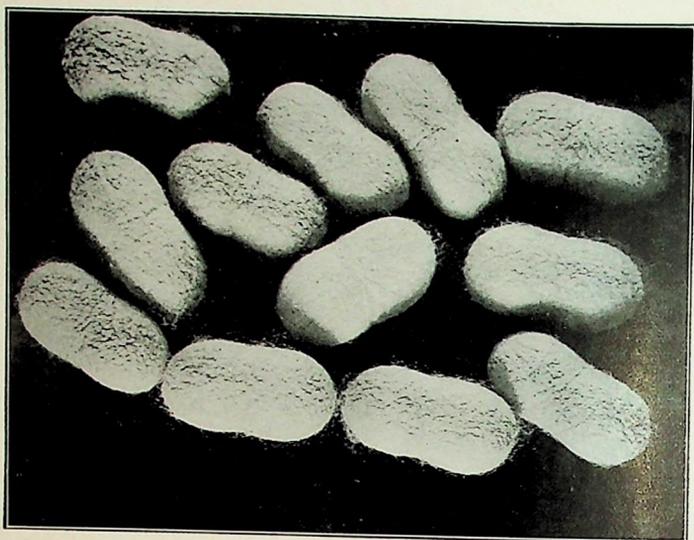


Photo by Nanking University

A few Specimens of very fine Cocoons produced at Nanking University.

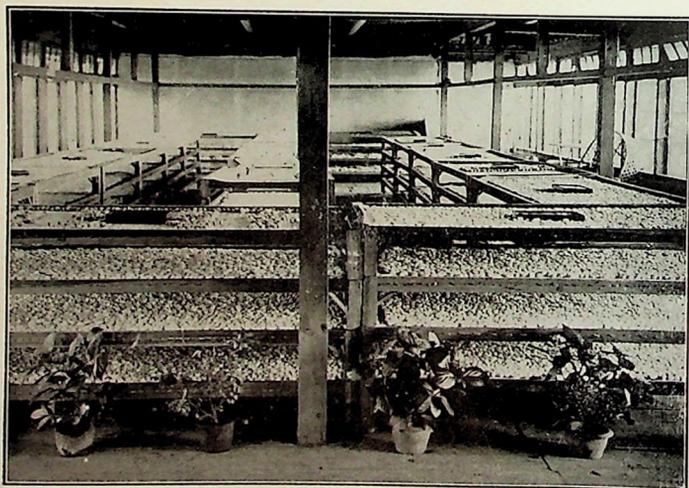


Photo by Int. Comm. for the Imp. of Ser. in China

Exhibition of Cocoons held recently at Nanking.

A COMPARATIVE STUDY OF COCOONS

A TWO YEARS' COMPARISON OF CENTRAL CHINA DISEASE FREE COCOONS YIELD TEST
KIANGSU PROVINCE CHEKIANG PROVINCE

	Districts of							
	WUSHI		SOOCHOW		KASHING		HANGCHOW	
	1927	1926	1927	1926	1927	1926	1927	1926
Net Yield	3.63	3.54	3.73	3.97	3.86	3.59	3.38	4.46
Gross Yield	3.93	4.13	3.97	4.18	4.13	3.93	3.76	4.82
Raw Silk	25.54%	24.9%	25.17%	24.0%	24.10%	25.5%	26.59%	20.7%
Long Waste	4.18	3.0	5.19	2.8	4.05	3.4	3.86	5.9
Chrysalis	52.22	49.9	53.71	48.2	49.65	50.7	48.85	52.5
Loss in Reeling	8.77	8.5	9.68	19.9	15.48	11.9	10.60	13.3
Double Cocoons	2.21	7.3	.24	.3	1.52	3.1	2.73	1.7
Pierced Cocoons .. .. .	.31	.6	.79	—	.22	.2	.63	—
Coloured Cocoons	—	—	—	—	—	—	—	—
Refuse Cocoons	—	1.4	—	—	—	.3	—	.9
Cover or Floss	5.17	5.1	5.22	4.8	4.89	4.9	6.04	5.0

PROPORTION DIFFERENT GRADES RAW SILK OBTAINED

First Grade	70.1%	69.4%	80.8%	75.7%	82.5%	63.5%	48.5%	62.5%
Second Grade **	21.0	11.1	12.0	18.8	11.8	26.4	24.3	20.8
Third Grade ***	8.9	19.5	6.6	5.5	5.7	10.1	27.2	16.7

PRODUCTION PER OPERATIVE PER HOUR

First Grade *	36 gms.	38 gms.	46 gms.	50 gms.	54 gms.	44 gms.	40 gms.	30 gms.
Second Grade **	32	30	33	42	32	23	35	19
Third Grade ***	25	31	33	31	29	19	30	15

SINGLE FILAMENT REELING TEST

Length in Meters	482	511	488	540	458	518	462	472
Breaks in Reeling .. .. .	.11	1.1	.7	2.07	1.47	2.6	.8	2.3
Breaks per 1000 Meters	2.24	2.10	.7	2.07	1.47	4.04	—	4.83
Cocoon Wgt. in Grams .. .. .	.391	.463	.395	.475	.523	.466	.312	.465
Wgt. Silk Reeled in Grams .. .. .	.110	.134	.118	.136	.104	.130	.103	.127
Size Filament in Denier	2.20	2.40	2.20	2.29	2.41	2.04	2.02	2.50
Net Yield	3.28	3.44	3.41	3.56	5.0	3.43	3.08	3.78

Reeling * 5 ends. ** 4 ends. *** 3 ends.

WILD SILK IN MANCHURIA

BY

Y. MORISE

INTRODUCTORY REMARKS

In point of the amount of export, wild, or tussore,* silk in Manchuria falls far behind beans, which rank first in the list of Manchurian staple products. Nevertheless, wild silk has a vast field of uses, and, therefore, is a very important item of world-wide merchandise. In China, besides being woven into pongee, it is often braided into cord for various uses, such as waist-bands and ribbons ("tui-tai-tzu") for fastening trousers. In America and in European countries its uses are still more various—rugs, tassels for decoration, lace, shirts, cloth and many other articles being made from tussore silk. In Japan women's shawls, table-cloths, lace strings, tassel-strings, women's parasols, and the like are made of wild silk, while of late, it is used in the place of cultivated silk for the wings of aeroplanes, packing-cloth for gun-powder and telegraph wire cord.

CHIEF PRODUCING DISTRICTS AND DISTRIBUTION

As to the origin of the wild sericulture in Manchuria, there is no authentic record, but it is most probable that the art of sericulture was first introduced into Kaiping Chow by Shantung immigrants in the Chiaching era of the Chin Dynasty, for Kaiping was the district with which Shantung was most closely linked at that time. The authorities of that period, regarding sericulture as one of the ways of making the most of the district where hills abound, thought it a wise policy to take steps to protect and encourage the industry. As a result those who took interest in it gradually grew in number as the immigrants from Shantung increased, and the rearing of wild silkworms spread out towards north and south, covering at last all the land between the northern part of the Kwantung Leased Territory and out-of-the-way mountainous places in Kirin Province. The most noted places for this industry are Kaiping, Hsiuyen, Antung, and Kwantien Prefectures, followed by Haicheng, Liaoyuan, Fengcheng and Fuchou Prefectures.

The distribution centres in each of the above prefectures are :—

- (a) Kaiping Hsien Prefecture :—Wanfuchuang, Chiehkuanjting ;
- (b) Hsiuyen Hsien Prefecture :—Wutaokou, Imienshan, Paichia-putzu ;
- (c) Antung Hsien Prefecture :—Tahoan ;
- (d) Kwantien Hsien Prefecture :—Changtien, Yungtien, Tapushih ;
- (e) Haicheng Hsien Prefecture :—Litzuyuan, Chaimucheng, Hsiao-kushan ;

* In the spelling of this word we are following Norman Shaw, whose work "Manchurian Tussore Silk" is the best upon the subject.

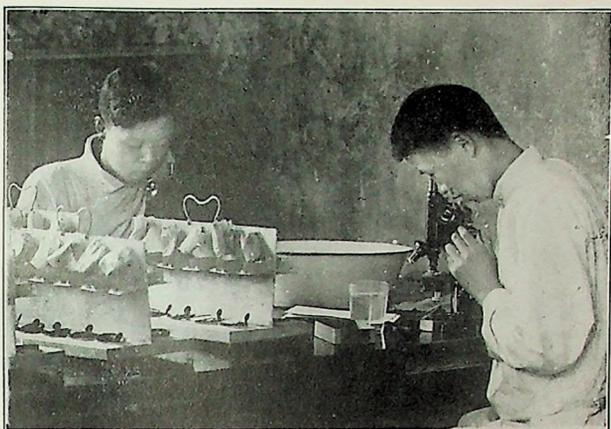


Photo by Nanking University

Examining the Intestines and Abdominal Fluids of Numbered Moths, whose Eggs, if found to be Disease free, will be offered for Sale to the Chinese Farmers.

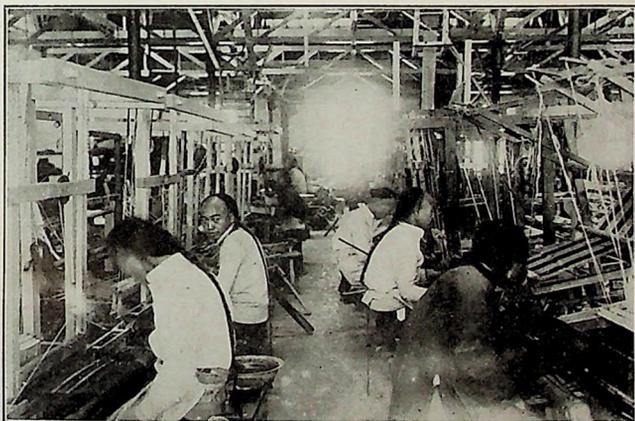


Photo by Y. Morise

Chinese weaving Tussore Silk in Native Looms in Manchuria.

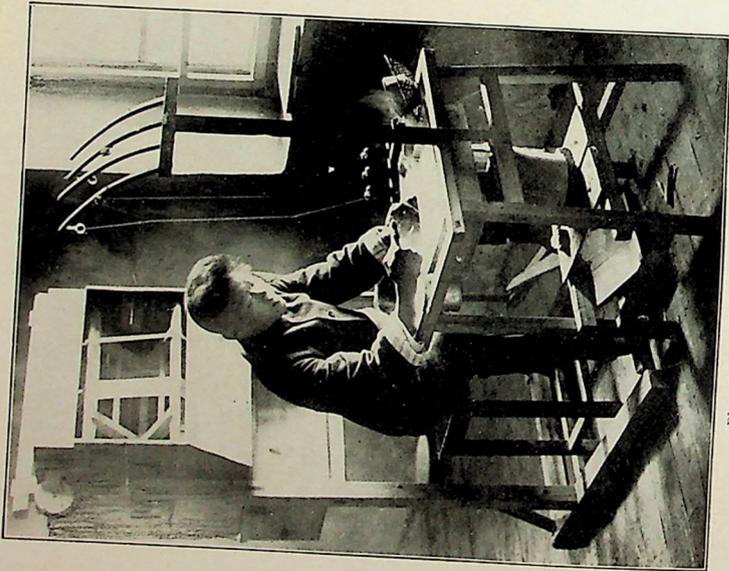


Photo by Int. Comm. for the Imp. of Ser. in China
A Chinese Reeling Machine as used in Central and
South China.

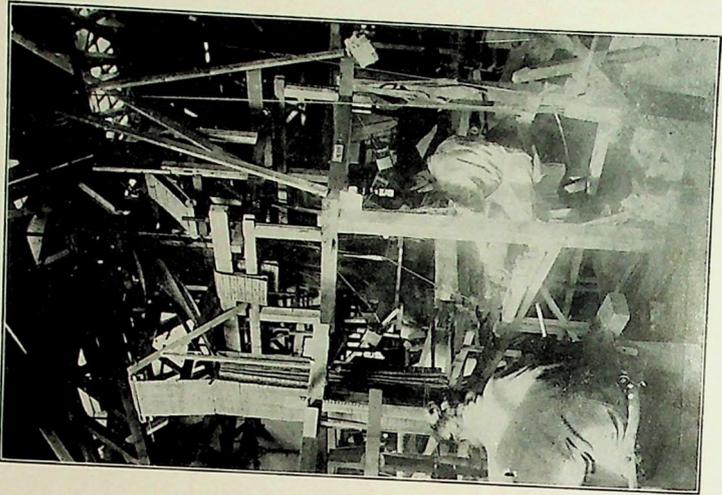


Photo by Y. Morise
Japanese Weaving Silk on Native Looms,
Manchuria.

WILD SILK IN MANCHURIA

- (f) Liaoyuan Hsien Prefecture :—Chienfossu, Laomukou ;
 (g) Fengcheng Hsien Prefecture :—Tanshancheng, Tsaohokou, Chikwanshan, Tungyuanpu, Chiumuchang ;
 (h) Fuchou Hsien Prefecture :—Sungshu, Wanchialing, Chienchang-kou.

The annual yield of wild silk is on an average placed at some 250,000 (cargoes), i.e. 8,000,000,000 (cocoon). Following are figures for the years 1921 to 1925 :—

1921 .. .. .	.. .. .	.. .. .	.. .. .	.. .. .	7,869,000,000 cocoons
1922 .. .. .	.. .. .	.. .. .	.. .. .	.. .. .	7,154,200,000 "
1923 .. .. .	.. .. .	.. .. .	.. .. .	.. .. .	9,059,900,000 "
1924 .. .. .	.. .. .	.. .. .	.. .. .	.. .. .	6,158,300,000 "
1925 .. .. .	.. .. .	.. .. .	.. .. .	.. .. .	11,623,400,000 "

The amount which is carried by the South Manchuria Railway has been increasing gradually since 1921. In 1925 over 12,000 tons of wild cocoons and 1,100 tons of raw wild silk were transported by this line. The accompanying figures may be of interest :

		Wild Silk Cocoons	Raw Wild Silk
1921 .. .. .	.. .. .	.. .. .	.. .. .
1921 .. .. .	.. .. .	10,567.6 tons	813.2 tons
1922 .. .. .	.. .. .	19,995.4 "	1,052.3 "
1923 .. .. .	.. .. .	8,809.2 "	587.9 "
1924 .. .. .	.. .. .	13,895.1 "	949.7 "
1925 .. .. .	.. .. .	12,163.6 "	1,176.6 "

In the statistical table of the amount of wild silk and cocoons forwarded from stations on the S.M. Railway lines, Sungshu and Fenghuangcheng stations are at the head of the list. That which is carried by the line south of Mukden is beaten in amount by that carried by the Antung-Mukden Line.

As to how wild cocoons and silk produced in Manchuria are absorbed at the four markets (i.e. Dairen, Yingkou, Antung and Mukden), the following table will give a general idea :

WILD COCOONS AND SILK (IN TONS) ARRIVING AT DAIREN, YINGKOU, ANTUNG AND MUKDEN.

Market	Dairen		Yingkou		Antung		Mukden	
	Tussore	Tussore Silk						
1921	5,386.4	319.0	1.3	52.5	3,295.7	391.9	387.2	1.7
1922	8,333.7	584.0	7.2	13.7	8,528.9	419.4	401.5	0.4
1923	4,019.3	243.6	17.6	48.9	2,790.8	258.1	24.4	0.9
1924	4,470.9	603.2	12.6	19.7	5,611.0	301.7	372.2	1.9
1925	3,971.4	498.0	2.7	59.9	5,771.3	550.0	284.0	12.8

EXPORT

The export of wild silk products from Manchuria depends upon the result of the year's harvest as well as upon the conditions of the demanding circles. The average export of raw wild silk and pongee for these five years amounts to 128,400 piculs, valued at Hk. Tls. 15,000,000.

Class	Year	1921	1922	1923	1924	1925
		Piculs	8,073	4,130	5,263	2,270	2,078
Wild Silk Yarn	Hk. Tls.	2,184,024	1,737,057	1,770,580	622,404	419,604
Wild Silk Spun Yarn	Piculs	19,873	14,114	21,306	15,127	28,148
	Hk. Tls.	10,693,291	9,501,335	13,463,174	7,707,081	10,960,633
Wild Silk Waste	Piculs	9,640	10,911	21,709	17,873	36,258
	Hk. Tls.	812,534	848,328	1,701,297	750,508	1,053,152
Wild Silk Cocoon	Piculs	92,586	114,307	61,478	48,385	71,006
	Hk. Tls.	2,149,586	3,660,973	2,213,691	1,124,783	1,111,779
Crysalises	Piculs	7,864	9,410	8,911	2,901	7,691
	Hk. Tls.	93,126	123,175	133,091	58,615	92,424
Pongee	Piculs	338	84	82	98	89
	Hk. Tls.	100,329	24,340	30,318	39,719	52,662
Total	Piculs	138,383	152,956	118,749	86,654	145,270
	Hk. Tls.	16,232,890	15,894,207	19,314,151	10,303,110	13,690,245

Let us take the following three items for study more particularly from the view point of the export trade: wild silk cocoons, raw wild silk and pongee.

1. WILD SILK COCOONS.

The export of wild silk cocoons produced in Manchuria has decreased correspondingly to the rise of the local reeling industry. The total exports from the three ports Dairen, Antung and Yingkou, are estimated, on an average of five years, at some 849,000 piculs, valued at Hk. Tls. 2,150,000.

Year	Antung	Yingkou	Dairen	Total
1921	35,873	81	64,496	100,450 Piculs
1922	59,078	15	64,624	123,717 "
1923	28,074	60	42,255	70,389 "
1924	28,658	298	22,330	51,286 "
1925	38,150	81	40,466	78,697 "

WILD SILK IN MANCHURIA

The percentage indicated by the above table for each port is : 56 per cent. for Dairen ; 44 per cent. for Antung ; and less than 1 per cent. for Yingkou. The reeling industry in Antung districts having developed remarkably, cocoons have come to have a good market there. The export to Chefoo, which is the best market for cocoons, is from Dairen. Yingkou, which was once prosperous in exporting cocoons with Haicheng and Kaiping for its hinterland, has now been deprived of its prosperity by Dairen and Antung. Yingkou now retains only a shadow of its former roaring trade in the exportation of pongee.

As will be seen in the following table of destinations of cocoons, Chefoo stands first, importing 60 per cent. or 70 per cent. of the whole volume. Cocoons produced in Shantung falling short of the demand there, large quantities of Manchurian cocoons find a ready sale in Chefoo.

	Destination	Year				
		1921	1922	1923	1924	1925
Japan	Proper Korea	243	603	155	1,626	100 Piculs
		—	24	2	109	— „
	Total	243	627	157	1,735	100 „
China	Shanghai	145	—	—	27,626	862 „
	Lungkao	15	373	118	75	166 „
	Chefoo	60,373	63,931	42,113	21,614	77,522 „
	Tsingtao	17	102	28	202	3 „
	Etc.	39,657	58,684	27,973	34	44 „
	Total	100,207	123,090	70,232	49,511	78,597 „
	Grand total	100,450	123,717	70,389	51,286	78,697 Piculs

2. RAW WILD SILK.

The export of raw wild silk develops a tendency to increase in a reverse ratio to the decrease of the export of cocoons.

	Antung	Dairen	Yingkou	Total
1921	25,247	7,951	4,397	37,595 Piculs
1922	19,959	9,276	1,920	29,155 „
1923	28,962	14,533	4,783	48,278 „
1924	22,025	9,793	3,453	35,270 „
1925	39,443	16,243	10,798	66,484 „
	(Spun yarn and silk waste included.)			

As the above table shows the greater part of the wild silk yarn export is through Antung : 59 per cent. from Antung, 25 per cent. from Dairen and 11 per cent. from Yingkou. Wild cocoons, produced abundantly

THE CHINA JOURNAL

in the Antung-Mukden Line zone and about Antung, have given rise to a flourishing reeling industry in this general district.

As to the destination of the raw wild silk, a good proportion of the export of this commodity from the three ports in Manchuria is destined for Japan, as will be seen from the following table :

DESTINATIONS OF THE WILD SILK EXPORTED FROM THREE PORTS IN MANCHURIA.

	Destination	Year				
		1921	1922	1923	1924	1925
Japan	Proper	20,960	12,346	17,359	12,341	21,009
	Korea	24	1,003	75	7	15
	Total	20,984	13,349	17,434	12,348	21,024
China	Shanghai	7,519	8,643	15,660	21,771	43,286
	Lungkao	2,753	907	1,519	530	1,130
	Chefoo	1,575	1,414	1,505	495	639
	Others	4,755	4,824	11,773	27	52
	Total	16,602	15,786	30,457	22,825	45,107
Other Countries		9	20	387	100	353
Grand Total		37,595	29,155	48,278	35,270	66,484

3. PONGEE.

Pongee exports from the three ports in South Manchuria are insignificant. Yingkou has practically no such trade, while the pongee which is exported from Dairen and Antung altogether does not reach 100 piculs a year.

THE AMOUNT OF THE PONGEE EXPORTS FROM THREE PORTS IN SOUTH MANCHURIA.

Ports	Year	1921	1922	1923	1924	1925
		Antung	Piculs Hk. Tls.	239 59,750	26 6,500	37 12,490	67 26,761	53 36,714
Dairen	Piculs Hk. Tls.	97 39,729	54 17,111	45 17,828	31 12,400	32 12,852
Yingkou	Piculs Hk. Tls.	2 850	— —	— —	— —	4 1,644
Total	Piculs Hk. Tls.	338 100,329	84 23,611	82 30,318	98 39,150	89 51,210

WILD SILK IN MANCHURIA

DESTINATIONS OF THE PONGEE EXPORTED FROM THREE PORTS IN SOUTH MANCHURIA.

	Destination	Year				
		1921	1922	1923	1924	1925
Japan	Proper	11	4	18	3	2 Piculs
	Korea	226	22	17	54	— „
	Total	237	26	35	57	2 „
China	Shanghai	6	3	4	15	79 „
	Lungkiao	—	2	—	—	— „
	Chefoo	14	11	18	7	3 „
	Tsingtao	76	39	22	18	3 „
	Others	2	—	3	1	2 „
	Total	98	55	47	41	87 „
Grand Total		335	81	82	98	89 „

THE WILD COCOON AND SILK MARKET.

Wild silk is affected by fluctuations of the general economic world, but not so strongly as in the case of cultivated silk. Generally the former follows the trend of the latter, as their uses are nearly alike.

The following tables show the market prices of wild cocoons and silk at Antung, which is the centre of this industry in Manchuria. Wild cocoons in Manchuria are quoted in Chenping silver at Antung, and in Feng-piao elsewhere, the unit of calculation being one thousand cocoons. Wild silk is quoted in Chenping silver at Antung and Kaiping silver tael, the unit of calculation being one bale (100 kin).

MONTHLY QUOTATIONS OF WILD COCOONS AT ANTUNG FOR THE LAST THREE YEARS (IN THOUSAND COCOONS AND IN CHENPING SILVER).

Months	Year			1924			1925			1926		
	Sup-er-ior	Med-ium	In-fer-ior	Sup-er-ior	Med-ium	In-fer-ior	Sup-er-ior	Med-ium	In-fer-ior	Sup-er-ior	Med-ium	In-fer-ior
January	3.80	3.50	2.50	1.83	1.75	1.40	3.00	2.80	2.60			
February	3.50	3.20	2.30	1.65	1.55	1.30	3.10	2.90	2.70			
March	3.00	2.80	2.10	1.51	1.42	1.23	2.90	2.70	2.50			
April	2.50	2.30	1.90	1.32	1.24	1.20	3.00	2.80	2.40			
May	2.00	1.80	1.50	1.43	1.36	1.25	—	—	—			
June	—	—	—	—	—	—	—	—	—			
July	—	—	—	—	—	—	—	—	—			
August	—	—	—	—	—	—	—	—	—			
September	1.90	1.80	1.30	2.27	2.10	1.60	—	—	—			
October	1.55	1.40	1.10	2.03	1.94	1.53	3.10	3.00	2.80			
November	1.80	1.60	1.20	1.62	1.56	1.30	3.50	3.10	2.90			
December	1.80	1.60	1.25	1.67	1.58	1.32	3.20	3.00	2.80			

THE CHINA JOURNAL

MONTHLY QUOTATIONS OF THE WILD SILK AT ANTUNG
IN 100 KOKU.

	SMALL REEL SILK				LARGE REEL SILK	
	(Superior)	(Weft)	(Second Grade)	(Inferior Grade)	(First Grade)	(Second Grade)
January	438	428	375	350	272	240
February	456	449	392	363	257	233
March	450	428	398	360	342	273
April	445	436	422	373	268	227
May	444	434	385	345	280	255
June	468	455	397	363	280	247
July	463	437	423	397	173	163
August	505	485	467	417	180	150
September	538	506	480	450	223	190
October	573	565	537	530	217	193
November	596	577	552	515	220	180
December	588	572	537	500	210	195

COMPARATIVE TABLE OF WILD SILK QUOTATIONS AT ANTUNG
FOR THE LAST TEN YEARS (IN 100 KIN).

	SMALL REEL SILK				LARGE REEL SILK	
	(Superior)	(Weft)	(Second Grade)	Inferior Grade)	(First Grade)	(Second Grade)
1917	355.00	—	—	—	200.00	—
1918	216.50	—	—	—	160.00	—
1919	299.00	—	—	—	231.00	—
1920	425.00	—	—	—	284.00	—
1921	567.60	530.00	521.00	402.00	313.00	276.00
1922	829.00	696.60	777.00	692.00	615.00	462.00
1923	881.00	841.00	785.00	655.00	520.00	432.00
1924	638.00	606.00	564.00	—	—	—
1925	464.00	446.00	420.00	390.00	—	—
1926	497.00	480.80	447.80	413.60	243.50	212.20

Quotations between 1917 and 1920 in the above table show prices on an average of both large and small reels of wild silk.

TRADE BETWEEN MANCHURIA AND JAPAN.

As shown in the following table wild silk, among the others, is exported in the largest quantity to Japan from three important ports in South Manchuria. The amount reaches 15,000 piculs annually. In 1926, 67 per cent. of the total exports of wild silk from these ports went to Japan, while the total exports of wild cocoons reached 40,000 piculs in the same year, nearly all of which went to various ports in China, mainly to Chefoo, Shanghai, and Lungkou.

WILD SILK IN MANCHURIA

The following tables show various ports of destination for wild cocoons for the last five years.

PORTS OF DESTINATION FOR WILD COCOONS EXPORTED FROM
THREE PORTS IN MANCHURIA.

	Year	1927	1926	1925	1924	1923
Japan	Cocoons	35	100	1,626	155	603 Piculs
	Wild Silk	16,774	19,197	12,341	14,375	10,402 "
	Silk Waste	4,233	1,812	—	2,984	1,944 "
China	Cocoons	40,329	78,518	50,869	70,232	123,268 "
	Wild Silk	7,842	8,914	4,959	11,807	7,132 "
	Silk Waste	17,803	34,263	16,558	18,650	8,696 "
Others	Cocoons	40,364	78,618	52,604	70,389	113,895 "
	Wild Silk	24,816	28,473	17,407	26,569	18,286 "
	Silk Waste	22,060	36,081	16,558	21,709	10,911 "

WILD COCOONS, ETC., EXPORTED FROM ANTUNG.

		1927	1926	1925	1924	1923
Japan proper	Piculs	25	Cocoons 88	1,347	149	572
	Hk. Tls.	525	1,494	77,972	4,470	16,843
	Piculs	16,521	Wild Silk 18,839	12,100	14,134	10,189
	Hk. Tls.	6,959,758	7,469,113	6,110,405	8,593,520	7,039,900
	Piculs	3,655	Silk Waste 1,812	—	2,988	1,944
	Hk. Tls.	133,366	33,373	—	300,438	93,081
Others	Piculs	8,192	Cocoons 38,150	29,976	28,074	59,078
	Hk. Tls.	198,725	620,041	660,466	930,752	2,116,888
	Piculs	18,583	Wild Silk 18,851	12,982	17,290	12,292
	Hk. Tls.	7,764,817	7,472,558	6,516,119	10,357,460	8,287,200
	Piculs	12,408	Silk Waste 18,664	7,727	11,672	5,667
	Hk. Tls.	509,845	562,696	328,404	994,619	403,434

The above table shows that almost all of the wild silk exported from Antung went to Japan. The exports for the last five years reached, on the yearly average, over 14,000 piculs. On the other hand, almost all of the wild cocoons, exported in a very scanty amount, go to Chefoo.

THE CHINA JOURNAL

WILD COCOONS, ETC., EXPORTED FROM PORT OF DAIREN

		1927	1926	1925	1924	1923
Japan proper	Piculs	10	Cocoons 12	3	6	31
	Hk. Tls.	639	120	54	172	692
	Piculs	253	Wild Silk 358	241	241	213
	Hk. Tls.	115,759	130,566	92,047	132,316	124,392
	Piculs	18	Silk Waste	—	1	—
	Hk. Tls.	1,152	—	—	68	—
Others	Piculs	32,172	Cocoons 40,466	22,330	42,255	54,802
	Hk. Tls.	693,437	578,902	569,667	1,416,389	1,667,968
	Piculs	6,011	Wild Silk 8,663	3,873	8,013	5,303
	Hk. Tls.	2,651,124	2,961,984	1,595,393	4,469,053	2,596,567
	Piculs	5,178	Silk Waste 7,580	5,930	6,520	4,015
	Hk. Tls.	333,186	204,660	231,270	443,360	334,369

Not more than ten piculs per annum of the wild cocoons are being exported from Dairen to Japan. Only 240 to 250 piculs of wild silk goes to Japan, the rest being destined to various ports in China.

Judging from the above facts, Antung, among the three important ports in Manchuria, is closely linked with the trade between Manchuria and Japan. As the textile industry in Japan develops, as it has in recent years, the export of wild silk and cocoons from Antung to Japan increases. Thus the greater proportion of the wild silk is being exported to Japan, that is, to Fukui and Gifu, where it is converted into pongee for exportation to America and other foreign countries.

TUSSORE SILK: From the forgoing article it will be seen how important is the wild or tussore silk industry in South Manchuria. Northern Shantung is, however, the most important manufacturing district of tussore, the silk fabric from this area being known all over the world as pongee. In "Scientific Notes and Reviews," page 275, will be found a short account of the tussore silk moth and worm.

SILK EXPERTS VISIT THE ORIENT: Of great importance to silk interests in the Far East is the visit now being made of the American Silk Classification Committee, headed by Mr. Cheney. The members of this committee arrived in Japan some weeks ago, the first sitting of the Silk Classification Conference being held at Yokohama on April 19, when the scientific method as used in the United States of testing raw silk was demonstrated by Mr. Boshard. Mr. Cheney did not arrive in Japan till April 30, owing to illness. The whole committee expects to leave Kobe for Shanghai on May 16.

EDITORIAL COMMENTS

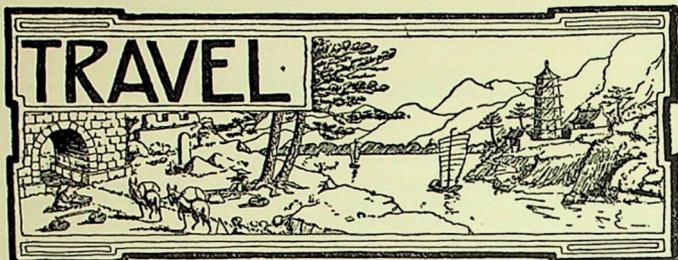
SILK FOR PAINTINGS IN CHINA

Various varieties of silks have been used for paintings. There was a coarse silk known as chüan (絹) and divided into two classes, one unsized—sêng (生絹), and the other sized—shu (熟絹). There was also white silk known as chien (練); and a thin silk gauze known as ling (綾). Silk was used for paintings more often than paper, which was reserved for script, but some artists used both materials. It is said of Li Kung-lin (李公麟) that he always used paper for original paintings and silk for reproductions of the work of others. Those who had the most perfect control of their brushes, like Mi Fei (米芾) and Chao Méng-fu (趙孟頫), used paper for their best work. The earliest silk was coarsely woven. It is doubtful whether or not we have any existing samples of silk anterior to the T'ang dynasty, though it is claimed that there are paintings of the Han dynasty done on silk of that period in the Stein collection of the British Museum, taken from the Tun-huang Stoa House (敦煌石室). I have a sample of this silk and cannot distinguish it in any way from the coarse silk—sêng chüan, of the T'ang dynasty, of which there are detailed descriptions in literature and of which I have an example. This kind of silk was used by Yen-Li-pên (關立本). There is also another type of T'ang silk, which is called lien chüan (練絹), or prepared silk. It is silk which has been beaten on a polished stone with a stick, sometimes covered with silver, until the interstices between the threads are filled and the silk has a continuous surface. This prepared silk was first used by Chou Fang (周昉) in his delineation of court scenes, and an example of it may be seen in the scroll by him in the Metropolitan Museum. The silk of the Sung dynasty had double strands for both warp and woof, being called shuang-sü chüan (雙絲絹); or the warp had double strands and the woof a single one. The latter was called tan-sü chüan (單絲絹). In addition to this silk, there was a coarser type known as "academy silk," yüan chüan (院絹), on account of it having been especially prepared for the use of the academicians. It was woven into various widths, the widest being seven or eight feet. Many of the surviving ancient pictures of China are on this type of silk. They were made in the Sung Academy of Painting and are reproductions of the work of great masters. The silk of the Yüan dynasty is practically the same as that of the Sung, with the exception that the double-stranded variety does not seem to have been produced. The Ming dynasty silk has single coarse strands both for warp and woof. It is similar to the coarse silk of the T'ang dynasty, but more closely woven. It was customary for early artists to size their own silk, but at the present time artists purchase from shops silk that has already been sized.

During the Ming dynasty there was still available quite a large supply of silk and paper made during the Sung dynasty, and it was common for artists of the Ming dynasty to use these materials of an earlier age. In the records of the Imperial Collection during the reign of the Emperor Ch'ien Lung as found in *Shih Chü* (石渠寶笈), Vol. VIII, P. 26, examples are given of Ming dynasty paintings which were done on the paper or silk of the Sung dynasty.

(Extract from Chapter III of a new book on "Chinese Painting" by John C. Ferguson).

J. C. F.



THROUGH THE SILK PRODUCING DISTRICTS OF CENTRAL CHINA

BY

ARTHUR DE C. SOWERBY

The term Central China as used in connection with the silk producing industry is somewhat misleading, for it includes the two provinces of Kiangsu and Chekiang and part of Anhui, an extensive more or less flat stretch of country lying between the Yangtze and Chientang Rivers on the eastern seaboard of the Republic of China. In the main it is an immense alluvial plain, undoubtedly originally laid down by the two rivers already mentioned, sparsely scattered in the east with low hills, which increase in number and extent as one moves westward, finally predominating in the west. Immense shallow lakes lie in the central and western areas while the whole of the flatlands are cut up by innumerable canals, creeks and ditches, practically all of which are effected by the tide, and are used to irrigate the fields of rice and other crops that grow abundantly in these rich areas. This network of waterways constitutes the highways of this region, practically all transport being by boat, and only narrow foot-paths crossing the fields between the villages, hamlets and farmsteads that are thickly scattered over the whole country. The number of these waterways is astounding, and in many areas it is impossible to walk a quarter of a mile in any direction without having one's progress impeded by a ditch or creek of larger or smaller dimensions. Undoubtedly by far the greater number of these ditches and creeks have been artificially created; in fact, they actually constitute an incomparably fine system of both drainage and irrigation, whereby what must originally have been an immense tidal swamp or marsh has been converted to the use of man, the agriculturalist. And so rich an area has it made, it now supports an enormous human population, whose density is probably not exceeded anywhere in the world. In every direction are large and important walled towns, with here and there great cities, between which

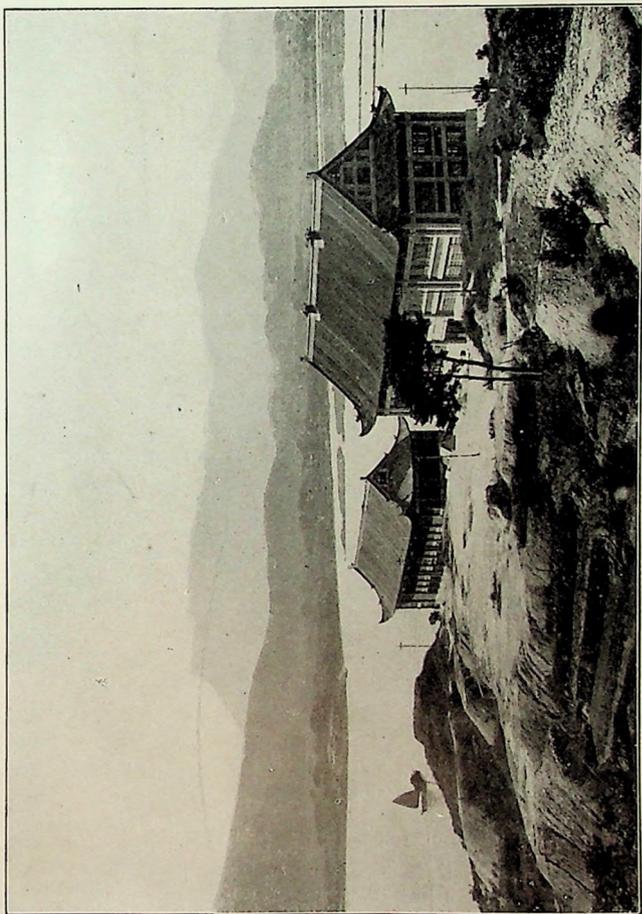
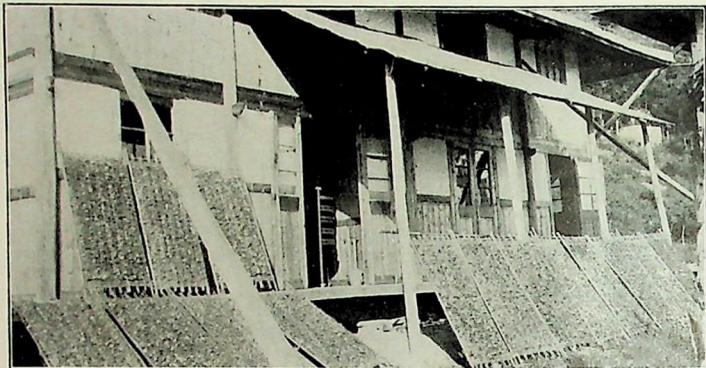
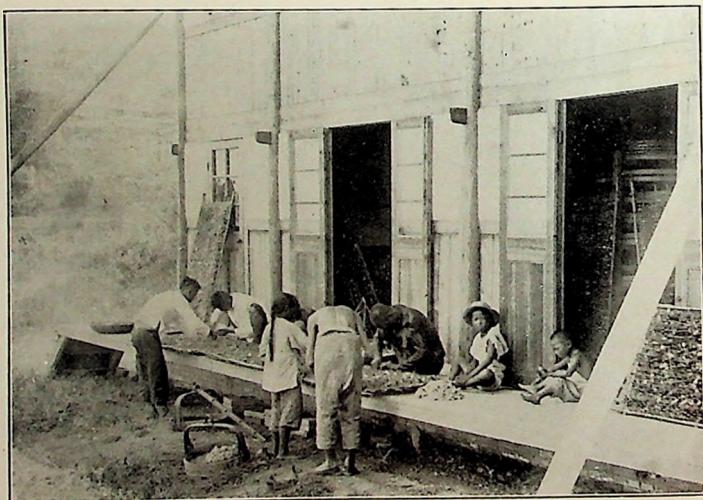


Photo by C. R. Kellogg

Buildings of the Fukien Christian University overlooking the Min River, Foochow, Fukien.



Bamboo Wattle Cocoon Mounts receiving an airing. Fukien Christian University.



Photos by C. R. Kellogg

Sorting Cocoons at the Experimental Station at the Fukien Christian University.

THROUGH THE SILK PRODUCING DISTRICTS OF C. CHINA

lie innumerable villages which in turn form the centres of countless hamlets and farmsteads, filled to overflowing with busy, industrious people.

This huge population of brown-skinned, toiling peasants draws its entire support from the rich, black soil, which is cultivated with an intensity that is almost unbelievable. For only a very few months of the year does any of it ever lie fallow, crop succeeding crop in bewildering regularity. During the winter the soil is heaped up into broad ridges with deep drainage ditches between, and planted with broad beans which come to fruition early in the summer. In the spring immense areas are similarly devoted to rape; so much so that sometimes for miles the country presents an unbroken sheet of golden-yellow blossoms, while the whole air is filled with an indescribable fragrance. Wheat also is grown in this way; while in spring, too, many of the fields are given over to a sweet-smelling clover or trefoil that carpets the ground with mauve-pink. Shortly the broad-beans, wheat and rape are harvested, and immediately the ridges are flattened out, and, behold, new crops appearing, soya beans, black beans, cotton and rice, the last in specially flooded fields. When these are at last gathered in, in the Autumn, many of the fields are called upon once more to yield of their strength, this time in the form of the ubiquitous cabbage and many other crops of the market garden order.

Between the fields and along the banks of the creeks and canals another and most important plant is cultivated. This is the mulberry, whose leaves form the staple diet of the silk-worms, to the cultivation and rearing of which the whole population is given over. The mulberry trees and bushes are grown on broad ridges raised some two to three feet above the level of fields they bound. These ridges are anywhere from five to twenty feet wide, and, as already stated, they line the banks of the creeks and canals, probably to the extent of 50 per cent, and their total yield of leaves for sericulture must be prodigious, running into millions of tons annually.

Finally, scattered over the flat areas are numerous groves of bamboo and shrubs or small trees of various kinds, usually to mark some family burial ground, while over the hills trees, low brush and scrub form a pleasing mantle of verdure. In some places pines are cultivated.

Needless to say this fertile plain with its ambient hills, rich crops and numerous red-walled temples and pagodas, frequently presents views of exquisite beauty; while the sportsman enjoys much excellent shooting, pheasants, wild ducks, teal and snipe, according to their seasons, being abundant.

Chickens, ducks, pigs, goats, humped cattle and water-buffaloes are reared, the first two in great numbers for their eggs and consumption in the towns, and the last two for draft purposes and the turning of water-wheels whereby the rice-fields are irrigated.

It will be seen, then, that this great area is entirely self-supporting. All manner of foods are produced locally, while silk and cotton, woven by the natives into fabric, supply the wherewithal for clothing. From the seed of the rape oil is expressed, which is used for cooking and may be used for lighting. From the soy bean sauces are made, while fresh green vegetables and fruits are grown sufficient for the needs of the inhabitants.

For fuel the stems of the crops and the scrub of the hills are used, while the reeds and rushes of the creek banks and swamps, the pines and quarries of the hills and the clay of the flats supply material for building. Even salt is produced in this area, famous salt pans existing along the coast between Chapu and Haice, or Hai Yen (lit. Sea Salt).

The great export is silk the bulk of which in the form of cocoons finds its way, passing through various hands, to Shanghai, which, of course, is the main port and largest city in the whole area. Other important cities are Soochow, Wusih, Chinkiang, Nanking, Hangchow, Huchow, Sungkiang and Kianing.

The southern terminal section of the Grand Canal runs from Chinkiang to Hangchow; while the Whangpoo River (Huang Pu), upon which lies Shanghai, drains a large section of the central area, having its origin somewhere in the hills of Chekiang and passing through the great lakes.

From the mouth of the Yangtze to Hangchow along the entire coast extends a high dyke, keeping out the sea, which otherwise during periods of high tides or storms might flood the country.

It is only natural that in an area cut up as this is with waterways there are an enormous number of boats of every shape and size, while a very large proportion of the population earn their livelihood on the water. Indeed, there are hundreds of thousands who are born, live and die in their *sanpans*, as the native craft are universally called. Many are fishermen, spending their lives in the pursuit of the finny denizens that swarm in the creeks and lakes. Every conceivable method of taking fish is used, fish-traps and booms, long nets, seine nets and dip-nets being among the chief of these.

That Western influence is penetrating this fertile and thickly populated area is evidenced by the sound of imported machinery in every town and large village and even in many of the hamlets, while everywhere clothes made of foreign material may be seen, as well as kerosene oil and lamps. Some, at least, of the wealth brought in by the sale of cocoons is in the form of foreign imported goods. Two important railways tap our region, one running from Shanghai to Nanking, the other from Shanghai to Hangchow; while many steam launches and fast motor launches maintain regular services from one place to another along the canals; but the bulk of the traffic is, and for some time to come will be, carried by native craft.

THE INTERNATIONAL COMMITTEE FOR THE IMPROVEMENT OF SERICULTURE IN CHINA: For details of the work of this organization during the past year (1927), the reader is referred to its Ninth Annual Report which has just been published. From this it may be seen that good work is being done. We have to thank Mr. Chang Ping Ho, who is in charge of the experimental station in the French concession, Shanghai, for many of the pictures used in this issue.

REPORTS FROM SILK IMPROVEMENT AND EXPERIMENT STATIONS IN CHINA FOR 1927

SERICULTURAL WORK FOR 1927 AT THE CHEFOO SILK IMPROVEMENT COMMISSION.

The Commission was started in 1920 for the purpose of improving all local silk products with the idea of increasing the trade and prosperity of the country in general. The Committee as organized in 1927 comprised a Chairman, who is the Superintendent of Customs, Vice-chairman and Treasurer the Commissioner of Customs, two representatives of the Chefoo Silk Guild, two representatives of the Foreign Silk Association, one Chinese sericulture expert and a foreign administrator. The Commission is financed by funds remitted on the duty of silks exported, and since its inception has received approximately Taels 400,000 for sole expenditure in advancing the aims of the organization.

1927 EGG PRODUCTION.

For the year, 300,000 mulberry layings and 20,000 oak layings (tussore) were produced by the Commission's staff, these amounts representing fifty per cent. increased production over 1926. The supply of selected eggs has been gradually increased each subsequent year, and for 1928, it is expected the production can be doubled. These eggs have always been distributed free of charge to selected sericulture farmers, as it has been the responsibility of the Commission to foster the interest and demand for their ultimate use; and as a result the prospects are very favourable for disposing of them at a nominal price beginning in 1929. There are no local organized egg producers, so the farmers who are inclined towards the use of disease free eggs have been obliged to patronize the Commission's eggs.

DISTRIBUTION OF ACORNS AND MULBERRY SEEDLINGS.

For 1927 approximately 6,000 piculs of acorns were distributed among farmers without cost to assist scrub oak planting in connection with oak silk culture. There are vast spaces of suitable but undeveloped land in Shantung for oak culture, and by developing the food for tussore worms, it eventually will mean the building up of a local industry. Within the past seven years the Commission has influenced the planting of sufficient oak to increase the area of same in Shantung Province by 53,000 *mow*. As it takes seven years for an oak of the local variety to reach maturity, the first trees planted in 1920 were ready for utilization as food for the worms in 1927. Mulberry seedlings have also been distributed free, and in a like manner the area of trees has steadily multiplied. For 1927 about 150,000 seedlings of the native Shantung variety were planted by farmers in the interior districts of the province adjacent to the immediate Chefoo district.

DEMONSTRATION WORK.

The Commission maintains five sub-stations in the country districts where scientific rearing and instruction is practiced for the benefit of the farmers. Each station is staffed with a sericulture assistant in charge, two training students from the main experiment station in Chefoo, overseers and eight coolies. The advantage of this type of work is fully recognized by the silk interests, and as conditions and finances permit this work will be expanded without limit.

CHEFOO SILK COLLEGE.

A course of instruction in sericulture has been offered continually for a number of years in which the students, apart from regular class instruction, are given practical work in mulberry and oak culture, worm rearing and raw silk reeling. Forty girl students were taking the course in 1927. About eighty students have finished the course since it was first offered by the Commission, the majority of which have returned to their native places, probably to carry on diversified phases of the silk

THE CHINA JOURNAL

improvement work learned while a student. There is no record of any of the students going to commercial egg production work, probably because sufficient impetus in the movement for selected eggs has not yet been gained.

SILK REELING.

Twelve reeling basins of the Shanghai type (copied Italian makes) have been installed at the College, and woman are being trained how to reel mulberry cocoons. A limited amount of testing equipment is in use, principally for the examination of the physical qualities upon silk reeled.

The Commission is glad to report that the confidence of the growers has been gained in many districts to which Chefoo is the port, a fresh and strong interest in the improvement of silk culture and the silk industry has been created, and a huge benefit from the use of selected eggs has been proved.

G. KRUPER,
Foreign Administrator.

Chefoo, China.
November, 1927.

SERICULTURE WORK FOR 1927 AT THE UNIVERSITY OF NANKING.

1927 EGG PRODUCTION.

Our 1927 production marked the third time for a production of more than a million layings of eggs. The exact number of layings was 1,072,495 as against 1,157,540 for 1926 and 1,124,400 for 1925. In view of the disturbed political and military conditions, this year's record is a much better one than either of the two previous years. There was a further increase in efficiency in production over previous years, the quality of the individual layings was higher, the percentage of disease is much smaller, running about four per cent. as against eleven per cent. for 1926 and sixteen per cent. for 1925. In spite of the somewhat small gross production, the net production in salable layings of eggs is greater than for 1926 or 1925.

1927 EGG DISTRIBUTION.

The results of our spring distribution of eggs were uniformly excellent and recent trips into the localities where our eggs had been used last year indicated a much greater demand for next year. The results secured by the farmers from the eggs distributed under our direction were most gratifying, and the reputation of our Golden Butterfly Chop has been very greatly enhanced.

MULBERRY PRODUCTION.

Our mulberry orchards produced about sixty per cent. of the leaves which were used last spring. The old orchards as well as the new are in excellent condition and it is hoped that the total needs in mulberry leaves for our 1928 production can be met from our own orchards. This will not only react favourably in keeping down the incidence of disease, but also will help reduce our cost of production.

DEMONSTRATION CENTERS.

The two demonstration silkworm rearing stations, the one near Kiangyin and the other near Wusih, in Kiangsu Province, will be continued in 1928. Already many more families have applied for co-operation than we shall be able to take care of. The sale of silkworm eggs in the localities in which the demonstration centers are situated are many times greater than in 1926.

JOHN H. REISNER,
Foreign Director of Sericulture.

Shanghai, China.
November, 1927.

SERICULTURAL WORK FOR 1927 AT THE FUKIEN CHRISTIAN UNIVERSITY, FOOCHOW, CHINA.

In the sericultural work carried out at the Fukien Christian University for the two years 1925 and 1926, the emphasis has been placed upon disease eradication, as no work in selection or cross-breeding could be done successfully until the stock was freed of pebrine. This first step was necessitated by the loss during our furlough of a large part of the stock previously selected to be free from pebrine. As a result of the two year's work a good supply of clean eggs is now on hand to begin the work in 1928.

The selection of disease-free eggs in this province is much needed. Random samples of moths, reared from cocoons bought in the market and tested in our laboratories, always show high infection with pebrine, quite often reaching nearly to 100 per cent. One group of four samples examined showed an incidence of infection of 88.2 per cent., 76.7 per cent., 99.4 per cent. and 96.4 per cent. each, or an average of 90.2 per cent.; while a second group of five samples tested 23.7 per cent., 82.4 per cent., 69 per cent., 24.8 per cent., and 62.8 per cent., an average of 52.54 per cent., and these samples were taken at random. For the years 1925 and 1926 the farmers about Foochow reported serious losses due to diseases amounting to almost 90 per cent. of the entire crop, as nearly as could be ascertained from questioning them whenever possible. Of course, no reliable data are obtainable. During the past season (1927) the situation has not been reported as so serious, and hopes for a better season in 1928 are entertained by many, although pebrine is always present to a large extent.

Attempts to meet the situation by the use of eggs imported from North China and Europe have been unsuccessful. The farmers cannot now be prevailed upon to try them any more, and in our work we have found that a very large percentage of the worms die of flacherie, due, doubtless, to the very high humidity and extreme warmth or our season at the time of rearing. With a modern well-built house, in which temperature and humidity can be properly controlled, this difficulty can doubtless be overcome. Also keeping monovoltine or bivoltine eggs from North China, Japan or Europe, in cold storage through the summer and rearing the worms during September, when our climate is cooler, sunny and dry, should be very effective. This will be thoroughly tested out in September of 1928. After all, however, the best method of solving the problem seems to be that of the improvement of the local and acclimated varieties, although it will be a slow and laborious task.

So far no study of the mulberry cultivation has been made, but experiments have now been started, looking toward the raising of mulberry trees on the hillsides. Wild trees are often found growing unattended on the hills, and, with proper care and attention, they would undoubtedly do much better. Then the best varieties of white mulberry could be grafted onto such stocks, and a better quality of leaf produced. With the thousands of acres of unproductive hillsides in Fukien facing us on all sides, often bearing old terraces that are now unused but still fertile from former decades, or possibly, even centuries, of cultivation, such an opportunity of obtaining an additional supply of leaves from land at present unused must not go untried and unchallenged.

During the progress of the work of the past two years some interesting figures of the effect of the pebrine disease have been obtained. In one experiment, out of 448 moths examined, only 13, or 2.91 per cent. were found to be free from pebrine. The diseased and disease-free worms from these moths were reared separately, but under similar conditions, with the result that the 13 clean moths produced 668 cocoons, while the 435 infected moths did not produce a single cocoon. Out of a number of experiments only one or two can be referred to. In one case, 27 layings of clean eggs produced 55 ounces of cocoons, while under precisely, similar conditions, 129 layings from the same lot, but infected with pebrine, produced only 68 ounces of cocoons, a loss of 74.1 per cent. as compared with the production of the disease-free eggs. From a study of the results of a number of such experiments it was shown that in this work, at least, (and it is probably typical of the conditions prevailing on a larger scale), the worms infected with pebrine produced on an average only 31.6 per cent. as much silk as the ones free from the disease, indicating a loss of 68.4 per cent. in silk production due to the effects of pebrine in the province. The

figures seem very high, but the reports from the silk farmers indicate frequent losses of 100 per cent. and in the village nearest to Foochow an apparent average during the past two years of 90 per cent. is reported. With most of the farmers the work in silkworm raising is a side line carried out in connection with the raising of rice, otherwise they would have to give up such unproductive work at once. This cleansing process may be a good thing in one way, for it drives out the careless and inattentive workers and puts a premium upon careful and thorough application, leaving in the industry only the best men.

The tremendous losses due to diseases, coupled with the excessive taxation of the successive governments and the depredations of bandits, make the lot of the silkworm farmer far from easy, and the faithful ones remaining in the industry in spite of its drawbacks surely deserve all the aid that can be given them.

C. R. KELLOGG,
Professor of Zoology.

Foochow, China.
November, 1927.

SERICULTURAL WORK FOR 1927 AT THE KWANGTUNG PROVINCIAL BUREAU OF SERICULTURE, CANTON, CHINA.

The sericultural improvement work is now carried jointly by the Kwangtung Provincial Bureau for the Improvement of Sericulture (under the department of Industries) and the School of Silk Industry of Lingnan University (formerly Canton Christian College). Most of the research and experimental work, extension and inspection work is under the Bureau and financed by the Kwangtung Nationalist Government, while the educational work is entirely in the hands of the School. Money from the China Foundation (controlling the American Boxer Indemnity fund) is expended in research and experiments of silkworm diseases.

The School of Silk Industry has the following equipment, the largest portion of which was donated by the silk people of the United States.

BUILDINGS.

Atwood Reeling Laboratory
Sericultural Building
Short Course Student's Dormitory
Egg Production Building
Staff Dormitory
Reeling Girl's Barracks.

EQUIPMENT.

Cold Storage plant, with a capacity for several million egg sheets
Kelvenator for refrigerating experiments
Demonstration reeling room with 30 basins
Experimental reeling room with different types of reeling basins
Set of silk testing equipment
Cocoon drying experimental laboratory
Two well equipped pathology laboratories
Five to six thousand dollars worth of miscellaneous equipment.

STAFF.

Administration.—A director, an assistant director, two secretaries, one accountant and a business administrator.

Research.—Pathology :—Two technical experts and assistants.

Raw Silk and Testing :—Two technical experts, one assistant and two mechanics.

Breeding.—Two technical experts, two assistants.

Egg Production.—Three assistants.

Mulberry Breeding.—One breeder.

Extension.—Two persons.

Country Office.—One person.

REPORTS FROM SILK IMPROVEMENT, ETC.

COCOON IMPROVEMENT.

Variety tests on some sixty varieties of worms from different parts of the world. The points studied are their adaptability to Kwangtung climatic conditions, yield and quality. Most of them can be reared only one or two crops a year. However, some are gradually being adapted to this environment and produce more crops. We are making line breeding on ten of the most suitable varieties and some few strains prove to be quite promising. Canton cocoons are a mixture of green and white, and we are isolating the white strains. Usually they are weaker in comparison with the green strains, but selection has uncovered some strong strains. We are also trying various combinations of eggs to be distributed to the cocoon farmers.

COLD STORAGE OF EGGS.

We stored only several hundred egg sheets for the egg producers, but this is becoming popular and we hope a great many more egg producers will have their eggs stored this year.

We also tried several cold storage experiments and found that hot water eggs (*i.e.* eggs after being artificially hatched by hot water) can be stored for the next crop if they cannot be sold during the preceding crop. At present they can not keep eggs over and either have to sell them at a very small sum or throw them away in case of a dull market. The supply and demand of egg sheets can be adjusted as in other countries with this method. We have not yet obtained any definite results in the cold storage of white eggs.

MULBERRY.

We have only a few varieties of mulberries in our testing plot, but will have more in 1928. We are making selections of strains for thicker, smoother and larger leaves with higher yield. Already over seventy individual varieties have been tested and found to have these qualities. Other experiments are the study of characteristics upon the local mulberries and fertilizer tests.

PATHOLOGY.

Experiments on the elimination of pebrine by Oxygen and on breeding diseased resistant strains are under way. Effort is being made better to adapt the Pasteur method of disease examination and much time is devoted finding to better methods of disease prevention. Also a systematic study of the four prevalent diseases is being carried out.

RAW SILK.

We are testing raw silk for filatures; quite successful experiments in the preparation of Canton waste by machinery are being tried. We are advocating this in the local filature and will have a few bales to send out for commercial use. In reeling, we are comparing the advantages and disadvantages of different reeling methods on Canton silk, such as sunken and surface reeling, comparing the adding of cocoons by hand and by chop sticks, etc. We are also working on a new type of cocoon dryer that we hope will take the place of the present slow drying methods, and also have started solving problems in the preparation of cocoons for reeling.

EXTENSION.

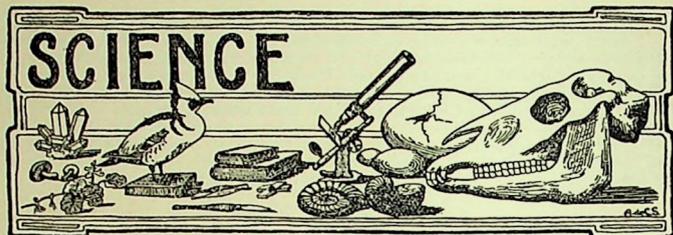
We have a branch office in the silk district directing and advising the worm farmers. The filatures are getting information through our branch office. We publish a bi-monthly bulletin giving information on the industry, and this is widely distributed among the silk people. We are organizing farmers' clubs to improve cocoons and to raise good eggs distributed by us.

EDUCATION.

The school of Silk Industry is offering courses of college standard in two groups—the raw silk group and the sericultural group. The College also takes in apprentices in limited numbers and gives short courses as deemed necessary.

P. K. Fu,
Assistant Director.

Canton, China.
November, 1927.



THE LIFE OF THE SILKWORM

BY

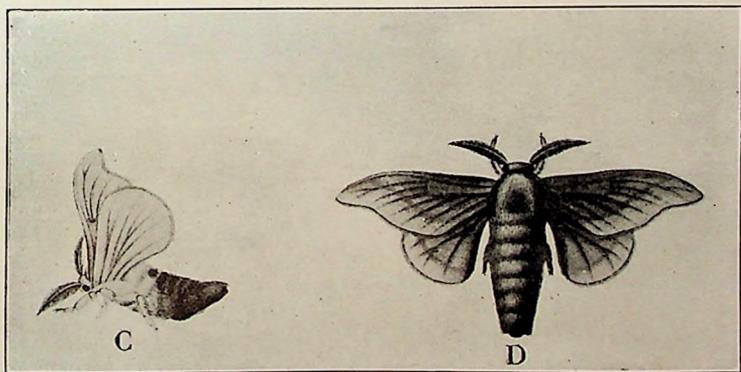
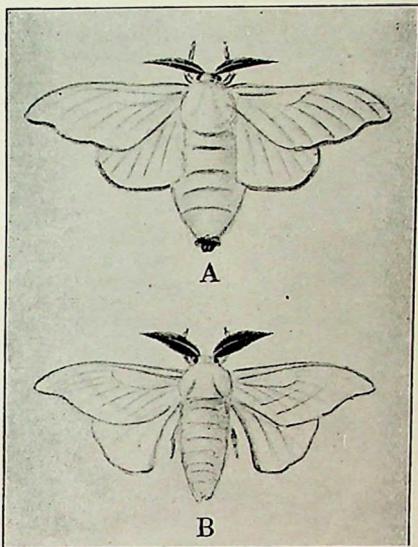
CLAUDE R. KELLOGG.

Early in April, or, sometimes, late in March, in Fukien, when a few of the earlier buds of the mulberry trees are expanding into leaves in response to the softening warmth of the oncoming spring, the silkworm awakes from its long winter's nap and hatches from the egg.

A few days before hatching the egg turns black and one may see through the transparent egg shell the little prisoner within patiently awaiting release. A thoughtful Nature has placed a weak spot, the micropyle, at one side of the flattened egg shell to make it possible for the "worm" to escape and through this the little creature gnaws its way to freedom. Just hatched from the egg the little silkworm is a tiny black object with a bright shining head and a very fuzzy-looking body, due to the presence of long black hairs, gaining for it among the Chinese the name of "little black ant." As it grows older, and during succeeding stages, the black hairs are lost and the skin of the body becomes lighter in colour, so that a full grown silkworm has a naked skin that is almost white.

The first act of the newly hatched larva of the wild relatives of the silkworm is to start to crawl upwards, as in some way the race has found out that in that direction are to be found the leaves necessary for sustenance. So strong is this tendency in most such larvae, that, if placed on an inverted branch with the leaves at the base, they will crawl upward away from their food and remain at the barren top of the branch vainly stretching for the expected leaves until starved to death. Not so, however, with the domestic silkworms, for, rendered dependent through long years of care by man, the tiny worms will remain close to the place of hatching, waving their heads back and forth, expecting some one to put the leaves within reach. If the food is not forthcoming the pampered little aristocrats will often starve to death rather than exert themselves to travel a few inches in search of food.

The natural food of the silkworms is the leaf of the mulberry tree, but they can be induced to eat lettuce if fed on it at first, and they can even



By Courtesy of the Int. Comm. for the Imp. of Ser. in China

The Silk Moth (*Bombyx mori*). A. Female, B. Male, C. Diseased Moth (note darkened Abdomen), and D. Dark Variety (not diseased).



Photo by Nanking University

Fully developed Silkworms.



Photo by Int. Comm. for the Imp. of Ser. in China

A Variety of Silkworms, known as "Dragon's Horn" worms, because they have peculiar Lumps upon their Bodies.

be matured on it, though the silk will not be of commercial value. Osage orange (*Maclura aurantiaca*) in America and "peepul" (*Ficus religiosa*) in India may also be substituted for mulberry leaves, but to do well the silkworm must have its proper food. Not only must it have the leaf of the mulberry for commercial success, but that leaf must be of the right age and quality. Young newly hatched worms must be fed on young tender leaves and as the worms mature they must be fed on the maturing leaves of the mulberry, so that the worms will grow up with the leaves, so to speak. Leaves from the southern Cantonese variety, or the local small-leaved variety (*Morus alba*) are the best with which to start the young worms, but as they mature they should have the large leaves of the Chekiang variety (*Morus multicaulis*) to do their best, for not all mulberry varieties will yield leaves of equal commercial value. Of the four best known varieties, the red, white, black, and *multicaulis*, the latter has the largest leaves and is the best for producing the highest quality of silk in this region. This mulberry, imported from Chekiang province, grows very rapidly and the leaves are so large and nutritious that silkworms of mature age fed on them grow better and produce better silk than if grown on any of the other varieties. The white mulberry (*Morus alba*) is used quite extensively in Fukien, where it seems to grow well, but the leaves are small and not so productive as the above variety. As it matures early it is often used to feed the young worms which are fed during their last stage on the large-leaved variety. The black mulberry (*Morus niger*) is often found in Europe and America, where it is in much demand as an ornamental tree and for its large-sized, black-coloured fruit, suitable for making delicious pies, but the leaves are too coarse to be advantageously used in feeding silkworms. The red mulberry (*Morus rubra*) is also of very little use in rearing silkworms.

A newly hatched larva of the silkworm is very tiny indeed, but it has wonderful powers of growth and development. Measuring at first only three millimeters and weighing only half a milligram, it feeds voraciously, during its larval life of thirty to thirty-eight days attaining a length of nine centimeters and a weight of five grams, or an increase of thirty times in length and ten thousand times in weight. A human child, growing at the same rate, would change from a cute little darling of twenty-four inches and weighing eight pounds to a man of sixty feet in height and weighing eighty thousand pounds. Who would want to be a human silkworm?

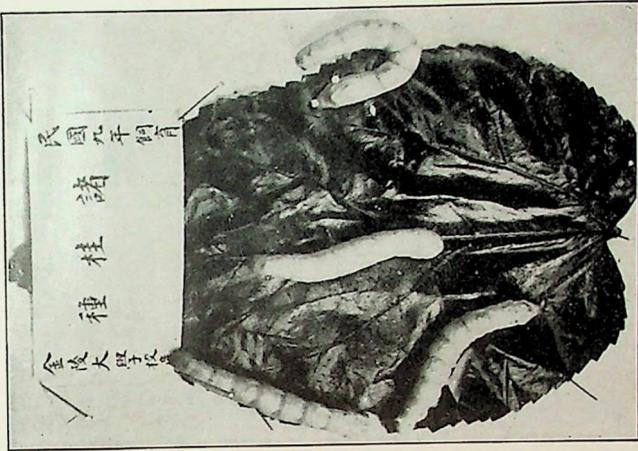
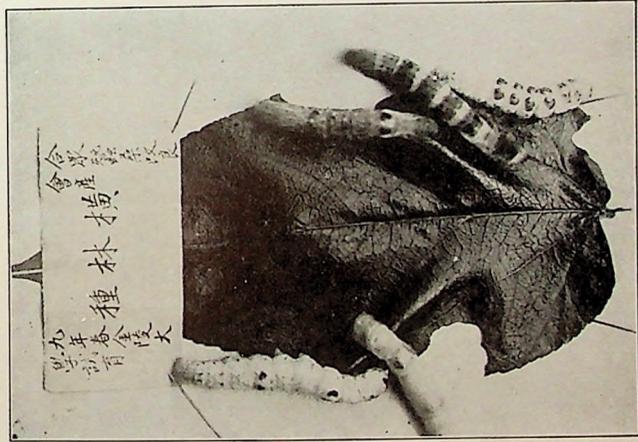
When just hatched from the egg the larva of the silkworm can very conveniently fast for several days without any harm, but after once beginning to eat it must have its food brought to it with great regularity. Also, the leaves must not be fed wet or too dusty for the silkworm is an epicure in the matter of food and will generally refuse anything not suited to its taste. If eaten, unsuitable food will very quickly bring on diseases. If, however, a kind fate has placed the silkworm in close proximity to the right kind of tender mulberry leaves, the little insect will begin to feed at once. So small are the jaws and so weak the muscles that control them that the baby silkworm cannot at first eat even the tenderest leaves of the mulberry, but must content itself with piercing the leaf and sucking the

exuding juice. Man, of course, must now cater to the little degenerate by slicing up the leaves until they are almost as fine as hairs, so there will be plenty of juicy surfaces to attack.

The young larva eats continuously for the first five or six days without stopping day or night. Every two hours at first, later every three hours, the attendant must furnish fresh leaves for the growing worm, getting up several times in the night to replenish the supply of fresh leaves. At the end of this time the little worm feels satisfied and goes into its first moult, or "sleep." At this time it ceases to eat, stands with its head held above the tray in a horizontal position and remains quiet for some time. Finally the old skin splits along the back, the insect wriggles out of it and appears in a new skin, larger and more pliant than the old one, to allow for further growth. The moulting period takes about twenty-four hours, depending upon the temperature, and it is a time of great danger to the tender little worm. Too much of a draft, a sudden fall in temperature, excessive moisture, or violent shaking about, may cause the death of large numbers of moulting larvae. Spores of bacteria and fungi are ever hovering around seeking an opportunity to begin their growth within the unprotected body of the silk-worm. The second feeding stage, or instar, lasts but four days, the third, four or five days, the fourth, from five to seven days, and the fifth and last stage from seven to twelve days, the moults requiring about twenty-four hours each time.

Eating continuously and growing so rapidly the worms require large quantities of leaves. To mature one ounce of eggs, the progeny of from seventy to eighty moths, requires between fifteen hundred and two thousand pounds of leaves, this amount representing the production of twelve trees of ten years of age, at least. Nearly half the required leaves are eaten during the last six or seven days of growth, one tray of about thirty-five thousand worms often eating fifty pounds of leaves in one day. At this time a marked increase in size can be noted from day to day, and one can almost see the worms growing. The rearing rooms at this time present a most interesting sight. Lying thickly over the trays, half buried among the large green leaves, the worms may be seen in almost every conceivable position, busily eating the leaves, the crunching of the crisp leaves making a sound like that of a gentle rain pattering on the roof. Holding the leaf with its small almost useless thoracic legs, and applying its head to the edge of the leaf, the worm rapidly cuts out little arcs, the jaws working horizontally, until nothing remains but the ribs and veins of the leaf. In like manner another leaf is seized and the process repeated, or, sometimes, the worm will bite a hole in the centre of the leaf, and, thrusting in its head, will, from this as a vantage point, cut out the same little arcs from the exposed edges of the opening until the entire leaf substance has disappeared. Within an hour after feeding the worms are to be seen resting on the unpalatable ribs and larger veins of the leaves, the remains of their feast, looking about for more leaves, but not thinking of bestirring themselves to go in search of them.

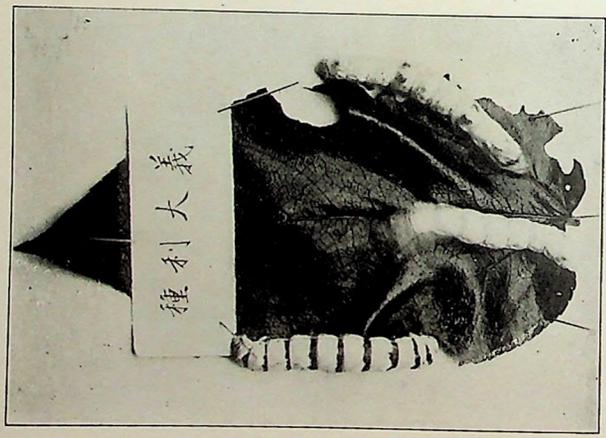
As the worms continue to increase in size the trays soon become overcrowded and they must be thinned out. Furthermore, some method must be devised to separate the worms from their old bed of refuse leaves,



Silkworms from Wen Ling, Chekiang.
Various Kinds of Silkworms.

Photos by Nanking University

Chu Kuei Silkworms.



Italian Silkworms.

Various Kinds of Silkworms.

Photos by Nanking University

"Dragon Horn" Silkworms.

THE LIFE OF THE SILKWORM

wherein lurk the germs of disease and decay, and from their sickly, and possibly diseased, brothers and sisters. To accomplish both these ends a piece of netting, the size of the tray and covered with fresh green leaves, is placed on top of the worms in the tray, and in a short time all the strong healthy worms are among the new leaves nibbling away to their heart's content.

When mature the silkworms lose their appetite and cease to eat, the silk glands, which have increased until they constitute about one-fifth of the entire weight of the worm, becoming so inflated as to make eating uncomfortable. The leaves in the intestine are then all digested and the entire contents voided, the silkworm, in consequence, shrinking in size, becoming sometimes a whole inch shorter than before. The body also becomes clearer and often pinkish in colour, and we know it is ready to begin spinning, the all important process for which it has been preparing during all the days of voracious feeding.

Silk, as it comes from the silkworm, is composed of two substances, fibroin and sericin, which differ from each other both chemically and microscopically, together with a small amount of waxy material and colouring matter. Fibroin is horny, forms the core of the fiber, and is insoluble in boiling water, while sericin is on the surface of the fiber and can be dissolved in boiling water to form "silk gum." There are two parts of fibroin to one of sericin in the fiber. The secretions of the two silk glands, coming singly to the spinneret, or seripositor, are combined on exposure to the air as they emerge and form one single fiber, covered with colouring matter of green, yellow, orange, salmon, and various shades of the above. In the process of washing in hot water the colour comes off and only the pure white fiber remains in most of the monovoltine silks, but in some of the polyvoltines the colour remains fast. So fine a product is this that a twisted thread of silk fibers, finer, even than human hair, will stretch five or six inches to one yard and will bear the weight of twelve to sixteen ounces. A cable of silk thread would sustain a heavier weight than any other fiber of similar size.

When ready to spin the mature larvae become restless and wander about looking for a place to which to fasten their cocoons. If left to themselves they would spin their cocoons on the walls and ceiling of the building, but in commercial silk production in South China they are given specially prepared spinning frames made of bamboo. Finding a suitable place, the worm weaves a few strands back and forth until a skeleton is formed to which the real cocoon may be attached. In five or six hours the outer envelope is finished and work is started on the inner cocoon, the source of commercial silk. Attaching this latter to the outer envelope the silkworm continues to spin, moving its head back and forth sixty-nine times per minute, gradually fading from view beneath the thickening fibers of silk until it can be seen no more. Even after disappearing into the cocoon its work is not done. It keeps up the spinning for a period of from twenty-four to thirty-six hours before the cocoon is completed, one cocoon often having over a thousand yards of continuous fiber.

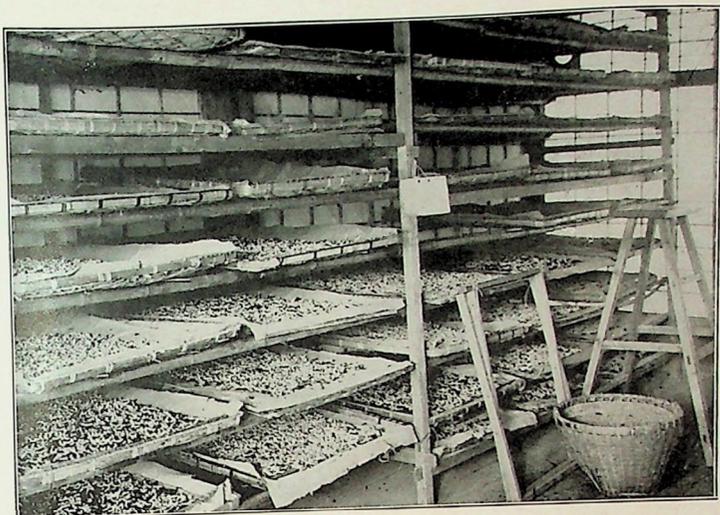
Meanwhile, hidden from view to the casual observer, but revealed to the prying eyes of the scientist, a most marvelous transformation is

taking place, destined to change the ugly worm into a beautiful moth, drawing admiration from all who see it. After casting off the larval skin and after the outer covering has become hard and solid, great changes are effected within the recesses of the shining brown shell. The white corpuscles, or phagocytes of the scientist, wander about the body devouring its substance until nearly all the larval organs and tissues have been changed into a thick milky fluid, the heart and nervous system alone escaping the general destruction. Then slowly the material begins to take shape and from this mass of wreckage are gradually reorganized the new organs to be used by the moth soon to emerge.

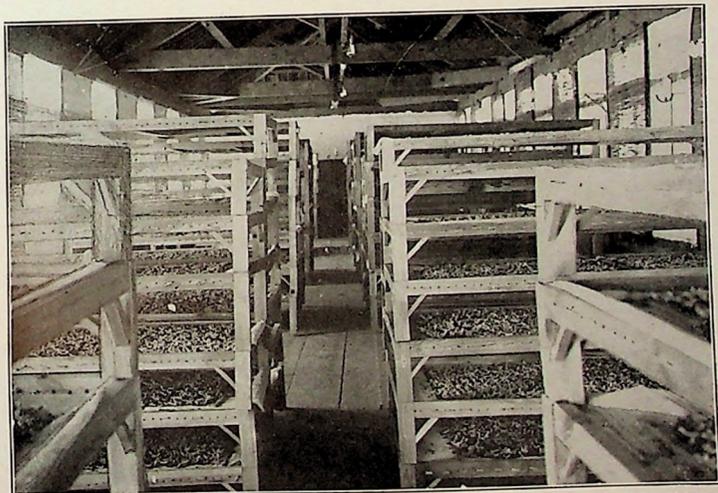
Just at this point, if the cocoons are wanted for commercial silk, the sericulturist steps in and kills the pupa to prevent it from changing into a moth and piercing the cocoon, rendering it useless except as waste silk; for in order that people may clothe themselves in silk many silkworms must annually give up their lives. Keeping the cocoons in an oven at a temperature of 270 degrees Fahrenheit for two hours will kill the pupa, but they are left in the oven for sixteen hours at the same temperature in order completely to dry the silk of the cocoon. In drying, the weight of the cocoon decreases 66 per cent. Dried cocoons, if kept away from insect pests, may be kept for a long time and in such condition may be shipped from place to place. Tons of such dried cocoons, packed in four to five hundred pound bales, are shipped annually from Japan to Italy.

At the end of some fifteen to twenty days, if the cocoon is not wanted for silk, the changes in the life history of the pupa are completed and the newly formed moth is ready to emerge from its prison house. As the mature silkworm moths for many generations have not used their mouth parts a jealous Nature has taken them away, but has provided another means of escape from the cocoon. A few drops of alcalin acid sent out from the mouth dissolve the gum of the cocoon and the moth is able to push aside the fibers, breaking many of them and rendering them unfit for reeling, in its efforts to get out.

Wet and very much bedraggled at first, with enormous abdomen and soft undeveloped wings, the silk-worm moth makes anything but a fine "first impression" on its initial appearance, but in a short time the wings expand and become dry and the transformation is complete. It is hard to imagine anything more beautiful than a tray full of freshly emerged silkworm moths, chalky white in the fresh bloom of their newly found maturity, fluttering their delicately marbled wings excitedly, and dancing about the tray, making very little actual progress, however, for long generations of disuse have rendered the wings incapable of service in flight. As soon as emergence has taken place, which usually occurs about three to five o'clock in the morning, mating occurs, the long courtship lasting throughout the day. Late in the afternoon the female is ready to deposit her eggs, a process which may occupy a space of several days, from seventy to eighty per cent., however being laid the first day. In all except one variety the eggs are glued securely to the paper or cloth on which they are laid. No food is taken either by the male or female moth, their mouth parts having atrophied to such an extent that food-taking is impossible. After about four or five days the male dies



Native Square Trays on their Racks and filled with Silkworms.



Photos by Int. Comm. for the Imp. of Ser. in China
Rows of Combination Trays and Stands in a special Room at one of
the Experimental Stations.

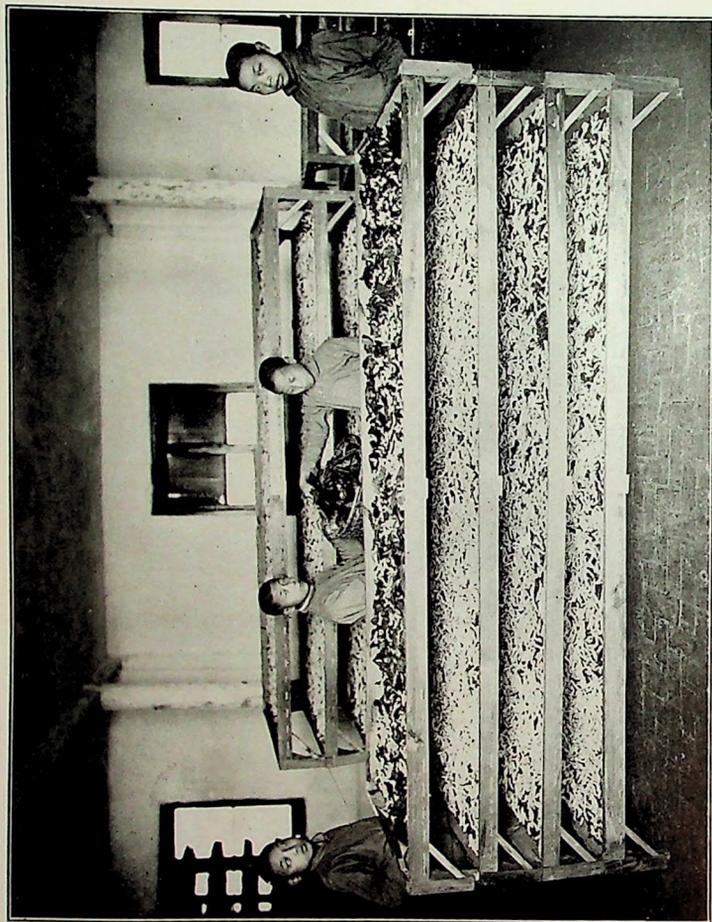


Photo by Int. Comm. for the Imp. of Ser. in China
Showing how the Combination Stands and Trays of Experimental Stations are used. By piling them one on top of another they are formed into Racks. This method greatly facilitates handling Worms in large quantities.

THE LIFE OF THE SILKWORM

and in ten or twelve days the female also succumbs, for with a group of from four hundred to seven hundred eggs properly laid, her life work is finished and the next generation provided for. Thus the silkworm, as commonly found in Central China and Europe, a larva for from thirty-three to thirty-eight days, a pupa for fifteen to twenty days, and a moth for from eight to twelve days, spends sixty-five days as an active insect and three hundred days as an egg, awaiting the awakening warmth of the following spring. The eggs of this type of silkworm, it is interesting to note, are said by experts not to hatch unless they have first experienced a season of hot weather followed by a season of cold. Though the natural time for hatching is April, man, by the use of incubators, refrigerators, and the proper chemical solutions, is capable of forcing a rude awakening of the tiny insect at almost any time of the year, subject to the above conditions. Furthermore, by raising or lowering the temperature of the rearing room, which should be as near 68 to 72 degrees Fahrenheit as possible, the sericulturist is able to shorten or prolong the length of the larval period, but he does so at the risk of decreasing the vitality of the worm and encouraging the appearance of disease and parasites.

Although the domestic silkworms of the world all belong to one species, *Bombyx mori*, three distinct races are recognized, based on the number of generations each passes through in one year. The monovoltine, which is the one commonly found throughout Europe and Central China, and the one to which the above life history refers, has only one generation per year. In Fukien this race hatches out during the first week in April and usually spins its cocoons about the middle of May, depending a little upon the weather conditions. The silk produced by this type of worm is thick and heavy and brings the highest price per pound of any of the silks. More than fifty per cent. of all the crop of China is probably of this type.

The bivoltine silkworm hatches out at about the same time as the monovoltine, and passes through two generations per year. The first generation of cocoons are not used for silk, as the monovoltines bring a higher price at that time, and only enough of the moths are reared to produce the second crop, which matures about the end of June, the eggs remaining until the following April before hatching.

The polyvoltine race passes through eight generations in the year in Kwantung and Indo-China, but has only five in Fukien. These worms hatch usually two or three weeks before the monovoltines and bivoltines and only enough are reared during the first two generations to produce eggs for the succeeding crops, which mature in July, August and September. Their life cycle is shorter than the monovoltine, taking just thirty-six days during the hot summer weather for the entire cycle as against sixty-five for the monovoltines.

With the three types of worms all able to live and thrive in Fukien, five crops of cocoons are possible in one summer. Furthermore, if facilities are at hand for cold storage and incubation of eggs, they can be so manipulated as to divide each one of the five crops into two, separated by two weeks from each other, thus making ten crops of silkworms maturing through the summer.

Silkworms, pampered and protected by man, are a prey to several parasites and diseases. A protozoan parasite, closely related to the malarial parasite of man, attacks the worms, destroying large numbers of them and decreasing the market value of the silk produced by others. In Italy and Japan the percentage of infection with this disease (pebrine) is only five per cent. in commercial plants, while in China the percentage will probably average from sixty per cent. to eighty-five per cent. Bacterial diseases, such as flacherie, grasserie, etc., attack the silkworm, and a fungus plant, allied to the molds, grows into the spiracles of the larva, suffocating it and filling the body with spores, making it hard and white like chalk. A parasitic fly, one of the family *Tachinidae*, barred from entering the silk-worm rearing houses, lays its eggs on the mulberry leaves in the field, trusting that a kind fate will convey them into the rearing house with the leaves. A large wasp, *Vespa orientalis*, often attacks the spinning larvae on the frames if put out of doors unprotected, and ants will carry off the small larvae piece by piece if they gain access to the trays.

From one of Nature's wild and unfettered creatures the silkworm has become the absolute slave and dependant of man, its very ancestry lost in the haze of a dim and forgotten past, absolutely beholden to its keeper for every bit of food and protection, and all its powers and activities concentrated on the one business of furnishing its never satisfied master the coveted fibers of silk, once a luxury bringing its weight in gold at the luxurious court of the dissolute Roman Empire, but now a necessity in the modern world. Unnumbered millions of silkworms, reared by hand in the humble huts of the peasants of Oriental countries or in the efficient sericultural establishments of the West, annually give up their lives; the fastest steamers rush the dried cocoons and raw silk over the trackless seas; closely guarded steel express trains with their precious loads of raw silk, dash across the continents; countless factories, their cavernous interiors vibrant with the whirring of tireless wheels, run ceaselessly day and night—all that man may clothe himself in soft and costly raiment.

When we learn that in one American silk factory alone, the daily requirement is one thousand pounds of raw silk, representing the product of three million cocoons, with an aggregate of seven hundred and fifty thousand miles of cocoon fiber, enough to reach thirty times around the earth, it may help us to appreciate a little better the greatness of the contribution of the silkworm to modern industry. In the future, when we use articles made from priceless silk, let us think with kindly interest, even tinged with reverence, of the humble silkworms whose sacrifices have made possible such a costly gift.



Young Mulberry Trees on the Plantation of the International Committee for the Improvement of Sericulture in China at Shanghai.



Photos by Int. Comm. for the Imp. of Ser. in China

Young Mulberry Trees showing a fine production of large Leaves.



Photo by Nanking University

Gathering Mulberry Leaves on the Nanking University Plantation.



Photo by Int. Comm. for the Imp. of Ser. in China

Preparing Mulberry Leaves. Plucking the Leaves from the Twigs.

DISEASES OF THE SILKWORM

BY

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I

DISEASES OF THE SILK-WORM CAUSED BY ANIMAL PARASITES

1. **PEBRINE**: Of the various diseases that afflict the silkworm, Pebrine, caused by an animal parasite, is one of the worst with which the silkworm rearers have to contend. Although not as infectious as Flatcherie nor as contagious as Muscardine, it very often appears suddenly, unheralded and unforeseen by the farmer, and carries off the entire crop of mature worms just at the moment they are preparing to spin their cocoons and repay him for his outlay of time and money, or it may lie dormant, and, weakening the worms, be really at the base of other serious troubles.

Although the silkworm is said to have been introduced into France in 1340 A.D., its cultivation did not seem to take root in French soil for another hundred years, and it was still longer before it became of great consequence. However, from the middle of the sixteenth century it increased tremendously in volume, reaching its climax in the year 1853, when twenty-six million kilograms of cocoons, valued at one hundred and seventeen million francs, were produced within the year. But in that year a blight suddenly fell on the industry. Worms appeared to wilt, languished on the trays, refused to eat, and often whole lots would die out entirely within a few days of the time they should have been spinning cocoons. If the worms did not die they would often spin frail cocoons and die in them, rendering the silk almost worthless. Because of the little black spots on the bodies of the stricken worms, the name of pebrine (pepper) came to be given to the disease by the French peasants. By the year 1856 the production of cocoons had dropped to seven million kilograms and in 1865 to four million kilograms. In 1876 De Quatrefages estimated the loss to France due to this disease in the thirteen years following 1853 to be no less than one milliard of francs and in Italy it was even more severe, estimated to be twice that amount. The loss of one hundred and twenty million pounds sterling in thirteen years, falling as it did in a comparatively restricted area and on one class of people in both countries, brought it to the attention of the government. In response to the appeals of the stricken peasants the Academy of Science in Paris sent Louis Pasteur to investigate the trouble and seek a remedy.

Some work had already been done on the disease. In 1849 M. Guerin Menville had observed in the blood of diseased silkworms certain vibrating corpuscles, but neither he nor the Italian Signor Filippi, who also studied the corpuscles, connected them with the disease. The corpuscles

were first accurately described by Cornalia and are therefore sometimes referred to as "Cornalia's Corpuscles." The French Academy had also previously sent two investigators, De Quatrefages and M. Pelignot, to the infected region, and after much study they issued two long reports in 1859 and 1860, but had no practical suggestions to offer.

When Louis Pasteur was sent by the Academy to investigate the disease the people were disappointed in having a "mere chemist" sent for the work, as they thought it should have been some renowned agricultural specialist, but it soon turned out that he was the best man that could have been chosen, both because of his former training in the study of microorganisms and because of his wonderful insight into problems. Pasteur was soon able to identify the disease with the corpuscles, and to prove that silkworms without the corpuscles were free from the disease, and that healthy worms, artificially infected with the corpuscles, contracted the disease in a definite manner, thus being able to prevent or produce the infection at will. His suggestion for eradication was a very simple one, but so efficient that to the present day no one has been able to improve on it except in minor details. His plan of examining the moth after oviposition under a microscope, and throwing away the eggs laid by diseased moths is to-day followed all over the world where the silkworm is reared and has practically stamped out the disease where ever thoroughly applied. In China, however, where, in so many of the silk-producing centres, little consideration is given to scientific management of the worms, the disease continues to take severe toll of the sericultural industry.

Pebrine is without question the worst scourge of the silkworm in China, annually causing tremendous losses to the silk producers. The disease may be contracted when the worms are very young, and, unknown to the farmer, the tiny parasites that produce pebrine will go on developing within the bodies of their hosts, weakening them, and, finally, if the conditions are suitable, destroying them just as they prepare to spin their cocoons. Then, for no reason known to the amazed farmer unskilled in laboratory methods, the worms so tenderly cared for, and into which he has already put so much time and money, suddenly die off in hordes and his profits are gone for the year. Or, if they do not actually die, the worms are so weakened by the parasites that are preying upon them, that they are able to spin only a small amount of silk, poor in quality, and die within the cocoons. Some, however, are able to pass this critical time and lay eggs, but their offspring, already tainted with the disease, start life with a handicap from which they never recover.

Pebrine is caused by a tiny animal parasite, *Nosema bombycis* Naeg., one of the *Protozoa*, belonging to the Class *Sporozoa*, thus making it a relative of the equally pernicious parasite causing malaria in man. Not only does it resemble the malarial parasite in its systematic position and life-history, but the effect upon the silkworm is somewhat comparable to that produced in the human subject by malaria. In both cases weakness, lassitude, impaired metabolism, and improper growth and activities result.

The parasite enters the body of the silkworm through the mouth as a tiny spore, (Plate I. Fig. 5. A) carried in with the mulberry leaves



Photo by Nanking University

Mulberry Leaves on Shelves waiting to be used.



Photo by Int. Comm. for the Imp. of Ser. in China

Cutting of Mulberry Leaves preparatory to Feeding to the Worms.



Photo by Int. Comm. for the Imp. of Ser. in China
Chinese Women feeding their Silkworms.



Photo by C. R. Kellogg
Silkworms well advanced feeding on Mulberry Leaves, in one of the round Trays used by the Natives.

DISEASES OF THE SILKWORM

eaten by the worm, and finally comes to rest in the alimentary canal. The entering corpuscle, or spore, is very small, measuring one to two microns in width and from two to four microns in length, and can only be seen by relatively high powers of the microscope, about four hundred diameters being the most suitable. When we remember that a micron is the thousandth part of a millimeter, which is 0.039 of an inch, we get some idea of the small size of the spore. It is oval in shape and pale bluish in colour and under a high power of the microscope two lighter coloured vacuoles may be seen, one in either end. The corpuscle is really a hollow cylinder with a cap closing one end, and containing, within its cavity, a long, fine, much-coiled hair and an amoeba-like form. Upon finding itself in the intestine of a silkworm the corpuscle "explodes" and the long hair extends itself to a length of from fifty-seven to seventy-two microns, forcing off the cap and allowing the release of the "amebula," (Plate I. Fig. 5. B). The latter creeps about in the intestine for a short time and then by simple division (binary fission) gives rise to two similar daughter amebulae. These wander about continually (Plate I. Fig. 5. C.) dividing and giving rise to new generations of new daughter cells until the body tissues and fluids become saturated with the wanderers. In the meantime many of the amebulae have penetrated into the cells lining the intestine, or the tissues of other organs, living at the expense of the cells, in which they pass another stage of their life history, dividing again by binary fission (Plate I. Fig. 5. D.) and increasing within the cell until the latter is destroyed. When the exhausted cell is no longer able to support the parasites, the undeveloped ones die, but the ripe ones (Plate I, Fig. 5. E.) burst out from the ruined cell and fall into the alimentary canal from which they are carried to the outside with the waste. Falling onto the leaves of the tray they secure entrance into the alimentary canal of another worm and the process is repeated.

With the amoeba-like forms wandering about the tissues of the body and continually dividing, their daughter cells entering and destroying the cells in various parts of the body, it is easy to see that the effect on the worm may be very severe. It takes twenty days after ingestion of the corpuscle before the first mature corpuscle of the next generation is produced, and thirty days must ordinarily elapse before the parasites will be sufficiently numerous to kill the host. This explains why it is just before spinning, about thirty days from hatching, that the worms so often sicken and die.

It is often possible, by raising the temperature of the rearing room and giving more frequent meals of fresh leaves, to shorten the feeding time and hasten maturity so that the worms may be able to spin cocoons before the parasites, even though present in fairly large numbers, can destroy them. Of course, such worms are useless for breeding stock, for besides being weakened by the forced growth, their offspring will have the disease in a much aggravated form. On the other hand, it is also true, particularly in regions in China where there are no facilities for controlling the temperature of the rearing house, that protracted cold and rainy weather will retard the development of the worms beyond their normal period of growth and the parasites, not in the least bit affected by

the untoward weather conditions outside, will continue to develop and increase in strength until they finally overtake their hosts and destroy them before they can spin cocoons. Knowing nothing about the parasites and their life history, the farmer blames the cold weather for the failure of his crop.

If a moth harbours *Nosema bombycis*, corpuscles of the parasite will be present in various parts of the body and some of them will wander into the ovaries. When the eggs are laid the corpuscles will be included within the membrane next to the egg itself, so that when the young worm bites its way out of the shell it may swallow the spore and begin its life already contaminated with the disease. When the worms die off within thirty days of the date of hatching it is very good evidence that they came from infected eggs and started life under a handicap. Male moths, even if heavily infected, may be used for mating without any fear of contamination of the eggs, although, of course their vitality will be lessened by the disease.

As the corpuscles of *Nosema bombycis* cannot retain their vitality longer than seven months outside of the body or egg of a silkworm the disease is easily controlled by sanitation and cleanliness, and with disease-free eggs to start with, and a clean rearing room, there need be no apprehension of danger of infection. Where bivoltine worms and polyvoltine worms are raised one generation after another great care is needed to avoid contamination, but even here it is possible to keep out the disease with proper care. Before the season opens and between generations of worms when raising polyvoltines it is necessary to wash the walls of the building and all equipment (except the spinning frames, which are passed through a flame) as well as the eggs in a one per cent. solution of copper sulphate for five minutes to destroy the spores of the disease. The solution must be carefully washed off the eggs after five minutes or the eggs will be injured.

No cure is known for the disease after contraction, but by following Pasteur's method the disease can be prevented. The female moths, after laying their eggs, are kept in separate boxes or cells until they can be examined under a microscope for the parasites. After death the moth is crushed in a drop of distilled water when the corpuscles may be readily identified under a microscope. The eggs of infected moths are discarded, only the layings from healthy moths being retained for rearing the following year. Such a method, entailing as it does, the separate examination of each individual moth whose eggs are to be used, is tedious and time consuming, but it is the only method at present known for preventing the disease. With such care the percentage of infected moths reared under laboratory management can be kept down to one or less, but for industrial purposes, "commercial seed," or the eggs produced by moths, descended from examined moths, but themselves unexamined, although reared under sanitary conditions, will usually run five per cent. or less infected and do very well. If, however, they are continually raised without repeated examinations, and particularly under unsanitary conditions, such as are found in so many of the rearing establishments of China, the percentage of infection rises about one hundred per cent. each

DISEASES OF THE SILKWORM

generation,—10 per cent., 20 per cent., 40 per cent., 60 per cent., etc.—and the stock is soon worthless. In Italy and Japan the work of examination is done by the Government, or under its supervision, and in those countries the percentage of infection among the moths is down to five per cent. in the commercial rearings and one per cent. in the laboratories.

In China, however, no attempt is made by the usual farmer to eradicate the disease, and as a result the Chinese moths are from sixty-five to ninety per cent. infected, causing tremendous annual losses. Where, for instance, in Italy one hundred and thirty pounds of cocoons are obtained from one ounce of eggs, in Fukien province only sixty pounds are procured. From one card of eggs in Europe \$22.50 worth of silk may be obtained, while from a card of eggs in Fukien about \$6.50 is obtained. Thus does China pay for her disregard of science. Without doubt, with the eradication of pebrine, China could produce four or five times as much silk as at present with a moderate increase of acreage in mulberry trees and added equipment.

Some results of tests made at the experiment station at Fukien Christian University in 1926 may be of interest. They are given in tabulated form to save space :

Of 448 moths examined, 435, or 97.09 per cent. were infected with pebrine.

The eggs of the entire lot were allowed to hatch and reared under identical conditions, the larvae of the 13 disease-free moths being reared by themselves, and the larvae of the 435 diseased ones by themselves with the following results :

Larvae of 13 moths, disease-free, produced	668 cocoons
Larvae of 435 moths, with pebrine, produced	0 cocoons

In the following notes, the eggs laid by the diseased moths were reared separately from those by healthy moths, all from the same series, and the differences in production carefully noted. All other conditions were absolutely the same, the only difference being in the presence or absence of pebrine disease.

Larvae of 27 moths, disease-free, produced	55 ounces of cocoons
" " 129 " with pebrine " " "	68 " " "
" " 129 " (4.77 times as many as 27)	should produce 262.35 " " "

i.e., the diseased larvae produced 25.19% as much as the disease-free larvae, or the loss due to pebrine was 74.91%.

Larvae of 42 moths, disease-free, produced	26 ounces of cocoons
" " 698 " with pebrine, " " "	112 " " "
" " 698 " (16.61 times as many as 42)	should have produced 431.86 " " "

i.e., the diseased larvae produced 25.93% as much as the healthy ones, or the loss due to pebrine was 74.7%.

Disease-free moths laid, on the average,	347.5	eggs per moth
Diseased moths	230.0	„ „ „

i. e., disease-free moths laid 27.15 eggs, or 8.5%, more than infected ones.

In other words, out of several samples taken at random, it was found that worms with pebrine disease were producing only 31.75% as much silk as those free from the disease, or, to put it differently, in these tests 68.25% of the silk was being lost because of pebrine. While it is always dangerous to generalize, even from sufficient data, from this little test, however, it seems not too far from the truth to state that in the neighbourhood of Foochow the silk-worms are producing only about 32% as much silk as they would be capable of doing if the pebrine were eradicated.

Only when, by careful selection of disease-free moths and a most thorough cleaning and sterilization of the rearing rooms and equipment used, the dread *Nosema bombycis* is stripped of its power, can we expect the silk industry in China to take its rightful place in the economic life of the country that gave it birth.

2. THE TACHINA FLY (*Fly Disease*): Other very troublesome parasites of the silkworm are various species of Tachina-flies (Family *Tachinidae*, of the Order *Diptera*). For the most part tachina-flies are among the best friends that man has, as they are parasitic on various harmful insects, often parasitizing as high as 85% to 90% of a generation of such injurious forms. In this case, however, a few individual species, although coming from an upright and most highly respected family, have made themselves a great nuisance by attacking a useful insect.

The tachina-fly looks much like the grey flesh flies, so often seen about decaying flesh, and might readily be mistaken for one by anyone not conversant with them. They can best be identified by a series of thick bristles pointing backwards on the abdomen. It is usually the custom for the tachina-flies to lay their eggs on the surface of the skin of their prey, the larvae then boring their way into the body, where they live at the expense of the host.

There are several species of tachina-fly attacking the silkworm in different regions of the world. The best known form is the one found in Japan, *Ujimyia sericariae* Sasaki, which does a great deal of damage there, and has a most interesting life history. Instead of laying its eggs on the surface of the skin, as is customary with most tachina-flies, this one lays its eggs on the mulberry leaves on the trees in the fields, confident that they will in some way find their way to the silkworm. That this confidence is justified is proved by the presence of so many of the parasites. Just how they gain entrance into the alimentary canal of the silkworm is not known, some asserting that the eggs are swallowed with the leaf, and others believing that they must in some way make their way through the skin. However it gains access to the body of the silkworm, the young parasite buries itself in one of the ganglia of the nervous system where it remains for about one week. At the end of this period, feeling

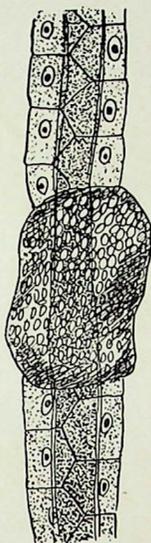


Fig. 1. Sporocyst in Spinning Glands. (After Doflein)

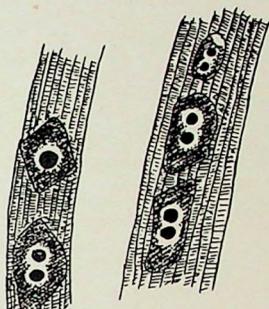


Fig. 2. Spores in Muscles (After Doflein)



Fig. 3. Ripe Spores (After Doflein)

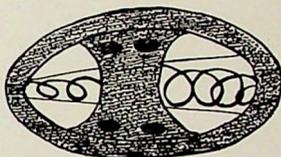


Fig. 4. Spore, Much Enlarged (Alter Minchin)

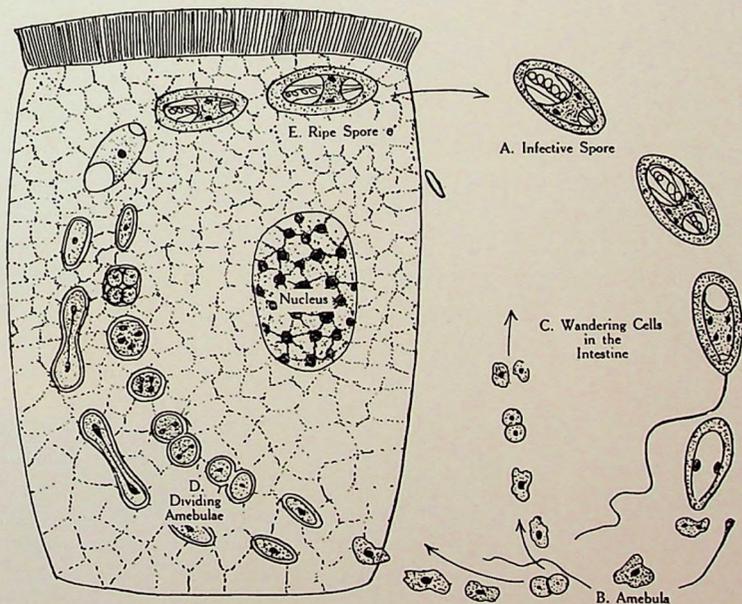


Fig. 5. Life-Cycle of *Nosema bombycis* Naeg. (From Doflein, after Stempell)

A. Within the Cell

B. Within the Intestine.

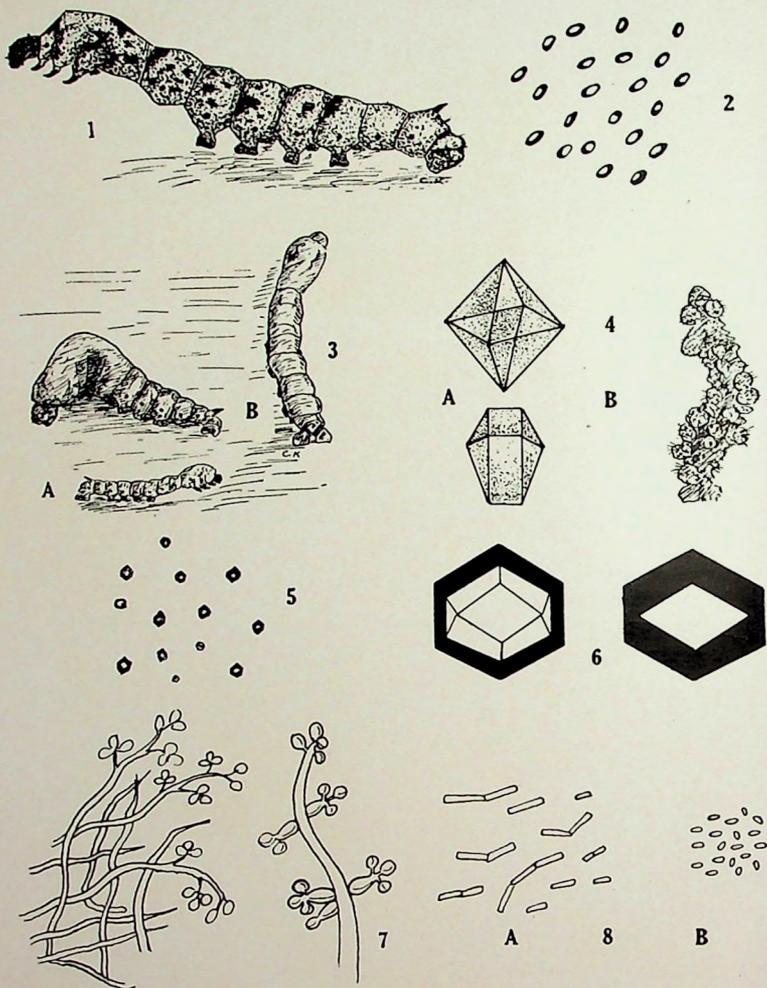


Plate 2.—Diseases of the Silkworm.

- Fig. 1. Silkworm with Pebrine. (Original) (Black areas Show Pebrine).
- Fig. 3. Comparison of Pebrinized (A) and Non-pebrinized (B) Worms. (From photograph).
- Fig. 5. Polyhedral Granules of Grasserie, as seen under the Microscope. $\times 450$ (Verson et Quajat)
- Fig. 7. Muscardine Fungus. $\times 500$ (From Mukerji)

- Fig. 2. Pebrine Corpuscles under Microscope. $\times 500$
- Fig. 4. A. Crystals of Calcium Oxalate. B. Crystals of Magnesium and Ammonium Oxalate on Silkworm Killed by Muscardine. $\times 450$ (Verson et Quajat)
- Fig. 6. Polyhedral Granules of Grasserie. (Viel, after Verson et Quajat). Greatly enlarged.
- Fig. 8. Germs of Flacherie. (A). Vibrions (B). Ferments. (After Pasteur)

DISEASES OF THE SILKWORM

the need of more air, it goes to the tracheal system of the silkworm where it presses its breathing pore, or spiracle, to the opening in the spiracle of the silkworm, remaining there the rest of its larval life, the anterior end of the parasite taking nourishment from the surrounding tissues of the host. Sometimes five or more of the parasites gain access to one host, in which case only one will mature, and the silkworm will die without spinning. In case only one parasite attacks the silkworm, the latter is usually able to complete its cocoon, but develops no further. When ready to pupate, the tachina-fly larva gnaws its way out of the host, piercing the cocoon if within one, and wanders about until it finds a place in the ground to pupate, where it remains until awakened by the return of warm weather in the following spring.

Unfortunately we have no determinations or records of the tachina-flies attacking the silkworm in China, but the form found in Fukien seems to follow closely the description of the Japanese form.

In Bengal and Assam there are two species of tachina-fly, *Crosocosmia sericariae* Rond., and *Tricolyya bombycis* Bech., attacking the silkworm. The latter of these species has eight or nine generations per year and the polyvoltine silkworms seven or eight, so that the fly is assured of plenty of victims upon which to work. One fly, laying them on the surface of the skin in orthodox tachina-fly fashion, may lay as many as two hundred eggs, so that a few of the parasites gaining entrance into a rearing room may ruin a whole crop of worms. Sometimes one egg only is laid on a worm, in which case the worm is able to mature and spin a fragile cocoon, but it never transforms into a moth, dying within the cocoon. At other times twenty or thirty eggs may be laid on a single larva of the silkworm, which then dies without being able to spin a cocoon.

3. PREDATORS: Besides the two parasites mentioned above the silkworm is attacked by several predators that kill and eat it at various stages. The rearing stands upon which the trays are placed must have their legs in bowls of water to keep out the ants which would otherwise attack the helpless larvae and carry them away bit by bit. Wasps (*Vespa orientalis*) attack the mature larvae on the spinning frames if placed out of doors unprotected. Small spiders will sometimes attack the silkworms in the trays, the worms being found dead with tiny holes where bitten. Rats are fond of both the larvae and pupae in the cocoons and must be carefully excluded.

When one considers the helplessness of the silkworm, due to its long contact with man, and realizes how many alert enemies are always lying in wait for it, one wonders how so many of the worms reach maturity and are able to spin cocoons.

II

DISEASES OF SILK-WORMS CAUSED BY PLANT ORGANISMS

1. FLACHERIE: For a long time silkworm rearsers in Europe, when they saw their worms blacken and die, recognized only one ailment and referred to it as "The Disease," (la maladie). It remained for Pasteur

to show in 1867 that there were really two diseases, pebrine and flacherie, concerned, each one due to an entirely independent and distinguishable organism. At that time Pasteur, with only his microscope and few of the aids known to modern bacteriologists, recognized and described two different types of bodies as the probable cause of flacherie. Later workers have largely copied the work of Pasteur until in 1922 Dr. C. S. Gibbs, of Nanking University, isolated a small spherical organism obtained from silkworms affected with flacherie, which, when inoculated into healthy moths, produced typical symptoms of the disease.

Micrococcus bombycis Gibbs is a small microorganism 0.85 to 0.90 microns in diameter, Gram-positive, and a facultative anaerobe which can be cultured and studied in the laboratory. Inoculated into rabbits, guinea pigs, domestic fowls, and even into the larve of certain Chinese moths, it produced no results, apparently being peculiar to silkworms. It is to be hoped that a continuation of this work may yield some practical results in the control of this troublesome affection.

Scientifically, flacherie disease is more complicated and less understood than either pebrine or muscardine. Some writers claim to have found two types of causative agents and speak of two diseases, true flacherie and gattine. Others think they are but phases of the same disease due to different stages in the life cycle of the same organism. Most workers, following Pasteur, recognize two distinct types of forms, (1), rod-like vibriions (Plate II Fig. 8 A), often seen attached end to end; and (2), smaller bodies (Plate II. Fig. 8 B), with about the same appearance as pebrine corpuscles, but only one-fifth their size, often seen in large groups, to which the name ferment-balls has been given. The vibriions attack the intestinal wall which then ceases to function, all the matter in the intestinal canal liquifies and decays, causing the bursting of the intestine, thus allowing the escape of the vibriions into the entire body. Filled with the seeds of decay the entire body soon turns black in colour and becomes soft and flabby to the touch, bursting and emitting a black fluid upon being touched. The action of the ferment-balls is slower, the fermentation in the alimentary canal bringing on death less rapidly, even allowing the silkworm to develop into a moth if the disease is contracted late in larval life.

Flacherie usually appears during the fourth stage, or just before the time for spinning the cocoon. Larvae which, previous to that time, have seemed vigorous and in good health, suddenly begin to languish, refuse food, and drag themselves to the edges of the tray, where they die very soon. If the disease appears in severe form, many of the worms may crawl onto the twigs or spinning frame and die there, their blackened bodies hanging limply from the brush. These bodies, soft and flabby, soon decompose, assuming a black colour, and if broken are found to contain a brown liquid which gives off a very pungent odour. Often an entire rearing of worms will perish in a day, but at other times the disease will act more slowly, allowing the worms to transform into pupae, which soon die and decompose within their poorly made cocoons. A few may produce moths, but if developed, such moths are misshapen and sickly, their bodies filled with the brown poison.

DISEASES OF THE SILKWORM

Essentially a fermentation disease, flacherie may be brought on by anything that would facilitate the development of fermentation processes in the body of the silkworm. Vibrions, similar in every respect to those found in diseased silkworms, may be found on mulberry leaves soaked in water and allowed to ferment. Among a number of contributing causes of flacherie may be mentioned the following :

(1). *Careless conservation of eggs.*—A lack of care in preserving the eggs throughout their winter rest, such as exposure to sudden changes in temperature, the drying action of wind or sun, allowing the eggs to become over-heated or moldy, will tend to bring on flacherie by weakening the worms and making them more susceptible to fermentation processes. This point is of more concern to silkworm rearers in the temperate regions than to those in the tropical or semi-tropical regions, as the latter raise the polyvoltine varieties and their eggs are not kept for so long a period. Washing the eggs in a 1% solution of copper sulphate, especially if they have come a distance by mail, is advocated by many as a precautionary measure.

(2). *Overfeeding.*—Young worms may with profit be fed four or five times a day without untoward results, but older worms should be fed only three times a day, particularly in their last stage. The tendency of the conscientious rearer, when he sees his worms stretched out on barren leaf stems, expectantly reaching their heads back and forth, is to feed immediately, but, as with people, a period of rest between meals is best for their health. Constant feeding, or feeding in too great quantities, acting as in human beings who overeat, will bring on indigestion, for flacherie is essentially a question of bad digestion.

(3). *Feeding wet leaves.*—Avoiding wet leaves is very difficult in many localities where the rearing season is apt to be rainy and wet, often with heavy downpours, and where drying facilities are hard to plan, but feeding any such water-soaked leaves in quantity is quite sure to prove fatal. Leaves that have for a time been submerged in water, as during a flood, even though they may appear normal, may have started to ferment, and if fed will cause trouble. Also, leaves that have been stored for some time in a poorly ventilated room may have begun to "sweat" and ferment, and such leaves should not be fed to worms.

(4). *Poor ventilation.*—The lack of clean fresh air in the rearing room is another cause of flacherie. In so many of the homes in Fukien the worms are kept in closely shut rooms, often dark and dirty, and further covered by cloth curtains to keep out the parasitic tachina-flies, so that proper ventilation is impossible.

(5). *Excessive heat.*—Contrary to the general opinion, the monovoltine silkworm is not a tropical insect, its ancestors, now vanished from the earth, originating in Northern China, and it does not do well if kept too warm, thriving best at a temperature of about 75 degrees Fahrenheit.

(6). *Crowding.*—Allowing the growing worms too little room on the rearing trays is a common tendency among Fukien silkworm cultivators. This stunts their growth and makes them a prey to diseases.

Flacherie is extremely contagious, once gaining entrance to a rearing room it sweeps everything before it, and the most careful disinfection of all apparatus and equipment (except the spinning frames, which are flamed) must precede each rearing. It is also inheritable, the larvae of moths so affected developing the disease. The silkworm rearers in China avoid the danger of infected eggs by buying cocoons, after themselves having carefully inspected the worms at spinning time, and rearing their own moths from which to collect the eggs.

Resistance of certain species, especially the Chinese and Japanese varieties, to flacherie has long been noted, this resistance having been attributed by Pasteur to their smaller size. Silkworm rearers also generally admit that varieties with smaller worms are more resistant than those with larger worms. M. G. Coutagne explains it thus, "As the worm grows, the surface grows according to the square of its dimensions and its volume according to the cube, with the result that the ratio of the surface to the volume progressively diminishes, and therefore its cutaneous breathing is accomplished in conditions more unfavourable." When we realize that the only means the silkworm has, aside from the alimentary canal, of getting rid of excessive moisture is through the skin, the relative decrease in the surface of the skin takes on greater significance.

In Indo-China and South China the worms of the indigenous varieties are all small and of rapid growth. Worms of larger size and apparently greater robustness, doubtless due to their longer feeding period, nearly always die of flacherie after the fourth molt, making it extremely difficult, if not impossible in most places, to raise the monovoltine type of silkworm, much richer in silk.

2. MUSCARDINE: This was first observed and reported in 1720 by Vallisneri who accurately described the external symptoms, such as the sudden death of the worms, their rosy hue at first, later turning to white, and the hardening of the body. In 1835 Dr. Bassi showed that the disease was due to a fungus organism and that the contagion was due to the spread of its spores. Later Balsama Crivelli studied the plant more thoroughly, classified it as a *Botrytis*, and named it *Botrytis bassiana* in honour of Dr. Bassi. The most exact and detailed study of the fungus is that by Dr. Vittadini.

Next to pebrine, muscardine is the most serious disease of silkworms in tropical and semi-tropical regions, where the warmth and humidity are more suitable to its growth than the cool dry atmosphere of Europe and Northern Asia. In Indo-China it makes great ravages among the silkworms during the months of February, March, and April, but, strange to say, during the months of July, August, and September, with a humidity of between 90% and 100%, it does not appear at all, possibly because the extreme heat (over 85 degrees Fahrenheit) causes the spores to lose their vitality.

Spores of muscardine, carried by the wind and falling on a silkworm, gain access to the interior of its body through the spiracles. Inside of the host, finding itself in a suitable environment, the spore begins to grow, sending out mycelial threads in the same manner as common bread mold (Plate II. Fig. 7). These mycelia spread through all the body of the

DISEASES OF THE SILKWORM

silkworm, attacking all organs but the spinning glands, and, becoming mature, produce more spores or conidia, which in turn produce more vegetative threads, until the body of the silkworm is filled with the fungus growth. The blood becomes acid and a microscopic examination reveals octahedral bodies of calcium oxalate (Plate II, Fig. 4 A), in the body fluids. Pulsations of the heart become less frequent and soon the worm succumbs. Within twenty-four hours after death, many of the branches of the fungus have protruded from the body of the silkworm and produced fruiting heads, which, on bursting, shower the spores all over the outside of the dead worm, giving it a chalky white colour. If a dead worm is left for eight to ten days longer in a humid atmosphere crystals of magnesium and ammonium oxalate (Plate II, Fig. 4 B), large enough to be seen with the naked eye, will form, and these give to the dead insect its rigidity. Before death a worm becomes pink in colour if affected with *Botrytis bassiana*, but if attacked by *Botrytis tenella* the stricken worm turns red in colour. Muscardine is much more contagious than any other of the silkworm diseases, as the spores are so light that they may be carried far by the wind or may float about on the particles of dust in the rearing room, or even be carried into the rearing room on the clothing of a visitor. As the life cycle corresponds fairly well with the length of time between molts of the silkworm and the spores can only gain entrance to the interior of its victim when it is changing skins, evidences of the disease are seen only at the moulting periods. Between moults very few worms are found dead with muscardine. In warm weather the course of the disease takes only three or four days, but in cold weather it may take from eight to ten days to complete a life cycle. The spores retain their vitality for many years and are capable of starting an infection on healthy as well as weakened worms. Fortunately both the prevention and the remedy are quite simple. Before each hatching the walls of the room and all the equipment to be used that season, with the eggs as well, must be passed through a solution of copper sulphate in water (1:100) and then washed in clean water.

Just before the eggs hatch out, the room should be further sterilized by fumigation with burning sulphur at the rate of an ounce to 100 square meters of space. Eggs and nets should not be subjected to the fumes of sulphur dioxide. If at any time during the rearing any worms dead with muscardine are found, the room and equipment must be again washed in copper sulphate and the worms shut up in the room for six hours with no food and an ounce of sulphur burned. An amount of sulphur sufficient to kill rats, bats, and lizards, or even human beings, has no effect on silkworms.

III

SILKWORM DISEASES NOT CAUSED BY LIVING ORGANISMS.

GRASSERIE: Although the earliest disease of the silkworm to become known, little has been learned even yet about grasserie. In India and South China it is a very serious malady, but in Europe and North China it is considered of so little importance that it has not been very

thoroughly studied. In France there is a proverb which says, "No grasserie, no cocoons" (*pas de gras, pas des cocons*). In Fukien Province the disease is very common, destroying large numbers of worms every year.

Worms affected with grasserie become restless, bloated, and lemon-yellow in varieties producing yellow cocoons, and milky-white in varieties producing green or white cocoons. The worm continues to swell and soon dies, looking then much like a sack filled with a yellow or milky liquid, according to the variety represented, the fluid in the body owing its colour to the breaking up of the silk glands and their accessories. Under the microscope this liquid is seen to contain an enormous number of granules, which at first appear to be round, but which, on closer examination, are seen to resemble crystals of a definite polyhedral shape (Plate II, Figs. 5 and 6).

Grasserie is not caused by a living organism and is therefore not contagious like flacherie and muscardine, nor is it "hereditary" like pebrine, but each worm must be separately affected by it. It does not appear in moths nor does it seem to affect the eggs to any extent. In tropical and semi-tropical countries it is likely to assume an epidemic form, due to the character of the food which affects all the worms at the same time, that is, during their fifth feeding stage. If the season has been dry and a sudden downpour of rain soaks the ground, the thirsty plants, cut back near the ground, and having short stems, will rapidly absorb a large quantity of water so that the leaves will then contain a too high percentage of moisture. Eating such leaves will bring on grasserie, or, if old worms in their last stage are fed on young and tender leaves, which contain more moisture than older leaves, they will contract the disease. It is the generally accepted view that grasserie is due to the sudden change in the food, giving young or water-filled leaves to older worms accustomed to mature, dry leaves.

Other minor causes of grasserie, all in the last analysis traceable to the above basic reason, are: (1) Feeding leaves gathered in heavy shade; (2) Keeping worms during the rainy season in a draught of air where the leaves may absorb moisture; (3) Feeding fresh leaves too soon after the worms have come out of a molt; (4) Allowing the older worms to eat young tender leaves, as when during the last stage, branches are placed on the trays which have young leaves at their tips.

Grasserie may be largely avoided by feeding worms during their last stage with mature leaves from trees, instead of from the low bushes, as is so frequently done in India and South China, and protecting the worms from cold draughts and excessive moisture.

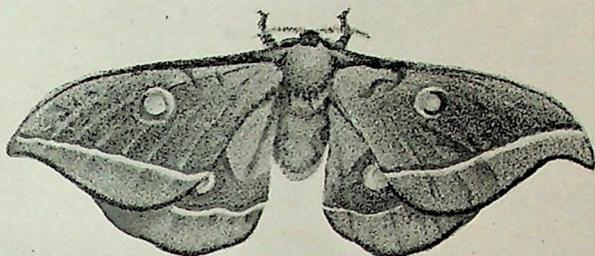


Fig. 33.—ANTHERÆA PERNYI, FEMALE (NATURAL SIZE).

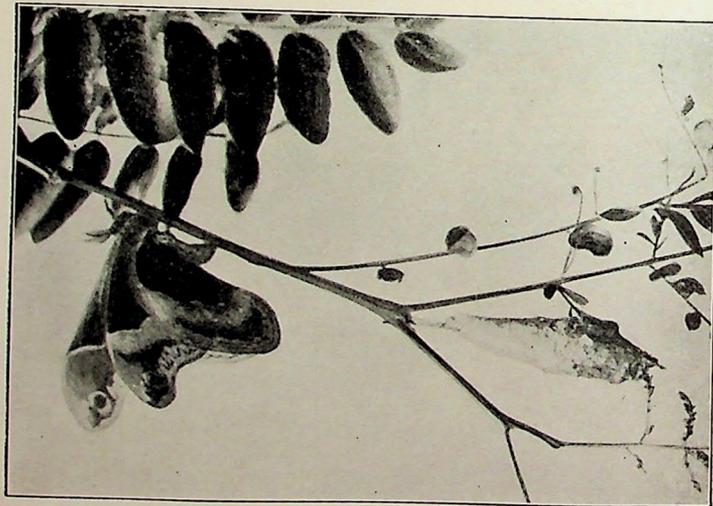


Fig. 34.—ANTHERÆA PERNYI, COCOON AND EGGS (NATURAL SIZE).

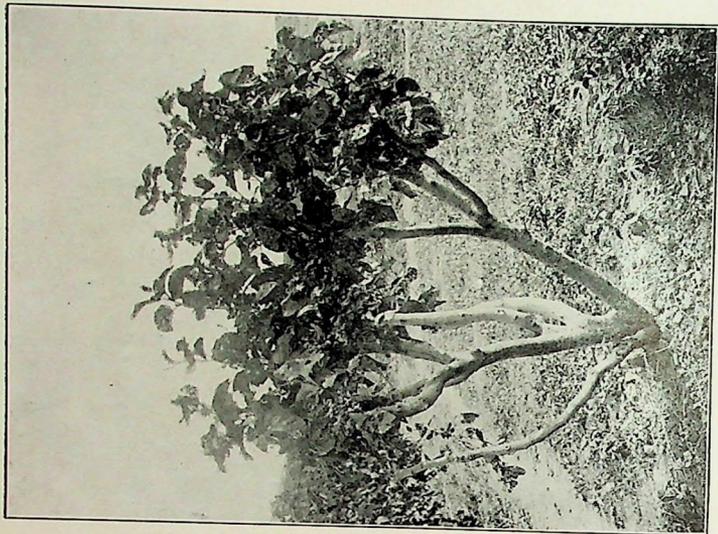


Fig. 35.—ANTHERÆA PERNYI, LARVA (NATURAL SIZE)

The Tussore Silk Moth of North China and Manchuria (*Antheræa pernyi*), Cocoon Eggs and Caterpillar feeding. (By Courtesy of the Chinese Maritime Customs from "Silk," II, Special Series No. 3.)



A Promethea Moth (*Callosamita promethea*), just emerging from its Cocoon, seen hanging from the Fork of the Twig. This is a North American species related to the Tussock Silk Moth and the Gigantic Atlas Moth of China.



The Enemies of the Mulberry Tree are many. Some, such as Borer Beetles, attack the woody Parts; others the Leaves. The above is a Mulberry Tree with diseased Leaves.

SCIENTIFIC NOTES AND REVIEWS

BIOLOGY

THE LARGEST MOTH IN CHINA: The family of moths known as *Saturniidae* is composed mainly of medium sized or very large moths. Indeed to it belongs the very handsome species known popularly as the Atlas moth and to science as *Saturnia atlas*, which is by far the largest of the moths found in China. It has a wing-span in the female of upwards of nine inches, the male being a little smaller. It is richly coloured varying shades of henna, brown, russet, chestnut, yellow and even pink, arranged in a characteristic pattern marked with black. On each of the four wings is a large transparent triangle bare of any scales, giving the effect of window panes. This handsome insect inhabits south China as far north as Fukien. Like all the members of the family *Saturniidae* the caterpillar makes for itself a strong cocoon of a silky fibre which is fastened to the under side of the branch of some tree. From the caterpillar of this moth the Chinese in Fukien extract a very fine quality of the so-called silk-worm-gut, which they use for traces in fishing.

THE TUSSORE MOTH AND ITS RELATIONS: Another and most important member of the family *Saturniidae* is the tussore silk moth (*Antheraea pernyi*), named after the Abbe' Perny, who was amongst the first to describe it. That this is the species which yields the famous tussore silk of Shantung and Manchuria is well known. It is a wild species, that is to say, it is not a purely cultivated form of silk-producing moth like *Bombyx mori*, the ancestral wild form of which is not known. Of a beautiful fawn colour with a large eye-like spot and a bi-coloured band on each wing, the tussore moth is a large species. Its caterpillar is also large, thick, heavily segmented and of a light green colour. Stiff hairs occur in tufts on the segments. It feeds upon the leaves of various kinds of oak or related trees. The chrysalis is invested in a strong cocoon of buff-coloured silk, suspended by a long stalk to a twig of the tree upon which the caterpillar has lived. The fibre of which this cocoon is composed is much coarser than that of the domesticated silk-worm. There is an enormous business in the producing and weaving of tussore silk in China, the centres of which are Chefoo in Shantung and Kaiping in Manchuria. In Japan the tussore silk moth is replaced by an indigenous species called *Antheraea yamamai*, though the Chinese species has now been introduced there and is flourishing. The Indian species is *A. mylitta*.

Another larger and more beautiful member of this family is the handsome Cynthia moth (*Philosoma cynthia*), whose caterpillar feeds upon the leaves of the varnish tree (*Ailanthus glandulosa*) and weaves a cocoon from which a coarse silk is obtained. In various parts of China, this coarse silk is utilized to weave silk for local consumption; there is no export trade in it. The moth is extremely handsome, larger than the tussore silk moth, but falling far short of the great Atlas moth. It is of an olivaceous greenish buff colour, varying to buff in some varieties, with white stripes and markings and a large crescentic or half-eye spot on each wing. The abdomen is spotted white. From China this moth has been introduced into both Europe and America, where, it was hoped, it might become a valuable silk-producer, but no satisfactory method has been discovered of reeling the silk from the cocoons.

Before leaving this family, what may, perhaps, be considered the most beautiful member of all should be mentioned. This is the Luna moth (*Actias selene*), closely similar to *A. luna* of North America. This is a large, pale or whitish green moth with long streamers on the two posterior wings, purple half-moon spots on each wing, and a dark maroon or purple bar running along the upper edge of each wing across the prothorax. It must be familiar to Shanghai residents, as it is often to be seen fluttering about the electric lamps on summer nights. Its caterpillar feeds on the willow and weaves a strong cocoon of coarse silk that has no commercial value.

One of the best known members of the *Saturniidae* in the United States is the Prometheus moth (*Callosamia promethea*), a picture of which, with its cocoon is here given. The best known British member of the family is the Emperor moth (*Saturnia carpini*).

A. DE C. S.

THE MULBERRY IN FUKIEN PROVINCE: Just how long the mulberry tree has been cultivated in Fukien Province for use in rearing silk-worms is very difficult to ascertain. Mulberry trees in some of the villages, still giving leaves, show good evidence of having seen some thirty or forty growing seasons, so the industry must have been established at least that long. Wild trees must have been here since time immemorial.

Several types of mulberry trees are found in the province. The commonest species is the white mulberry (*Morus alba*), distinguished by the white colour of its bark and by possessing rather small leaves, only three or four inches long. If not cut back, it produces a large quantity of fruit, but the efforts of the sericulturist are towards less fruit and more leaves. This tree grows readily in any good soil, but attains its maximum growth in the rich and fertile soil along the banks of the River Min. Some of the trees are grown in all the villages that rear silk-worms, but they are seen in greatest profusion in the village of Gang Cia, sixteen miles west of Foochow on the Min River. Here the trees, in addition to being planted in every available plot of ground in the village, are used as hedges surrounding the individual farm houses and lining the street of the village, so that, viewed from a hill, the buildings look like tile-covered rafts floating in a sea of green. Mulberries everywhere, and all trimmed down to the same level of six feet to facilitate the picking of the leaves.

The white mulberry also does well on the hills, wild specimens sometimes attaining a height of from thirty to forty feet. With proper care and fertilizing they would undoubtedly do well on the narrow hillside terraces, rich in the accumulated fertility of decades of disuse. Work is being carried on at Fukien Christian University in an effort to develop a supplementary crop that will utilize the now unused portions of the hillsides.

The large-leaved variety (*Morus multicaulis*) has been imported in large numbers from Chekiang province. Its high productiveness and large nutritious leaves make it the variety best suited to mature the worms during their last feeding stage. One village near Foochow makes a specialty of raising this type of tree to supply the silk-worm rearers of the upper villages with the leaves to use in maturing their silk-worms. In most villages, however, both varieties are grown, no such specialization taking place as in South China. Both of these varieties of mulberry trees do best on rich loamy soil superimposed on the sandy banks of the river, where they may be flooded every year.

The red mulberry (*Morus rubra*) is sometimes seen growing as an outcast in the villages, but it is of little use.

Both white and large-leaved mulberry trees do well in Fukien Province, and by utilizing the terraced hillsides as well as the rich valley ground, there could easily be sufficient leaves produced to support a thriving sericultural industry of from fifteen to twenty million dollars per annum.

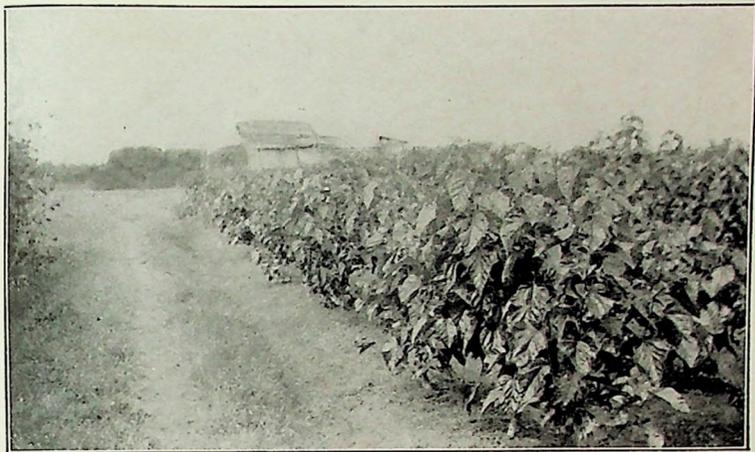
C.R.K.

TECHNOLOGY

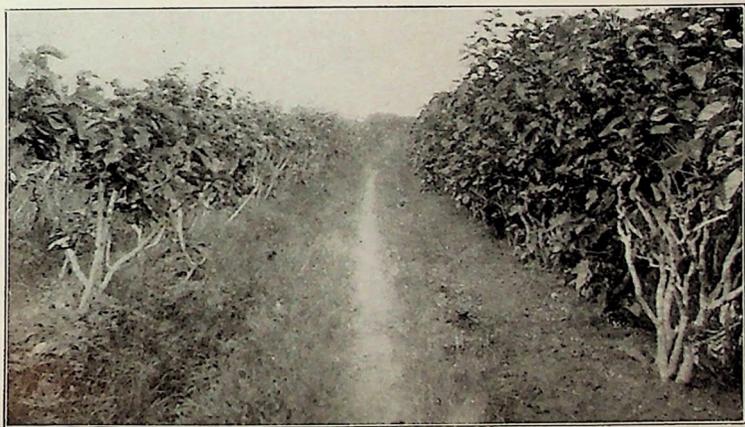
HOSIERY PRODUCTION IN CHINA: In no branch of the textile industry is a higher standard of silk required than in hosiery knitting. Unevenness, slugs or other irregularities which may slip unnoticed into average grades of silk cloth would entirely spoil the appearance of a silk stocking.

For many years the Chinese have been knitting silk stockings on machines operated by hand. About ten years ago the first power-operated automatic machines for knitting silk stockings were installed in China. Since then the majority of full-length stockings of foreign style have been produced on these modern machines, the hand-machines continuing to produce knee-length silk hosiery for the Chinese market. Two years ago the first full-fashioned machinery was put into operation for making hosiery comparable in quality to the most expensive imported article. So to-day one will find in shops catering to the Chinese a wide assortment of hand-made stockings in Chinese styles, and in shops catering to the foreign trade a variety of stockings made according to the most approved modern methods, and all of this hosiery is made from Chinese silk by Chinese labour. China has made rapid strides in its hosiery knitting industry during the past ten years, and, as an important result, imports of hosiery are decreasing.

C.J.F.

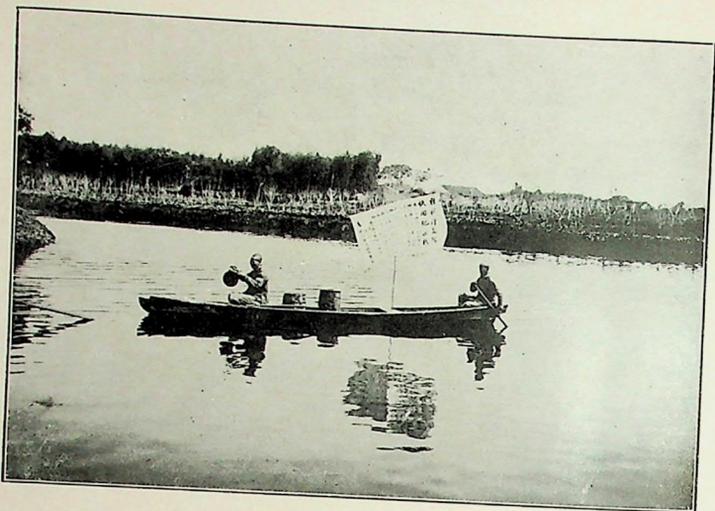


Fine Leaves produced in Fukien from *Morus multicaulis*.



Photos by C. R. Kellogg

Avenues of Mulberry Trees as Grown in Fukien, where every available bit of Ground in some Districts is utilized for this purpose.



Methods adopted by Messrs. Brunner, Mond & Co. to persuade the Chinese Farmer to use Artificial Fertilizers for Mulberry Trees and thereby help to eradicate Hookworm Disease.

SCIENTIFIC NOTES AND REVIEWS

JAPAN'S SILK INDUSTRY AND TRADE

In a report on the silk market for 1927 in the Japan Advertiser's Annual Review of Finance, Industry and Commerce, 1927-8, it is claimed that the industry in Japan generally experienced a good year. There was certainly a larger volume of business done, and no noteworthy failures of companies took place.

Since America surpassed Europe as a consumer of Japanese raw silk in 1919, there have been many changes in the manner of doing business in this important industry.

Realizing that the technical skill in silk manufacture, the management of cocoon raising and silk manufacture and the mode of conducting transactions in raw silk in Japan still leave much to be desired, Mr. Teijiro Yamamoto, the Minister of Agriculture and Forestry, inaugurated last year a special organization called the Silk Committee, composed of thirty members drawn from among officials and experts with deep knowledge and ample experience in order to investigate the industry and lay plans for its immediate improvement. Mr. Yamamoto himself assumed the presidency of this committee, and it is expected that good results will be secured in the near future. The silk industry in Japan dates from a very remote period, and to-day there is a very important export to America of Japanese silk. A great deal has been done in recent years in sericulture in Japan, especially the advance in biological study of the silk-worm and its application to actual practice.

Plans for the New York Cotton Exchange to commence trading in silk futures are in process of formation, and it is believed that these plans when fully put into effect will provide insurance against the marked fluctuations which have characterized the raw silk trade in the past, and will permit American manufacturers to hedge their raw materials.

In spite of falling prices of silk during the past year, Government statistics brought forward to prove that the poor farmer who raises cocoons has lost heavily, it is argued by those in the trade in Japan that the fact that there is a yearly increase of output of silk indicates that the farmer is making money.

The reelers appeared to suffer most from the fall in price of silk during 1927.

THE SILK ASSOCIATION OF AMERICA AND IMPROVEMENT OF SILK INDUSTRY IN CHINA.

The extremely important contributions to the improvement of the silk industry in China by the Silk Association of America, both as an association and by individuals in it, are not nearly so well known in China as they deserve to be.

In the Canton area in addition to contributions to the running expenses of the silk improvement work carried on by the Canton Christian College, now called Lingnan University, over a period of years, the Silk Association of America has contributed at least one building, and, through its interest, two other fine buildings have been contributed by members of the Association, the latest addition being the Atwood Silk Reeling Laboratory. At least fifty thousand dollars gold has been contributed in buildings and equipment.

In Fukien province, contributions have been made to the Fukien Christian University to help develop sericulture improvement and promotion through the University.

In the Yangtze Valley area, the Silk Association of America was one of the original contributors to the initial fund of The International Committee for the Improvement of Sericulture, which committee later received annual grants from the Chinese Government through the Maritime Customs Service. It has also contributed very heavily towards the establishment and upkeep of the Shanghai Silk Testing House, 10A Hongkong Road, and the introduction of uniform tests for Silk exported from Shanghai, particularly to the United States. In 1922, it contributed \$G.21,000 to the University of Nanking for a sericultural building and its equipment. This latter building is probably one of the finest buildings in all China devoted to sericulture. It has a capacity of over a million layings of eggs per crop. In 1924, the Association contributed \$G.4,000 for a mulberry orchard for the University of

THE CHINA JOURNAL

Nanking, and on several other occasions have contributed towards the running expenses of the sericulture department of the University.

Through its representatives in Shanghai, valuable investigations into the problems of sericulture and flature management, as well as original studies of cocoons, have been carried out. These have been of much benefit to the Silk Industry in China as a whole.

DEPARTMENT OF SERICULTURE OF THE COLLEGE OF AGRICULTURE AND FORESTRY, NANKING UNIVERSITY: The production of disease free eggs from selected cocoons has always been one of the main lines of work. For the last three years the gross production of this improved seed has exceeded one million layings annually, and the percentage of disease has been reduced from over eighty per cent. in the early years to an average of five per cent. in 1927. The net production of saleable layings of eggs, over 900,000, last year have all been disposed of this year to silk raising farmers, chiefly in the Yangtze Valley and particularly in Kiangsu Province. Five demonstration stations are being managed this year under the direct supervision of the Department of Sericulture, in important silk producing centers, with over 800 families co-operating, using our own "Golden Butterfly" chop eggs and modern methods of management, including proper disinfection of rearing rooms and rearing equipment, control of temperature and moisture and proper methods of feeding. Arrangements have also been made with cocoon merchants to buy the cocoons so produced at an advance of at least ten dollars per picul over market prices.

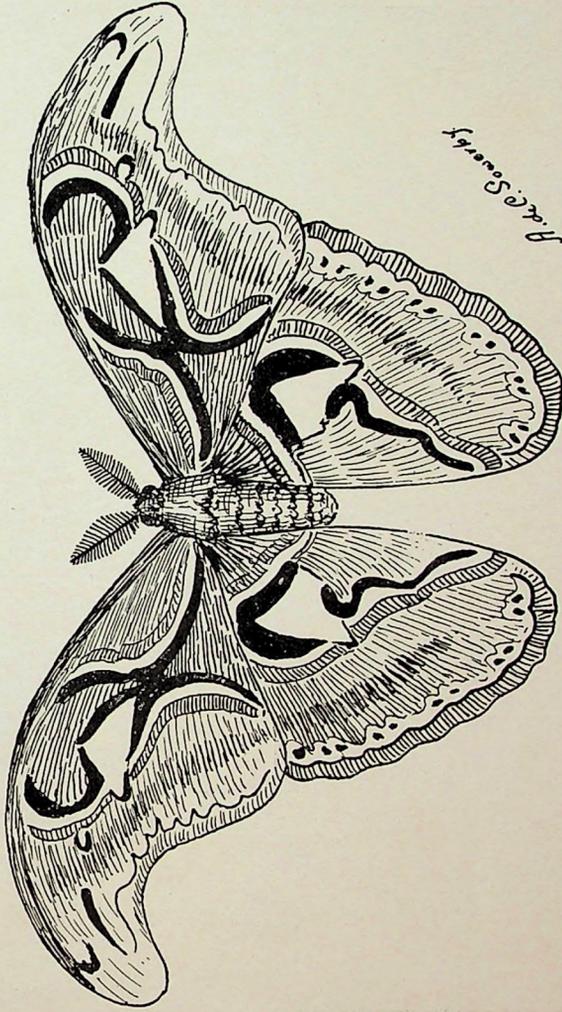
The University now owns and manages 250 *mow* of mulberry orchards. Each year for the past four years from 50,000 to 100,000 mulberry seedlings have been grafted to good varieties for distribution and sale to farmers. The University also has an important and large collection of types and varieties of mulberry trees for scientific study.

For its sericulture work, the University has a fine, large brick and concrete building contributed to it by the Silk Association of America, well equipped for the production of cocoons and disease free seed. The Department of Sericulture is in charge of Mr. Kuh Ying, a graduate of Tokyo Imperial University, to whose ability and efficiency and loyalty is due the major share of the University's contribution to sericultural improvement. Important scientific investigations, especially in disease studies and control, are being carried on by the Bacteriology section of the Department of Biology. Much financial assistance has been received from the Silk Association of America in addition to the gift of the Sericulture Building, and active co-operation has been maintained with the International Committee for the Improvement of Sericulture in China.

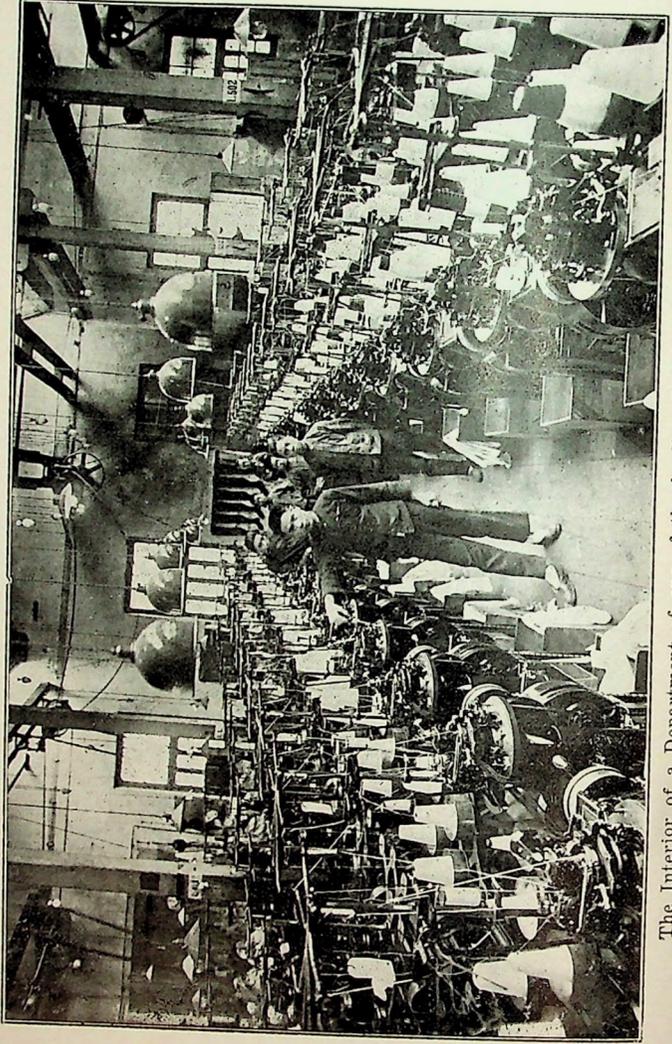
JOHN H. REISNER.

MEDICINE

MULBERRY CULTIVATION AND HOOKWORM ERADICATION: In a paper by Dr. F. Oldt of the Canton Hospital, China, which appeared in *The China Medical Journal* of March, 1926, the interesting point is brought forward that the use of Ammonium Sulphate with night soil by Chinese farmers in fertilizing mulberry shrubs results in a marked destruction of hookworm eggs. Tests were made to ascertain the number per 100 grams of hookworm larvae in cultures of night soil mixed with other fertilizers, and a mixture of 88% of night soil and 12% of ammonium sulphate gave remarkable results, in many cases completely destroying all hookworm larvae. Acid phosphate mixture was found to make, if anything, a more favourable medium for hookworm eggs and larvae. Thus, it is claimed, that by mixing 12% of Ammonium Sulphate into night soil a safe, hookworm free fertilizer for mulberries may be made. Considering the terrible ravages of the hookworm disease throughout the silk-producing areas of Central and South China, this discovery is of the utmost importance, and steps should be taken by the authorities to encourage the Chinese farmers to use Ammonium Sulphate wherever possible.



The Largest Moth in China. The gigantic Atlas Moth (*Saturnia atlas*) which ranges from Fukien Province southward to India and measures as much as Eleven Inches across the Wings.



The Interior of a Department of one of the leading Hosiery Mills in Shanghai,
under British management.

SHOOTING AND FISHING NOTES

SHOOTING

LARGE BAGS OF WINTER SNIPE : The only information of note that has reached us from the shooting field since our last number appeared is concerning some unusually large bags of winter snipe that were made during the Easter holidays. One party of five guns—W. McBain, W. Gande, D. Anderson, F. Veda and A. de C. Sowerby—made a bag during three days of 80 couple, consisting of 79 couple of winter snipe and one couple of pintails. This bag was made in the Sitai Lake district and is considered somewhat of a record for winter birds. Another fine bag was made by Colonel M. H. Logan and one companion in the Nanking area, the bag consisting of 95 couple, shot over a period of two days. While good, this bag is, perhaps, not quite as interesting as the other, since winter snipe are known to be very much more plentiful in the Nanking district than in the swamps of the Sitai Lake area. In the latter district snipe were found to be very fond of alighting in the rape, beans and clover, fully half the birds shot being found in this kind of cover.

Another bag worth mentioning was made by four guns from H.M.S. Kepple on March 18, when 35 couple were shot at Nanking in one day. Shooting over four days, afternoons only, with two, three or four guns, 170 couple were bagged.

A POPULAR ERROR ABOUT SNIPE : Judging from a statement made in one of the morning newspapers of Shanghai recently, there is some confusion in the popular mind in regard to the names of the different kind of snipe we have in these parts. It would seem that those who do not shoot have the impression that spring snipe, like spring chickens, are young birds. This is not the case. The term "spring snipe" is given to two species of snipe that do not winter in these parts, as opposed to the term "winter snipe," which is given to the common snipe, individuals of which are to be found in these parts throughout the winter. The two spring snipe are alternately called (1) the pintail, or lesser spring snipe (*Gallinago stenura*) and (2) Swinhoe's or greater spring snipe (*G. megala*). The former has 26 tail feathers, six of which on each side are reduced to narrow pin-like shafts, while the latter has 20 or 22 tail feathers, the outer ones of which are narrow, but longer and broader than those of the pintail. The common or winter snipe (*G. coelestis*) has only 14 tail feathers, all long and broad. For this reason it is sometimes called the fantail.

Four other snipes are known to occur in this area, though three of them are very rare and the fourth is not considered a true snipe. These are (1) the solitary snipe (*G. solitaria japonica*), a large bird, almost the size of the woodcock, having 20 tail feathers, of which eight are large, two are smaller and ten are very small; (2) Latham's snipe (*G. australis*), with 18 tail feathers, only the two outermost of which are reduced in size; (3) the Jack snipe (*Limnocryptes gallinula*), a very small species, about half the size of the common snipe, but very like it in general appearance; and (4) the painted snipe (*Rostratula capensis*), well known to every sportsman for its slow flight and bright, well-marked plumage, especially in the female.

MULBERRY TREES AND SHOOTING IN CHINA : Every sportsman in China who has done any shooting in the central and southern provinces is familiar with the annoyance not infrequently caused by the mulberry plantations along the banks of the creeks and round the paddy fields, which form so characteristic a feature of the landscape in these parts. To begin with, the branches of these bushes are so irregular and spiky as well as tough and unyielding, that they make progress through the groves very difficult; while they often overhang the paths round the fields to such an extent as to make it necessary frequently to walk almost bent double. It will readily be seen what effect this must have on the sportsman's aim when birds get up from the fields he is beating. To walk in the open field itself does not help the case much, since the mulberry trees obscure the sportsman's line of vision, which, in a country like China is a serious matter, owing to the

THE CHINA JOURNAL

ubiquitousness of the Chinese peasant. It is positively dangerous to shoot in China unless one has a clear vision of upwards of 100 yards. Snipe or pheasants getting up over mulberries should not be fired at unless they are well up in the air, which generally means out of range, or at best so far away as to render a shot very doubtful. Under no circumstances should a bird be fired at till he has cleared the tops of the mulberries, unless, of course, the sportsman is dead sure there is no one in front of him. Whether the birds know the protection the mulberries afford them is a question, but it is noticeable that they always seem more plentiful in the vicinity of plantations of these shrubs.

A. DE C. S.

SHOOTING IN MANCHURIA; MAY NOTES: The spring migration of geese and ducks has proved a sore disappointment to the sportman in Manchuria this year. To begin with, the advance guard of the feathery migrants met with a terrible disaster on March 25th, when, lured too far northwards by an unusually mild spell of weather, which lasted several days, the birds were suddenly caught in a combined sleet and snow storm, which then turned into a raging snow blizzard. By night the temperature fell well below zero and next morning thousands and thousands of birds were lying in the fields in a helpless condition, their wings frozen stiff.

The Chinese peasants were quick to avail themselves of this heaven sent chance, and car loads of wild geese and ducks were shipped to the Harbin market.

Evidently this disaster got widely noised abroad among the feathery tribe, for the main forces of wild fowl seem to have taken another itinerary, giving the usual Manchurian routes a wide berth. The flights were very thin and irregular, and many species of duck practically failed to make their appearance.

Then in April the weather chose Saturdays and Sundays to play its worst pranks upon sportsmen. On April 1st I was caught by a snow storm which left over five inches of snow behind. Next Saturday I embarked upon an expedition up the Sungari River in a row boat. A typhoon which sprang up from nowhere blew us on to an island, on the shore of which our boat capsized, and there we remained marooned for two long days until help arrived.

However, if wild fowling was poor, blackcock and capercaillie toks this year are excellent. Good reports have come in from Halasu, Barim, Buchedy and Hingan, and the toks are expected to last well into the middle of May.

Snipe have made an early appearance and are plentiful this year. Although many good marshy grounds near Harbin have been drained and ploughed over by the incoming hordes of new Chinese settlers, there are still some good locations left, where bags up to a hundred birds a day can be made by a good shot without much difficulty.

Bear pelts will be in a fair condition up to the middle of the month, but great care should be exercised when on the hunt, for it is the bear's mating season at present and the males are in a nasty temper.

The fisherman ought to give his tackle a general overhaul, for after the 20th of May salmon will begin to feed and occasionally a trout will rise to a well chosen and well placed fly.

V. DE FRANK.

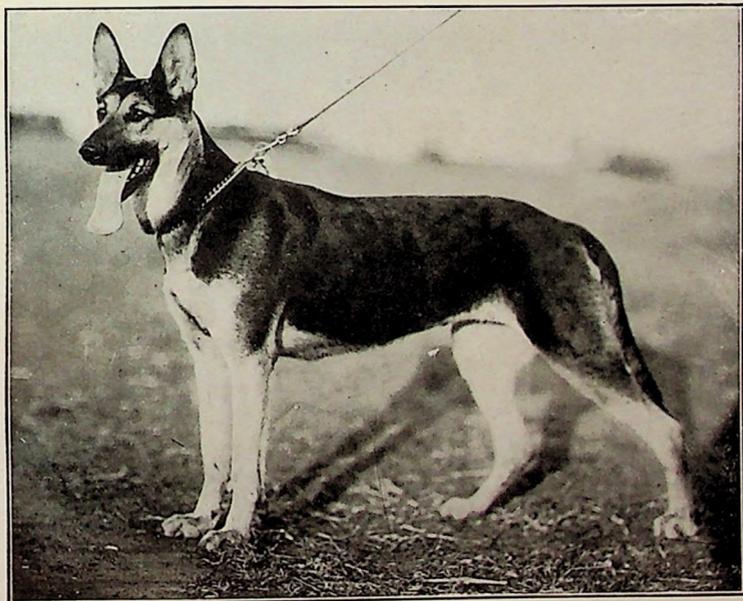
FISHING

LITTLE DOING IN THESE PARTS: We have nothing whatsoever to report regarding fishing in the Shanghai district, although now is a good season for certain kinds. Most of the keen anglers who used to supply us with data have left for home, and we occasionally hear from them that they are getting good fishing where they are. For interest in fishing we fear we must look further afield, and in this connection we may say that we have received some interesting pictures from Mr. F. Veda of big-game fishing in New Zealand waters. Space does not allow us to reproduce them here, but we hope to do so in our next issue. Meanwhile we may remind some of our readers that excellent sea bass fishing is to be had during the early summer and early autumn at Wei-hai-wei and Pei-tai-ho. They should prepare now for this sport.



Photo by W. Gande

A fine China New Year's Bag of Pheasants, Woodcock, Bamboo Partridge and Hares at Ta-ching, near Hangchow.



Champion Gilda von Dörnerhof, S. Z. 78475. Sire: Siegfried von der Horstburg, S. Z. 67544; Dam: Elsa vom Walrabe, S. Z. 67473. Owner Mrs. Nina Dexter, Graustein Kennels, U.S.A.



Photos by Ah Fong

Greyhounds of the Greyhounds Racing Association of China and
their Trainers at Thorburn Road Kennels, Shanghai.

H. Bradish J. Piggin G. Norman G. McKay.
Buchanan, Paleface, Lady's Wood, Frontier Force, Vodka, Garden
City, Romford Kelly 2nd.

SHOOTING AND FISHING NOTES

FISHING IN THE TIENSIN DISTRICT: The following letter has been received from Tientsin, showing that good fishing of a sort is being had there:

Dear Sir,

I received your letter dated the 19th March acknowledging my notes on the fishing round this part, and as you say that further correspondence on the subject will be appreciated, I will proceed to give you a short account of what sport I have been able to get during the holidays.

Fishing afternoons and evenings up to six o'clock from Friday to Monday, inclusive, I managed to make the following bag, my wife fishing with me and catching nearly half:—

- 9 Carp averaging from 1-1½ lbs. each.
- 3 Catfish about 1 lb. each.
- 2 Eels about 1 lb. each.
- 1 Knife-fish 9" in length.

The Bait used was worm.

With regard to weather conditions, on Friday we had a southerly wind, force 3-4. The fish were biting freely. We lost quite a few through having to fish a long way out. With a cross wind this made it very difficult to keep a tight line for striking. Result:—5 Carp. 3 Catfish 1 Eel.

Saturday there was no wind at all; weather hot and sultry; a falling glass and fish off the feed. Result:—2 Carp.

Dust storm during the night which brought the glass back to normal by morning. (Sunday)

Sunday the wind from the northward. Fish again off the feed. Troubled by crabs which seemed to be continually at the bait, sometimes severing the gut above the hook. Result:—One Eel. One Knife-fish.

Monday the weather was settled again. Wind from the south-west. Lost what appeared to be about four good fish through striking too late. Crabs again worrying the bait, though not as bad as the previous day. Result:—2 Carp (our biggest).

The carp appear to be in fine condition, full of fight. I have been wondering whether ground baiting would induce the larger ones to feed and whether they could be educated up to taking paste. As I stated in my previous letter to you, with paste I have had no luck at all. There is no doubt that carp are more in evidence than any other fish here, and I feel sure that good bags of even large fish could be made if one could only get to know the right bait and their habits better. They seem to feed best between the hours of 2 and 5 p.m., after that they seem to go off the feed. I have never seriously tried about and after dusk with the aid of a torch. I have found this good for large carp at home.

A few days after the ice had gone I happened to be having a look round the waters and saw quite a few dead fish, some running up to about 4 lbs. in weight. Apparently they had got caught when the first frost occurred, before they could get into deep water and mud.

I have seen a few large fish jumping which I took to be culter, also the other afternoon I saw a fair sized serpenthead basking just under the surface.

With regard to the spawning season, I have not as yet been able to discover the exact time it takes place. What appears to be the time is when the hot weather comes along and the weed gets thick, it is then that one sees the spawn floating on the surface and in the weed. The fish get lazy and go off the feed too. As I have already said, the fish at the present moment are in excellent condition. Anyway it would be interesting to know how conditions out here compare with the home close season.

This is all I have to report at the moment. Next week-end I intend having another go and will give paste another chance on a spare rod and see if I can do anything with it against carp.

I am sorry I have not been able to give exact weights, but I lost my Hardy balance some time ago. What weights are given are, if anything, *under* what a weighing would give.

Yours sincerely,

R. STEWART-SCOTT.

Tientsin, 10th April, 1928.

THE KENNEL

HOW TO TELL A GOOD DOG.

Here in China where the novice has no opportunity to visit dog shows (except once a year) and where no magazines devoted entirely to dogs can be bought, the question of buying a dog becomes an extremely difficult one.

Nobody wants to own a poor specimen, but in most cases the novice will only have a vague and general idea of what the particular breed he wants should look like. The only advice I can give is to *buy a pedigreed dog*. Many people do not know what a pedigree should look like. For their information a four generation pedigree is printed here. It is that of a fine looking and well bred Alsatian bitch, Gisa von Burg Cellu, SZ 310252, the property of Mr. Jos. Schwabacher, Secretainerie Kennels, Germany).

Parents	Grd. Parents	Grt. Grd. Parents	Grt. Grt. Grand Parents
Horst vom Flügelrad 102966 Sch. H	Austr. Sieger Intern. Sieger Claus v. d. Für- stenburg 77117	Held v. Riedeken- burg 62307	Marc v. Hohenesp 52757 Sch H.
		Berra v. d. Fürsten- burg 67423 PH	Bella v. Riedekenburg 46051
			Alex v. Westfalenheim 59298
	Afra v. Hausen 92801	Nores v. d. Kri- minalpolizei 60933	Clara v. Herkulespark 61209
		Gisela v. Flügelrad 71585	Horst v. Boll 8306 PH
			Austr. Siegerin 14 Gisa v. d. Kriminalpolizei 43848
Flora v. d. Secretainerie 83489 PH	Edi v. Herkule- spark 62730	Holl. Sieger 13 Jung Tell v. d. Kriminalpolizei 24511 PH	Billo v. d. Hoffstadt 62559 PH
		Hexe v. Mundts- dorf 46145	Freia v. Flügelrad 46862 PH
	Chrimhilde v. d. Secretainerie 67614	Jokel Edeweiss 38292 PH	Sieger 10 Tell v. d. Kri- minalpolizei 8770
		Brunhilde v. d. Secretainerie 64592 Bl H	Gerta v. Boll 8310
			Sieger 09 Hettel Ucker- mark 3897 HGH
			Asta v. Mundtsdorf 31096
			Jokel v. Schwetzingen 1861 HGH
			Grete v. Nahetal 9826 HGH PH
		Norbert v. Lobdengau 34888	
		Krimhilde Hildenia 38180 PH	

When examining the pedigree of the dog you intend to buy, first of all convince yourself that it has been signed by a kennel club; without such a signature it is of no value, except as a personal guarantee from the seller.

Further, as it takes two good dogs to produce one good puppy, look for champions both on the sire's and on the dam's side. Nearly all the champions in the world come, not only from the same strains, but from the same individuals. A good pedigree is therefore the surest guarantee of a good dog.

THE ALSATIAN.

A careful study of the photographs of some of the famous dogs of to-day (See *The China Journal*, March and April) will be of great help to the novice in forming an idea of the standard of the Alsatian or German Shepherd Dog.

When choosing a dog it will, however, be well to remember the following few very important things:

Structure: The body should be long, strong and well muscled. Dogs should not be under 24 and bitches not under 22 inches high. The proportion of length to height is extremely important, and should be as 8 or $8\frac{1}{2}$ to 10. In no case should the proportion be less than as 9 to 10.

Angulation: Angulation is extremely important, but very hard for the novice to judge of. The shoulders should be long and sloping, well muscled and set flat against the body; round ribs are a serious fault. The thighs should be broad and strong, and the whole impression of the hindquarters should be one of sharp angles. The stifle should be long, and should present a sharp angle with the upper thigh as well as with the hock.

Back: The back should be straight and strong. One of the most serious and most common faults of the German Shepherd Dog is a soft or sway back.

Head: The head should not be too long and narrow, nor too broad and coarse. The forehead, which is only very slightly arched, should run in a slanting line continuing into the long, strong muzzle without any abrupt stop. (A common fault in very inferior dogs like the great majority of those seen here in China, is a short, broad skull stopping with an abrupt dip before a weak, pointed muzzle).

Ears: Medium in size, set high on the head, and carried erect. (The ears of most China-bred dogs are far too small).

Legs: Strong and straight.

Feet: Round, short and compact and very strong, with well arched toes. Short nails.

Tail: Long and bushy (reaching at least to the hock). At rest hangs straight down, during exercise level with the back, during excitement raised, but never to be curled over the back. Ring or roll tail is a very bad fault, and extremely common here in China.

Coat: Smooth, harsh and dense outer coat, good undercoat. The hair on the neck should be long and thick.

Colour: All colours are permissible, but white and very light colours are not deemed so desirable.

If buying a young puppy take a careful look at both parents—the puppy is most certainly going to resemble the parents very closely, so it is useless to hope that a puppy from inferior parents will “turn out well.”

After having assured yourself that the parents are good specimens of the breed, subject the litter of puppies to a thorough examination. Reject the soft, fluffy, light-boned ones, and choose the hard, well-muscled little fellow with the heavy bone-frame.

A good idea when buying a young pup is to weigh him. The bigger and heavier he is, the more likelihood that he will grow into a big, strong dog. Never buy a puppy of the lowest weight given below; it is very unlikely that he will ever grow into a strong, healthy dog.

This scale of weight is copied from von Stephanitz, the greatest authority alive on German Shepherd Dogs and one of the founders of the breed. The heaviest and

THE CHINA JOURNAL

lowest weight do not, of course, mean that no puppies are ever lighter or heavier, but during the ten years Captain von Stephanitz kept records, these weights were the lightest and heaviest he met with.

At the end of	Lightest weight lbs. ozs.	Average lbs. ozs.	Heaviest lbs. ozs.
1st week	1.03	1.13	2.05
2nd ,,	2.00	3.05	5.05
3rd ,,	2.12	4.10	6.04
4th ,,	3.10	5.15	7.13
5th ,,	4.05	7.15	10.09
6th ,,	5.09	9.11	12.04
7th ,,	6.11	11.15	15.01
8th ,,	8.00	14.07	18.08

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GREYHOUND RACING CLUB FORMED: On April 23, at a meeting of those eligible for membership, a Greyhound Racing Club was formed having the sole right to the use of the "Luna Park" race course. A well drawn up set of rules was unanimously passed and the following gentlemen elected to serve on the Executive Committee:—Messrs. W. R. B. McBain, H. E. Arnhold, R. Bailey, J. Liou, M. C. Tsai, P. Kwok, H. Brian Bates, A. de C. Sowerby and F. B. Marshall. For the Balloting Committee were elected the members of the Executive Committee and Drs. Evan Jones and J. E. Murray and Messrs. W. H. Chen, R. A. C. Watson, T. Veitch and M. S. Pan.

GREYHOUND RACING IN SHANGHAI: Rapid strides have been made toward the completion of the "Luna Park" race course on Ward Road, where the Greyhound Association of China has acquired a piece of land for the purposes of racing greyhounds. The track has been turfed and is already looking green, while the stands have practically reached completion. It is hoped, weather and circumstances permitting, to be able to hold the trials for the classification of the dogs shortly, and that the opening date for the first race meeting will be about the middle this month. The dogs are in excellent condition, having been kept fit on the training grounds. From their general appearance and demeanour they are as keen as any to get a sight of "Cuthbert" the electric hare, in motion. Everything, as far as can be seen, augurs a successful start of what is likely to be a very popular sport in Shanghai. The course is an exact replica of that at the famous White City in London; while the splendid kennels provided for the dogs at No. 20 Thorburn Road are second to none in the world.

REGISTRATION OF DOGS IN SHANGHAI: It may interest Dog Fanciers to learn that The China Kennel Club has now made arrangements to undertake the registration of thoroughbred dogs of the following breeds, whether same are China-born or Imported:—

Alsations	Chows	Pekinese
Airedales	Collies	Pointers
Beagles	Dachshunds	Pomeranians
Bulldogs	Fox Terriers (Smooth)	Pugs
Bullterriers	Fox Terriers (Rough)	Retrievers All breeds
Boston Bulls	Greyhounds	Scottish Terriers
Bloodhounds	Great Danes	Sealyhams
Bassets	Irish Terriers	Setters All breeds
Border Terriers	Japanese	West Highland Terriers

Registration will be divided into two classes:—

Class A. Dogs already in possession of pedigrees issued by any recognised Kennel Club.

Class B. Dogs without pedigrees but believed to be thoroughbred.

THE KENNEL

Owners of animals coming under Class A. desirous of registering their dogs are requested to bring or send the *pedigrees only* to the Honorary Secretary of The China Kennel Club at No. 8 Museum Road, when particulars will be entered in The China Kennel Club Register and a Certificate issued on payment of Registration Fee Dollars Five (\$5.00).

Owners of animals coming under Class B. desirous of registering their dogs, are requested to *take their dogs* to the Honorary Veterinary Surgeons of The China Kennel Club, Drs. Keylock and Edgar, Gordon Road, when after examination the necessary registration will be effected if the animal is passed. Registration Fee Dollars Ten (\$10.00).

It is hoped that sufficient owners will register their dogs so that it may be possible to arrange Classes at the forthcoming Show for both Class A. and Class B. animals.

CHINA KENNEL CLUB ANNUAL DOG SHOW: The annual dog show of the China Kennel Club will be held by kind permission of the stewards of the Race Club in the enclosures beneath the Grand Stand at the Race Course on Saturday, May 19. Applications for entry forms should be sent in to the Honorary Secretary, Mr. H. Brian Bates, at 8 Museum Road, and all entries must be sent in by May 12 at the latest.

The following special cups have been presented to be competed for at the show:

1. A Cup presented by Mrs. Percy Smith for the best dog exhibited by a Chinese owner.
2. A Cup each presented by Mrs. Else Duncan, Hoffnungsheim Kennels, for the best China-bred Alsatian dog or bitch, and for the best China-bred Alsatian puppy of either sex.
3. A Cup presented by Mr. A. J. Richardson for the best China-bred Bull puppy, nine to eighteen months old.

Entrance of dogs for these cups will call for an additional fee of \$2.00.

A. DE C. S.

THE GARDEN

THE MULBERRY: As a garden plant the mulberry has little to recommend it beyond the fact that it produces a rather sweet palatable fruit, which in the species known as the black mulberry (*Morus nigra*) attains a considerable size and may even be described as luscious. The plant, usually not much more than a shrub, though if left long enough attaining the dimensions of a tree, bears an abundance of heart-shaped, dark coloured leaves with serrated edges, and is of a fairly shapely habit of growth. The leaves are deciduous, and the branches, unless cut back continually, somewhat spiky and straggly, so that in winter the shrub is not very attractive.

The black mulberry is a native of Western Asia, whence it spread into Europe, being used in Italy, France and Spain for the cultivation of the silk-worm till it was replaced by the white mulberry (*Morus alba*). This is a species with large leaves, much better suited to the rearing of silk-worms. It is a native of China, the finest variety being known as *latifolia*, a native of Chekiang.

In North America the red mulberry (*Morus rubra*), a species with small leaves, is indigenous.

Closely related to the mulberries is a tree that is extremely common round Shanghai. This is the paper mulberry (*Broussonetia papyrifera*), so called on account of its being used in Japan for the manufacture of paper. The famous tapa-cloth of the South Sea Islands is also made from the bark of this tree.

In China the white mulberry is extensively cultivated in connection with the rearing of silk-worms, especially in the provinces along the Yangtze Valley and southward, as well as in certain parts of Shantung.

THE CHINA JOURNAL

The fruit of the mulberry, though having somewhat the appearance of a long blackberry, is very different from the latter. It is what is known as a sorosis, and is composed of a mass or inflorescence of female flowers in which the perianth leaves have become swollen and fleshy.

GARDENING NOTES; MAY.

INSECT PESTS: It is always of the greatest importance to watch for and eradicate if possible insect pests in a garden, for a garden infested with noxious insects is a sorry sight. We are reminded of the distracted gardener's plaint:

A garden is a loathsome thing—	Is powerless, yet the fool
Oh what?	(Next door) contends that slugs are not,
Blight, snail,	Not slugs! in gardens! when the eve is
Pea-weevil,	cool?
Greenfly, such a lot	Nay, but I have some brine,
My handiest tool	'Tis very sure they shall not walk in mine.

Now comes the rose beetle, a species of chafer, whose grub lives in the earth feeding on the roots of rose bushes, and causing the bush to wither and die away. An operation is the only remedy, the grub must be forcibly extracted from his dugout. Caterpillars, a small green variety, will soon appear on roses and should at once be picked off and destroyed. Birds are useful allies to the gardener and should be encouraged, not even excluding the sparrow. The other day we watched several sparrows going carefully over a rose bush picking off and swallowing tiny green caterpillars that later would have eaten every leaf of the bush.

Wood-boring insects are not easy to detect till they have done the damage. It is usually the grub, sometimes of beetles, sometimes of moths, that eat away the interior of tree trunks and branches. These have natural enemies in the way of certain wasps, which pierce the bark with their long ovipositors and lay their eggs inside the wood-boring grub within. These wasps should never be destroyed, in fact, it is well to leave all bees and wasps alone, for none do any harm and most do good. Do not confuse the saw-fly with the wasps, which it resembles, and to which it is related, belonging to the same family. The saw-fly's grub is a destructive wood-borer.

PUBLICATIONS RECEIVED

BOOKS: The Chemistry of Leather Manufacture; American Chemical Society Monograph No. 12, Revised Edition, Vol. I, by John A. Wilson: The Chemical Catalog Co., Inc., New York.

Furs and Skins, compiled by U. M. S. Torresani: The Maritime Customs, China. Fuhrer durch Pompeji, by August Mau: Verlag von Wilhelm Engelmann, Leipzig.

The Port of Shanghai, Fifth Edition: Whangpoo Conservancy Board, Shanghai. Is China Mad? by D'Auxion de Ruffe, M.A.L.L.D., Translated from the French by R. T. Peyton-Griffin; Kelly & Walsh, Ltd., Shanghai.

An Outline of Universal History, by G. E. Sokolsky: Commercial Press, Ltd., Shanghai.

PERIODICALS: American Journal of Science—Chinese Economic Journal—Chinese Economic Bulletin—Discovery—Modern Review—World's Work—Philippine Journal of Science—Biological Bulletin of the Marine Biological Laboratory, Woods Hole, Mass.—The Far Eastern Review—The Journal of Parasitology—Extrême-Asie—Bollettino del Laboratorio di Zoologia Generale Agraria—Man—Geographical Review—The Chinese Social and Political Science Review—The Mid-Pacific Magazine—Game and Gun—The Journal of the Society of Chemical Industry, Japan—The Chinese Recorder—Japan—The Annals and Magazine of Natural History—The New Zealand Journal of Science and Technology—The Salmon and Trout Magazine—Natural History—Lignan Science Journal.



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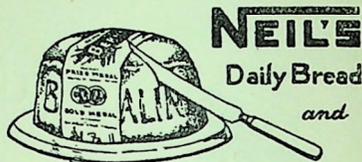


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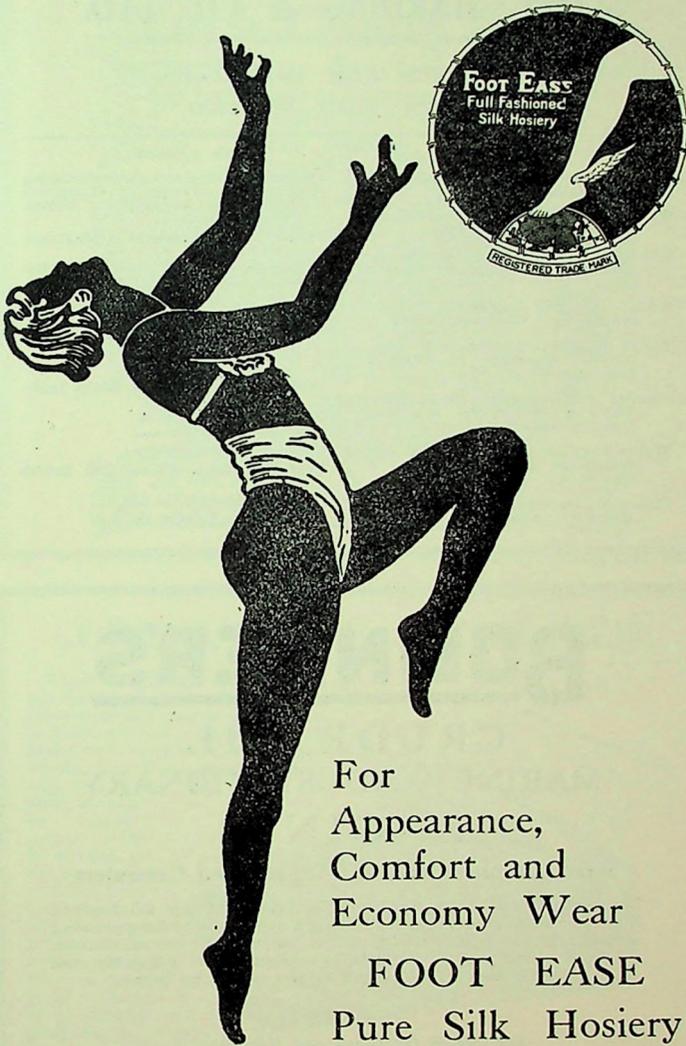
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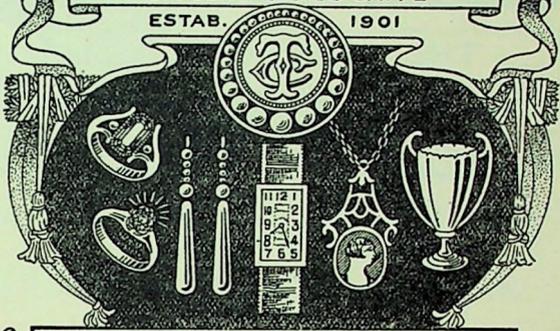
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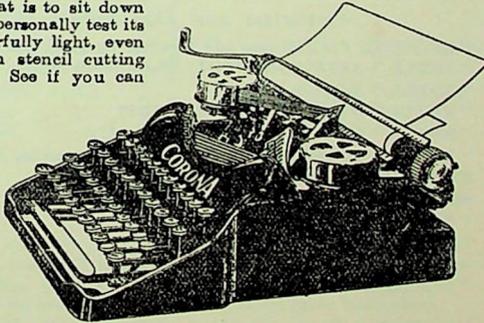
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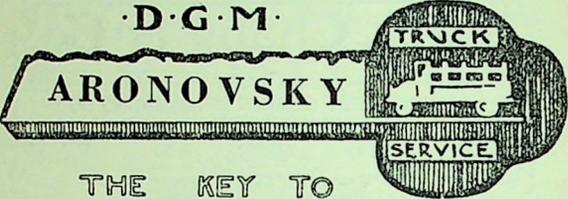


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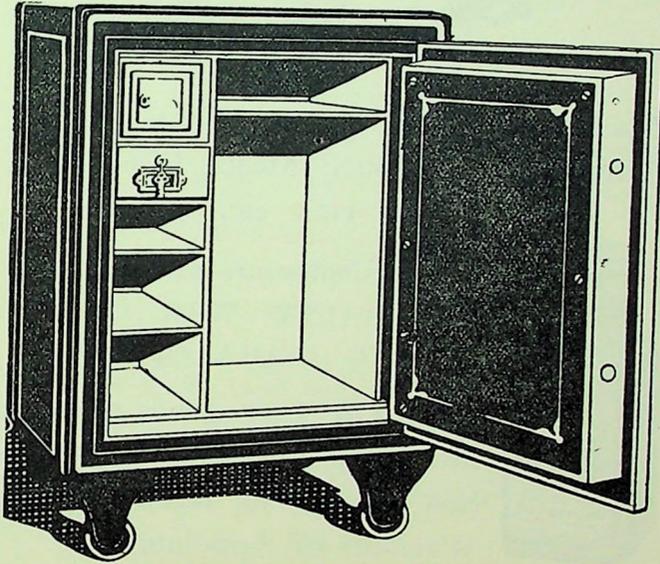
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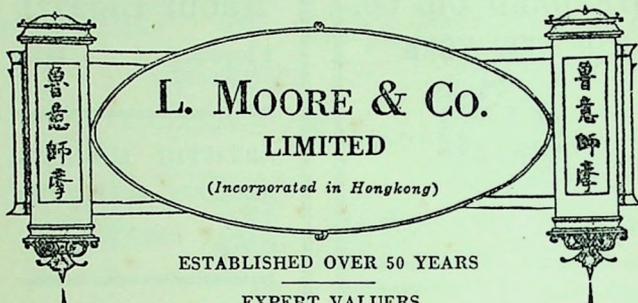
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