SUMMARY

OF

THE PRINCIPAL CHINESE TREATISES

UPON THE

CULTURE OF THE MULBERRY

AND THE

REARING OF SILK WORMS.

TRANSLATED FROM THE CHINESE.

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NOTE BY THE PUBLISHER.

This "SUMMARY" was first translated from the Chinese, by Stanislas Julien, member of the French Institute, and Professor of Chinese Literature, in the College of France, and printed at the Royal Press, in Paris, by order of the Minister of Public Works, Agriculture, and Commerce. The French copy from which this Translation was made, was transmitted from Paris, to the SECRETARY OF STATE, and by his recommendation has been translated and published here.

WASHINGTON, *February*, 1838.

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PREFACE

TO

THE AMERICAN EDITION.

THE attention of the American People having been attracted for several years to the culture of silk, with all its attendant advantages, both to individuals and as a source of national wealth, the following compilation, from Chinese authors, made by authority of the French Government, it is hoped will prove interesting, and not entirely unprofitable, to the yet incipient *sérigène* art in the United States. Notwithstanding the superiority of the French in the arts and sciences, and length of time which has elapsed since the introduction of the manufacture of silk into France, (in the reign of Francis I.) the fact, of the great superiority of the Chinese culture is frankly admitted by M. CAMILLE BEAUVAIS, the gentleman at whose instance the French Minister directed this Translation to be made from the Chinese works. Such is the strength of his testimony on one point, that he asserts, "*the Chinese lose in the rearing scarcely one per cent. of their worms, whereas the French lose more than fifty*"! So important is silk to the civilized nations of the globe, so many and various are the fabrics wrought from this beautiful material, so familiarly known, and of such universal consumption, that the manner of its production cannot fail to be a subject of earnest inquiry and of interesting investigation to our enterprising citizens. It is well calculated to excite surprise and astonishment, that the gorgeous velvet, the rich brocade, the transparent gauze, and the delicate blonde, should all have their origin from the labors of an apparently despicable worm. The egg of this insect exceeds not the size of a grain of mustard-seed, yet so amazing are the results

produced, that the proceeds of its industry actually constitute the chief source of wealth of the most populous and perhaps the richest nation of the globe. In the language of a French writer, "if the cocoons (in China,) were collected together, they would form mountains." "The two provinces, of Nankin and Chekiang, alone send every year to the Court three hundred and sixty-five barks laden not only with pieces of wrought silk, satins, and velvets of various kinds and colors; but even with rich and costly garments of the same material." For the long period of four thousand four hundred and thirty-eight years, the Government of China has extended its paternal care to the culture of silk: the Empress herself setting an example to the peasant in the requisite labor. Hence their proficiency, and the universality of the culture in the Chinese Empire.

An important fact is gathered from the following Treatise: the culture of silk is, with few exceptions, co-extensive with the growth of the mulberry, and that tree grows in every province of China, from the extreme North to its Southern boundary; and, perhaps, no tree is susceptible of being more widely diffused. In Europe, not unsuccessful experiments have been made near Stockholm in Sweden, Novogorod in Russia, and Brandenburgh in Prussia. It is true, all attempts to domesticate the silk worm in England and Ireland have proved abortive; but that is no doubt owing to the extreme humidity of the climate. The Chinese work *Nong-sang-thong-kioué*, says: "they [the silk worms,] like not wet leaves," and elsewhere, "that moisture is exceedingly injurious to them;" which is verified by the experience of England. For the same reason the culture of silk in France, is limited to the Southern Departments, the Western being, like England, too humid. It may be objected that the climate of the United States is colder than that of Europe in equal parallels of latitude, and, consequently, too cold for the culture of silk in the same degree; such is, undoubtedly, the fact as regards extremes of temperature; but we feel assured, that from the superior dryness and heat of the summers of the United States, and the perfect ease with which the mulberry is grown and propagated, that a great proportion of this country is better adapted to the culture of silk than even the South of Europe. From experiments made by the scientific and practical cultivator, Count Dandolo, in Italy, it is satisfactorily ascertained that increase of temperature promotes the maturity of the silk worms; in other words, shortens their life and labor, without lessening the quantity of silk.

It has been ascertained, by laying before silk worms at the same time various kinds of mulberry leaves, they will eat first the white, next the red, and lastly the black, in the order of the tenderness of the leaves. The tartarian holds a high place in their esteem. The red mulberry, *morus rubra*, the second in the order of preference, is indigenous to the Middle and Southern States, and is remarked by botanists, as growing from Virginia to Louisiana. Abundant experiments have demonstrated that the white mulberry may be successfully cultivated still farther North in the United States. The Chinese assert "*that their mulberries grow in all soils, and with every aspect;*" which, from the extreme industry and sedulous care of that people, is not to be doubted. Early efforts were made to naturalize the silk worms in the American Colonies by the British Crown and chartered companies, in Virginia in 1662, and in Georgia and South-Carolina in 1732. They failed, after some partial success. The failure has been ascribed to various causes, such as the more profitable culture of cotton and tobacco, the sparseness of population, the distant market; but in no instance that we have seen, has it been charged to climate, ill success of the mulberry, or atmospherical influences, which oppose so fatally the extension of the culture in Western Europe. From a careful review of those early experiments, we are satisfied that the meagerness of the population, and the distant market for their raw material, were the effective checks to the prosecution of the silk culture in Virginia, South-Carolina, and Georgia. The aspect of things is materially changed within the last century; the wilderness is now a populous country—the fifteen or twenty thousand inhabitants are many millions—the raw, thrown, or manufactured silk would now find a ready purchaser or consumer without crossing the Atlantic—and speedy remuneration be the consequence to the grower.

At the hazard of prolonging these prefatory remarks to an inordinate length, we think it not irrelevant here to give, in the briefest form possible, some general facts upon this subject. The value of silk imported into the United States in 1836 was $22,862,177. The annual value of silk manufactured in England is £14,000,000, or about $62,000,000.—Four million pounds of raw and thrown silks are annually imported, at about £1 5*s* per pound. France exported in 1824 manufactured silks to the value of 100,000,000 francs, or about $19,000,000. Raw silk is sold in France at twenty-two francs per pound, or about four dollars eighteen cents. One pound of raw or reeled silk may be manufactured into six-

teen yards of *gros-de-Naples*, the nett cost of which will be £2 3*s* 7*d* sterling. From one ounce of eggs it is possible to obtain one hundred and sixty-five pounds weight of cocoons: in Italy, one hundred pounds is the average quantity. Each healthy cocoon, as it is gathered, contains more than the seventh part of pure cocoon; but the quantity of reeled silk obtained seldom averages more than one twelfth of the weight.—Two hundred and forty, to two hundred and fifty cocoons weigh one pound. The proportion of mulberry leaves consumed to the pure cocoon produced, is eighty-seven pounds to one; and the proportional weight of mulberry leaf and of reeled silk is as one hundred and fifty-two to one. The length of thread of a single cocoon is stated by different authors to be from three hundred yards to six hundred and twenty-five. The weight three and a quarter English grains. According to these data, which are given more in detail in Lardner's Cabinet Cyclopædia, it is found one pound of reeled silk requires twelve pounds of cocoons; that rather more than twenty-eight hundred worms are employed in forming these cocoons, and that to feed them one hundred and fifty two pounds of mulberry leaves must be gathered. This pound of reeled silk will make sixteen yards of *gros-de-Naples*, ordinary quality, or fourteen yards of the best description.

In the history of this branch of industry the fact is developed, that in every country, where it has been introduced, from the Celestial Empire to Western Europe, the fostering care of Governments has been extended and *needed* for the attainment of success. The art itself, in its infancy, like the feeble insect whence it is derived and supported, appears incapable of more than a sickly and unprofitable existence, without the aid of superior intelligence, and superior care. The chronicles of a long line of Chinese Emperors show their paternal solicitude, in their decrees, wherein the Empress is enjoined to set an example in her own person to the empire, by attending to the rearing of silk worms. Under the auspices of Justinian, and his peculiar care, the culture of silk was introduced into the Roman Empire. It was at first a Royal monopoly; but did not long remain so; soon spreading to Greece, and particularly in the Peloponessus. Roger I, King of Sicily, after his successes in Greece, transported a considerable number of captive silk-weavers from that country, whom he compulsorily settled in Palermo, and obliged them to impart to his subjects a knowledge of their art. In such high esteem was the manufacture of silk in Venice, that the business was considered a noble

employment, and might be practised without degradation by the aristocracy. The introduction of the silk worms into France has been attributed to Louis the XI, and to Francis I; certain it is, however, that the people of France made rapid progress in this pursuit under the fostering care of the monarch, and timely and well devised bounties for the planting and culture of the mulberry tree. Henry IV, in his letters-patent for the establishment of silk manufactories in Paris, conferred titles of nobility for success and perseverance. Nurseries of the mulberry were established, and at first the trees were given away by the Government, unsuccessfully; but at length a more judicious plan was adopted. A reward of three livres was offered to the cultivator, for every tree that should be found in a thriving condition three years after it had been planted. Thus stimulated, the cultivation was eminently successful. The results are shown in the modern statistics of France, and how amply the outlay of three livres per tree has been repaid by the revenue accruing to the crown from the manufacture of silk.

The experience of nations will not be lost upon the United States. Her statesmen, her legislators, and her people are awake to the subject. We have only to will it, to naturalize the culture and manufacture of silk, and the time is believed to be not distant, when this important branch of industry will be added to the resources of our national prosperity. The present work has been translated and published as our humble mite to the accomplishment of this great work.

WASHINGTON, *February*, 1838.

PREFACE

TO THE FRENCH EDITION.

THE Minister of Public Works, of Agriculture and Commerce, has invited M. CAMILLE BEAUVAIS to write the Introduction which precedes the Translation of M. STANISLAS JULIEN. No one was more capable of appreciating the merit of the methods adopted in China, for the cultivation of Mulberry Trees, and the rearing of Silk Worms. Indeed, M. Camille Beauvais has already put several of these methods into practice, and it is to the employing them that he is indebted for the improvement introduced by him in this useful work.

In the publication of this Translation, with the concurrence of M. Camille Beauvais, the Minister of Public Works, of Agriculture and Commerce, has wished to show him the value which he attaches to his important labors, and to prove, at the same time, to those who raise Silk Worms, that the methods adopted, with so much success, by this learned agriculturist, are worthy of attracting their attention.

INTRODUCTION.

THE translation of a Chinese Work, which treats of a great branch of industry established for a long time on our soil, is an enterprise which will be variously appreciated. Whatever may be the opinion of those who raise the silk worms, and of the learned persons who will read this publication, I hope it will always remain as a testimony of the superiority of the Chinese in all the practical details embraced in the culture of silk, and the surprising results which they have obtained.

Some minds, influenced by ancient traditions, will perhaps consider this multitude of trifling attentions, which the Chinese lavish upon the silk worms, as childish; others will only see some proceedings little different from theirs in appearance, or will say, that they may be proper to the climate of China, and not be applicable in ours; and, perhaps, some persons will forget the work, after having read it. But time and experience will, I hope, cause these natural methods, these delicate attentions, these wise and multiplied precautions the Chinese Authors recommend, to be appreciated at their just value.

It is easy to comprehend that an observing People, who invented before Europe, the compass, printing, and gunpowder, and who for forty centuries regarded the culture of silk as its principal source of wealth, have brought it to a high degree of perfection, and we cannot do better than go to the fountain head for new light and the latest improvements.

If by a judicious application of the Chinese methods, we can equal their success, the aspect of that branch of industry will soon be changed in France. It will then assume a more stable character; the uncertainty now dreaded, will make room for a sure and regular system, which will relieve the raising of the silk worms from the

grievous chances to which imperfect and variable methods expose them every day. But to attain this end, and, by useful changes, to demonstrate the importance of this work, time and long experience are required. We ought to know, thoroughly, the spirit which presides in all the Chinese works, if we wish to naturalize them among us, and to employ them with certainty, and with success.

We hope that the advanced state of science in France, will sometimes give us the advantage over the Chinese, in the application of their methods. I will quote on this subject an interesting fact, which is found in this translation. The Chinese convinced that the purity and frequent renewing of the air are indispensable to the health of the silk worms, have contrived a system of ventilation, which, though it appears incomplete to us in some respects, yet presents several traces of resemblance to that which we owe to M. Darcet.

The exterior air is made to enter by tubes, which are placed at intervals, and which can be opened even with the floor. When the air of the silk room becomes foul, it escapes by small windows made in the ceiling. These same tubes also serve to cool and refresh the silk rooms; they are to be shut when one wishes to elevate the temperature.

Indeed, this system is far from equalling that of M. Darcet,* which unites simplicity to energy, and offers the double advantage of keeping a regular temperature, and of causing the air to circulate in the silk room. But, however imperfect the ventilation practised by the Chinese may appear to us, it nevertheless shows how that industrious nation has made efforts to insure the constant success of the silk culture.

I have already tried two Chinese methods, which have given me

* In establishing, by my desire, a simple and economical system of ventilation, which now bears the name of its Author, M. Darcet has added a new and eminent service to all those for which the arts are already indebted to him. The patriotism and disinterestedness which this learned man has shown on this occasion, cannot be too much praised.

The Minister of Public Works has had a certain number of models of that apparatus executed, which have been transmitted to the Prefects, to be deposited in the archives of those Departments, which were occupied more especially with the manufacture of silks. (C. B.)

the most happy results: the frequent feeding of the worms, and their perfect uniformity, ought to commence at their hatching, and be maintained with care during the continuance of their feeding. I now consider these two customs, as acquired in the *sérigène* industry, (silk culture,) as an indispensable means of success. I have taken the idea from a short memoir of P. d'Entrecolles, published by P. Duhalde. Struck with this unexpected result, and seeing that the abridged work of the learned missionary left many things to desire, I have thought it necessary to have recourse to the Chinese Authors themselves, to obtain more precise and complete information of the silk worms and mulberry trees. I thought I ought to make the request of the Minister of Commerce and Agriculture to have two chapters of a great Chinese work translated, which treats this double question in a new and profound manner.*

The Minister of Commerce felt all the importance of a publication destined to improve one of our richest branches of industry, and in order to prove his solicitude, he is eager to have the translation of the Chinese book printed at the expense of Government, for distribution; afterwards to the cultivators of silk, and the agriculturists, who will find there the elements of new experience and useful improvements.

To be assured whether the methods contained in this Treatise are improved since its publication, which goes back nearly a century, M. Martin (of the North) conceived the happy idea of sending a copy of the manuscript Translation to M. Louis Hébert, one of my scholars, whom Government sent a year ago upon the coasts of China, with the special design of studying the methods of those countries, and of bringing back any precious varieties of mulberry trees and silk worms, which may be unknown to us.

This translation has been confided to Mr. Stanislas Julien, member of the Institute, and professor of the Chinese language and literature,

* The translation of the Treatise on the raising of Silk Worms, has been made in virtue of a decision of M. Passey, the 23d of August, 1836: This is M. Martin, (of the North,) actual Minister of Commerce and Agriculture, who has charged M. St. Julien to translate the Treatise on the Cultivation of Mulberry Trees.

(C. B.)

at the College of France. It offered immense difficulties to a man, who, by his literary habits, found himself completely a stranger to the proceedings which he had to describe, and who met, for the first time, with the greater part of the technical terms which explain them. The raisers of the silk worms, and the agriculturists, will observe the patience and sagacity required of M. Julien, to enter so intimately upon this subject, and exposing all the details with a clearness and precision which one could only expect from a person versed in that culture.

The original of that translation made part of a great and magnificent Agricultural collection, published by order of the Emperor, where is given a summary of the most scattered works which treat of the cultivation of mulberry trees, and the rearing of silk worms. The Compilers have only reported faithfully the different methods used in China, without seeking to show those which appear to them the best, or to explain the contradictions which sometimes appear there. These apparent contradictions will be easily excused, seeing that the Authors of this work desired to make known the methods of the different provinces, methods which are necessarily subordinate to the wants of each locality to the advancement of its inhabitants, and the difference of climates.

I should like, in terminating these reflections, to call the attention of the reader to some important points of the Chinese work; for example, upon the manner of making the butterflies lay their eggs, and of preserving the eggs; also, of the means employed to make them hatch at the same time. I will point attention, from the same authority, to the disastrous effects which result from the sudden introduction of cold and damp air in a silk room, where the temperature is high, as well as the fatal influence which is produced by the fermentation of the leaves, upon the health of the silk worms. I will add another fact, to give in a few words an idea of the incontestable superiority of the Chinese methods over the European: it is, that *they hardly lose one silk worm out of a hundred*, while the Europeans *lose fifty out of a hundred.*

CAMILLE BEAUVAIS.

ADVERTISEMENT

OF

THE TRANSLATOR.

A STRANGER to the *sérigène** industry, and to the science of Agriculture, it does not belong to me, above all, after the Introduction of M. Camille Beauvais, to speak of the practical advantages which the Chinese work offers, and of which I now publish the translation.

I will only present to the reader some details, purely literary, of which, some will not, perhaps, be uninteresting. The Chinese, whose

* To characterize the industry which takes its source in the work on silk worms, many epithets have been created in latter days, derived from the Greek or Latin, of which the inaccuracy was the least defect. Mr. Henry Bourdon, has substituted for it, with cause, the word *séricifère* (which produces the silk.) Without finding fault with the expression made use of by this learned young man, I take the liberty of proposing, in my turn, the epithet *sérigène*, (produced by the silk worms.) It is more concise, and can qualify with sufficient justice the industry, which is the object of this translation. In fact, the Greek word, Σὴρ (*sèr*) signifies *the caterpillar which produces the silk.* Σὴρ· σκώληξ γεννῶν τὸ σηρίκον: *Vermis qui producit sericum filum.* (Greek Dictionary of Hesychius, page 1176.) The plural Σῆρες is found in the same sense in the letters of the Emperor Julian, (Epist. 24.) Οἱ περσικοὶ σῆρες: *Persici bombyces seu vermes qui serica fila nent.* (See the great Dictionary by Henry Estienne, London edition, the word Σῆρες.)

The termination *gène*, signifies born of, begot, produced by. It derives this meaning from the Greek γενὴς (in the compound adjectives.) I will quote here the example Διογενὴς Ὀδυσσεὺς, *Ulysses born of Jupiter*, (Homer's *Odyssey*, book v, verse 203.) Thus, from the Greek etymology the expression of the *industrious sérigène* signifies exactly the *industry resulting from the silk worms, produced by the* (work of the) *silk worms.*

literature is the richest in the world, possesses many hundred works upon agriculture, which, among us, always comprises the *raising of Silk Worms and the cultivation of Mulberry Trees.* They have also particular treatises, such as the *Tsan-chou*, the *Tsan-king*, (books on silk worms); the *Nan-fang-tsan-chou*, methods used in the south; the *Pé-fang-tsan-chou*, methods used in the north of China, the *I-sang-tsong-lun*, General Considerations upon the Cultivation of Mulberry Trees, etc. But among the twelve thousand Chinese volumes which the Royal Library possesses, there are but three works which treat in a manner more or less extensive of the double question which occupies us. The first is a small Encyclopædia of the Arts and Trades, in 3 volumes, 8vo., entitled *Thien-kong-khaï-we*, of which the second edition has appeared in 1636. Brief proceedings are found there, which competent persons have thought very interesting. I have given them the greater part in the Supplement, (page 187–169.) The second work is found in an agricultural collection of sixty books, entitled *Nong-tching-tsiouen-chou.* It has been composed by *Siu-kouang-ki*, who, after having obtained the degree of Doctor, occupied successively the most eminent offices, and became preceptor to the eldest son of the Emperor. We see in his biography,* that in the 35th year of the reign of *Chin-tsong* (1607), he received lessons from a learned European named *Li-ma-teou*, (the celebrated missionary, Matthew Ricci), and that he studied under his direction astronomy, mathematics, in their application to the Chinese calendar, and the theory of fire-arms. The Emperor *Ssé-tsong* having heard that *Siu-kouang*, who had just died, had left a great work on agriculture, entitled *Nong-tching-tsiouen-chou*, ordered it to be presented to him by the

* *Ming-ssé* (Annals of the Dynasty of the *Ming*), book CCLI, folio 15, imperial edition, of twenty-four historians of the first order, in 700 volumes, small folio. Peking, 1739.

nephew of the author, and ordered it to be printed at the expense of the State.

The third work is entitled *King-ting-cheou-chi-thong-khao*, or a General Examination of Agriculture, composed by order of the Emperor. It is twice as extensive as the preceding collection, and is composed of LXXVIII books, distributed in 24 volumes, small, in folio, printed with all the care and elegance that distinguishes the imperial editions. This compilation, undertaken a hundred years after, (in 1739,) in virtue of a special decree, by learned men of the first order, aided by the most skilful agriculturists of the empire, gives him a high importance. The extent of this work, its official character, and recent date, if compared with the two collections abovementioned, have made me resolve to extract from it the Treatise on the *Cultivation of Mulberry Trees and the raising of Silk Worms*, the translation of which the Minister of Commerce has intrusted to me.

If I was not afraid of being misled from my subject, I would make all the objects known which this agricultural encyclopædia embraces. I will content myself to say that a complete treatise can be found there, (books XXI–XL.) of leguminous plants, of grain, and particularly of the cultivation of rice, accompanied by a number of figures engraved with care, of which more than a hundred represent the ploughing instruments of the Chinese, and the machines which they make use of for the irrigation of the fields. The part which I have translated occupies books LXXII, LXXVI.

The reader will be able to form an idea of the immense riches of the Chinese literature, by learning that the agricultural collections, entitled *Cheou-chi-thong-kao*, from which my translation is extracted, made a part of the library of the most estimable works in China, of which the publication was ordered in 1773, by the Emperor *Khien-long*, and which, according to the decree of this prince, was composed of a hundred and sixty thousand volumes. This collection

was to form four libraries, called *Ssè-kou*, or the *four Treasures*. It yet continues to be printed, and in 1818 there had already appeared seventy-eight thousand six hundred and twenty-seven volumes, of that vast collection.* There has been published by order of the Emperor two accurate catalogues; one very much abridged, in fifteen small volumes, 12mo., (Peking, 1775,) and the other very extensive in one hundred and thirty-eight volumes, 8vo., (Peking, 1782.)

* The following is a Catalogue of the bibliographic divisions in which are distributed these 78,627 volumes.

CLASSICAL OR REGARDED AS SACRED WORKS.

(KING.)

NOTE.—The numbers that follow each article indicate the number of volumes contained in all the works comprised in that division. The first, relative to *I-king*, embraces 1,526 different works.

The Book of Variations (*I-King*)	1,750 vols.
The Book of Annals (*Chou-King*)	661
The Book of Songs (*Chi-King*)	951
The Book of Manners and Customs (*Li-King*), that is to say the three Rituals entitled *Tcheou-li*, *I-li*, and *Li-ki*	2,168
The Chronicle of the Kingdom of Lou	1,818
The Book of filial Piety (*Hiao-King*)	17
Works relative to the interpretation of *King*	717

THE FOUR CLASSICAL BOOKS.

The great Doctrine, the Invariable medium, the Discourses of Confucius and the Philosopher *Meng-tseu*	732
Works upon Music	482
Elementary Books	913

HISTORICAL WORKS.

Collection of the Histories of all the Dynasties	3,681
Annals, in Chronological order	2,066
General History	1,205
Particular Histories	1,485
Collections of Ordinances and Imperial Decisions	1,474
Biographies	949
Historical Documents	18
Descriptions of particular Districts	389

If the translation of this work had been executed at Peking, by some missionary, surrounded by help of all kind, and aided by the lights of Chinese literati, whom no difficulty could stop, it would have been as irreproachable, as perfect, as that of an English work written in London, with the assistance of the most enlightened men of Great Britain.

The position of a *sinologue* in Europe, is far from being as advantageous as that of these ancient missionaries of Peking, to whom we

Chronology	29 vols.
Geography and relations of voyages, descriptions of foreign countries	4,788
Administration and Government	392
Political Institutions, Laws, and Edicts	3,785
Bibliography and Inscriptions	700
Criticisms on particular histories	382

RELIGION, PHILOSOPHY, AND OTHER SCIENCES.

School of Confucius, Philosophers of	1,694
Military Science	153
Jurisprudence	94
Agriculture	195
Medicine	1,813
Astronomy and Arithmetic	643
Physic, Physiognomy, Astrology	432
Painting, Music, Printing, Dancing	1,658
Natural History, Dieteticks, etc	363
Miscellaneous	9,200
Writings of an inferior order, such as marvellous histories	1,358
Bouddhique works	32
Works of the sect of *Tao-ssé*	442
Poems of various kinds and Literary Collections	28,998
TOTAL GENERAL	78,627 vols.

These details have come in part from the Asiatic Journal of Paris, (July, 1834, page 64 seq.) It would have been easy for me to translate from the great imperial Catalogue the titles of other bibliographic divisions, adding thereto the numbers which complete the collection of 160,000 volumes; but I have thought this notice, incomplete as it is, will give a sufficient idea of the extent of Chinese literature, and of the resources and materials of every species which it offers to the persons who cultivate it in Europe.

owe so many useful works. It is necessary to struggle every moment, and, perhaps, without help, against the difficulties of the most redundant and complicated of all the languages. The obstacles infinitely multiply, if the text to be translated be full of technical terms and details, and if the difficulties of a subject which is strange to it, be joined to the difficulties of the language.

Such are the difficulties I have met with, in the course of my translation, I hope they will serve as an excuse for the faults which have escaped me, and that they will give me some title to the indulgence of learned men, and men of the world.

STANISLAS JULIEN.

PARIS, 15*th March*, 1837.

NOTE

UPON

THE TEMPERATURE OF CHINA.*

It is thought better to join to this publication some remarks upon the temperature of China, to show in what physical condition the Chinese are placed for the cultivation of mulberry trees and the raising of silk worms: such is the object of the following note :

China extends from the 22d to the 41st degree of north latitude; and, from its near situation to the tropic, the mean temperature of this vast country seems to be superior to that of the south of Europe, which stops at the 36th degree of latitude; but, in the Memoirs upon the *isothermes* lines, or upon the distribution of heat on the surface of the globe, (Society of Arcueil, tom. III.,) M. de Humboldt has shown, from a great number of observations, that in the same latitude the mean temperature was much more elevated, in Europe and Africa, than in Asia and America. Thus to limit ourselves to China, the observations of missionaries and other travellers have fixed the mean temperature of Peking at 12°, 7 centigrades; that of *Nangasaki*, Japan at 16°; that of Macao at 23°, 3; that

* I owe the following Note to the kindness of Mr. Edward Biot, whom I have the honor of numbering among my scholars. The Minister of Commerce, having desired that I should unite to my translation some remarks upon the temperature of China, has offered me the results of inquiries he has made on this subject. I have accepted them with eagerness, convinced that his scientific knowledge has furnished him the means of giving to these determinations all the exactness that observations collected by travellers could have obtained.

of Canton at 22°, 9; and if compared with the cities of Europe and Africa, where the temperature is analogous to that of those four cities, the following table will be found:

Asia.	Latitude.	Mean Temperature.	Europe and Africa.	Latitude.	Mean Temperature.
Peking	39° 54′	+ 12°, 7	Paris	48° 50′	+ 10°, 6
			Lyons	45° 40′	+ 13°, 2
			Montpellier	43° 36′	+ 15°, 2
Nangasaki	32° 45′	+ 16°, 0	Toulon	43° 7′	+ 15°, 8
			Rome	41° 53′	+ 15°, 8
			Naples	40° 50′	+ 17°, 4
Canton	23° 8′	+ 22°, 9	Algiers	36° 58′	+ 21°, 1
Macao	22° 12′	+ 23°, 0	Cairo	30° 2′	+ 22°, 4

From this comparison it may be concluded that the mean temperature of Peking, and of the north of China, is sensibly equal to that of Lyons, and more elevated than that of Paris, by two degrees. The central provinces of China, between the Yellow and *Kiang* rivers, being situated under latitudes little different from that of *Nangasaki*, their mean temperature ought to be from 15 to 16 degrees, or about that, of our Provence. The mean temperature of Macao and Canton is more elevated than that of Algiers, by two degrees, of which the geographical position is more northern by 15°. It approaches that of Cairo, which is situated in 30° of latitude, and which is found farther north by 7 to 8°, than the two Chinese cities.

But, it must be observed, with M. de Humboldt, that the temperature of winter and that of summer, appears to differ much more in Asia and America, than in Europe and Africa. Thus, at Peking, after Amyot, who observed there, for six years, the mean temperature of the warmest month is +29°, 1; the summer, like that of Naples, whilst the mean temperature of the coldest month is 4°, and the thermometer remains there for three months below zero, like at Copenhagen, more north than Peking by 15° in latitude. According to the Dutch, at *Nangasaki*, in 32° of latitude, the temperature

of the warmest month is +30°, 5, as it is at Cairo, situated in 30°; and the temperature of the coldest month is 5 to 8 degrees above zero; sometimes the thermometer descends to 3°, results which correspond with the winters of Marseilles, situated in 43° of latitude. At Macao in 22° of latitude, La Perouse has found +15°, 5 for the mean temperature of January, and which is observed equally at Algiers, much more north than Macao; and the mean temperature of the Chinese city being superior by 2° to that of Algiers, the summer ought to be there sensibly warmer.

Recent observations confirm these variations between the temperatures of winter and summer in China. Thus, in 1816, during the return of the Ambassador of Lord Amherst, a series of thermometrical observations made in the month of September, between the 38° and 35° of latitude, give 23°, 58 for the mean temperature of this month, and which is equally remarked in our Provence. In 1820, at Timkowski, in Mongolia, in 40 to 45° of latitude, in the month of October and November the thermometer descended from 10 to 15 degrees below zero. A French Missionary established in 1833 in East Tartary, at *Si-wang*, in 41°, 39′ of latitude, relates extraordinary differences between the temperatures of summer and winter. According to him, the thermometer rises to 37° 5 centigrades in summer, and descends to 37° 5, below zero in winter. "During this last season spirits-of-wine only remained liquid, and when a metal is touched with moist hands, the epidermis of the fingers remains attached thereto."* In conclusion, a useful remark upon the temperature of the central provinces is furnished us by a Missionary who has lived ten years in China, and which limits the cultivation of the orange to the 30th degree of latitude, while in Provence we have orange trees as high as the 43d degree.

From the data furnished by the original texts upon the production

* Annals of the Propagation of Faith, Nos. 40 and 50.

of divers provinces of China, and from the reports of Missionaries, the greater part of the silk is produced in the central provinces of China, situated between the 25th and 35th degrees of latitude; and it is well established by the preceding observations that the mean temperature of these central provinces differs but little from our Provence; the winters there are a little milder, and the summers rather warmer.

The quotations in the commencement of the present translation, indicate that the manufacture of silk extended, anciently, to the provinces of the north of China, and it may be presumed that it is not entirely abandoned there now.

These provinces are, as we have seen, exposed to singular alternations of cold and heat; but the raising of silk worms commences in April, and at that epoch of the year the air is sufficiently warm to raise them throughout China. Their development may yet be aided by the artificial heat described in the work. The cold of winter in these provinces seems very rigorous, yet the mulberry trees do not freeze, but we do not know every species of mulberry possessed by the Chinese. When they shall be received, through the care of Mr. Louis Herbert, whom Government sent a year ago to China, it is hoped they will succeed in France, and that they will resist the cold of our climate.

CULTIVATION

OF

MULBERRY TREES.

GENERAL REMARKS.

Tchin-iu, being Governor of the province of *Kien-té*, ordered every man of the nation to plant fifteen feet with mulberries. [Annals of the dynasty of *Liang*; biography of *Tchin-iu*.]

The Emperor gave to each man twenty acres of land, on condition of their planting fifty feet with mulberries. [Annals of the dynasty of *Weï*; Memoirs upon Provisions and Commerce.]

When the agricultural labors are terminated, or when the rain prevents persons from working in the fields, every thing must be taught relative to the cultivation of mulberry trees. [Annals of Northern China; biography of *Sou-tcho*.]

The Emperor *Hien-tsong*, who ascended the throne in the year 806, ordered all the inhabitants of the country to plant two feet with mulberries in each acre of ground. [Annals of the dynasty of *Thang*; life of the Emperor *Hien-tsong*.]

The first Emperor of the dynasty of *Song* (who commenced to reign in the year 960) promulgated a decree to prevent the mulberry and jujube trees from being destroyed. (The leaves of that tree may serve to feed the silk worms.) [History of the dynasty of *Song*.]

An imperial decree says:

If, among the people, men are found who grub up the uncultivated ground, and plant a great quantity of mulberry trees, only the ancient tax will be exacted from them. [Extract from the same work.]

DIFFERENT KINDS OF MULBERRY TREES.

1st. The small mulberry trees (dwarf trees) have long branches, called *niu-sang* (ladies' mulberry trees) and *i-sang*. [*Eul-ya* Dictionary.]

2nd. The *yen-sang* or *chan-sang* is the wild mulberry tree, the mountain tree. [Same work.]

3rd. The *tseu-sang* or seed mulberry tree; its fruit shoots out before its leaves. [Japanese Encyclopedia, book LXXXIV, fol. 1.]

4th. The mulberry tree called *khi-sang* (that is to say, chicken mulberries) have leaves veined with red; they are

rather thick. The silk worms that are fed on them produce a thin cocoon, which furnishes little silk. [*Tchong-chou-chou.*]

5th. The white mulberry tree bears thick leaves, that are as large as any one's hand. The cocoons of the worms that are fed on them, enclose a strong and abundant silk. This leaf furnishes twice as much silk as that of the ordinary mulberry tree. [Ibidem.]

6th. The mulberry trees, of which the leaves are plaited, and covered with a yellow pellicle, is called *kin-sang*, or the gilded mulberry tree. All the silk worms cannot be fed on the leaves of this tree, of which the color foretells that the tree will soon dry and perish. [Ibidem.]

There are some mulberry trees that do not produce fruit; they are vulgarly called *nan-sang* or male mulberry trees. [Japanese Encyclopedia.]

The mulberry trees, of which the fruit sprouts out before the leaves, necessarily bears very few leaves. [*Tchong-chou-chou.*]

To sow mulberries, the fruit of the black mulberry tree of *Lou* must be taken. The yellow mulberry trees of the country of *Lou* cannot be preserved a long time. [*Thsi-min-yao-chou.*]

The mulberry trees of the country of *Khing* (ancient name of the province of *Hou-kouang*) and of the country of *Lou*, may be planted in level plains, where the ground is limey and clayey, and also in light earth. If the ground touches a mountain or hill, that is hard and mixed with red

are veins, it is only suitable for the mulberry trees of the country of *Khing*. [*Nong-sang-yao-tchi.*]

The different kinds of mulberry trees are very numerous, we cannot describe them all.

The best are those of the country of *Lou*, and of the country of *Khing*. The mulberry trees of *Khing* yield a great quantity of fruit, but those of *Lou* very little. Those of which the leaves are thin, pointed, and divided in lobes, are the trees of the country of *Khing*. They bear solid and hard leaves.

The mulberry trees of the country of *Lou* have round, thick, and juicy leaves.

The mulberry trees of which the branches and leaves are large, and thick, are a species of those of *Lou*.

The mulberry trees of *Khing* have solid roots and full hearts; they last for a long time. Those are the kind to be planted.

The mulberry trees of *Lou* have less solid roots, and hearts not so full; they cannot last for any length of time, (dwarf mulberry trees.) Trees called *ti-sang* are formed from them; but the trees of *Khing* have neither as many branches, nor as many leaves, as those of *Lou*. Branches of the mulberry tree of *Lou* may be grafted upon them; they then live for a long time, and yield an abundance of leaves.

If the mulberry trees of *Lou* be employed to obtain the species of tree called *ti-sang*, (dwarf trees) and if they be re-produced by twigs, they propagate without interruption, and last an infinite time.

The silk worms that are fed with the leaves of the mul-

berry trees of *Khing*, produce a firm and strong silk ; it is fit to make *cha* and *lo-cha*, (kinds of thick gauze and crape.)

The leaves of the mulberry trees of *Lou* agree with the worms that are large ; those of the trees of *Khing* with the small worms. [*Nong-sang-thong-khioué.*]

The work entitled *Thsi-min-yao-chou*, decribes the manner of obtaining the best seed of the black mulberry trees.

The two ends of the mulberry must be cut off with a pair of scissors, and only the middle part taken. The seed of the two extremities are comparatively smaller than the others, and if sown they produce little mulberry trees, called *khi-sang*, (chicken mulberry trees) and *hoa-sang*, (flowering mulberry trees.)

The intermedial part of the mulberry has larger and harder seed. The trees that proceed from them have firmer and stronger branches, and they bear thick and nourishing leaves. [*Nong-sang-thong-khioué.*]

The mulberry trees called *ti-sang* (dwarf trees) ought to be planted in a garden near a well. If grass springs up around the roots of the trees, the earth must be turned up with a spade. When it does not rain they must be watered. When the silk worms are hatched they ought to be watered three times a day ; the leaves will then grow very quickly.

Among the different kinds of mulberry trees there are some that sprout out early, others late. It is from among the mulberry trees which are in leaf the earliest, that those

are chosen, from which the trees called *ti-sang*, or dwarf mulberry trees, are formed. [*Nong-tching-tsiouen-chou.*]

In the work, entitled *Tchong-hoa-min*, it is read: There are two kinds of mulberry trees: one bears the fruit of which we sow the seed: it sprouts out in the first or second month, (February or March.)

The following is the manner the other kind is multiplied:

A pliant branch is bent to the ground, and maintained in that position by a clod of clay. Each bud produces a branch. When this mulberry tree has attained the height of two or three feet, its roots are then formed. The mother branch to which it belongs is then cut, and it is transplanted in another place. It soon becomes a tree. [Same work.]

In the memoirs of *Hoang-sing-tseng*, entitled, General Considerations upon the Cultivation of Mulberry Trees, we read:

There are some mulberry trees called *ti-sang*, (dwarf trees,) they come from *Nan-tsin*. There are some mulberry trees called *thiao-sang*, or trees formed from layers; they are brought from the neighbouring plains of *Hang-tcheou-fou*, in the province of *Tche-kiang*. They are sold the ten first days of the first month of the year, (February.)

The market is situated at *Pé-sin*, near the bridge called *Kiang-tchang-kiao*. The merchants come at the rising of the sun, and spread out their plants of mulberry trees to the right and left of the bridge. At 12 o'clock they retire.

OBSERVATIONS UPON THE CHOICE OF MULBERRY PLANTS.

The mulberry with a wrinkled bark yields only small and thin leaves; those of which the bark is white, the joints long, and have large buds, are the leafy trees of *Chi*, (diospyros;) they always bear large and thick leaves. The cocoons spun by worms fed on them are firm, and furnish a great deal of silk.

The tall white mulberries succeed well upon the declivity of hills, in the angle of a wall, or by the side of a hedge.

The mulberry trees of less height, with a black bark, should be planted in moist ground. [Same work.]

The mulberry trees with black bark, which produce no seed, when the leaves are not too thick, are good for the nourishment of newly hatched silk worms. (Same work.)

The trees of the country of *Wang-haï*, are multiplied in the same manner as those with the white bark. The tree called *thsé-teng-sang* (or mulberry tree with rose-like branches) grows high and strong.

The white mulberry tree, or the tree with white bark, yields very little seed, it is multiplied by layers. If a person has seed they can sow it, but it must be in the shade. Heavy well filled cocoons will be formed, which will produce twice as much silk as the ordinary ones. [Same work.]

THE PLANTING OF THE MULBERRY.

In the fifth month, (June,) the mulberries must be gathered and put into water. The pulp must be crushed with the hands, and washed several times. When the seed is separated, it must be dried in the shade.

Ten acres of fertile land, or what is better, land that has

not been cultivated for a long time, must be prepared. In each acre three *ching* (kind of measure) of millet and mulberry seed, mixed together, must be sown. The millet and mulberry trees ought to vegetate at the same time. The mulberries must be dug, transplanted and arranged so as to stand at suitable distances from each other. When the millet is ripe it must be reaped. The mulberries have also grown, and attained a height equal to the millet; they must be cut close to the ground, with a sickle, or a sharp scythe; leave them to dry in the sun, and when it is windy, burn them. For that, it is always necessary to choose the moment when the wind blows from a favorable quarter.

The mulberry plants will shoot forth the following spring. One acre will yield leaves enough to nourish the silk worms of three hurdles. [*Khi-ching-tchi-chou.*]

When the fruit of mulberry trees, and the trees called *tché* have come to maturity, the black fruit of the mulberry trees of *Lou* must be gathered; they must be washed the same day in water, and the seed separated. They must be dried in the sun, and sown in beds of earth, which should be dug and watered, as if for the cultivation of the plant called *Kouei*, (mallows.) The ground should be constantly weeded, and kept clear of noxious plants. The next year, in the first month, (February,) the mulberry trees must be taken up and transplanted, leaving between each plant a distance of four or five feet. This operation can be done equally, in the second and third months of Spring. The ground must not be ploughed. Generally, the failure of mulberry plants proceeds from the ploughing; the iron of the plough cuts and wounds the roots.

The seed must be thickly sown, because, notwithstanding

the great care that is taken with the cultivation, a great number of the mulberry trees often die. The trees grow slowly from seedlings in beds. To have them grow fast, slips of the black mulberry tree must be taken. Those persons that have no mulberry plants are obliged to sow the seed.

The earth should be spaded about the mulberry trees, and *lo-teou* (dolichos) and *siao-teou* (phaseolus radiatus) sown there. For two years after having planted the mulberry trees, care must be taken, not to gather the leaves, because the trees that have had the leaves taken from them, when young, do not grow half so fast as the others.

When the mulberry trees are as large as one's arm, they must be transplanted in the second month, to about thirty feet apart.

The trees of one row must not correspond with those of another, otherwise they will injure the *lo-teou*, (dolichos) the *siao-teou*, (phaseolus radiatus.) We will also add, that if the mulberry trees were planted in regular lines, they would constrain the movement of the plough.

The following is the time, when the layers ought to be taken. In the first or second month branches must be bent down, and fixed to the ground with hooks or forked sticks. When these branches have pushed or sprouted some inches, they must be surrounded with dry and well pressed earth. If the earth is damp the young shoots will rot. In the first month of the next year, (February,) the mother branches must be cut and the roots transplanted. [*Thsi-min-yao-chou.*]

Whenever a field of mulberry trees is ploughed, it must not be near the trees; the trees would be injured, and the

plough broken. In the places where the plough has not passed, the soil must be turned over with a spade, the straggling roots cut even with the ground, and the soil enriched with the dung of the silk worm.

First sow the seed; then plant the cuttings. The third operation consists in arranging the mulberry trees in the nursery. [Same work.]

The twelfth month, (January,) is the most proper month for the pruning of the mulberry trees. The first month, (February,) is not so good; the second month still less so. In general, when there are many mulberry trees, they ought to be pruned largely; when there are but few, they ought to be cut with a great deal of discretion.

The seed of the mulberries, before being sown, must be washed with care, and dried in the sun, and then sown in well cultivated ground. [*Tchong-chou-chou.*]

Instead of sowing the seed, to obtain mulberry trees, we think it better to lay the branches along the ground, and to transplant the twigs, when they have taken root.

The following is the mode of propagating mulberry trees in *Tché-kiang*. They strip a branch of its leaves and plant it in the ground; that operation is called *kia-sang*. Then the head is again covered (the superior extremity of the slip of a tree) with a shell, for fear the rain, of the third month, might injure the bark. After the second year, these slips are strong and vigorous.

The nursery beds of mulberry trees must not be spaded in the middle of the day. [*Tchong-chou-chou.*]

When the time for sowing has come, the seed must be mixed with some ashes from the branches of the mulberry trees, and they must be soaked to make them soft. The

next day the seed must be washed with care, and those that float are rejected.

The full seed must be dried in the sun, until the absorbed water has entirely evaporated. They can then be sown, and they never fail to grow rapidly. [*Nong-sang-thong-kioué.*]

The following passage is from the work entitled, *Sse-nong-pi-yong:*

New seed of the mulberry should only be sown. Old seed must not be used, because it is in a great measure barren. The most advantageous method is to sow it in a very shady square, or to cover it with a kind of small roof, in the form of a tent. The shade of hemp is not so favorable, that of millet still less so.

Between each plant of the mulberry five to seven inches must be left, and they must be frequently watered, until they have attained the height of three feet; then the hemp must be cut.

In the tenth month, (November,) they must be cut even with the ground, dry grass is then spread over them, and the whole burnt over. The fire must not be too strong, because it will injure the roots.

The place must be covered with decomposed vegetable manure, until the following Spring; afterwards the weeds and grass so reduced to manure must be raked up, and the plants watered. From each plant many shoots will come; the strongest must be preserved, and the others cut.

When the mulberry trees have good roots, they do not require the shade; they must be frequently watered.

In the autumn, the mulberry trees of *Lou* will be from five to seven feet high, and those of *Khing* from three to four.

The mulberry trees of *Lou* may be transplanted and

changed to dwarf trees. The trees of *Khing* can be planted and raised in a garden.

To succeed in the cultivation of dwarf mulberry trees, they must be restrained in their growth by the prescribed rules, and care taken that they do not wither.

Those persons who have not large mulberry trees, content themselves with the dwarf. This kind of tree requires but half the labor. Some persons have both the large and dwarf mulberry trees. When the first are in full bearing the others are abandoned.

The dwarf mulberry trees must be watered three times a day, in order that they may grow rapidly. When the silk worms have recovered from their great torpidity, (the third moulting,) the mulberry trees sometimes cannot reproduce leaves, recourse must then be had to the dwarfs. In this manner the latter silk worms arrive at maturity without ever wanting leaves. [*Ssé-nong-pi-yong.*]

METHOD OF TRANSPLANTING THE DWARF MULBERRY TREES.

In a garden surrounded by walls, a piece of ground is chosen, well cultivated with the plough and spade, and in a square of ground, of five feet, a ditch must be dug on each side, two feet in breadth and two in depth.

In one acre of ground two hundred and fifty cuttings may be planted. In the bottom of the ditch, three *ching*, (three-tenths of a bushel) of well-rotted manure must be spread. Fresh manure will not answer. In a good soil only a small quantity is required; an equal quantity of earth must be mixed with it, then a bucket of water poured in, in order to make a soft compost. A plant of the mulberry tree of *Lou* must be chosen, that has grown from seed, in the

squares of ground. Then it must be raised up by a spade, with its roots; seven inches of the stalk must be left with the root, and the rest removed; then the wound must be burnt with a hot iron.

In each ditch a plant must be placed in the middle of the soft mud, and it must be carefully set at the bottom of the cavity, (when a quick result is required two must be planted.) It must be lifted up lightly four or five times, in order that the roots and fibres may take a good direction. The top of the stalk must be even with the ground; surrounded and filled in to the top of the ditch, with well decayed (or warm) earth.

The next day the earth must be pressed or rammed down to make it more compact, until it fills but half the hole. The earth lying under these roots is naturally compact; without that, the roots would not adhere strongly to the earth, and this defect would cause a great many mulberry trees to perish.

The upper half of the ditch must be filled with well decayed (or warm) earth; it must be lightly pressed down, so as to level it and fill the hole.

The earth that touches the stalk must not be very compact; because the buds will have some difficulty in pushing.

Above the stalk a small hill must be raised, made of light earth, about five or six inches high. In this manner a small gutter is formed around it, through which the rain and the watering penetrate. When the shoots spring up from the ground to the height of four or five inches, only one or two branches must be left on each plant.

If they are spaded and watered according to the prescribed rules, they will grow, in one year, to the height of about five feet.

The next year, the branches must be cut even with the ground; the leaves serve to feed the silk worms. A steel hedging bill, with a thick back, must be used, which cuts the branch by a single stroke. The irregularities must be smoothed, and the cut made even, when the instrument is dull and cannot cut the branches by a single stroke. The rain injures the roots. The stalk of the dwarf mulberry trees must not come out of the ground; they ought to push from below the surface of the earth.

Those of which the stalks are above ground, are called *khio-kao*, that is to say, as high as a foot. The branches that shoot above the stalk are not strong, and moreover, it is seldom that they are not injured and broken by the rain and wind.

Below the cut place, several shoots spring around the stalk. Four or five branches may be left to each plant, and all the others pruned away. Every year the tree must be cut even with the ground. By degrees the root will become strong and vigorous; a greater number of branches may be gradually left.

In regard to the stalks of wild mulberry trees of the country of *Lou*, they can be planted as the others; they succeed equally well with the others; the above mentioned rules are to be strictly followed. At the expiration of three years, a mulberry tree will be in full growth; at the end of five years the roots interweave. The interlacing of the roots is injurious to its vigor. In the spring the interwoven roots must be cut, and manure put at the root of the tree. As soon as it has been watered, and moistened by the rain, it resumes its growth and vigor. Afterwards, when the roots are supposed to be enlarged, the branches must be bent down to the ground, and plants are obtained by layers, that must be transplanted to another enclosure,

and which are afterwards cultivated, according to the rules we have already prescribed.

Three years after their planting, the new mulberry trees spring up with vigor. When the branches of mulberry trees are cut to nourish the silk worms, only one branch above the foot of the old mulberry tree must be cut. It is planted, and at the expiration of a year, it will have taken root; afterwards these plants must be taken up, and carried elsewhere to form rows of mulberry trees. In this manner the mulberry trees are propagated infinitely. But when the branches of the mulberry trees of *Lou* are cut to feed the silk worms, their thread has little strength and suppleness. It would be better to plant, in a suitable proportion, the mulberry trees of *Khing*; their leaves are used to feed the silk worms, after the third moulting, when the leaves of the other mulberry trees have failed. [*Ssé-nong-pi-yong.*]

THE FAVORABLE SEASON FOR PLANTING.

Attention ought to be paid to the season, and the qualities of the soil. The ten days that precede and follow the period called *Tchun-feu*, (the 21st of March,) and the whole of the tenth month, are the most favorable periods. In the ten days that precede and follow the time called *Tchun-feu*, (the 21st of March,) the trees begin to revive; for that reason it is better to plant the mulberry trees then. This is done, in countries situated to the east of *Lo-yang*, in an extent of a thousand *li*, (hundred leagues.) In other countries their seasons ought to be conformed with. The mulberry tree grows easily; and its vegetative life is suspended, and it ceases to push only in the eleventh month,

(December;) all the other months of the year are proper for that operation.

Hemp or millet seed must be thinly sown to give shade to the mulberry trees. Every year, the third day of the third month, (April,) when the weather is clear or rainy, it will be easy to discern the good from the bad.

MANNER OF RAISING MULBERRY TREES.

In a garden, surrounded by walls, (or hedges,) a place well cultivated with the plough, or hoe, must be chosen, and a square hole, about three feet wide must be opened.

Liquid manure must be poured there, exactly like the dwarf mulberry trees are planted, then a mulberry tree of *Khing*, provided with all its branches, must be taken from one of the squares where it has come from seed. It must be raised up with its roots, by a spade, and planted in the hole, in the manner above mentioned: after having pressed and levelled the earth of the hole, with the surrounding ground, a hill of light earth must be raised above each stalk, to the height of one or two feet, and all around will naturally be formed a circular gutter, (if it does not rain it must be watered.) When the trunk of the mulberry tree has attained the height of a tall man, the top of the tree must be cut off, and the horizontal branches will then grow more rapidly. Let it grow and extend itself, and do not cut the new branches. In the spring they must not be lopped, for after being cut, for several years the tree will remain weak and unhealthy; but in the twelfth month, (January,) or the first month, (February,) of the following year they may be pruned without injury.

If the tree has been watered and cultivated in a proper manner, in Autumn it will be as large, and as high, as those

rafters, which are called *tchouen*. In the tenth month, (November,) or in the Spring of the following year, the mulberry trees may be transplanted, and arranged in the nursery.

If this method be not followed, and the mulberry trees are raised in a garden, there is a great deal of danger in transplanting the young trees, to range them in the nursery, for the wind and rain never fail to kill a great number of them.

The wild mulberry trees of the country of *Khing*, of which the stalk is not strong, can be transplanted with their roots, in an enclosure where they will be cultivated like those we have just spoken of.

They are to be cultivated according to the method prescribed for the dwarf mulberry trees. When they have pushed forth, the most vigorous branch must be left, and the others pruned away. They will grow to the height of a tall man. To raise plants of this species, the rules mentioned above must be followed.

When the fruitful influence of the Spring begins to be felt, a lateral branch of the dwarf mulberry tree must be taken, and cut from three to five inches from the extremity, and it must be bent down in a furrow made at the foot of the tree.

Many persons make use of the plants of mulberry trees, others bend down some branches in the ground; that depends on the cultivator.

The furrow where the branch is bent down ought to be five inches in depth. The branch must be fixed in that position by a hooked stake. Two are required if the branch be short, and three if it be long.

After that operation, the branches proceeding from the buds shoot upwards; they then have the form of the teeth of a rake. Upon the horizontal branches only one bud

ought to be left, at the distance of about five inches, and cut off all the others; their leaves will nourish the young silk worms.

In the fourth or fifth month, (May or June,) when the weather is mild, about mid-day, the two sides of the horizontal branch must be surrounded with rotten pond earth; a small hill above the branch must be formed Then the horizontal branch becomes a torpid root. In the evening it must be watered. (During the night the torpid root shoots out fibres.)

In Autumn each sucker forms a stalk of the mulberry tree. In the tenth month, (November,) and sometimes before, or after the beginning of the next year, the torpid roots are cut at the two ends, and taken out of the ground; pieces about the length of a cane, must be cut, and thrust in the vertical holes made for that purpose. Each root produces a plant of the mulberry tree.

By this method an infinite number of plants may be procured.

MANNER OF PLANTING BRANCHES.

In a garden surrounded by walls, holes must be dug the same as for the dwarf mulberry. When it is perceived that black eyes commence to push upon the branches of the mulberry trees of *Lou*, with large leaves, a long branch of more than a foot in length must be cut, the two ends must be cut off, and the place of the incision burnt.

Plant in each hole, two or three of these branches, inclining them a little. When the buds come out, the stalks must be surrounded by a hill of light earth, from three to five inches high; to each stalk only a single branch must be left. In the Autumn it will be several feet high. The

following year the leaves of the branches may be gathered to feed the silk worms.

These mulberry trees have only to apprehend the effects of the mid-summer's sun. If they have moisture, (literally speaking, watering,) and shade, not a single one will perish. They can also be planted in small squares of ground, (arranged like the white squares of a draught board.)

If, in the enclosure, there are no branches which can be cut, a mulberry tree of *Lou*, with large leaves, must be chosen from another place; the required branches must be cut in the last month, (January,) and preserved in a hole made in the ground. If they be exposed to the air, they will soon wither.

The time is waited for, until the black eyes of the branches of the mulberry trees begin to push. The hole made in the ground is then opened, and it will be perceived that the eyes, of the branches deposited there, have also pushed. The two ends of the branches must be cut, the place of the cut burnt, and after having planted them, they must be proceeded with according to the rules above laid down.

The following is the manner of raising, in an enclosure, the small mulberry trees, of the species of *Lou* or those of *Khing*. In the last month, (January,) the extremities of the branches that do not grow well must be cut. When the plants are very small, three to five branches near the top must be left, if they be rather large, about ten of the branches near the top a foot in length, and all the others cut off.

In the following Spring, at the time when the eyes begin to push, the plants must be bared, then taken up with the roots and transplanted to spacious ground, in regular lines, eight yards apart. The mulberry trees must be planted opposite to one another, leaving between each plant a space

of four or five yards. The distance of eight yards left between each row of mulberry trees, will allow the plough to pass through them in like manner as four or five yards space left between each tree will allow the ground to be cultivated with a hoe.

This nursery must be surrounded with thorny hedges. In the last month, the small scions which have pushed during the year upon the horizontal branches must be thinned and pruned in an uniform manner. The following year the leaves of these trees can be gathered to feed the silk worms. [*Nong-sse-pi-yong.*]

MANNER OF PRUNING LARGE MULBERRY TREES.

The branches must be thinned, and above all, pruned in time. It ought to be done in order that the branches may acquire strength and push early, and that the silk worms may not want leaves.

If the branches are cut off, those that remain will acquire strength, and the leaves will become thicker and more nourishing. If this year they are pruned at the proper time, the long branches will become strong and vigorous; the leaves of the next year will shoot out early, and they will be thick and glossy.

All the branches from the centre must be cut, so that a man may stand up and easily make use of the axe. The branches and leaves fall outside of the tree; that is much better, than to be obliged to remove all around the tree a heavy ladder. A man thus placed in the centre of the tree, can do as much work as two persons placed outside of the tree. Too many branches must not be allowed to grow, otherwise they cannot be cut without hard work; moreover, the leaves will be thin and destitute of taste.

Moreover, the art of properly pruning the mulberry trees, is one of the most important points for the raising of silk worms. Many persons do not know how to make beforehand the necessary preparations when the cessation of agricultural work gives them leisure. They only occupy themselves with the mulberry trees, when the season of tending the silk worms, has overloaded them with trouble. In this manner they are overcharged with double work, and often the silk worms want necessary nourishment. If on the contrary, these mulberry trees have been pruned, according to the rules, so that the branches can be easily reached, and the leaves obtained with facility, the silk worms will not wait for their food, the leaves will come in proper time, and, moreover, they will be thick and glossy.

The method used in the country of *Thsin* is called *lo-sang*. In the last month of the year, (January,) all the superfluous branches must be pruned away, and those that are left be much thinned; afterwards upon the branches that are preserved, four eyes must be left, and the others picked off. The next year the branches that were left will have become strong; the black twigs which will have grown from the middle of the eyes will be three feet in length; the leaves will be twice as thick as usual, and will present a smooth and brilliant surface. During the raising of the silk worms, they can be gathered with the hand; the external branches only, that shoot forth, must be left. After having grown luxuriantly, until the Autumn, they will have obtained the length of eight or ten feet. In the last month of the year, (January,) they must be again pruned, as before. After the expiration of several years, if the branches that have been left appear to overload the tree, they must be pruned at their base.

This method is followed in the country of *Lo-yang*, to

the east of the Yellow river; but a different mode is adopted north of this river, in the province of *Chan-tong*.

When the mulberry tree has attained the height of five to seven feet, from the period of its transplantation, the tops of the branches must be cut. As the branches of the centre have been removed, those that remain will grow in a horizontal direction, and extend outward. When the tree has become large and strong, a man can stand up in the centre.

When the tree has attained its *maximum* of strength and growth, the stalk and the branches must be cut in the centre.

There are three kinds of branches that must of necessity be removed.

1st. The branches inclining towards the root;

2d. Those which bend inward, towards the trunk;

3d. Those which grow in pairs; one must be cut;

4th. Those growing in a good direction, but which are too thick and too bushy.

The last month of the year, (January,) is the most favorable for pruning: the month that follows is less so. In the last month of the year the sap is quiescent, and the cessation of labor in the country leaves much leisure to the cultivators. Those persons who prune in the Spring, only do it in order to peel them easily, (to make paper,) but that causes the mulberry trees to lose a great quantity of sap.

Those persons who wish to make use of the bark of the mulberry tree can take the branches, cut in the last month, (January,) and deposite them, with a southern exposure, in a hole, covered up with earth. They must be taken out in the second month, (March,) and they then peel very easily. [*Nong-sse-pi-yong.*]

METHOD FOR SOWING MULBERRIES.

The seed of the mulberry must be sown in the fourth month. Small beds must be spaded up, with a southwestern aspect, and rotten manure, mixed with earth, must be spread on them, then raked smooth and watered, in order that the earth may be well saturated; afterwards mulberry seed must be sown. Some persons mix and sow them with an equal quantity of millet seed. The seed being well moistened and softened with water will not be long in germinating; and they will be soon sheltered from the rays of the sun. Some cultivators sow hemp seed in advance, south and west of the squares. The young mulberry trees are soon shaded by the hemp, and are thus sheltered from the summer sun. When they have attained the height of two or three inches, they must be watered in dry weather. If the seed has not been sown with millet, a small roof covered with mats may be constructed above the plants. The mats can be spread during the day, and rolled up at night. When the extreme heat has passed, it is no longer necessary to shelter the young plants.

After the tenth month, (November,) the mulberry plants and the stalks of the millet must be cut even with the ground; then, at a favorable time they are to be burned over, and afterwards the ashes covered with manure.

ANOTHER METHOD.

(Wou-pen-sin-chou.)

In well cultivated ground, a bed of millet must be weeded with care; a large straw rope must be taken, and a piece cut off, soak the two ends, (two or three inches of

each end,) in flour diluted with water; or, what is still better, water in which rice has been boiled. In the centre of each end of the rope, ten mulberry seed must be inserted; afterwards the rope must be laid down in the middle of a furrow dug in the millet bed. The two ends of the rope must be compressed and covered with clods of earth, then a light covering of earth must be spread upon the intermedial part of the rope. One or two yards farther, another piece of the straw rope must be laid down, continuing to dispose of the pieces of rope in regular lines, in the whole extent of the millet bed. It will be proper to water it after a dry spell of weather. The tenth month the millet and mulberries ought to be cut and burnt upon the place, and the ashes covered over with manure, as we said before. In the Winter and Spring they must be covered with snow, that has been strewn with manure. Before or after the period called *Thsing-ming*, (the fifth of April,) the manure should be swept away.

During rainy weather the mulberry trees must be transplanted to proper distances from one another, as they were sowed in the squares. This method saves much trouble to the cultivator; and powerfully favors the growth of the mulberry trees, which, by this means, gain two years over the others.

If a person has any seed from the preceding year, it must be sown in the Spring, which is much better; but afterwards a small wall must be raised to protect the young plants.

Some persons fear giving themselves too much trouble and embarrassment in making use of the straw ropes. They mix an equal quantity of mulberry and millet seed, and sow it in the half of a gourd. They place it in a quarter of the field that is cleared with care.

If dry weather is feared, a bed of the millet must be cho-

sen, and good earth spread there in an equal manner, made in small squares throughout the whole extent of the bed, then water and sow the seed.

ANOTHER METHOD.

In the Spring of the year, in well manured ground, trace regular lines from the south to the west, sow hemp in an equal manner. Afterwards mix mulberry seed with the dung of the silk worms, or with the seed of torrified millet. After rain plough that portion north of the hemp once, and then sow. This is as advantageous as if a small roof had been constructed, covered with mats, in order to protect the mulberry plants sowed with an equal quantity of millet seed.

The mulberry plants are benefited by the shade of the high and tufted stalks of the hemp, without depriving them of the air and dew. When ten acres are sowed in this way little labor will be required to succeed.

The dwarf mulberry trees are obtained from the trees of *Lou.* Slips of the mulberry trees of *Lou* must be planted and cultivated, according to the rules we have described above.

On the dwarf mulberry tree leave four or five branches; it must be cultivated with the spade, and manured. The branches not being very numerous, the leaves shoot out in small quantities. The juice of a great number of leaves unites in one. That leaf grows rapidly. That is called a dwarf mulberry tree.

MANNER OF PLANTING DWARF MULBERRY TREES.

In Autumn, in well prepared ground, a piece of land must

be thoroughly ploughed and divided into small squares,* which must be covered with manure and vegetable mould.

Before and after the time called *Tchun-fen*, (the 21st of March,) the branches of the mulberry trees which were buried in the last month of the year, must be taken up. Those whose buds have germinated, must be chosen, and cut the length of seven or eight inches; a furrow must be dug in each square, they must then be watered, and laid down to be planted; afterwards cover them with three or four inches of earth. If the earth laid upon them is too deep, the branches will push with difficulty. The earth ought to be pressed and levelled with one's hand.

Sow to the east, south, and west, of each square, from five to seven seeds of hemp.

After the fifth month, (June,) the buds gradually push. Manure must often be added. Some time after, when the branches are high, these mulberry trees will have become what is called dwarf trees.

When the mulberry trees are one or two years old their sap is less abundant, and the stalk is necessarily very brittle.

After the time called *Tchun-fen*, (21st of March,) the squares must be opened, with a spade, the mulberry trees taken up, and transplanted to some other place. In the portion of the squares, situated to the north, a wall of earth must be formed, at the bottom of which a hole must be made with a dibble, and in each hole pour a certain quantity of water. Then the plants of the mulberry trees must be taken and planted, with the wall for a support. The roots must be spread out in an uniform manner. Afterwards

* N. B. In another part of this book these squares are marked like those of a draught board. The white are those to be cultivated, and no care is given to those parts represented by black squares. ST. JULIEN.

the root of the young tree must be covered up again with earth, well trampled on. The earthen wall, and the earth of each square, ought to be raised about three or four inches. In general, the roots of the plants, and small trees newly planted, ought not to be shaken or agitated; it is for that reason earthen walls are made, to defend them from the north wind, and to concentrate upon them the rays of the sun. At the present day it often happens that when the small mulberry trees are transplanted, having nothing but their roots and fibres, not an inch of earth is left. But it happens, when these plants are transported to a great distance, the wind and the sun drys up their vital moisture, and when they have been planted it is seldom that they grow again, or if they do, they never acquire any vigor; and then it is imputed to the nature of the soil, which is a very great error.

When a great number of plants are dug up, and which are to make a long voyage before being planted, they must be placed in bundles of ten each, the roots watered with liquid dirt, on which a thick covering of earth must be spread; then they must be carefully enveloped in grass or reeds. Before packing them, compact and well cemented white clay can be applied around the earth that covers the roots. Then the plants of mulberry trees must be placed in the carriage-box where they will be sheltered from the wind and sun. The stalks must be covered with a straw mat.

Before replanting the mulberry trees, the square in which they are going to be put, must be spaded, and manured.—At the time of planting them they must be watered, and afterwards cultivated according to the rules prescribed above.

THE MANNER OF PLANTING MULBERRY TREES IN AUTUMN.

Mulberry trees are generally transplanted in the Spring; but, at that time of the year they are often shaken by the wind; the rains of the Spring, joined to the winds, make it difficult for the mulberry trees to succeed. This is not all: the weather becomes warmer by degrees, and the buds and leaves cannot support the heat; from these causes a great number die; or, rather, if they shoot out, a considerable space of time is required for them to acquire strength. If the first stalk be pruned away, a second will push more vigorously. The trees become flourishing from the first application of the pruning knife. These happy effects of pruning are, above all, remarkable in the dwarf mulberry trees.

In the Southern countries the plants are planted in the tenth month, (November,) but to the north of the Yellow river, the climate is extremely cold; for that reason it is better to plant them in the Autumn. The most favorable period for that operation is that of abundant rains. The squares ought to be a foot or more in depth. One or two inches of stalk must be left, above the level of the earth, the remainder being removed. After having finished planting, the earth must be well trodden about the roots of the trees, and the place of the incision must be covered up with earth. When the ground is frozen, spread a quantity of manure around it. After the heat of the Spring, a hill of earth must be made in the form of a funnel, or inverted cone, around each tree, and above the manure. Rain water may thus be collected about the plants; and, if it becomes dry, they can be watered in the interior. On the south side of the plants hemp seed must be sown in the spring of the

year. By the time the rainy season has set in, the buds will have produced bushy branches. Then you have the dwarf mulberry tree.

Some persons cut the slender branches, and leave one or two strong ones. The following year the mulberry will become a tree. Other persons lay the branches down in the ground, and, in that manner one tree produces ten others; that method is better than if whole trees were planted.—These layers never fail to succeed, and the trees they produce become bushy and flourishing.

In the tenth month, (November,) the vitality of the tree is suspended; it is better to plant the mulberry trees, by covering the top with earth. The whole stem of the tree must be cut away, and planted, as in Autumn.

In the winter months the sap descends. As soon as the influence of the Spring is felt, they push together; and, in the space of a year, the new shoots will exceed in height the tree which furnished the cuttings or layers.

When the mulberry trees of two years old are planted, if at the period called *Kou-yu*, (20th April,) there should be some buds and leaves, showing little vigor, the bottom of the stalk must be attached to something solid, and all the superior part removed, only leaving some inches of wood, above the level of the earth. A small hatchet may be used, but it is better to use a very sharp hedging bill, or pruning knife.

A hill of earth must be raised above the place where the stalk has been cut; on the south side of the tree, five to seven millet seed must be planted. At the expiration of ten days the tree will begin to push, and small branches grow from the buds. In dry weather water frequently. After the time called *Li-hia*, (the 6th of May,) this method

should be discontinued; it is equally impossible to continue it in very hot weather.

In every month of the year, the mulberry trees can be transplanted, except during the time called *Ta-han*, (which commences the 2d of January, and ends the 4th of February.)

MANNER OF OBTAINING LAYERS.

After the time called *Han-chi*, (the 5th of April,) a mulberry tree, more than two years old, must be taken; a deep furrow must be dug by the side of it, and the whole body of the tree laid down and confined in that position by the help of solid stakes. Small branches, which have germinated, are left above the surface of the earth. Cover with earth the large branches, and the stalk of the tree. All around the tree a border must be made, with the earth, so as to form a kind of funnel, to retain the water. In dry weather it ought to be frequently watered. If a person has no tree fit for the operation described above, they must be contented to dig a furrow at the root of the tree, where the horizontal branches must be buried, by fixing them in the ground, with the assistance of crooked sticks. In the sixth month the whole tree must not be buried.

MANNER OF PLANTING MULBERRY TREES OBTAINED FROM LAYERS.

Towards the end of Autumn, when the cultivators have much leisure, deep square holes must be dug in advance, where the earth preserves its dampness during the winter,

so as to diminish the work, at the period when the approaching new season requires all the mulberry trees to be planted at the same time.

In each of these holes, which ought to be more than two feet square and deep, spread two *chings* (two-tenths of a bushel) of rotten manure, which has been well mixed with earth. Raise the ground on the north side, and lower it on the south, in order to retain the snow of Winter, and the rain of Spring.

In the last month of the year, (January,) take two or three large and long branches of the mulberry tree of *Lou*, join them together, and cut the lower part; cut with a sharp hatchet, and scar the cut, by passing it lightly through the fire. Bundles are made of forty-five branches, and laid in a hole, exposed to the south, care being taken to separate each bunch by a bundle of rice straw.

The hole should be three or four feet long, and as many deep. The holes ought to be dug before-hand, for fear of experiencing many difficulties, if it be delayed until the cold has frozen the ground to a certain depth.

Cover these bundles of branches with a thick bed of earth. After the time called *Tchun-fen*, (21st of March,) they must be taken out. Then open the first hole, pour three or four *chings* (three or four tenths of a bushel) of water in, and sow twenty to thirty millet seed there. The branches must then be taken and bent down, (in the form of a circle,) and tied in that position with a straw rope, and covered up in the middle of the hole, and three or four inches of earth put over. If by chance the buds of the branches have pushed two or three inches, the surrounding branches must be covered with a foot of earth. The earth must then be well trodden, in order to make it compact and

close, but small hillocks of light earth must be formed above the growing buds. Some time after, when the buds will have acquired a certain growth, the earth which surrounds them will separate from them. On the south side of the hole some hemp seed must be sown in advance; the ground must be kept shaded and damp. Water constantly.

As to the mulberry trees which have been planted by laying down the whole tree, some earth must afterwards be spread over them. The branches which proceed from the buds will grow rapidly and soon attain considerable height. The lateral branches must be cut, and after the expiration of three years, these mulberries will have become trees. Some persons who wish to have dwarf mulberry trees, cut the extremities of the branches, and plant them in the earth, so as to hide the top of the stalk. Two or three must be tied together, and planted according to the method described above. Other persons make a hole in a radish and plant there a small bough, which borrows a little nourishment and strength from it; this proceeding is yet more advantageous than the other. A small square hole is then dug and the mulberry tree and radish are buried there after the method already prescribed.

PLANTING MULBERRY BRANCHES UPON BEDS OF EARTH.

In the Autumn, well manured ground must be prepared. In the second month, (March,) it must be levelled. Form the beds high, with an east and west aspect, having between them proper distances. The ground must be dug, and the square holes opened. Then take up the branches of mulberry trees that were buried in the last month, and plant

according to the prescribed rule. Sometimes the strong and tall branches, having but one root, are planted in the same manner.

When the branches are planted, in order to reproduce mulberry trees, the new shoots may be cut largely, if there are many old mulberry trees. But when there is but a small number, it is to be feared that the following year the silk worms will want food if the trees are cut without discretion. It is for that reason we give here the best methods to direct the cultivator, who wishes to sow mulberries, to make layers, or to plant cuttings; it is for him to choose, of these three methods of reproduction, which soever may be most convenient for him.

Suppose a village, where two neighboring cultivators associate their work. They raise a small square enclosure, having one hundred yards for each front of the nursery.—(If the inhabitants be numerous, and possess much land, the labor divided between them will be still less for each.) Each cultivator will make two hundred yards of the enclosure, the ground in the enclosure will contain ten thousand yards. At every three feet a mulberry tree will be planted, which will make ten thousand plants for the whole nursery, and five thousand trees for each family. But if a family by itself alone can make an enclosure of two hundred yards, the ground it encloses cannot contain more than two thousand five hundred yards. If the rule, indicated above, be followed, and the mulberry trees planted at one yard distant from each other, only two thousand five hundred plants can be placed there.

When two cultivators are associated together, they ought to endeavor to avoid all quarrels and law-suits. The best way is to divide the nursery, in the middle, with a live hedge.

This manner of cultivating the enclosure is much more advantageous than by a single person. Thus, at first, double the number of mulberry trees may be planted; afterwards their mutual assistance tends to lighten a great deal the individual labor. [*Nong-tching-tsiouen-chou.*]

In the work entitled *Ssé-chi-louï-yao*, we read: When the mulberry trees are planted, it must not be at too great a depth, otherwise they will not germinate. When they have attained the height of one foot they ought to be surrounded with manure.

TCHONG-HOA-MIN.

Mulberry trees are planted in the first and second months (February and March); they may also be planted in the eighth month (September). The roots must be carefully placed, in a straight natural position, and covered and surrounded with compact earth to keep them steady. The roots of the mulberry trees should be watered with liquid manure; they will not fail to grow with vigor. According to the opinion of *Siu-kouang-ki*, manure must be used at the time of planting.

When the mulberry trees are to be planted, the ground must be weeded and manured. The pruning of the stalk is called *Kia.*

Near the base of the tree branches of about one foot in length must be left, and they must be deeply buried, leaving only one inch above ground. The tree must be cultivated and made to grow by watering it. The place of the cut turns black. It may be covered with a shell, or better still, if done with wax, to prevent the rains of the fourth month from penetrating the wood, and rotting it. The

ground ought to be manured all around the tree, so that its roots may penetrate and extend themselves on all sides. If the foot of the mulberry tree is only watered, it will soon perish. It ought not to be watered with water only, liquid manure should be mixed with it.

In two years after planting, the mulberry trees will be in a flourishing condition. The part covered with earth ought to be stirred every month with the hoe. Some persons turn the earth up twice, to a depth of one or two feet. Then the earth must be moistened with liquid manure, without water. The ground all around the mulberry trees must be watered, so as to reach the roots, that extend to a distance; this practice must be continued until the gathering of the leaves. After the lapse of three years, the mulberry trees will sprout out with remarkable strength. If the vigorous branches be not cut, and neither plants nor shrubs are left near the mulberry trees, they will acquire new strength, and the leaves that will be gathered for the raising of silk worms will be luxuriant and healthy. Soon after the branches must be pruned away where they unite, and a large space left around the trunk. Then the branches of the following year will grow with more strength, and the leaves will become thicker. If each year the superfluous branches be removed in this manner, the others will become flourishing.

The silk worms ought not to be raised in the Autumn.—If they be, the branches of the following year will be weak and delicate, and their leaves will be thin and destitute of juice.

The roots of the mulberry trees must be surrounded with manure, the dung of the silk worms, ashes of rice straw, mud of canals, or with rich and fertile earth. But at the

beginning of the planting, instead of the manures indicated above, aquatic plants and cotton seed should be used. The roots will be kept warm, and the tree will grow rapidly.

According to an author named *Siu-kouang-ki*, a paste of beans, hemp, or cotton seed, of hog, sheep, cow, or horse manure, may be used.

At the commencement of Spring the branches will grow with rapidity. The small dried boughs must be lopped off. When a tree is low and small, its roots must be opened, and surrounded with mud; without it, the leaves will grow slowly, and they will become thin and destitute of juice.

When the branches are laid down in the ground to make layers, they rot if the ground is damp; but if the ground is warm the roots soon grow. It is more advantageous to reproduce the mulberry trees by layers than by seed.

There is an insect called *sang-nieou*, that does a great deal of injury to mulberry trees. Its nest must be looked for in the cracks of the bark, and some oil of the tree *thong*, *(bignonia tomentosa,)* poured upon it, the insect is immediately destroyed.

Some persons make use of the plant *pou-mou-tsao*, the leaves of which resemble those of the bamboo. This plant is boiled, and with the decoction the leaves attacked by this insect are watered. Leguminous plants may be cultivated among the mulberry trees.

The kind of tree called *yang* must not be planted in the mulberry nursery. The cracks in the bark give refuge to a great number of insects, which eat the epidermis of the mulberry trees, and there place their nests where their eggs will be hatched. *Siu-kouang-ki* says to the contrary, that these trees must not be banished from the nursery of mulberry trees; only great care must be taken to destroy the insects they harbor.

The mulberry trees of *Wang-haï* are planted in the same manner as the white mulberry.

In the twelfth month, (January,) the ponds must be opened, and the trees surrounded with manure; that is to say, their roots must be surrounded with muddy ground. In the second, and sometimes the third, sixth, and seventh months, the mud with which the roots of the mulberry trees have been surrounded must be removed.

The mulberry trees with rose-like branches, are of a species that grow strong and high. It is not necessary to prune them in order that their branches may become thick. They ought to be planted much sooner than the others. It is better to plant them near the house, but it is not necessary to surround the roots with pond mud. It is only when these mulberry trees are young, they must be surrounded with manure, before winter comes. Some persons manure them two or three times. The twelfth month, (January,) is the most favorable period for that operation.

In the work entitled *Nong-sang-yao-tchi* we read: Whenever the mulberry trees have been newly planted, the branches ought not to be cut, or the leaves gathered until the proper time. The leaves which grow upon the long branches from the middle of the tree must not be gathered. Leaves of the lateral branches which have not been pruned must be gathered, in order that the branches and the small boughs may enlarge and become bushy. Then the mulberry trees must be surrounded with a hedge to prevent cattle and other domestic animals from browsing on the leaves, and from shaking or pulling up the trees. Afterwards, when the middle boughs have acquired strength, the lateral branches may be removed.

When the roots are strong and extended, the sap rises in

abundance, towards the boughs of the centre ; then the mulberry tree grows, and soon becomes a strong and tall tree. It strengthens every day, and shows every sign of rich vegetation.

SUPPLEMENT

TO THE

CULTIVATION OF MULBERRY TREES.

to the fig and mulberry trees may be the cause of its being regarded as a species of sycamore. It grows on mountains and stony places."

In the work entitled *Ssé-nong-pi-yong*, we read:

It is advantageous to graft the branches of mulberry trees of *Lou*, (large species of mulberry trees,) upon stocks of the trees of *Khing*, (Dwarf mulberry trees.)

In order that the graft may succeed, the time must be chosen when the movement of the sap draws near, and with strict regard to the parts brought in contact, and which must be kept close together by the assistance of a strong ligature, and enveloped with a thick plaster of grafting clay or composition, so that they may not be displaced or exposed to the frost. The ten days which precede the term called *Tchun-fen*, (21st of March,) is the first favorable time for that operation; the five days that precede or follow, form the limitation (or the second period, which is less favorable than the first;) but the most favorable time is that when the eyes of the branches have taken a black tint. This rule ought to be followed in all climates; but clear weather and a warm day is required. If the union of the parts be not very close, the sap will find great difficulty in circulating between the stock and graft; if they are not bound together by a strong ligature, the wind and cold will insinuate between them and prevent their uniting. The wild stocks bearing small fruit of a disagreeable taste, after having been grafted, will produce much larger fruit, and of an excellent flavor. For similar reasons it has become the custom to graft mulberry trees to improve the leaves.

When grafts are wanted for use at a distance, they must be cut in advance ; and the favorable season taken for cutting the branches.

When the branches stored with buds, that are to be transported to a distance, are cut, they must be enveloped in reed leaves, and packed in a new, unvarnished basket, with diospyros branches. When the opening of the basket has been well covered, and the grafts are perfectly sheltered from the exterior air, they may be transported to a distance of a thousand *lis*, (a hundred leagues) without running the risk of being injured by the cold. For fruit trees, grafts must be taken from the three year old branches ; the manner of preserving and uniting them, (grafting,) is the same as with mulberry trees.

Siu-kouang-ki says : For that purpose the best branches are those of the same year ; it is an error to recommend for that object branches of three years old. Grafting must be deferred, absolutely, until the last quarter of the moon.— This operation may be performed after the second quarter of the moon, and during the first quarter of the following moon ; but the last day of the moon is much more favorable. The time between the first and the second quarter is unfavorable ; grafting must then, absolutely, be abstained from ; the time of the full moon is still more dangerous.

CLEFT GRAFTING.

To begin : The stock must be sawed horizontally, at a small distance from the ground. With a sharp knife, with the point turned up, two oblique incisions about an inch and a half in length, must be made right and left in the bark

and liber, so that, approximating at their extremities, they form an acute angle.

Then a graft, five inches long, and nearly as large as one's finger, must be taken, and cut in the form of a prism for about an inch and a half of the lower end. Warm it in the mouth for a moment, then insert it in the cleft which has been made in the side of the stock.

It is very important that the union of the two parts should be precise, in order that the wood and bark of the old tree may coincide perfectly with the wood and bark of the graft, (which is destined to improve or renovate it.) The same stock may thus receive several cleft grafts, when its size will permit.

Take then fresh cow dung, well mixed with earth, and envelope the graft; afterwards it must be firmly wound round with green bark of the mulberry tree. This is not all; the ligature of bark must be covered with the same composition as before; afterwards the graft must be covered with five inches of moist earth; finally, thorny branches must be placed around the ball of earth to protect the graft.

When the new shoots have protruded through the damp earth, and are one or two feet in length, all may be cut off, except two or three, and these should be supported by props.

Siu-kouang-ki says: The depth of the cleft should be in proportion to the strength of the tree, and the size of the graft. It is important that the bark and wood of the graft coincide exactly with the bark and wood of the stock; but there is one thing more important still; it is the perfect correspondence of those parts which communicate the sap.

When large mulberry trees are to be grafted, it is better to use the *cleft graft*, or the *graft by insertion*. For the small mulberry trees, the best grafts are those like the *ear of*

a horse,* and by *compression*, namely, by budding. When a tree is grafted even with the ground, it must be surrounded with clayey earth, as described above, and if it be a cleft graft, to half of the height of the graft; the cleft may be covered with paper only; afterwards it must be enveloped with an old piece of mat. Place damp earth around to nourish the graft; it should be so done as to afford shelter from the air and wind. Instead of a piece of mat, an old earthen vessel without a bottom may be used. Water when the earth is dry, to preserve the proper humidity. Shoots will soon push through the damp earth, which envelopes the grafted place. Care must be taken not to remove this earth; but in the Autumn, when the shoots have acquired strength, and the graft is firmly joined, this earth becomes useless. As soon as the grafts are well set, and they partake of the life of the stock, they can be left, if the strength of the tree, and the number of horizontal branches permit it.

BUDDING OR INOCULATION.

When budding is to be performed shorten a horizontal branch to within about a foot of the stem. (The length to be left, cannot be rigorously determined; attention must be paid to the strength of the tree.) Having selected a bud or germ from the graft, enter the knife half an inch below a bud, cut quite through the bark to the wood, separating the bark to the same distance above the bud. A very thin slip of wood is also taken with the bark and liber bearing the bud.

Below the bud, and upon the wood, there is a small

* Query? Whip grafting.

heart (which agriculturists call *corculum*) as large as a grain of rice; it is the vital principle of a branch or limb. When the bud is cut remove the wood only with the point of the nail, leaving the corculum attached to the small plate of bark and liber.

Moisten the bud for some moments in the mouth, and then apply it upon the horizontal branch, where it leaves an impression. It must be taken again, and held in the mouth; then with the point of the knife upon the line so impressed, make an incision or scollop in the bark and liber upon the stock of the same size with the bud, so as to bare the wood. Then insert the bud in the place prepared for it (upon the horizontal branch.) The bud or germ must be turned upwards, that it is to say, in its natural position.

The grafted parts must be firmly bound above and below with fresh and thin bark of the mulberry tree. The ligature must be tied in a careful and proper manner. If it be tied too tight, the circulation from the stock cannot be communicated to the graft; if too loose, the two parts will not be sufficiently compressed to adhere, and the operation will not succeed.

Cow dung must be kneaded with clayey earth, and the four sides of the graft covered with it, leaving the bud free.

The number of buds will be in proportion to the size of each stock.

MANNER OF GRAFTING SMALL STOCKS.

Grafting with grafts cut in the form of a horse's ear, (that is to say, whip grafting,) may be performed. In the

nursery, upon the young mulberry trees of *Khing*, (dwarf mulberry trees,) planted the preceding year; their stocks must be cut obliquely, like the ear of a horse, two inches from the ground. Afterwards, a graft of the same size is taken from a mulberry tree of *Lou*, (a mulberry of the large kind,) cut it of a corresponding shape, (*en oreille de cheval*) and fit it to the stock, and bind them firmly together with soft fresh bark of the mulberry. The graft must be covered with cow dung mixed with clayey earth, and the grafted stock surrounded with damp earth. When the buds of the graft have pushed through the earth, one or two can be left, and the others cut. In the Autumn they will have attained the height of a tall man. The following year, they must be transplanted to the plantation to cultivate them there. The rules given above must be conformed with. The graft must be absolutely of the same size with the stock upon which it is engrafted. The bark and liber must coincide exactly. (It is the most important point.)

In the work entitled *Wou-pen-sin-chou*, we read the following:

The fruit of all mulberry trees improve by grafting.—Whenever the branches are to be grafted, the finest ought to be chosen. It is better to make use of old branches, turned towards the sun, (the south.) They are stronger and more flourishing. The young branches exposed to the north are weaker, and succeed with difficulty. The root and the trunk each follow their species unchanged, though the dwarf mulberry tree of *Khing* may be grafted upon the large mulberry tree of *Lou;* the *meï* (plum tree) upon the almond tree, and the peach on the pear tree.

There are five modes of grafting: 1st, grafting on the body of the tree, (cleft grafting;) 2d, grafting the roots;

3d, the graft in the bark; 4th, the graft on the branches; 5th, by budding, (scollop grafting,) inoculation or budding.

In the work entitled *I-sang-tsong-lun*, we read:

The second month of the year is the time to graft. The different methods are, *cleft grafting*, the graft *by insertion*, *scollop grafting*, and the graft *by budding* or *inoculation.*

There is yet the graft called *houan-tsié*, or the graft *of exchange.* This expression is applied to the operation when the mulberry tree is grafted on the tree *tchu-kou*, (see the commencement of the article on grafting;) its leaves become thicker and larger.

THE END OF THE CULTIVATION OF MULBERRY TREES.

RAISING

OF

SILK WORMS.

THE RAISING

OF

SILK WORMS.

PRELIMINARY OBSERVATIONS.

TESTIMONY FROM CHINESE AUTHORS,

WHO SPEAK OF THE CULTIVATION OF THE MULBERRY, AND THE RAISING OF SILK WORMS, FROM THE MOST ANCIENT TIMES, (4438 YEARS AGO,) DOWN TO THE YEAR 976 OF THE CHRISTIAN ERA.

In the Book on Silk Worms we read:

"The lawful wife of the Emperor *Hoang-ti*, named *Si-ling-chi*, began the culture of silk."

It was at that time that the Emperor, *Hoang-ti*, invented the art of making garments.

OBSERVATIONS BY THE TRANSLATOR.

The same fact is mentioned, more in detail, in the General History of China, by P. Mailla, in the year 2602, before our era, (4438 years ago.)

"This great Prince, *(Hoang-ti,)* was desirous that *Si-ling-chi*, his legitimate wife, should contribute to the happi-

ness of his people. He charged her to examine the silk worms, and to test the practicability of using the thread. *Si-ling-chi* had a large quantity of these insects collected, which she fed herself, in a place prepared solely for that purpose, and discovered not only the means of raising them, but also the manner of reeling the silk, and of employing it to make garments."

It is through gratitude for so great a benefit, says the history, entitled *Wai-ki*, that posterity has deified *Si-ling-chi*, and rendered her particular honors, under the name of the *Goddess of Silk Worms. (Memoirs upon the Chinese.* Vol. 13, page 240.)

It is written in the chapter *Iu-hong*, of *Chou-king*, one of the five canonical books of China:

" The mulberry trees may be planted, and the silk worms raised."

OBSERVATION.

According to the annals of China, this chapter was composed about the year 2205 before Christ, (4041 years ago.) See the *Chou-king*, translated by P. Gaubil, page 45. [St. Julien.]

It is written in the *Book on Worms*, one of the five canonical books, chapter *Pin-fong*, ode 1:

" In the month, when the silk worms are fed, (in the fourth month,) the leaves of the mulberry trees must be gathered."

OBSERVATION.

This chapter was composed by *Tcheou-kong*, uncle to the Emperor *Tching-wang*, about the year 1115 before our era (viz: 2951 years ago). [St. Julien.]

We read in the *Li-ki*, or Book of Ceremonies, (one of the five canonical Chinese books,) in the chapter *Youeï sing*:

"In the last Spring month, the young Empress purifies herself, and offers a sacrifice to the Goddess of Silk Worms. She goes to the fields, situated to the east, and gathers mulberry leaves herself. She forbids the noble ladies and ministers' wives all ornamental dress, and she dispenses with the labors of her waiting-women, who sew and embroider, so that they may be able to give all their attention to the raising of silk worms."

OBSERVATION.

The *Li-ki*, (or Book of Rites,) from which this passage has been extracted, was compiled by Confucius, whose birth was 551 years before Christ.

The work we translate has many similar passages, which relate to the fourth and eleventh centuries before Christ. [St. Julien.]

In the work entitled *Nong-sang-thong-kioué*, we read:

"The place called *kien-kouan*, (or the house of cocoons,) is that where the Empress herself raises silk worms. In ancient times, there was a plantation of mulberry trees, belonging to the State, and a building called *Tsan-chi*, (or the house of the silk worms,) which had the same destina-

tion as that which is now designated by the expression, *ki-en-kouan*, namely, the house of cocoons.

"The young Empress purifies herself, and offers a sacrifice to the Goddess of the Silk Worms, as an example to the whole empire, and to promote the general culture of silk. The Empress repairs to a mulberry plantation. She first cuts a branch; an attendant, who holds a basket, receives the leaves of the mulberry trees; afterwards the Empress cuts three branches. A maid of honor, endowed with the title of *Chang-chou*, (or President,) throws herself on her knees, and says: It is enough. The attendant who holds the basket receives the leaves, and carries them to the silk worms. It is forbidden to carry the leaves of the mulberry tree to that part of the palace called *Ken-chi*, or the golden house."

In the history of the Emperor *Hiao-wen-ti*, whose reign began in the year 163, before Christ, it is observed:

"By a decree the Empress was commanded to gather the leaves of the mulberry trees herself, to feed the silk worms, and to furnish the garments destined for sacrifices."

THE YEAR 156, BEFORE CHRIST.

The Emperor *King-ti*, made a decree, and commanded the Empress to gather some mulberry leaves herself, in order to set the example to the whole empire.

THE YEAR 48, BEFORE CHRIST.

The mother of the Emperor *Youen-ti*, visited the house

of cocoons, (or of the silk worms,) and followed by the Empress and the ladies of the palace, she went and gathered some mulberry leaves.

THE YEAR 58, ANNO DOMINI.

Under the reign of *Ming-ti*, of the dynasty of *Han*, the Empress and her attendants raised silk worms.

THE YEAR 220, ANNO DOMINI.

Under the dynasty of *Weï*, the wife of the Emperor *Wen-ti*, raised silk worms, in a place situated to the north of the city, so as to conform to the ritual of the dynasty of *Tcheou*. [Work composed in the tenth century before Christ.]

BETWEEN THE YEARS 265 AND 275 ANNO DOMINI.

Under the reign of *Wou-ti*, of the dynasty of *Tsin*, in the years of *Thaï-khang*, the Emperor built a house called *Tsan-kong*, for the silk worms. The Empress went herself, to gather mulberry leaves, in order to conform to the ancient customs of the dynasty of *Han*, and those of *Weï*.

BETWEEN THE YEARS 454 AND 457, ANNO DOMINI.

Under the dynasty of *Song*, the Emperor *Hiao-wou-ti* had a house constructed for the silk worms.

The Empress gathered, herself, the leaves of the mulberry trees, conformably to the usage of the dynasty of *Tsin*.

The author of the work entitled *Nong-sang-thong-kioué*, continues to quote some analagous facts, which he had gathered from the history of the Emperors, from the years of *Thien-pao*, (from 968 to 976,) of the dynasty of *Song*, under which he lived, so as to show, that from the highest antiquity, the Empress raised silk worms as an example to the whole empire.

In the work entitled *Tsan-lun*, or Considerations upon the Silk Worm, we notice:

"Every species of tree requires a particular soil, except the mulberry tree alone, which grows every where; and, consequently, there is not a single place in the empire where silk worms cannot be raised."

The book on worms says, in chapter *Pin-fong*, (composed about the year 1115, before Christ:)

"A young girl takes her elegant basket and follows the concealed paths, to gather mulberry leaves."

By this passage it is seen that silk worms could be raised in the country of *Pin*.

OBSERVATION.

The country of *Pin* corresponds with the territory of which *Si-gan-fou* is now the capital, of the present province of *Chen-si*, which is situated in the northwest of China.—[St. Julien.]

In the ode of *Tsang-tchong-tseu*, of the same work, we read: "Take care not to destroy our mulberry trees."

This passage shows that silk worms could be raised in the country of *Tching*.

OBSERVATION.

The country of *Tching* corresponds with the country of *Tching-tcheou*, a dependency of the department of *Khaï-fong-fou*, in the province of *Ho-nan*, which is situated in the centre of China. [St. Julien.]

In the ode entitled *Tche-sin*, we read:

"The mulberry trees grow upon steep hills, and poplar trees in moist valleys."

This passage shows that silk worms could be raised in the kingdom of *Thsin*.

OBSERVATION.

The country of *Thsin* corresponds to *Thaï-youan-fou*, which is now the capital of *Chan-si*. That province is situated in the north of China. [St. Julien.]

In the ode entitled *Mong*, we observe:

"The mulberry leaves have not yet fallen; they are fresh and abundant." *(Ibid.)* "The mulberry leaves become yellow and fall."

Also, in the ode entitled *Sang-tchong:*

"He made an appointment to meet me among the mulberry trees."

These two passages show that silk worms could be raised in the kingdom of *Weï*.

OBSERVATION.

The country of *Weï* corresponds with the territory of *Weï-hoeï-fou*, in the province of *Ho-nan*, which is situated,

as its name indicates, south of the Yellow river. The *Ho-nan* is situated in the centre of China. [St. Julien.]

In the ode entitled *Hoang-i*, we find:

" He cuts, he lops the trees, called *yen*, (wild mulberry trees,) and *tché*, (thorny trees,) the leaves of which serve to feed silk worms."

This passage shows that silk worms could be raised in the country of *Tcheou*.

OBSERVATION.

The author continues to show, by quotations from ancient works, that silk worms could be raised in the country of *Tcheou*, which corresponds with a part of the actual province of *Hou-nan*, which is situated in the centre of China; in the countries of *Lou* and *Thsi*, (in the province of *Chan-tong*,) in the north of China; in the country of *Thsou*, (ancient name of the central province of *Hou-kouang*, of which has been formed, under the present dynasty, the provinces of *Hou-pé* and *Hou-nan*;) in the kingdom of *Liang*, which makes a part of the actual territory of *Ho-nan*, a central province of China, and in the country of *Cho*, which corresponds with a part of the present territory of *Ssé-tchouen*, a western province of China.

The author thus terminates this article: " The five kinds of seed may be cultivated, and harvests obtained, in the coldest countries of China; further, mulberry trees may be successfully cultivated under any temperature whatever."

CONSTRUCTION

OF THE

SILK WORMS' APARTMENT.

In the Book of Rites, (written by Confucius, in the fifth century before Christ,) it is observed:

"The Emperor and his vassals were obligated to keep a plantation of mulberry trees, belonging to the State, and a nursery for silk worms. It was established near a river or brook of running water; its height was about eleven cubits, and surrounded by a hedge of thorny shrubs."

SAME WORK.

Lots were drawn by the ladies of the three palaces, and the noble-women who were pure, and surrounded with happy omens, thus chosen, were sent to the nursery, to feed the silk worms, and occupy themselves with all the care of their raising.

THSI-MIN-YAO-CHOU.

The windows in the four fronts of the building must be opened, and paper pasted on them, to protect the worms from the exterior air. In the interior of the silk room fires must be lighted at the four angles.

SAME WORK.

In the third month, at the period called *Thsing-ming*, (the 5th of April,) the women charged with the feeding of the silk worms, are ordered to prepare their dwelling, and to stop up the holes and cracks through which the air might penetrate.

SAME WORK.

The silk worms naturally love repose, and fear loud cries; therefore, their house should be quiet, and exempt from all noise. They love the heat, and fear the damp; their apartments should, therefore, be constructed of boards. In a quiet and retired house they will not be troubled with the cries and clamor of men. In a close house they will be sheltered from the sudden south winds. In a house constructed with plank they will be sheltered from the exhalations and damp vapors of the earth.

THE BOOK ON SILK WORMS.

The silk worms like an apartment with a mild temperature; on the contrary, the cocoons should be kept in cool places.

WOU-PEN-SIN-CHOU.

The house of the silk worms ought to be distant from all impurities, and every thing that exhales a disagreeable odor, such as stables, cow-houses, &c. Care must be taken during the night, that no light may penetrate the windows, or suddenly be shown, in the dwelling of the silk worms. Do

not extinguish, in the silk room, paper matches, such as emit a great deal of smoke.

When the worms are newly hatched they fear the dust made in sweeping. They are disturbed by crying and weeping; they do not like persons to come in their apartments, who are not perfectly clean. For example: A woman who has been brought to bed less than thirty days, or who has her menses.

(That observation is drawn from another work upon the same subject.)

SAME WORK.

Whenever the silk worms are raised in Autumn, the time of their hatching is not distant from the three periods called *San-fo*. (They fall in the middle of Summer.) The heat (of the Summer) yet subsists, and as it occasions a great deal of dampness in the apartments of silk worms, the necessary measures must be taken for the air to circulate freely in every part of the nursery.

CONSTRUCTION OF THE OVEN.

In the middle of the house, a hole must be dug, of which the size and depth must be proportioned to the dimensions of the nursery. The ordinary size of this hole ought to be four feet square. On the four sides, a square brick wall, cemented with mortar, must be raised two feet in height. Cow dung must be taken well dried, and reduced to powder, and the bottom of the hole must be covered with a bed of this powder, three or four inches thick. Above, a layer of small pieces of dry wood must be spread, at least five inches in diameter, which has been cut in the last month of the year. Mulberry, acacia, elm, or any kind of hard and solid wood may be used. Upon these pieces of wood spread a second bed of dry and pulverized cow dung. In the empty places, between each piece of wood, the pulverized cow dung must be well beaten down so as not to leave the smallest space; for if an empty space be left, the fire will produce flame, which may injure the house, and besides, this fire would not last for any length of time. When the hole is completely filled, and the pulverized cow dung, that covers the pieces of wood and fills the spaces between, is well pressed down, a bed of the same matter must be spread on. Seven or eight days before the hatching of the silk worms, live coals must be put on the dry cow dung and covered over with hot ashes.

The dry cow dung takes fire, and emits for six or seven

days a black and yellow smoke. One day before the hatching of the silk worms, the door must be opened to dissipate the smoke, then carefully shut. From that moment the wood and the dry cow dung are completely on fire, to the bottom of the hole.

When the silk worms are young, they like the heat and fear the smoke, consequently a bright fire must not be made; moreover, a smart fire sometimes burns with force, and sometimes suddenly goes out; it cannot constantly spread an equal and uniform heat. But when the fire we recommend is once well lighted, it does not produce any smoke, and it can be preserved for one or two months without being extinguished, or diminished. A mild heat is experienced without its being perceived that there is fire in the apartment. But if small branches be burnt, they will produce a smoke that will be spread throughout. It is necessary to construct on the edges of the hole, a small square wall of bricks, about two feet high, so that the heat may ascend and penetrate to the middle of the apartment, and spread there in an equal manner. This wall will serve to prevent those persons who move round the silk room at night, from falling unawares into the hole. The house being constructed of dry and proper materials to receive the heat, the partition walls will soon become warm. The smoke proceeding from the pulverized cow dung, suffocates all the insects which might injure the silk worms.

Cow dung diffuses a wholesome smell in the apartment of the silk worms.

OBSERVATION OF THE TRANSLATOR.

The surface of the hole ought to be covered with square

tiles, pierced with holes, to facilitate the escape of the heat.

The old paper employed to cover the windows, must be replaced by white and perfectly clean paper. For fear the heat will escape, care must be taken not to raise the window shutters, or the straw mats from the windows, or the doors, during the time the old paper is being pulled off, and new pasted on. At the top of each window, place four large window blinds, or screens, of firm texture. They must be arranged in such a manner as to roll up or unroll when wanted. (*Ssé-nong-pi-yong.*)

NONG-SANG-THONG-KIOUE.

When a nursery is wanted, for the silk worms, a house must be constructed, exposed to the south. Above all, a smooth and agreeably situated place must be chosen. The best exposure is that exactly to the south; that of the south west is not so good, that of the east still less so.

If the house is old, it must be swept with a great deal of care, and plastered a long time before it will be wanted. If it is done a short time before the hatching of the silk worms, the partition walls will preserve a dampness which will be fatal to them. Some persons cover the house with tiles, others with thatch. Timber and wood work must be plastered within and without to prevent the danger of fire. In the nursery, pillars must be placed, furnished with cross pieces, to receive the frames. The windows must have a large opening, to admit sufficient light to distinguish the sleeping and the awakening of the silk worms. Above the

shelf, small dormer windows should be opened, to increase the light of the morning and evening, when required.

Even with the ground, pipes, or air conductors, communicating with the outside, must be placed at regular distances, and arranged so that they can be opened and shut easily. They will serve to dissipate dampness, or to expel dangerous effluvia.

SAME WORK.

When persons wish to raise silk worms, they must at first open a room, situated to the east, to feed the newly hatched silk worms. They must be taken from this room before and after their second moulting. The window turned to the west, must be shut with care, because the rays of the setting sun are particularly injurious to the silk worms. The south west wind is very dangerous for the silk worms. A row of trees, four to five feet distant, must be planted on the outside so as to shelter them.

The author here employs many words to indicate the place of the idols, and the practices of devotion, which must be followed for the success of the nursery.

SAME WORK.

When persons wish to feed the newly hatched silk worms, they must as first open a room with an eastern aspect. At the four angles, concave niches must be constructed, (small stoves) arranged like the three stars of the constellation of the heart, that is to say, in triangularly, in order to distribute the heat, in a uniform manner. The author adds, that the smallness of the room allows it to be easily warmed.

NONG-SANG-THSIOUEN-CHOU.

When the silk worms are about hatching, they require an extreme heat; at that time the air is still cold. After the third sleep (or the third moulting,) the silk worms require coolness. At that period the air is warm. Besides the wind, rain, dull, and clear weather often comes on unexpectedly; the temperature of the morning and evening, that of the day and night, undergoes great changes. If under these circumstances, the proper measures are not taken, the silk worms soon become sick. But all these changes of the atmosphere may be guarded against, if the rules we have described, above be faithfully followed.

All around the nursery, (that is to say, at each window,) window blinds must be placed, which can be rolled up and unrolled at will. In the middle of the room, a fire must be lighted under ground. If the silk worms require heat, and the external air be cold, the mats that cover the windows must be let down, and the heat disseminated throughout the nursery. Then the cold from without cannot penetrate there, and a mild temperature is enjoyed throughout. But if it be rigorously cold, it will be impossible to warm the apartment, even by opening the doors of the oven; clods of dry dung must be lighted on the outside, and when they are set on fire, and produce no smoke, they must be placed at the four angles of the silk room. Soon a mild heat will be spread throughout; and as soon as the cold is diminished the rest of the burning lumps must be carried away.

When the silk worms require cooling, and the exterior air is warm, the openings of the heated pipe must be shut, and the window blinds raised up; then the interior heat moderates, and the fresh air from without penetrates the

nursery. If it be sultry, it will not be sufficient to raise up all the window blinds to dissipate the heat. The paper must then be removed from the windows, the small dormer windows of the roof must be opened, and the air conductors also, which are even with the ground, and fresh water must be sprinkled outside of the windows, and about the bottom of the sash. A cool air will soon circulate in every part of the nursery.

When that sultry heat is dissipated, the paper must be again pasted on the windows, and the air pipes stopped up. In this manner the silk worms are neither incommoded with the heat nor cold, from the commencement to the end of the season. They have very little sickness among them, and the cocoons are as good as may be desired. It is by observing these proceedings that all the success of the raising of silk worms depends. But the cool air must not be suddenly replaced by warm; the fire must be increased gradually. If the cold rapidly succeeds to heat, the silk worms will become yellow and soft. When it is too warm, a cool air must not be introduced suddenly in the nursery; the windows should be opened by degrees. That precaution is necessary, for if the heat be suddenly replaced by a cool air, the silk worms will turn white and die. It is a serious danger, which should be known beforehand, in order to remove the causes which give rise to it.

ON BATHING

THE EGGS OF SILK WORMS.

The old Dictionary *Eul-ya*, says there are three kinds of insects which form cocoons: 1st, the *Siang*, or the silk worms fed on mulberry leaves; 2d, the *Tcheou-iu*, those fed on leaves of the jujube, and trees called *hoa* and *louan*; 3d, the *Hang*, which is fed on leaves of the plant called *siao*.

In the *chou-king*, (one of the canonical Books of the Chinese,) it is written: "The first day of the moon, of the last Spring month, the Prince's wife washes the eggs of the silk worms in the river."

ABRIDGED HISTORY OF THE KINGDOM OF OU.

In the district of *Nan-yang*, the silk worms form cocoons, eight times a year.

KOUANG-TCHI.

There are several varieties of silk worms, the autumn, winter, and wild silk worms.

YONG-KIA-KI.

In the district of *Yong-kia*, there exist eight species of the silk worm :

1st. The silk worms called *Hang-tckin-tsan*, form their cocoons in the third month, (April.)

2d. The silk worms called *Tché-tsan*, that is to say, worms which are fed with the leaves of the tree *tché*, form their cocoons at the commencement of the fourth month, (May.)

3d. The silk worms called *Hang-tsan*, form their cocoons in the fourth month, (May.)

4th. The silk worms called *Ai-tchin-tsan*, that is to say, cherished and precious silk worms, form their cocoons in the fifth month, (June.)

5th. The silk worms called *Ai-tsan*, or cherished silk worms, form their cocoons towards the end of the sixth month, (July.)

6th. The silk worms called *Han-tchin-tsan*, that is to say, cold and precious silk worms, form their cocoons in the seventh month, (August.)

7th. The silk worms called *Ssé tchou-tsan*, that is to say, silk worms from a fourth laying of eggs, form their cocoons at the beginning of the ninth month, (October.)

8th. The silk worms called *Han tsan*, that is to say, cold silk worms, form their cocoons in the tenth month, (November.)

In the same work we read :

All the silk worms of the first kind, which mature twice a year, (that is to say, those that lay eggs for a second progeny the same year,) are called *Tchin-tsan*, that is to say,

precious silk worms. There are few persons that raise silk worms called precious.

The worms of the fifth class, called *Aï-tsan*, or cherished silk worms, proceed from the eggs of the worms of the third class, anciently called *Hang-tsan*.

When the silk worms (of the first class) called *Hang-tchin*, have formed their cocoons, in the third month, (April,) the moths appear, and their eggs must be collected. In the seventh and eighth month, the eggs open, and the moths are hatched. A great number of persons raise this species of silk worm. They are called *Hang-tsan*, or silk worms of the third class.

When silk worms called *Aï-tsan*, or cherished silk worms, (of the fifth class,) are wanted, eggs of the worms of the third class, called *Hang-tchin*, must be taken, and put in an earthen vessel, the dimensions of which should be in proportion to the quantity of eggs that are required to be preserved. The opening of the vessel must be stopped up with paper, then the vessel must be placed in a basin, filled with spring water, in order that the cool air may delay the hatching of the eggs. Thus the eggs must be left from three to seven days; at the expiration of that time they hatch, and the silk worms can be raised. They are called *Aï-tchin*, or cherished and precious silk worms; they are also named *Aï-tseu*, or beloved children. They are of the fourth class.

When they have formed their cocoons, the moths come forth and lay their eggs. Seven days after the laying of eggs, they hatch and become silk worms. A great number of persons raise worms of that kind. They are the worms of the fifth class, called *Aï-tsan*, or cherished silk worms.

Care must be taken that the water surrounding the vase be of the height of the eggs it contains; for, if the exterior

water be raised above the line of the eggs, they will die, or not be hatched. If the exterior water be lower than the eggs, then they will not feel the cool air, and their hatching will not be delayed. If their hatching be not prevented, they cannot be preserved from three to seven days in the vase. If they cannot be kept from three to seven days in the vessel, when they hatch, they will fail to *accomplish their task*, that is to say: they will attempt, in vain, to spin their cocoon. When the moths have come forth, and the females have laid their eggs, they cannot hatch at the end of seven days; these eggs will not hatch until the following year; but they must be deposited under the shade of a bushy tree. Some persons put them in unbaked earthen vessels. They hatch in from three to seven days, and the worms which proceed from them succeed in forming a good cocoon.

TSA-HOU-HING-CHOU.

Thirteen varieties of silk worm are now distinguished:

1st. The silk worms which have three moultings, and only hatch once;

2d. The silk worms which have four moultings, and hatch twice; that is to say: those whose eggs produce a second crop in the same year;

3d. The silk worms with white heads;

4th. The silk worms called *Hié-chi-tsan;*

5th. The silk worms of the country of *Thsou.* (*Thsou* is the ancient name of the present province of *Hou-kouang.*)

6th. The black silk worms; among them, some hatch once, others twice. (See 2d;)

7th. Ash colored silk worms;

8th. The silk worms hatched from an Autumn moth;

9th. The silk worms hatched in the middle of Autumn;

10th. The silk worms called *Lao-thsieou-eul-tsan*, (literally, old towards Autumn;)

11th. Silk worms of the last of Autumn, called *Lao-hiaï-eul-tsan*;

12th. Silk worms called *Kin-eul-tsan;*

13th. Silk worms that work in the same cocoon. Sometimes two, sometimes three silk worms, spin together in the same cocoon.

In general, the silk spun by the worms, which moult thrice, differs much from that of the worms which moult four times.

HAI-NING-HIEN-TCHI.

On the night preceding the period called *tsing-ming*, (the 5th of April,) those who raise silk worms envelop the eggs in a covering of cotton, and place it under them, in their bed; they think the natural heat of the human body, hastens the hatching of the silk worms.

SAME WORK.

The twelfth day of the last moon of the year (that is to say, at the end of December, or in the month of January, when there is an intercalary moon,) all those who raise silk worms bathe the eggs in salt water, expose them to the fumigations of the melongena, and envelop them in a piece of rice ball. At the end of twenty-four days they

take them out; they afterwards wash them in fresh water, and wait for the coming of Spring.

SSE-NONG-PI-YONG.

The summer silk worms are of another species; they are vulgarly called *San-tsan*, or third silk worms.

The silk worms which are raised in the Spring, lay eggs for the Summer; those that are raised in Summer, lay eggs for the Autumn; those of the Autumn, lay eggs for the Spring of the following year. None of these eggs must be neglected, for otherwise eggs will be wanted for the next raising.

SAME WORK.

The silk worms of Autumn, are also called *Youen-tsan*, that is to say: second silk worms, or silk worms of a second rearing. But in gathering the leaves to feed them, they never fail to injure the tree. It sometimes happens, that some misfortune from heaven destroys the Spring silk worms, the raising of the Autumn silk worms cannot be dispensed with, but must be done to repair the loss. But the late crops are surer and more advantageous than those of the commencement of the year.

Siu-kouang-ki, says: "The men of the present day do not raise the Autumnal silk worms; they are contented to preserve the eggs of the Summer for the crop of the following Spring. They succeed equally well."

The same author again says: "It is a very just idea to say, the Autumn silk worms serve to repair the losses

which may have been experienced in the Spring, and to supply the wants of the year. In the Autumn there are many fine days; consequently, the raising at that time promises more certain success, than that of the Spring. But now-a-days we meet with people who say: *the Autumnal silk worms can no longer find tender leaves.* We see that they are totally ignorant of the powerful reasons which may oblige them to attempt a rearing in Autumn, from the necessity of sometimes repairing the losses which have been experienced, and of supplying the wants of the year. When the silk worms are raised in the Summer, or Autumn, care must be taken to preserve them from the gnats and flies."

SAME WORK.

After the period called *Thsing-ming*, (after the 5th of April,) the eggs commence to change. At first they assume an uniform colour, and swell up; afterwards they grow round and present a pointed side. Their centre resembles the colour of willow trees, in the beginning of Spring. At last they are transformed into worms, which have the appearance of small black ants. The worms which fold themselves in a circular manner, and resemble a mountain that is seen at a distance, are those which must absolutely be preserved; but those with flat heads, which are dry, and appear as if they were burnt, as well as those of a sky-blue, and yellow, or flesh color, must not be raised.

SAME WORK.

Some persons water the eggs with salt water. That operation is called *sien-tsan*, that is to say, *baths of the silk*

worms. The eggs thus washed, produce the best silk worms.

The worms of which the eggs were not washed, are called *Ho-tsan*, that is to say, ardent silk worms, (they are those of Autumn.) They are less esteemed than the preceding.

In the work entitled *Sang-tsan-tchi-choué*, we read:

"Those who wish the eggs to hatch quickly, often unfold, and roll up one by one, the leaves of the paper where the moths have deposited their eggs. (This paper should be manufactured of cotton, or the bark of mulberry trees. According to the ideas of the Chinese, they banish from the nurseries every thing made of hemp; for example: ropes and hempen cloth. Our European paper would be very injurious to silk worms.) Those who wish to retard the hatching, unfold the leaves at distant intervals, and afterwards roll them in a tight manner, without leaving the least empty space in the centre of the roll."

HOANG-SING-TSENG, SAYS:

The twelfth day of the last moon, in December, or in January, if there is one intercalary month, the eggs must be soaked in salt water, and taken out the twenty-fourth day. Then the silk will be much easier to wind.

ANOTHER AUTHOR, SAYS:

The eighth day of the last moon, the leaves covered with eggs must be dipt in water where the ashes of the mulberry branches have been boiled, or the ashes of grass. They

must be taken out at the expiration of one day. The twelfth day of the second moon, a bath must be given to the eggs, on the morning of the period called *Thsing-ming*; then they must be wrapped up in cotton paper, and deposited in the kitchen. Wait until the mulberry leaves are as large as a tea-spoon, then envelop the eggs in cotton: at night they must be covered with warm garments which have been worn during the day; in the morning they must be wrapped in blankets. When the eggs are hatched, the worms must be warmed by artificial heat; but so long as they are not out of the egg, they ought to be well taken care of, and hatched by the heat of fire.

When it is desirable to soak the leaves of paper, covered with eggs, the ashes of the mulberry tree must be used; the leaves should be moistened, and powdered with the ashes. Afterwards they must be rolled and soaked in the water where a certain quantity of salt has been dissolved. If it be apprehended that the rolls of paper will swim, they must be kept in submersion, by placing them under a china plate. The paper ought to be taken out the twenty-fourth day.

The leaves must be washed in running water, to remove the ashes, or they may be washed in a basin. Afterwards they can be newly hung up in the cool air, and the eggs hatched in the beginning of Spring. If part of the eggs do not hatch, they must be kept in darkness, and nothing more is to be feared from a useless expense of leaves.

The twelfth day of the second moon, leaves of plants called *thsaï* and *yé-thsaï*, blossoms of the leek, peach tree, and white beans, must be taken. They must be crushed in water, and afterwards the leaves must be bathed in it.

When the females lay eggs, they generally stop at the

end of one night. In the contrary case, the silk worms produced by their eggs, cannot all hatch together.

SAME WORK.

Many persons preserve the eggs of the silk worms, in bamboo boxes, when they are exposed to all the changes of the damp, tepid, hot, or burning weather. If they are subjected, suddenly, from cold to excessive heat, they are affected by it in a fatal manner. The inhabitants of the province of *Tché-kiang*, call that *Tching-pou*. That expression implies, that the silk worms contract a disease, when they are in the egg, (literally, *on the linen cloth*, or on the leaves of paper.) The worms of those eggs are yellow when hatched: the worms hatched of a yellow colour, are not worth the trouble of raising. They may be compared to a child who has contracted a disease in the womb. At its birth, it is weak and feeble. It is difficult to cure it of this innate disease. In general, when one wishes to preserve the eggs of the silk worms, the leaves must be spread on bamboo boards, making it so as not to be exposed to the wind or sun. Moreover, they must be covered with a silk cloth to prevent butterflies, or insects from the cotton plant, eating them.

Much snow may be expected about the first day of the last moon, it may be in the course of the last moon. Leaves covered with eggs are spread in the midst of the snow. After one day they must be taken up, and newly spread on bamboo boards, and covered as before with a silk cloth.

When Spring comes, the precise time when the eggs are about hatching must be attentively observed; powdered cinnabar, must be taken, diluted in luke warm water, and

the eggs dipped in that water. The water should be neither too cold nor too warm ; it ought to be kept at the temperature of the human body.

SAME WORK.

Before the worms are hatched, the eggs should be weighed, and the weight written on the back of the paper to which they are attached. When the silk worms are hatched, take care not to separate them from the paper. There are many persons, who as soon as they see the worms hatch, detach them from the paper, with a small broom or quill ; but these little beings, as delicate and slender as a hair, or a bit of silk, cannot support the wounds given them with the broom or quill. The mulberry leaves must be cut into extremely fine shreds, and spread in an equal manner, upon a large sheet of paper. The side of the paper, on which the worms are hatching, must be applied to that which is covered with bits of the mulberry leaves. The worms liking the smell of mulberry leaves, descend themselves on the paper, destined to receive them.

Then the paper, on which the eggs were, must be newly weighed ; the quantity of hatched worms will be known, and it can be calculated how many leaves will be required to feed them. It is much better to have more leaves than are wanted for the number of silk worms to be raised. Then an abundant nourishment will be had for the silk worms, and one will not be exposed to the misfortune caused by a scarcity of leaves.

There are many persons who do not make this calculation beforehand ; but when the leaves are about failing, they find themselves reduced to the most painful extremities ; they pawn, or sell their effects to procure them.

They have the grief of seeing their silk worms tormented by hunger; the hurdles are strewed with worms that languish and die. Thus, by their want of forecast, they uselessly sacrifice the lives of a great number of these precious insects.

NONG-SANG-TSI-YAO.

It depends on one's self to retard or hasten the changing of colour, in the eggs; but care must be taken to change them in a natural manner, and not to compromit the life of a silk worm enclosed in the egg.

When the leaves of the mulberry tree are grown, at eight or ten o'clock in the morning, the sheets of paper must be taken out of the vase, unrolled and hung up. There is no rigorous rule to determine the progress of the eggs. Only the first day, their color must be changed to three tenths, the second day to seven tenths. Then the leaves must be rolled, they must be put in a paper tube, with the two ends well pasted, and they must be replaced in the vase. The third day, towards twelve o'clock, the rolls must be again taken out of the vase and unfolded. Their color will then be completely changed.

NONG-SANG-PI-KIOUE.

The art of raising silk worms begins with the choice of the eggs, and the preservation of the cocoons. Select in the cocoon room, the cocoons that are turned towards the light (that is to say, those from the top of the cocoon room) such as are brilliant, neat, and of a firm texture.

The moths which come out the first day, are called *miao-ngo* (viz: grass moths. The latest of all, are called *mo-ngo*, (that is to say: the last butterflies.) Neither of them ought to be kept. Only those which come out after the second day must be taken. The sheets of the paper must be spread upon the cases of a shelf, then the males and females come close together and copulate. When the evening comes, the male butterflies must be taken away, and the females must be placed on sheets of paper, leaving an equal distance between them. The eggs which are found in lumps, ought to be thrown out. When the females have laid a number of eggs, they must be left on the sheets where they are deposited and covered from three to five days. When the sheets are hung up, the eggs ought to be turned outward (read: in-ward) for fear the wind may cause them to perish.

SAME WORK.

At the winter solstice, and the eighth day of the last moon, the eggs must not be bathed in too deep a water.

After having dipped them, they must be taken out. The fifteenth day of the moon (when it is full) several sheets must be taken, covered with eggs and rolled together. Tie them firmly with a string of mulberry bark, (or of cotton,) and suspend them before the porch or vestibule of the house, at the height of a long pole, in order that they may be exposed to the cold which is felt at the close of the year. After new-year's day the rolls must be spread out, and placed upright in an earthen vessel. At the end of ten days, when the sun is above the horizon, the leaves must be taken out of the vessel. Whenever the weather has been

dull or rainy, they must be exposed to the heat of the sun, as soon as they commence to hatch.

Such is the manner of bathing and preserving the eggs of the silk worms.

WOU-PEN-SIN-CHOU.

At the time called *thsing-ming*, (the 5th of April,) take the leaves covered with eggs, which have been deposited in an earthen vessel and transport them, sheltered, from the wind to a room where a mild heat reigns, and suspend them at half the height of the apartment.

At the time called *kou-iu*, (28th April,) expose the leaves to the air and sun, but they must be inverted or turned inside out. You must roll from left to right those that were rolled contrarily, and you must roll from right to left those that were rolled the opposite way; every day you must change and roll them in a different way from the old one. After having sufficiently rolled and unrolled them, you must put them as before in the vase.

When the time of hatching approaches, the leaves must be carried to a room where they will be sheltered from the wind and sun; the silk worms will hatch *all at once*.

SAME WORK.

To make the silk worms descend, when hatched, there are many persons who strike the reverse of the leaves with a small stick of peach wood. When the worms have descended, they gather them together with a small broom or quill, put then in an envelope of paper and weigh them, then spread them upon the hurdles. Afterwards, at the

different periods of their existence, they experience diseases which are frequently produced by that dangerous practice.

When the worms are hatched, a bed of chopped straw must be placed on a hurdle, where are likewise placed one or two jujube fruits, cooked in the ashes. Before the hatching of the silk worms, the leaves covered with eggs must be weighed. After the hatching, the newly hatched worms must be spread on the chopped straw, distribute them in an equal manner, and very distant from one another.

When the worms are all hatched, the empty leaves must be weighed, and the exact quantity of worms to be raised will be known.

If the rules we have just laid down are faithfully followed, not one silk worm out of a hundred will be lost.

We see persons, at the present day, who deposite on a single mat, worms proceeding from one or two ounces of eggs; they are heaped up, and pressed against one another. The infallible result is, that they lose a great number of silk worms.

When a person has newly hatched silk worms, the proceeds of three ounces of eggs, it is necessary to spread them in an equal manner upon a large hurdle. Above all, do not raise too great a number of silk worms, for, if your means only permit you to nourish the silk worms proceeding from three ounces of eggs, and, from cupidity, you attempt to raise the worms of four ounces of eggs, you will soon feel the want of space, hurdles, laborers, and fuel. In this manner you will lose, at the same time, your silk worms, and the expenses incurred in that unprofitable attempt.

NONG-TCHING-TSIOUEN-CHOU.

In the work entitled *Ssé-nong-pi-yong*, we read:

"To make silk worms hatch, the degrees of heat and cold, proper for them, must be known, and the manner of hastening or retarding their hatching, in order that *not one may hatch before or after the others.*

"The following method must be pursued:

"When the eggs have assumed an ash color, the leaves covered with eggs must be united two by two, and extended upon a clean frame. Afterwards they must be rolled up tightly and the two ends tied with a pack-thread, (of cotton or bark of the mulberry tree,) and the rolls placed upright in a clean, cool room, where there is no smoke.

"The evening of the third day, the rolls must be taken, unfolded, and extended on the hurdles. It is a very happy circumstance if none of the worms are hatched. But if by chance there are any hatched before the others, they must be taken and thrown out. Afterwards the leaves must be taken three together, rolled in a loose manner, and deposited in the room newly warmed for the silk worms. The time of the rising of the sun must be attentively observed, then the leaves must be unrolled, and spread, one by one, upon hurdles in the middle of the yard. If there is any dew the hurdles must be placed in a cool room, or under a kind of tent. Some time after, the leaves must be transported to a room prepared for the silk worms, and they must be spread, one by one, upon hurdles placed on the ground.—After a few moments the silk worms will hatch *all at once*, looking like small black ants. There will not be one that will hatch before or after the others. The hatched worms must then be weighed with the leaves of paper, to know the

number of silk worms to be fed, and to calculate, in advance, the quantity of leaves which will be wanted."

SAME WORK.

When the newly hatched worms are made to descend, they must be dealt carefully with, spread upon the hurdle in an equal manner, and a proper space left between them. Care must be taken not to wound them, or to press one against the other. As soon as the worms are all hatched, the fresh and tender leaves must be taken, and cut in very fine shreds, with a very sharp knife; then they must be spread, with a coarse sieve, upon the sheets which are to receive the silk worms, and under which a bed of chopped straw must be previously spread. The cut leaves must be spread in an uniform manner, in very light layers. Afterwards the sheets of paper must be taken, where the worms newly hatched are, and they must be applied to the mulberry leaves; the worms descend themselves on the mulberry leaves. If some worms are too long a time in descending, or if they ascend upon the back of the sheet of paper, or if they do not descend, when the leaf is turned over, they must be thrown away, with the leaf to which they remain attached. They are diseased worms, that it would be impossible to raise.

SAME WORK.

The success in raising silk worms depends on the precaution which is taken in the beginning, and subsequently, not to expose them to any danger. If the silk worms do not revive *all at once*, from their first sleep, or moulting, it proceeds from their not having changed color, and not hatching

all at once. If they do not change color, and do not hatch *all at once,* it is because the rules prescribed to preserve the eggs, have not been strictly followed.

SAME WORK.

In the work entitled *Thsin-kouan-tsan-chou*, we read:

"The first day of the last moon the eggs must be collected and watered with cow's urine; afterwards they must be washed with clean water. It must be so done that the sheets of paper covered with eggs be not torn. (An author advises to strengthen them with threads of cotton or silk, basted at distances according to their length and breadth.")

FOOD FOR THE SILK WORMS.

KOUAI-KI-TCHI.

The greater part of the Spring silk worms have four moultings, all the others have but three. The inhabitants of the country of *Youé* express the idea attached to the word *mein*, sleep (moulting) by the word *yao*, youth. Thus they say: the first, second and third youth of the silk worms.

THE BOOK ON SILK WORMS.

Three brilliant colors are distinguishable in the silk worm:

When they are of a shining white, feed them moderately;

When of a dazzling blue, they must be abundantly fed;

When their skin is wrinkled, it is a sign that they are hungry;

When they are of bright yellow, diminish, by degrees, their food.

THSI-MIN-YAO-CHOU.

Whenever the silk worms are fed, the window blinds must be raised up, and closed again when they have finished eating. The light excites an appetite in the silk worm,

(literally: as soon as the silk worms see the light they eat.) After a plentiful meal they grow and become large.

THE BOOK ON SILK WORMS.

The next day, after the hatching of the silk worms, mulberry leaves, or leaves of *tché*, dried in a well-aired place, must be given to them. When they are about the twentieth of an inch long, they will eat five times during the day and night.

The ninth day they refuse food during one day and night. This repose is called the first moulting.

Seven days after, they again moult, as the first time.—When they have eaten some leaves and attained the length of the tenth of an inch, they will feed six times during the day and night.

Seven days after they moult as before.

Five days after they leave off eating. This abstinence lasts for two days, (the sixth and seventh days;) it is called *ta-mien*, or the great moulting. Then the silk worms eat but half the leaf. They will feed eight times during the day and night.

Three days thereafter they have a great appetite; then they will eat the whole leaf. They will feed ten times during the day and night. Before three days have elapsed, they begin to work at their cocoons.

When the silk worms begin to feed, after each moulting, leaves must be spread lightly over them. If the leaves are thrown in upon them, sensations will be produced destructive to their appetite.

OBSERVATION BY THE TRANSLATOR.

The preceding extract relates to silk worms of four moultings, the raising of which lasts a longer time than that of the ordinary silk worms, that is to say : silk worms of three moultings.

HO-PI-SSE-LOUI.

When the silk worms lay down and remain motionless, that repose is called moulting. During the time of moulting they do not eat, either the mulberry leaves, or leaves of the tree, *tché*. At the end of one day and night, they shed their skins.

There are some silk worms which have three moultings, and others four.

HOANG-SING-TSENG, SAYS :

From the hatching of the silk worms to their third moulting, cut leaves ought to be constantly given them. When the ardent silk worms are fed, that is to say, Autumn silk worms, they must be carefully watched. As soon as they have eaten their leaves, give them more, for they will fall sick, if they breathe the heat of the silk room fasting.

NONG-SANG-TSI-YAO.

Towards the end of Autumn, before the mulberry leaves turn yellow, a large quantity must be gathered. They must be dried and broken up in such a manner so as to be reduced almost to powder. They must be preserved in a place

warmed by a fire that produces no smoke. They wll answer the next year to feed the Spring silk worms, after each of their moultings.

SAME WORK.

The eighth day of the last month, (January,) small green peas, called *lo-teou*, (dolichos,) must be soaked in fresh water. They must be spread on frames, not very thick, and dried in the sun. Wash some clean rice in pure water and dry it also. These green peas and rice must be preserved in a shaded place. Flour made from them, will serve to feed the silk worms, after their last moulting. It must be spread equally on the leaves given to them for food.

SAME WORK.

Manner of Feeding the newly hatched Silk Worms.

The leaves of the mulberry must be frequently cut in very fine shreds, and lightly spread over them with a sieve. The food ought to be distributed without interruption. In the space of one hour (two of our hours) four meals must be given them, which makes forty-eight repasts in the space of one day and night.

SAME WORK.

Food must be given to the silk worms without fail during the day and night. If their repasts are multiplied, it will necessarily result, that they will soon arrive at maturity; but if their meals are rare, and not numerous, they will attain their growth slowly.

When the silk worms attain maturity in twenty-five days, one frame or hurdle will furnish twenty-five ounces of silk.

If in twenty-eight days, only twenty ounces can be obtained. If the time be one month, or forty days, one hurdle will furnish but ten ounces of silk.

Those persons who feed silk worms ought to endeavor not to sleep. Laziness has serious inconveniences.

Every time the silk worms are fed, all the hurdles must be visited with the greatest attention. It is essential for the leaves to be distributed in an equal manner. If the weather be dark and rainy, if the exterior air be cold, before feeding the silk worms, dry branches of mulberry trees must be taken, or rather a handful of rice straw, stripped of all its leaves, fire must be put to it, and the flame put around and above the hurdles in order to dissipate the cold and damp which benumbs the silk worms. After that operation they must be fed. In that manner they do not contract any disease. The time of their general moulting must be observed, and then the feeding must be suspended. Afterwards nothing is given them to eat, until they are all recovered from their torpid state. If food is given them, when there are but eight or nine-tenths of them recovered, they will not arrive, *all together*, at maturity ; besides, great numbers of them will be lost.

From the second to the great moulting, (the third moulting,) when the worms assume a glossy yellow color, and when they are disposed to moult, the nourishment must be suspended, and they be transported to other frames. Afterwards, when they are all recovered, they must be slowly fed, that is to say : they must have their repasts given them at long intervals, and leaves must be spread on them in very light layers. If the leaves were distributed too abundantly, they would eat without appetite and become sick. Now, as it is the food which gives strength and life to the silk

worms, the greatest attention must be paid to see that it be suitable and possesses all the proper qualities. The silk worms like not leaves saturated with rain or dew; if they eat of them the greatest number immediately fall sick.

SAME WORK.

When the silk worms recover from their great moulting, (their third moulting,) the heat of the rooms must be diminished when it incommodes them. At that time frequent meals must be given them. If a south wind blow, the window blinds must be let down, and the straw mats of the doors closed. At that moment they must be transported to other hurdles. When the silk worms are spread on the hurdles, the distance of one finger must be left between each one. Then the small green peas, which were reserved from the month of January, must be taken, and soaked in a small quantity of water, until they germinate: afterwards they must be dried in the sun, and reduced to powder.

The clean rice, which was also laid by in the month of January, can be employed for the same use, after having been boiled by steam, and reduced to flour. At the fourth feeding, that flour must be spread in an uniform manner, upon mulberry leaves. It will refresh the silk worms, and dissipate the internal heat they feel at that period of their age, and which is a mortal poison to them. The silk they afterwards produce, is more abundant, easier to reel, and, besides, it is stronger and more brilliant.

If there be but a small quantity of fresh leaves, the leaves which were cropped the preceding Autumn must be taken, pounded again and reduced to powder. The new leaves must be lightly moistened, and the powdered leaves spread

on in an uniform manner. Thus a want of leaves may be supplied. The leaves of the plant called *ou-kiu*, (*cicorium intubus ?*) can also be used as a substitute for that flour.

NONG-SSE-PI-YONG.

Same Subject.

Early in the morning, the roots of the mulberry trees must be watered, and the leaves gathered soon after. If they are watered early in the morning, the leaves will be very juicy; if they are gathered soon after having been watered, they will not wither.

They must be cut in fine shreds with a well sharpened knife, and spread in light layers, with a coarse sieve. If a very sharp knife be not used, the leaves will loose their juice; if they be not cut very thin, they will cover and overload the silk worms. If a sieve be not made use of, they will not be distributed in an equal manner; if the cut leaves be not distributed in an equal manner, the silk worms will not all eat an equal quantity.

The juice of the leaves is not very abundant; at the expiration of some time, it dries up; for that reason the leaves immediately after the watering require to be sifted on the silk worms.

The first day, two repasts an hour must be given them, that is to say, about forty-eight repasts in the space of a day and night.

The second day, thirty repasts must be given them, in the same interval of time, and the leaves which are distributed to them, must be cut a little smaller.

The third day, only twenty meals must be given them (during the day and night,) composed of leaves thinner than the second day. They must be kept in great obscurity and heat. Generally, the newly hatched worms require darkness. When they recover from their sleep, or moulting, a little light ought to be allowed them ; at a later period, when they show a smart appetite, a great deal of light must be given them.

SAME WORK.

Another Method.

As soon as the leaves are cut very fine, they must be spread in light layers with a sieve. Four repasts must be given by the hour, (two of our hours,) which makes about forty-eight repasts in the space of one day and one night. Some persons give but thirty-six in the same interval of time. This is my opinion. The newly hatched worms only feed on the juice of the leaves. If their repasts are not multiplied they will resemble young foster children who are deprived of milk from their infancy; consequently, they never fail to be weak, pitiful and sickly.

Leaves full of juice, which have been gathered the preceding night, from the branches exposed to the south-east, must be given them. These leaves must be kept apart, in an earthen jar, and cut up very fine as soon as they have been taken out.

SAME WORK.

Method for diminishing the Food and hastening the Moulting.

When the silk worms are disposed to sleep, (to moult,)

their food must be diminished in proportion to the degree of yellow or white which their skin assumes; the leaves destined for their food, must be cut in fine shreds, and frequently spread in light layers.

When the silk worms are completely yellow, they ought to be transported, in succession, to other hurdles, without caring whether the sky be dark or serene, if it be in the morning or the middle of the night. When they have been transported to other hurdles, the feeding must be suspended until they have all recovered from their moulting, when they may be fed again. This is called *diminishing the food* and *deciding the moulting*. These two expressions imply, that the nourishing of the silk worms, which are disposed to moult, must be diminished, (care must be taken not to cover or overload them with leaves,) and, on the other side, the silk worms must be abundantly fed, (which are not disposed to moult,) in order that they may quickly moult. Not only will they *all moult together*, but they will be exempt from diseases caused by the accumulation of leaves, and the internal heat which consequently follows.

NONG-SANG-THONG-KIOUE.

The silk worms may be found in ten different situations: They may be cold or hot, starved or satiated, sufficiently far apart, or too near together, asleep or awake; they may eat slowly or with appetite.

SAME WORK.

Injurious things to the Silk Worms.

1st. The silk worms do not like to eat damp leaves;

2d. They do not like to eat warm leaves;

3d. The newly hatched worms do not like the smell of fish, fried in a pan;

4th. They do not like to be in the neighborhood of persons who pound rice in mortars;

5th. They do not like to hear strokes on sonorous bodies;

6th. A woman, who has borne a child within a month, ought not to be *the matron of silk worms;* that is to say: ought not to be charged with the raising of silk worms;

7th. They dislike men, who smell of wine, to give them food, to transport them from one place to another, or to spread them on hurdles;

8th. From the time they are hatched, until maturity, the silk worms dread smoke and odorous exhalations;

9th. They do not like to have skin or hair burnt near them;

10th. They do not like the smell of fish, musk, or the odor of certain herbaceous animals, (like the goat, &c;)

11th. They do not like to have a window, exposed to the wind, to be opened during the day;

12th. They do not like to receive the rays of the setting sun;

13th. They do not like, when the temperature of their habitation is warm, to have a sudden cold or violent wind introduced there;

14th. When their habitation is cool, they do not like a sudden change to excessive heat;

15th. They do not like dirty and slovenly persons to enter their room;

16th. Care must be taken to keep all noxious effluvia and filth distant from the apartments of the silk worms.

SAME WORK.

The third day, between ten and two o'clock in the afternoon, three hurdles, or frames, must be placed upon another stage. The one above protects the worms from the dust; that below protects them from dampness: and the middle one is destined to receive the silk worms. Young silk worms when incommoded by internal heat must be changed. A small quantity of worms, occupying a space as large as a square of a chequer-board, must be deposited on the middle frame; they will soon cover it entirely. By degrees the quantity of food must be increased. In the morning, if the weather be clear, the window situated to the east can be opened, and during the day, those which are in an opposite direction to the wind. By degrees they will change color; and, accordin to the color they assume, their food must be increased or diminished. When they are completely yellow, food must not be given them. They remain motionless, and that is called *theou-mien*, (or the first moulting.) When they have been removed after their first moulting, six meals may be given them, during the space of one day and night. The second day, the quantity of leaves must be gradually increased. The windows can be half opened. From the first moment they begin to turn yellow, they must be kept very warm. When they are entirely torpid they require a great deal of heat; when they are perfectly recovered, they only want a moderate heat.

'When the silk worms are removed, after their second moulting, and are all recovered, light repasts ought to be given them at first. Four repasts in one day and night will be enough. The next day the quantity of leaves may be augmented by degrees. Some persons open the windows.

From the first moment they begin to turn yellow, they require a good heat; when they are once torpid, a moderate heat ought to be allowed them; when they are all recovered they require a mild heat.

When the silk worms are removed after their third moulting, and they are all revived, three repasts must be given them during one day and night. The first repast ought to be very light; the second lighter than the first, the third the same as the first. If these three repasts be not administered with much caution, the silk worms will feed slowly until the period of their maturity. The second day, the quantity of leaves must be increased by degrees. The windows can be thrown entirely open, and the dormer windows above the frames may be likewise opened.

From the first moment they begin to turn yellow, they require a mild heat; when they are completely torpid a lukewarm heat is required; when they are all revived they require coolness. After each repast a basket of leaves must be taken, and the tour of the shelves made. If an empty place is perceived (upon a hurdle) it must be covered with leaves strewn with rice flour. After the seventh or eighth feeding, (from ten to two o'clock,) cut leaves must be spread upon the hurdles; they must be moistened equally with fresh water; then, after a lapse of some time, sifted rice flour must be spread, being careful to distribute it in an uniform manner. For each basket of leaves a *ching*, (a kind of measure,) of fresh water and four ounces of flour must be used. If the flour cannot be had, a basket of new leaves only must be used; it will furnish a repast for the silk worms of a frame.

[Extract from *Nong-tching-tsiouen-chou.* The powder of leaves, which are spread on fresh leaves, fills the body of

the silk worms, (that is to say: is very nourishing,) and disposes them to make a firm and thick cocoon, the silk of which is remarkably strong.]

When the leaves are cut up, moisten them with fresh water; then sift the powdered leaves, and spread them in an uniform manner.

After the great moulting of the silk worms, (the third moulting,) from three to five meals of that kind must be given them at certain intervals. When the silk worms approach their maturity, they require light and frequent repasts and moderate heat.

SAME WORK.

If among the silk worms there be any that are backward, that is to say: which do not appear disposed to moult at the same time with the others, frequent supplies of food ought to be given them, in order to accelerate and cause their moulting, at the same time with the rest of the hurdle.—When the silk worms do not moult all at once, it proceeds from a species of disease, which dates from their hatching. This method must be followed to remedy it: If among the silk worms which are completely yellow, some change their white color, and begin to turn yellow, much time is not required to become completely so. By the aid of very frequent feeding they will soon overtake the others; in fact, multiplying the feeding hastens the period of their moulting.

But when the greatest number are completely yellow, many blue and white ones are found, they are far from becoming entirely yellow, and frequent repasts given them will be useless trouble; it is impossible for the latter to arrive at the moulting at the same time with the first.

The change of color in the silk worms is the least change

that is experienced. When they moult they cease eating, and shed their skin; then they experience a great change. But the greatest of these changes, is their metamorphosis from the chrysalis into butterflies, or moths. When a silk worm is completely yellow, its mouth is shut, it no longer eats, but sleeps, or is torpid; it then resembles a man afflicted with some dreadful disease; the blood spreads throughout, its body experiences great modifications. If it remains a day and night without eating, its moulting produces a happy relief.

If, then, there be many blue and white silk worms, and their feeding be too much hurried, their health will be disordered, and a precocious moulting will not produce relief. When those which were blue or white turn yellow, and are disposed to moult, all the others have accomplished their moulting, and are recovered.

When the silk worms begin to recover from their moulting, they want but little food; they resemble a convalescent patient, to whom only slight nourishment is given to repair, gradually, their strength. If while the backward ones moult, the nourishment of the earliest be suspended, they will languish with hunger and weakness, yet you are compelled to wait; and, besides, one will be obliged to give them food when the backward ones are recovering. A great number will contract diseases, and very little silk will be gathered from them. For that reason the author of *Tsan-king*, or the *Book on Silk Worms*, says, with much reason, that "the irregular moulting of the silk worms always causes a diminution of silk."

SAME WORK.

When the silk worms are just hatched their color is black.

Their food must be gradually increased. Three days thereafter they gradually become white; then they gain appetite. Leaves, not cut so small, must be given them. When they are blue, it is the period of their great appetite. Leaves must then be given them more abundantly, and not cut so small. When they again become white, they feed slowly; their food must be diminished a little. When they are turning yellow they have but a delicate appetite; their food must be again diminished. When they are completely yellow, they entirely cease eating; that is called their moulting.—When they are recovered, they change from yellow to white, from white to blue, from blue to a second white color; at last from white to yellow; this is their second moulting. At each moulting they experience the same changes of color. They must be observed with care, in order to diminish or to increase their food, of which the quantity ought to vary, according to the different situations in which they are found.

The leaves which are given them, ought to be neither wet with dew, nor dried in the wind or sun, nor impregnated with disagreeable smells, for as soon as they have fed upon them, they will contract diseases. If care be taken to preserve, in advance, a sufficiency of leaves for three days, there will be nothing to fear from long rains: the silk worms will never have to eat damp leaves, and at the same time, they will not suffer from hunger. When leaves are again gathered, the heat arising from the accumulation in sacks, must be completely dissipated before giving them to the silk worms. The space of one day and night is, for the silk worms, like unto a year with its four seasons. The morning and evening are the Spring and Autumn; the middle of the day resembles the Summer; and the middle of the night Winter. In these four periods of the day the weather is never the same. When a good fire is preserved in the silk

room, great attention ought to be paid to keep it at the corresponding temperature for each one of those four periods. The degree of heat ought not to be constantly the same.—From the time they are hatched, until their second sleep, (moulting,) the silk worms require a moderate heat. The matron of the silk worms, (the person who takes care of them,) ought to wear a single garment, (that is to say: not double.) She must regulate the temperature of the silk room, according to the sensation of cold and heat she feels.

If she feels cold, she necessarily will judge that the silk worms are cold, and the fire must then be increased; if she feels warm, she will conclude from it, that the silk worms are too warm, and the fire must then be suitably diminished.

When the silk worms are all asleep, if the sky be clear and brilliant, between ten and two o'clock the windows must be opened, to introduce air and light in the apartment. If the wind be southerly, the windows to the North must be opened; if northerly, the windows on the South side must be opened. The air which enters from a side opposite to the direction of the wind cannot injure the silk worms.

When the silk worms have recovered from their great moulting, (the third moulting,) three repasts must be given them, then the paper that covers the windows must be cut with a pair of scissors, to allow the air and light to penetrate into the apartment. The silk worms will not be disturbed or incommoded.

After the great moulting, when the windows have been opened, and the paper cut from the windows, if the exterior air is too warm, an unglazed earthen vessel must be placed at the entrance of the door, in which the water must be often renewed, in order that the air may be refreshed in its passage. If the wind raises, if it should rain, or if the night becomes cold, the windows must be closed immediately.

NONG-TCHING-TSIOUEN-CHOU.

The silk worms are of a warm constitution. It is better to make use of a fire during the whole time of the raising.

The following is a method of warming the nursery:

A long stove, placed upon a hand-barrow, must be made use of, so that it may be carried by two men. When the leaves are spread on the silk worms, wait until they have climbed upon the leaves, and then bring in the stove, which must be carefully lighted outside of the apartment. The fire should consist of hot coals; it must be covered over with a bed of straw ashes, to prevent a red and brilliant flame. When the silk worms have finished eating, the stove must be carried back. Afterwards, when other food is given to the silk worms, the same stove must be brought in each time. Then the silk worms will escape the diseases which heat causes; but if the stove be introduced when the silk worms are hungry, they soon become warm. If the stove be introduced soon after having given them food, that is to say: when they are under the leaves, not having had time to ascend them, they will soon be incommoded by the fermentation of their dung, and they will, besides, be overloaded by the leaves spread upon them.

SAME WORK.

When the air of the silk room is warm, if it be suddenly made cold, the silk worms will lose their appetite, and feed no longer. Then a chafing-dish, filled with clods of dry cow dung, well ignited, and free from smoke, and by the aid of an iron fork must be moved about repeatedly above the frames. That operation dissipates the cold, which benumbs the silk worms, and they soon feed with an appetite.

ON THE DISTRIBUTION OF THE SILK WORMS UPON THE FRAMES, AND THE SPACE TO BE ALLOWED THEM.

THSI-MING-YAO-CHOU.

When the silk worms are moulting, three frames are constantly required. The middle frame is destined to receive the silk worms, the superior and the inferior ought to remain empty. The lower frame preserves the worms from the dampness of the ground, the upper preserves them from the dust of the apartment.

WOU-PEN-SIN-CHOU.

When the silk worms are about hatching, they require cool air. A bed of chopped straw must be spread on the frame; wheat straw must not be used. Every day they must be removed once upon other frames; if they are not changed, it generally happens that white spots come over them.

ON REMOVING THE SILK WORMS.

In removing the silk worms many persons must be employed in order to perform it quickly. If they are left for a long time, heaped up in the baskets, they become heated and perspire abundantly. In consequence, a great number of them fall sick and die. By degrees they will diminish

every time they are removed ; and those which later arrive at maturity, will only produce small and ill supplied cocoons.

The dung of the silk worms must be frequently removed. If it be not carried away, they become heated. The heat produces fermentation, and causes a putrid effluvia. Afterwards a large number of silk worms turn white and die.

Whenever the silk worms are removed they must be distributed upon the frames in such a manner as to leave some space between them ; if they are placed too near together, the strongest will feed at the expense of the weakest. It is necessary to make the tour of the frames often, and to visit them with care. Moreover, if the air does not circulate freely in the apartment, and the door be suddenly opened, a fatal wind may penetrate, and a great number, consequently, turn red and die. When the silk worms are distributed upon the frames, it ought to be done in a tender manner ; they must not be thrown down, or they will be wounded by striking against each other. The health of a great number of silk worms will suffer, and afterwards they will become what are called *laï-lao-ong ;* that is to say : *lazy old men.* They leave a red chrysalis.

NONG-SANG-YAO-TCHI.

Two frames must be placed below the one where the newly hatched silk worms are. When the sun has risen above the horizon, a frame must be taken away and dried until the setting of the sun. It must then be replaced under the frame where the silk worms are. The next day remove a frame again from beneath, expose it to the rays of the sun and then replace it, as at first. In that manner the silk worms will naturally receive a mild and temperate heat.

That frame must be removed as soon as they have eaten, after the second moulting.

SAME WORK.

There are some silk worms which turn white and die; it arises from their having been injured by damp exhalations, within a short time after their hatching. When the sky is clear and serene, take three or four frames and carry them quickly into the apartment of the silk worms, after having exposed them for some time to the rays of the sun. Then as one frame is removed and replaced by another, so continue to change them, until all the frames of the silk worms are sufficiently warmed by the heat of the sun.

The country people, vulgarly say: "when the dung of the silk worms is dry and scattered, it is a sign that they are in good health." When the dung appears in damp heaps, and of a shining white, it announces that the silk worms are sick; the frames must then be quickly changed. But if at the time, when it is proper to change them, a damp rain or a cold wind comes on, it will not do to remove them; the straw of rushes, chopped to the size of a bean, must be taken, and one or two bushels distributed on each frame; it must be spread in an equal manner upon the silk worms. Then a layer of fresh leaves must be placed over them. Soon after the silk worms ascend to eat the mulberry leaves. The bed of rush straw separates the silk worms from the dung, and relieves them from that inconvenience. As soon as the sky has become serene, they must be removed to other frames; if a person has no rush straw, the rice straw will supply its place.

SSE-NONG-PI-YONG.

The silk worms produced by three ounces of eggs, which occupy a single frame at the moment of their hatching, will cover thirty frames at the close, or last period of their lives. In general, one-tenth of an ounce of silk worms, newly hatched, will furnish a frame of silk worms, in supposing that the frame is as usual, ten feet long, and two feet wide. If the frames are of a smaller dimension, they ought to receive a smaller quantity of newly hatched worms. If they are too numerous for the space they occupy, they will find themselves close, and, consequently, serious accidents will result from it.

Those persons who intend raising silk worms, to cover more than thirty frames, ought to increase the number of frames destined for the young silk worms, (hatching silk worms.)

Those who only raise a small quantity of worms, can make use of baskets with small borders.

SAME WORK.

The third day, between ten and twelve o'clock, three frames must be placed upon a separate stage. The hatching worms, which have deposited a light bed of dung, must be changed. It must be done with a delicate hand. A quantity of silk worms which (at the moment of their hatching) occupied a space the size of a square of a chequer-board, ought to be distributed upon the middle frame.

REMOVAL OF THE SILK WORMS AFTER THEIR FIRST MOULTING.

SSE-NONG-PI-YONG.

Place four frames upon a separate stage, and the worms which have deposited a light bed of dung must be changed. When they have eaten abundantly, a quantity of silk worms, which, at their hatching, occupied a space as large as a man at draughts, will fill the two middle frames; a quantity of silk worms, which occupy a space no larger than a small piece of money, will cover the third frame.

REMOVAL OF THE SILK WORMS AFTER THEIR SECOND MOULTING.

A quantity of silk worms, which at the moment of their hatching occupy a space no larger than a small piece of money, will cover six frames. When they have eaten abundantly, the same silk worms will cover twelve frames.

REMOVAL OF THE SILK WORMS AFTER THEIR THIRD MOULTING.

A quantity of silk worms, which, at the moment of their

hatching, occupy a space as large as two pieces of money, will cover twenty-five frames. When they are all torpid, the bed of chopped straw must be removed; they will then fill thirty frames.

To remove and separate the silk worms, in a proper manner, it must be done with promptitude and tenderness. They must be separated from one another, and an equal space left between them, for fear they should wet themselves, and reciprocally injure one another. The silk worms evacuate freely; for that reason they must, absolutely, be separated. When they have deposited a large quantity of dung, it is necessary to remove them to other frames. If they are not separated they will be too much crowded. If the frames are not changed, they will be injured by the abundant humors which they void. For that reason, these two operations ought to be performed with great celerity.

The silk worms are weak and delicate beings; they suffer much from being rudely handled. When they are small, they must be treated with great care and a kind of affection; but when they have become large, there are few who pay any attention in removing them. They are heaped together, pell mell, for a long time, and they are tumbled about, or let fall. This defect of care and precaution causes their diseases, and often destroys them; therefore, they should be touched with a light hand, and distributed upon the frames at an equal distance from one another.

SANG-TSAN-TCHI-CHOUE.

The silk worms of four moultings are of a different species; they are raised in the same manner, as the Spring silk

worms, (which have but three moultings.) Only after the third, they must be distributed upon fifteen frames. When they have fed abundantly, they must be spread upon twenty frames; and after the great moulting, (the fourth moulting) they must be distributed upon thirty frames.

NONG-SANG-THONG-KIOUE.

Upon each stage three frames are placed; the first is destined to receive the dust of the apartment, and that below, to intercept the dampness of the ground. A-bed of chopped rice straw must be spread upon the middle frame, in order that it may receive the silk worms which are removed. This rice straw must be broken, and softened in an equal manner, upon the middle frame; then a sheet of paper must be spread above, of which the extremities are pasted to the edge of the frame. Upon that sheet of paper, the silk worms must be placed.

NONG-TCHING-TSIOUEN-CHOU.

Hoang-sing-tseng says: When it is desirable to remove the silk worms, rice straw, crushed in a mill, must be spread, in advance, upon other frames. It renders them healthy and active, and preserves them from diseases Some persons change them by the aid of a net, which they strew with mulberry leaves. See Plate, 2.

ENTRANCE OF THE SILK WORMS

IN THE COCOON ROOM.

NONG-CHOU.

The floor of the cocoon room must be boarded with planks of the fir tree, six feet long, and three feet wide. A frame, pierced with large holes, must be constructed of the thin bamboo from which arrows are made. In these holes some reeds must be inserted; then long and large bamboo branches, stripped of their leaves, must be crossed above. The cocoon room must be covered with a frame work of woven reeds.

The silk worms will then have a place, where they can establish themselves in safety without fear of falling. When the interior of the cocoon room is well arranged, when it affords the necessary depth and proper security, and the frame presents no interval, the silk worms must be successively spread over it. At first, the frame must be a little inclined, until the worms are emptied of excremental matter, afterwards they must be moderately warmed with a small brasier, or pan of live coals. When they have begun to enclose themselves in their cocoon, (that is to say: when their cocoon will have formed a light net work,) the heat must be increased by degrees. They must not stop in the middle of their work; if the temperature be a little too

cold, they walk upon their silk and cease to spin. When it comes to be reeled it will frequently break. In general, one will be obliged to have the cocoons boiled, and silk stuff made of it, because it is impossible to reel it from one end to the other.

THSI-MIN-YAO-CHOU.

When the silk worms have arrived at the age of maturity, if it happens to rain, it will injure the cocoons; it will be better also to establish the cocoon rooms in the interior of the nursery.

OBSERVATION.

The round and oblong cocoons rooms must be placed outside.

A parcel of small dry branches must be laid upon the frames, and the silk worms spread on them. When that operation is performed, they must be again covered over with a bed of dry branches. One stage, or story, can support ten large frames.

ANOTHER METHOD.

In place of small dry branches, the stalks of plants may be used, on which the silk worms must be spread. The frames must be suspended, between wooden pillars, with cords, or hooked sticks. Several may be arranged one above another. When the frames are suspended, they must be moderately warmed by means of chafing-dishes placed

below. As soon as the silk worms feel the heat, they work industriously; but if they are affected by the cold they will work slowly. The frames must often be visited. As soon as they are warm enough, the chafing-dishes must be removed. If a cool air circulates above in the cocoon room, (while the lower part is warm,) the silk will not be spoiled by the dampness produced by the silk worms; the silk worms that die, will immediately fall, and the cocoons of the other worms will not be injured by coming in contact with them, the dung will not adhere to the cocoons, nor produce any blemish. If the silk be impregnated with dampness, it will be difficult to prepare it for the dye; if the cocoon be soiled, the silk will easily break; if the cocoon be defective, it will be good for nothing.

The cocoon rooms furnished with stalks of dry plants, are as advantageous as those we have just described.

SAME WORK.

There are some countries where the place for cocoons is outside, (in the open air;) but if in the evening the air becomes cold no silk worm can form its cocoon. When the cocoon rooms are warmed, the silk will be fitter to receive the dye; besides it acquires lustre and whiteness.

WOU-PEN-SIN-CHOU.

The ground on which the cocoon rooms are established, ought to be high and level. It must be well aired in the interior. Small branches, or dry stalks of plants, must be spread there in an equal manner; afterwards the silk worms must be distributed there, leaving a proper distance between them; if they are too near, they will create too much heat;

if they are crowded, they spin with difficulty; and, moreover, their silk will be difficult to reel. The cocoon rooms must not be established in places exposed to the northeast, nor where domestic animals are raised; neither under trees, above a hole, nor near places covered with manure or stagnant waters.

NONG-SSE-PI-YONG.

The following is the manner of establishing the cocoon room: A dry and warm place must be chosen, in order that neither the cold nor dampness can penetrate into the interior of the cocoon room. When the worms approach their maturity, a fire must be lighted upon the ground where the cocoon room is to be located, until it is perfectly dry; afterwards the remains of the fire and the ashes must be swept away, and the cocoon room constructed.

SAME WORK.

Six diseases of silk worms are noted in the cocoon room:
1st. When the silk worms dirty the cocoon room;
2d. When the silk worms fall in the cocoon room;
3d. When they move about without spinning;
4th. When they change in red chrysalis;
5th. When they turn white and die;
6th. When they turn black.

The foulness of the cocoon room arises from portions of leaves which the mature worms have brought with them, they ferment and produce a fatal moisture.

The five other diseases always result from the moisture of the ground, or the cold of the exterior air.

ROUND COCOON ROOMS.

PLATE VI.

Han-chi-tchi-choué.

The cocoon rooms must be established upon elevated ground; each of them may contain silk worms of six large frames. When the silk worms have attained nine-tenths of their age, a few leaves must be distributed to them, then they must be removed upon the frames of the cocoon room with baskets in the form of sieves. They must be gently handled, when they are taken to be put upon the frames in the cocoon room—they ought to be at equal distances; and afterwards covered with small dry branches or stalks of the bean plant. Other silk worms must be disposed of, as were the first, until the third frame is emptied; they must then be newly covered with a bed of dry branches. After that operation the position of any reversed branches must be corrected and straightened, (that is to say: those of which the lower part is turned upward,) in order that the silk worms may ascend; they can receive all the silk worms of three more frames. In covering the top of the cocoon rooms with dry plants, a round form is given it; it must be surrounded with frames at the bottom, and covered at top with straw mats in the form of a cone, so that the top of the cocoon room will resemble the apex of a tent or pavilion. On the approach of evening, the cocoon room must be surrounded

with new straw mats, from the top to the bottom; the next day, when the sun is sufficiently above the horizon, they must be taken away. The following night the cocoon room must be again surrounded with mats. After three days. the work of the cocoons will be finished, and straw mats will be no longer required.

The oblong cocoon rooms, called *ma-theou-tso*, ought to be equally furnished with straw mats. The construction of these cocoon rooms requires a greater quantity of materials. The interior ought to be provided with a stage to receive the frames with the silk worms.

When a person has a large quantity of silk worms, large oblong cocoon rooms ought to be made use of, called *ma-theou-tso*. It is best to establish them in a place with a north and south exposure.

SAME WORK.

During the three days that follow the installation of silk worms in the cocoon room, between eight and ten o'clock in the morning, the straw and bamboo mats, with which the cocoon room is covered, must be removed, and the silk worms exposed to the heat of the sun, until two o'clock in the day; afterwards it must be covered up again as before. If the heat is too strong, the cocoon room must be covered with a simple lattice-work of reed, to protect the silk worms from the heat of the sun.

ANOTHER METHOD.

If the weather be rainy at the time when the mature silk worms are ready for the cocoon room, one must be contented to establish the cocoon room, in the silk room at the bot-

tom of the stage. The doors and windows must be opened, in order that the air may circulate freely. In the morning and evening, or if the weather be cold or rainy, the doors and windows must be shut, and the room warmed, by placing therein a chafing-dish with dry dung well ignited. That is better than changing the worms of the cocoon room at the commencement, or at the middle of the work, when, in the first instance, they would have been exposed to the rain.

ANOTHER METHOD.

Nong-sang-thong-kioué.

In the southern countries it is the custom to establish the cocoon room in the house ; in the North, they are constructed outside ; at the South they are placed in the house, because but few silk worms are raised, and it is easier to take care of them, (literally: distinguish ;) but that is not practicable, when one has a large quantity of silk worms. In the northern countries the greater part of the cocoon rooms are placed outside; but it often happens, that a multitude of worms are stifled and crushed ; thus the cocoon room, of the South and the North, have their particular inconveniences. The following observations are due to a skilful raiser of silk worms.

In the South and the North, when there are few silk worms, the doors and windows of the nursery are opened, and the cocoon room established there. That method is good, but it must be renounced if one has a large quantity of silk worms.

In the middle of the yard a long shed must be construct-

ed, and covered with dry Spring grass, and the cocoon room is there established. All around this shed shelves of planks must be placed, where small dry branches must be spread; then the silk worms must be spread there, placing them at proper distances. The shelves must be surrounded with mats of rush, to protect the silk worms. Adopting that method, no disease occurs in the cocoon room. The plan appears excellent.

NONG-TCHING-TSIOUEN-CHOU.

The cocoon rooms provided with stalks of dry plants are much better than those that are now used. It is for this reason this method is not followed. The cocoon rooms, placed outside, are only used in the northern countries, and in the South the raising of silk worms happens at the period of the rains called *Meï-yu*, (in April,) consequently it will be very difficult to employ this kind of cocoon rooms; therefore (in the South) every body is obliged to establish the cocoon rooms in the interior of the house. The cocoon rooms ought to be warmed with chafing-dishes placed below, some feet apart.

SEQUEL TO THE ROUND COCOON ROOMS.

In the construction of the cocoon room, stubble, dry branches, straw mats, &c., are made use of. When a person wishes to construct a round cocoon room, the centre must first be established; divide the circumference into five parts, the middle whereof should be of pine boards. Plant five poles, and tie them together at the top, afterwards they

must be surrounded with rush mats: that is called the heart; namely: the centre of the cocoon room. Then dry branches must be laid all around, against the mats, where the silk worms are to ascend. When the silk worms are placed in the cocoon room, the lower part must be surrounded with rush mats, and covered, high up, with straw, in the form of a cone, or so as to imitate the top of a tent.

These are called *touan-tso*, or round cocoon rooms.

MA-THEOU-TSO,

OR OBLONG COCOON ROOMS.

PLATE V.

Stakes must be planted at the two ends, and joined by cross pieces, which must be covered on each side with thin laths; it is thus the bottom of the cocoon room is constructed. For the rest, the ordinary method must be followed. (See the commencement of the chapter on cocoon rooms.)

These oblong cocoon rooms are generally used at the North. I have seen in the South, (says the author,) people who establish the cocoon rooms in their own houses. They spread short stalks of dry plants upon the frames, that have already served, during the raising, and the silk worms are there installed. This proceeding requires little work and care, and the silk worms will not be exposed to any of the accidents which cause a great number to perish in the cocoon rooms placed outside.

OBSERVATION.

The text here repeats the description of the cocoon rooms of the South, which has been given above.

The author adds: Such are the cocoon rooms generally used in the South. If the cocoon rooms of the South and North are compared, of which we have spoken higher up, it will be seen that their size and figure, (that is to say: their round or oblong form) vary, according to a large or small quantity of silk worms. But if these two kinds of cocoon rooms are examined with care, it will be seen that they have each their particular inconveniences. In the South, where few silk worms are raised, the cocoon rooms are small and narrow. The raising of silk worms in these countries is an amusement; therefore, they are not of much profit.

The cocoon rooms of the North are indeed large, but they present serious defects. The accumulation of dry branches, (or stalks of plants,) smothers a great number of silk worms. The rain often wets the cocoon rooms, and sometimes the wind also turns them over; added to that, the enormous difference that exists between the exterior and the interior temperature. Hence diseases are created in the cocoon rooms, which considerably diminish the number of cocoons. But as these customs are inveterate, it is very difficult to reform them suddenly. There is, adds the Chinese author, another method which has been communicated to me by skilful raisers of the silk worms.

They calculate nearly the quantity of silk worms they raise, and select, in the yard, a wide space. They construct there a light frame work, covered with straw mats, a long shed, which the remainder of the year, may serve for other uses. When the silk worms are prepared to spin, they establish the cocoon room there. At first they form the lower part of each cocoon room, and proportion it to the dimensions of the shed. Between the two ranges of the cocoon

rooms, a sort of passage must be left, large enough for a man to pass freely, and prevent the danger of fire. Afterwards in each cocoon room, shelves of planks must be arranged one above the other, and covered with dry branches, on which the silk worms must be spread, leaving between them a proper space. When that operation is terminated the cocoon room must be surrounded with double mats.

If one has but few silk worms and much room, the doors and windows of the nursery may be opened, and the cocoon room established there. That method is excellent. In the first place the silk worms are well covered at the top, and they have not the dampness of the ground to fear, (when the cocoon rooms are placed outside.) Added to that, the shelves of plank, (or frames of the stages,) offer them a large and plain surface, where they can work at their ease. There are some persons who warm the cocoon rooms. This proceeding is excellent to dry and strengthen the thread which the silk worms spin; this improvement is one of the useful things which has been borrowed from the cocoon rooms of the South and the North. It would be very important if every body followed that method, which never causes regret, and constantly offers every advantage to be desired.

CHOICE OF THE COCOONS.

THSI-MIN-YAO-CHOU.

When a selection of cocoons is to be made, in order to obtain the eggs, those which are found in the middle of the cocoon room must absolutely be chosen. Those which are near the top produce very little silk, (or a very thin silk;) those near the bottom produce eggs which will not hatch.

NONG-CHOU.

As soon as the frames have been taken from the cocoon rooms, the floss of the cocoons ought to be removed immediately, so that they may not ferment and spoil. If one has a large quantity of cocoons, they must be preserved under beds of salt; then the butterflies do not go out, and the silk will be supple, strong and glossy.

The following is the manner of preserving the cocoons:

At first the cocoons must be exposed to the sun, until they are perfectly dry. A large earthen jar must be placed in a hole dug in the earth; at the bottom of the jar a mat of bamboo must be spread, afterwards it must be covered with large leaves, of the thong tree, (*bignonia tomentosa.*) Then a layer must be made of about ten pounds of cocoons, upon which two ounces of salt must be spread; they must be newly covered with leaves of the same tree. Thus, layers of cocoons must be placed one over another, until the

jar is entirely full. Then the jar must be hermetically closed, by covering it with clay.

WOU-PEN-SIN-CHOU.

When silk worms are to be raised, the eggs to be procured from the cocoons, must be thought of before any thing else. Now-a-days, when the cocoons are collected it is the custom to keep them altogether upon the frames. Some persons not having time to reel all their silk, butterflies are seen to go out and lay eggs almost immediately. The accumulation of cocoons produce a kind of fermentation, and the heat causes the butterflies to hatch before the proper period. This premature developement has never any good results, for the butterflies are sick ; and from thence it comes that the silk worms produced from their eggs, are affected by diseases from the moment of their hatching.

When the cocoon rooms are opened, (if one wishes to have proper cocoons for reproduction,) those must be chosen, which are found in the upper part, and which are turned towards the light ; those are strong and well conditioned cocoons. They ought to be separated, and put in a well aired chamber, and spread upon very clean mats, a layer of the thickness of a single cocoon only. After the cocoons have rested upon the frames the necessary time, for the metamorphosis of the chrysalis, the butterflies go out themselves without being affected by the diseases which we have described above.

SAME WORK.

A large number of persons are required to select, at the same time, all the cocoons which may be wanted ; they

must be spread in beds of the thickness of a single cocoon, and they must be preserved in a cool place. The butterflies will come out so very late that it will not be necessary to hurry the reeling of the silk.

HOANG-SING-TSENG, SAYS :

The cocoons which are oblong, brilliant and white, yield very fine silk. The cocoons, which are large, obscure, and of a blue color, like the skin of an onion, furnish a coarse silk. The floss must be removed which covers the silk.— The cocoons which are moistened in the inside, by the humors of the silk worms, are called *in-kien*, that is to say : dark cocoons.

Those which are thin and mixed, yield a common and coarse silk. The cocoons must not be left exposed for a long time, to the rays of the sun ; otherwise, the silk will be burnt, and it will be difficult to reel it. The same thing happens when perfume is burnt in the room where the cocoons are.

The large cocoons are called *tsou-kong*, that is to say : coarse work.

HAN-CHI-TCHI-CHOUE.

When the silk worms have spun their cocoons, those which are firm, and whose surface has large stripes must be chosen ; they can be quickly reeled. For that they must be exposed to the steam of boiling water, and afterwards reeled, by placing them in a basin filled with lukewarm water.

OBSERVATION OF THE TRANSLATOR.

The expression of the text, *ling-pen*, literally signifies *basin of cold water*. The sense I have thought proper to adopt, "(lukewarm water,) is taken from a positive passage of Book xxv, folio 8, verse, line 2."

The cocoons which are thin, and of which the surface has fine stripes, can never be easily reeled. They must not be exposed to the vapor of boiling water. They must be reeled by placing them in a basin filled with warm water.

SAME WORK.

Manner of Killing the Chrysalides by means of the Vapor of Boiling Water.—Plate IX.

OBSERVATION BY THE TRANSLATOR.

"In the Chinese Encyclopedia, entitled *San-thiaï-thou-hoeï*, it is recommended to throw in the kettle two ounces of salt, and one of oil; the author assures us, that it prevents the silk from drying, and renders it easier to reel."

Three bamboo baskets must be taken, with a cover made of soft straw, and it must be placed upon the top of a kettle of boiling water. Place two baskets on the cover, where from three to four inches of cocoons must be spread. The temperature must be frequently tried, by putting the back of the hand on the cocoons of the upper frame. If the hand cannot endure the heat, the under basket must be drawn away, and another put on the first. The steam must not be too powerful, or it will soften the silk too much; neither

must it be too weak, otherwise, the butterflies will pierce the cocoons.

If the back of the hand cannot endure the heat, the temperature of the water is at the proper degree of heat for the end proposed. Then the baskets are to be carried to the silk room, and the cocoons spread on a frame; they must be lightly stirred with the hand. If the cocoons fill the frame, and commence to form a heap, they must be separated, and a portion spread (that is to say: one half,) upon another frame.

Wait until the cocoons are entirely cooled; afterwards they must be covered with small willow branches.

All the cocoons must be steamed the same day; for if all the moths be not killed, those of the remaining cocoons will come out the next day.

NONG-SANG-THONG-KIOUE.

When one has a large quantity of cocoons, and they cannot be reeled at once, they must be preserved under layers of salt, and then the butterflies cannot go out. That method is generally followed in the South, but a great number of earthen jars are required.

I have read the work entitled, *Nong-sang-tchi-kioué*, which is used in the North, and the following is what I have found on this subject:

When the cocoons are gathered, the best way is to reel them immediately; but if it cannot be done in consequence of not having a sufficient number of laborers, the chrysalides must be killed, and the cocoons reeled at leisure.

There are three ways of killing the chrysalis:

1st. By exposing the cocoons to the heat of the sun:

2d. By wetting them with salt water;

3d. By exposing them, in bamboo baskets, to the steam of boiling water.

This last method is the best, but there are many persons who do not know how to practise it. The drying in the sun injures the cocoons; the surest plan is to preserve the cocoons in earthen jars, under alternate layers of salt and leaves.

NONG-TCHING-TSIOUEN-CHOU.

When salt is put on the cocoons, it moistens them, and penetrates to the bottom. Now-a-days, many persons only lay the cocoons in earthen jars. They tie up some salt in bundles of one or two ounces, in paper of bamboo bark, or leaves of the nympha. That method is equally good, but the top of the jar must be hermetically shut, so that air cannot penetrate; for that purpose clay, mixed with salt, must be used.

SUPPLEMENT

TO THE CHINESE TREATISE

UPON THE RAISING OF SILK WORMS.

SUPPLEMENT

TO THE CHINESE TREATISE

ON THE RAISING OF SILK WORMS.

EGGS OF THE SILK WORMS.

Each chrysalis changes to a moth. After the expiration of three days, it pierces the cocoon and comes out. The male and female resemble each other. The female remains immoveable, the male flies about in search of the female, to whom he unites himself. After having been united one day and a half, he quits her. As soon as the male butterfly has left the female, he withers and dies. The female immediately lays her eggs. Some persons make the females lay their eggs upon paper, (made of the bark of the mulberry tree,) others on a piece of linen. Every country has its customs. In the district of *Kia* and *Hou*, a thick paper is made use of, manufactured of the bark of the mulberry tree. The following year, the same leaves of paper may be used.

A female butterfly lays about two hundred eggs, which adhere to the paper; the eggs are distributed over the paper in an equal manner, without being accumulated together.

The matron of the silk worms, (she who superintends the raising,) must preserve them in order to hatch them the following year.

ON BATHING THE EGGS OF SILK WORMS.

We only describe the methods which are followed in the districts of *Kia* and *Hou*. In the former, the sheets of paper covered with eggs are exposed to the dew of the heavens, or else they are washed in lime water. In the latter district salt water is generally used. Two *chings*, (two tenths of a bushel) of water, that runs from heaps of salt must be taken and poured in a vessel, and a sheet of paper covered with eggs must be put there to bathe; the same is done with the lime water. The twelfth day of the last month of the year, the leaves must be immersed, and soaked until the twenty-fourth of the month, that is to say: for twelve whole days, after which they must be taken out. They must be drained and dried in a mild heat; afterwards they must be preserved with care in a box. They ought not to be shut up together when the air is moist.

The eggs will hatch at the time called *Thsing-ming*, (the 5th of April.)

Those persons who expose the eggs to the dew, do it at the same time with those we have just spoken of. They put the sheets of paper in wicker baskets, which are hung up at the four angles of the roof, and each one is loaded with a small stone to retain them in place. They are thus abandoned to the frost, snow, wind, rain, thunder, and lightning. They must be taken down at the end of twelve days; afterwards, they are preserved in a box, as we have

seen above, and kept there until the time called *Thsing-ming*, (the 5th of April.)

The latter eggs, that is to say: the eggs of Autumn, which proceed from a second laying in the year, ought not to be washed.

PRECAUTION FOR PRESERVING THE EGGS.

A small frame must be made with four pieces of bamboo, and leaves placed upon them. Suspend it upon an elevated joist, where it will be exposed to the air, and sheltered from the sun. It will be dangerous to permit the smoke of the oil of *thong*, (*bignonia tomentosa*,) or fumes from charcoal to circulate about the leaves containing the eggs. In the winter months, do not expose the eggs to the reflection from the sun, which has the effect of rendering them empty and steril. When a great deal of snow has fallen, the leaves must be hastily taken in. The next day, when the snow has passed, they may be suspended as before. The last month of the year must be waited for to wash them, and deposite them in the box.

DIFFERENT KINDS OF SILK WORMS.

There are some early silk worms, (silk worms proceeding from eggs laid in the Spring of the year,) and the late silk worms, (worms proceeding from the eggs of Autumn.) Every year the latter hatch five or six days before the others, (that is to say: they take five or six days less to hatch; they also form their cocoons much sooner, (that is to say: they arrive at maturity much quicker;) but these

cocoons are of a description one third lighter than the others. When the first are occupied in making their cocoons, the others have already changed into butterflies, and have laid new eggs; which permits a second raising, that is to say: to employ those eggs in rearing a second crop, the same year.

(The Chinese author adds in a note that the chrysalides of the late silk worms, must not be eaten.)

When the leaves covered with the eggs of the silk worms are washed according to the three customary methods, care must be taken to note the manner each leaf has been treated, for if a mistake occurs, or if, for example, the eggs that have been exposed to the dew, be soaked in salt water, all the eggs will become empty and steril.

Only two colors are distinguishable in cocoons: white and yellow. The country of *Tchouen-chen*, and that of *Tsin-iu*, only furnish yellow cocoons without any mixture of white; the districts of *Kia* and of *Hou*, only furnish white cocoons without any mixture of yellow.

If a white male moth copulates with a yellow female, the silk worms hatched from that union will form a cocoon which will participate of those two colors.

The yellow silk* can be whitened by washing it, and having it soaked in lard taken from pork kidneys; but there are two colors which the dyers cannot make it take: one is called *piao-pé*, (a greenish white color, like that of the fruit of the pear or almond tree,) and peach blossom color.

Cocoons are of various forms. The cocoons of the late silk worms, (worms of Autumn,) resemble a long gourd,

* M. Darcet has bleached some yellow cocoons by means of pork fat. (St J.)

the cocoons of the silk worms, of which the eggs have been exposed to the dew, are pointed and long, like pistachio nuts. There are some round and flat, like peach kernels. There is another kind of silk worms, which do not refuse leaves soiled with mud. They are called *tsien-tsan*, that is to say: *despised* silk worms, or those that are not esteemed; they yield a large quantity of silk.

There are some silk worms that are entirely white, speckled, perfectly black, and striped with brilliant colors; but all give the same silk. Now-a-days, in poor houses, it is the custom to couple an early male, (male Spring butterfly) with a late female; (that is to say: proceeding from the Autumn eggs:) eggs are obtained from them which produce silk worms of a very remarkable species.

The wild silk worms form their cocoons, of themselves, that is to say: without the assistance of the cocoon room. They come from *Tsing-tcheou*, of *Y-chouï*, etc. The garments made with their silk, are neither injured by rain, dirt, nor by oil.

When the female butterfly has come out, it can immediately fly. Its eggs are not deposited on paper. In other countries wild silk worms are found, but they are rarer there than in the two places above named.

FEEDING OF THE SILK WORMS.

Three days after the time called *Thsing-ming*, (the 8th of April,) the silk worms hatch without requiring the heat of garments or blankets. The nursery for the silk worms ought to face to the southeast. The interior walls are papered to stop up any cracks through which the air might

penetrate. When it is cold, the silk worms must be warmed with chafing-dishes, filled with live coals. Whenever the young silk worms are fed, tender leaves cut in small shreds must be distributed to them. In order not to injure the knife, the wooden block, (or the table,) must be covered with rice or wheat straw. When the leaves are gathered, they must be put in an earthen jar, for fear the wind may dry them.

Before the second moulting, when the silk worms are to be changed from the frames, they must be raised with a small bamboo stick, of which the extremity is rounded. But after the second moulting, they can be taken up with the fingers. The changing of silk worms is a painful and assiduous work. Lazy persons, in changing the frames, accumulate a large quantity of leaves upon the worms. These leaves, mixed with dirt, and dampness, produce a deleterious fermentation, which causes a multitude of silk worms to die.

When the silk worms are disposed to moult all together, they do not moult until after having thrown around them some threads of silk, which aids them to disembarrass themselves from their skin. Those who remove them to other frames ought to pick up with much care the leaves on which they rest, and only give them those that are perfectly clean. For if, in awakening from their torpid state, they should eat a single mouthful of the leaves, where the threads of silk are pasted, they swell and die immediately.

After the third moulting, if it be very hot weather, the silk worms must be hastily removed into a cool and spacious room. Care must also be taken to shelter them from the wind. In general, after the great moulting, (after the third moulting,) the frames must be changed after twelve

feedings. If they are assiduously taken care of, a large quantity of silk will be obtained.

OF THINGS THE SILK WORMS FEAR.

The author gives nearly the same advice as has been read before, page 121.

He adds the following observations:

The silk worms particularly fear the southwest wind. When it blows with force, if care be not taken to shut the windows and blinds, the silk worms from all the frames will sometimes be lost. Whenever a disagreeable odour is smelt in the silk room, leaves of withered mulberry trees must be burnt to dispel it.

OF MULBERRY LEAVES.

All soils are favorable for the cultivation of mulberry trees. In the districts of *Kia* and *Hou*, mulberry trees are reproduced by layers. By the aid of bamboo stakes, the lateral branches of mulberry trees are brought by degrees to the ground. In the Winter months, they are covered with earth. In the following Spring, when the roots are formed, the layers must be separated from the parent branches, and planted elsewhere. The sap of the tree flows into and concentrates in the leaves, and the mulberry tree no longer bears blossoms or fruit.

When leaves are wanted, they must be gathered by cutting them with a pair of scissors. As soon as the mulberry tree has obtained the height of seven or eight feet, the top must be lopped off, and the leaves then grow with greater

abundance. The branches can be drawn towards the person gathering them, who cuts them, and afterwards picks the leaves. It is not necessary to make use of a ladder or to ascend the tree.

The following is the method that must be followed to propagate mulberry trees by seed. Towards the time called *Li-hia*, (the 6th of May,) when the fruit of these trees is purple and ripe, they must be gathered, crushed, and soaked in yellow clayey water, afterwards it must be sown and watered, on the surface of the soil. In the Autumn of the same year, the young mulberry plants will be a foot high. They must be transplanted the following year. If they are manured and watered carefully, they will grow rapidly. If among them some are found bearing fruit and blossoms, their leaves will be thin and not abundant. There are also some mulberry trees called *hoa-sang*, that is to say: flowering mulberry trees; their leaves are very thin and unfit for the nourishment of silk worms.

The grafted mulberry trees bear thick and nourishing leaves. There are also leaves produced by the tree of *tché*; use is made of them to supply the want of mulberry leaves. I have not seen, says the Chinese author, the trees of *tché*, in the province of *Tché-kiang*, but these trees are very numerous in the province of *Ssé-tchuen*. In poor families they are given to the silk worms when the mulberry leaves are exhausted. Strings for the bow and guitar ought to be made of the silk of worms which have been fed on leaves of *tché*. Their cocoons are called *ki-kien*. That expression implies, that the silk obtained from it is flexible and strong.

Whenever the leaves are gathered, scissors must absolutely be used. The best are those from the village of

Thong-kiang, which belongs to the district of *Kia*. In the other villages it is impossible to procure any as sharp.

MANNER OF CUTTING THE BRANCHES.

The branches of a new shoot produce, the next month, a greater quantity of leaves. By cutting a large number of branches, the gathering of the leaves is rendered easier. The leaves of the second pushing serve in the second month of Summer, to feed the late, or Autumnal silk worms. Then one must be contented to gather the leaves, and the branches must not be cut. When the second leaves have been gathered, the third growth will push in the Autumn.

The inhabitants of the province of *Tché-kiang*, leave them to fall after frost. They gather them one by one, and employ them for the nourishment of sheep. These sheep yield an abundant supply of wool, which is very profitable.

OF LEAVES THAT ARE INJURIOUS TO SILK WORMS.

After the great moulting, that is to say: the third moulting, all the worms eagerly eat the damp leaves. Those that have been gathered during rainy weather may be spread upon the ground, and given to the silk worms. If the leaves which have been gathered in clear weather are moistened with water, and given to the worms, their silk will have a lustre and brilliancy.

But when the silk worms have not undergone their third moulting, if the leaves are gathered in rainy weather, they must be suspended with a cord under the projection of the

roof, where they will be well exposed to the air. From time to time the cord must be shaken, until the air has perfectly dried them; but if they are dried with the palm of the hand they will become warm and lose their lustre. In the end the color given to the silk will not fail to tarnish and fade.

Whenever the worms are fed before their moulting, it is very important to fill them well; but when they recover from their moulting, they can, without inconvenience, wait half a day before being fed. The damp leaves which are gathered in rainy weather are injurious to the silk worms. If then there is any fog in the morning, the leaves must not be gathered, but wait until the mist has disappeared. Then the leaves may be gathered whether the weather be clear or rainy. If the leaves are wet with dew, they ought not to be gathered until they have been dried by the rays of the rising sun.

DISEASES OF THE SILK WORMS.

The silk worms often contract diseases while yet in the egg. After they are hatched, it depends on man to prevent those which arise from dampness, heat and accumulation of the worms. When the worms are changed from the frames, at the time of their first sleep, that is to say: after the first moulting, and varnished baskets are used for that operation, they must not be covered, in order to allow the dampness in which they abound to evaporate.

Whenever a silk worm is on the point of falling sick, the top of its head becomes brilliant, and all its body takes a yellow tint. Its head gradually grows larger, and its tail

becomes thinner. If at the time when the silk worms enter all together upon the moulting, there are some that move about, and do not sleep, or that take little nourishment when all the others eat with appetite, it is a symptom of sickness. They must be quickly removed, for fear they will corrupt all the others by their contact. Generally, a very healthy silk worm sleeps upon the leaves. Those that remain under the leaves are weak and lazy worms, that make a very thin cocoon, or rather that do not know the art of forming it. Those that throw their silk carelessly and form too large a cocoon, are stupid, *(sic,)* and not lazy worms.

MEANS OF KNOWING THE SILK WORMS THAT ARE MATURE ENOUGH TO SPIN.

When the silk worms have sufficiently eaten of the leaves, it is very important to know the precise time when they are ready for spinning. The silk worms generally hatch between eight and ten o'clock, it also commonly happens that at the same period of the day they are ripe enough to spin their cocoons.

When a silk worm is mature, the two glands at the bottom of its throat are clear and transparent. If they are too young by one-tenth, when they are put in the cocoon room, they will give very little silk; if they are too old by one-tenth, and they commence to let threads of silk escape, they will never fail to make a thin cocoon. A well practised eye is required to seize them at a proper time. Those persons endowed with a perfect knowledge of the subject, are never deceived respecting a single silk worm. It is extremely

difficult to take, at the proper time, the black silk worms, because the transparency that announces their maturity, cannot be perceived.

OBSERVATION BY THE TRANSLATOR.

From another Chinese author we read:

When the silk worms have finished all their moultings, and begin to assume a bluish color, it is a sign that they are mature enough to spin their cocoons.

FORMATION OF THE COCOONS.

COCOON ROOMS CALLED CHAN-PO, USED IN THE DISTRICTS OF KIA AND HOU.

OBSERVATION OF THE TRANSLATOR.

The Chinese expression, *chan-po*, signifies a frame covered with small protuberances (literally, hillocks). This last word denotes uncovered cones, where the silk worms ought to ascend. See PLATE No. 7.

The most perfect cocoon rooms are those that are called *chan-po*, and which are used in the districts of *Kia* and *Hou*.

In other countries the silk is not dried by fire (at the moment it is spun). The silk worms are allowed to spin between rice stalks, or in the middle of a box. The fire does not penetrate the thread of the silk worm, and the air does not cool it. For that reason, the taffetas, that are manufactured in the districts of *Tchang-tan* and *Ju-cho*

easily rot by washing. As to the garments woven of the silk that the districts of *Kia* and *Hou* produce, they can bear a hundred washings without the substance of the silk losing any of its strength and quality. The following is the manner of constructing the cocoon rooms:

The frames must be woven of split bamboo reeds, and placed upon a stage, supported on each side by wooden pillars at the height of six feet. At the bottom of this frame, chafing-dishes, filled with charcoal, must be placed at the distance of four or five feet apart. When the silk worms are put on the frame, only a little fire is required to induce them to work. As the silk worms like the heat, they immediately go to work, and are no longer seen to climb or move about. When the cocoon is commenced, and forms a light net work, half a pound of lighted coal must be added to each chafing-dish. As the silk worms throw their silk, it dries, and immediately hardens; hence it comes, that for a long time it retains its strength. It is not good to cover the cocoon room with a plank roof: a cool air must circulate in the upper part, whilst the lower must be warmed by fire in chafing-dishes. Whenever the upper part of the cocoon room is warmed, the butterflies cannot lay good eggs. When eggs are desired the cocoon room must be warmed in the lower part, as the plate indicates.

The small elevations (cones) which are placed on the frames, are made with rice or wheat straw, cut the same length, and twisted with the hand; afterwards they must be fixed on the frame. A great deal of strength is required in the hands to twist the straw of these cones. As the frame of this cocoon room is composed of bamboo reeds, woven together, and sufficiently scattered between them, a bed of

short straw must be made there, to prevent the silk worms from falling to the ground, or in the fire.

HARVEST OF THE COCOONS.

At the expiration of three days the work of the cocoons is finished; then the frames must be taken down, and the cocoons picked up. The silk that floats around the cocoon is called *ssé-kouang* (it is the floss silk). The old women of the district of *Hou* sell it very cheap; a hundred *sapecks* (seventy-five cents) a pound. It is removed by the aid of a piece of copper coin, which must be held with the three first fingers of the hand.

This floss is spun, and common stuff manufactured from it, called *hou-tcheou*.

When the cocoons are stripped of the floss it is necessary to spread them out on large frames, placed upon the shelves; they remain there until they are reeled (if it can be done soon after the harvest). If the cocoons should be shut up in those small chests (or trunks) which are used in the kitchen, they would rot by the dampness produced by the chrysalides, and the silk would break every moment in reeling it.

MEANS OF GIVING STRENGTH TO THE SILK.

What follows, we find in the article which treats of embroidering.

Whenever a person wishes to embroider flowers, or ornaments in tissue, it is absolutely necessary to make the chain

with the silk of the provinces of *Kia* and *Hou* (see above, the cocoon room, called *chan-po*). That silk has been dried twice, that is to say: while spinning, and afterwards in reeling from the basin. It is not to be feared that the threads of that chain will break during the tissue work.

Extract from the same Work, (fol. 31, *verse* L, 4.)

The following is the manner of obtaining excellent silk; it is expressed in six words:

1st. *Tchou-kheou-kan;* that is to say, the silk must be dried when it comes out of the mouth of the insect. For that purpose chafing-dishes with small coals must be placed at the bottom of the frame. See PLATE 7.

2d. *Tchou-chouï-kan;* that is to say, the silk must be dried when it comes out of the water. When the silk is reeled, two small chafing-dishes must be placed five or six inches from the reel, each containing four or five ounces of lighted coal. The rapid movement of the wheel produces the effect of wind. It gives activity to the fire, and causes the thread that is reeled to dry rapidly. If the weather is clear and bright, and a great deal of air circulates in the silk room, it is not necessary to make use of fire.

TREATISE

UPON

THE WILD SILK WORMS.

NOTE. It is thought proper to reprint here, as a necessary completion to the preceding Treatises, the Memoir of P. D'INCARVILLE upon Wild Silk Worms. This important work, which is only found in a collection of 16 Volumes, of the Memoirs of the missionaries of Peking, (Paris, 1777) may prove very useful to the raisers, if, as it is to be hoped, the Government receive the eggs of wild silk worms from M. Louis Hébert, who has been sent to the coasts of China, to obtain such valuable species of the silk worm and mulberry as do not exist in Europe.

MEMOIR ON

WILD SILK WORMS,

BY P. D'INCARVILLE.*

The observations made by Pliny, the naturalist, upon the caterpillars of the cypress, fir, ash, and oak trees, from which the inhabitants of Cos obtained their silk, has started the idea of making some research into that subject. We have found that in the third year of the reign of *Ouen-ti*, (a hundred and fifty years before Christ,) the wild silk worms multiplied in forests, and gave a large quantity of silk; and, likewise, in the second year of *Youen-ti*, of the same dynasty, (forty-four before Christ,) with the remark, that the cocoons of these worms were *as large as eggs (ta-jou-tan)*. We have found the same fact related in the Annals of the years 26, 231, 441, 449, 627, 638, &c., anno domini, always with the remark, that these cocoons were as large as eggs, except in 627, when it is said, they were as large as apricots; to which the annalist adds, that six thousand five hundred and seventy measures have been

* Extract from Volume II, (pages 579-601,) of Memoirs relating to the history, sciences, arts, &c., of the Chinese, by the missionaries of Peking. Several pages of remarks, foreign to this subject, have been suppressed.

gathered. The statements of the ancients relative to that kind of worms, their extraordinary multiplication in the years they have been spoken of, give us the right to conclude that if they yielded some silk, in other years, it was in very small quantities. Let us suppose it was the same with the silk worms of the island of Cos, and it will be very easy to explain why silk was so rare and precious.

To return to the caterpillars of the cypress, fir, ash, and oak trees, from which the inhabitants of the island of Cos obtained their silk, we have all these trees in France. The caterpillars of a tree in one country are the same in all other countries. Would it be badly imagined to draw an inference from that fact? Would there not be some room to make it? All that our gratitude can dare for a benefactor whose name will ever be in our mouth, and upon our lips, is, to relate that which is practised in China, and, for our justification, to rely upon his wisdom to excuse the anxiety to make use of it in the proper time and manner. We ask the favor, that this notice and all others we may take the liberty to offer to him, may only be communicated to the public as materials belonging to the subject under examination. Even if the deceased father D'Incarville, had not made researches and experiments upon the silk worms, of which we are about to speak, we would never have dared to risk ourselves, by saying any thing upon the testimony of books alone; but this respectable and learned missionary, of whom so many excellent memoirs have been lost or buried, having undertaken to reply upon this subject, to the questions that the Minister and several learned men have addressed to him, he set himself to work, made experiments, and his journal, worthy in all respects of his sagacity and exactitude, has fortunately fallen into our hands. We cannot

now acquit ourselves of what we owe to his memory, but we have not the baseness or bad faith not to do him honor, for what we owe to his work.

What Pliny relates of the silk worms of the island of Cos, in the seventeenth section of the eleventh book, is very difficult to understand and explain as it appears to us. Has the text been altered? Has the signification of some word, been lost? This learned man, who has made so many researches, and preserved for us so much learning, had he defective memoirs upon that article? We leave the question to be decided by those who have a right to pronounce: for ourselves, it appears to us very remarkable and worthy of attention, that of the three kinds of wild silk worms which are raised in China, two kinds are raised on the ash and oak trees, as in the island of Cos. We would not dare to say that they are not also raised on the cypress and fir trees, because as we cannot know to a certainty, what is practised in the provinces, we do not believe that the silence of the books suffices to draw the conclusion. Even suppose that the learned gentlemen, prepossessed against the wild silk worms, only speak of them in passing; perhaps it is, that the Government does not wish to promote or extend the method of raising them. It has been affected not to say a word in the great agricultural collection, which has been published by order of the reigning Emperor. The idea suggested itself, that these modern silk worms, having the indelible stain of being neglected and despised by antiquity, a learned man disgraces himself in speaking of them in detail: but the present Ministry is not blinded by such prejudices, which operate only with the helots of the school of Confucius. For, perhaps, these wild silk worms, being more precarious and more difficult to raise

than the silk worms of the mulberry trees, the allurement of gain will have sufficed to make them prefer the latter, the silk of which commands a much higher price.

We have seen above, that the wild silk worms have been known for a long time in China; but when they commenced to raise them annually, to procure their silk, we do not find stated any where: we do not even find it anterior to the last dynasty, forming a part of the tribute of the provinces, nor entering into the imperial manufactures of the present day. It may be, that the singular art of raising that kind of worms has been practised secretly in some districts, without attracting the attention of the Government. It appears in the imperial collection, *Hoang-ming-chi-ta*, published under *King-ti*, of the last dynasty, about the year 1456, that the Government takes no notice of the silk of the wild silk worms; but when, making continual efforts to secure abundance of corn, and of the raw materials for clothing, it fixed what each place should pay in silk from the worms of the mulberry, in hemp, or cotton, and, seeing that the province of Canton obtained silk from the wild worms, they taxed it to furnish every year a certain quantity. As the multiplication of the wild silk worms has been regarded and announced to the Emperors as a relief to the misery of the people, and as an extraordinary assistance sent by heaven, it may be the desire of perpetuating that branch of industry, has caused experiments and researches to be made; but the books we have read do not name him who first succeeded.

Three kinds of wild silk worms are enumerated: those of *fagara*, or of the pepper tree of China, those of the ash, and those of the oak tree. Before entering into any detail it is essential to make these three trees well known.

We have called the pepper tree of China *fagara*, after P. D'Incarville. It appears, in fact, to resemble it; but we doubt if it be of the same species. As that tree is of an easy and very common culture in the province of Canton, where our vessels resort, it would be easy to bring plants to France; for besides, the seed, seed-pods can be used in place of pepper, which would be important for the kingdom, and the silk worms of that tree are those which yield the most beautiful and the greatest quantity of silk. According to M. Duhamel, the illustrious and zealous promoter of the public good, who says of the *fagara*, it appears to us very doubtful if those of China can succeed in the Northern provinces of France; but we are persuaded that it would succeed very well in Provence, Languedoc, and Roussillon. An ignorant person sees nothing very important to the country in the acquisition of a new tree; but a statesman, a citizen, sees in a useful tree a lasting inheritance for the whole nation.

In China two kinds of the ash tree are distinguished, the *tcheou-tchun*, and the *kiang-tchun*. The *tcheou-tchun* is the same as ours, and it is on that the wild silk worms are fed. The *kiang-tchun* is very different from the first by its blossom, its seed, and above all, by its smell, as will be seen by the notice we have taken of it. Our moderns are, perhaps, too ready to laugh at what Pliny, the naturalist, has said of the ash tree; we would not be at all surprised that the *kiang-tchun* fully justified him. The compass of Europe is not yet large enough to measure the universe. What quantities of plants and trees are in the world!—Those of China, which are immense, will not, perhaps, be known in the West for many centuries.

The oak, on which a kind of wild worms are fed, if we

be not deceived, is what the botanists call *quercus, orientalis castaneæ folio, glande reconditâ in capsulâ crassâ et squamerosâ.* It is in the royal garden, as well as we remember ; but we have, assuredly, seen it near Toulouse, in a garden, which would be too painful for us to name.

The wild silk worms of *fagara* and of the ash trees, are the same, and are raised in the same manner. Those of the oak tree are different, and require to be dealt with rather differently.

The great and essential difference between the silk worms of the mulberry tree, and the wild silk worms, is that the Author of nature has given to these last a spirit of liberty and independence absolutely unconquerable. Patience, perseverance, and Chinese industry have been foiled there. It would be useless to risk new attempts. Our religious books have taken silk worms for the symbol of the resurrection, be it the soul in grace, or of the body in life eternal. The wild silk worms appear to be preferred. Their cocoons being finished, they remain enclosed from the end of Summer, or the beginning of Autumn, until the Spring of the next year. This long residence explains why they are made so strong and so compact. Cocoons have even been seen, after being forgotten a whole year, to send forth their butterflies the next; and, it is notorious in the province of *Chan-tong* and several other places, that the metamorphose of the chrysalides can be retarded to the middle of Summer.

The Chinese have a manner of distinguishing the cocoons which give male or female butterflies: among those they can likewise select the ones which give the strongest and the most beautiful butterflies. As the cocoons selected are the hope of the next year, this choice is important. If the rules to make this choice are the same as those which are

followed for the silk worms of the mulberry tree, which is very likely, we have nothing to add to what has been said in the *Memoir on Mulberry Trees and Silk Worms.* To keep the cocoons more commodiously, they are strung together by their extremities, on a thread of silk, and several strings are formed like beads. The sole precaution that is necessary to preserve them, consists in suspending them in a place where they will be sheltered from the north wind, the rain, sun, and cold air. The Chinese do not disapprove of their being housed; but, to believe them, it is always better to follow nature as nearly as possible; and, the wild silk worms, as every body knows, suspend their cocoons to the trees on which they feed, without even seeking the most sheltered places.

It is much more difficult to make the wild silk worms hatch than those of the mulberry tree: I have said to hatch them, it would be better to say, to procure the metamorphosis, for they hatch without any care. Father D'Incarville failed in the first attempt; the half of the Summer had passed, though he had done his best, without obtaining a butterfly. "I thought I was deceived," said he, in his journal, "and that he (his agent) had given me cocoons in which the chrysalides had perished." Upon which, disheartened with this ill success, he shut them up in a drawer, where he forgot them, and found them hatched in the month of October, when he opened the fatal prison where he had put them, and where they had miserably died. To make these butterflies hatch, the cocoons must be strung and suspended in a warm room, watered and dampened several times during the day, in the warmest weather. There are some who prefer to expose them to the vapor of a large vessel of warm water, which is milder, and better imitates

the dampness of the air, which makes them hatch in rainy weather. We do not find how many days are necessary for the change or metamorphose of the chrysalides, and we conclude, that there is no fixed time; that it is advanced or retarded without our being able to divine the cause; but it is not common to wait more than eight or ten days, when proper weather is chosen: that is to say, damp and warm weather. If it be delayed a little longer, we will have the gratification to see all the cocoons send forth their butterflies nearly at the same time.

The butterfly of the wild silk worm, says P. D'Incarville, has glassy wings, of the fifth class of *phalenes*, according to the system of M. de Réaumur. It carries its wings parallel to the superfices of its position, and leaves its body entirely uncovered: its wings are no more extended when it flies, than when at rest. This butterfly has scarcely its wings dry, when it seeks to make use of them, and fly. As persons are sure of drawing the males by means of the females, the liberty of flying outside is left to them; but the females are taken, as soon as they come out of their cocoons, and are attached with a thread of pretty long silk by one of their wings, and the other end attached to a large dried bundle, of a species of millet, suspended in the air, and which the botanists call *milium arundinaceum*. The Chinese by this plan obtain great advantages. The males impregnate the females the first and the following nights, though they sometimes disappear entirely during the day. The females, which are tied to the bundle of millet, deposite there their eggs after the second night, and continue to do so about eight or ten days; but towards the end they lay much less. The entire laying is not less than four or five hundred eggs. The heat of the season suffices to make the

wild worms hatch, and that, generally, at the end of ten or eleven days.

The first idea which suggests itself relative to wild worms that are raised upon trees, in the open air, makes us believe at first that they scarcely require any care, and are much easier to rear than the silk worms of the mulberry tree; but it is not so by a great deal. When the small silk worms come out of their eggs there are some persons who suspend the bundles of millet upon a branch of the *fagara* tree, in such a manner that they can climb from their cradle upon the leaves of that tree; others cut a branch, put it in a vessel full of water, and attach there their millet, with all its new inhabitants, the number of which augments momentarily until they nearly equal the number of eggs. The reason of these different proceedings is the extreme delicacy of the worms, their weakness, and their enemies. If the tree where it is desired to establish them be at all accessible to the ants, and other carniverous insects of the season, so tender a game attracts them, and in a short time they make a dreadful havock; which remark, *en passant*, explains sufficiently well why it is that the wild silk worms so rarely multiply and live in sufficiently large quantities to yield many cocoons. The best way to protect them, in their first infancy, is, after a great rain, to surround, with a small ditch, full of water, the *fagara* or ash tree, which has been chosen for their place of abode. But a branch put in a vessel of water is much surer. The most intrepid ants dare not swim to catch their game; for, to judge of the daintiness of these amazons by their avidity and eagerness, these newly hatched worms are the most dainty fare of their table. The flying insects of the season are yet more thirsty for their blood than the ants; it is much more difficult to defend them from their continual attacks.

Nature has taught the small worms to gain quickly the leaves of the tree which are to nourish them, and to unite themselves in the same neighborhood on different leaves, so as to form there a body, and alarm their enemies by their numbers. They even take care to lodge themselves upon the under surface of the leaves, where they attach themselves wonderfully, and where it is more difficult to attack them. Hardly are they dried and accustomed to the influence of the air, than they eat with a good appetite, and attack the *fagara* and oak leaves by the edges, help themselves, and feed without scarcely reposing. "It happened in the first day that I had carried my newly hatched worms to the tree," says P. D'Incarville, "a great rain suddenly came on, which made me very uneasy for their lives. I thought it was all over with them, and that not one would have resisted the torrents of water which fell. As soon as the storm had passed, I went to see if there was one to be found. I found them eating with great appetite, and grown sensibly larger." Far from the rain being injurious to them, it benefits them by the coolness it produces in the air, and by dispersing all their enemies. They suffer, moreover, from dryness, because the leaves they feed upon being then less abundant in juice, they become constipated. Their delicacy and neatness, if they have any, is not against their health. If they void their small feces with difficulty, they bend themselves without ceremony on their backs, draw them with their teeth, and drop them; which is done in the twinkling of an eye: then they begin to eat again. The food profits them so much in the beginning, that they grow and increase from day to day nearly half their size.

The wild silk worms moult four times, and each moulting is but four days distant from the preceding. The third day they eat little; but the fourth day, when they are hardly

cleared from their skin, they indemnify themselves with usury, for the diet of the preceding day. It is then that they can almost be seen to grow. These small worms entirely lose the love of social life after their first moulting; the taste for solitude gains upon them, and they separate to go and live in their way, remote from one another. This new inclination is mutually advantageous; for, if they remained assembled together in community upon a single branch, they would soon consume all the leaves, besides, the tree would suffer from it, they would have a journey to make to gain another branch, and the fast, which would be inevitable, would retard their moulting, or even abridge their lives, which are so short. Their dispersion is yet more necessary for their preservation; for if their enemies found them thus re-united, they would make a more terrible destruction, and, perhaps, none would be able to escape.—Hornets, wasps, ants, ravens, and all small birds without exception, are eager for their blood. The admirers of Providence may well exclaim, in considering how these caterpillars, without defence and exposed to so many dangers, have been able to preserve and perpetuate themselves, from the beginning of the world, in the midst of so many enemies; a miracle so much the more striking, because, before their silk obtained for them the care of men, the greater part of them must perish at the period of hatching in years unfavorable to their propagation. The following method has been invented to defend them from the birds: the heads of the *fagara* or ash trees, on which they put them, must be rounded and covered with a net of meshes, close together, to prevent the birds from getting to them. It is an expense, but it is necessary; and one is well remunerated by the silk which is gathered. The hornets fall upon them above all, when they are small, cut them in two and devour

them, though the net alarms them at first, but the allurement of their prey gives them courage to traverse the meshes, and one that has passed through invites all the others. Artifice and allurements must be used in the neighborhood, by sticks covered over with honey, where they must be burnt with a wisp of straw when there is a great number of them. P. D'Incarville relates as an ocular witness, that scarcely does a toad fix its eyes upon one of these caterpillars than it swoons and falls; the toad respires, and in drawing its breath receives it in its mouth and swallows it. Then, he adds, if he had not closely watched, his whole republic of silk worms would have been in danger of perishing in a few days. As the Chinese books have neglected this matter, we will say nothing more upon the subject.

We had forgotten to say in its place, that a little before or after the first moulting, if the newly hatched worms were left on a branch of the fagara tree, and put in a vessel of water, or if they were at first placed on the tree itself, care must be taken to proportion the number to the tree destined for them, or on which they must be left.—That attention is essential, because if these worms were in too large a number, they would strip off all its leaves, which, perhaps, would not suffice them: being more uncovered, they would there be more exposed to their enemies, less sheltered from the rain and sun; and then, when the time comes to spin their cocoons, they will be in a great deal of distress and embarrassment. The true time to make that distribution is the day that precedes or follows their first moulting. As they disperse as soon as the moulting is over, it will be impossible to distribute those which are already lodged on their tree if that moment be missed; and it would be forcing the others, to retain them on small

branches, where their lodging and provisions would be too near together.

The four moultings, which take place at intervals of four days, being finished and passed, the wild silk worms have nearly all their growth, and are at least twice as large as the silk worms of the mulberry tree. "It is a caterpillar of the first class, according to the system of M. de Réaumur," says father D'Incarville; "it is of a green color mixed with white, not perfectly smooth, with six tubercles, six on each ring. The hairs of these tubercles are covered with a kind of white powder." After the eighteenth or nineteenth day, the wild silk worms lose all appetite, and successively pass from a sullen apathy, or half numbness, to uneasiness and very lively agitation. They run here and there, as if they feared making mistakes in the choice of a leaf they are about selecting, and a place to spin their cocoon, and await their revivification the next year. It is generally from the nineteenth to the twenty-second day from their hatching that they commence this great work. Be it in order to have wherewith to fasten the first threads of the tomb about to be built—be it to increase its thickness and solidity, it curls up a leaf in the form of a gondola, and encloses itself under the tissue it spins, and which is finished by forming a cocoon of the size of a hen's egg, and almost as hard. This cocoon has one of its extremities open, in the form of an inverted funnel; it is a passage prepared for the butterfly's future egress. With the assistance of the liquid with which it is moistened, and which it directs toward that place, the moistened threads yield to its efforts: it breaks through its prison when the time arrives.

In collecting together all we have just said, it is evident that the wild silk worms are easier to raise in many respects than the silk worms of the mulberry tree, and, perhaps,

merit the attention of the Ministry, by whom alone it should be decided, whether it would be useful to the kingdom to procure a new kind of silk, instead of that of our provinces, or to have experiments made with care, which would determine the fact, and make it known whether we can succeed in raising them. All that is necessary for us to add to what we have said, is, that these worms are a source of wealth for China itself, though each year so prodigious a quantity of silk is gathered from the worms of the mulberry tree, that, according to the saying of a modern writer, mountains could be made from it. It is true that the silk of the wild worms is not to be compared to the other, and never takes permanently any die; but, in the first place, it costs less care, or, rather, scarcely requires any in the places where the climate is favorable to the wild worms, because all that is risked in neglecting them is to have a less abundant crop; yet one is master of a larger quantity by multiplying the number of trees destined for the worms. 2d, As the cocoons of the wild worms are not reeled, but spun like floss silk, much time and workmanship are dispensed with. 3d, The silk they furnish is of a fine flaxen color, lasts double the time of the other at least, and does not stain so easily; drops even of oil or greese do not spread on it, and are very easily effaced. The stuffs made of it wash like linen. 4th, The silk of the wild worms fed upon the *fagara* tree, is so beautiful in certain places, that the stuffs made of it dispute the price with the most beautiful silk stuffs, though they are plain and simple druggets. When we have said the silk does not reel, and does not take the die, it is a fact we relate. European industry, aided and enlightened by the enterprise of French genius, would, perhaps, invent the mode of reeling the cocoons of wild worms, and of dying the silk.

P. D'Incarville having neglected to put the cocoons in a cool place, had some butterflies in twelve, others in fifteen days, after the caterpillars were enclosed, that is to say: eleven months too soon. Nevertheless, there are some places where, though contrary to the institutions of nature, in general made to be followed, the common custom is to manage two crops of wild worms, one in the Spring, the other at the end of Summer.

We now come to the wild worms of the oak tree, with leaves like the chestnut tree. They are made to hatch like those of the *fagara* and ash trees; but their earliest infancy is more delicate. The wind is very injurious to them: care must be taken to raise them upon branches of oak, placed in vessels full of water, as was said above, and they must be kept in an inhabited room, well closed, and with a southern exposure: but attention must be paid to open the windows when the weather is fine. Those who think it dangerous not to accustom them at first to the open air, adopt the method of planting their branches of oak upon the edge of a river or brook, at the distance of a foot and a half or two feet; but, in order not to expose them to the fatal effects of the wind, they protect them with a shelter of strong mats on the side from whence it blows.

We have nothing particular to add upon the life they lead, and the care the worms of the oak tree require when they are carried after their first moulting to the tree where they are to finish their short career. They are exposed there to the same perils as those of the *fagara* and ash trees: they are defended in the same manner. Dryness appears to be very injurious to them. P. D'Incarville seeing his worms thirsty, presented them some water, on the end of a straw, and he saw them suck a great number of drops, without appearing to quench their thirst. Thus, the Chinese

take care to choose rainy weather to make them hatch, and the neighborhood of water to raise them. A much more important remark of P. D'Incarville is, that they can be fed, as he fed them from necessity, when the leaves of the chestnut-oak fails, on leaves of the common oak. We insist upon this point, because the oak tree of the East is uncommon in France, and because it will, perhaps, be possible to find on our common oak trees the true wild caterpillar of China, which gives silk of the second kind. P. D'Incarville says "that it is of the first class, according to the system of M. de Réaumur, like that of the *fagara* and of the ash; viz: that it has sixteen legs. The six in front are covered with a sort of shell or scale. Eight are pectoral, and two caudal. The pectoral legs or holders, are furnished with hooks, which assist the insect in climbing. Its greatest singularity is a species of brilliant scales, resembling burnished silver. Some have them over each stigmate; others have fewer or even none at all; but these last have, upon the tops of the tubercles of the third row, from the spot where the hairs grow, a crown or circle of brilliant gold."

The worms of the oak tree are slower in making their cocoons than those of the *fagara* and ash trees, and they proceed differently. Instead of bending a leaf in the form of a cup, they put two or three together, shut themselves up in them, and there spin their cocoon, which, though larger, is of a very inferior silk; for it must not be omitted, a great difference exists between the silk of the *fagara*, ash, and oak trees. That of the first is most valued: the *siao-kien* is made of it, which is very beautiful and costly. It is, however, but a species of drugget, though very fine, and of admirable use. The *tsiao-kien* is made of that of the caterpillars of the ash tree, and the *ta-kien* of the oak. If our merchants wish to buy at Canton these three species

of drugget, they must address themselves to a trusty person, for, as druggets are made of ferret silk, it is easy to impose on a stranger.

After the gathering of the cocoons, those intended for eggs must be selected for use at the end of Summer, or the following Spring; and after having strung them in the manner described, they must be hung up in proper places. There is a choice to be made among the other cocoons: this choice is made by pressing them between two fingers. Those that resist are the best, and have the most silk; those that yield are middling, and have less silk. The two extremities of both kinds must be cut with a pair of scissors, separate them, and put them in two bags of linen hemp, when they must be tied up with a pack-thread; then they must be plunged in a large kettle of boiling lie, which has been strained. This lie, which ought to be strong, must be made of the ashes of the jujube tree, or stalks of buckwheat, or of a kind of persicaria, from which indigo is obtained. When the cocoons have boiled an hour, the bag of the middling ones must be opened, to see if the lie has had the effect that is required, to unravel easily. As this lie is only intended to dissolve the glue or gum that joins the silky threads of the cocoon, European ingenuity will, perhaps, find some solvent more active and quicker. When the cocoons of the first bag are at the desired point, they must be drawn from the kettle; then those of the second bag must be examined from time to time so as not to injure them. If both be withdrawn from the kettle at the proper time, the bags must be pressed till the lie escapes, and they must then be left until the next day to dry. If they are withdrawn too late from over the fire, after having squeezed out the water, of which they are full, by pressing them in the bag, they must be spread on the hurdles to dry them.

While they are yet damp, they must be emptied of their chrysalides, and turned inside out, so as to form a kind of cowl. If one has not then the leisure for this purpose, it will repay the trouble afterwards, to soak them some time in warm water, when this work is to be done.

The cocoons emptied of their chrysalides and turned inside out, in the form of a cowl, are very easy to spin. They have only to be put again in lukewarm water, inserted one in the other, as thimbles for sewing are put, and then wound on a small distaff to the number of ten or twelve. The art of spinning is too well known in France, and we have too confused ideas to persist in the details. All that we can permit ourselves to add, is, that the Chinese are very skilful, and that to see their distaffs, spindles, and spinning-wheels, one would not believe that so fine, so clean, and regular a thread could be drawn from them. To speak, in general, the Chinese are yet in the first ages of improvement for all their instruments. Their skill improves, and their tools and instruments remain the same. Let us yet add another word on the silk of wild worms. That of the worms of the oak can be spun with a spinning-wheel; and when the silk of the worms of the *fagara* and ash trees is wanted to be of a finer thread, the floss silk is taken from about the cocoons before having them boiled: but if a person in France commences to raise the wild worms, French industry will soon discover all that is most proper to obtain an excellent profit from their labor.

It is seen with what intention we propose to make experiments, in imitation of the Chinese, upon wild silk worms of the *fagara*, ash and chestnut-oak. These experiments, which only require care, attention, and patience, can occupy, in different places, the sagacity and zeal of opulent citizens, who go to pass the fine season in the country. It is so de-

lightful to render one's self useful, and to contribute to the public abundance, that we do not doubt that many will prefer these experiments to many amusements as expensive as frivolous, which occupy the leisure of the rich on their farms. The public, to whom they will render the account of any partial successes, will compare them, improve them one by the other, and decide upon the use the common good will prescribe. Who knows if it be not reserved to some one of these experiments to enrich France, with some new kind of silk, or perhaps even to simplify the manner of raising the silk worms of the mulberry tree? For, at last, if it is more difficult to rear them on trees than the wild silk worms, it is not impossible, perhaps, in climates where the season is more favorable to them. Who knows, even, if this will not be the true means of giving to our silks a degree of perfection and beauty, which the constraint the worms labor under, deprives them of at present.

NOTICE ON THE ASH TREE OF CHINA, CALLED *HIANG-TCHUN.*

Here are distinguishable two kinds of ash trees: the *tcheou-tchun*, the stinking ash tree; and the *kiang-tchun*, the fragrant ash tree. The first has always appeared to us to be the same as ours, because we were contented with appearances, and put ourselves to little trouble to examine it nearer. What we have written on wild silk worms has made us fear we were deceived: we have examined the blossoms of that tree, they appear different to us from those our botanists describe. The petals are five in number, and

less elongated, and the stamens are in greater number, and smaller, and the pistil and receptacle to which the flowers are attached appear different. We insist upon these trifles, because we have indicated the ash tree as the ordinary food for a kind of wild worms, and that if the kind of which we have spoken, was very different from ours, the worms would not be willing to feed on them.

The fragrant ash, named in Chinese, *kiang-tchun*, is very different from ours in many respects. In as much as the leaves of the *tcheou-tchun* have a disagreeable odour, those of the *kiang-tchun* have an aromatic and agreeable smell, for those who love strong perfumes. Botanists, who have joked on what Pliny says of that tree, ought to have observed, that what is true of one kind is not always so of another, and the same species, in its individuals, perhaps, may be very unlike in different countries. The climate, soil, exposure, year, and season, have warned naturalists for a long time, that one fact concludes nothing against the other. At the first view, the fragrant ash appears to be exactly like ours; it comes in the same places, grows to the same height, the branches and stem are the same, its leaves are ranged in the same way by pairs upon one side. But in regarding it closely, it will be found that the leaves of the fragrant tree are of a brighter green, more slender, and are not terminated by a single leaf. The flowers and fruit are entirely different.

1st. The cluster of flowers is more like that of the grape, and the flowers which are of different sizes, do not bloom so much at a time, and last longer.

2d. The flower is composed of a small calix of five white petals; of four stamens, which spring from a reddish receptacle, or a small round summit; of a pistil, that comes out of the embryo fruit.

3d. The embryo, that serves as a base to the pistil, becomes a fruit, covered with a woody and hard bark, that opens in five follicles, at its maturity. Under these follicles, are ranged, upon the five faces of the pith, which is in the middle, two or three seed. These seed, formed like the wing of a fly, and almost as slender towards the point, enclose at their base a seed, of a figure that varies, but composed of two lobes which cover the germe.

If all the flowers were productive, the cluster sustaining the fruit would not be strong enough; but it is rare for a sixth part to remain. Notwithstanding where the fruit begins to enlarge and lengthen, they would be taken at a distance for a bunch of unripe grapes.

The pith, rounded at its extremity, and presenting five surfaces to which the seed are attached, is a spongy substance like the pith of the rush; but it is more compact.

The Chinese throw into boiling water the first buds and tender shoots of the fragrant ash tree, then they take them out, and steep them in vinegar, to eat with rice, as we do pickles. It must be used very cautiously, under the penalty of being covered with biles in case of impure blood.

Physicians use the leaves, blossoms, and second skin of the bark of the roots.

As the *fagara* is ranged in the class of ash trees, and from the descriptions given of it, it is probable that it is the *hou-tsiao*, of the Chinese, on which the most beautiful wild silk worms are fed, we will merely add the drawing to that of the stinking and fragrant ash trees, without any other description, because it speaks for itself.

The treatise on trees and shrubs, by the illustrious M. Duhamel, is the only book where we have found some details upon the *fagara* tree. If that of which he speaks is the same as that of China, we dare predict to him that it

will resist the winters of France, because it bears the winters of *Pe-tche-li*, which are much longer and much more rigorous. The Chinese adopt a principle in botany and agriculture that deserves to be examined. According to them, when one wishes to preserve the trees and plants of strange countries, the most studied care is necessary for the first plants; but when one has gathered seed it is easy to propagate them, above all after the second generation. If the seed of the second or third generation do not succeed, it is because the climate is not favorable to those trees and plants; they can never there naturalize them. The *fagara* tree succeeds wonderfully on the mountains in the environs of *Péking*. Perhaps our winter rains are injurious to them, and it would be advantageous to preserve their roots from dampness, by planting them on the top of a hill, with a southern aspect, and by surrounding them with a small platform, such as is made for grape arbors and accacias in many places.

FINIS.

DESCRIPTION OF THE PLATES.*

PLATE 1. *Tsan-lien*, leaves of paper on which the female butterflies have laid their eggs. Page 103.

PLATE 2. *Tsan-wang*, nets to change the silk worms. It is commonly used in the South, for silk worms of all ages. In the North it is only used when they are small. See page 136, line 18.

PLATE 3. *Sang-long*, net-work baskets, to transport the leaves. They are particularly used in the South.

Ibid. Figure 4. *Sang-kia*, instrument for cutting the leaves. The two pieces in the form of the letter V, ought to be two or three feet in height. The left hand furnishes the leaves, and they must be cut by lowering the blade with the right hand. This instrument is only used in the North of China, where the greatest quantity of silk worms are reared; this proceeding is very expeditious.

Another kind of instrument is also used, called *thsié-tao*.—It has two handles like tanners' knives; it ought to be about two feet and a half long. Use is made of it when there is a large quantity of silk worms.

In the South, when the silk worms are small, the leaves are cut with a small table knife, the blade of which is thin and well sharpened (a dull blade would cause a waste of sap from the leaves). As the silk worms grow larger, stronger knives are used.

* The original Chinese work is accompanied with forty plates. All the figures have been omitted which were already known, and only those preserved that presented a character of novelty.

PLATE 4. *Tsan-po*, frames or hurdles for removing the silk worms, or changing their litter. It is generally done at the North, where a great many more silk worms are raised that at the South. The facility of rolling and unrolling, renders them very proper for their destined use.

PLATE 5. *Ma-theou-tso*, oblong cocoon rooms. See the text, page 146.
Ibid, Figure 2. Interior hurdle of that cocoon room.

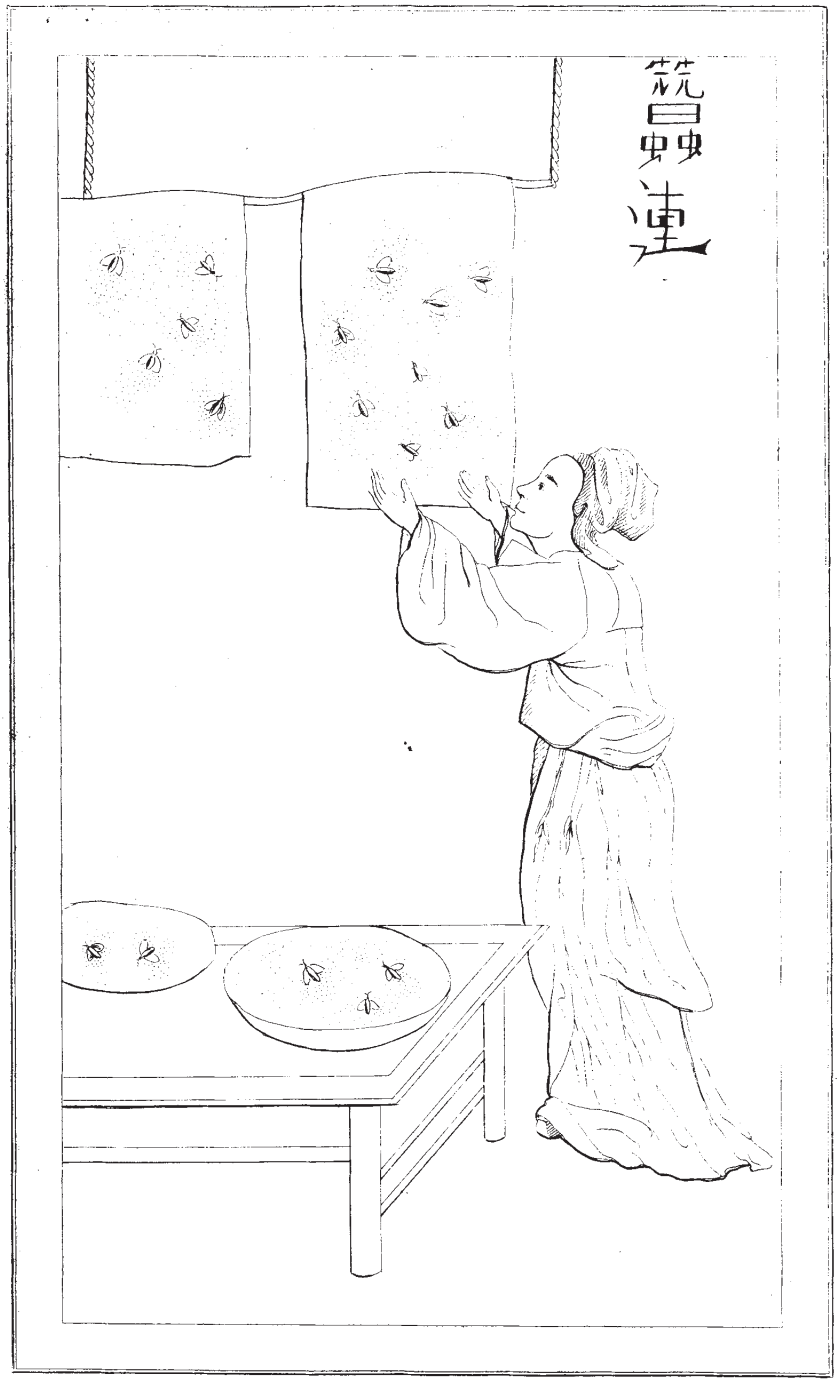
PLATE 6. *Touan-tso*, round cocoon room. See the text, page 141.

PLATE 7. *Chan-po*, cocoon room employed in the districts of *Kia* and *Hou*. See the text. Supplement, page 168.

PLATE 8. *Kien-ong*, jars where the cocoons are preserved under layers of leaves and salt. See the text, page 154.

PLATE 9. *Kien-long*, apparatus to kill the chrysalides by means of the vapor of hot water.
There are some persons, who put two ounces of salt and one ounce of rape seed oil into the hot water, in order that the silk may not dry and that it may be easier to reel. See the text, page 152.

PLATE 10. This plate makes no part of the Chinese work. We owe its communication to the kindness of M. Huzard, (of the Academy of Sciences,) who possesses a large number of drawings executed in China, relative to the raising of silk worms. This new arrangement, where the hurdles are warmed by chafing-dishes, confirms the observations developed in the article *chan-po*, of the Supplement. (Page 168.) Their method, which appears to present great advantages, differs from that of the raisers of Europe, who lower the temperature of the silk room at the time when the silk worms spin their cocoons.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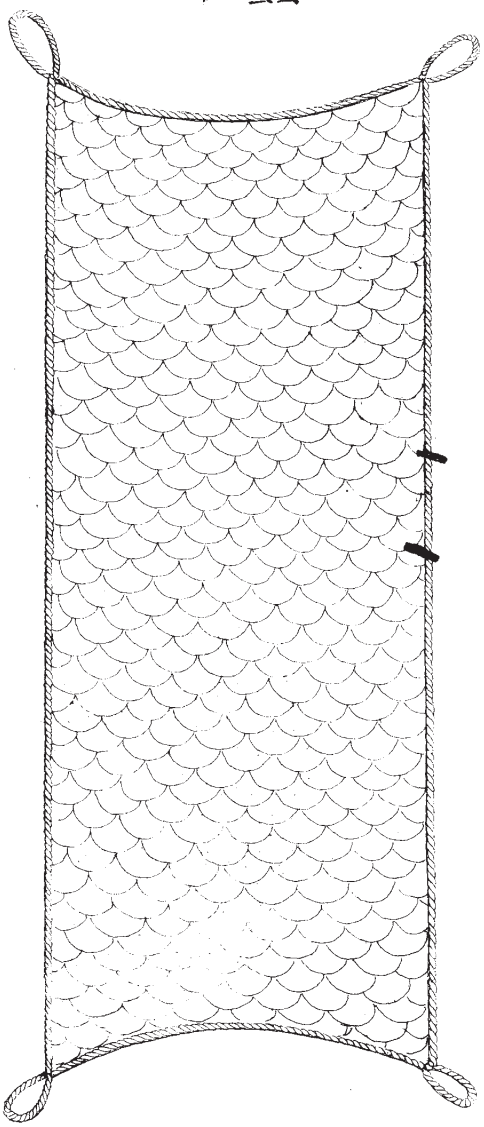

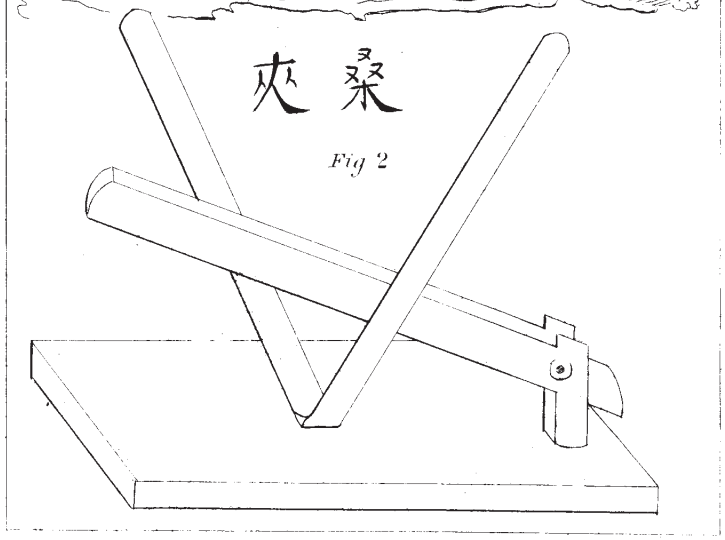

Fig 2

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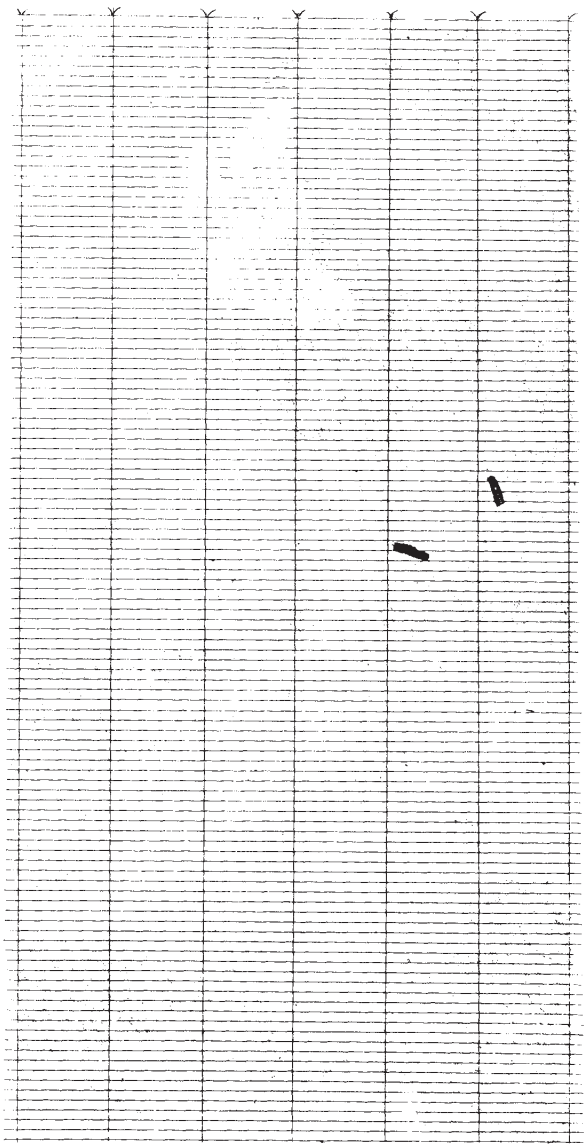

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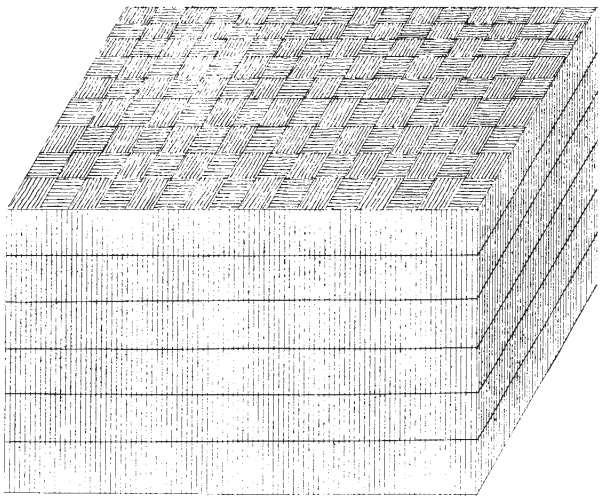

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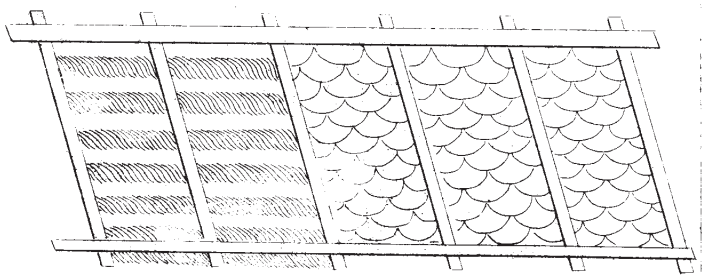

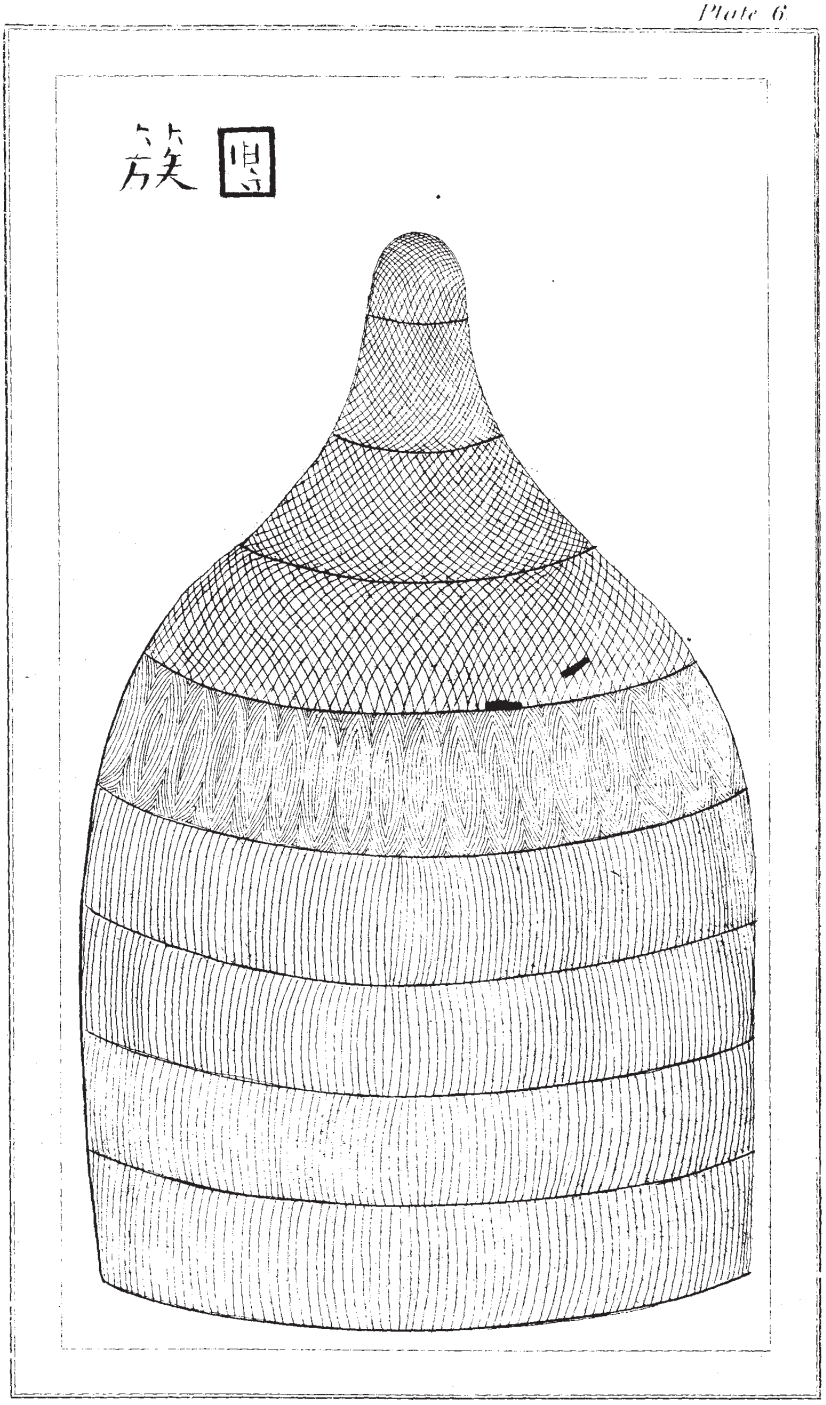

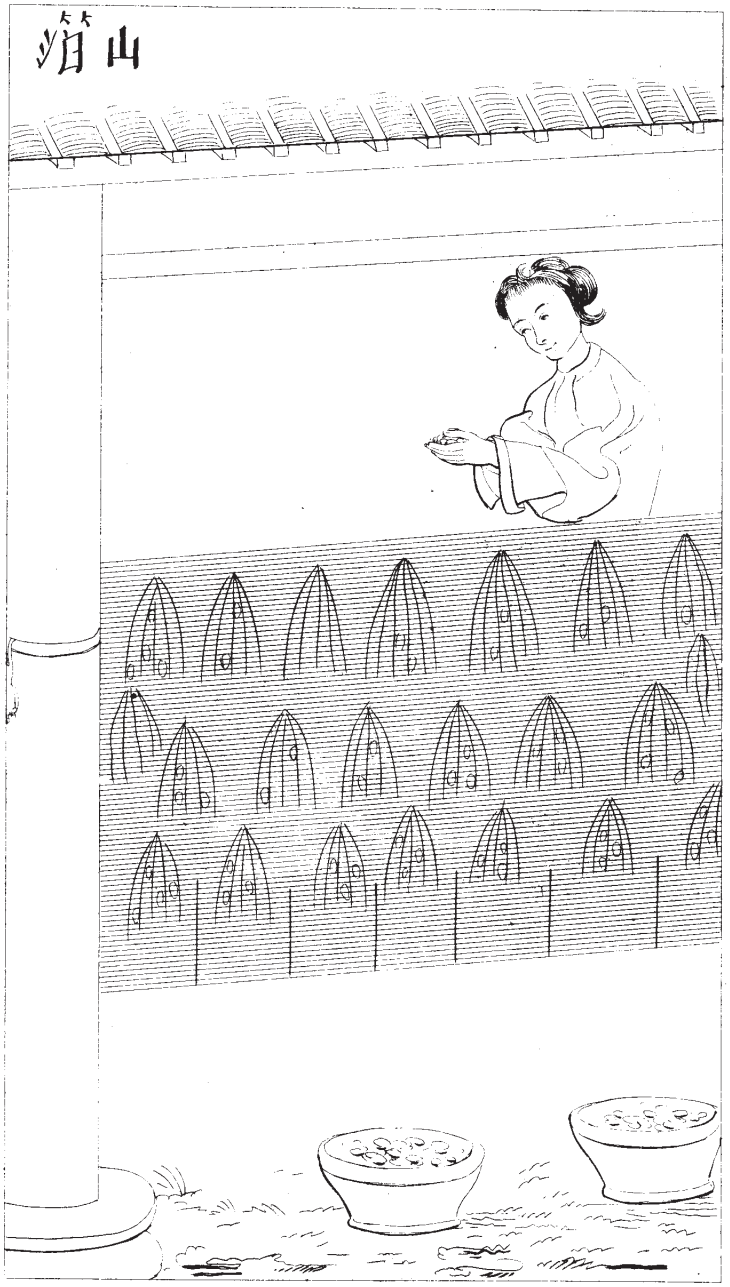
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