scientific agriculturist and what the department of Agriculture does in the direction of crop improvement for the benefit of the ryot with the knowledge of Botany it has in its possession. If Botany is studied from this point of view, I am sure you will agree with me, that the study will not only be interesting but is worth all the trouble you take in mastering it, because it would help to improve the lot of a class of people who need our help most.

THE STORY OF TEA

BY S. DORASWAMI AIYAR, B. A.,

Assistant, Messrs. Parry & Co., Ltd., (Fertiliser Dept.).

Tea is probably the most popular beverage in the world, the total consumption being some hundreds of million pounds per annum. The cultivation of this plant has enabled thousands of acres of what had been, for many centuries, waste land in many countries to be converted into valuable plantations; and the cultivation of the plant, the manufacture of tea and the commerce in tea have given lucrative employment to thousands of people.

The principal countries consuming large quantities of tea are China, Japan, the United Kingdom, the British Colonies, Russia, the United States of America and the Netherlands. The consumption in some European countries, particularly, Germany, France and Denmark and in the Asiatic countries, principally, India, Tibet, Burma and Persia has been increasing. The principal countries producing tea are China, Japan, India, Ceylon and Java.

Tea in China. Tea was known to the Chinese from very early times, even many centuries before Christ. The Chinese names for tea, *Theh* or *Tha* and *Tcha* or *Cha* occur in several ancient literary works. The word *ming* was also used to denote tea. It is said that in the middle of the fourth century A. D. Wang Meng, the father-in-law of the then Emperor, was fond of drinking tea but his friends found it to be too bitter, and that a later Emperor, Wen-ti (589—605 A. D.) was recommended by a Buddhist priest to drink boiled *ming* leaves as a cure for headache. For some centuries tea was probably used only as a medicine. It was only in the 6th or 7th century that it came to be used as a beverage. The use of tea as a beverage should have been so general in China in the 8th century that a duty was imposed on it for purposes of revenue. About the year 850 A. D. an Arab merchant who travelled in China has mentioned in his account of travels that the people of China were accustomed to the use of tea as a beverage and that the leaves were being sold in all towns.

The cultivation of tea began to increase from the 9th century and considering the enormous population and the widespead consumption

of tea among the Chinese, China must be considered as the chief tea-producing country in the world. In fact "China" and "Tea" have been inseparably associated. In China, tea is grown mostly on small farms of even 4 to 5 acres each. It is said that practically every cottager has his own little tea garden to supply the wants of his family and any surplus is sold. Tea estates or plantations, as we understand the terms, are very few. The methods and appliances employed by the Chinese in the manufacture of tea are very simple and practically the whole of the manufacture is carried out by the hand.

For centuries, the Chinese have been making "black tea" and "green tea". It was supposed that these were products of two species, *Thea bohea*, producing the black tea and *Thea viridis*, green tea. It was only in the middle of the last century that it was established that the question of green and black teas, as also the various qualities of these, was a matter of soil, age of leaf used and method of manufacture, and not to there being two botanically different species. In the Russian and North American markets green tea has been in demand and as the green tea prepared by the Chinese lacked the vividness of colour, artificial colouring of green teas was practised. Gypsum and Prussian blue are the most commonly used for this colouring or "facing" as it is called. The colouring is effected by thoroughly mixing the tea with a compound of calcined gypsum and Prussian blue. From 1911, however, the American market was closed to such artificially coloured teas. It is said that the Chinese themselves never use the artificially coloured teas.

Teas for home consumption and for the Chinese community abroad are often scented. Finished tea has the property of absorbing odours and the fragrant flowers of jasmine, orange and roses furnish the perfume. The flowers are moistened and mixed with the tea in varying proportions and the two left in contact for 10 to 14 hours, the heaps being covered with a cloth. The tea rapidly absorbs the perfume. The flowers are removed and the scented tea is then blended with unscented tea, the mixture being perfumed throughout.

For a very long time China was having a good overland trade in tea with Tibet, Siberia and Russia. In the absence of roads tea had to be carried on men's backs and so it was an advantage to have it in as compact a form as possible. Consequently the manufacture of "brick tea" became popular from very early times. Besides the compactness there is also the advantage that the quality and character of the tea are better preserved. For Tibet the brick tea is made from very cheap and coarse teas, including even stalks and twigs, and for Russia, "tablet tea" or small bricks are made using green and black tea dusts. The bulk of the dust used for these is of Chinese origin but during the past few years large quantities of siftings and dust are imported from India, Ceylon and Java.

During the past few decades the export trade of tea from China has been declining owing to the increase in production in other countries, particularly, India, Ceylon and Java and owing to the change in the taste of the people, particularly of the British Isles who prefer Indian and Ceylon teas to the Chinese. In 1864 the proportion of China tea in the world's exports amounted to 97%, while in 1911 it was only 24% and at the present time it is still lower. There is, however, a steady market for China tea in Russia and Tibet.

Tea in Japan. There is an interesting legend about tea. Dharma, a celebrated hermit, held in sanctity in Japan and China, was doing severe penance and had remained seated on the hard ground fourteen years without moving his body. He had also forbidden himself sleep. One night, however, he fell asleep. Indignant with himself for this weakness he cut off his eyelashes and cast them away, "as miserable tempters, sullying the sanctity to which he aspired." It is said that his eyelashes took root in the place where they had fallen and a bush shot forth, bearing leaves which the people of the country picked, and whereof they made an aromatic infusion which chases away sleep.

There is no doubt that tea was introduced into Japan from China in the ninth century. Its cultivation on an appreciable scale probably took place in the thirteenth century. As in China, tea is grown in small plots by peasants but there are also some large plantations. The Japanese exercise greater skill in cultivation and manufacture of tea than the Chinese. The methods of manufacture are more improved and machines of a simple type are largely used. The tea produced in Japan is the green tea. The principal markets for Japanese tea are Canada and the United States.

There are some peculiarities in the cultural methods adopted in Japan. Tea is frequently grown in continuous hedges, a few feet apart, and not in separate bushes as in other countries. This method is said to result in heavy crops. Instead of pruning the bushes, they are clipped with shears after the main plucking. In the Uji district there is the remarkable practice of growing tea under artificial shade, the effect being the production of a better quality of leaf and of a darker green colour. Bamboo poles are fixed at intervals and arranged to support a suitable frame-work, over which bamboo mats or straw are spread. This provides shade to the growing plants. After the crop has been plucked the matting and straw are removed. The shade grown tea is greatly valued by the Japanese and it is grown practically for home consumption. Tea is often grown interplanted with mulberry, plums and pears. It is said that the area under tea has been declining owing to the greater interest taken in mulberry plantation.

Tea in Formosa. Cultivation of tea was introduced into Formosa early in the nineteenth century by some Chinese immigrants. But it was only in the seventies of the last century that tea planting was

carried on extensively. Like China and Japan, most of the tea gardens in Formosa are small and owned by peasants. The most noticeable feature in the cultivation of tea in Formosa is the practice of layering adopted on a large scale. It is said that nearly three-fourths of the tea grown in Formosa have been raised not from seed but from layers. It is believed that propagation by layering retains unimpaired the specific qualities of the tea and that deterioration sets in if the plants are raised from seed. Formosa produces the famous "Oolong teas" which have a distinctive flavour and possess a great reputation, especially, in the United States.

Introduction of Tea-drinking in Europe. There is no doubt that tea drinking was very common in the 16th century in China and Japan and that China must have had considerable export trade in tea for a very long time. In all probability Russian traders might have been the first to introduce tea in Europe. The first treaty between China and Russia was made in 1590 but no mention is made of tea in it. It is said that the Chinese Embassy took some chests of tea as presents to the Russian Court and that the Czar was so pleased with it that he sent a special messenger every year to the Chinese frontier to obtain a supply.

The use of tea had spread to the East Indies from China and Japan. It was conveyed to Holland by the Dutch East India Company. From Holland it was carried to England about the middle of the seventeenth century. In the *Mercurius Politicus* of September, 1658, there was an advertisement of the "China Drink called by the Chineans *Tcha*, by other nations, *Tay* alias *Tee*" as being sold in London. Thomas Garway was the first tea-dealer in England and in 1659 and 1660 he sold tea at prices varying from 15s. to 50s. per lb. In 1660 tea drinking was also general that an Act of Parliament imposed a tax of 8d. on every gallon of tea, coffee and chocolate made for sale. There is an entry in Samuel Pepys' diary for the 28th September 1660 which reads "I did send for a cup of tea (a Chinese drink) of which I had never drunk before" and "Home, and there find my wife making of tea, a drink which Mr. Pelling the Pothicary tells her is good for her cold and defluxions".

The East India Company began to take interest in tea. In 1664 the Company presented King Charles II with two pounds and two ounces of tea. The first importation by the Company was in 1669 and it consisted of two cannisters containing 150 lbs. In 1677 the Company had taken steps to secure regular supplies, the total quantity imported that year being 4,713 lbs. and it was at that time thought worth their attention as a branch of their trade, as tea was then sold in London at £ 5 to £ 10 per pound. The supplies of tea were got *via* Madras and Surat and not direct from China.

carried on extensively. Like China and Japan, most of the tea gardens in Formosa are small and owned by peasants. The most noticeable feature in the cultivation of tea in Formosa is the practice of layering adopted on a large scale. It is said that nearly three-fourths of the tea grown in Formosa have been raised not from seed but from layers. It is believed that propagation by layering retains unimpaired the specific qualities of the tea and that deterioration sets in if the plants are raised from seed. Formosa produces the famous "Oolong teas" which have a distinctive flavour and possess a great reputation, especially, in the United States.

Introduction of Tea-drinking in Europe. There is no doubt that tea drinking was very common in the 16th century in China and Japan and that China must have had considerable export trade in tea for a very long time. In all probability Russian traders might have been the first to introduce tea in Europe. The first treaty between China and Russia was made in 1590 but no mention is made of tea in it. It is said that the Chinese Embassy took some chests of tea as presents to the Russian Court and that the Czar was so pleased with it that he sent a special messenger every year to the Chinese frontier to obtain a supply.

The use of tea had spread to the East Indies from China and Japan. It was conveyed to Holland by the Dutch East India Company. From Holland it was carried to England about the middle of the seventeenth century. In the *Mercurius Politicus* of September, 1658, there was an advertisement of the "China Drink called by the Chineans *Tcha*, by other nations, *Tay* alias *Tee*" as being sold in London. Thomas Garway was the first tea-dealer in England and in 1659 and 1660 he sold tea at prices varying from 15s. to 50s. per lb. In 1660 tea drinking was also general that an Act of Parliament imposed a tax of 8d. on every gallon of tea, coffee and chocolate made for sale. There is an entry in Samuel Pepys' diary for the 28th September 1660 which reads "I did send for a cup of tea (a Chinese drink) of which I had never drunk before" and "Home, and there find my wife making of tea, a drink which Mr. Pelling the Pothicary tells her is good for her cold and defluxions".

The East India Company began to take interest in tea. In 1664 the Company presented King Charles II with two pounds and two ounces of tea. The first importation by the Company was in 1669 and it consisted of two cannisters containing 150 lbs. In 1677 the Company had taken steps to secure regular supplies, the total quantity imported that year being 4,713 lbs. and it was at that time thought worth their attention as a branch of their trade, as tea was then sold in London at £ 5 to £ 10 per pound. The supplies of tea were got *via* Madras and Surat and not direct from China.

The annals of the East India Company record that in February 1684 the Directors wrote to Madras in these terms :— "In regard *thea* is grown to be a commodity here, and as we have occasion to make presents thereof to our great friends at Court, we would have you yearly to send us five or six cannisters of the very best and freshest that which colours the water in which it is infused most of a greenish complexion is best esteemed."

The import of tea was a private monopoly of the East India Company. The imports began to increase steadily and in the closing years of the seventeenth century it was said to average about 20,000 lbs. a year. In 1703 the imports were about 100,000 lbs. ; in 1721 it attained 1,000,000 lbs. It is said that during the 100 years from 1710 to 1810 the sales of tea by the East India Company amounted in the aggregate to 750,470,016 lbs. valued at about £ 130 millions sterling.

By an Act of Parliament the monopoly of the East India Company was abolished in 1833 and since then owing to unrestricted trade, competition was stimulated and prices fell greatly. At the same time the taxation on tea was also gradually reduced. As a result of all these the consumption of tea increased. In 1836 the consumption was about 40 million lbs. while in 1880 it had increased to 160 million lbs. and at the present time it is about 500 million lbs.

Tea in India. On account of the very profitable nature of the monopoly of the China tea trade enjoyed by the East India Company, the question of growing tea in India did not present itself to the Company for several decades. Difficulties with China induced the British Government to urge strongly on the East India Company the desirability of raising tea in India. In 1780, seed was got from China and planted in Calcutta by Captain Kyd. But no progress was apparently made. In 1788, Sir Joseph Banks made a suggestion to Warren Hastings that tea might be grown in Bihar, Rangapur and Chich-Bihar but the suggestion was not acted upon for some years. In the meanwhile, between 1821 and 1826 tea plants were discovered by Major Bruce and Mr. Scott in parts of Assam and Manipur. But serious attention was not paid to these discoveries. In 1834, Lord William Bentinck took up the matter and appointed a Committee to report on the most hopeful situations for an experimental cultivation of tea. Mr. Gordon was sent to China to procure seed and plants and to bring to India a few Chinese growers. In the meantime, the wild tea of Assam was re-discovered by Jenkins and Charlton. Gordon was therefore recalled from his voyage to China. A Commission was sent to Assam to report on the indigenous tea. They could not agree as to the plant met with in Assam and they recommended that for the purpose of the experiment "the China plant and not the degraded Assam plant" should be used. Gordon was sent again to China but he resigned without making a report.

A third mission was sent to China under the guidance of the botanist, Mr. R. Fortune, expenses of which were partly borne by the Royal Horticultural Society of England. The mission was successful. The true nature of black and green teas over which there was a controversy for many decades was explained. Mr. Fortune wrote three valuable books which contain full particulars of the Chinese tea industry and also details of the seeds, plants etc. conveyed by him to India. Experimental plantations were laid out in the district of Kumaon, in the Himalayas, and in Assam. The Government gradually ceased to take direct interest and the plantations were made over to private enterprise. The Sibsagar plantations were sold to the Assam Company in 1840 and this is the first tea concern in India.

The first consignment of Assam-made tea was sent to London in 1838 and it consisted of 488 lbs. and it fetched a price of 9 s. 5 d. per lb. This was manufactured under many disadvantages and consequently it did not afford any fair criterion as to what the possibilities of the future would be. The report of London experts was quite satisfactory although the tea had different characterisitics from those of China teas. The *Asiatic Journal* of those days had the following remarks about the British Indian tea.

> " The decision of the public, however, has not been unanimous. Ladies particularly those of mature age and judgment, whose jurisdiction in all matters connected with the tea-table ought not to be disputed, were enthusiastic in their praises of the new tea, but many of the lords of creation, especially stout gentlemen, whose previous habits had better qualified them for discussing the merits of port wine and bottled porter, compared it somewhat irreverently to chopped straw, and some pleased to display their facetitiousness by observing that a mixture of gunpowder was wanted to make it go off ."

In the fifties of the last century tea cultivation appeared to be so promising and attractive that speculators eagerly rushed into it. In a few years the whole of the upper portion of the province of Assam was under tea. Tea planting extended to Darjeeling, Chittagong and Chota Nagpur. It also began to extend to the Nilgiris, Wynaad and Travancore in South India.

From the seventies tea cultivation has been making good progress. The total production of tea in India is over 500,000,000 lbs. annually. The production in S. India alone is 65,000,000 lbs.

During the past ten years the production of tea in all the tea-growing countries had exceeded the demands and consequently prices fell so much that tea growing appeared to be unprofitable. In order to stabilise the industry there has been, during the past five years, an international agreement to restrict production and to control exports. This has worked so well that the industry has again become a fairly profitable one.

An interesting feature of the tea industry in India is the organised efforts of planters to increase the sales of their tea. For this there is a cess fund. At first this was a voluntary levy on the planters coupled with a contribution from the Government for the purpose of advertising Indian tea. This was done from 1893 to 1903 when a Tea Cess Act was passed making compulsory a small tax on all exported tea. The fund is administered by a representative committee and it is expended on many forms of advertisement both in India and abroad in order to enhance the demand for Indian teas. Considerable success has attended these efforts in the United States and Russia and in some countries of Europe. Consumption of tea in India itself has increased on account of this advertising. In South India alone, the consumption of tea was 4,027,107 lbs. in 1925 and 13,876,268 lbs. in 1936.

Tea in Ceylon. Up to the middle of the last century coffee cultivation was the most important in Ceylon, but, in the sixties, a terrible fungous disease (*Hemileia vastatrix*) ravaged the coffee plantations and in a few years the "leaf disease" had ruined many plantations. The planters turned their attention to other crops such as cinchona, cardamoms, cacao etc. but without much success. Then they turned their attention to tea and this retrieved their position. In fact, the modern tea industry of Ceylon was built upon the ruins of coffee-planting.

Although tea had been planted in Ceylon in 1839 and 1841 the first regular plantation was opened only in 1867. For a few years the increase in acreage was not very marked but from 1877 it began to increase rapidly. In 1877 the acreage was only 2,720; by 1887 it had come to 170,000 and in another decade to 350,000. Now there are 450,000 acres under tea in Ceylon. Some of the plantations are interplanted with rubber.

Tea in Java. Tea was introduced into Java by von Siebold in 1826. In 1828 the Dutch Government assumed control of the industry and established plantations which were let out on contract system whereby the finished tea was sold to the Government at a fixed price. This system did not work satisfactorily as contractors cared more for the securing of large quantities of tea while the quality of tea and the permanent well-being of the plantations were not cared for. The contract system was therefore abolished in 1860.

In 1852-53 Jacobsen imported better seed from China and practically laid the foundation of the modern tea industry in Java. In 1878 the "Assam Indigenous" variety was imported from India and from that date the Chinese tea has been replaced by the Indian tea. The climate and soil conditions are favourable. The average yield is very good but the quality is only medium. In Java modern machinery and methods are adopted for the manufacture of tea. From 1890 the industry has been expanding rapidly. Holland is the chief market for

Java tea but exports are made to Australia, the United Kingdom and Russia.

Tea in other Countries. In Africa, tea is produced in Natal and Nyassaland. It is, however, not of much importance. The bulk of the production is consumed locally. In Russia, tea is grown on a small scale in the Caucausus. Chinese varieties are found to be the best suited to the country. Tea-growing in the United States has been the subject of experiment for nearly a century. There are a few plantations in Carolina and Texas. Tea is grown on a small scale in Jamaica. It has also been grown in several localities in the Malaya. In Malacca and the French colony of Annam tea is grown to some extent. Small quantities are also grown in Mauritius, Fiji and the Andamans.

In Burma and the Shan States a peculiar form of tea is prepared known as the "Letpet" tea which is only consumed locally and not exported. It is used as a vegetable and only rarely used as a material for infusion. The young leaves are thrown into boiling water and allowed to remain for some time to get softened. They are then taken out and rolled by hand and then rammed down tight into the hollow of a bamboo and the top closed with a stopper of leaves. After standing in the shade for a couple of days with the stoppered end down, to drain off any water, the stopper of leaves is removed and the portion above the rammed in leaves is filled in with ashes mixed with a little water. The bamboos are buried underground until the "letpet" has matured. The tea pickled in this way is eaten with a little oil, garlic, fish, etc.

Other Teas and Tea Substitutes. Among the other "teas" the most important is the "Paraguay tea" or "Yerba de Mateē". This is prepared from the leaves of *Ilex paraguariensis* a shrub belonging to the holly family. It is found commonly in Brazil and Paraguay and in these countries it is also cultivated on a large scale, even as regular plantations. It is one of the most important economic products of South America and several million pounds of *matē* are used in the S. American countries and in small quantities even in Europe.

The "black drink" of the North American Indians known as "Youpon" is prepared from *Ilex cassine* found in the eastern and southern shores of the United States, for some distance inland.

The "Bushman tea" of South Africa is prepared from *Cyclopia genistoides*. "Bourbon tea" known also as "Faham tea" is derived from *Angraceum fragrans* which is found growing as an epiphyte on the trees of the forests of Bourbon and Mauritius. The green leaves of this have a persistent vanilla-like odour.

During the Great War many substitutes for tea appeared. It is said that a "*German Tea*" was prepared in 1917 by the consumers themselves and consisted of mixtures of leaves of myrtle, raspberry, strawberry plant, bramble, flowers of the lime, of heather, woodruff and camomile. The fruits of wild rose, apple peelings and dried apples were made use of. A special brand of tea consisted of "a chopped mixture of the flower of lavender and elder, liquorice root, leaves of coltsfoot, of the strawberry plant, of bramble, birch and water mint."

ROLE OF INSECTS IN RURAL RECONSTRUCTION

BY M. C. CHERIAN, B.A., B. Sc., D. I. C.,
Government Entomologist, Coimbatore.

Introduction. It is proposed to place before you a few items of work which could find a place in any programme of rural reconstruction, viz., beekeeping, Eri silkworm rearing, control of crop pests and sanitation. These subjects will show the part played by insects in rural reconstruction. They have been specially selected as the Entomological section is doing work in this direction.

Beekeeping. It will be admitted by every one that the lot of the ryots in these days is not an enviable one. The income from agriculture being poor, he has to look to other avenues to enhance his earnings. Beekeeping on scientific lines offers great scope as a cottage industry.

In the limited time at my disposal it is not possible to describe in detail the habits of the honey bees, how the different members of the colony are produced, their varied duties and the perfect organisation of a bee colony. I think, however, a few words should be said about the advantages of beekeeping as a subsidiary industry. In the first place this industry does not require much capital and this is a point in its favour especially in a country like India. A few hives and a honey extractor are the only important appliances needed for starting beekeeping and these require only a small outlay. A teakwood hive costs only Rs. 3 to 3—8—0 and a honey extractor depending on the size and metal used costs from Rs. 2—8—0 to Rs. 9. The small extractor costing Rs. 2—8—0 devised by the section is quite enough for a ryot owning a few hives. A hive is capable of yielding 15 to 20 lbs. of honey under favourable pasturage and weather conditions. Even if the average is taken only as 6—7 lbs. at the present price Rs. 7 to 10 may be got per hive per annum. It will thus be seen that this industry is a profitable concern.

In the second place, in many parts of our Presidency there is no dearth of bees or bee pasturage. The Indian bee can be procured without much difficulty. The bee paturage plants are also available in most of the districts throughout the year.

In the third place, the training required in beekeeping is not of a complicated nature. A working knowledge of the various items in the management of bees such as catching swarms and wild colonies, fighting against bee enemies, care of the colonies during the lean as well as the breeding seasons, extracting and storing honey, etc., can be gained in about a month. It is always safe to begin with a few colonies and increase them later on after gaining more experience.

Apart from giving us honey the bees are good pollinators and this is an additional reason for rearing bees. This aspect of their good work is not realised by many. The fruit grower and the florist have to depend mainly on insects for their pollination and among insects honey bees are the best.

Yet another reason why beekeeping should be practised is that honey is a good food in itself and also of medicinal value. Miss Kennedy Bell, an authority on beekeeping and one who was chosen by the British Broadcasting Corporation to deliver a course of lectures on beekeeping states as follows about honey.—"Honey is not and should not be considered as a luxury. It is a first class food and should be used as daily article of diet by every family ; it has been predigested by the bees and hence its purity and excellence. Cane sugar is actively poisonous to many people if it is taken in any quantity and to all if taken in large quantity ; but honey acts as normal producer of heat and energy. The value of honey cannot be over-estimated for children, invalids and aged, also for the ordinary hardworking man and woman. It is an easily assimilated food and as it is predigested by the bees it is of special benefit to weak digestive organs of elderly people. Every body can eat honey with impunity and digest it when often he cannot touch any other sweet food." Honey is also said to have medicinal properties and some of the publications on *Ayurveda* bear testimony to this fact.

There is yet another product of the honey bees, namely, wax. In scientific beekeeping, however, the wax combs are used over and over again for rearing brood and storing honey. It is not destroyed as in earlier days when honey had to be squeezed out of the combs.

After having stated the advantages of beekeeping, let me very briefly narrate to you the work of the Department under three heads—research, propaganda and training.—At the instance of the Director of Agriculture, Madras, an Apiary was started by the Government Entomologist during 1931 and there are at present about 40 bee colonies in working condition. The more important of the various items of research consist of the study of bee pasturage plants, bee enemies and their control, artificial feeding of bees, trials of range of flight, acclimatising the hill bee on the plains, bee appliances, etc., and very interesting results have been obtained from these lines of investigations. In addition to research, a good deal of propaganda is also being done by the section and the district staff. Demonstrations in hiving bee

colonies, and in the care and management of bees, etc., are being held in different parts of the Presidency. Bee colonies, samples of pure honey as well as the necessary apicultural requisites are being exhibited in most of the exhibitions and fairs and these, as a rule, attract numerous visitors—Attempts are also made to sell as many hives, extractors, etc., as possible to the public. Literature on bee-keeping—scientific as well as popular—is being published. To meet the numerous demands for advice from the public a popular account of the subject was prepared by Mr. S. Ramachandran, Assistant in charge of the apiary and published as bulletin No. 37 of this Department and a revised second edition of the same has already been issued. A Tamil translation of the above bulletin is also being got ready. As these are priced publications a short pamphlet on "Practical hints on beekeeping" has been prepared recently and sent to the press. Special mention should also be made of the "Honey Week" organised by the Section in April last and conducted throughout the Presidency. In addition to research and propaganda, about 25 students are trained every year in the theory and practice of bee culture. Besides these students, 27 departmental officers were trained during last year and it is hoped that these officers will try their best to popularise the industry in their respective sub-circles.

Ericulture. The silkworms are yet another of the useful insects. The two important worms in this Presidency are the Mulberry and Eri silkworms, and as there is a paper on the former by Krishnamurti* a few facts about the latter alone are given here. Ericulture has also some scope as a cottage industry. The worms are fed on castor leaves. The silk produced by them though not as good as mulberry silk is stronger, finer and more durable than cotton. Unlike mulberry silk, the thread is not continuous and as such it should be carded and spun like cotton.

The acreage under castor in this Presidency is about three lakhs. As the crop is grown by many ryots there will not be any dearth of food plants. The climatic conditions are such that the worms can be reared in many places throughout the year except for two or three months during the hot season. The necessary rearing appliances are not costly either as these consist of a few bamboo trays for rearing worms, a few baskets for placing the mature worms for spinning cocoons and a shelf for keeping rearing trays. The worms are fed at regular intervals but feeding them is not a difficult process. One advantage in the rearing of eri worms is that no life is taken and the moths are allowed to come out of the cocoons. This is not so in the case of mulbery worms where the thread produced is a continuous one and as such the pupae will have to be stifled to prevent the thread being broken by the emergence of adult moths.

* *The Madras Agricultural Journal*, 25; 239—244 (1937).

Now a word about the economics of ericulture. An acre of castor yields between 6000 and 8000 lbs. of leaves. About 80 lbs. of leaves will be required to feed sufficient worms to produce 1 lb. of cocoons. Taking 6000 lbs. of leaves per acre we get 75 lbs. of cocoons. One maund (82 lbs.) of pierced cocoons sells at Rs. 55 to 60 in Assam.* It should, however, be stated that one drawback at the present time is that there is no market for cocoons in Madras. The Industries Department when addressed on the subject has stated that in case the silk is spun into cloth they will try to find a market for it. Perhaps the formation of co-operative societies for the purchase of cocoons and spinning cloth will solve the problem.

Control of Crop Pests. Till now we have been dealing with insects which help us in rural reconstruction. It should, however, be remembered that there are many insects which devastate our crops and are thus our enemies. The work of the Entomologist is a continuous struggle against these marauders but thanks to the researches into the life histories and habits of these insects it has been possible to cope with many of them. Especially is this so in the case of kitchen garden crops grown in villages near important towns. In such places there is great scope for growing vegetable crops and flower plants. Pests, such as plant lice on lablab, *Epilachna* on brinjals, *Papilio* caterpillar on curry leaf, the cabbage caterpillar (*Plutella*), cockchafer beetles on roses, the jasmine bug, the chrysanthemum caterpillar, etc., can be dealt with by agricultural, mechanical and insecticidal methods and as such the growing of the crops should prove to be a remunerative concern.

Sanitation. It is a well known fact that insects are very important in connection with disease. Malaria, yellow fever, filariasis, etc., are transmitted by mosquitoes. Sleeping sickness, a terrible disease prevalent in Africa, is transmitted by tsetse flies. Fleas have a great part to play in the spread of plague, and bedbugs are accused as carriers of Kala-azar fever. The house flies are responsible to a great degree for the spread of diseases like typhoid (enteric), dysentery, cholera, tuberculosis and diarrhoea. Howard, the well known entomologist, in one of his publications, states that the house flies should be known as typhoid flies, so as to focuss the attention of the public on these extremely dangerous insects. There is no exaggeration in saying that house flies are the filthiest of insects and their habits the most disgusting. They breed in all sorts of filth, human excreta, decaying vegetable and animal matter, manure heap, etc. They feed on the matter contaminated with germs and then settle on our food and infect it with germs carried on the different parts of their body. It has been found by examination that six million germs have been carried by a house fly. I am sure every one will agree with me that

* Messrs. Haribuksh Lachminarayan, Fancy Bazar, Gauhati will be willing to purchase cocoons at the above rates, Gauhati delivery.

the flies which carry such huge numbers of germs are a danger to public health, and those who kill them should be regarded as good citizens doing service to humanity in general and to themselves in particular. Some work has been done in connection with the control of house flies by the Entomology section. The use of what are known as 'Minnesota' and fly maggot traps has given some measure of success. The former devised by Washburn for trapping adult flies is about 2 ft. long, 1 ft. high and 8" wide. It consists of three portions, a base board with two bait pans, another board which carries two wedge shaped structures having wire gauze sides open at the top and bottom and a wire gauze cover for encapping the adult flies trapped. Baits are placed in the two receptacles and flies attracted by the bait enter through the space between the two boards and feed on it and later, fly up through the slits and are practically imprisoned inside the wire gauze receptacles. Jak fruit, sugarcane, meat, fish, etc., were tried as baits and of these fish, slightly putrified gave the highest catches. In one day as many as 6081 flies were caught in one of these traps. The cost of the trap is Rs. 5 and the cost of meat or fish used as bait will be about 4 to 6 annas per month.

The fly maggot trap as the name implies is for trapping maggots. It consists of a wooden frame work enclosed by wire netting all round and is open above for dumping in manure. This is provided with a zinc drain filled with water. The maggots which breed in the manure heap in the course of their wanderings fall into the drain and are drowned. The trap is to be gradually filled with manure until it is full. Assistant Entomologist, T. V. Subramanya Ayyar has been conducting certain experiments to make the dung more attractive to the flies for egglaying. Of the various substances tried by him such as citronella oil (at a strength of $\frac{1}{4}$ oz. per gallon of water) and gingelly oil cake (3 ozs. per gallon of water soaked overnight) were found to be the most effective. Of the two, gingelly oil cake being easily available and cheaper, should be preferred. A galvanised iron sheet, bent along the length and hung up a little above ground level and filled with manure as in the other case has been found to serve the same purpose. In this case the maggots travel along the length and drop down at the ends and can be trapped in mud chatties below the two ends.

It has to be admitted in this connection that traps such as those mentioned above help the reduction of flies only to a limited extent. The most important thing however is to attend to the breeding places of flies. The proper disposal of night soil, village and town rubbish etc., will to a great extent solve the problem for which the co-operation of the health officers is necessary.

Conclusion. There are other ways as well in which insects affect man but I hope I have placed enough material before you to show the part played by them in rural reconstruction.