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DECEMBER, 1922

THE LINGNAAM
AGRICULTURAL REVIEW



COLLEGE OF AGRICULTURE
CANTON CHRISTIAN COLLEGE
CANTON, CHINA
1922

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THE LINGNAAM AGRICULTURAL REVIEW

Published by the College of Agriculture

Canton Christian College

C. O. LEVINE, M.S. EDITOR

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LING NAAM AGRICULTURAL REVIEW.

The agricultural work of Canton Christian College was inaugurated in 1907 when the first agriculturist was appointed to the college staff. The work grew steadily from small beginnings until 1921 when it was greatly enlarged in scope by a liberal appropriation from the Kwangtung Government. In the fall of 1921 the College of Agriculture was effected. The work is now organized in four divisions: Education, Extension, Industries, Research and Experiments; and five departments: Agricultural Manufacturing, Agronomy, Animal Husbandry, Horticulture and Sericulture.

In the past the research work in agriculture carried on at Canton Christian College was published in bulletin or book form or in such publications as the Philippine Journal of Science, Journal of Dairy Science, Journal of Heredity and the Lingnaam Magazine (Chinese). Hereafter such work will be published in the Review. It is also urged that others in the Orient who are doing work related to agriculture will contribute papers for publication.

In the beginning the Review will be published twice a year only. Later, when there are more workers in the field, it may be advisable to change it to a quarterly or monthly publication.

THE WATER BUFFALO FOR DAIRY PURPOSES*

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Canton Christian College, Canton, China.

(Received for publication, June 1, 1922.)

HISTORY OF THE WATER BUFFALO.

The original home of the water buffalo (*Bubalus bubalis* Lyd.) is not definitely known. Credit for the first domestication of this class of bovine is probably due to the people of northern India where today the undomesticated form still exists, although in small numbers.

At an early date the water buffalo was domesticated and had reached what is now southern and southwestern China. Chinese literature refers to it as having been used as a draft animal and as a source of beef for centuries by the farmers of southern China.

PRESENT DISTRIBUTION

Today the water buffalo, as a domesticated animal, is common in practically all of India, Siam, Malay States, Indo-China, southern China as far north as Shanghai, the Philippine and Hawaiian Islands and other islands of the Pacific Ocean. From the Hawaiian group they have been imported into Brazil in South America. At an early date, as early as 600 A. D., according to some writers, they reached southern Europe, where to-day, in Italy, they may be found plowing the small fields of the Neapolitan farmers. Great numbers are kept on the bottom land of the Danube, the Theiss, and the Drave in Austria and Hungary, and in Italy on the plains lying to the north and east of Naples. Indian dairy breeds have been introduced into Trinidad, where they are used as draft animals and are both worked and milked by Hindu coolies (1). No attempt has ever been made to introduce them into the United States.

Wild buffaloes are still to be found in India, in the grassy jungles along the large rivers of that land, and in the open, marshy prairies. The finest specimens are in Assam and Burma, and in the Straits Settlements, Java, Ceylon, Sumatra and Borneo (1). A wild form, different from the Asiatic species, exists in parts of Africa.

*Part of the data in this paper has been published in various journals and bulletins (See reference 4 at the close of this paper).

GENERAL DESCRIPTION

When compared in size with other classes of animals in the bovine group, the water buffalo is a relatively large animal. The average size for mature animals of the beef-draft type, which is the type common in China and in the islands of the Pacific, is between 800 and 1,400 pounds. In height, they vary from 46 to 50 inches at the withers. The dairy breeds of northern and central India, especially those in the region of Delhi in the Bombay presidency, are much larger in size (2). A herd of thirty cows of this breed in Kowloon, near Victoria, Hongkong, which were studied by the writer in 1918, and again in 1921, varied in height from 56 to 60 inches at the withers. The weight of this breed is considerable more than that of the beef-draft type common in China. Animals in ordinary flesh, in which condition there is very little fat on the body, weigh from 1,500 to 1,800 pounds. Other minor dairy breeds of India are the Jafferabad, from the west, and Deccani and Nagpur breeds from the central part of India (2).

In color, the water buffaloes are dark grey, or almost black, with now and then white markings on their face and legs. Pure white albinos are sometimes seen, especially in parts of Tonkin province in Indo-China and on the Island of Hainan, in which regions they are in special favor because of their supposed immunity to rinderpest.

The skin of the water buffalo, like that of the pig, has practically no sweat glands. For this reason the buffalo likes to wallow in mud or water on a hot day and thereby it gets its name, *water buffalo*. The mature animal has very little hair on its body. The sides, back and thighs of the animal are almost bare of hair. The shoulders and knees have the most hair, where it is about 2 to 3 inches long. The buffalo calves are born with a rather heavy coat of long, rather soft dark hair all over the body, which gradually disappears after one year of age is reached and is replaced by shorter and coarser hair, thinly distributed over the body. The horns of the buffalo are characteristic, although they vary in size and shape with different breeds. In general, those of the beef-draft type are long, thick and triangular at the base, fairly sharp at the tip, with distinct grooves on the upper surface. They are directed out, back and somewhat upward from the head, and curve inward at the tips. The length of the horns, measured on the outside of the curve, is usually about 2 feet, although they may vary from 12 inches to 4 feet or more. The movements of the water buffalo are slow and unwieldy, similar to that of the elephant.

The udders of both the beef-draft type of China and dairy breeds of India are rather small, but well shaped, with well developed teats that are somewhat constricted at their attachment to the udder. The animals have a wide back and loin, with short legs and a large barrel. The body of the Chinese buffalo, as a rule, is short and compact, and well built for draft purposes. The croup is decidedly sloping. They fatten readily and buffalo beef from young animals is similar in quality to that of the *Bos taurus* or *Bos Indicus*, although it is darker in color.

LEVINE: WATER BUFFALO.]

[LINGNAM AGR'L REVIEW, VOL. I, NO. 1.]

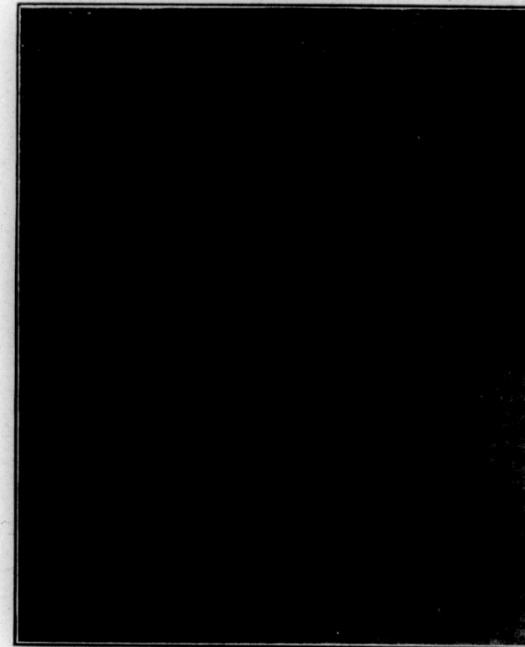


Fig. 1. Delhi (Indian) buffalo cow and calf one day old. Owned by Indian dairy in Hongkong. Samples of milk from this herd averaged 11.00 per cent butter fat. British authorities report that in India these cows give as much as 40 and 50 pounds milk a day.

Photo by C. O. Levine.



Fig. 2. Buffalo cow No. 52 in Canton Christian College dairy. This cow has a production record for 322 days of 2,639.36 pounds milk testing 11.16 per cent butter fat and a total of 294.89 pounds butter fat.

Photo by C. O. Levine.

PLATE I.

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Fig. 3. Delhi (Indian) dairy buffalo bull, Hongkong.

Photo by C. O. Levine.



Fig. 4. Native buffalo bull (No. 96), used in Canton Christian College dairy.

Photo by C. O. Levine.

PLATE 2.

There are a number of striking differences in the Delhi dairy breed of buffalo from India, and the beef-draft type of China mentioned above. The horns of the Delhi breed rise from the head in an upward and backward direction and then curl over the head like the horns of a ram and for this reason, in the Philippine Islands, they are called *ram's horn* buffaloes. The body is lean and angular. The teats are well placed and of rather large size. They have a very large frontal bone in the head and small, wall eyes. Although rather fierce looking on account of their large horns, prominent forehead and glassy eyes, the Delhi buffaloes are very docile and easily managed. The beef-draft type of southern China, on the other hand, while easily managed by the natives of that land, dislike strangers, especially Europeans, who on first acquaintance find them difficult to manage.

USES

The principal use of the water buffalo in China and the Pacific Islands is for draft purposes. Surplus animals, or animals too old for good use in the fields, are fattened and slaughtered for beef.

They possess great strength, although they are not fast in getting over the ground when compared with draft horses. It was found by Gandencio Evaristo (3) at the College of Agriculture, Los Banos, Philippine Islands, that in fairly light soil and on a rainy or cloudy day, a buffalo could plow 5,000 to 7,000 square meters.

For uplands, where water is not available close at hand, the buffalo is of little use on sunny hot days except where work is limited to the early morning or late afternoon. This is because it is unable to stand the heat of midday without being kept constantly cooled with water on its body surface.

In India, where the religion of the natives largely prohibits the use of the flesh of animals for food, the buffalo is used for draft and dairy purposes only. When used for draft purposes, they are used singly, single-tandem, or two are yoked together and driven in the way which oxen are generally used. As a rule, in China only one buffalo is used on a plow. The plows cut a furrow slice from six to eight inches wide and two to five inches deep.

THE CHINESE DRAFT WATER BUFFALO AS A DAIRY ANIMAL

No dairy breed of water buffaloes has yet been developed in China. This is probably due to the fact that the Chinese did not consider milk from animals of any special value as human food until the advent of the Europeans in China. It is strange that this opinion should have generally prevailed, for the Tibetans on the west and the Mongolians on the north have, since ancient times, been users of dairy products in the form of milk, butter and cheese, made from cow's, goat's, yak's or mare's milk. It is only during the present generation that the Chinese have begun to use

milk to any extent and its use today is confined chiefly to the regions where the Chinese have come in contact with Europeans and western ideas.

The fact that the milk of the Chinese buffalo cow is very rich in fat and is palatable, has been known in a general way for many years, but it is only some sixteen years ago that the first water buffalo dairy was started in Canton. In some villages of Kwangtung the buffalo has been used for dairy purposes for possibly one hundred years.

STUDY OF THE WATER BUFFALO AT CANTON CHRISTIAN COLLEGE

During the past six years considerable data in regard to the Chinese water buffalo as a dairy animal has been collected by the writer while on the agricultural staff of the Canton Christian College. Some of this data has been published in various journals and bulletins (4).

EXPLANATION OF MILK ANALYSIS AND RECORDS

The tables which follow give the analysis of milk and the production records of cows for which we have records for entire lactation periods.

Butter fat analyses were made twice a month. The Babcock method of testing for fat was used. The morning and evening milk was tested separately. The average of the two tests was taken as the average test for the month. At the beginning of these studies the milk for twenty-four hours was weighed twice a month. The average amount of milk for the two weighings was taken as the average daily production for the month. During the past three years, which represent two-thirds of the work reported here, each cow's milk was weighed at each milking. The average of 12 days' milk each month was taken as the daily production for the month.

The total solids (consisting of the fat, sugar, proteins and ash), were found by evaporating a weighed sample of milk in a steam bath until the weight became constant. The ash was determined by heating in a crucible over a gas flame until the weight became constant. The protein were determined by the Kjeldahl method as described by Hawk in his Practical Physiological Chemistry, fourth edition, pages 410 and 483. The sugar was found by subtracting the sum of the ash, protein and fat from the total solids. The percentages in each case were found by dividing the weight of the final product by the weight of the sample of milk analyzed.

FEED

During most of the period when these data were collected the buffalo cows were fed a grain mixture consisting of 7 parts rice bran, 4 parts wheat bran, 3 parts broken rice and 2 parts of ground peanut cake. Each cow was fed daily 4 pounds of this mixed feed for each 5 pounds of milk given daily. The cows were fed twice a day. About 1½ ounces

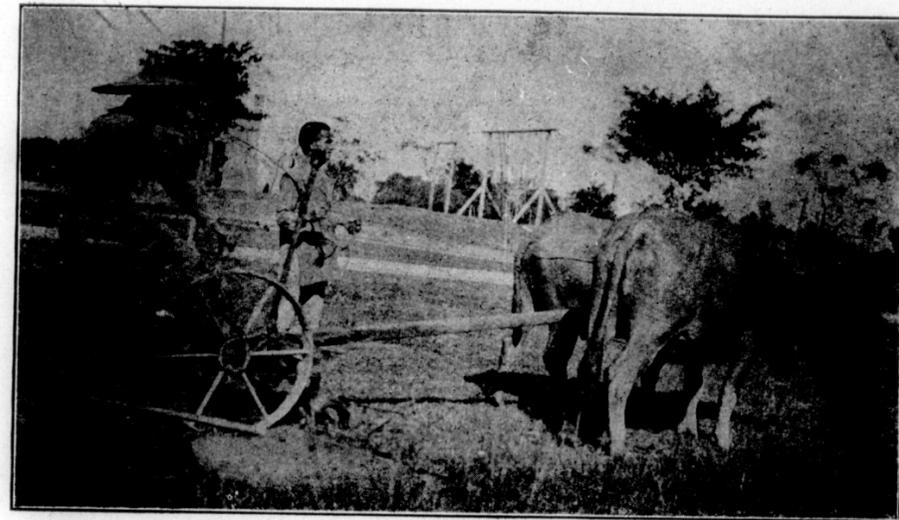


Fig. 5. Dairy buffalo cows of Canton Christian College are used for draft purposes when dry. Photo by C. O. Levine.



Fig. 6. Buffalo bull at work plowing rice field. Chinese buffaloes are muscular and well built for draft purposes, but are very slow in getting over the ground. Photo by C. O. Levine.

PLATE 3.

of salt mixed with the grain was fed daily to the cows. In addition, once a week, the cows were allowed to eat salt freely. Enough water was mixed with the concentrates at each feeding to make a thick mash. The cows were fed all they could consume four to five times a day of a mixture of green cut grasses, which amounted to 60 to 100 pounds a day per cow.

PRODUCTION RECORDS

Table 1 brings out a number of important facts about the milking qualities of the water buffalo in China. The average per cent of fat for the 23 cows for which records throughout 25 complete lactation periods are available, is 11.05. This is similar to result obtained by E. R. Dovey (5), with buffalo milk in the Philippine Islands. The average amount of milk produced for 25 lactations was 1,934.53 pounds. The highest record of 2,922.40 pounds was made by cow 56. The average amount of fat was 213.77 pounds, the highest being 325.53 pounds for cow 54. Another important fact brought out in these records, as shown in table 1, is the long lactation periods of the buffaloes. As a rule, the cows in the college herd are milked for 8 to 11 months, the length of time, in most cases, depending on how soon after freshening they are bred. They are usually bred two to three months after freshening. When fresh, they give from 5 to 15 pounds a day, which amount gradually diminishes throughout the lactation period.

The production capacity of the cows recorded in this paper is striking when we consider the fact that the cows were ordinary village cows of the beef-draft type, whose ancestors had never been used for dairy purposes.

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TABLE NO. 1.—Analysis of milk, length of lactation period, amount of milk, amount of fat and percentage of fat of Chinese water buffalo milk at Canton Christian College.

COW NUMBER	LACTATION PERIOD days	TOTAL MILK pounds	TOTAL FAT pounds	AVERAGE FAT per cent
2	244	1077.60	123.87	11.44
4	332	1345.10	170.18	12.65
51	330	2838.70	279.18	9.83
52	344	1978.34	219.63	11.11
52	322	2639.36	294.89	11.16
53	278	1934.60	211.96	10.90
54	365	2660.30	325.53	12.23
55	252	1883.70	226.37	12.02
56	353	2922.40	287.03	9.87
57	251	1578.00	164.90	10.45
58	365	2329.20	253.29	10.87
60	273	1849.60	201.57	10.79
62	339	1510.00	160.34	12.62
63	325	2448.80	279.03	11.03
69	310	1504.60	149.38	9.93
71	348	2071.70	228.11	11.45
76	305	1221.80	139.90	11.61
76	359	1818.51	206.57	11.36
77	365	1924.30	189.93	9.87
79	355	2148.49	228.23	10.62
83	365	2204.00	233.03	10.60
85	234	2074.63	235.17	11.33
92	230	1366.42	126.18	9.22
95	365	1550.31	195.62	12.61
102	365	1482.31	183.68	12.39
Averages	319	1934.53	213.77	11.05*

*The average percent of fat was secured by dividing 213.77 by 1934.53.

TABLE 2.—Complete analyses of buffalo milk: The samples analysed were herd samples taken from twelve cows in the college dairy in November, 1917. The milking in the morning was begun at four, and in the afternoon at two o'clock.

SAMPLE NUMBER	FAT	ASH	PRO-TEIN	SUGAR	TOTAL SOLIDS	WATER
	<i>per cent</i>	per cent	per cent	per cent	per cent	per cent
1. Morning milk	11.00	0.94	6.04	4.00	21.98	77.02
2. Afternoon milk	12.80	0.90	6.10	3.57	23.37	76.55
3. Afternoon milk	13.00	0.71	5.71	3.32	22.74	76.98
4. Afternoon milk	13.63	0.74	5.94	3.57	23.92	77.08
5. Afternoon milk	12.10	0.90	6.14	3.83	22.87	77.04
6. Afternoon milk	14.00	0.92	6.42	3.78	25.21	74.79
7. Morning milk	11.50	0.95	5.80	3.70	21.95	77.05
8. Morning milk	12.00	0.94	6.00	3.60	22.54	77.45
9. Morning milk	12.34	1.04	6.28	3.71	23.10	76.63
10. Morning milk	12.20	0.77	5.90	4.23	23.02	76.98
Average	12.46	0.89	6.03	3.74	23.29	76.89
European cow's milk average..	3.69	0.73	3.63	4.88	12.83	87.17

As seen by table 2, the milk contains more than three times as much fat, a great deal more protein and sugar and somewhat more ash and accordingly the total solids are nearly double those of European cows' milk.

Tables 3 to 27 show in detail the monthly production of individual cows.

Cow No. 83 (Table 23) has the highest monthly milk record of 381.92 pounds for March, 1921. Cow 54 (Table 9) has the highest monthly butter fat record, having produced 37.93 pounds in October, 1918. Cow 102 (Table 27) has the highest record of butter fat percentage in any one month. In February, 1921, her milk averaged 17.00 per cent fat.

In most cases there is a steady increase in percentage of fat from the beginning to the end of the lactation period. Many cows begin with 8 to 10 per cent fat for the first month and gradually increase to 15 to 17 per cent for the last month of lactation.

Tables 28 and 29 show the variation, by months, of butter fat content and milk produced. Charts 1 and 2, (following table 29) show graphically this variation. In these charts curves show the average monthly butter fat percentages and milk production for 25 lactations. Curves for lactations that varied considerably from the average are also shown.

ANALYSIS AND PRODUCTION OF THE DELHI (INDIAN) DAIRY BUFFALO MILK

In the region of Hongkong there are a number of Delhi dairy water buffalo herds owned and managed by Indians. Dr. Adam Gibson, formerly the Colonial Veterinarian of Hongkong and milk inspector for that territory, has informed the writer that the percentage of fat in the milk of this breed is similar to that of the Chinese water buffalo. According to British authorities in India, cows of this breed in India commonly give from 30 to 50 pounds of milk a day (3).

In January, 1919, the writer visited an Indian water buffalo dairy in Kowloon, which at that time had a total of twenty cows giving milk. In July, 1921, the writer again visited the herd and made a composite analysis of the milk and found it to contain 11.00 per cent butter fat. The average milk production for the twenty cows was 15 pounds. Some of the cows had recently freshened, while others were in the seventh and eighth month of lactation. The feed at that time consisted of dry rice straw for roughage, and for concentrates they received a small amount of cooked broken rice and wheat bran. The cows were crowded into a dark, damp, poorly ventilated and dirty barn. With proper care, and the addition of succulent feed in the ration, the production of this herd could no doubt be greatly increased.

CHARACTERISTICS OF BUFFALO MILK OTHER THAN THAT SHOWN BY ANALYSIS

Water buffalo milk is pure white in color. Butter made from the milk is also pure white. It is wholesome and very palatable. Students and teachers (both European and Chinese) at the Canton Christian College prefer water buffalo to European cow's milk. On account of its having a high per cent of solids, it has a richer flavor, and European cow's milk testing 4 per cent fat seems thin and watery after drinking buffalo milk.

DISEASES

Among water buffaloes, as well as among the cattle of the Orient, probably the most common disease is a contagious disease known as rinderpest. The disease is somewhat like the chronic form of hog cholera, in that it is usually accompanied with fever and causes lesions in the inner lining of the intestines, but it is not always as fatal as is cholera among hogs. A new method of immunizing with anti-rinderpest vaccine has fortunately been developed by the veterinarians in the Bureau of Agriculture of the Philippine Islands which renders the animals immune to the disease for two years or longer.

Tick fever, commonly known in the United States as *Texas fever*, after the region in which it is most common in the United States, is prevalent in South China. The disease is fatal to cattle imported from tick-

free regions. Fortunately ticks do not travel far and breed only in grassy places. European cattle, in southern China, are usually kept in barns and in dry lots and suffer very little from the tick. The tick fever seems to have little or no effect on the water buffaloes. They are apparently very highly resistant to the disease.

TUBERCULOSIS

According to Dr. Heanley of the Hongkong Bacteriological and Vaccine Laboratory, tuberculosis has never been found among the buffaloes of South China, and in thirteen years' inspection of animals and carcasses in the Hongkong government slaughter house, where all animals slaughtered for food are inspected by government inspectors, only two cases in the humped cattle have come to notice. Both cases were bullocks. The disease is as common among European cattle as it is in America. Dr. Gibson, who inspected the carcasses of buffaloes slaughtered in Hongkong for the past thirteen years, at the rate of several hundred a week, confirms Dr. Heanley's report in stating that he has never seen tuberculosis lesions in the water buffalo.

Dr. M. Prettner made a careful study of the resisting power of the water buffalo against experimental tuberculosis (6). Only when he injected tubercular material a number of times in the same buffalo, in amounts many times that required to induce tuberculosis in a cow or goat, could he produce the disease in the buffalo. In fact, even then, upon post-mortem, the organisms were found only in the inflamed area around the point of injection of the tubercular material. The buffaloes had to be kept in an underfed and run-down condition in order to produce ever this slight infection. He reports that among five thousand buffaloes slaughtered for meat, no case of tuberculosis was observed.

THE BUFFALO COMPARED WITH THE EUROPEAN COW AS A DAIRY ANIMAL

There are a number of commendable features in the use of the buffalo cow as a dairy animal. The amount of butter fat in milk in the better buffalo cows of China (see production tables) is not insignificant when we consider that there has been no breeding for production. Ordinary cows give more than 2,500 pounds of milk containing from 150 to 325 pounds of fat in one year. The *ram's horn* buffaloes of India rank with the best breeds of modern dairy cattle, both in production of milk and total butter fat. The fact that the buffalo has no sweat glands in the skin makes it an easy animal to keep clean. The scant hair on the body affords a poor hiding place for lice and they can be easily detected and gotten rid of. The absence of tuberculosis among buffaloes and their resistance to the tick fever adds to their value as dairy animals.

OBJECTIONS TO THE WATER BUFFALOES FOR DAIRY PURPOSES

One of the chief reasons why so few buffalo cows are used for dairy purposes in China is no doubt because of the fact that they give but little milk, and that, while it contains about three and one-half times as much fat and nearly twice as much total solids as does European milk, it usually sells for the same price as the latter. However, as soon as the public knows the value of buffalo milk, it should command a much higher price than at present. The fact that cows, which have not been especially bred for milk production, but simply selected from among ordinary buffalo herds, produce as much as 10 pounds of milk a day for several months, suggests the possibility of individuals giving a much larger amount of milk, when selection for increased production has been carried out for a few generations.

In warm weather, buffalo cows need a bath twice a day in order to keep at their best. It is the custom for them to be driven for about one-half hour each day to canals or ponds, which are not always clean, for this wetting. To overcome this objection, tanks might be constructed in which clean water could be kept for their bath, or they might be wet twice a day by pouring clean water over them with buckets or with a hose where water pressure can be secured.

THE FUTURE OF THE WATER BUFFALO IN DAIRYING

In India the buffalo is the chief source of milk where it is not only competing with good native breeds of the "humped" variety of cattle but also with modern breeds of European dairy cattle.

There is a strong prejudice among Europeans in certain parts of India against the use of buffalo milk because of the unsanitary methods under which it is frequently produced. In parts of India, the buffalo is a scavenger, subsisting largely on not only the refuse of the kitchen, but also on horse dung, and even on human waste. Naturally the flavor of milk produced from such feed has an uninviting odor and flavor. With the education of the village farmers in better feeding methods, this condition will no doubt be improved.

It is the opinion of the writer that the water buffalo should become an important dairy animal in the southern half of China as well as an important source of butter for the four hundred million people of this vast country. Unlike the Indians, the Chinese have not been users of milk in the past, but are rapidly taking to the use of this beverage through the example set by Europeans. With intelligent selection and breeding among the beef-draft buffaloes of China it should be possible to develop within a few generations a dairy breed of high producing ability.

TABLE 3.—Production of cow No. 2

Freshened January 29, 1917

Lactation period ended September 30, 1917

MONTH	MILK PER DAY	TOTAL MILK	BUTTER FAT	TOTAL FAT
	pounds	pounds	per cent	pounds
January.....	7.50	14.90	11.09	1.66
February.....	5.00	140.00	11.10	15.54
March.....	3.80	117.80	10.10	11.89
April.....	6.10	183.00	12.34	22.58
May.....	4.10	127.10	11.08	14.08
June.....	5.00	150.00	11.02	16.53
July.....	4.70	145.70	11.48	16.73
August.....	3.50	108.50	12.37	13.42
September.....	3.00	90.00	12.72	11.44
Total number of days in lactation period.....				244
Total pounds milk.....				1,077.00
Total pounds butter fat.....				123.87
Average percentage butter fat.....				11.50
Average daily milk production in pounds.....				4.39

TABLE 4.—Production of cow No. 4

Freshened January 2, 1917

Lactation period ended November 30, 1917

MONTH	MILK PER DAY	TOTAL MILK	BUTTER FAT	TOTAL FAT
	pounds	pounds	per cent	pounds
January.....	4.60	133.40	12.60	16.82
February.....	4.63	134.40	13.50	18.14
March.....	5.60	173.60	12.79	22.55
April.....	4.60	138.00	12.59	17.37
May.....	4.40	136.40	12.40	17.96
June.....	4.00	120.00	12.80	15.36
July.....	3.50	108.50	13.79	14.97
August.....	3.00	93.00	11.16	10.38
September.....	3.80	114.00	12.50	14.25
October.....	3.83	118.80	12.70	15.09
November.....	2.50	75.00	11.12	8.34
Total number of days in lactation period.....				332
Total pounds milk.....				1,345.10
Total pounds butter fat.....				170.18
Average percentage butter fat.....				12.65
Average daily milk production in pounds.....				4.04

TABLE 5.—Production of cow No. 51
Freshened July 4, 1918
Lactation period ended May 30, 1919

MONTH	MILK PER DAY <i>pounds</i>	TOTAL MILK <i>pounds</i>	BUTTER FAT <i>per cent</i>	TOTAL FAT <i>pounds</i>
July	11.20	304.4	8.90	27.03
August	11.60	359.6	9.12	32.80
September	11.80	354.0	9.50	33.65
October	10.20	316.2	9.71	30.70
November	9.00	276.0	10.40	28.71
December	8.20	254.2	10.12	25.72
January	7.80	241.8	10.14	24.52
February	7.50	210.0	10.16	21.34
March	6.50	201.5	10.13	20.42
April	6.20	186.0	10.10	18.70
May	4.35	135.0	10.00	13.50
Total number of days in lactation period				330
Total pounds milk				2,838.70
Total pounds butter fat				279.18
Average percentage butter fat				9.83
Average daily milk production in pounds				10.21

TABLE 6.—Production of cow No. 52 Lactation 1
Freshened June 1, 1920
Lactation period ended May 11, 1921

MONTH	MILK PER DAY <i>pounds</i>	TOTAL MILK <i>pounds</i>	BUTTER FAT <i>per cent</i>	TOTAL FAT <i>pounds</i>
June	7.25	217.50	8.56	18.62
July	6.33	227.00	8.88	20.16
August	6.33	196.20	10.02	19.66
September	6.36	190.80	10.44	19.92
October	6.14	190.30	11.72	22.30
November	5.20	155.70	10.60	16.97
December	5.60	172.36	11.87	20.46
January	5.30	164.30	12.43	20.42
February	6.40	178.08	12.49	22.24
March	4.30	133.30	13.09	17.45
April	4.30	129.90	13.83	17.97
May	7.40	22.90	15.11	3.46
Total number of days in lactation period				344
Total pounds milk				1,978.34
Total pounds butter fat				219.63
Average percentage butter fat				11.11
Average daily milk production in pounds				5.79

TABLE 7.—Production of cow No. 52 Lactation 2
Freshened July 9, 1921
Lactation period ended May 27, 1922

MONTH	MILK PER DAY <i>pounds</i>	TOTAL MILK <i>pounds</i>	BUTTER FAT <i>per cent</i>	TOTAL FAT <i>pounds</i>
July	12.57	276.50	9.12	25.22
August	12.10	375.10	9.46	35.48
September	10.20	306.00	10.81	33.08
October	8.09	242.00	10.55	25.53
November	7.28	218.40	9.38	20.51
December	8.60	266.60	10.70	28.53
January	7.84	243.10	13.29	32.31
February	8.07	225.96	12.60	28.47
March	9.17	236.80	12.76	30.22
April	5.87	176.10	14.70	25.89
May	2.35	72.80	13.13	9.56
Total number of days in lactation period				322
Total pounds milk				2,639.36
Total pounds butter fat				294.89
Average percentage butter fat				11.16
Average daily milk production in pounds				8.23

TABLE 8.—Production of cow No. 53
Freshened October 28, 1918
Lactation period ended July 31, 1919

MONTH	MILK PER DAY <i>pounds</i>	TOTAL MILK <i>pounds</i>	BUTTER FAT <i>per cent</i>	TOTAL FAT <i>pounds</i>
October	12.6	50.5	10.71	5.41
November	10.1	303.0	10.53	31.90
December	9.6	303.8	10.51	31.94
January	8.6	272.8	10.63	28.99
February	7.6	221.2	11.41	25.24
March	7.3	226.3	10.54	23.85
April	6.5	195.0	10.46	20.40
May	5.6	179.0	10.33	18.49
June	3.0	90.0	12.75	11.48
July	3.0	93.0	14.38	13.37
Total number of days in lactation period				278
Total pounds milk				1,934.60
Total pounds butter fat				211.06
Average percentage butter fat				10.91
Average daily milk production in pounds				7.12

TABLE 9.—Production of cow No. 54
Freshened September 20, 1918
Lactation period ended September 20, 1919

MONTH	MILK PER DAY pounds	TOTAL MILK pounds	BUTTER FAT per cent	TOTAL FAT pounds
September	10.8	108.0	10.64	11.49
October	11.3	350.3	10.83	37.93
November	11.1	333.0	11.43	36.07
December	9.5	294.5	11.66	34.34
January	9.2	285.2	12.32	35.13
February	8.5	235.2	12.45	29.25
March	8.2	254.4	12.55	31.93
April	7.1	213.0	11.88	25.30
May	6.7	201.5	13.00	26.20
June	4.5	135.0	13.83	18.68
July	4.0	124.0	14.60	18.10
August	3.1	96.2	14.38	13.83
September	1.5	30.0	17.50	5.25

Total number of days in lactation period	365
Total pounds milk	2,660.30
Total pounds butter fat	325.53
Average percentage butter fat	12.23
Average daily milk production in pounds	7.29

TABLE 10.—Production of cow No. 55
Freshened September 20, 1918
Lactation period ended May 30, 1919

MONTH	MILK PER DAY pounds	TOTAL MILK pounds	BUTTER FAT per cent	TOTAL FAT pounds
September	10.3	103.0	10.89	11.22
October	10.0	310.0	10.93	33.88
November	9.3	279.0	11.40	31.81
December	8.8	272.8	12.36	33.72
January	8.1	251.1	12.21	30.91
February	8.2	210.5	12.44	26.18
March	5.8	179.8	12.55	22.57
April	5.6	168.0	12.51	21.02
May	3.6	109.5	13.75	15.06

Total number of days in lactation period	252
Total pounds milk	1,883.70
Total pounds butter fat	226.37
Average percentage butter fat	12.02
Average daily milk production in pounds	7.47

TABLE 11.—Production of cow No. 56
Freshened September 1, 1920
Lactation period ended August 19, 1921

MONTH	MILK PER DAY pounds	TOTAL MILK pounds	BUTTER FAT per cent	TOTAL FAT pounds
September	13.30	399.0	8.50	33.91
October	10.50	311.6	8.13	25.34
November	9.80	294.0	8.90	26.16
December	9.40	291.4	10.66	31.07
January	8.18	250.5	10.12	25.35
February	8.54	236.3	8.70	20.56
March	7.39	239.3	11.00	27.33
April	7.55	226.5	11.30	25.59
May	7.43	230.3	10.90	25.10
June	6.55	196.5	10.94	21.49
July	5.39	167.1	9.60	16.04
August	2.35	79.9	12.73	10.17

Total number of days in lactation period	353
Total pounds milk	2,922.40
Total pounds butter fat	287.03
Average percentage butter fat	9.87
Average daily milk production in pounds	7.55

TABLE 12.—Production of cow No. 57
Freshened May 25, 1919
Lactation period ended January 31, 1920

MONTH	MILK PER DAY pounds	TOTAL MILK pounds	BUTTER FAT per cent	TOTAL FAT pounds
May	7.93	47.6	8.54	4.07
June	9.75	292.5	7.49	21.91
July	8.75	271.3	9.22	25.01
August	8.00	248.0	9.04	22.42
September	6.36	191.0	11.64	22.23
October	4.30	133.3	12.71	16.94
November	5.00	150.0	12.80	19.20
December	4.38	135.8	12.73	17.28
January	3.50	108.5	14.60	15.84

Total number of days in lactation period	251
Total pounds milk	1,578.00
Total pounds butter fat	164.90
Average percentage butter fat	10.45
Average daily milk production in pounds	6.28

TABLE 13.—Production of cow No. 58
Freshened June 1, 1920
Lactation period ended May 30, 1921

MONTH	MILK PER DAY pounds	TOTAL MILK pounds	BUTTER FAT per cent	TOTAL FAT pounds
June	5.00	150.0	11.90	17.85
July	8.35	258.9	10.19	26.38
August	7.50	232.5	10.27	23.87
September	7.57	227.1	10.41	23.64
October	6.84	212.0	10.79	22.87
November	6.18	185.5	11.32	21.00
December	5.60	173.6	11.52	20.00
January	5.25	162.8	11.35	18.48
February	6.42	179.8	10.62	19.10
March	6.76	209.6	10.88	22.80
April	6.04	181.2	10.54	19.09
May	5.04	156.2	11.66	18.21
Total number of days in lactation period				365
Total pounds milk				2,329.20
Total pounds butter fat				253.29
Average percentage butter fat				10.87
Average daily milk production in pounds				6.39

TABLE 14.—Production of cow No. 60
Freshened December 1, 1918
Lactation period ended August 30, 1919

MONTH	MILK PER DAY pounds	TOTAL MILK pounds	BUTTER FAT per cent	TOTAL FAT pounds
December	10.1	312.0	10.40	32.48
January	10.0	310.0	10.92	33.85
February	8.8	274.4	11.27	30.93
March	7.8	241.8	10.69	25.85
April	6.0	180.0	10.17	18.30
May	6.5	201.5	10.00	20.15
June	4.4	135.0	11.61	15.68
July	3.2	99.2	13.33	13.22
August	2.8	83.7	13.28	11.11
Total number of days in lactation period				273
Total pounds milk				1,837.60
Total pounds butter fat				201.57
Average percentage butter fat				10.97
Average daily milk production in pounds				6.73

TABLE 15.—Production of cow No. 62
Freshened May 20, 1920
Records here began June 1, 1920, and continue for 365 days

MONTH	MILK PER DAY pounds	TOTAL MILK pounds	BUTTER FAT per cent	TOTAL FAT pounds
June	2.62	78.5	11.46	9.00
July	3.65	113.2	11.48	12.99
August	3.00	93.0	11.33	10.54
September	5.36	160.8	12.79	20.56
October	4.96	153.8	13.70	21.07
November	4.19	125.7	13.09	16.45
December	4.90	151.9	12.23	18.57
January	4.89	151.7	12.22	18.54
February	5.18	145.0	12.26	17.32
March	5.24	162.4	13.70	22.24
April	3.77	113.2	12.82	14.51
May	2.03	60.8	14.06	8.55
Total number of days of lactation represented in table				365
Total pounds milk				1,510.00
Total pounds butter fat				190.34
Average percentage butter fat				12.62
Average daily milk production in pounds				4.14

TABLE 16.—Production of cow No. 63
Freshened December 10, 1918
Lactation period ended October 31, 1919

MONTH	MILK PER DAY pounds	TOTAL MILK pounds	BUTTER FAT per cent	TOTAL FAT pounds
December	9.6	201.6	10.52	21.21
January	10.1	313.1	10.37	32.46
February	10.2	285.6	10.48	29.94
March	9.7	300.7	10.43	31.36
April	8.8	264.0	10.68	28.20
May	9.5	294.5	11.14	32.81
June	6.0	180.0	12.05	21.69
July	7.1	220.1	12.87	28.33
August	4.9	151.9	13.56	21.60
September	4.5	135.0	13.70	18.50
October	3.3	102.3	13.61	13.93
Total number of days in lactation period				325
Total pounds milk				2,448.80
Total pounds butter fat				279.03
Average percentage butter fat				11.03
Average daily milk production in pounds				7.53

TABLE 17.—Production of cow No. 69
Freshened January 7, 1921
Lactation period ended November 13, 1921

MONTH	MILK PER DAY pounds	TOTAL MILK pounds	BUTTER FAT per cent	TOTAL FAT pounds
January	10.30	247.4	8.69	21.49
February	8.01	224.4	8.42	18.89
March	7.62	236.2	8.88	20.97
April	5.74	172.2	9.65	16.62
May	5.25	162.8	9.60	15.63
June	4.81	144.3	10.43	15.05
July	3.67	112.8	11.49	12.96
August	2.90	89.9	12.01	10.80
September	2.35	70.5	13.57	9.57
October	1.26	39.1	16.75	6.55
November	.34	5.0	16.95	.85
Total number of days in lactation period				310
Total pounds milk				1,504.60
Total pounds butter fat				149.38
Average percentage butter fat				9.93
Average daily milk production in pounds				4.80

TABLE 18.—Production of cow No. 71
Freshened October 14, 1920
Lactation period ended September 27, 1921

MONTH	MILK PER DAY pounds	TOTAL MILK pounds	BUTTER FAT per cent	TOTAL FAT pounds
October	10.91	185.5	9.23	17.12
November	8.50	255.0	9.33	23.80
December	8.54	264.7	9.91	26.23
January	7.40	229.1	12.20	27.95
February	7.39	206.9	10.82	22.39
March	6.87	213.0	10.68	22.65
April	6.58	187.8	12.30	23.10
May	5.05	156.6	11.33	17.74
June	4.78	143.3	13.19	18.90
July	3.05	94.6	10.78	10.20
August	2.50	77.5	14.55	11.28
September	1.90	57.7	11.70	6.75
Total number of days in lactation period				348
Total pounds milk				2,071.70
Total pounds butter fat				228.11
Average percentage butter fat				11.01
Average daily milk production in pounds				6.00

TABLE 19.—Production of cow No. 76 Lactation 1
Freshened October 31, 1919
Lactation period ended August 31, 1920

MONTH	MILK PER DAY pounds	TOTAL MILK pounds	BUTTER FAT per cent	TOTAL FAT pounds
November	7.21	216.5	9.00	19.49
December	4.65	144.2	10.34	14.91
January	6.00	186.0	11.50	21.39
February	3.93	110.2	12.72	14.02
March	3.55	110.2	12.72	13.73
April	3.63	109.0	12.60	13.56
May	3.50	108.6	12.50	13.56
June	3.61	108.5	12.50	13.56
July	2.25	69.8	13.00	9.07
August	1.90	58.9	13.72	8.08
Total number of days in lactation period				305
Total pounds milk				1,221.80
Total pounds butter fat				139.90
Average percentage butter fat				11.45
Average daily milk production in pounds				3.91

TABLE 20.—Production of cow No. 76 Lactation 2
Freshened November 30, 1920
Lactation period ended November 24, 1921

MONTH	MILK PER DAY pounds	TOTAL MILK pounds	BUTTER FAT per cent	TOTAL FAT pounds
December	9.80	303.8	10.48	31.84
January	7.66	237.5	10.73	25.48
February	6.93	194.0	10.55	20.47
March	6.50	201.5	11.44	23.05
April	6.07	188.1	11.18	21.03
May	5.50	170.5	11.33	19.32
June	4.52	135.6	11.70	15.87
July	3.96	122.8	11.24	13.80
August	3.00	91.5	11.69	10.69
September	2.50	75.9	12.83	9.74
October	2.30	70.7	16.13	11.40
November	1.11	26.7	14.53	3.88
Total number of days in lactation period				359
Total pounds milk				1,818.51
Total pounds butter fat				206.57
Average percentage butter fat				11.36
Average daily milk production in pounds				5.07

TABLE 21.—Production of cow No. 77
Freshened November 25, 1920
Lactation period ended November 24, 1921

MONTH	MILK PER DAY pounds	TOTAL MILK pounds	BUTTER FAT per cent	TOTAL FAT pounds
December	9.57	296.8	9.26	27.47
January	8.10	251.1	7.74	19.44
February	7.84	219.5	8.41	18.46
March	8.30	257.3	9.41	24.21
April	6.37	191.1	9.08	18.93
May	5.62	174.3	9.99	17.41
June	4.56	136.8	10.97	15.00
July	3.26	101.1	13.39	11.54
August	2.80	87.7	11.87	10.41
September	2.70	81.5	12.26	9.99
October	2.30	72.5	13.58	9.85
November	2.28	54.6	12.44	6.79
Total number of days of lactation represented in table		360		
Total pounds milk		1,924.30		
Total pounds butter fat		189.93		
Average percentage butter fat		9.87		
Average daily milk production in pounds		5.35		

TABLE 22.—Production of cow No. 79
Freshened December 1, 1920
Lactation period ended November 20, 1921

MONTH	MILK PER DAY pounds	TOTAL MILK pounds	BUTTER FAT per cent	TOTAL FAT pounds
December	11.74	363.9	9.04	32.90
January	9.65	299.2	10.34	30.93
February	9.17	256.8	9.45	24.32
March	8.59	266.5	10.30	27.45
April	6.85	205.5	10.68	21.74
May	6.15	190.6	10.56	20.13
June	4.90	147.0	10.97	16.12
July	4.19	129.9	11.80	15.33
August	3.43	106.3	12.24	13.01
September	2.78	89.3	13.17	11.76
October	2.24	69.4	15.87	10.80
November		24.1	15.78	3.80
Total number of days in lactation period		355		
Total pounds milk		2,148.49		
Total pounds butter fat		228.23		
Average percentage butter fat		10.62		
Average daily milk production in pounds		6.05		

TABLE 23.—Production of cow No. 83
Freshened February 14, 1921
Lactation period ended March 31, 1922

MONTH	MILK PER DAY pounds	TOTAL MILK pounds	BUTTER FAT per cent	TOTAL FAT pounds
February	13.04	182.6	8.55	15.79
March	12.32	381.9	8.28	31.62
April	10.08	302.4	9.22	27.88
May	8.44	261.6	10.31	26.99
June	7.37	221.2	10.41	23.03
July	5.41	167.6	11.45	19.19
August	4.84	149.9	11.17	16.74
September	4.13	124.2	12.68	15.75
October	3.79	117.5	13.50	15.86
November	3.75	112.5	12.37	13.92
December	3.11	96.6	11.98	11.55
January	1.85	57.3	13.42	6.25
February	2.05	28.7	13.00	3.71
Total number of days of lactation represented in table		365		
Total pounds milk		2,204.00		
Total pounds butter fat		228.28		
Average percentage butter fat		10.35		
Average daily milk production in pounds		6.04		

TABLE 24.—Production of cow No. 85
Freshened May 30, 1921
Lactation period ended April 30, 1922

MONTH	MILK PER DAY pounds	TOTAL MILK pounds	BUTTER FAT per cent	TOTAL FAT pounds
June	12.11	363.3	8.99	32.66
July	10.32	319.9	10.45	33.43
August	8.06	249.9	10.31	25.76
September	8.80	264.0	11.01	29.07
October	5.32	164.9	11.33	18.68
November	5.21	156.3	12.80	20.01
December	5.12	158.7	11.74	18.63
January	4.16	129.0	12.95	16.70
February	3.56	99.7	14.00	13.96
March	3.07	95.2	14.73	14.02
April	2.46	73.8	16.60	12.25
Total number of days in lactation period		334		
Total pounds milk		2,074.70		
Total pounds butter fat		235.47		
Average percentage butter fat		11.34		
Average daily milk production in pounds		6.21		

TABLE 25.—Production of cow No. 92
Freshened September 12, 1921
Lactation period ended April 22, 1922

MONTH	MILK PER DAY <i>pounds</i>	TOTAL MILK <i>pounds</i>	BUTTER FAT <i>per cent</i>	TOTAL FAT <i>pounds</i>
September	10.50	183.9	9.49	17.45
October	10.87	333.1	8.95	29.81
November	7.90	237.0	10.23	24.28
December	8.17	253.3	10.00	25.33
January	7.07	219.1	6.65	14.57
February	2.30	66.2	10.00	6.62
March	1.56	48.3	10.01	4.83
April	1.15	25.3	13.00	3.29
Total number of days in lactation period				230
Total pounds milk				1,366.42
Total pounds butter fat				126.18
Average percentage butter fat				9.22
Average daily milk production in pounds				5.69

TABLE 26.—Production of cow No. 95
Freshened October 1, 1920
Lactation period ended November 19, 1921

MONTH	MILK PER DAY <i>pounds</i>	TOTAL MILK <i>pounds</i>	BUTTER FAT <i>per cent</i>	TOTAL FAT <i>pounds</i>
October	7.15	221.7	10.70	23.72
November	5.20	156.0	12.34	19.25
December	4.82	149.4	12.68	18.95
January	3.35	103.9	12.80	13.29
February	5.04	141.1	12.35	17.43
March	5.40	167.4	11.45	19.17
April	4.42	132.6	13.46	17.84
May	4.06	125.9	10.36	13.05
June	3.74	112.2	13.98	15.69
July	3.41	105.0	15.21	15.98
August	2.57	79.7	15.65	12.47
September	1.82	56.4	15.59	8.79
Total number of days of lactation represented in table				365
Total pounds milk				1,550.31
Total pounds butter fat				195.62
Average percentage butter fat				12.61
Average daily milk production in pounds				4.30

TABLE 27.—Production of cow No. 102
Freshened February 27, 1921
Lactation period ended April 30, 1922

MONTH	MILK PER DAY <i>pounds</i>	TOTAL MILK <i>pounds</i>	BUTTER FAT <i>per cent</i>	TOTAL FAT <i>pounds</i>
March	7.60	235.7	9.48	22.34
April	7.71	231.3	10.40	24.05
May	6.86	212.7	11.08	23.58
June	5.21	156.3	11.24	17.57
July	3.92	121.5	12.95	15.73
August	3.68	114.1	12.45	14.21
September	2.70	81.0	14.10	11.42
October	2.27	84.9	17.18	14.59
November	2.46	73.8	15.44	11.39
December	2.46	76.3	16.77	12.79
January	1.96	60.8	16.83	10.23
February	1.22	34.0	17.00	5.78
Total number of days of lactation represented in table				365
Total pounds milk				1,482.31
Total pounds butter fat				183.68
Average percentage butter fat				12.39
Average daily milk production in pounds				4.06

TABLE 28.—Monthly fat percentage in milk of 23 buffalo cows for 25 lactation periods.

Cow	Month										
	1	2	3	4	5	6	7	8	9	10	11
2	11.10	10.10	12.34	11.08	11.02	11.48	17.37	12.72			
4	12.60	13.50	12.79	12.59	12.40	12.80	13.79	11.16	12.50	12.70	11.12
51	8.90	9.12	9.50	9.71	10.40	10.12	10.14	10.16	10.13	10.10	10.00
52	8.56	8.88	10.02	10.44	11.72	10.60	11.87	12.34	12.47	13.09	13.83
52	9.12	9.46	10.81	10.55	9.38	10.70	13.29	12.60	12.76	14.70	13.13
53	10.53	10.51	10.63	11.41	10.54	10.46	10.33	12.75	14.38		
54	10.83	11.43	11.66	12.32	12.45	12.55	11.88	13.00	13.83	14.60	14.38
55	10.93	11.40	12.36	12.21	12.44	12.55	12.51	13.75			
56	8.50	8.13	8.90	10.66	10.12	8.70	11.00	11.30	10.90	10.94	9.60
57	7.49	9.22	9.04	11.64	12.71	12.80	12.73	14.60			
58	11.90	10.19	10.27	10.41	10.79	11.32	11.52	11.35	10.62	10.88	10.54
60	10.40	10.92	11.27	10.69	10.17	10.00	11.61	13.33	13.28		
62	11.48	11.33	12.79	13.70	13.09	12.23	12.22	12.26	13.70	12.82	11.06
63	10.52	10.37	10.48	10.43	10.68	11.14	12.05	12.87	13.56	13.70	13.61
69	8.69	8.42	8.88	9.65	9.60	10.43	11.49	12.01	13.57	16.75	16.95
71	9.23	9.33	9.91	12.20	10.82	10.68	12.30	11.33	13.19	10.78	14.55
76	9.00	10.34	11.50	12.72	12.72	12.60	12.50	12.50	13.00	13.72	
76	10.48	10.73	10.55	11.44	11.18	11.33	11.70	11.24	11.69	12.83	16.13
77	9.26	7.74	8.41	9.41	9.08	9.99	10.97	13.39	11.87	12.26	13.58
79	9.04	10.34	9.45	10.30	10.68	10.56	10.97	11.80	12.24	13.17	15.87
83	8.28	9.22	10.31	10.41	11.45	11.17	12.68	13.50	12.37	11.98	13.42
85	8.99	10.45	10.31	11.01	11.33	12.80	11.74	12.95	14.00	14.33	16.60
92	8.95	10.23	10.00	6.65	10.00	10.01	13.00				
95	10.70	12.34	12.68	12.80	12.35	11.45	13.46	10.36	13.98	15.21	15.65
102	9.48	10.40	11.08	11.24	12.95	12.45	14.10	17.18	15.44	16.77	16.83
Average	9.36	10.16	10.68	11.21	11.25	11.25	12.05	12.57	13.02	13.25	13.89

TABLE 29.—Monthly milk production of 23 buffalo cows for 25 lactation periods. (Figures in pounds)

Cow	Mo.										
	1	2	3	4	5	6	7	8	9	10	11
2	140.00	117.80	183.00	127.10	150.00	145.70	108.50	90.00			
4	133.40	134.40	173.60	138.00	136.40	120.00	108.50	93.00	114.00	118.80	75.00
51	359.60	354.00	316.20	276.00	254.20	241.80	210.00	201.50	186.00	135.00	
52	217.50	227.00	196.20	190.80	190.30	155.70	172.36	164.30	178.08	133.30	129.90
52	375.10	306.00	242.00	218.40	266.60	243.10	225.96	236.80	176.10		
53	303.00	303.80	272.80	221.20	226.30	195.00	179.00	90.00	93.00		
54	350.30	333.00	294.50	285.20	235.20	254.40	213.00	201.50	135.00	124.00	96.20
55	310.00	279.00	272.80	251.10	210.50	179.80	168.00	109.50			
56	399.00	311.60	294.00	291.40	250.50	236.30	239.30	226.50	230.30	196.50	167.10
57	292.50	171.30	248.00	191.00	133.30	150.00	135.80	108.50			
58	150.00	258.90	232.50	227.10	212.00	185.50	173.60	162.80	179.80	209.60	181.20
60	312.00	310.00	274.40	241.80	180.00	201.50	135.00	99.20	83.70		
62	113.20	93.00	160.80	153.80	125.10	151.90	151.70	145.00	162.40	113.70	
63	313.10	285.60	300.70	264.00	294.50	180.00	220.10	151.90	135.00	102.30	
69	247.40	224.40	236.20	172.20	167.80	144.30	112.80	89.90	70.50	39.10	
71	255.00	264.70	229.10	206.90	213.00	187.80	156.60	143.30	94.60	77.50	57.70
76	216.50	144.15	186.00	110.20	110.20	109.00	108.60	108.50	69.75	58.90	
76	303.80	237.50	194.00	201.50	188.10	170.50	135.60	112.76	90.45	75.90	70.70
77	296.80	251.10	219.50	257.30	191.10	174.30	136.80	101.10	97.70	81.50	72.50
79	363.94	299.15	256.76	266.50	190.64	147.00	129.90	106.30	89.30	69.40	
83	381.92	302.40	261.64	221.20	167.60	149.89	124.20	117.50	112.50	96.60	57.30
85	363.30	319.90	249.90	264.00	164.90	156.30	158.72	128.96	99.68	95.17	
92	333.09	237.30	253.27	219.10	66.10	48.30					
95	221.70	156.00	149.42	103.85	141.12	167.40	132.60	125.86	112.20	105.09	76.67
102	235.69	231.30	212.70	156.30	121.50	114.10	81.00	84.90	73.80	76.20	60.76
Average	279.51	246.13	237.60	210.24	182.76	168.38	154.90	133.31	123.04	107.53	95.00

09 12

THE WEIGHT OF WATER BUFFALO COWS

In winter of 1920 and 1921 the Canton Christian College secured a large pitless stock scale from America for us in connection with its animal husbandry work, particularly for use in the college dairy. In March of 1921 the scales were erected and the writer began taking regular readings of weights of all buffalo cows used in the dairy and for draft purposes at the college.

The table which follows gives the weights of 24 mature buffalo cows, which in most cases were recorded over a period of 12 months. During this period each cow was weighed every other week on Monday and Tuesday mornings. This made from four to six weighings of each cow each month. The averages of these weights for each month were calculated and taken for the month's weights and are the figures given in the table. The minimum and maximum weights for 12 months or less are given for each cow, as well as the average weight of each cow for this period.

The average weight of the 24 buffaloes for the period, obtained by adding individual average in the bottom row of the table, and dividing the total by 24, is 1076 pounds. The average weight of the lightest cow during this period was 911 pounds for cow No. 104. That of the heaviest was 1309 pounds for cow No. 77. The lightest monthly weight was 884 pounds for cow 104 in the month of July, 1921. The heaviest monthly weight was 1365 pounds for cow No. 77 in September, 1921.

All the cows were in good condition thruout the period covering the time when the weights were taken. Fifteen cows freshened or aborted during the period represented by the table. No. 52 freshened July 9, 1921; No. 56 October 25, 1921; No. 57 June, 1921; No. 62 September 2, 1921; No. 69 February 28, 1922; No. 71 December 10, 1921; No. 74 aborted May 26, 1921; No. 76 freshened March 20, 1922; No. 83 aborted October 26, 1921; No. 85 freshened May 30, 1921; No. 87 August 17, 1921; No. 92 Sept. 12, 1921; No. 95 December 16, 1921; No. 105 August 17, 1921; No. 106 September 2, 1921; and No. 108 January 5, 1922. Nos. 58, 77, 79, 101, 102 and 107 freshened before and following the period when these weights were recorded.

There were no thin or very fat cows in the lot, with the exception of cows 57 and 62, which were fattened and sold to a Canton butcher. In the writer's opinion the cows probably carried 50 pounds more flesh than the average buffalo cows kept for draft purposes in southern China, altho they were no fatter than the average buffalo cows kept for dairy purposes.

Table showing the weights of 24 water buffalo cows at Canton Christian College over a period of 12 months. Figures in pounds. (Continued on next page)

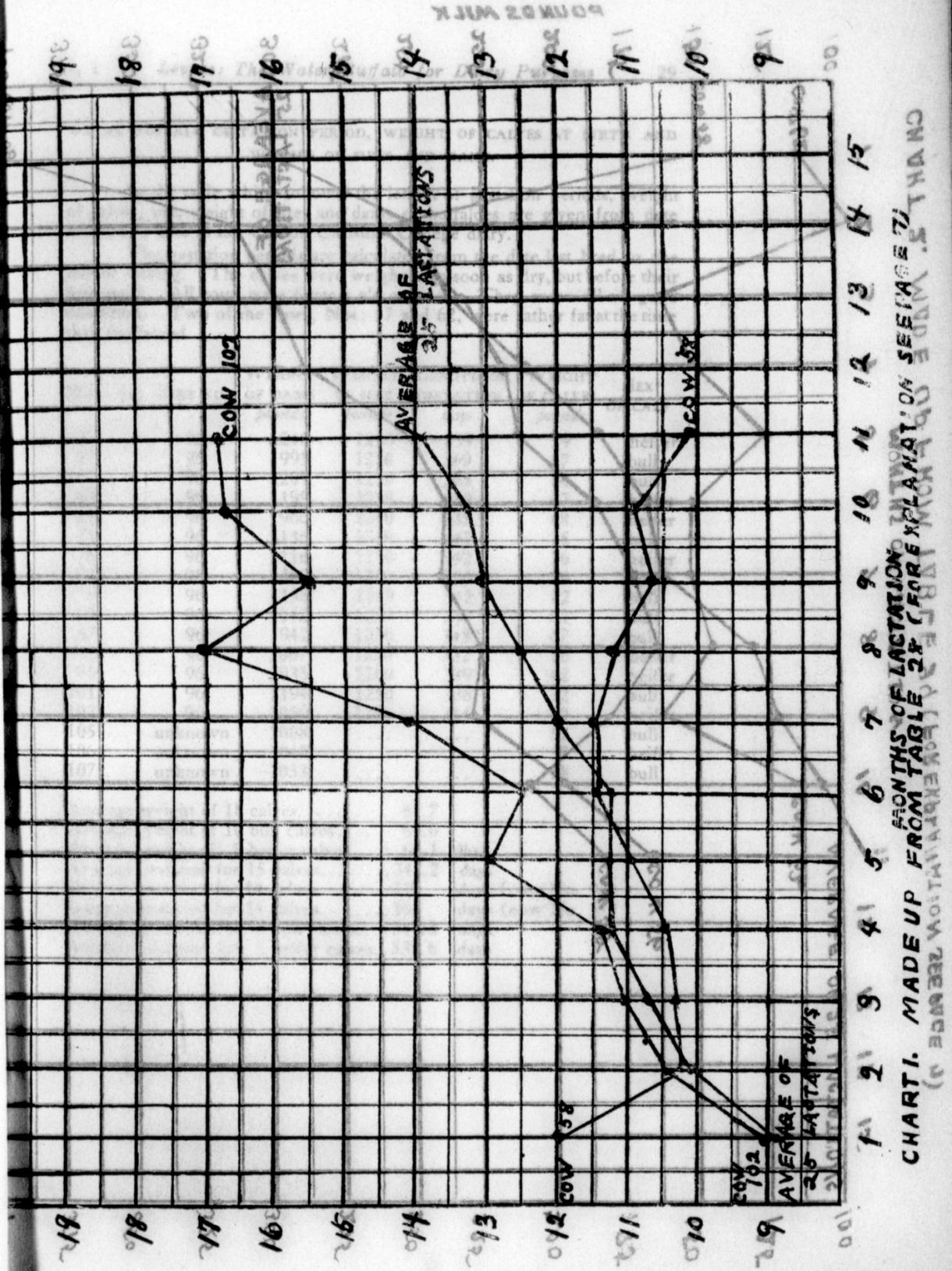
Month	Cow	52	56	57	58	62	69	71	74	76	77	79	83	85
April 1921		1152	974	1228	1009	1130	963	1044	958	1033	1185	1139	1144	1101
May		1180	1017	1269	1028	1153	997	1078	983	1069	1210	1005	1159	1065
June		1239	1020	1229	1045	1185	1013	1100	1000	1099	1254	1062	1140	992
July		1235 <i>fresh</i>	1055	1191 <i>fresh</i>	1092	1243	1045	1129	1021	1098	1289	1110	1207	1023
August		1199	1086	1234	1118	1293	1092	1191	1008	1133	1334	1156	1241	1028
September		1265	1081	1212	1120	1270 <i>fresh</i>	1152	1200	977	1157	1365	1187	1249	1038
October		1183	1038	1191	1106	1093	1109	1201	962	1138	1352	1168	1229	1012
November		1165	962 <i>fresh</i>	1205	1129	1095	1095	1225	976	1116	1348	1137	1197	1008
December		1154	934	1179	1127	1089	1089	1144 <i>fresh</i>	962	1130	1341	1210	1176	1008
January 1922		1163	922	1155	1152	1093	1093	1107 <i>fresh</i>	965	1127	1351	1182	1167	1013
February		1197	910	1150 <i>sold</i>	1150	1110	1110 <i>fresh</i>	1113	950	1127	1343	1160	1177	1107
March		1170	940	...	1140	...	970 <i>fresh</i>	1083	923	1130 <i>fresh</i>	1333	1145	1140	1110
Minimum		1145	910	1155	1009	1093	970	1044	923	1033	1185	1062	1140	1008
Maximum		1265	1086	1269	1152	1293	1109	1225	1008	1157	1352	1210	1249	1107
Averages		1200	995	1209	1101	1199	902	1136	996	1116	1309	1138	1186	1042

1360

Month	Cow	87	92	95	101	102	103	104	105	106	107	108
April 1921		882	930	847	...	...	...	...	...	...	...	...
May		936	991	945	1110	965	896	...	...	...	...	...
June		976	1008	977	1141	994	943	...	...	...	...	...
July		1034	1066	1022	1203	1006	975	884	...	...	...	...
August		1018	1119	1070	1112	1037	<i>died</i>	902	1120	1000	...	...
September		944	1042	1143	1255	1050	...	931	1000	1090	...	...
October		900	990	1126	1246	1044	...	926	967	1050	...	...
November		900	963	1163	1253	1062	...	<i>sold</i>	984	1074	1045	...
December		897	991	1089	1230	1078	...	...	993	1038	1013	...
January 1922		905	1005	1013	1198	1052	...	...	1004	1045	1015	775
February		970	1013	1007	1164	1050	...	...	983	1060	1037	fresh
March		937	960	1020	1220	1043	...	...	977	1023	1053	1037
Minimum		882	930	847	1110	965	896	884	967	1000	1013	975
Maximum		1034	1119	1163	1255	1078	975	931	1120	1090	1057	1037
Averages		942	1007	1035	1194	1035	938	911	1008	1048	1048	1005

Table showing the weights of 24 water buffalo cows at Canton Christian College over a period of 12 months. Figures in pounds.

(Continued)



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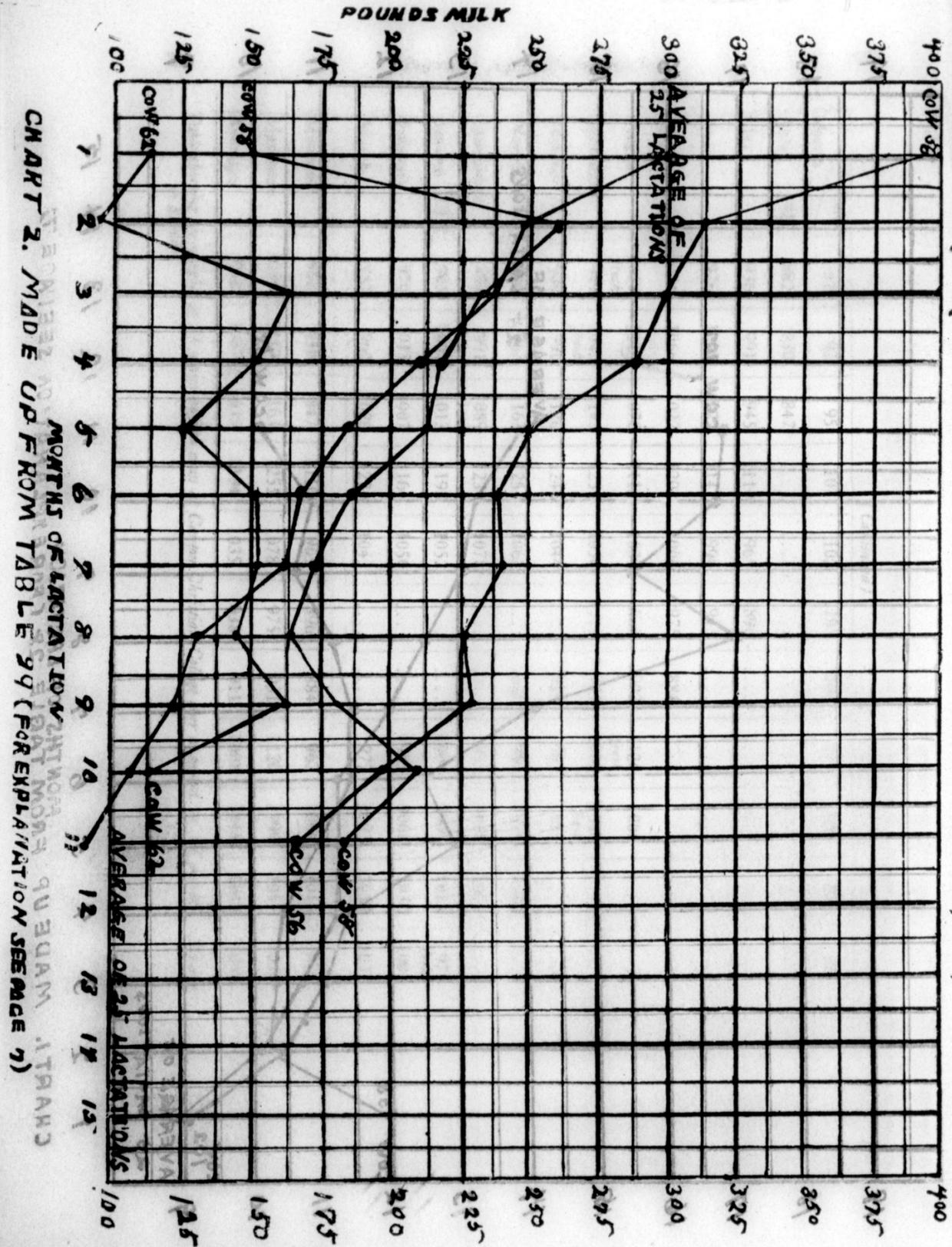
WATER BUFFALO GESTATION PERIOD, WEIGHT OF CALVES AT BIRTH AND WEIGHT OF Sires AND DAMS.

In the table which follows, the length of gestation periods, weight of calves, sex, weight of sires and dams of buffaloes are given from date secured to date in the Canton Christian College dairy.

The gestation periods are calculated from the date last bred to the day of calving. The calves were weighed as soon as dry, but before their first meal. All cows were 6 years old or over. They were all in good condition. Two of the cows, Nos: 57 and 62, were rather fat at the time they freshened.

DAM NO.	SIRE NO.	WEIGHT OF DAMS pounds	WEIGHT OF SIRE pounds	LENGTH OF GESTATION days	WEIGHT OF CALVES pounds	SEX OF CALF
52	96	1240	1250	339	79	heifer
56	96	995	1250	349	67	bull
57	96	1209	1250	363	80	bull
62	96	1199	1250	339	67	heifer
69	96	966	1250	335	68	heifer
71	96	1136	1250	341	75	bull
76	96	1116	1250	342	76	heifer
77	96	1309	1250	356	76	bull
79	96	1138	1250	342	82	bull
85	96	1042	1250	341	61	bull
87	96	942	1250	348	67	bull
92	96	1007	1250	332	60	heifer
95	96	1035	1260	339	62	heifer
101	96	1194	1250	338	72	bull
102	96	1050	1250	344	60	heifer
105	unknown	1008	....	...	52	bull
106	unknown	1048	....	...	57	heifer
107	unknown	1033	....	...	58	bull

Average weight of 18 calves..... 67.7
 Average weight of 10 bull calves.... 69.0
 Average weight of 8 heifer calves 66.1 lbs.
 Average gestation for 15 calves.....343.2 days
 Shortest gestation for 14 calves.....332 days (cow No. 92)
 Longest gestation for 14 calves..363 days (cow No. 57)
 Average gestation for 8 bull calves...347.3 days
 Average gestation for 7 heifer calves. 338.6 days



REFERENCES CITED

- (1) F. LAMSON-SCRIBNER: In Cyclopedia of American Agriculture, by L. H. Bailey, *iii*, 292.
- (2) HEWLETT: Breeds of Indian Cattle, Bombay Presidency, 32-33, 40.
- (3) EVARISTO: Philippine Agriculturist and Forester, *iv*, 131.
- (4) LEVINE: Notes on Farm Animals and Animal Industries in China, Canton Christian College (Canton, China), Bul. 23 (1917), 35-47.
 LEVINE AND CADBURY: A Study of Milk Produced in Kwangtung, Canton Christian College, Bul. 18 (1917).
 LEVINE: Analysis of Water Buffalo Milk in South China. Philippine Journal of Science, *xv*, 91-103, July, 1919.
 LEVINE: The Water Buffalo a Tropical Source of Butter Fat. Journal of Heredity, *xi*, 51-64, February, 1920.
 LEVINE: The Water Buffalo as a Dairy Animal. Journal of Dairy Science, *iii*, 340-352, September, 1920.
- (5) DOVEY: The Composition of Carabao's milk. Philippine Journal of Science, *viii*, 156, June, 1913.
- (6) PRETTNER: The resistance of the buffalo against experimental tuberculosis. Centralblatt für bakteriologie u. parasitenkunde. 1 abt. Orig., *xxxi*, 681-686.

SERICULTURE IMPROVEMENT IN SOUTHERN CHINA.

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THE OUTLOOK

When one takes into consideration the fact that China is the home of the silk industry, that from this country it has spread to other parts of the world, that sericulture has reached such a low level in China to-day, and that other countries have so far surpassed her in the production of this modern necessity, the outlook may seem gloomy. The Western world is pressing for more silk and looking for greater sources of supply. China is one of the few remaining countries where labor is still cheap enough to produce large quantities of silk at a reasonable cost and she should have long ago seen the possibilities for the development of this industry.

On the other hand, when we look into the remote past and realize that it was the observant eye and keen mind of one of the progenitors of the present Chinese people which discovered that this *worm* spun a cocoon which could be used as a fibre for weaving cloth and that it could be unwound from one end to the other without breaking, it gives high hopes for what may be accomplished in bringing the industry back to its proper place. Such hopes are further strengthened when we see how eagerly the efforts made to bring this about have been accepted in South China and how quickly the people have come to understand the plans for improvement which are being outlined.

The production and sale of mulberries and silk are very highly organized in South China, perhaps better organized than in any other part of Asia. New methods can quickly be incorporated into the industry and become effective, as soon as the people see the need of them.

The knowledge of sericulture in South China is very vague to most people outside of the two southern provinces of Kwangtung and Kwangsi. This is perhaps due to the fact that they are more or less isolated geographically and ethnologically from the rest of China. There has been only limited intercourse between the North and the South. The Western world approaches China through Shanghai and the South is forgotten. Most of the books upon sericulture in China, even those written in Chinese, refer to conditions and methods in the central and northern provinces. And yet an industry has grown up differing materially from that of the rest of China, peculiar in many respects, but very profitable in the past and with great promise for the future.

QUALITY OF SOUTH CHINA SILK

South China produces a type of silk very different from that of any other silk producing country, although resembling that of Tonkin, Siam and India. This silk is very fine, soft and spongy. It has a wonderful "sheen" and takes dyes readily. The cocoons are small and thin, but proper handling makes them larger and thicker. When a skein of Shanghai silk is placed beside one from Kwangtung the difference between the coarser, harsher and more wiry dull silk of the Yangtze region and the fine, soft, shiny silk of the South is quickly noticed. The result is that Kwangtung or "Canton," silk is increasingly demanded by Western countries to produce certain silk fabrics, such as crepe and velvet for which it is eminently suitable. The idea seems to be prevalent that Shanghai silk is of a better quality than Canton silk. The above statement answers this question. They are different and have different uses and neither one can be said to be better than the other. As soon as the diseases of the silk worm are eliminated and the methods of handling them are improved the southern silk becomes stronger, but it will always be soft and fine. Nowhere in China are such soft shiny silks woven or such beautiful embroideries produced as in the South with Canton Silk.

EXTENT OF THE SERICULTURE INDUSTRY IN SOUTH CHINA

In Kwangtung province there is an area approximately 60 miles square, in the delta region between Canton, Hongkong and Macao, where silk is produced. It is also produced along the West River in a belt from a quarter to a half mile on each side of the river, as far as the Kwangsi border and into that province along the rivers in a similar manner nearly to its western border. North of Canton and north of Swatow there is a little silk produced in very small quantities but too small to be considered at the present time. To the southwest there are also several small areas of production. In the Island of Hainan there is also some silk produced but of a variety differing somewhat from that of the mainland. Probably if all of these areas were consolidated they would about equal an area of not more than 600 square miles. This however is only an estimate as we are not yet in a position to state accurately the limits of the silk regions. For scientific work we have the advantage of having the silk districts contiguous and easily accessible for the most part. Investigations and propaganda can be carried out with the least possible loss of time and money. Information passes rapidly through the adjoining districts. In the sale of special products such as "egg sheets" it is possible to pass quickly from one market to another and reach many people in a short time.

SIX CROPS OF WORMS IN SOUTH CHINA

South China sericulture is peculiar in another point. The climate and method of cultivating the mulberry make it possible to rear at least six crops of worms in rapid succession and sometimes seven. Although the



Fig. 1. Examining moths with the microscope for disease spores, Canton Christian College.

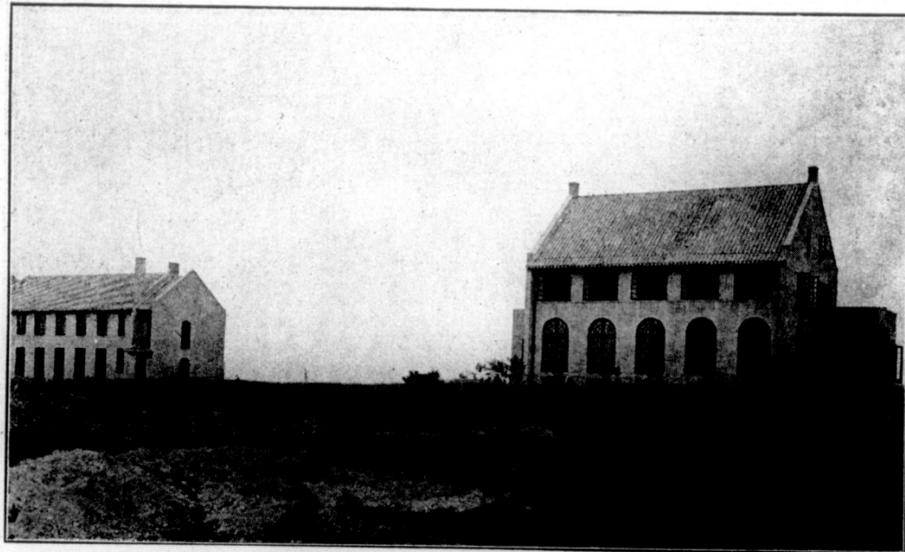
Photo by Canton Christian College.



Fig. 2. Selecting moths and putting each one under a cone for egg-laying. This makes it possible to examine each female, and if she contains disease spores, to destroy her eggs. Only eggs from disease free moths are used for hatching at Canton Christian College.

Photo by Canton Christian College.

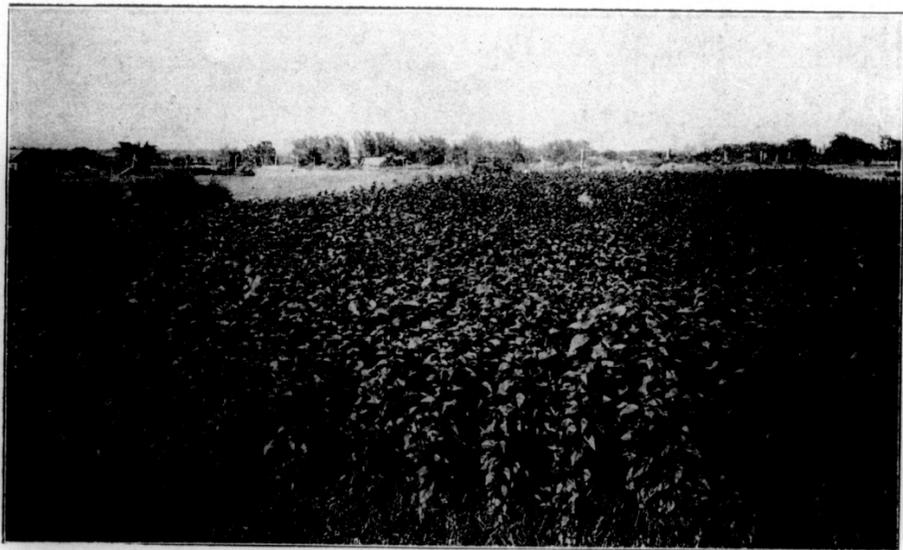
PLATE I.



SILK BUILDINGS, CANTON CHRISTIAN COLLEGE.

Fig. 3. Building on right is the main building for offices, laboratories and rearing rooms. The one on the left is a dormitory for students. Both buildings are now much too small and a large house for rearing silkworms is urgently needed.

Photo by Canton Christian College.



ONE OF THE MULBERRY FIELDS, CANTON CHRISTIAN COLLEGE.

Fig. 4. These mulberries are grown as shrubs. They are cut to the ground and allowed to grow up new each year.

Photo by Canton Christian College.

PLATE 2

worms are of a small variety and the resulting cocoons smaller, the fact of being able to rear so many crops in one season makes it possible to produce a large total crop.

EXPORT OF SILK FROM CANTON

Canton raw silk is exported to the amount of one-half to two-thirds that of Shanghai which draws from an area of production probably at least ten times larger, but a region with only one crop each year. During 1920-21 the Canton exports nearly doubled and came close in amount to those from Shanghai, due to the excessive demand for Canton crepes in America.

The following table will show the relation of exports of Canton raw silk to those from Shanghai to Japan:—

	CANTON	SHANGHAI	JAPAN
1918	39,789 bales	75,228 bales	235,822 bales
1919	57,041 ,,	95,003 ,,	284,401 ,,
1920	39,492 ,,	55,270 ,,	171,963 ,,
1921	61,566 ,,	73,163 ,,	261,265 ,,

With the introduction into the Canton filatures of the American standard reeling, a larger proportion of the Canton raw silk is finding its way to the American market.

The following table shows the proportion of Canton silk which has been going to America:—

	AMERICA	EUROPE
1918	15,451 bales	24,338 bales
1919	34,626 ,,	22,415 ,,
1920	25,181 ,,	14,311 ,,
1921	48,057 ,,	13,509 ,,

POSSIBILITIES OF INCREASING THE PRODUCTION OF SILK IN SOUTH CHINA

South China is eminently adapted to the production of her present type of silk provided more scientific methods can be employed. It has been proved quite conclusively that the types of silk worm from Central China and Japan do not succeed in the tropical climate of the South unless very great care is exercised in their rearing; many varieties will not live at all because of the heat. Many attempts have been made in past years by farmers to introduce these northern worms but they always report that the worms sickened and gave poor results, in exact accordance with our experiments.

In certain centers it is being advocated that the Central China or Japanese worms should supplant Canton silk worms. This will be found impossible except for a crop in February and March when the temperature is sufficiently low. But as we already have a two generation worm here which breeds in the spring and has a silk of the Canton type, it is difficult to see the need for a change of this sort.

At the present time the silk producing areas can be made to product from three to five times the present crop of silk if certain conditions of disease elimination and rearing can be effected. When that has been accomplished there are areas which can be encouraged to take up silk production totalling probably, at a conservative estimate, four times that already in mulberries. Some of these areas have reared silk worms in the past and given it up because of the presence of disease. Already as a result of the small amount of work done by this college there are indications that it will be easy, whenever the work is well under way, to encourage new districts to enter the industry.

DEVELOPMENT OF SERICULTURE IN JAPAN

The growth of sericulture in Japan shows what might be done in China by the introduction of scientific methods and by the careful supervision of the industry. With the opening in Japan of the treaty ports to foreign nations in 1858, her golden era in silk began. Since 1868 her exports of raw silk have increased over 20 times and their value over 60 times. In 1919 the returns from raw silk were one quarter of the returns from all exports.

Between 1871 and 1875 Japan exported 691,000 kilos of raw silk, Canton 945,000 kilos and Shanghai 2,996,000 kilos. In 1915 Japan exported 12,005,000 kilos of raw silk, Canton 1,845,000 kilos, and Shanghai 5,460,000 kilos.

There facts give some idea of the way in which the industry has grown in Japan as compared to China. This growth is mainly due to the interest which the government has taken in organizing the industry and in introducing modern scientific methods of producing and handling silk. A few years ago researches carried out by the government silk experiment stations resulted in increasing the silk from the cocoons reared from an egg sheet by nearly fifty per cent.

TOTAL SILK PRODUCTION IN SOUTH CHINA

How much silk South China uses for itself cannot be told as no system for gathering such statistics has yet been organized by the government. It is certainly several times the amount which is exported. One estimate says that 315,100 piculs* were produced in Kwangtung in 1921. Even peasants may often be seen wearing silk in South China. Several large districts weave immense quantities of silk cloth of many kinds and hand filatures are still every day sights even in the larger districts where steam filatures are common. Usually the poorer quality of cocoons are unwound by the women in the homes and used for local weaving, the best cocoons being sold to the steam filature to unwind and export to foreign countries. The Chinese people are themselves wearing more and more silk and the prices of local woven silk have increased nearly 33 per cent. during the last two years.

*one picul = 100 catties = 133 pounds.

VARIETIES OF SILK WORMS

Before proceeding further the following details regarding silk production in South China may be of interest:

Two varieties of silk worms are reared in South China, one bivoltine and one polyvoltine. Both produce the same general quality of silk, soft and spongy and with a high lustre and the same type of soft cocoons, but the bivoltine cocoons are large and the fibre a little coarser than the other. The bivoltine cocoons are called *Tai Tso* (大造)* and the polyvoltine *Lun Uet* (輪月). A hybrid between these has been made with a slightly larger cocoon and was formerly called *Saam Tso Kwai* (三造歸). This hybrid is now called *Lun Uet* (月輪) and is reared through out the province to the exclusion of the true "*Lun Uet*" worms. It has brought many difficult problems into the industry. The worms are smaller than those of Central China, white or with a few black spots. The cocoons are elliptical, rather soft and white or lemon yellow in varying intensities of color.

REARING SILK WORMS

The silk worm moths are made to place their eggs on large sheets of paper 25 x 15 3/4 inches in size. At the end of the season these papers are rolled up in a paper wrapper and hung in the coldest place in the house. There they remain from August or October until middle or late January, when the eggs begin to hatch. The alternation of warm and cold weather during the winter causes them to hatch this early, and what is more, to hatch very irregularly. This is probably one of the causes of weakness in our worms. About 1000 men in Kwangtung confine themselves to egg production and during January and early February rear these early hatched worms on mulberry leaves which have been forced to bud earlier than normal. These leaves are very expensive and often of very poor quality due to weather conditions. As the season is cold, the worms are reared in rooms kept at a high temperature (often 100° F., or more) with charcoal burners. The result is small weak worms and cocoons and small eggs. This is the source of all the eggs which come to the farmer when the mulberry leaves are ready to pick and he begins to rear worms in late February or early March. This system is followed for both types of worms. If they were able to keep the egg sheets in cold storage at an even temperature and take them out to hatch in late February or March they would have more evenly hatched and stronger worms and better cocoons.

The *Tai Tso* worms are reared by the farmer for only one crop after this egg crop and are preferred to the *Lun Uet* because of their greater size and strength. The egg producers preserve the dark eggs from the second crop until the next January when they rear a crop again only for egg production.

The hybrid worm which is now called *Lun Uet* continues for at least six generations more, one after the other in close succession. About five weeks on the average covers the time from egg to egg again. This

**Tai Tso* means 'big generation' i.e. the worms and cocoons of this type are larger than the common variety.

means intensive, concentrated work for the farmer from February to mid-October. If this worm were a true polyvoltine silk worm, such as probably existed at one time in the province, the eggs would all be thin-shelled and cream colored and would hatch naturally in seven to ten days after laying, but the hybrid which is now reared produces such eggs only during the first two crops. With the third crop thick-shelled, dark colored winter eggs begin to appear and at the fourth crop all are dark eggs. Such eggs will not hatch naturally until the next January. To secure the six crops as was the custom with the former polyvoltine worm, the farmers have found that by immersing the eggs in hot water for a few seconds on the morning after they are laid by the moth, they can force the embryo to develop and hatch and so they can get six crops of cocoons each season. This watering of the eggs is a very delicate process and can be done successfully by only a few men, which is probably one of the reasons why egg production has come into the hands of only a few men. The forced hatching of the eggs is another reason for the weak, diseased condition of our silk worms. The necessity for it also hinders the introduction of modern scientific methods of egg inspection.

Eggs are sold on markets maintained by private owners in each large town. There the farmer buys what sheets he can rear. They are sold by the weight of moths employed to lay the eggs. The standard is an 8 Chinese ounce (10.67 English ounces) sheet, which means that 8 ounces by weight of moths were required to lay the approximately 200,000 eggs on the sheet. Prices range from 50 cents* to \$10 a sheet depending on conditions of weather and mulberry crop.

The largest silk districts are in the low, level delta region of the Pearl and West Rivers. The land is subject to frequent floods and during a flooded season the mud floors of the mud-walled, thatched houses, in which the worms are reared, are not many inches above the water. The result is a house with an atmosphere charged heavily with moisture, a condition not favorable to silk worms. Besides this the room where the worms are kept is always shut off by itself and often at the least suggestion of a lower temperature charcoal fires are started to maintain a higher temperature. These rearing rooms are always as small as possible. The result is worms are reared under very crowded conditions in a hot humid atmosphere without circulation of air. Windows are almost lacking so very little light and no ventilation can be admitted.

In the handling and feeding of the worms the farmer tries to utilize all his available space and so crowds the worms in the baskets so that they are actually often seen lying on top of each other. This means that much mulberry leaf is "trodden underfoot," not eaten, ferments and causes disease, not to mention loss to the farmer who must buy his leaves on the leaf market at a high price, often from \$5.00 to \$8.00 per picul. The average price is from \$3.00 to \$4.00 per picul. When this condition is added to the forced hatching, the wonder is that any worms survive at all, and in many cases they do not.

*Throughout this paper, unless specifically excepted, all prices are given in Canton subsidiary silver currency. At present exchange \$1.00 Canton currency is approximately equivalent to \$0.50 United States currency.

DISEASE A GREAT HINDRANCE IN RAISING SILK WORMS

Let us add one more condition which is not favorable; that is the presence of "pebrine." Samples of cocoons when brought in and the moths allowed to emerge always test out from 50 to 100 per cent, with an average of 80 per cent, of bad infection with this disease. This weakens the worms and predisposes them to "flacherie" and other diseases, which are very prevalent in Kwongtung due to tropical conditions. Pebrine can be easily controlled as experience has shown. The life cycle of the pebrine organism is about 28 days and our silk worm reaches full growth in 18 days so that microscopical inspection seems to eliminate it more thoroughly than elsewhere. In one lot of moths reared at Canton Christian College inspected recently, 1550 showed one moth with medium infection and two with a questionable infection. Better results could not be secured.

It would seem that a combination of conditions had united in South China to prevent the silk farmers from getting good crops and the result has been that many farmers and even whole villages have abandoned the industry as a losing proposition. They live on so narrow a margin that they cannot risk money year after year in a business which often gives only failure.

We might almost repeat the above story of faults for mulberry culture. Mulberries are grown by one farmer and sold to another who rears silk worms. This phase of the industry has been organized about as elaborately as cocoon production but needs very badly some scientific study of value of the different varieties which are grown and methods of picking, marketing and storing leaves. Many losses of worms can be traced to poor quality or condition of leaf.

In spite of the adverse conditions prevailing, the hope for the future of this industry in South China is very bright. It is concentrated so that all districts can be reached easily. The six crop system per year makes it possible to get results in one year which require six years in Central China. The farmers realize their difficulties and are eager and quick to take advantage of any solution when its value is once demonstrated to them. The Canton Christian College has demonstrated by four years work, in a small way, what can be done.

SERICULTURE WORK AT CANTON CHRISTIAN COLLEGE

The work in Sericulture at Canton Christian College began during the season of 1919 when the Comité Internationale pour l'Amélioration de la Sericulture dans le Koungtung asked the College to cooperate with them. This committee had been formed by the British, French and Chinese Chambers of Commerce of Canton with a representative of the Government and later a representative of this College. By levying a tax of ten cents per bale on the total export figures of each individual firm, both foreign and Chinese, a sum was raised sufficient for their experimental work. Cocoons were purchased on the market and egg sheets produced

for hatching. Three stations were selected for experimental work, one of these being at Canton Christian College. A farmer from Shun Tak district was engaged to care for the worms and a room in a wooden building on the campus set aside for them. The building proved unsatisfactory, being small and poorly ventilated so that the results were not extremely encouraging.

The College also planted 3000 mulberry trees. The equipment, trees and labor were furnished by the International Committee, and the building, land and supervision by the College.

The results of the work of the International Committee were very satisfactory, the percentage of disease being reduced from 79 per cent in the original cocoons purchased from the market, to 16 per cent in the second crop. The moths increased the number of eggs laid from an average of 250 to 400, and the cocoons were larger and stronger. When the egg sheets were sent to the farmers they obtained excellent results and were eager to receive more.

The work of this committee was, however, short lived. An appeal was made to the Government to appropriate money from the Customs surplus to carry on the work on a large scale. The government did not respond and the Committee dissolved feeling that it was useless to continue unless funds were available in large amounts.

The following year, 1920, the College was left to push the work alone. No money was available and there was no suitable place for rearing worms. It was felt however that if the work was allowed to drop at that time, the propaganda for silk improvement in South China would be very much delayed. As we had a small mulberry field and the equipment given to us by the International Committee, a corner of the Biology Laboratory was set aside and two members of the staff fed the worms through the summer. All of the improved eggs of the Committee had been given away so the College had to start anew. Cocoons were purchased on the market for the first egg crop. The moths from these were about 85 per cent diseased. By the end of the season the pebrine in the stock was reduced to one-half of one per cent. This is the stock from which the present Canton Christian College silk worm eggs are being produced.

Aside from producing a stock of disease free worms for future work, these two first years were years of investigation. They gave an opportunity to study the characteristics of the local worms, methods of handling and of disease reduction. As much time as possible was spent in the field to study and observe local methods and problems. This was very essential to the future development of the work.

During the year representatives of the Silk Association of America came to Canton and very generously gave the money for a large building for sericulture. Also Mr. Marcus Frieder of the General Silk Importing Company gave the money to erect a dormitory building for short course students. These buildings were erected on a slight hill south of the College campus with broad slope to the south and east where mulberry fields could be planted as soon as the land could be bought from the villages.

Unfortunately the buildings could not be finished prior to the opening of the season of 1921, so the first crop of worms had to be reared in the Biology laboratory. The second crop was started in the new building. This building is intended for offices, class room and laboratory use and experimental work. There are four large rooms on the first floor which can be temporarily used for rearing silk worms, but two of these must eventually become class rooms, another library and museum, and the other reserved for research work. The large rooms on the second floor are reserved for microscopic work in egg selection and for the preparation of egg sheets. A large basement furnishes room for storage of mulberry leaves, stoves for heating water, toilet and water tank. A large attic gives ample storage room for equipment. The lack however of a proper water supply is a serious handicap. A well and a gasoline pump are badly needed to furnish the constant and abundant supply of water needed in such work as this and for the students and workmen housed in the buildings. The rainfall is not enough during most of the year to keep the tank filled for more than two days at a time.

During the two years just referred to, the then department of Agriculture had seen the future possibility in silk work and had furnished money and labor to plant as much land as was available to mulberries, so that at the beginning of 1921 we had about 20 acres (100 mau) of mulberry trees to draw upon for leaves. This has now been increased to 22 acres (110 mau).

Up to the present season (1922) the care of the mulberries was left with the department of Agriculture. But this year with the organization of the College of Agriculture and with Sericulture as a department of that College, mulberry production and study has been assigned to the department of Sericulture.

During 1921 worms were reared to the fullest limit of food supply. One experienced assistant and two apprentices with three workmen comprised the staff. Mr. Chan Lim Paak very generously gave a sum of \$2000 which covered the greater part of the expenses. To a large extent this was again a year of experiment and feeling our way. We were able to produce 450 sheets of disease free eggs (each sheet containing approximately 200,000 eggs) of the standard local type. Half of these were given to farmers to get them interested in our product. They showed great eagerness to get more but were not eager to pay much for them. The other half of the sheets however we were able to sell at market price or a little below market price. During July and August an epidemic of flacherie came upon us due to the unusual heat and dryness. This was our first experience with this disease in so virulent a form and it seemed best to hold up egg production until a study could be made of the disease. This gave a setback to the work of propaganda but made it possible at that early stage of the work to learn more about the prevalent diseases and how to control them. A very definite impression was also made on the farmers, in one or two silk districts, of the possibility of eradicating disease in the silk worm and producing larger, stronger cocoons.

The last crop of worms in October 1921 gave us 132 large egg sheets to carry over the winter. To test the effects of cold storage on wintering eggs in South China, these were put into cold storage in Hong-kong and kept at a temperature of 40° F. from mid-October to early February. No attempt was made to rear the first crop in January. This rearing in over-heated rooms with forced mulberry leaves during the coldest month of the year must be abolished, and it seemed best to lead the way in this.

COLLEGE EGGS NOW IN GREAT DEMAND

A month before time to put the egg sheets on the market a sample was taken from cold storage and hatched to make sure that they had not been harmed by the cold. A notice was sent out and posted on the markets where eggs had been sold the past season explaining about the eggs and pointing out that although they would be dark colored winter eggs, whereas the eggs their merchants would put out for sale would be first generation light colored eggs, these cold storage eggs would be stronger and hatch more evenly. A special representative was also sent down to explain this to the people, but when the egg sheets were actually seen the farmers would have nothing to do with them. To induce purchasers we had to sell at \$1 to \$1.60 per sheet when the market price was \$10 to \$12 per sheet. This was a good investment however from many points of view for the purchasers soon found that these eggs all hatched within a period of 24 hours, whereas the eggs sold by other egg producers hatched over a period of 3 to 4 days. Furthermore the worms were unusually strong and large and all the sleeps were taken together in regular order, indicating very healthy worms. Large and strong cocoons resulted. At two markets since then egg sheets have been sold and selling has been extended to more markets. Everywhere the egg sheets sell at once, farmers crowding around the table and reaching for them without making any examination or talking price, a sign of extreme confidence. At the last market the price ranged from \$1 to \$1.50 per sheet. College egg sheets brought \$4 with no question raised, one woman even offering \$4 for a sheet which had been eaten in part by a rat. Orders have come in from many distant parts of the province, so far has their fame spread. The following translation of an item in a newspaper from one of the silk districts shows the scorn in which these scientifically produced eggs were held by the farmers at first but the change of attitude after their experience with the cold storage eggs:

Quotation from "Naam Tsan Tri-weekly News," Siu Laam, Kwongtung, Canton, April 22, 1922.

The High Price of Canton Christian College Silk Worm Egg Sheets.

"During the first crop of the season, Canton Christian College Sericulture Department, carefully studied a method of improving the silk worms and sent egg sheets to Siu Laam for sale. At first the farmers had

no confidence in them and despised and made fun of them, calling them chemical egg sheets which means useless egg sheets in the Chinese idiom. The farmers did not dare to buy them, hence their price went down to one-tenth of the market price. After they had come out they proved especially good and strong. Everybody praised them very much.

"Now it is the time for the second crop. Those who made the best profit in their first successful trial, are coming here to buy the 'Ling Naam' egg sheets again. Several days ago a man sent by the College hung up his sign and gave a talk about the method of developing the eggs and then sold sheets again. When the farmers saw him they crowded around him 'like ants coming to fresh meat'. They vied with each other in paying the high price for the eggs. Other people sold their egg sheets at under \$1.00 each but the price of 'Ling Naam' eggs went up to \$1.70 and \$1.80 each."

Farmers who reared from College eggs were able to get from fifty to seventy-five cents more per catty (1½ lb.) for their cocoons than the market price. That would mean for the ordinary small farmer an increase of \$40 to \$60 on each crop, a very appreciable increase in the income of a farmer for 5 weeks work, when each copper adds to the wall between him and starvation.

A still further effect of this work has been that many native egg producers have purchased the cocoons from farmers who have bought our eggs. Their custom is not to rear worms after the first crop in January, but to buy strong cocoons from farmers rather than rear them for themselves. This meant a large price to the farmer, but most of all, that the egg producers were preparing for sale eggs which would have not more than 1 per cent of disease, a vast improvement over their 50 to 80 per cent. of disease. The effect of the work of the College therefore was multiplied about eighty times.

From February to June 30, 1922, 1152 egg sheets have been produced. This is the limit which the capacity of the buildings and mulberry fields put upon the work. There are probably about 500,000 sheets of eggs sold in the province every month. We are producing only an extremely small part of that total. The College should be in a position to produce at least 1000 sheets per month. With the reputation which 'Ling Naam' silk worm eggs now have all over the province, although so few have been produced to date, we can charge a fixed price at least double the average market price. In a few months the business could be self-supporting, if the capital investment for buildings and mulberry fields could be found from outside. By working through the egg dealers and having them produce eggs from our stock, the production of good eggs can be increased from 1,000 to 80,000 sheets per month, one-sixth of the supply for the whole province. Given one year for the growth of our mulberry plants, and the second year for egg production by us on this scale, a marked and radical change in the quality of the cocoons brought to the filatures in South China would be seen. Of course we should even-

tually produce more than 1,000 sheets to meet the whole situation, say 5,000 sheets per month.

The present season a budget of \$10,000 has been provided by the College of Agriculture to meet the needs for egg production. This covers the care and upkeep of mulberry fields and the picking of leaves, as well as care of the worms. A staff of 14 is employed besides village women for special needs. To produce 1,000 sheets per month a staff of about 30 would be necessary and at least 100 acres of mulberry.

For the proper development of this work there is needed besides this a large building especially constructed for rearing worms for egg production and a cold storage plant where egg sheets can be kept over winter at an even temperature and so avoid the weakening effects of alternating temperature and early hatching. Also a great saving would result by being able to keep egg sheets over periods when the market conditions are poor and bring them out for sale when conditions improve.

The emphasis in the work of improving sericulture has been laid on good egg production because the eradication of disease from the eggs is fundamental and other improvements may follow later. Worms suffering from infection of *pebrine* are always weaker and besides producing thin cocoons are always more subject to infection with other diseases and to the effect of bad feeding and housing. The first emphasis has therefore been placed upon this phase of the work. In all other silk producing countries where modern scientific methods have been adopted for silk worm egg production, it is possible to produce large quantities of eggs which can be inspected for pebrine spores with the microscope. These countries usually have only from one to three crops a year and ample time is available for the slow process of inspection. In South China with six crops per year and only 7 to 10 days between the laying of the eggs and their hatching there is not sufficient time in which to inspect with the microscope. This condition is rendered more critical because of the necessity of placing eggs in hot water the morning after they are laid, which makes it impossible to carry out microscopic inspection of large quantities of eggs in the five to six hours available before they are watered. To meet the situation the following plan was worked out:—

There is time in the morning before putting them into hot water to inspect with the microscope sufficient eggs to be used for hatching the worms reared by the College. This means that the College stock is practically disease free and can be kept so each generation. From these sheets of eggs can be made and sold to the farmer, without microscopic examination, and in a form to which the farmer is accustomed. Pebrine will double in each generation. For illustration: we may say that there is $\frac{1}{2}$ of one per cent. of disease in the College stock. In the worms reared by the farmer there will be not more than 1 per cent. Then if the native egg producers get the cocoons from these worms and make egg sheets from the moths their sheets are only 1 per cent. infected against the usual 50 per cent. to 80 per cent. of infection, and the effectiveness of our work is greatly increased.

For the past two years this system has been followed and the farmers have been very quick to see the results. In spite of the faulty methods of feeding and handling, their cocoons have been much larger and stronger. In order to develop a system of inspection of all eggs sold, a cold storage plant will be necessary.

In preparing the eggs for hatching for the College stock, great care is taken to choose only the perfect cocoons and the largest and most perfect females for egg laying. Again if a circle of eggs from any moth is not laid in a regular manner it is discarded. This work of selection has resulted in three years in a remarkable change in the local silk worms. The worms are 25 per cent. larger than the stock from which they came and we require one-fourth more baskets to hold our worms than the farmers usually estimate are needed for the worms from a given quantity of eggs. The farmers notice this at once. Very little flacherie is present in any of them and all their life processes go on with a clock-like regularity unknown among diseased stock. The cocoons have increased two to four per cent. in weight. The moths are also much larger. The native egg producer usually places eight Chinese ounces of moths on an egg paper to cover it with a layer of eggs. The College moths are so much larger that seven ounces will produce as many eggs as the eight ounces did formerly. On a recent market we were offered \$3.60 per catty for cocoons of the grade of the sample we exhibited, whereas the market price for the usual grade of farmers' cocoons at that time was from \$1.50 to \$2.00 per catty. Farmers with their poor methods are getting from fifty to seventy-five cents a catty more for cocoons from our eggs than their neighbors for cocoons from local stock. The original cocoons from which the college stock came 3 years ago were bought in the place where most of the improved eggs have been sold.

The most promising result of this work is that the egg merchants are taking advantage of the College product to improve their own eggs. It is to be hoped that we may find a way to enlarge this work at once so that within a space of two years a decided change may be seen in the quality of South China raw silk.

There is much scientific research to be done before Canton silk is completely perfected. The system of putting eggs into hot water must be abolished. This problem is now being investigated and it is to be hoped that within another year or at the most two years a worm exactly the counterpart of the *Luen Uet* worm can be produced which will differ, however, in having eggs which do not need to be forced to make them hatch for the six crops. We are also working to produce a strain of pure white cocoons. By next season it should be possible to transfer all the College stock to a white spinning worm and eliminate the yellow spinning ones. There is still room for enlarging the worm and cocoon and many other problems of pure research which must be taken up carefully before we put their results out to the farmer through our eggs.

Mulberries are claiming attention also. Many good worms have been spoiled by being fed poor leaves. Several varieties are grown together in the same fields in South China. We are planning for experimental plots in which to isolate and study carefully each variety. Methods of cultivation must be improved; methods of marketing are not perfect and must be studied carefully. The mulberry of South China has been most remarkably adapted to the needs of the local silk worm, but it will be advisable to test mulberries from other regions and countries before deciding that they cannot be improved. In one point we have already improved the mulberry of our College fields, by planting on higher land and putting plants farther apart. The College should soon enter the field of producing the best type of mulberry plant for sale to the farmer.

Another step must be taken at once if the industry is to be quickly affected. Farmers must learn better methods of handling their worms and of housing them. With this in view we have taken in a class of students whom we call apprentices. Ten such men have been accepted to date who serve as workmen and learn by experience. In this way they get a good practical hold of the processes. Three of these men are going out to start work similar to that of the College next year in their own districts. Two will go into business with their families in producing cocoons for sale. The others have not decided yet what they will do but will probably enter some practical phase of the work.

A short course with 14 students is now being conducted, to run from May 1 to October 31, 1922. The 14 men have been sent to us by the Magistrate of the Shun Tak District at his expense to receive practical training and return to help improve the silk industry of that district. The Shun Tak District is the largest silk producing district in Kwongtung. The course given these men consists of class work in botany, zoology and general agriculture, sufficient to give them an understanding of the habits, physiology and culture of worms and mulberries. Lectures are also given on the handling of silk worms and their diseases and on the preparation and marketing of raw silk. Accompanying this class work is a great deal of practical work. Two crops of worms are being reared by the students themselves, the entire process from hatching of eggs to preparation of egg sheets being carried out by them unassisted. When they have finished this course and return to Shun Tak it is hoped that their work can be correlated with that of the College so that we can enlarge the field of our own efforts and also help them to apply their knowledge in a practical way.

A half year course is given during the second semester to college students. This consists of lectures, laboratory work and practice in rearing worms, together with visits to silk districts and filatures. The purpose is largely to interest college students in the great problem of silk improvement. Not many of the students will become sericulturists, but many will be able in other ways to help the industry. From these classes, however, three men have been secured to specialize in sericulture and become assistants in the department. One joins the work July 1, 1922, and the other two after further special study. An opportunity is also given for

college students who have had this introductory course, to make special studies of small problems during the summer vacation.

No attempt has been made to push the development of a School of Sericulture requiring a course of several years study, partly because of lack of funds, but mainly because we feel that sericulture should be pushed from the bottom with the farmer and not from the top with the scholar, except to such an extent as may be necessary to train a few men to help develop the work. There is, however, no School of Sericulture in South China and there is a limited need for a more advanced course to train leaders for the work. A one-year college course in sericulture would fill the need for the present. The coming year we hope to organize such a course.

The conditions in filatures in South China are such that there is urgent need for training foremen in the best methods of preparing raw silk and waste silk. It would also be well if special training could be given to the women who work in the filatures by means of short winter courses at times when the filatures are closed. For this a small model filature is urgently needed.

Our work to accomplish its full purpose must first reach the farmers who are producing the silk cocoons rather than the merchants and exporters who are selling the prepared product. In egg production this is being done. As was pointed out earlier, there are many faults in the housing, feeding and handling of the silk worm and in the care of mulberry plants and marketing of the mulberry leaves. Faults of this sort are not easily remedied for to do so the farmer must make considerable money outlay and in many cases must change from the customary procedure of many generations. In China custom is a chain which binds the common people tightly. The majority of the farmers cannot read or write and are extremely ignorant and superstitious. Such farmers can only be taught by demonstration. What they see with their eyes they can understand, and, if a profit results from a new method, there are always a few keener minds to lead the way in adopting it. The spirit of new China is progress and this spirit is beginning to reach even to the better farmer class.

As it is not possible to reach these farmers by schools or printed leaflets, the following methods of approach have been adopted. After the "good egg" idea, the next logical step seems to be to persuade them to rear their worms in houses which are better ventilated, drier and lighter. Several visits were made to silk districts to study the houses in which silk worms are reared. In the two largest silk districts, mud-walled, thatched houses, such as the farmers live in themselves, are also the homes of the silk worms. In fact they usually share the house with the farmer's family. With the help of an architect plans were made for a small model house of the usual type, to cost only about \$30 or \$40 more than the usual cost to the farmer. This house is now under construction at the College. It has a raised floor of cheap tiles so that it may be kept dry. There are also small windows in the walls and a ventilator in the roof, as well as a stove especially constructed to carry off the fumes of the charcoal fires which

must be used in early spring and late fall. Wood or coal fires are out of the question because of expense. This house will be tested the present summer and if successful will be an object lesson to visiting farmers and to students. It is hoped that funds will be available by the next year to erect several of these at strategic points in the important silk districts, put a trained man in charge of each one and show the farmers what a change can be made in silk worms by better housing. Several apprentices at a time might be taken at each station and the better methods of feeding and handling the worms taught to them. Such a station would be made self-supporting by the sale of cocoons or egg sheets, after the initial expenditure for land, house for attendants and house for silk worms.

In addition to this method of demonstrating, a field agent will begin work on July 1, 1922, whose first duty will be to visit the farmers who have purchased egg sheets from the College and assist them with advice and suggestions. If anything goes wrong so that they do not get the results expected from our product it will be possible to show them the reason why. This man has made a special study of sericulture at the College, is well qualified to get the good will of the farmers and will have the prestige of the degree of B.Sc. in Agriculture from this College. Several more men of this type should be trained and engaged for such extension work as soon as possible.

Demonstration and extension work will be supplemented by printed matter for those who can read. The experimental work is also not being neglected and as soon as the results have a practical bearing they will be incorporated in what goes out to the farmer.

The work as begun and as outlined above will be pushed as rapidly as land, equipment, and funds are available. Within a year the work in egg production should be self-supporting and ought eventually to cover the cost of experimental and extension work. It cannot do this at present, however, nor can it be made to cover cost of needed land and buildings. The filature should cover cost of maintenance by sale of raw silk, when the plant is installed. The work of instruction cannot be made self-supporting but the various phases of it are essential to the improvement of our silk.

A METHOD OF INDEXING AND FILING CHINESE PLANTS
ILLUSTRATED BY
A SYSTEMATIC ENUMERATION OF THE PLANTS
OF THE CANTON CHRISTIAN COLLEGE CAMPUS

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An index which lists plants in the order of their botanical relationship, and which records both Latin and native names, is a valuable aid in the study of the flora of a region. The average student of botany, the home gardener and the horticulturist, appreciate the technical procedure of the botanist as he systematically leads, by means of a key, to the determination of the correct position in the plant kingdom to which a specimen belongs. However, the average individual finds the path too intricate for his own execution. In plant breeding and hybridizing, in introducing to a region exotic forms and species, or in the commonplace cultivating of plants, both the amateur and the expert are ever conscious of the value of an orderly classification. One soon learns to systematically group in mind the plants of his acquaintance, or perhaps to arrange them in a small herbarium of his own, if he finds a simple method of procedure. It is a pleasure, and also a help, to know the family and generic names of plants. The vernacular-Latin index is an aid in this direction if it has been carefully compiled by those who are well acquainted with the local names of plants and who have sought the help of a botanist in their Latin determinations.

Indexes to Chinese plant names that give the corresponding Latin scientific names will prove indispensable links in bringing together Chinese and Western knowledge concerning plants. Chinese students and investigators are naturally interested in the modern scientific system of plant classification, as it gives them a knowledge regarding plant relationships for which their own systems of classifying plants do not provide. On the other hand, Western scientists working with plant life are coming to realize the importance of fuller information concerning Chinese plants. Copious indexes are the logical means for making known to the Western world, and for preserving from the ravages of time and change to which China is now subjected, the centuries of experience and knowledge in the cultivation and uses of plants in China.

FORMER EFFORTS TO INDEX CHINESE PLANT NAMES

Previous attempts have been made to link the Chinese names of plants to their Latin equivalents. The renowned Japanese botanist, Professor Jinzo Matsumura (25) of the Imperial University of Tokyo, published in 1915 a revised and enlarged edition of his *Shokubutsu mei-i*. Part I of this work, *Chinese Names of Plants*, gives the common cultivated and wild plants of China, alphabetically arranged first by their generic and then by their specific names. Under each species Matsumura lists the Chinese names in characters, with reference to such famous authorities for his application of names as E. Bretschneider (2); Wu Ch'i Hsun 吳其濬 (36), author of the illustrated Chinese botany published in 1848; L. Diels (9); E. J. Eitel (11); H. A. Giles (15); Augustine Henry (19); T. Kawakami (21); J. Legge (22); J. Loureiro (24); E. H. Parker (28); F. P. Smith (32); E. H. Wilson (38); S. W. Williams (37), and also other miscellaneous publications, Chinese and Western, including the important Chinese work *Pen Ts'ao Kang Mu* 本草綱目 (23). Matsumura listed the Chinese characters used as plant names at the end of his volume; but unfortunately these are not arranged in any very useful order and cross reference is most difficult.

In the belief that Matsumura's work should be made more readily available to all students of Chinese and Japanese plants, Mrs. Caroline R. Byrd (3) and Miss Katharine H. Wead (35) prepared, under the auspices of the Office of Crop Physiology and Breeding Investigations of the United States Department of Agriculture, a *Radical and Subradical Index to Chinese Plant Names listed in J. Matsumura Shokubutsu mei-I**. In dealing with Chinese names of plants this is a very useful key to Matsumura's work.

In the acquisition of Chinese names of Canton plants the most outstanding work to date is that of E. H. Parker (28) who published lists in the *China Review* of 1886. Numerous other individuals and organizations have been interested in the problem here in Kwangtung and have compiled brief lists of local names, or recorded them in personal copies of botanical works. R. T. Cowles (7) E. J. Eitel (11), and I. G. Genähr (14) have striven to incorporate in their dictionaries as many Latin determinations of plants as possible; but they, too, have been open to error. Unfortunately no effort was made to record Chinese names in the most complete botanical work of the province, *Flora of Kwangtung and Hongkong (China)* by S. T. Dunn (10) and W. J. Tutcher (34). The ambitious work of the Commercial Press (6), Shanghai, China, compiled by thirteen editors, and published in the year 1918 with Latin, Chinese, and Japanese indexes, under the title *Botanical Nomenclature (A Complete Dictionary of Botanical Terms)*, is subject to numerous errors in that it also is largely a compilation of previous authors, without the careful checking of determinations by a widely experienced and well equipped botanist.

*This is a photographed work and may be secured by arrangement with the Library of the United States Department of Agriculture, Washington, D. C.

DIFFICULTIES INVOLVED IN A WORK OF THIS KIND

A work of this nature is not simple but engrossed with numerous difficulties. It is not always easy to obtain the Chinese names of plants, especially those in the wild. Chinese names differ greatly according to locality and dialect, resulting in much duplication and confusion. Furthermore, the collector, Chinese or Western, is constantly open to error in writing the Chinese characters or the romanization of the Chinese name he has heard. If he calls to his assistance the Chinese peasant he is open to the error, common among the less educated of China, of writing the most simple character representing the sound of the word. These difficulties lead to many errors on field labels, and numerous corrections must subsequently be made when it is evident that the characters used are not the correct ones. Obsolete and vulgar forms of the Chinese characters, as also Chinese synonyms, must also be given due consideration.

The problem is unusually complex in China because of the wealth of Chinese literature, ancient rather than modern, which deals with Chinese terminology and uses rather than with taxonomy of plants under discussion. Only within very recent times has there been any effort toward a Chinese lexicon of family and generic plant names that will serve the nation as a whole. Lack of co-ordination of forces and hasty determinations have already resulted in much confusion. The time is not ripe to discontinue the consideration of local and district names as these are the only ones that lead into the very considerable, traditional information of the Chinese village people and also into the provincial, prefectural and district gazetteers (13) or annals. Before the time of the Republic each political division of China published, at regular intervals, these geographical records which, with numerous other information, contain helpful knowledge regarding plants and plant products. The plant names therein recorded should not be ignored.

A NATIONAL SYSTEM OF INDEXING PLANTS DESIRABLE

The logical procedure for those interested in the flora of China is to encourage the organization of district herbaria where local plants will be collected and names assembled, and where these will be linked to their Latin equivalents only by national or world-renowned botanists, who alone are sufficiently equipped and experienced to do so. A botanical survey of China of this kind is an ambitious program, but it is the logical one to relieve the present confusion and to bring together the knowledge of the people in a scientific way. The early adoption of a national or universal system of indexing plant names and arranging them in herbaria, as herein proposed, is of important consideration. The value of this system not only should appeal to the botanist or horticulturalist but should be of some interest to the ethnologist who should thereby be greatly facilitated as he traces the history and migration of man in China. In Kwangtung this consideration is of special interest in that there are living in this province the Hakkas, Loi, and Miao aboriginal tribes; and a comparison of their names of plants with those of the Chinese is a fascinating study.

HISTORY OF THE CANTON CHRISTIAN COLLEGE HERBARIUM

In 1915 Dr. Walter T. Swingle of the Office of Crop Physiology and Breeding Investigations, Bureau of Plant Industry, United States Department of Agriculture, visited the Canton Christian College and suggested the organization of a college herbarium. Several students were subsequently sent to the Philippines for training under Prof. E. D. Merrill of the Bureau of Science of the Philippine Islands. Prof. Merrill visited Canton in the fall of 1916, organized the Canton Christian College herbarium, and trained a native plant collector, Mr. To Kang Peng (杜廣平). From the inauguration of the work this close co-operation has been maintained, resulting in economy and efficiency. Prof. Merrill (26) has identified all of this material and has published his findings in various issues of the Philippine Journal of Science. Duplicate sets of some of these collections have been sold to various herbaria throughout the world.

The herbarium, built up almost entirely from the collections of Messrs. C. O. Levine, E. D. Merrill, To Kang Peng and the writer, contained in 1920, roughly, four thousand sheets of Kwangtung plants, representing about two thousand species. Of these, no less than 25 species are newly described. One family, one genus and about 30 species are reported new to Kwangtung, and about ten species new to China. During these years a large collection of varieties of citrus species and citrus relatives were assembled by Mr. Kwok Wa Shau (郭華秀) and the writer under the auspices of the United States Department of Agriculture. The writer (17, c) has been especially interested in assembling varieties of the lychee and lungan and other species of the family *Sapindaceae*. He has supplemented the collection of Kwangtung plants with a large number of sheets secured while travelling in Indo-China and Siam in pummelo investigations.

F. A. MCCLURE'S RECENT EXPLORATIONS

During the past year Mr. F. A. McClure, of the Department of Horticulture, of the College of Agriculture, has devoted most of his time to explorations in the province. The primary objects of Mr. McClure's trips were to supplement the collections, continue citrus investigations, secure economic data on the plants and plant products of Kwangtung, and search for orchids. Prof. Oakes Ames of Bussey Institute, Harvard University, is especially interested in the two latter fields in which he is co-operating.

During the fall of 1921 Mr. McClure travelled in Kwangtung, and to Indo-China from whence he proceeded to the Island of Hainan in company with Dr. A. S. Hitchcock, systematic agrostologist of the United States Department of Agriculture and custodian of the section of grasses of the Division of Plants in the U.S. National Museum. Dr. Hitchcock was collecting and studying the grasses, especially the bamboos. Mr. McClure left Dr. Hitchcock at the coast and proceeded to the Five Finger Mountain in the interior of Hainan. On this first trip he collected 1560 numbers

of which a large number are new species or are new to Kwangtung. Prof. E. D. Merrill is about to publish in the Philippine Journal of Science a description of the new species and also an enumeration of the plants of Hainan.

Mr. McClure, on a second trip, was ably assisted by Messrs. To Kang Peng (杜廣平), Luk Tak (陸德), Ts'ang Wai Tak (曾懷德), Tang Kam Wong (鄧金旺), Sai Chik (細隻), and Chung Yuk Fan (鍾燦燦), and he and his party have the distinction of making the first known ascent to the top of the Five Finger Mountain, which heretofore has been considered inaccessible. It is expected that Mr. McClure's second trip will net many new and rare species. Prior to Mr. McClure's explorations only 350 species were known from Hainan. His collections have increased this number to about 1200 species. A limited number of duplicate sets from these collections will, during the coming year, be offered for sale by the Canton Christian College.

INDEXING KWANGTUNG NAMES OF PLANTS

In 1919, the writer (17a) and Miss Elizabeth H. Groff (16) arranged, from the material collected to that date, a *Preliminary Draft of a Chinese Index to the Botanical Names of Kwangtung Plants* in which they listed the Latin names in the order of families and genera, and attached and indexed Chinese names in both characters and Cantonese romanization. In this work the Chinese lists of names, taken from the field labels of the plants in the herbarium, most of which up to that time has been collected in the wild, was supplemented by an equal number of local names of cultivated plants. Collectors were thereby provided with references to Chinese names of plants not as yet represented in the herbarium. The acquisition of a considerable addition of economic material followed in the latter part of 1919 and 1920.

In the summer of 1919 this list of Kwangtung plant names was greatly enlarged by the work of a group of students who devoted a part of their vacation to card indexing plant names contained in the Kwangtung gazetteers (13), to which they had access. They also incorporated names secured from the Kwangtung Agricultural Experiment Station. Cards representing this work are assembled at the college in the order of stroke and radical arrangement herein recommended. A bibliography of these and other Chinese reference works should be compiled at an early date. The lists of plant names should ultimately include references to local and national Chinese literature, relating to the flora of the region under study. The preservation and utilization of Chinese knowledge concerning plants will thereby be greatly facilitated.

A THREE-PART ARRANGEMENT OF PLANTS OF KWANGTUNG PROVINCE, CHINA, AND THEIR CHINESE NAMES (17B)

In the summer of 1920 all local plant names were carefully romanized according to the Eitel (11)-Genähr (14) system. Both Latin and Chinese character lists were carefully tone marked and then checked and

typed. Mr. Chan Cheuk-hin (陳卓軒) of the college inserted the Chinese characters in beautiful and clear style. In the summer of 1921 family and generic indexes were compiled in the office of Crop Physiology and Breeding Investigations, and Parts I and III were photographed in four volumes, at Washington, D. C.*

Part I of this work consists of a Chinese character, stroke index of local plant names of Kwangtung province, giving the number of every radical and subradical of every initial character in accord with the system established by P. Poletti (29). Each name in character is followed by the full romanization according to the Eitel (11)-Genähr (14) system. To the extreme right of these names appear reference numbers to the herbarium or to Part III, wherein are the Latin equivalents for all names definitely associated with known species as determined by Prof. E. D. Merrill. The large number of Chinese names appearing in Part I, without reference numbers to Part III, might have been greatly reduced by cross reference to Matsumura (25) or other authors previously mentioned. It was deemed wise, however, in this work, not to depend upon any former efforts, but to gradually send to Prof. Merrill the plants collected under these Chinese names in order that past errors, in such linking, may be reduced to a minimum. The reference symbols followed in this work are those adopted from the Engler (12) and Prantl (30) system of family arrangement with an alphabetical generic tabulation as followed in Part III. The adoption of also the De Dalla Torre (8) and Harms (18) generic numerals is now recommended to surplant this series of index symbols.

The number of Chinese names appearing in Part I totals about 6,500, of which slightly less than one-fourth have been collected and have been traced, by means of Prof. Merrill's determinations, to their Latin equivalents. Many of these names are duplications or synonyms and many more represent varieties rather than species. For example, in Part III under *Citrus grandis* Osbeck, no less than 32 names of pummelo are given; *Litchi chinensis* Sonn., 68 lychees; *Prunus japonica* Thunb., 27 plums; *Prunus mume* S. et L., 10 Japanese or Chinese apricots; *Prunus persica* L., 13 peaches; *Pyrus calleryana* Decne, 23 pears; and *Diospyros kaki* L., 15 persimmons.

Part II is a romanized index of these local, Kwangtung plant names arranged according to the Eitel (11)-Genähr (14) dictionary except that an exact alphabetical order of the second and third names is followed, rather than a grouping together of all names with the same first character. The Eitel-Genähr index numbers are shown on the left of the romanized name and the characters on the right. Poletti (29) numbers do not appear but each name carries a page reference to Part I. The index numbers referring to the herbarium, or Latin equivalents in Part III, are the same as those appearing in Part I.

This romanized index, Part II, was not completed until the summer of 1922 and contains, in addition to the 6,500 names appearing in Part I, 1,100 more names representing a supplementary list to Part I of the

*Copies of this work may be secured by arrangement with the Library of the United States Department of Agriculture, Washington, D. C.

varieties of rice and other farm and horticultural crops exhibited at the Provincial Agricultural Fair held in Canton in the spring of 1922. This supplementary list and Part II will soon be sent to Washington for photographing.

Part III represents a systematic enumeration of all the plants of Kwangtung Province contained in the Canton Christian College herbarium in the summer of 1920. The grouping is according to Engler and Prantl's (12) arrangement. De Dalla Torre and Harm's (8) generic numbers appear to the right of each generic name but a consecutive numbering, in alphabetical order, of genera and species, is followed. This was the arrangement in use in the herbarium at that time. It has recently been changed to the more systematic classification of De Dalla Torre and Harms (8). The index numbers have been correspondingly changed. Chinese names, both of local and general use, appear in characters in this part, in so far as they have been definitely associated with families, genera, and species. Only the local names have been romanized. There is also a central column of numbers, between the Latin and Cantonese names, which is a page reference to the species in the Flora of Kwangtung and Hongkong (China) by S. T. Dunn (10) and W. J. Tutcher (34). This is the only compilation of Latin names of Kwangtung plants available at the present time, and it was deemed desirable to give special page reference to this work to which access, by Chinese plant names, has not heretofore been possible.

ADOPTION OF ENGLER AND PRANTL AND DE DALLA TORRE AND HARMS SYSTEMS, AND THE ARRANGEMENT OF SPECIMENS IN THE HERBARIUM

The family arrangement of plants in the Canton Christian College Herbarium is that of A. Engler (12) and K. Prantl (30) in *Die natürlichen Pflanzenfamilien*. This is doubtless the best system for China. In some herbaria the filing of genera, under the families, is alphabetical; in others the more systematic arrangement of C. G. De Dalla Torre (8) and H. Harms (18) in *Genera siphonogamarum ad systema englerianum conscripta* is followed. In this latter work the authors present two sets of genera numerals: one, a consecutive numbering, from the low to the high, of all known genera of flowering plants in the plant kingdom; and the other a similar numbering of these genera within each family. De Dalla Torre and Harms do not assign, in their tabulation of genera, the Engler and Prantl family numbers, although, at the beginning of their work, they give the numbers of the genera falling within each family as numbered by Engler and Prantl. At the top of each page is printed the name of the family to which the genera on that page belong. Thus, we find the genus *Citrus* under the family *Rutaceae* numbered 4100, representing its evolved position among known flowering plants; and also with number 115, representing its similar position within the family to which Engler and Prantl have given the number 137.

The numerous possibilities of these systems, in filing specimens in the herbarium, are at once apparent. Some will prefer to ignore the

Engler and Prantl numbers and affix, for example, 4100 to all species in the genus *Citrus*; and others will claim it is better to give both the family number 137 and the genus number 115. In spite of the disadvantage of a long number, we of the Canton Christian College, after various trials, have concluded that for a uniform system of indexing and filing it is best to apply the numeral 137.4100 to all plants within this genus. We have, therefore, placed in a convenient position on each plant specimen sheet the Engler and Prantl family number, followed by a decimal and the De Dalla Torre and Harms genus number. The species is indicated by a dash and the first three letters of the specific name. Thus, specimens of *Citrus nobilis* Lour., are marked 137.4100-*nob* and are filed in alphabetical position, according to species, in the genus folder. We are now providing a special position on the identification labels for this "Classification Number."

THE VALUE OF GROUP NUMBERS IN INDEXING THE COMMON NAMES
OF PLANTS

We have never before seen these systems of numerals applied to the indexing of local plant names. Our present scheme has been worked out upon such basis as would meet our own local needs and at the same time fit into a more national or universal plan. The application of the system will become plain by reference to the lists of native plant names, in character and romanization, of varieties and species represented on the campus of the Canton Christian College. The student interested in a special group soon becomes acquainted with the number of that group; as for example, *Rutaceae*, 137 and *Rosaceae*, 126. If interested in *Citrus*, and citrus relatives, in casting his eyes over long lists of native plant names, one naturally picks out those marked 137; while 137.4100 becomes of even greater significance. Now if the system provided only the larger number, assigned by De Dalla Torre and Harms, the student might soon come to know that 4100 represents *Citrus*, but he could not readily recall the large group of numbers representing the Citrus relatives.

It will become apparent at a glance that if a uniform system, such as this, is widely adopted by the men at work in the field in a country like China, where names are almost numberless, there will be a gradual bringing together of names, under species. This will be invaluable in digesting and dispersing the present and past Chinese knowledge concerning plants. And there is no more simple means of giving the Chinese the full benefit of all that has been written in Western countries. The publications necessary for the various parts of China need not be elaborate, for the indexes will readily lead into standard floras, encyclopedias of horticulture or gardening dictionaries. Similar advantages will accrue in other countries where the system is used, the field of the botanist will thereby become more familiar to the amateur, and world plant relationships will be better understood.

Perhaps the greatest value in the suggested plan is the ease in referring to plants, under their native names, in the herbarium. The genus

covers should all be numbered in accord with this system. Direct access to the herbarium specimen of the plant is thereby possible from check lists of native names, without reference to Latin equivalents. Furthermore, native helpers, employed in local herbaria, can be used to advantage, in spite of the fact that they do not speak a foreign language. And a minimum of confusion and disorder will result where labor, that cannot be readily taught the use of Latin names and botanical relationships, is employed.

TIME-HONORED CHINESE SYSTEM OF PLANT CLASSIFICATION NOT
ENTIRELY IGNORED

The Chinese, up to the time of the Republic, had never developed a taxonomic system of plant classification, though in Wu Chi Hsun's, 吳其濬-(36) work we find a large number of helpful drawings. In recent years there has been an effort in China to adapt the Western binomial system to the Chinese language, and to incorporate Chinese knowledge with that of this system. In this procedure Latin names are usually written with the Chinese as an extra precaution against error.

In former times the Chinese showed their practicability in this as in other fields by grouping plants according to kinds, or to their utility. One of the earliest Chinese treatises dealing with plants in a botanical way is that of Chi Han-齊含-(5), a minister of State under Hui Ti (惠帝) of the Chin Dynasty (晉紀), A. D. 290-307, who had previously been governor of Canton. Chi Han's work, *Features of Plants to the South* (5), gives interesting accounts of eighty species of plants known at that time in South China, treated under four classes: herbs, forest trees, fruit trees and bamboos. The gazetteers (13), one of the most fruitful Chinese sources of information concerning plants, make their presentation in the usual order of Chinese classification: flowers (花), vegetables (菜), fruits (菓), grains (穀), grasses (草), trees (樹), medicinal plants (藥) and incense or perfume plants (香).

In *Plants of Kwangtung Province, China, and Their Chinese Names* (17b) this manner of grouping has been preserved in Parts I and II by placing between the characters and romanized words a small character, as above, representing the class to which the plant belongs, if such classification has been established. Separate lists of Chinese flowers, vegetables, fruits, medicinal or perfume plants, etcaetera, can readily be assembled. These should prove especially valuable to students and workers who are particularly interested in any one or more of these groups.

NATIONAL IMPORTANCE OF A SCIENTIFIC BOTANICAL NOMENCLATURE IN
CHINESE

The problem, as we have thus far faced it at the Canton Christian College, has been chiefly a local one. With the many peoples and dialects of our province, the dissimilarity in plant names assigned to a species is

quite sufficient for the consideration of the present. However, we have not been entirely negligent of the importance of early assigning to each family, genus, and species, and ultimately to each variety so clearly recognized by our country people, a national plant name in Chinese characters. Only by so doing may we expect from China a sympathetic appreciation of our Western nomenclature. The practical application of a family and generic terminology will soon be widely understood if it appears in characters which will be used in China as are the Latin names in Western countries. But in all scientific work the Latin should always be carried side-by-side with the Chinese.

Matsumura's (25) work was a noble effort to compile, under the binomial system, the Chinese names of plants known to previous authors, Western and Chinese. He, rightly, made no effort to assign national or Chinese scientific names to the plants he listed. This work remains to be done by Chinese, well versed in both the ancient and modern literature of their country, who have travelled widely and studied China's flora first-hand, and who have at their disposal library and herbarium facilities to qualify them for the work. The thirteen editors of *Botanical Nomenclature* (6) made the first monumental effort in this direction, but in the years to come their work will be subjected to critical revision and to a more systematic botanical arrangement.

When Prof. Chung Kuan-kuang (鍾觀光), of the Peking Government University, visited the Canton Christian College in the latter part of 1919, he was asked to contribute his knowledge of the more national Chinese names of the plants which appeared in our herbarium. Accordingly, Prof. Chung assigned names in Chinese characters to many of the families, genera, and species listed. In this procedure he first drew upon Chinese botanical literature, and where no reference was therein possible he applied the knowledge acquired from his own wide research and travel. Wherever Prof. Chung had published authority for his citations he stated such in a parenthesis placed immediately to the right of the name assigned. In this conformity Prof. Chung abbreviated three frequently quoted Chinese botanical works as follows: Pen ts'ao kang mu, (綱) = 本草綱目 (23); Chiu huang pen ts'ao, (救) = 救荒本草; and Chih wu ming shih t'u k'ao, (考) = 植物名實圖考 (36).

In Part III of *Plants of Kwangtung Province, and Their Chinese Names* these more national scientific Chinese names appear under the Latin family name, to the right of the generic and under the specific names. It is hoped that at some future date Prof. Chung will find it possible to bring together a bibliography of Chinese botanical works and to assign names to those which are at present without them. In the lists which follow Prof. Chung's assignments have been incorporated. The family names are with few exceptions those found in *Botanical Nomenclature* (6), but a difference in the application of generic and specific names, as also an indication of the limited scope of *Botanical Nomenclature* to the flora of South China, is indicated in the following tabulation of two important families:

	RUTACEÆ	ROSACEÆ
Number of genera in each family reported by Canton Christian College	15	15
Number of genera, as above, to which Chinese names have been assigned in <i>Botanical Nomenclature</i>	3	9
Number of genera, as above, to which Chung has assigned Chinese names	11	8
Number of genera, as above, to which assignments of Chinese names by Chung and in <i>Botanical Nomenclature</i> have been identical	2	3
Number of species in each family reported by the Canton Christian College	26	33
Number of species, as above, listed in <i>Botanical Nomenclature</i>	9	13
Number of species, as above, to which Chung has assigned Chinese names	16	17
Number of species, as above, to which assignments of Chinese names by Chung and in <i>Botanical Nomenclature</i> have been identical	2	7

SYSTEMATIC ENUMERATION OF THE PLANTS OF THE CANTON CHRISTIAN COLLEGE CAMPUS

The enumeration of plants herein tabulated is a catalogue of native and introduced varieties and species reported from the campus of the College prior to July, 1922. The list not only includes trees and shrubs but all wild flowering plants that have been found here, as also the many fruits, vegetables, and flowers that are experimentally tested or cultivated on farm and campus.

The system of indexing Chinese plant names described above is fully illustrated by this summation and the indexes which follow. It should be clear to the reader that this list does not consist entirely of Merrill determinations as recommended and followed in *Plants of Kwangtung Province, China, and their Chinese Names* (17b). This procedure has been impracticable when dealing with so many cultivated forms. Merrill determinations were adopted wherever possible, but if he had not seen a herbarium specimen they were traced by means of their Chinese names: first, by reference to Matsumura (25) through the Byrd-Wead (3)

index; and if not therein located then through *Botanical Nomenclature* (6). This method was unnecessary in the determination of the cultivated plants introduced from the West. The nomenclature followed in Bailey's (1) *The Standard Cyclopaedia of Horticulture* was adopted for this group.

It is not practicable to publish in the present issue of the Lingnaam Agricultural Review the complete enumeration of the plants of the Canton Christian College campus. However, three tables are herein presented and these will illustrate the system we have followed. Table I indicates, in part, the evolved position of all plant representatives on the campus, when these have been classified according to the Engler and Prantl (12) and De Dalla Torre and Harms (8) systems. Their numbers appear in the column to the left. Under each specific number is a small Chinese character indicating the Chinese classification: flowers, trees, etc. The Chinese, national, family and generic names are those adopted by Prof. K. K. Chung and Commercial Press (6). They are presented in character with English translation. Under the species the local, Cantonese names are given. These have been romanized and also translated in English. The references are to important works: Dunn and Tutcher (10), *Botanical Nomenclature* (6), Matsumura (25) and Bailey's *Cyclopaedia of Horticulture* (1). Table II illustrates the alphabetical index of the romanized Cantonese plant names. The numbers to the left are the Eitel-Genähr (11b) dictionary numbers. This index is especially useful to those who do not understand Chinese characters. Table III illustrates the Chinese character index arranged: (1) according to the total number of strokes in the first character and (2) to the radicals which are the numbers appearing in the column to the left. The question marks sometimes appearing in the index numbers indicate indetermined genera and species.

A family and generic index, in character, of the more literary Chinese names will prove valuable to Chinese investigators. There should also be a similar alphabetical, family-genera index. The common English names of plants are of some interest to the Chinese, but it is questionable if the use of these should be encouraged in China. However, such an index could readily be added. The numerous possibilities of the system are apparent. If strictly followed it provides an orderly procedure for the grouping and study of plants.

TABLE I—Portion of Manuscript Copy of Systematic Classification of the Plants of the College Campus

Index No.		D.&T.	Bot.	Mat.	Bai.
1.	CYCADACEÆ	256	1518		1:120
	Phoenix tail family-鳳尾科- or Iron banana family-鐵蕉科-				
1.1-	<i>Cycas</i>	256	1518		1:120
	Iron banana genus-鐵蕉屬-				2:931
1.1- 花	<i>C. revoluta</i> Thunb.	256	1309	107	2:932
	<i>Fung mei ts'o</i> --鳳尾草--Phoenix tail grass: at the southern entrance to Martin Hall and in the gardens.				
4.	GINKGOACEÆ		154		1:119
	Ancestral tree family-公孫樹科- or Silver almond family-銀杏科-				
4.10-	<i>Ginkgo</i>		154		1:119
	Ancestral tree genus-公孫樹屬-				3:1338
4.10- 果	<i>G. biloba</i> L.		153		3:1338
	<i>Pak kwō</i> -白果-White fruit: not commonly reported from the Canton region, but edible fruits said to be produced in the district of Hweichow (惠州), are sold upon the markets of the city. Several potted specimens are in the gardens.				
5.	TAXACEÆ				
	Red pine family--紫杉科--		1097		1:120
5.13-	<i>Podocarpus</i>	256	1496		1:120
	Arhan pine genus--羅漢松屬--				5:2724
5.13- 樹	<i>P. macrophylla</i> Don			273	5:2724
	(<i>P. longifolia</i> Hort.) <i>Lo hon ts'ung</i> --羅漢松--Arhan pine: potted ornamentals in the gardens.				
6.	PINACEÆ				
	Pine cypress family--松柏科--				1:120
6.22-	<i>Pinus</i>	256	547		1:120
	Pine genus--松屬--				5:2632
6.22- 樹	<i>P. armandi</i> Franch			266	5:2637
	Reported from China but not commonly from Kwangtung. C.C.C. In- troduction No. 564.				
6.22- 樹	<i>P. bungeana</i> Zucc.		301	266	5:2639
	Reported from China but not commonly from Kwangtung. C.C.C. In- troduction No. 565.				
6.22- 樹	<i>P. massoniana</i> Lamb.	256		267	5:2640
	(<i>P. sinensis</i> Benth.) <i>Ts'ung</i> --松--Pine: the only species commonly reported from Kwangtung and of wide distribution. Scattered groups are on the campus and a beauti- ful grove, <i>Pine Grove</i> , is located on a hill to the southeast.				

TABLE II—Portion of Manuscript Copy of an Alphabetical List of Local Names (Cantonese Romanization) of the Plants of the College Campus.

FÚ		FUNG	
1244 ^c Fú kwá	275.8591-cha	1334 ^c Fung tsuk ₂ c ₂ múi	126.3396-mum
1244 ^c Fú mak ₂ c ₂ fá	280.9595-arv	1337 ^c Fung ^c lü ^c ts'ó	129.3924-ger
1244 ^c Fú ti ² c ^c cham	128.3804-dip	FUNG ²	
1245 ^c Fú c ₂ mi c ₂ lán	38.1110-rox	1351 Fung ² c ₂ mi c ₂ k'au	79.2292-?
FUK ₂		1351 Fung ² c ₂ mi c ₂ k'wai	21. ?-?
1300 Fuk ₂ c ₂ chau kwat ₂	137.4100-gra	1351 Fung ² c ₂ mi c ₂ lán	44.1311-gad
1300 Fuk ₂ c ₂ chau pāk ₂ c ₂ lám	139.4140-?	1351 Fung ² c ₂ mi c ₂ ts'ó	1.1-rev

TABLE III—Portion of Manuscript Copy of a Stroke and Radical, Chinese Character Index of the Local Names of the Plants of the College Campus.

FOURTEEN STROKES		FIFTEEN STROKES	
Radicals		Radicals	
112- 1 碰桔	137.4100-nob	59- 72 影樹	128.3556-?
118- 75 籬篔竹	19.?-?	64- 64 撐篙竹	19.424-mul
120- 58 綠豆	128.3901-mum	64-200 摩士多獵	78.2221-vul
120- 58 綠棍	139.4140-pim	64-200 摩氏	280.8900-?
120- 62 綫藤	128.3891-obt	75-117 樟木	102.2782-cam
120-175 緋桃	126.3396-per	75-117 樟州芋	23.755-?
140- 85 蒲桃	222.5578-jam	75-117 樟樹	137.4100-nob
140-113 蒜頭	38.1049-por	75-117 樟腦樹	102.2782-cam
142- 40 蜜柚	137.4100-gra	75-117 樟樹	102.2782-cam
142- 40 蜜桶柑	137.4100-nob	75-124 櫻樹	64.1961-ela
142- 40 蜜露	275.8599-mel	85- 39 菠茄	175.5014-esc
152- 50 蕪蕪	280.1960-ori	85- 74 潮州荷蘭荳	128.3855-sat
160- 75 蕪椒	256.7404-amm	85- 74 潮州六月白石榴	218.5501-gra
164- 35 酸三食大	130.3939-car	85- 74 潮州石榴	218.5501-gra
164- 35 酸味子	147.4327-bur	85- 74 潮州柚	137.4100-gra
164- 35 酸柑	137.4100-nob	85- 74 潮州柑	137.4100-nob
164- 35 酸桃	126.3396-per	85- 74 潮州酸桔	137.4100-nob
164- 35 酸桔	137.4100-nob	120-176 緬甸合歡	128.3443-?
164- 35 酸梅	126.3396-?	130-124 膠樹	64.1961-ela
164- 35 酸黃皮	136.4091-lan	140-162 蓮花	88.2508-nel
164- 35 酸橙	137.4100-sin(?)	162- 93 暹加羅佛桃	126.3396-per
167-138 銀合歡	128.3447-gla	162- 93 暹芋	23.755-?
167-138 銀粘	19.193-sat	167-101 鋪地錦	253.7138-chu
167-138 銀華樹	66.2045-rob	167-101 鋪地錦	253.7138-phl
196- 16 鳳仙花	168.4856-bal	174-147 靚忌廉	128.3854-odo
196- 16 鳳尾草	1.1-rev	174-147 靚黃金	275.8599-mel
196- 16 鳳尾球	79.2292-?	177- 32 鞋板芋	23.755-?
196- 16 鳳尾葵	21.?-?	195- 72 魯士	250.7014-?
196- 16 鳳尾蘭	44.1311-gad		

BIBLIOGRAPHY †

- (Bai.)*—Bailey, Liberty Hyde, 1858—
 - The standard cyclopedia of horticulture...6 v. New York, The Macmillan company; 1914-17.
 - A collection of plants in China. (Gentes herbarum, no. 1). Ithaca, N.Y., 1920. 49 p. illus.
- (Br.)—Bretschneider,** Emil, 1833-1901.
 - Botanicon sinicum I; notes on Chinese botany from native and western sources in Journal of the North-China branch of the Royal Asiatic society, 1881. New series, vol. 16, pp. 18-230. Photographed copy of the original in Library, U.S. Department of agriculture, Washington, D.C.
 - Botanicon sinicum II; notes on Chinese botany from native and western sources in Journal of the China branch of the Royal Asiatic society for the year 1890-91. New series, vol. XXV, Shanghai, 1893.
 - Botanicon sinicum III; notes on Chinese botany from native and western sources. Botanical investigations into the materia medica of the ancient Chinese in Journal of the China branch of the Royal Asiatic society, new series, vol. XXIX, no. 1, 1894-95, Shanghai, February, 1896.
- Byrd, Mrs. Caroline Rixford, comp.

Radical and subradical index to Chinese plant names listed in J. Matsumura...Shokubutsu mei-i, rev. ed. Pt. I Chinese names of plants...Chinese characters arranged according to radicals and subradicals (Poletti system) by Caroline R. Byrd and Katharine H. Wead. Washington, D.C., U.S. Department of agriculture, 1920.
- Chao Wang Su (周王權).

Chiu huang pen ts'ao (救荒本草).
- Chi Han (齊含), Nan fang ts'ao muh chuang (南方草木狀), in Ku chin tu shu chi cheng (古今圖書集成), po wu hui pien (博物彙編), ts'ao muh tien (草木典), section 273, published under Imperial authority, 1726.

†The form of this bibliography is in general that used in the Library of Congress United States of America.

*A mnemonic symbol is sometimes given in addition to the numerical one in order to facilitate reference to plant names.

**Bretschneider is also the author of numerous other botanical and historical works or China not herein listed.

- 6 (*Bot.*)—Commercial Press, comp.
Botanical nomenclature (a complete dictionary of botanical terms)—植物學大辭典 Shanghai, China, Commercial press, Ltd.
- 7 —Cowles, Roy T.
A pocket dictionary of Cantonese; Cantonese-English with English-Cantonese index. Hongkong, Kelly & Walsh, 1914. 296, 124 p.
- 8 —De Dalla Torre, C. G.
Genera siphonogamarum ad systema englerianum conscripta ab authoribus Dr. C. G. De Dalla Torre et Dr. H. Harms. Lipsiae sumtibus Guilelmi Engelmann, 1900-1907.
- 9 —Diels, L.
Die flora von Central-China; Engler's botanische jahrbücher für systematik, pflanzen-geschichte und pflanzengeographie, vol. XXIX, 1901.
- 10 (*D. & T.*)—Dunn, Stephen Troyte.
Flora of Kwangtung and Hongkong (China); being an account of the flowering plants, ferns, and fern allies together with keys for their determination preceded by a map and introduction, by Stephen Troyte Dunn, B.A., F.L.S., . . . and William James Tutcher, F.L.S. . . London: published by His Majesty's stationery office; printed by Darling and Son, Ltd., 1912. 370 p.
- 11 —Eitel, Ernest John.
a—Hand-book of Chinese Buddhism; being a Sanskrit-Chinese dictionary with vocabularies of Buddhist terms in Pali, Singhalese, Siamese, Burmese, Tibetan, Mongolian, and Japanese. 1888.
b—A Chinese-English dictionary in the Cantonese dialect by Dr. Ernest John Eitel; revised and enlarged by Immanuel Gottlieb Genähr of the Rhenish missionary society. Hongkong: Kelly and Walsh, Ltd., 1910.
- 12 —Engler, Adolfo.
Die natürlichen pflanzenfamilien von A. Engl erund K. Prantl . . .
- 13 (*Gaz.*)—Gazetteers.
The numerous, official gazetteers or annals of China were issued periodically from provincial, prefectural and district headquarters, and are of many editions. *A catalogue of official gazetteers of provinces, prefectures, and districts of China*, arranged by the number of strokes in the first character of the name of the territory covered was prepared in the Office of

- the chairman, Library committee, Department of agriculture, in June, 1920 and photographed in Washington, D. C., February, 1922. A list of Kwangtung annals arranged according to prefectures and districts is given in appendix I of *The Lychee and Lungan* (No. 17,c).
- 14 —Genähr, Immanuel Gottlieb.
A Chinese-English dictionary. . . rev. (*See No. 11*).
- 15 —Giles, Herbert Allen, 1845—
A Chinese-English dictionary, by Herbert A. Giles. . . 2d ed., rev. & enl., Shanghai. . . Kelly and Walsh, Ltd. London, B, Quaritch (1909-1912).
- 16 —Groff, Elizabeth Howry, joint comp.
See No. 17 a.
- 17 —Groff, George Weidman, 1884—
a—Preliminary draft of a Chinese index to the botanical names of Kwangtung plants arranged by G. W. Groff and Elizabeth H. Groff. Canton, China. Typewritten MS.
b—Plants of Kwangtung province, China, and their Chinese names (in three parts): Pt. I, stroke index of Chinese character local plant names of Kwangtung province, . . . ; pt. II, romanized index (Eitel Genähr system) of local plant names of Kwangtung province. . . ; pt. III, systematic enumeration of the plants of Kwangtung province represented in the Canton Christian College herbarium, according to Engler and Prantl's arrangement with De Della Torre and Harm's numbers of the genera and also consecutive numbering of the families, genera and species recorded from Kwangtung province, . . . by G. Weidman Groff. . . Washington, D C., photographed in the office of crop physiology and breeding investigations, United States Department of agriculture, 1921.
c—The lychee and lungan; with eleven appendices, including contributions by Frederick V. Coville, Walter T. Swingle, Edward Goucher and Michael J. Hagerty all of the United States Department of agriculture; sixty-eight illustrations and one color plate. New York, Orange Judd Company, Canton Christian College; London, Kegan Paul, Trench Trubner and Co., Ltd; Canton, China, Canton Christian College. 1921. 188 p.
- 18 —Harms, H., joint comp.
See No. 8.
- 19 —Henry, Augustine.
Chinese names of plants in Journal of China branch of the Royal Asiatic society; new series, vol. XXII. 1888.

- 20 —Hongkong Horticultural Society.
A gardening vocabulary in English and Chinese, published by the Hongkong horticultural society. 21 p.
- 21 —Kawakami, T.
A list of plants of Formosa. . . 1910.
- 22 —Legge, James, 1815-1897.
The Chinese classics. . . in seven volumes, 2d ed., rev. . . Oxford, Clarendon press, 1893-95.
- 23 —Li Shih Cheng (李時珍).
Pen ts'ao kang mu (本草綱目).
- 24 —Loureiro, Joannes De.
Flora cochinchinensis: sistens plantas in regno Cochinchina nascentes. . . cum notis Caroli Ludovici Willdenow. Barolini, Hande et Spener, 1793. 2 v. Photographed copy of the original in the U.S. Department of agriculture library. See also commentary by E. D. Merrill (*No. 26, d*).
- 25 (*Mat.*)—Matsumura, Jinzo.
Shokubutsu-mei-i, rev. and enl. Tokyo, Maruzen co., n. d. 2 v.: 1. Chinese names of plants; 2. Japanese names of plants; pls.
- 26 —Merrill, Elmer Drew, 1876—
a—Notes on the flora of Kwangtung province, China. Manila, Bureau of printing, 1917; p. 99-111, repr. from the Philippine journal of science, v. 12, no. 2, sec. c, botany.
b—Notes on the flora of Loh Fau mountain, Kwangtung province, China. Manila, Bureau of printing, 1918; p. 123-161 repr. from the Philippine journal of science, v. 13, no. 3, sec. c, botany.
c—Additional notes on the Kwangtung flora. Manila, Bureau of printing, 1919; p. 225-261 repr. from the Philippine journal of science, v. 15, no. 3.
d—A commentary on Loureiro's Flora Cochinchinensis. Manila, 1919. 693. Typewritten MS.
- 27 —Osbeck, Pehr, 1723-1805.
Dagbok ofwer en Ostindisk resa aren, 1750, 1751, 1752. Stockholm, Tryckt hos Lor. Ludv. Grefing, 1757.
- 28 —Parker, Edward Harper, 1849—
Chinese names of Canton plants in China review, 1886 . . .
- 29 —Poletti, P.
A Chinese and English dictionary, arranged according to radicals and subradicals. . . Shanghai, printed at the American Presbyterian press, 1896.

- 30 —Prantl, K., joint. comp.
Die natürlichen pflanzenfamilien von. A. Engler and Prantl. . .
- 31 —Sanpson, Theophilus.
Botanical writings, relating to China, 1867-1869; with a biographical sketch by Dr. E. Bretschneider. Washington, department of agriculture, 1921. 95 leaves. Photostat copies of various articles published in notes and queries for 1867, 1868, and 1869.
- 32 —Smith, F. P.
Contributions toward the materia medica and natural history of China. 1871.
- 33 —Soares, F. P. de V.
Names of vegetables and flowers in English and Chinese. Hongkong. 6 leaves.
- 34 —Tutcher, William James, joint auth.
See No. 10.
- 35 —Wead, Miss Katharine Howes, joint comp.
See No. 3.
- 36 —Wu Ch'i Hsun (吳其濬).
Chih wu ming shih t'u k'ao (植物名實圖攷).
- 37 —Williams, Samuel Wells.
A syllabic dictionary of the Chinese language, 1903. . .
- 38 —Wilson E. H.
Plantae Wilsonianae: an enumeration of the woody plants collected in western China for the Arnold Arboretum of Harvard university during the years 1907, 1908, and 1910 by E. H. Wilson. (Publications No. 4) 3 v. 1913-17. Arnold Arboretum, Jamaica Plain, Mass.

NOTES ON THE ISLAND OF HAINAN*

F. A. McCLURE

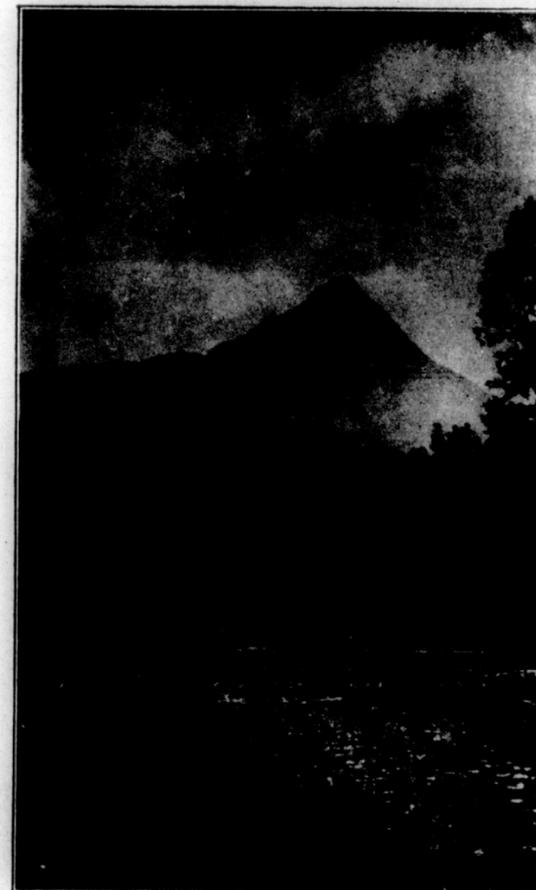
Instructor in Horticulture

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The tradition of wealth and inaccessibility which has long enshrouded the interior of the Island of Hainan, especially the Five Finger Mountains, has awakened in the minds of many the desire to penetrate to the heart of the island and explore the forested mountain slopes and ravines for their fabled wealth of gold, incense woods, timbers and drug plants, and to scale, if possible, the highest peak of the Five Finger range. Mr. G. W. Pearson (1), former British Consul at Hoihow† (海口), after returning from a trip to the interior accompanied by Lieut. J. de L. Simonds, R. G. A. and Mr. Newton of the America Presbyterian Mission, writes thus eloquently: "All attempts to reach the summit of the Five Finger mountains, from which, under favorable conditions, the whole geographical aspect of the island would reveal itself as a map, have signally failed Mr. Whitehead, a naturalist, having conquered the lower slopes, perished there. Mr. Rocher ultimately succumbed to the diseases acquired on the journey; and the real pioneer of Hainan, Mr. Jeremiassen, died in the interior without having accomplished the ascent. Other travellers have but skirted the foothills. It was partly with the object of overcoming the baffling obstacles which surround the key to the Island of Hainan that we set out on our journey, and, although only partly successful, we saw enough to be certain that the unexplored heights would yield most interesting results to experts in almost any branch of science who could endure the hardships which the ascent must entail." It gave me, therefore, something of a thrill when the Canton Christian College, in September, 1921, granted me the privilege of making my first trip, and in March, 1922, of making a second trip, to the interior of Hainan for the purpose of exploring the plant resources of that little known country and of reaching, if possible, the summit of the Five Finger Mountains.

*EDITOR'S NOTE—In a later issue of the REVIEW a list of the plants collected by Mr. McClure will appear.

†When available the romanization of geographical names and places adopted by the Chinese Postal Department is used. In other instances local or Cantonese pronunciation is followed.



View of Five Finger Mountain from the west.

PLATE 1

1
8
5
3
2
9
7



FIG. 1. The highest peak of the Five Finger Mountain Range, Hainan, showing copper tablet nailed to a pine tree commemorating the occasion of Mr. McClure and his party reaching the summit.



FIG. 2. The Five Finger Mountain Range from the southwest.

PLATE 2

TWO EXPEDITIONS TO HAINAN

On the first trip I was accompanied by To Kang P'eng (杜英平) who has for some years been a plant collector for the College, Tang Karm Wong (郭金旺) of Nodoa (那入), who served as interpreter and general helper, and one inexperienced collector. On the second trip I was much better equipped as to help, having with me, besides the two named above, Luk Tak (陸德), a man who collected plants for several years under the direction of the late Mr. W. J. Tutcher, formerly director of the Hongkong Botanical Gardens; Tsang Wai Tak (曾懷德), an experienced collector of zoological as well as botanical specimens; Chung Yuk Fan (鍾煒蕃) a young Hakka from Ling Shui (陵水), southern Hainan; and one general helper from Fa Hui (花墟) Hainan. We had no regular gang of carriers but depended upon hiring them as we needed them from day to day, or from one village to the next.

We spent the last two and one-half months of 1921 in Hainan, first making a week's trip to Kachek (嘉積) in the company of Dr. A. S. Hitchcock of the U. S. National Museum, who was making a brief study of the Graminae of the Island, and later going overland from Hoihow to Nodoa, and thence to the Five Finger mountains. On the return we followed the same route, this time, however, going by way of the Tingan River (定安) from Fa Hui to Hoihow. We spent one month at Nodoa, visiting the nearby Lin Fa (蓮花), or Lotus, Sha Po (沙礁), or Cooking Pot and Pat Ka (筆架), or Pencil Rack ranges for plant specimens.

On our second trip we followed the water route from Haihow to Fa Hui and thence went overland to Nodoa. This time we did not stay long at Nodoa but went directly to the Five Finger Mountains where we spent about one month. Returning, we traveled eastward around the north side of the Five Fingers, passing Lia Mui (嶺門) and Kachek on our way out to Hoihow.

GENERAL DESCRIPTION OF HAINAN

For the benefit of those to whom the name of Hainan is not familiar a few facts as to its location, size, etc. may be service.

The island of Hainan lies between the meridians $108^{\circ} 30'$ and 111° east longitude, and between the parallels 18° and $20^{\circ} 30'$ north latitude. It is about fifteen miles directly south of the peninsula of Luchow; and is a part of the province of Kwangtung. Hoichow, its port in the north, is about 265 miles from Kwangtung.

The greatest length of the island, from northeast to southwest, is about 150 miles, and its greatest width, from northwest to southeast, is about 90 miles. The coastline is fairly regular.

The northern and eastern parts of the island are a broad undulating plain, broken only occasionally in the north and northeast by small solitary hills and cones of volcanic origin. The southern portion is mountainous and reaches its highest elevation in the Five Finger range a little south of

the geographic center of the island. To the northwest of the Five Finger range, about two days' journey, is the Hung Mo (紅毛) or Red Mist Range which extends far in a southwesterly direction. It approaches the Five Fingers in altitude. To the south of the Five Fingers, about two days' journey, is the Seven Finger range which, tho not so extensive as the Red Mist range, is quite high. To the southwest, within an easy day's journey, is a small range called T'it Mun Ling (鐵門嶺), beyond which to the west, the T'it Mun Loie of T'it Mun Tung (鐵門洞) are said to live. The Five Finger range extends, in general, from northeast to southwest. Quite near it, at the northeast end and running almost at right angles to it, is a small range known as Pak Fa Ling (白花嶺). To the north are the Yung Ko Ling (擁高嶺), Pak Shek Ling (白石嶺), Fan Ngau Ling (番牛嶺), which are extensions of the Red Mist range, and Loi Mo Ling (黎母嶺), a larger and separate range.

At the eastern foot of the Red Mist range arises the main branch of the Chong River (昌河), which empties into the sea at the west side of the island. Another stream has its source on the northwestern slope of the Five Finger range, which, flowing north for about a day's journey, turns broadly to the east and joins, or makes, the Kachek river.

The Tingan River (known also as the Golden River), which drains the larger part of north central Hainan, has its source to the southwest of Namfung. From a point a few miles east of that market, where it is broken by the Lui Kung T'an (雷公灘) or Thunder Rapids, it serves as an artery of trade between the interior and Hoihow.

In going from Hoihow to Fa Hui by land one crosses much soil of volcanic origin, and by making a slight detour to the right from the main road one may pass along the west foot of two prominent extinct volcanic cones, known by the Chinese, because of their resemblance to a saddle, as Ma On Shan (馬鞍山). The land near these cones, although fertile, is so rock-strewn that little cultivating can be done and most of the immediate region is given over to fruit orchards. The lychees in this district rank first in Hainan for size and flavor. They begin to ripen about the last of May.

AGRICULTURAL AND INDUSTRIAL OBSERVATIONS

Just outside this rock-strewn region are broad stretches of rich brown, fertile soil which, though yielding enough rock to build all the roads, fences, and houses needed by the people, is cultivated largely with dry-land crops such as sugar cane, millet, beans, upland rice, etc. We saw one field of cotton here. The paddy rice which this soil produces is the finest I have ever seen.

Passing on west beyond On Yan (安仁) one sees more pasture land and fewer crops until one reaches the valley of the Tingan river at Fa Hi where the land is intensively cultivated again. Just a little distance west of Fa Hi, on a branch of the Teng On river, there is an orchard of



FIG. 1. A little stopping place of two thatched huts. In South China, large covered baskets, known as *lohs*, are used everywhere by travellers. A coolie load is two baskets containing from 140 to 200 pounds of baggage.



FIG. 2. Our party at the house of a Loi Chief at Yik Tsok Mou.

PLATE 3



FIG. 1. A Loi Chief puddling a field for planting rice seedlings by driving his entire herd of water buffaloes, round and round over the flooded area. This method of preparing the fields for rice planting is very practical in fields too stony for plowing.



FIG. 2. Loi women planting rice on hilly land that has been roughly cleared of trees and shrubs by burning. The woman in the foreground has leprosy feet.

PLATE 4

Tea Oil trees which were in full bloom as we passed them on our return trip in January. The beauty and fragrance of these exquisite flowers is not easily surpassed.

On leaving the Tingan valley, westward bound, one comes again to the broad, rolling, prairie land, where there is little but wild grass, which is kept pastured short by the village cows. Across this broad level plain there is an almost constant stream of carriers who meet the boats at Fa Hui with merchandise for Hoihow and receive in turn loads of cloth, food, etc., for Nodoo and the markets of the interior.

Once one is west of Fa Hui, he is never out of hearing of the squeak of the complaining ox-carts. Besides being required to carry loads of from 500 to 800 cattie, these carts are subjected to the indignity in construction of having their two wheels fastened rigidly to their axles, so that there can be no differential adjustment. They are drawn by two water buffalo, hitched tandem. On account of their peculiar axle construction and narrow tread wheels these carts soon get their tracks in a terrible condition, and once they get into an old track there is no getting out, for the cuts are often worn so deep that the axle drags on the ground. Accidents are not a few where driver-boys, shaken off by the swaying of the carts over bumps and depressions, are crushed and horribly mangled under the narrow wheels. These carts are used mostly for transporting rice and wood.

As one approaches Nodoo he comes into another river valley whose waters flow into the ocean on the northwest side of the island. Wet-land rice is here the predominant crop; but there is much rolling land that is allowed to grow up in shrubs and underbrush which furnishes fuel for the villages. Peanuts are a common crop in the sandy land. Indigo, also a legume, is another crop which is grown rather extensively.

AGRICULTURAL COMPANIES

The country to the west and north of Nodoo has long been known to hold much gold and tin ore. Many efforts have been made to form companies for the purpose of exploiting the mineral as well as the agricultural resources there. Most of them have failed, for one reason or another. Two of these companies are still extant, and, although neither is flourishing, the K'iu Hing Kung Sz (橋興公司) is probably the more prosperous. They confine their chief activities to agriculture, their principal crops being rubber, coffee and tobacco, although they grow some pineapples, bananas, and carambolas.

This company has more than 20,000 rubber trees, of which 10,000 are mature enough to tap. Of these they are working only six thousand because they are short of help. They also have 300,000 mature coffee trees of three species. Although these crops have been grown near Nodoo by these companies for a number of years, and the soil seems admirably adapted to them, the farmers have not yet taken up their cultivation.

The chief promoters of the company, being Cantonese, use only Cantonese labor. This has two unfortunate results, in that they are limited in their labor supply, and a more lamentable phase of it, the people of the neighborhood miss whatever profit they might derive either through experience on the farm under expert supervision, or through contact with the workers on the farm. At Kachek, a large number of coffee, rubber, and cocoanut plantations are being planted by the natives.

FLORA BETWEEN HOIHOW AND NODOA

For the most part, the flora between Hoihow and Nodoo is fairly uniform, consisting largely of shrubs, vines, grasses, and low herbs. As one proceeds to the south from Nodoo the flora rapidly changes; differences in altitude, latitude, and soil formation probably play some part. About nine miles to the southwest of Nodoo is the 'Dome,' known by the Chinese as the Sha Po Ling (沙煲嶺) or Cooking Pot range, rises to an altitude of more than 800 meters, about six miles to the southeast of Nodoo is a more extensive range known as the Lin Fa Ling (蓮花嶺), Lotus Range, some peaks of which reach an altitude equal to that of the 'Dome'. In the ravines of these ranges the really interesting flora begins. Here, where the dense shade and the moist atmosphere provide the proper conditions, aerial orchids abound. Large forest trees are also found to some extent. It is to be regretted that even the upper slopes of these ranges of medium altitude are kept pretty well burned off.

RED MIST, LOI MOTHER, AND FIVE FINGER RANGES

In the central and southern parts of the island we find higher ranges such as the Red Mist range the Loi Mother range, the Five Finger range, and others, whose summits and upper slopes and ravines are all heavily wooded. The lower slopes, however, are kept bare by fires set by the Loies. It is only in those areas high up that are unmolested by fires that the really big trees are found, one exception being the Sweet Gum trees which add so much picturesqueness to every rolling countryside where they have been spared. I have never seen them in dense forests. They seem to prefer the open hillside where they have plenty of room to grow and flaunt their splendor.

Considerable lumbering is done in the Five Finger mountains by the aborigines under the direction of the Hakkas and other Chinese, and we secured at Nodoo, (through Dr. C. G. Salsbury), at Kachek, (through Rev. W. M. Campbell), and at the Loi village of Yik Tsok Mau, samples of more than twenty splendid woods which are highly valued as material for the making of coffins, boats, and furniture as well as for construction of houses. The forests of the interior also yield rattan of several species, as well as incense woods, wild teas, and drugs, which are collected by the aborigines and find their way into commerce largely through Hakka traders.

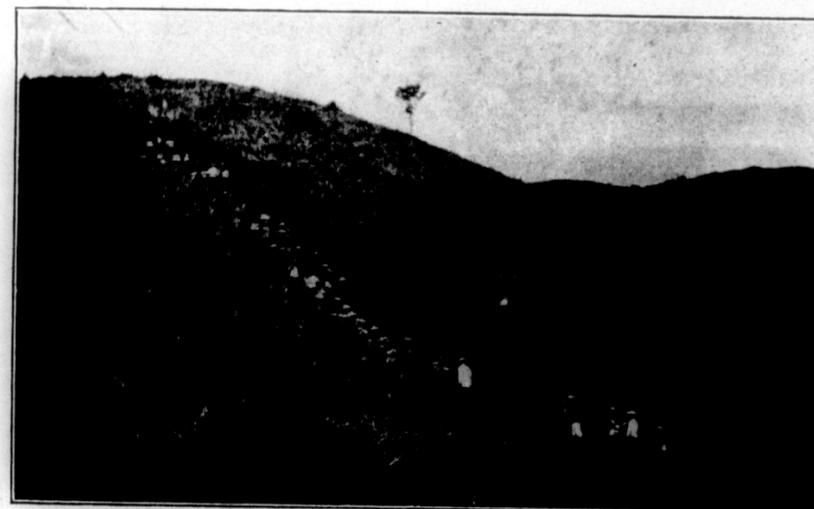


FIG. 1. The collecting party and carriers.



FIG. 2. A view of the valley in which Fan Ya is situated at the foot of the Southwest end of the Five Finger range—looking west.



FIG. 1. Loi woman and baby. This method of carrying babies is one of the characteristics that distinguish the Loies from the Chinese, who carry the babies on their backs.



FIG. 2. Two Loi women, probably from the Pak Sha (white sand) tribe, judging from their clothes and the comb in the one woman's hair. The one with a hat has the betelnut chewing habit very badly. The other has a large goitre.

PLATE 6

FIVE FINGER MOUNTAIN FLORA, AND CAVE

One could spend a year diligently collecting plants in the interior of Hainan without exhausting the flora. Our time unfortunately being very limited, we chose to spend it all at the Five Finger range because of its range in altitude. We found collecting very difficult there as it must be in any dense forest where the trees are tall and the sunlight is largely shut out by the intermingling of their branches. But the woodcutters' paths which are found up to a height of about 4000 feet made progress easier and helped us keep our bearings. Through the help of a Loi we discovered a cave on the southwestern side of the mountain at an altitude of about (3500 ft. *), which, though very inadequate in size, served as headquarters for several days while we collected plants and explored the heights of the mountain. Our success in reaching the summit was largely due to our finding the cave.

FIRST ATTEMPT TO SCALE THE HIGHEST PEAK

Our first attempt to scale the highest peak was made on Dec. 14, 1921. The climb grows increasingly difficult as one progresses above the cave, and the grade exceeds 45° a good part of the way. The insecurity of the footing would make the ascent utterly impossible but for the presence of small trees, shrubs, and tufts of grass which provide support. Owing to lack of time we fell a little short of accomplishing the entire ascent, reaching only the summit of the first peak at the southwest end of the range. Although it is only an hour's climb across to the second and highest peak, it was already late in the afternoon and we were not prepared to spend a December night on the mountain top.

The descent was even more difficult than the ascent had been; and we were caught in the dark before we had covered more than two-thirds of the distance. It was with considerable difficulty that we found our way back to the cave. Our progress down the steep slope was seriously impeded by the tangled rattan vines that bristle with long thorns and sharp hooks. The forest being continually soaked with rain, there was no material for a torch, and we had to search by the light of matches for the trail we had blazed on the ascent.

THE SUMMIT REACHED ON SECOND EXPEDITION

Our second attempt to reach the summit, in which we were successful, was made on April 30, 1922. This time we prepared to spend the night at the summit, knowing that both the ascent and the descent would be too much to attempt in one day. We started from the cave at ten in the morning and arrived at the summit of the highest peak at about 4:15 in the afternoon. The last part of the ascent, where the slope is quite steep, is made doubly difficult by the dense, inter-tangled growth of shrubs, bamboo, and saplings.

*Difference between reading at cave and simultaneous reading at the Sea Level is 4.038 mm. Correction negligible.

It was not possible, we found, because of perpendicular rock cliffs on either side, to reach the summit of the second peak from the southwest without crossing the first peak. Ascent from the north may be possible, but it appears even more difficult than that from the southwest.

The summit of the peak is about thirty by fifty feet in extent and is covered with shrubs. Pines and bamboo also grow there side by side. We cleared away some of the shrubs to make room for a camp. A fire was a necessity, for the air was quite cold. The wood of a fallen pine made excellent fuel. We attached a copper plate with the names of our party and date of reaching the summit to a pine tree at the top of the peak.

During the winter months the summit of the Five Fingers is rarely, if ever, entirely free from clouds. In spring and summer, however, the summit is sometimes visible in the morning; and I had dared to hope to be able to make some valuable geographical observations from the splendid vantage point that the summit offers. But although the night was clear we were dismayed to see with the rising of the sun the gathering of a mist from everywhere into clouds which obstructed our view seriously. We could not see to make further observations than to substantiate the relation of the different ranges and the direction of the rivers described in an earlier paragraph.

The altitude of the highest peak of the Five Finger range, according to calculations based on the readings of a pocket aneroid barometer which I carried and simultaneous readings made at the Maritime Customs Station at Hoihow, twenty feet above sea level, is 7300 feet. The British Admiralty Charts record the altitude as 6300 feet. This figure was arrived at by triangulation from sea level, and is probably more accurate than the observations I was able to make with my simple equipment.

THE PEOPLE OF HAINAN

Not the least interesting thing about the Island of Hainan is its people. The population is made up of Chinese of Foochow origin, Hakkas who have come from the mainland of Kwangtung, and a great many tribes of Loi peoples who are supposed to be more closely related to the peoples of French Indo-China and Malaysia than to the Chinese. A dialect very similar to that spoken in Foochow is the most common medium of intercourse and is known as Hainanese. The Hakkas, of course, speak their own Hakka dialect among themselves, and the Loies of each tribe speak a different dialect in their homes and among themselves.

THE SHAANG AND SHUK LOIS

The Loies are commonly classed by the Chinese into two main groups—the *wild* Loies, (Shaang Loi 生來), who occupy the interior of the island, and the *tame* Loies, (Shuk Loi 熟來), who mingle freely with the Chinese, adopting their social customs and dress. To the superficial

observer the *tame* Lois are very like the Chinese, and according to Miss M. M. Moninger (2) the only sure criterion by which these folks may be distinguished from each other and from the Chinese is the dialect which they speak among themselves in their homes.

So far as I know, no comprehensive study has been made of the peoples of Hainan. Certainly such a study would reveal many very interesting facts and relationships. Most interesting from certain points of view, are the *wild* Lois that inhabit the interior of the Island, and Miaos, another primitive people of different origin, who live more or less intermingled with the Lois and yet remain quite distinct from them.

Passing south from Namfung one finds himself almost immediately among the *wild* Lois. They are called *wild* not because they are in the stage of savagery, although by most criteria they would be classed considerably below their *tame* brothers in the scale of civilization, but rather because they never have been completely reduced to submission by the Chinese. Although the Chinese collect various irregular taxes from them and wreak upon them military vengeance of a sort in case of offence against their authority, no expedition against the Lois has ever been really successful. The country is very thinly populated; travel is exceedingly difficult, especially for an army; and in case of an invasion the Lois simply evacuate the country so completely that there is nothing for the invaders to do but make their way back to headquarters.

We found the Lois not especially hospitable, but neither were they hostile, and we had no trouble in finding lodging. We always went to the house of the head man or chief and were never turned away. We did once find a village, which we approached after dark, completely deserted because the people were afraid we were robbers or a detachment of Chinese soldiers. Our arrival at a village, however, was usually taken by the people as a matter of course. No special attention was paid to us as a rule beyond the curiosity that was commonly exhibited. One old chief killed a chicken and asked us to supper with him. And he insisted that if we should ever return we must let him know in advance so that he could kill a pig and make a feast for us. But he was an exception, and for the most part we had to bargain for what we got. The chief interest exhibited by the people was in getting what they could out of us.

SOCIAL CEREMONIES

Social ceremony seemed to me to be almost utterly lacking, although no doubt I missed much that is actually in practice. Usually upon my arrival at a village the chief as well as the people simply stood and stared at me until I nodded and smiled at them, whereupon they returned the recognition. On one occasion, however, upon entering the house of a chief for the first time I was pleasantly surprised when he gave me a formal greeting. The greeting consisted of a short, squatty bow with the hands brought simultaneously to a level with the eyes, palms inward and vertical and fingers straight, pointing toward each other. One of my

carriers, a man from another district, made his entrance shortly after me, and as he came in he made the same squatty bow to the chief and the assembled crowd, simultaneously bringing his hands to a position as if to receive something. A similar salute, even more brief, was returned to him.

LITERACY AMONG THE LOIS AND MIAOS

On the whole, the Lois are illiterate. It is only occasionally that one is found who can read or write. And the extent of the literacy of many of the head men is the ability to write their own names. Mr. Pearson (1) refers to Chinese schoolmasters who are maintained by the Chinese in many of the Loi villages for the purpose of exercising authority over the people. I saw only one such man (at Hong Ma Tsuen) and he seemed to be doing very little to educate the children. The Lois are said to exhibit far less eagerness for learning than the Miaos.

Rev. B. C. Henry (3) quotes the following from a Chinese work entitled "Fresh Notices of Kwangtung." "The Le women all carry a piece of lacquered wood, on which are written several lines of a Le ballad; the writing, however, is like the wriggling of worms, and cannot be deciphered." Whether this has reference to Loi characters as such is not clear. As far as I could discover, the only writing now in use is the Chinese character.

Practically all the Loi men and many of the women speak the Hainanese dialect in addition to their own native dialects. Anyone, therefore, who can speak Hainanese can make himself understood among them.

THE RELIGION OF THE LOIS

The religion of the Lois is largely superstition and devil worship and there is always employment for the necromancer. Along the paths in the country one sees eggs stuck up on forked sticks and cups of wine set in a row for the purpose of attracting the evil spirits away from the villages to the less frequented places. The household idols get their regular "feasts" of wine, chicken, and rice. Certain idols have jurisdiction over definite territory. They are kept by the head men and at stated intervals are moved from place to place with great ceremony. A certain spirit, with unlimited power of good and evil over the whole land, is supposed by the Lois to have his dwelling-place at the top of the Five Finger mountains. Most of the little children, many of the women, and occasional men have sewn to the back of their jackets a piece of white cloth on which mystic characters have been written by the necromancer for their protection against devils that attack one from the rear.

MUSIC OF THE LOIS

The Lois are, generally speaking, a happy-go-lucky people, who live from hand to mouth and who do little work until forced by necessity. They even thresh, hull, and polish their rice as they need it, meal by meal. They

are lovers of music and are fond of singing. One of the chief features of their wedding ceremonies is the night of singing in which the bride and groom engage with their most intimate friends. As they work in groups or carry their burdens there is nearly always some one of them singing. Even the children have their little songs.

They have bamboo musical instruments of several sorts, one being a curious nose flute whose strains are very faint and melodious. Many of the men carry a curious sort of "jew's harp" upon which they play in their leisure moments.

The women even turn into music the monotonous drudgery of pounding rice; for as they work, three or four in unison, they beat out a lively rhythmic tattoo with their wooden pestles against the sides of the big wooden mortars.

GREAT NEED OF MEDICAL AID

Everywhere I found the Lois in need of medical attention. One seldom sees a body free from disease. Scrawniness and underdevelopment is the rule rather than the exception among the grown-ups. But the little children present the most pitiful appeal with their knock-kneed legs and distended abdomens. Trachoma is very common among children and adults. Hookworm also seems to be prevalent. Coughs and colds are universal among big and little. They wear inadequate clothing in winter and many of them, being without bedding, depend upon a fire for warmth during the night.

DRINKING AND SMOKING AMONG THE LOIS

They are immoderate drinkers of wine, and the detrimental effect on their eyesight as well as their general health is evident. Even the women drink wine, and on one occasion I saw a party of men and women at a feast, all of whom seemed more or less intoxicated.

Both men and women smoke, and when the women work in the fields they carry with them a bamboo water pipe and a smoldering sheaf of rice straw with which to "light up". Every now and then they take their turn at sucking their lungs full of the potent smoke of "natural leaf."

LOI HOUSES

The Lois houses are usually built with end posts of heavy timbers, set deep into the ground for support, and bearing a substantial ridge pole. The walls are of bamboo, either plastered with mud or not, according to the industry of the builder. The roof is of thatch grass, with heavy bamboo poles and saplings as rafters and sheeting. It extends over the walls several feet both at the sides and at the ends of the house, thereby furnishing a shelter from rain and sun where wood is stored and where the rice pounding is done. The eaves extend so low that it is impossible to see out at the side without stooping.

The floor is usually made of split bamboo or rattan laid about three-fourths of an inch apart and is a foot or more above the ground. Pigs, chickens and dogs run under the house and pick up whatever of an edible nature falls through the cracks in the floor. Although the lighting is poor, the ventilation is splendid; for there is an opening six inches to a foot wide all around between the top of the wall and the roof.

The furniture is of the simplest kind and is very meagre. There are no chairs or beds, and the only table is a rickety one placed in front of the family idols which occupy a prominent place in the house. While the idols dine from a table their worshippers squat about on the floor eating from the cooking pot! The stove consists of three stones set in a triangle in a mud platform which is built up level with the floor, usually in the middle of the room. The floor on either side of this fireplace serves as a bed at night. Bowls and chopsticks are used by the Lois except when they are traveling or working in a distant field. Then they carry with them lunch which consists of rice cooked to a paste and moulded into balls of convenient size.

CLOTHING WORN BY THE LOIS

As to dress, many of the Loi men have little that would distinguish them from the Chinese. Some still wear the loin cloth, by whose size, shape, and material the men of the different tribes can often be distinguished. The men of some tribes wear a sleeveless jacket of coarse cloth or the bark of a tree. The hair-dress of the men, too, is sometimes characteristic of the different tribes, the "Big Knot", for instance, wear their hair done in a large knot on the forehead. Now, however, most of the Loi men who have come in contact with the Chinese shave their heads periodically, thus obliterating any distinguishing marks as to hair-dress.

With the women the dress is much more elaborate and more distinctive. By the patterns of embroidery used on the jackets and skirts, women of different tribes can easily be distinguished. Sometimes headcloths are worn which are characteristic. Ornaments of silver and brass, while almost universally worn, are often characteristic—the earrings, for example, of the women of one tribe in the Sanghoe River valley are so heavy that they have to be tied over the head in order to allow the women freedom in working. The number of bead and silver necklaces is another mark by which the women of some tribes may be distinguished.

The jackets of the Pak Sha (白沙) Loi women are V-necked and are put on over the head. At either side at the hips is an oblong strip of embroidery often with the dragon as its chief motif. The jackets of the other Loi women are open in front with metal fasteners rather for ornament than for utility. The women who wear this style of jacket wear under it a plain or embroidered blue cloth similar to that worn by the women of Tonkin and Annam. This cloth is foursquare and one corner is fastened at the neck while two corners are drawn around the waist and fastened at the back.

The skirts of the women of the different Loi tribes are also distinctive. They rarely reach below the knees, and are usually made entirely of colored embroidered cloth, although sometimes only one or two bands of embroidery are combined with one of plain weave. The skirts are cylindrical in shape and too narrow for comfortable walking. Although they vary somewhat in length the distinguishing feature of the skirts of the women of the different tribes is the pattern of the embroidery with which they are decorated.

AGRICULTURE AMONG THE LOIS

The agriculture of the Lois is very primitive. Their chief crop is paddy rice and the soil is, almost without exception, prepared for the young plants by driving water buffalo or yellow cows over the flooded fields until they are tramped into a quagmire. The water is then drained off and the surface leveled by means of a wooden scraper wielded by hand. The women are universally responsible for pulling the young rice plants, tying them into bunches for distribution, setting them out, watching to keep away birds and other thieves while the crop ripens, and finally reaping the grain. They dry it, too, in the sun, and it is they who pound out the rice and polish it as it is needed for food.

So far as I have been able to ascertain, no fertilizer is applied to the paddies, and the soil depends largely for its long sustained fertility upon the manure dropped by the cows as they tread the fields and the ash which is washed down from the adjacent fields after the annual burning of the heavy crop of grass that springs up each year.

Dry-land rice and flint corn are planted also to some extent. For these crops "new" ground is always prepared by burning off a strip of forest or a field that has been allowed to lie fallow for several years. The ash thus provided adds just the element in which the soil is likely to be lacking. For corn the land is dug up with hoes or in some cases plowed, but for dry-land rice no further preparation is made than the burning of the cover and clearing off the stones. When the land is ready for rice the whole village turns out to plant the crop. The men are armed with sharpened sticks with which they punch shallow holes about six or eight inches apart. The women, following with little baskets filled with dry-land rice, drop eight to fifteen grains in each hole and cover them by raking a bit of loose earth over them with a short stick. They expect a germination of about 50 per cent.

The possession of fields goes by families; but when harvest time comes the village or district chief is said to distribute the grain among the family heads according to their needs and to the industry with which they have worked in the pooling of labor by which the fields are prepared and sown. He is said also to keep a generous portion of the crop for his own trouble.

HARVESTING AND STORING RICE

It is a point of interest that the Loies harvest their rice by cutting off only the heads with a portion of the stalk just long enough to tie conveniently into a bundle. This makes greater convenience in handling than the Chinese method, which I have seen commonly in practice, of harvesting all the straw with the grain. The most obvious reason for the Chinese practice is that generally wood is expensive fuel and rice straw is a passable substitute. The Loies, of course, have abundant supplies of wood within easy reach.

The system used for storing the rice is very sensible and very effective. To each side of a row of firmly set posts about seven feet high and six inches in diameter and distant from each other six feet, bamboo poles about an inch and a half in diameter are bound horizontally at intervals of six inches. The bunches of rice are stuck, butt first, between the bamboos in such a way that the bearded heads form a very effective watershed. A canopy of grass thatch which projects about two feet on either side protects the grain from heavy downpours of rain. The open construction gives good ventilation and allows the sunlight to strike the rice daily. The whole is surrounded by a strong fence that keeps out the village cattle and hogs as well as their undomesticated brethren, the deer and wild boar.

Besides this temporary shelter where the rice is thoroughly cured and dried, there is always another, more substantial structure, in which the rice is finally stored. Its size is determined by the annual needs of the family, or the need of the family between rice crops. This storage house is usually a squatty structure, scarcely higher than a man, raised about a foot from the ground and so built as to exclude rain and rats. The better ones are splendidly constructed of fine large timbers and carefully cut and pegged together. The poorer ones are tightly woven of bamboo, with a double thatch roof. In some villages these granaries are raised the height of a man from the ground on posts which are girt with tin to prevent the ascent of rats.

The crops of the Loies are constantly menaced by the wild herbivora in the nearby forests and many devices are used to protect them. Wherever possible, fences are erected, either of small bamboos woven together or of sharpened sticks driven into the ground at close intervals and bound together with vines. The new, white shoots of pandanus, or palm leaves, are stuck in great numbers in the newly sown rice beds to frighten away the birds. The newly planted paddies are protected from the invaders by the noise of a clever device made of a section of bamboo so balanced that a small stream of water flowing into the open end causes it to tip, empty and fall back, striking a stone.

The distilling of rice wine, or whiskey, makes very serious inroads on the supply of rice, and usually before the new crop comes on a few families find themselves having to cut down their daily consumption or go to a neighboring district to buy. While we were at Fan Ya the people

of that and neighboring villages were short of rice. The people at Yik Tsok Mau were even harder pressed, and they were not only buying what they could from their neighbors but even cutting their coming crop before it was quite ripe in order to get enough to eat. The Hakkas, too, who invariably have a lot of Loies in their debt, collect their heavy toll from each crop. And unfortunate indeed is the man who is forced in time of stress to buy from them, for their prices are exorbitant.

LOI GARDENS

Loi gardens contain a curious conglomeration of plants of different kinds. Tobacco always predominates, and there are usually some corn and beans and occasional plants of cassava, caraway, lettuce, peppers, etc. Each hut has its trellis which is covered with luxuriant pumpkin vines. The blossoms and young leaves provide a more constant source of supplement to the rice diet than any other vegetable in the garden. Another plant found in nearly every Loi garden is a plant from the leaves of which the Loies make their blue dye. It is different from the legume from which the Chinese commonly extract indigo.

As for livestock, the wealth of a Loi is usually reckoned by the number of cattle or ponies or both that he possesses. The ponies are tethered out near the villages while the cattle are turned loose in the bush or on the open grassy hillsides, often with no one to watch them. They usually come home of their own accord at night unless they are stolen, as is often the case. One of the most common sources of trouble between Loi tribes is the stealing of cattle from one tribe by members of another tribe. Certain tribes have the reputation of being cattle thieves.

There are usually a few hogs around each village, but never many. They resemble the Canton type in most characteristics. The chickens are of a mongrel breed and are entirely unprepossessing. They suffer seriously from the ravages of hawks that swoop down almost hourly from the nearby forests.

REFERENCES CITED.

1. PEARSON: *The Island of Hainan (Private edition)*
2. MONINGER: *The Isle of Palms, page 1.*
3. HENRY: *Ling-Nam, page 386. See also pages 413, 430 and 445.*

A PRELIMINARY REPORT OF HOOKWORM
INVESTIGATIONS

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During the summer of 1922 a study was begun of the distribution of hookworm in relation to the feces storage jars or *kongs*, common in the surrounding villages and in other parts of China.

The work is being undertaken with the joint cooperation of the departments of Biology, Agronomy and Medicine of the College, and of the Health Service of the Canton Hospital. A large part of the summer was devoted by the writers to this investigation, which promises to be of fair importance as time goes on. Work will continue through the winter months, and longer if necessary. Full reports, covering all phases of the investigation, are projected.

Of a large number of coolies employed by the College for gardening and other agricultural work, practically two-thirds were found to be infested. Most of these people are from neighboring villages, and are typically representative of the average local, rural population. Not many, however, were found to show symptoms of *Ankylostomiasis* although in most subjects eggs could be readily demonstrated at almost any time by the Kofoid method of salt water flotation. This method of examination has proven exceedingly useful and one month was given to this routine study of cases.

In order to obtain free-living worms in the soil for study and identification we have used the method of Baermann with great success. This method has given us a collection of worms from the soil near the infected *kongs*.

An especially interesting characteristic of the hookworm eggs is their ability to remain alive in the jars for considerable time without undergoing division. An experimental jar set up in the laboratory was found to contain eggs for one and one-half months, practically as fresh and numerous as when first put in and with most of the eggs still in the eight cell condition just as they are voided. The feces in this jar were from a hospital patient and were completely under our control. Another jar

containing material from a local *kong*, subject to daily examination, exhibited eggs for practically as long a time and gave parallel results. The eggs sink to the bottom of the jars, both in the laboratory jars and in the field *kongs*, and there they remain with little or no advancement for a long time. The deciding agent for inducing division seems to be the relation of the egg to oxygen rather than to heat or moisture, although both these are essential; eggs from the same source, under the same laboratory conditions, mixed with soil hatched quickly into worms, as in nature, while a check experiment remained essentially the same as when taken from the field. A laboratory jar into which air was pumped for a considerable time revealed some further development of the eggs beyond check experiments of the same material, under the same conditions. We were unable to obtain complete development, possibly due to imperfections in our pump.

The collection of samples for identification and study of the distribution of worms in the soil of the rice fields, and in soil near the *kongs* occupied some time. We used the Baermann apparatus for this. We preserved the worms, after centrifuging them for concentration, in alcohol and glycerine. Boiling mercuric chloride gave us an excellent killing and fixing agent which showed little of the usual distortion of violent agents. The mercury was removed with iodine. Specimens of these worms are in the hands of experts for certain identification.

The distribution of the more ubiquitous parasites, roundworm and whipworm has been noted and recorded. We find they are abundant and are usually associated with hookworm.

We have under consideration designs for sanitary privies that will lead to the conservation of the fertilizing value of the materials involved, and also eliminate the carriage of worms.

Regular observations of *kongs* in the field have confirmed nearly all laboratory results. It is planned to extend these observations farther out into the villages.

BIOLOGY NOTES

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During the past year a small number of snakes were collected by Mr. F. A. McClure in the island of Hainan. We are arranging to have these identified for a report later.

A termite has been found which may be *Cryptotermes hongkongensis* or a new species. Another is *C. formosanus* Shiraki collected in the swarming season on the island of Cheung Chau, near Hongkong.

COELENTERATA

Pteroides sp. nova?
Oculina sp.
Eudendrium ramosum L.
Sertularia sp. nova?

Ophiarchnella infernalis M. & T.
Ophiothrix stelligera Lyman.
Ophiactis savignyi M. & T.
Polycheria rufescens Brandt.
Cucumaria sp. nova.

ECHINODERMATA

Asterina sp. nova.
Astropectin vappa M. & T.
Linckia laevagata L.

MOLLUSCOIDEA

Membranipora sp. nova.

ARTHROPODA

Caprella sp.

All these are new stations for the described species, and all new species are being described. They add considerably to our fauna. Many other unidentified forms are still to be heard from since the experts to whom they were intrusted have not yet reported.

During the fall of 1922 a study of the life history of *Agromyza phaseoli* Coq. was undertaken and completed but more time is needed to finish certain observations. It has never before been reported from China, and its introduction cannot be looked upon with too little apprehension. It prevents the cultivation of some legume-crops on the campus at certain seasons.

A systematic study of the ferns and their allies is now well under way. It is planned to have keys to all genera and species represented in our flora, as well as data on each species. We have now over a hundred species collected and identified. This is part of a more general plan to cover the whole of the flora from time to time by similar full reports.

In conjunction with the hookworm investigations a collection of free-living, soil-inhabiting nematodes is being formed.

The collection of butterflies is still carried on.

During the past year we had the opportunity to collect and to examine a number of the more common littoral and freshwater shell-bearing mollusca occurring near Canton and at Cheung Chau, Hongkong territory. The shells enumerated include only a fair sample of what might be obtained after longer search under more favorable conditions.

It is interesting to note the alliance of this fauna with that of the islands of the Pacific and with that of the California coast. A number of species occur here that are found on the opposite shore but there is a very complex admixture of the more definitely warm-water forms and with some of endemic origin. The observations of Ralph Arnold (Palae. San Pedro. Calif. Acad. Sc. '03) concerning the tertiary shells of San Pedro and Japan show us the affinities at once of the living shell-bearing mollusca of these two regions and likewise add to our observations concerning the relationship between the whole Pacific molluscan complex. The molluscan fauna of southern China appears to be palaeotropical considered in its broadest aspect.

(Our determinations were made by H. A. Pilsbury of the Philadelphia Academy.)

GASTROPODA

BULLIDAE

Bulla ampulla L.

ACMAEIDAE

Helcioniscus eucosmia Pils.
H. toreuma Rve.

HALIOTIDAE

Haliotis diversicolor Rve.

TURBINIDAE

Turbo coronatus var. *gramulatus* Gmel.
T. intercostalis Pils.
T. japonicus Rve.

NERITIDAE

Nerita lineata Gmel.
N. undata L.
N. crepidularia Lam.
N. albicilla L.

SOLARIIDAE

Architectonica perspectiva L.

LITTORINIDAE

Littorina irrorata Say.
L. palliata Say.

VIVIPARIDAE

Viviparus rossgeri V. Mildff.
V. ciliata Rve.
V. orientalis Lea.
V. chinensis Gray.
V. aeruginosus Rve.

CERITHIIDAE

Cerithium morus Brug.
Clava sinensis Gmel.

MELANIIDAE

Melania ebenina Brot.

STROMBIDAE

Strombus pugilis var. *alatus* Gmel.
S. canarium L.
S. succinctus L.

TURRITIDAE

Turris desbayesii Doumet.

GASTROPODA

- CASSIDIDAE**
Cassis japaonica Rve.
C. inflata Shaw.
C. strigata Gmel.
- DOLIIDAE**
Tonna allium (Sob.) Dillon.
Pyrula dussumieri Val.
P. ficus L.
- CYPRAEIDAE**
Cypraea arabica L.
C. carneola L.
C. erronea L.
C. moneta L.
C. erosa L.
C. helvola L.
- MURICIDAE**
Murex torrefactus Sowb.
M. adustus Lam.
M. fulvescens Sby.
M. tribulus L.
Papana bulbosa Sol.
Cymatium (*Turrotriton*)
pfeifferiana Rve.
Gyrineum tuberculata Br.
- THAISIDAE**
Thais luteostoma Dillon.
T. lapillus L.
- NYCTILOCHIDAE**
Bursa rana L.
Distortrix reticulata Link.
- COLUMBELLIDAE**
Columbella versicolor Sby.
- BUCCINIDAE**
Buccinum undatum L.
Eburna lutesa Lamb.
Alectrion olsola Soby.
- TROCHIDAE**
Monodonta labro L.
Tegula rusticum Gmel.
- T. nigerrima* Gmel.
T. argyrostoma Gmel.
Astraea undosa Wood.
- VOLUTIDAE**
Mitra aurntia Desh.
- OLIVIDAE**
Olivella sayana Rav.
O. (Callianax) biplicata Sby.
O. scripta Lam.
- CONIDAE**
Conus suturatus Rve.
C. carinalis Hw.
C. sulcatus Hw.
- TURRITELLIDAE**
Turritella bacillum Kiener.
- HELICIDAE**
Eulota similis Fer.
Polygyra albelabris Say.
Camaena cicatricosa Mull.
- CYCLOPHORIDAE**
Cyclphorus elegans Midff.
- PYRAMIDELLIDAE**
Pyramidula alternata Say.
- NATICIDAE**
Natica Polinices mamilla L.
N. P. melanostoma Gmel.
N. P. didyma Bolton.
Sinum neritoideus L.
- AURICULIDAE**
Melanpus luteus Guoy.
- SCALIDAE**
Epitonium lamellosa Lam.
- SIPHONARIDAE**
Siphonaria japonica Don.
S. cornuta Gld.
S. sirius Pils.

PELECYPODA

- ARCIDAE**
Arca (Scapharca) campechensis
 Gmel.
A. decussata Sby.
A. obtusa Rve.
A. granosa L.
A. (Brabatia) fusa Brug.
Parallelepipedum torta St. March.
- MYTILIDAE**
Mytilus smaragdinus Ch.
M. californicus Conrad.
M. edulis L.
Modiolus fortunei Dkr.
Septifer virgatus Wiegen.
- PINNIDAE**
Pinna incurva Gmel.
Atrina tuberculosa Sby.
- PERNIDAE**
Malleus albus Lam.
- OSTREIDAE**
Ostrea laperousi Lamb.
O. cristata Born.
- PECTENIDAE**
Pecten pyxidatus Boru.
P. circularis Sby.
P. circularis var. aquisulcatus
 Capr.
P. gibbus var. irradians Lam.
Amusium pleuronectes L.
- SPONDYLIDAE**
Spondylus cruentata Lisch.
S. imperialis Chemi.
S. sinensis Sby.
- UNIONIDAE**
Anodonta woodiana Lea.
- VENERIDAE**
Tapes variegata Handley.
T. tristis Lam.
T. philippinarium A and R.
T. phenax Pils.
Trveta stultorum Maue.
Gafarium divaricatum Gmel.
Venus (Chione) cancellata L.
V. C. thiara Dillw.
- CARDIIDAE**
Cardium robustum Sol.
C. rugosum Sby.
C. sinensis Sby.
- CHAMIDAE**
Chama rubra Rve.
- MYIDAE**
Corbula erythrodon Lamb.
- SOLENIDAE**
Solen grandis Dkr.
- TELLINIDAE**
Tellina alternata Say.
Metis balaustina L.
Paphia striata Lam.
Caecella cuminii Desh.
- CYRENIDAE**
Corbicula fuscata Lam.
C. fluminea Mull.
- PTERICOLIDAE**
Ptericola phaladiformis Lamb
- ANOMIIDAE**
Anomia simplex D'Orb.

AGRICULTURAL NOTES

PLANT INTRODUCTIONS

Recent plant introductions made by the College consist chiefly of those brought from the United States in February by Mr. G. W. Groff. At that time the citrus collection, which includes many native species and varieties, was enriched by the Washington Naval and Selecta oranges, the Little River grapefruit, and the Satsuma looseskin orange. Numerous citrus hybrids and citrus relatives were also introduced for testing in connection with the co-operative work with the Office of Crop Physiology and Breeding Investigations of the United States Department of Agriculture.

A large collection of peaches, almonds, apricots and plums, and a smaller one of pome fruits, chiefly pears, were secured from the Office of Foreign Seed and Plant Introduction of the United States Department of Agriculture. Six different kinds of pomegranates, the natal plum, *Carissa grandiflora* DC., the Queensland nut, *Macadamia ternifolia* F. Nuell, and species of *Acacia*, *Artocarpus*, *Boehmeria*, *Cassia*, *Casuarina*, *Chrysophyllum*, *Garcinia* and other promising genera for Kwangtung were also introduced.

The popular vegetable of tropical America and especially Porto Rico, the chayote, *Sechium edulis*, was secured from Mr. F. O. Popenoe of Altadena, California. These flourished for a time but did not withstand the July and August rains. We noted, however, that they grew better on high, sandy slopes and we believe they should be tested on some of the hills of northern Kwangtung and Fukien.

The pecan should prove a very valuable nut tree for China. Through the help of Mr. C. A. Reed, Nut Culturist of the United States Department of Agriculture, the College imported 15 pounds each of Moneymaker, Stuart, Alley, Pabst and Schley varieties, and also a number of budded trees. We had a very low percentage of germination but have in stock about four hundred seedlings which will be ready for distribution next spring.

We are continuing work with the avacado and have a large number of trees to set out next spring. Some of these were secured from Mr. F. O. Popenoe of Altadena, California, and some from the Hawaii Agricultural Experiment Station. Mr. W. A. Spinks, the avacado expert of Duarte, Cal. visited the College in the spring and brought with him seeds and budwood of some of his best trees.

FARM ANIMALS IMPORTED

The shipment of Holsteins and Toggenburg milk goats, also imported by Mr. G. W. Groff in February, are doing well. The shipment included three Holstein heifers, one Holstein bull, six mature does, one buck, and six kids born en route to China. Two of the does were

shipped from Canton to Mr. D. S. Tappin in the Island of Hainan. Four does which kidded enroute gave an average of six pounds of milk a day on arrival at C. C. C. Four months after arrival the average was three pounds a day for each doe.

The goats, with the exception of the buck, were a gift from Mr. Carl P. Sheddan of Englewood, California. They are the foundation animals of what will very likely become an important class of dairy animals for China.

The Holsteins were purchased from W. A. Morris and Sons Corporation, of Woodland, California. The animals were carefully selected by Mr. Frank Morris and Prof. W. E. Tomson and Mr. John H. Brennan of the Animal Husbandry Division of the University of California.

When imported the three heifers were fifteen and the bull twelve months old. The heifers are all sired by King Aaggie Mead No. 221694, who is by the famous bull King Mead of Riverside who has two daughters with records of above 28,000 pounds milk, and 1,000 pounds butter fat, and six that average above 22,000 pounds milk and 1,000 pounds of fat in one year. The dams of the heifers are also of excellent breeding. The bull is sired by Sir Aaggie De Kol Mead No. 286173, five of whose nearest dams have yearly records averaging 27,000 pounds of milk and 904.51 pounds of butter fat.

The College has been very fortunate in getting all of its dairy cattle, including water buffaloes, protected from rinderpest by vaccination with the new Boynton vaccine, made by Dr. W. H. Boynton of the Veterinary Division of the Philippine Bureau of Agriculture. This vaccine renders the animal immune to rinderpest for two or more years.

During the past year two Berkshire gilts were secured from the Philippine Bureau of Agriculture. A Berkshire boar was secured from the Bureau some months previously. These are the first Berkshires to be tried in Canton. We are also experimenting with Large Yorkshires, secured two years ago from Hongkong, the original stock of which came from Australia.

AGRONOMY

The Agronomy Department received twelve varieties of rice chiefly from Texas, U.S.A., through the kindness of Mr. P. H. Young of Southeastern University, Nanking, who brought the rice from America. This rice was planted in March and harvested in the summer. The crop showed various stages of maturity for the different varieties. Some proved to be quite promising. Further tests are being made for the second crop. The varieties are Shinriki, Acadia, C. I. No. 2835, Fortuna, Tokalon, Wateribune, C. I. No. 1428, Onsen, Carolina Gold, 16000, Delitus, and Honduras.

Attempts to grow alfalfa in the Canton region have never been very successful. This may be due to planting it on soil not sufficiently drained. Alfalfa grows well when planted in the fall on fairly well-drained soil, but is killed by the continuous rains of the summer. This fall, plantings of legumes, chiefly alfalfa, will be made in experimental plots on high, naturally well-drained ground. The legumes which will be planted are: Red clover, Grant Hubbard clover, Yellow sweet clover, Alsike clover, and alfalfa (Grimm, Kansas, Hairy Peruvian, and Smooth Peruvian varieties).

SERICULTURE

Almost daily requests for Ling Naam inspected eggs are being received by the Sericulture Department from outlying districts. On account of the limited supply of our eggs, it has been necessary to confine our attention to the two districts of Shun Tak and Heung Shan, but we are hoping to enlarge our plant next spring and at that time it may be possible to supply some of the other districts.

The Canton Christian College expects to have a large exhibit in the International Silk Exhibition which will be held in New York next January and February. Mr. C. W. Howard, head of the Sericulture Department, will be there in person to explain the distinctive features of the silk work in southern China.

Mr. Howard writes from America that there is a tremendous interest in Canton Silk on the part of the American Silk Merchants. Some even go so far as to prophesy that the Canton silks may be practically the only silks in demand next year.

The students in the six months course in Sericulture are progressing very well. They should be a very real factor in the future improvement of Sericulture in southern China.

FARM AND LABORATORY EQUIPMENT

One of the problems in agricultural education is the introduction of modern machinery suitable for conditions in China. Farm machinery has been contributed by various American firms for experimental and instructional purposes.

The following list includes the names of principal machines now in use at the college, and the firms who have contributed them.

One-horse plows and harrow, and live-stock scales—Montgomery Ward & Co., Chicago, Ill.

Cream separators—Associated Manufacturers, Waterloo, Iowa; Sharpless Separator Co., West Chester, Pa; and Montgomery Ward & Company, Chicago.

4-horse power engine—William Galloway Co., Waterloo, Iowa.

10-Saw hand cotton gin and condenser—Continental Ginn Co., Birmingham, Ala.

Milk bottle filler—Creamery Package Mfg. Co., New York.
(Through the Northwest Trading Co., Hongkong).

Pressure canner—Berger and Carter Co., San Francisco.

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AGRICULTURAL PUBLICATIONS
OF
CANTON CHRISTIAN COLLEGE

BULLETINS.

- General Bulletin No.* 5 GROFF, G. W., Agricultural Reciprocity Between America and China. 34 illustrations. 40 pages. English. \$0.20.
- " " " 12 GROFF, G. W., The Papaya for South China. 8 illustrations. 7 pages. English. Chinese edition under title (木瓜) 8 pages. \$0.10.
- " " " 18 LEVINE, C. O., and CADBURY, W. W., A study of Milk Produced in Kwangtung. 2 illustrations. 9 pages. English. \$0.10.
- " " " 23 LEVINE, C. O., Notes on Farm Animal and Industries in China. 8 illustrations. 54 pages. English. \$0.40.
- " " " 25 GRAYBILL, H. B., Lawn Grasses for South China. 6 illustrations. 6 pages. English. \$0.20.
- " " " 27 LEVINE, C. O., Butchering and Curing Meats in China. 9 illustrations. 41 pages. English. \$0.40.
- Agricultural* " " 4 FUNKHOUSER, W. L., A Garden Guide for South China. 4 pages. English. \$0.40.

PERIODICALS.

- The Lingnaam Agricultural Monthly (Chinese)
The Lingnaam Agricultural Quarterly (Chinese)
The Lingnaam Agricultural Review (English)

TEXTS.

- GROFF, G. W., The Lychee and Lungun. 63 illustrations. 188 pages. \$5.00. (Also published by Orange Judd and Co., New York).

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THE LINGNAAM
AGRICULTURAL REVIEW



COLLEGE OF AGRICULTURE
CANTON CHRISTIAN COLLEGE
CANTON, CHINA
1923

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Published by the College of Agriculture

Canton Christian College

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Publications sent in exchange for the Lingnaam Agricultural Review should be addressed, LIBRARY, Canton Christian College, Canton, China.

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Correspondence regarding subscriptions, and manuscripts intended for publication, should be sent to the EDITOR, Lingnaam Agricultural Review, Canton Christian College, Canton, China.

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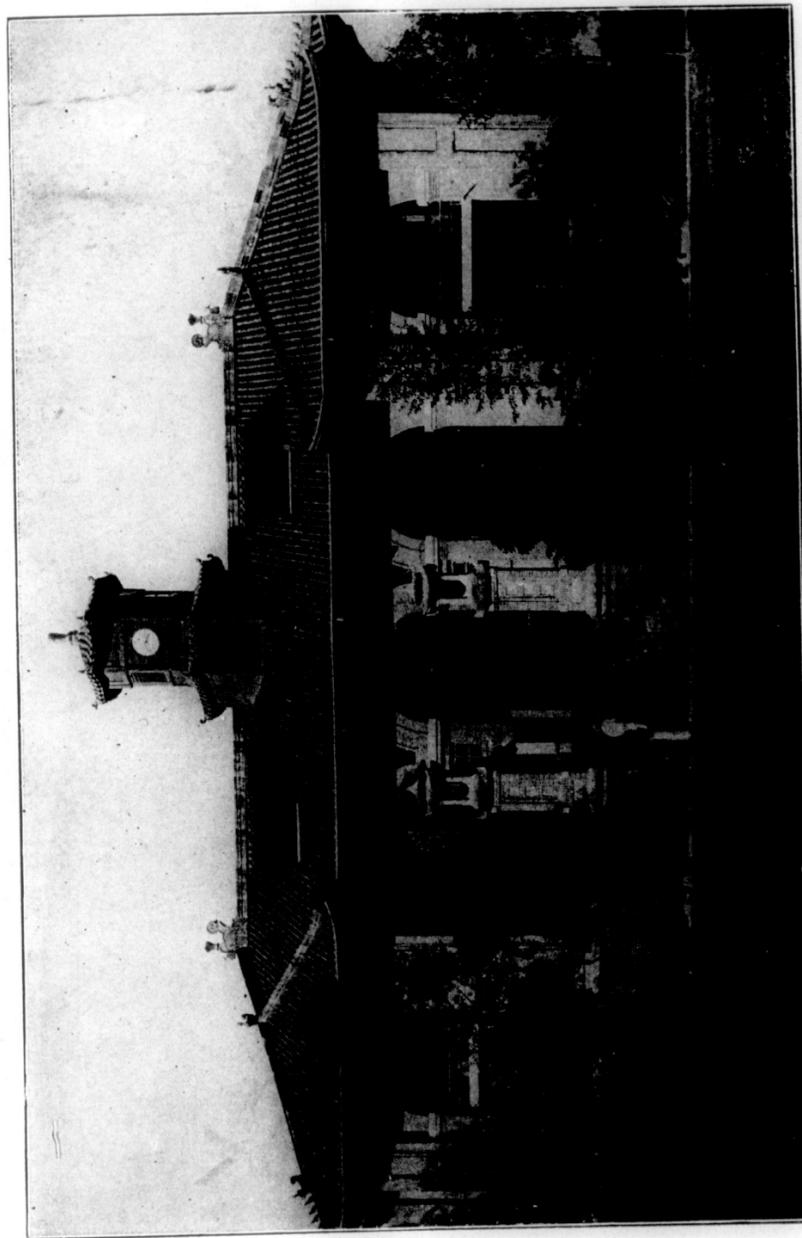
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LINGNAAM AGRICULTURAL REVIEW.

The agricultural work of Canton Christian College was inaugurated in 1907 when the first agriculturist was appointed to the college staff. The work grew steadily from small beginnings until 1921 when it was greatly enlarged in scope by a liberal appropriation from the Kwangtung Government. In the fall of 1921 the College of Agriculture was effected. The work is now organized in four divisions: Education, Extension, Industries, Research and Experiments; and five departments: Agricultural Manufacturing, Agronomy, Animal Husbandry, Horticulture and Sericulture.

Before the publication of the first issue of the *Review*, the research work in agriculture carried on at Canton Christian College was published in bulletin or book form, or in such publications as the *Philippine Journal of Science*, *Journal of Dairy Science*, *Journal of Heredity* and the *Lingnaam Magazine* (Chinese).

It is urged that others in the Orient doing research related to agriculture will contribute material for publication in the *Review*.



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FEEDING CHICKENS IN CANTON*

W. L. FUNKHOUSER AND L. HOH.

Canton Christian College

(Received for Publication, December 1, 1922.)

A large number of chickens are consumed daily in Canton. There are thirty hotels and restaurants which furnish western style food in this large city. The information secured by questioning most of these shops shows that they each have an average daily consumption of twenty chickens. In addition to those furnishing western dishes, there are more than two hundred and fifty typical Chinese restaurants ranking from middle to first class, each having an average consumption of thirty chickens daily. Furthermore, there are probably more than three hundred and sixty small restaurants located mainly on the street corners, which furnish cheap food for the working-men and the common people. These also use a considerable number of chickens daily. The total number of poultry consumed each day in Canton, including those killed and butchered in the home kitchens, is probably in excess of 15,000 birds.

SOURCE OF CHICKENS

The chickens consumed by the people in Canton come mainly from three sources: namely, the districts bordering the North River, the East River, and the Shui Tung (水東) regions. Wuchow (梧州) chickens are sometimes found on the Canton market but not in very great numbers. The chickens from the various places are shipped by boat or rail to the wholesale dealers in Canton who sell them to the small shops and to hotels and restaurants.

HOW THE CHICKEN ARE HANDLED IN THE WHOLESALE SHOP

There are no intermediate handlers of the chickens between these wholesale dealers and the larger consumers, such as the large restaurants, although there are many retail shops in Canton which buy and fatten chickens. The business, however, of the retail shops is limited chiefly to the field of residents and other small consumers. It is a general rule for the larger consumers to keep just enough fowls to meet their needs for about four or five days, so they do not give much attention to fattening. The wholesalers, also, do not make a practice of fattening the chickens before selling them as they think fattening is not profitable in view of the present high prices of feed and other expenses such as labor and rent. The chickens being held for sale, however, are fattened to some extent. The custom is to keep birds hungry at the time when sales are likely to be made. When prospective buyers arrive the chickens are fed up with mash meal and cooked rice.

*The work represented in this paper was done by Mr. L. Hoh under the direction of Mr. W. L. Funkhouser as part of the requirements for the degree of Bachelor of Science in Agriculture at Canton Christian College.

The price for the chickens with empty crops is eight to ten cents more per catty* than that of full-fed chickens.

AGE OF THE CHICKENS FOR FATTENING

The age generally considered best for fattening is four and one-half to six months. Birds about this age weigh about one and one-quarter catties* for pullets and one and one-half catties for capons. This custom of fattening nearly mature fowls is practiced generally by the chicken feeders. It is quite generally known that the growing bird will not put on fat as rapidly as one that is nearly mature.

FEEDING

The Cantonese have raised chickens for generations and probably not less than 85 per cent. of the population in Canton know how to keep chickens, yet tested rations have not been worked out and made available for the public.

There seems to be only one ration which is known and commonly used in Canton. This ration is made by scalding about 10 catties of rice bran and from 7 to 10 catties of broken rice in a bucket having a capacity of about 60 to 70 catties of water, with the boiling aqueous waste from the distillation of spirits taken directly from the kettle in the rice wine shop. This distiller's waste costs at present about sixty-five cents Canton silver per picul† or two buckets, while two years ago it was not more than twenty to thirty cents per picul. The proportion of the broken rice and rice bran for this ration varies a great deal with different feeders. Some use five catties of broken rice and fifteen catties of rice bran. Each feeder has his own formula which is based on his personal experience. Chickens fed in this manner for three weeks make an average gain of one-fourths to two-fifths of their original weight.

Besides the above feeds the feeders may sometimes use cooked sweet potatoes as a substitute for the rice bran, with a small increase of the proportion of broken rice. Green vegetables and kitchen waste are commonly used in raising chickens but seldom by the feeders who feed fowls in large numbers. In commercial feeding they are fed once early in the morning, once at noon, and once late in the afternoon. The amount of the mash given to the birds averages about three leungs‡ per head per day. Usually the noon meal is a little lighter than the morning and night meals and some may even do away with the noon meal and have the night meal shifted up to 2 or 3 p.m. every day.

The length of the fattening period with this ration also varies a great deal. The shortest seems to be 14 days and longest generally not longer than 30 to 40 days. It is also a common practice for the feeders

* One catty is equal to one and one-third pounds.

† One picul is equal to one hundred thirty-three and one-third pounds. One dollar Canton currency is equal to about fifty cents U. S. cy.

‡ One leung is equal to one and one-third ounces.

to hasten the process by giving the chickens cooked broken rice once a day or once every two or three days at the rate of two to four handfuls to each crate of six to ten birds. This addition of cooked rice is said to stimulate the appetite of the fowls so they will eat double the usual amount for that particular feeding. This method is made use of by the feeders for the feeding just before weighing at the time of selling their fowls.

WATER AND SANITATION

The question of a constant water supply has not yet been considered important by the Chinese poultry feeders. They have little or no idea of the importance of using pure, uncontaminated water, or of disinfecting the water when necessary. They furnish water to the fowls in earthen-ware pans whenever they think that the birds need water, instead of providing fresh, clean water at all times.

No attention is given to the sanitation of the feeding quarters. The droppings of the fowls may be removed in some cases once every one or two days, but in others cases less frequently. The fowls are kept in crates in dark, quiet, and poorly ventilated rooms, generally on the second floor of the shop. It is a common practice for the feeders to curtain the crate in order to keep the birds quiet and thus facilitate fattening. If this is done the curtains are made by cutting bran sacks into two halves and hanging them on nails over the sides of the crates. Some of feeding rooms in Canton are kept so dark that the feeders must light the rooms artificially at the time they feed. There are no feeding rooms in Canton which give the impression that the feeders know how to protect their fowls through sanitation from being attacked by diseases, which at times carry off fowls in great numbers.

FLUCTUATION OF PRICES

In the study of the fluctuation of prices throughout the year it was found that there are five peaks of high prices. The first of these is about a month's time around the Spring or Tsing Ming Festival; the second is during the time of the Summer or Dragon-boat Festival; the third is during the Autumn or Full Moon Festival; the fourth is at the time of the Winter Festival; and the fifth is for a few days before and following the Chinese New Year. On these five big occasions, which occur every year, it was found that the consumption of fowls increases one-fifth to one-third above the normal and the prices increase ten to twenty per cent. Taking the year as a whole, the highest peak of the curve falls at New Year's time. This is because the first seven to fifteen days of the year are considered to be holidays for the shopmen, as well as for other classes. People at this time are having home festivities and enjoyments of all kinds in which roast chicken and duck figure in no small degree. It is also true that the people of Canton have a better appetite for meats in the winter than during any other season of the year. The decrease in production of poultry in the winter may be another very important

factor which influences the price of the product at that time of the year. Trading and transportation are largely discontinued and do not begin again until seven to fifteen days after New Year's Day. All of these factors together no doubt are influential in creating high prices for poultry at the beginning and end of the year. The prices paid for live chickens throughout the year vary from fifty cents to one dollar or more, Canton currency, a catty.

EQUIPMENT

1. *The Bamboo Baskets for Transporting Chickens.* The baskets for transportation are made entirely of split bamboo in the form shown in the illustration. The size varies from the capacity of a few birds to that for fifty or even a hundred fowls. It has a concave cover to keep the fowls from getting out and a hexagonal bottom strengthened by strong pieces of split bamboo. The largest chicken baskets cost about thirty cents, and if well made can be used for a long time with reasonable care.

2. *The Fattening Crates.* There are two general types of fattening crates in use in the Canton region. The one type is constructed entirely of wood and the other type is framed with wood and the slats are made of bamboo. Each compartment of the crate has a width of about 2½ feet and a depth of about 1 foot 3 inches. The space between slats is 2 inches. The rows of compartments are arranged one on top of the other in two to three rows and from three to five or even more compartments in each row. It is also common to have a fourth row of very much larger dimensions to serve as a base for the upper rows and in diversified fattening shops this row has an open top at the front and is used for containing ducks and geese. The general form of the crate is shown in the illustrations.

3. *The Feeding Trough.* The feeding trough is made of wood in the form of a truncated cone. The idea of constructing the trough in this shape is to prevent tipping when the chickens are crowding and struggling around it during the time of feeding. The basin, which is in the top of the cone is about 2½ inches deep and 6 inches in diameter. The bottom of the cone is about 10 inches wide, and the height is about 5 inches.

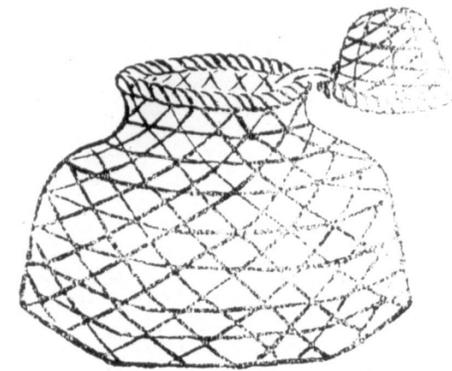
4. *The Wooden Buckets.* The buckets which the poultry feeders use for holding and carrying feeds are made of wood and are 16 to 20 inches in diameter and the same dimensions for height. When the feeder needs the mash meal he puts the right amounts of rice bran and broken rice in each of the buckets and carries them to the distiller's for the distiller's waste. He then stirs the mixture thoroughly and carries it home. The mash meal is kept in the buckets until it is used up.

FATTENING CHICKENS FROM DIFFERENT REGIONS

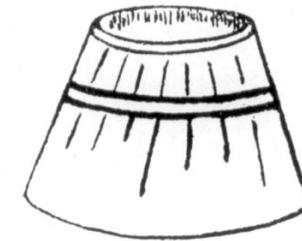
Poor quality of meat has been a criticism of the skinny, long-necked, heavy tailed, and high-legged chickens from the Shui Tung (水東) regions. The fattening quality of these chickens is also con-

FUNKHOUSER AND HOH: FEEDING CHICKENS]

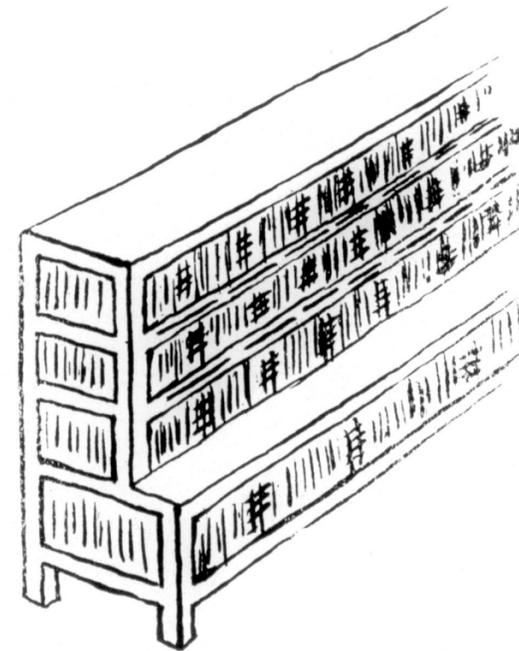
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BAMBOO BASKET



FEEDING TROUGH



FATTENING CRATES



WOODEN BUCKET

EQUIPMENT USED IN FATTENING CHICKENS IN CANTON

sidered to be inferior to those from any other region for it is hard to make them gain in weight. The chickens from the North River and the East River regions are recommended for fattening purpose. It is said that the chickens from the North River regions will make greater gains in weight and give better quality of meat than any of the others. In Canton the fowls from the North and East River regions are as a rule referred to as "local" chickens.

FEEDS AVAILABLE FOR CHICKENS IN CANTON

The feeds listed here are those which are obtainable in Canton for chickens. Owing to the many disturbances, both political and financial, which have occurred in this part of China during the year, (1922), the prices of all feeds have been abnormally high. The prices listed are average prices.

<i>Products</i>	<i>Prices per 100 catties Canton currency</i>
Broken rice (米碎)	\$5.00
Rice bran (米糠)	3.50
Wheat bran (麥糠)	5.50
Sesame bran (芝麻糠)	2.50
Soy beans (黃豆)	8.00
Peanut cake (花生粕)	7.50
Soybean cake (豆餅)	7.00
Whole sesame (芝麻)	5.00
Sesame cake (芝麻餅)	5.00
Beancurd waste (豆渣)	0.60
Sweet potatoes (番薯)	1.50
Distiller's waste (酒糟)	0.45
Shrimp waste (蝦糞)	7.00

All the products listed are very common and easy to get except the sesame and its products, bean curd waste and shrimp waste. The whole sesame is handled by wholesale shops of the same nature as the wholesale shops dealing in rice and its products and are located in the same part of the city. The cakes of sesame are obtained in large grocery stores where sesame oil is manufactured. The largest shop in Canton of this kind is the Chi Mei Chai (致美齋), which stands opposite to the Sheng Wong Temple (城隍廟) in the midst of the city. The quarters for the sesame bran shops are the same as for the hulling shops in the south-west part of Honam Island, called Fung On Kiu (鳳安橋).

In getting the beancurd waste one must go to the small shops manufacturing beancurd which are distributed in various parts of the city.

Distiller's waste is sold by the rice wine distilleries of Canton in large quantities every day. The villages near the distilleries are getting this product at a cost of about six cents per bucket of about 65 catties for transportation by water. This material will keep from getting rancid as long as a week or more if kept in a cool, dry place.

This preliminary study of chicken feeding in Canton has impressed us with the need of careful experiments which will give reliable information in regard to economical and practical feeding rations and methods. Such experiments are now under way at Canton Christian College, and it is hoped that before long this information will be available for those interested in feeding chickens, either for home use or for commercial purposes.



SOY BEANS VERSUS OIL MEAL IN THE RATION OF THE DAIRY COW *

C. O. LEVINE

Canton Christian College

One of the most difficult feeding problems for dairymen is to obtain a suitable protein feed at a reasonable price. Since the feeds of high protein content in many localities cannot be home-grown, the dairy farmer necessarily must purchase these feeds, which, as a rule, are on the market at a very high price. Soy beans are grown in most parts of China, except in the southern part, and there is a possibility that they may be fed more extensively and thus help solve the protein supplement problem. Although they are not grown to any extent in southern China, they are on the market in that region at a price that compares favorably with other feeds high in protein, such as peanut cake. Furthermore, peanut cake is unpalatable while soy beans are relished by cows. Information regarding the feeding value of soy beans compared with other protein supplements is needed.

This experiment, the purpose of which was to compare soy beans with old process linseed oil meal as a protein supplement for dairy cows, was conducted in America. The results, however, are of important significance to China where soy beans are very generally grown or are available, and where other feeds high in protein are, as a rule, not available or are available only at a high price.

Very little research work has been done in comparing soy beans with other concentrates in the ration for dairy cows. Otis (2) reports that, in most cases, soy beans can be made to take the place of oil

* Most of the work represented in this paper was done by the writer when in the Graduate School at the Iowa State College of Agriculture and Mechanic Arts, during the winter of 1919-20. The experiment was repeated at that institution the following winter; and the results of the two experiments, which are very much the same, are published under the title "Soy Beans as a Home-Grown Supplement for Dairy Cows" in bulletin No. 24 of that institution.

Since returning to Canton Christian College in 1920 the writer has fed soy beans to both European cows and water buffaloes in a ration with wheat bran and rice bran with good results. The beans must be coarsely ground or soaked in water for 24 to 30 hours, otherwise they will pass through the digestive tract of the cows largely undigested. Ground beans are more readily digested than soaked whole beans.

Feeding soy bean cake has also proven very successful in the Canton Christian College dairy. It is purchased in cake weighing about 70 pounds. For feeding it is cut or broken at the barn into pieces not more than one-half inch in diameter and mixed with other concentrates, such as wheat bran and rice bran. Soy bean cake is palatable and relished by both water buffaloes and European cattle.

meals as a feed for dairy cows, and he also states that soy beans produce a soft butter when used in large proportions and, for this reason, recommends that the soy beans constitute only a small portion of the grain ration. It was found by Price (3) that cottonseed meal and soy beans had practically the same value for milk production. Cook (1) found that cottonseed meal and soy beans were about equal in value for milk and fat production, with a slight advantage in favor of the soy beans.

In selecting cows for this experiment, an attempt was made to secure only those animals which were good feeders and whose lactation would extend throughout the entire experiment. Information concerning the animals used is given in Table I, and, where necessary, it is calculated to the day on which the experiment started, namely, January 17th, 1920. All the cows were in good working condition throughout the experiment.

TABLE I.
ANIMALS USED.

Cow number	253	556	189	225
Breed	Grade	Grade	Holstein	Guernsey
Age of cows	5 yrs. 8 mos.	3 yrs. 2 mos.	7 yrs. 9 mos.	7 yrs. 8 mos.
Date freshened	9/21/19	7/28/19	9/20/19	7/31/19
Length of lactation, days	117	172	179	230
Date of breeding	Open	Open	Open	12/27/19
Previous lactations	3	0	5	3
Length of pregnancy, days	....	....	....	21

The experiment was divided into three periods of thirty days each, and the thirty-day periods were divided into three sub-periods of ten days each. Only the data obtained in the second and third ten day sub-periods of each thirty-day period were used, as the first ten-day sub-period of each period was considered as a transition period during which time the digestive system was allowed to adjust itself to the change of feeds.

The roughage part of the basal ration consisted of corn silage and third cutting alfalfa hay, both of the 1919 crop. These feeds were grown on the Iowa State College Dairy Farm, and were of good quality. The amount of roughage was controlled by the live weight and appetite of the animals, being kept as near as possible to thirty pounds of silage and six pounds of alfalfa hay per one thousand pounds live weight per day. The amount of silage allowed daily varied considerably with the different

individuals. The amount of alfalfa hay consumed was six pounds per head per day for all animals, except cow No. 356, as she would not consume more than three pounds of hay daily during the greater part of the experiment.

The concentrate part of the basal ration consisted of equal parts, by weight, of cracked corn and ground oats.

The total amount of grain fed was determined as far as possible by the production, condition, and appetite of the animals. The silage, alfalfa hay, and the grain mixture were fed in all of the periods and the protein supplements were fed in the proportion of three to four parts of the supplement to six parts of the basal mixture by weight. The protein supplements were old process linseed oil meal and soy beans. The linseed oil meal was locally purchased, and the soy beans, which were grown on the College farm, were fed cracked. The oil meal was fed in periods I and III, and the soy beans in Period II. Every effort was made to keep the feed consumption uniform, so that the average of the oil meal periods might be used as a basis with which to compare to soy bean period. The prices of feeds used are given in table II.

TABLE II.
FEED PRICES

Feed*	Per 100 lbs. (U. S. Currency)†
Corn silage	\$0.40
Alfalfa hay	1.25
Cracked corn	2.40
Ground oats	2.70
Old process oil meal	3.50
Soy beans	3.50

Salt, in the form of blocks, was kept before the cows at all times. The blocks were dried and weighed at the beginning and end of each thirty-day period. Two-thirds of the total consumption of salt for each thirty-day period was taken for the consumption during the last twenty days of each period.

* None of the feeds used in this experiment, except soy beans, are commonly found on the market in most parts of China. In Canton the price of soy beans shipped in from North China, varies from five to eight and one-half cents local currency a catty, or seven to eleven cents a pound. Due to the unsettled condition of the country the price since 1921 has been above seven cents a catty. Peanut cake is generally available at the same price as soy beans, or at a little lower cost. In North China the price of beans is lower than in South China.

† One dollar U.S. cy. is roughly equal to two dollars Canton currency.

The live weights of the cows were considered as the morning weights obtained by weighing the cows after eating hay and before drinking. They were permitted to drink twice a day.

The animals were milked twice each day and the milk from each cow was weighed at each milking. Composite samples of the milk from each cow were made in ten-day periods. The samples were kept in pint fruit jars and were preserved with corrosive sublimate. Fat determinations were made of these composite samples by the Babcock method.

TABLE III.
SUMMARY OF PERIOD I.
SUPPLEMENT OIL MEAL.

Cow No.	Average Live Weight Lbs.	Production			Feed Composition				Water Lbs.	Salt Lbs.
		Milk Lbs.	Fat per cent.	Fat Lbs.	Silage Lbs.	Alfalfa Lbs.	Grain Mixture Lbs.	Protein Supplement Lbs.		
253	1072	411.4		17.94	620	120	118	65	1172	0.94
356	880	281.2		16.73	500	60	80	44	661	0.52
225	999	238.2		10.73	420	130	132	44	821	0.51
189	1246	467.6		17.77	620	120	80	72	1028	1.02
Totals and averages	1049	1398.4	4.52	63.17	2160	420	410	225	3682	2.99

TABLE IV.
SUMMARY OF PERIOD II.
SUPPLEMENT CRACKED SOY BEANS

Cow No.	Average Live Weight Lbs.	Production			Feed Consumed				Water Lbs.	Salt Lbs.
		Milk Lbs.	Fat per cent.	Fat Lbs.	Silage Lbs.	Alfalfa Lbs.	Grain Mixture Lbs.	Protein Supplement Lbs.		
253	1058	375.9	..	19.79	600	120	106	53	1042	1.39
356	850	256.8	..	16.84	460	60	80	40	633	0.47
225	997	221.7	..	11.32	400	120	80	40	731	0.34
189	1245	413.7	..	16.95	6400	120	120	60	1182	0.92
Totals and averages	1037	1268.1	5.12	64.90	2100	420	386	193	3588	3.12

TABLE V.
SUMMARY OF PERIOD III
SUPPLEMENT OIL MEAL

Cow No.	Average Live Weight Lbs.	Production			Feed Consumed				Water Lbs.	Salt Lbs.
		Milk Lbs.	Fat per cent.	Fat Lbs.	Silage Lbs.	Alfalfa Lbs.	Feed Mixture Lbs.	Protein Supplement Lbs.		
253	1078	397.3		17.87	600	120	120	60	1113	1.38
356	858	255.8		14.58	400	60	80	40	762	0.42
225	993	232.6		10.82	400	120	40	40	674	0.31
189	1265	416.2		14.15	700	120	80	60	1296	1.02
Totals and averages	1049	1301.9	4.41	57.42	2100	420	420	200	3845	3.13

TABLE VI.
SUMMARY.

Protein Supplement	Average Live Weight Lbs.	Production			Feed consumed				Water Lbs.	Salt Lbs.	Cost U. S. c.	
		Milk Lbs.	Fat per cent.	Fat Lbs.	Silage Lbs.	Alfalfa Lbs.	Grain Mixture Lbs.	Protein Supplement Lbs.			100 Lbs. Milk.	1 Lbs. Butter Fat.
Oil meal	1049	1350.2	4.47	60.30	2130	420	365	213	3764	2.54	\$2.30	\$0.52
Soy beans	1037	1268.1	5.12	64.90	2100	420	386	193	3588	2.10	2.43	0.47
Increase	.....	.....	.60	4.60	.....	.....	21.00	.....	.....	.....	0.13	.....
Decrease	12.00	82.1	.....	.....	30.00	.....	.....	20.00	176	0.44	.....	0.05
Increase %	.....	.....	15.00	8.00	.....	.....	6.00	.....	.....	.....	.....	.....
Decrease %	1.00	6.00	.....	.....	1.00	.....	.....	9.00	5.00	0.17	6.00	10.00

DISCUSSION OF RESULTS.

The average live weights were practically the same in both the oil meal and the soy bean periods. The consumption of silage and alfalfa hay was also about equal. Slightly more grain and slightly less protein supplement were consumed with the oil meal than with the soy bean ration. This difference in consumption of oil meal and soy beans, however, is accounted for by the fact that a little more soy beans than oil meal, in proportion to the grain mixture, was allowed, rather than any preference to oil meal over soy beans on the part of the cows. The beans were readily eaten by all the cows, and when a free choice of the mixed grain and beans was offered, every cow preferred the beans to the mixed grain.

A decrease of six per cent. in yield of milk, and an increase of eight per cent. in yield of butter fat, were secured with soy beans over oil meal. As is shown in Table VI, the cost of producing one hundred pounds of milk was six per cent. higher for soy beans, and the cost of producing one pound of butter fat was ten per cent. less for soy beans than for oil meal, at the prices given.

TABLE VII.
NET RETURNS OVER FEED COST (U. S. CURRENCY)

Protein supplement.	For 100 lbs. milk.	For 1 lbs. butter fat.
Oil meal	\$1.69	\$0.39
Soy beans	\$1.88	\$0.42
Increase with soy beans	\$0.19	\$0.03
Decrease with soy beans	.....	.....
Increase with soy beans	11%	1%
Decrease with soy beans	.....	.....

In getting the net returns over feed cost, milk was figured at \$3.50 per one hundred pounds milk containing 3.50 per cent. fat, with a margin of five cents for each variation of 1 per cent. in butter fat from the standard set. Butter fat was value at 70 cents per pound, with \$1.00 per one hundred pounds for skim milk.

As is shown by Table VII, the net returns for one hundred pounds whole milk was 11 per cent. higher with the soy beans with oil meal.

SUMMARY.

1. In the experiment conducted at Ames, soy beans gave six per cent. less milk and eight per cent. more fat than did oil meal.
2. When both soy beans and old process oil meal were valued at \$70.00 gold per ton, the net returns for one hundred pounds of milk were eleven per cent. higher with soy beans than with oil meal. There was practically no difference in the net returns for one pound of butter fat.
3. Soy beans and soy bean cake are palatable and are excellent feeds for both European and water buffalo cows.
4. Whole beans will, to a large extent, pass through the digestive tract without being digested, and should be soaked for about 30 hours before feeding, or should be coarsely ground.
5. One-fourth to one-half of the concentrate part of the ration for the dairy cow may consist of ground or soaked soy beans, or ground soy bean cake.

BIBLIOGRAPHY.

1. COOK A. S.
Soy beans versus cottonseed meal.
New Jersey Agr. Exp't. Rp. 26, (1913) 293.
2. OTIS, D. H.
Experiments with dairy cows.
Kan. Agr. Exp't. Sta. Bul. 125 (1903).
3. PRICE, J. N.
Homegrown rations in economical production of milk and butter.
Tenn. Agr. Exp't. Sta. Bul. 80 (1908).

THE FAT CONTENT OF WATER BUFFALO MILK ON
PARTIAL MILKING, AND OF THE MILK FROM
EACH QUARTER *

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It is known that the first portions of milk, the fore milk, from European dairy cows contain much less fat than do the last portions, or stripings. McKay and Larsen (1) and Wing (2) give three possible reasons for this variation; first, the milk in the canals of the teat and lower portion of the milk reservoir is present under such condition as to allow creaming to proceed; second, the larger fat globules, being of nearly the same size as the smaller ducts, meet some obstruction in their downward passage and are only drawn when the last milk is removed; and third, the fore milk has been subjected to a re-absorption process of the lymphatics.

If the milk in the reservoirs of the udder is affected by gravity so as to produce creaming, thorough massaging of the udder before milking should disturb this effect of gravity, and cause the fore milk to be higher in fat content than when the udder is not massaged before milking.

According to McKay and Larsen (3) the dairy cow's udder is composed of four glands, two on the right and two on the left side, thus making the cow's udder in four quarters. There is no connection between the right and left glands but there is some connection between the two right glands on the same side. The milk in the right quarters can not be drawn from the left quarters, and vice versa; but a portion of the milk in the rear quarters can be drawn from the front quarters, and a portion of that in the front quarters can be drawn through the rear teats on the same side. This suggests that there might be a difference in fat content in milk from the right and left sides, but the percentages of fat in milk from the front and rear quarters on the same side are likely to be very nearly equal.

It was the object of this experiment to study: (a) the milk fat percentages on partial milkings from buffalo cows; with and without massaging the udder before milking, in order to determine the effect of gravity on creaming of the milk in the udder; and (b) the fat content of partial milkings from each quarter of the udder in buffalo cows.

RÉSUMÉ OF PREVIOUS WORK.

A survey of the literature on percent. of fat on partial milking shows that a good deal of study has been done with European cows, but no reports on such studies of water buffaloes have come to the attention

*The work represented in this paper was done by Mr. K. F. Koo, under the direction of Professor C. O. Levine, as part of the requirements for the degree of Bachelor of Science in Agriculture, Canton Christian College.

of the writers. The results obtained by those who have studied the fat content of European cows on partial milking are given in Table I.

TABLE I.—ANALYSES OF FAT IN FORE MILK AND STRIPPINGS.

Workers	Percent. of Fat in	
	Fore Milk	Strippings
McKay and Larsen (4)	0.10	12.00
Wing (5)	1.00	10.00
Richmond (6) .....	....	10.00
Isaachsen (7)	1.00	10.00
Leach (8) Cow No. 1	1.32	9.63
Cow No. 2	1.07	10.36
Van Slyke (9) Cow No. 1	0.90	9.80
Cow No. 2	1.60	8.10
Cow No. 3	<u>1.60</u>	<u>8.30</u>
Averages	1.07	9.80

EXPERIMENTAL PROCEDURE

In this experiment the buffalo cows in the College dairy were used. Information in regard to the animals is given in Table II. The age, length of lactation and breeding are calculated to the day on which the experiment started. The body weight for each cow is the average of the weighings on two consecutive days during the week before the experiment started. All of the cows were in good health and condition throughout the experiment.

TABLE II.—ANIMALS USED.

Cow No.	56	71	106	109
Age	mature	mature	mature	mature
Date freshened	10/25/21	12/10/21	9/2/21	1/1/22
Date exp. started	3/18/22	3/19/22	3/20/22	3/21/22
Length of lact. in days	144	99	168	79
Date of breeding	12/10/21	open	12/13/21	2/4/22
Weight of cow, lbs.	940	1070	1010	1630

During the experiment the concentrate part of the ration consisted of a mixture of 7 parts of rice bran, 4 parts of wheat bran, 3 parts of broken rice and 2 parts of ground peanut cake, by weight. The amount of the grain mixture was fed to the cows according to the production of milk. About 3 pounds of grain mixture for every 4 pounds of milk produced was given daily. Just enough water was added to the concentrates when put in the manger to make the mixture sticky. The concentrates were fed twice a day. One feeding was given at 5 a. m. and the other at 5 p. m.

The roughage part of the ration was freshly cut, green, native grasses. The cows consumed 70 to 90 pounds of green cut grasses daily. This feed was served four times a day during the two milkings and after feeding the concentrates.

Salt was mixed with the concentrates in such amount that each cow consumed about one and one-half ounce daily. In addition, once every 10 days the cows were given salt in their mangers. The cows were allowed water three times a day. The samples for fat analyses were taken at the afternoon milking, which was at 2 o'clock. 100 c. c. of fore milk and the same amount of strippings from each cow was drawn into a marked half-pint bottle. Separate and composite samples of the fore milk and strippings from the four quarters were tested as shown in Table III. The quarters were numbered as follows: left rear quarter No. 1, left fore quarter No. 2, right rear quarter No. 3 and right fore quarter No. 4.

The usual method of milking water buffalo cows is to massage the udders with warm water for one to five minutes in order to get the cow to "give down" her milk. The farther along in lactation the more massaging is necessary. Analysis of fore milk with and without massaging were made.

The samples were collected once a week from each cow. The fat determination was made by the Babcock method (10). The results are tabulated in Tables III and IV.

Since separate analysis of the milk from each quarter with massaging the udder showed very little difference in fat content of the different quarters, milk from the four quarters was mixed for making the fat analysis of fore milk without first massaging the udder.

TABLE III.

ANALYSIS OF FORE MILK AND STRIPPINGS WHEN THE UDDER IS FIRST MASSAGED

Sample No.	Cow No.	Daily Milk Prod. in lbs.	o/o of Fat in Normal Milk	Per cent of Fat in Fore Milk from four quarters				Average of 4 quarters per cent	Per cent of Fat in Strippings from four quarters				Average of 4 quarters per cent		
				Comp. Samp.	1	2	3		4	Comp. Samp.	1	2		3	4
1	56	9.3	12.6	10.5	10.0	12.0	9.5	11.0	14.0	14.8	13.5	13.3	13.5		
2	56	9.0	11.8	9.5	8.5	10.8	8.2	10.5	13.5	14.5	12.5	13.0	14.0		
3	56	8.9	11.7	10.2	9.0	11.0	9.4	11.0	12.8	13.5	12.0	13.0	13.3		
4	56	8.9	12.5	10.3	8.5	11.5	9.2	11.0	14.1	16.2	12.8	15.0	13.2		
5	56	8.6	13.0	11.0	10.0	12.5	10.5	12.2	14.5	15.0	13.5	15.5	13.5		
6	56	9.2	12.0	10.0	8.5	12.0	9.5	11.0	13.5	13.4	13.0	14.5	12.5		
7	56	9.0	11.0	9.0	8.2	10.0	8.7	10.5	12.6	13.0	12.0	13.5	11.6		
Average	56	9.0	12.0	10.1	9.0	11.4	9.3	11.0	10.2	13.6	14.3	12.8	14.0	13.1	13.6
8	71	8.6	12.0	9.3	9.0	9.5	9.3	9.5	14.0	16.5	14.0	16.0	9.5		
9	71	8.7	13.5	12.5	13.0	12.0	13.5	12.5	15.5	18.0	12.5	18.0	14.0		
10	71	8.9	11.5	9.0	9.0	9.0	9.0	8.0	13.5	15.5	13.0	14.5	12.5		
11	71	8.5	13.3	12.5	13.0	12.5	13.0	12.0	14.0	15.5	14.0	14.8	11.7		
12	71	8.1	11.5	10.5	9.5	10.5	10.8	10.5	13.5	14.0	12.5	15.0	11.6		
13	71	8.2	10.5	8.5	8.5	9.7	8.5	8.0	13.0	15.0	12.5	14.0	14.0		
14	71	8.3	12.5	11.0	10.5	11.3	11.3	10.0	14.8	17.0	15.5	17.0	12.5		
Average	71	8.5	12.1	10.5	10.4	10.6	10.8	10.1	10.5	14.0	13.4	15.6	12.2	14.0	14.3
15	106	8.0	11.5	10.9	12.3	10.5	10.5	9.8	12.2	13.0	12.0	12.7	11.5		
16	106	8.1	11.5	11.0	11.3	11.5	11.0	11.0	12.7	13.0	11.5	13.5	12.5		
17	106	8.2	14.3	14.0	14.5	14.0	14.5	14.0	13.5	13.0	13.0	14.5	13.5		
18	106	8.0	13.5	12.6	13.0	12.6	13.0	12.3	12.3	14.5	13.0	13.5	13.0		
19	106	7.9	12.5	12.0	12.0	12.6	12.0	12.0	13.0	14.0	12.4	13.0	12.5		
20	106	7.5	14.5	14.5	14.5	14.0	14.1	13.5	15.0	15.5	14.0	15.5	14.1		
21	106	6.6	15.5	15.5	17.5	16.5	18.5	17.5	16.0	16.0	16.0	16.8	15.0		
Average	106	7.8	13.3	13.1	13.6	13.1	13.4	13.9	13.5	13.6	13.9	12.4	14.4	13.9	13.6
22	108	8.3	10.0	9.0	7.0	9.8	7.8	9.0	12.0	11.5	12.0	12.0	12.0		
23	108	8.1	11.5	10.0	9.5	11.5	9.0	10.5	15.0	15.0	12.0	17.5	15.0		
24	108	8.0	9.0	9.3	8.0	11.0	7.8	9.8	12.0	13.5	12.4	10.0	12.0		
25	108	8.7	12.0	11.0	9.0	12.5	10.5	12.0	15.0	11.5	17.0	15.5	16.0		
26	108	8.7	11.0	9.5	8.0	9.8	8.8	10.5	13.5	15.0	12.5	12.0	14.0		
27	108	9.0	11.0	9.0	8.0	10.0	8.5	9.5	14.5	14.3	11.0	16.0	14.0		
28	108	9.0	12.5	9.7	9.0	10.0	8.5	10.3	15.0	16.5	13.5	17.5	14.0		
Average	108	8.6	11.0	10.8	8.4	10.6	8.7	10.1	9.5	13.7	13.9	13.4	14.4	13.9	13.7
Average 4 cows		8.5	12.1	10.8	10.4	11.4	10.5	11.0	10.8	13.8	14.5	13.1	14.6	13.1	13.7

TABLE IV.—ANALYSIS OF FORE MILK AND STRIPPINGS WITHOUT PREVIOUS MASSAGING OF THE UDDER.

Sample No.	Cow No.	Daily Milk Prod. lbs.	Percentage of Fat in		
			Normal Milk	Fore Milk	Strippings
29	56	8.6	13.0	10.2	14.0
30	56	7.9	13.5	10.0	13.5
31	56	7.4	13.3	9.0	14.0
32	56	6.6	12.8	9.5	14.5
33	56	7.2	12.0	9.2	13.0
34	56	6.7	13.0	9.0	14.2
35	56	6.8	12.8	9.0	13.7
Average	56	7.3	12.9	9.4	13.8
36	71	7.4	13.5	4.5	16.0
37	71	6.6	12.0	5.6	14.0
38	71	7.1	12.5	7.0	16.0
39	71	7.1	12.8	7.5	14.5
40	71	6.8	13.8	9.0	15.8
41	71	6.5	8.5	8.5	14.5
Average	71	6.9	12.2	7.0	15.1
42	106	7.2	13.5	10.0	13.0
43	106	6.0	13.0	11.5	14.5
44	106	6.9	15.0	12.8	14.0
45	106	7.2	14.6	9.5	13.5
46	106	6.8	14.3	12.0	13.3
47	106	7.1	14.3	11.3	13.7
Average	106	6.9	14.1	11.3	13.7
48	108	9.6	13.5	7.8	17.5
49	108	8.0	12.5	9.0	14.0
50	108	7.3	12.5	8.0	13.5
51	108	8.0	11.5	7.0	15.5
52	108	7.9	11.0	6.4	14.3
53	108	7.6	12.5	8.0	15.8
54	108	8.4	10.5	7.3	13.8
Average	108	7.0	12.0	7.5	14.9
Average 4 Cows		7.1	12.7	8.5	14.4

DISCUSSION OF RESULTS.

The averages in Table III for the fat content of fore milk and strippings when the udder is first massaged, show very little difference in the fat percentage in either fore milk or strippings of the four quarters. The four quarters give fore milk varying in fat percentage from 10.3 to 11.4 and the strippings 13.1 to 14.4. In the composite sample the fore milk contained 10.8 per cent fat. By averaging the butter fat percentages of the four quarters the fore milk contained 10.9 per cent fat. The average of these two figures, 10.85, will be taken as the true average for the fore milk. Both the composite and average analysis of the strippings from the four quarters have 13.8 per cent fat. This is a difference of only 2.95 in fat content in fore milk and strippings.

Table IV shows that when the cow's udder was not massaged, the fat content was as low as 4.50 per cent. for fore milk and as high as 16.00 per cent. fat for the strippings in the same cow (sample 36). The average for 26 samples taken in this way gives 8.80 per cent. fat for the fore milk and the average of the strippings gives 14.40 per cent fat. The average difference in fore milk and strippings is 5.6 per cent fat as compared with 2.9 per cent fat when the udder was massaged before milking.

The variation in the percentage of fat in the fore milk and strippings was not as great as has been reported for foreign cow's milk. This is probably due in a large measure to the fact that the small fat globules of buffalo milk pass along the milk ducts more readily than do the larger fat globules in European cow's milk. C. O. Levine (11) found the size of fat globules in buffalo cow's milk to vary from 1.8 to 10 micromillimeters in diameter, the most of the globules being from 2 to 6 micromillimeters in diameter. McKay and Larsen found (12) that Jersey milk contained fat globules from 8 to 10 micromillimeters in diameter.

The fact that the fore milk was considerably lower in fat, when the cow's udder was not first massaged as compared with that given after thorough massaging, substantiates the theory that gravity may cause creaming of the milk in the udder. Massaging the udder apparently disturbs the creaming effect of the gravity so that there is difference in fat content between the fore milk and the later drawn milk.

SUMMARY

1. There was no significant difference in percentage of fat in milk from each of the fore quarters of either the fore milk or strippings.
2. When the cow's udders were massaged before milking the average percentage of fat in fore milk was 10.85 while that of the strippings was 13.80.
3. When the cow's udders were not massaged before milking, the average percentage of fat in fore milk was 8.8 while that of the strippings was 14.40.

4. Points 2 and 3 indicate that gravity, resulting in creaming of the milk in the udder, is an important factor in causing the difference in butter fat content of the first and last milk drawn.

REFERENCES

1. MCKAY, G. L. AND LARSEN, C:
Principles and practice of butter making, pp. 73-74.
2. WING H. K.
Milk and its products, p. 30
3. MCKAY, G. L. AND LARSEN, C:
Principles and practice of butter making, pp. 22-23.
4. MCKAY, G. L. AND LARSEN C:
Principles and practice of butter making, pp. 73-74.
5. WING, H. K.
Milk and its product, p. 30.
6. RICHARD, H. D:
Dairy Chemistry, p. 307 (1920).
7. ISACHSEN, H:
Bis Foringsforsak Sta. Norges, landbrukshoiskole, 1913, pp. 48-69;
Exp. Sta. Record of U. S. Dept. of Agr. V. 32 (1915) No. 1 p. 75.
8. LEACH, A. E:
Food inspection and analysis, p. 128 (1914).
9. VAN SLYKE:
Modern methods of testing milk and milk products.
10. FULLER, J. M.
Using the babcock test, Oklahoma Agr. Exp. Sta. Bul. No. 107, June 1915.
11. LEVINE, C. O: Unpublished data.
12. MCKAY, G. L. AND LARSEN, C:
Principles and practice in butter making, p. 7

PARASITIC INFECTIONS AS AN ECONOMIC LOSS
TO THE COMMUNITY

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The time has passed when parasitic infections can be considered helpful to the individual which harbors them. On the other hand statistics prove that heavily infected populations are less productive than those which are relatively free from infections. At the same time the physiologist has been studying the effect of the parasite on the host and has shown that any foreign animal organism living within the body of man or other animals not only lives at the expense of that animal without any profit to the animal, but that any such infection, no matter how slight, is positively harmful to the host. While this detriment is partly due to the destruction of cells and tissues of the body, the greater share is due to secretions and excretions of the parasite which poison the body and make it react abnormally.

In the Western world the important parasites of man and domestic animals have been known for a number of years. Their effects on the host are fairly well known and their life histories reasonably well understood. In the Orient Japanese investigators have worked hard to solve the problems of tropical medicine in Japan, American physicians have studied the problems of parasitology in the Philippines, the Dutch have made important studies in Java, while in Malaya the British and in Indo-China the French medical officers have not only investigated the causes of disease but have done much to make those countries fit places in which to live. In China, aside from the epoch making discoveries of Sir Patrick Manson in the last century, no serious study of the parasites of man and domestic animals has been attempted until the last few years. While the distribution and life history of these disease-producing organisms is becoming better understood in China, and treatment for certain diseases is being effected, *the problem of stamping out these infections is the important one*, and as yet nothing in this line has been attempted *en masse*.

This work in the prevention of disease consists of the following steps:

1. A thorough knowledge of the structure and life history of the organism which is the cause of the disease. The structure of each stage must be known in order that the organism can be recognized whenever it is encountered. A knowledge of the life history involves the tracing of the successive stages of development from one adult period to the next adult period in the series. It also includes the recognition of larval hosts through which the parasite is obliged to pass in reaching the adult stage, and (equally important) of those hosts which may serve as alternate reservoirs to conserve the infection.

2. An investigation of each parasite and the disease which it produces to discover the places where barriers may be effectively established in fighting the disease. In some cases, as in malaria, the incidence of the disease can be reduced (a) by treating all individuals infected with the organism, and (b) by making it impossible for mosquito larvae to develop. In other cases, the proper preparation and supervision of the food will measurably reduce the incidence of disease. Perhaps more important than either of these lines of prophylaxis is the proper disinfection of night soil before it is used for fertilizing the fields.

3. Education of the people, so that they will understand that certain measures of precaution are necessary in order that parasitic diseases may be eliminated.

The Orient, and particularly China and Japan, is more heavily infected than certain parts of the Occident because of favorable climatic conditions and customs of the people which make it possible for the life histories of many species of parasites to be completed. This is peculiarly true in South China, where the moisture and temperature combine to make parasitic life very abundant and where the customs of the people are conducive to such infection. These infections may be divided into three major groups, namely, 1) those which gain entrance through contaminated food, 2) those which gain entrance by boring through the skin, and 3) those which are incurred through the bite of an insect or other arthropod. From a rather hasty examination of the region of Canton, I would designate the following parasitic infections as probably important diseases of the district.

Group 1. Digestive tract invasion.

Fasciolopsis buski, the large intestinal fluke, which is taken in with the uncooked water chestnut and red water lily. An infection of man and hogs.

Fasciola hepatica and *F. gigantica*, the large liver flukes, which are taken in with grasses and water cress. Common in sheep, goats, cows, and water buffaloes and occasionally found in man. These infections have been found to occur in the C. C. C. dairy herds, including those animals recently brought out from America. It seems highly probable that the infections may be attributed to infected grass eaten by the animals.

Clonorchis sinensis, the lesser liver fluke, which is eaten along with uncooked fresh and (probably) dried fish. Common in man, cats, and dogs.

Paragonimus westermani, the lung fluke, which gains entrance to the intestine with the ingestion of infected uncooked fresh-water crab meat. The infection exists in this district and is probably found in man.

Diphyllobothrium mansonii, Manson's tapeworm, which is incurred by eating infected frog legs or snakes insufficiently cooked. Common in dogs and cats and occasionally found in man.

Taenia saginata, the beef tapeworm, which is taken in with insufficiently cooked infected beef or (probably) water-buffalo meat. An occasional parasite of man in South China.

Ascaris lumbricoides, the large roundworm of the intestine and *Trichuris trichuira*, the whipworm, which gain access to the intestine through contamination of their eggs on food and in water. The commonest parasites of man in South China.

Entamoeba dysenteriae (histolytica), the causative agent of amoebic dysentery, which gains entrance to the digestive tract when the cysts are taken in with food or water. A very common parasite of man throughout the Orient.

Since all of these infections are incurred through food or water that contain the infective stage, they may all be eliminated by the proper cooking or disinfection of all food consumed. This includes supervision of the food from the time it leaves the stove until it is consumed. Particular care should be taken to see that flies do not contaminate food or water for they are the mechanical transfer agents of a multitude of disease germs. Furthermore, proof has not yet been produced to show that uncooked food of any kind in China can be consumed with safety.

Group 2. *The Skin Route of Invasion.* This group consists of the hookworms, *Ancylostoma duodenale* and *Necator americanus*, and the Oriental blood fluke, *Schistosoma japonicum*. A heavy toll of human energy is exacted each year in South China from hookworm infection. Man alone is the final host of the worm. Prophylaxis consists in keeping the skin protected from infected mud.

The blood-fluke has been found to produce a tremendous amount of disease in the Yangtze Valley. Thus far it has been found in South China only at Foochow, Swatow and Shiuchow, although the conditions favorable for its existence are present in the Pearl River Delta. Prevention consists in keeping away from "infected water."

Group 3. *Transmission through Insect Bites.* In South China these infections have mosquitoes or lice for their transfer agents.

Malaria. This consists of three types, the 48-hour fever, the 72-hour fever, and the malignant fever. All are transmitted to man through the bite of an *Anopheles* mosquito. These are extremely serious infections of man in South China. Medical treatment of all cases in the neighborhood and anti-mosquito campaigns constitute the known means of eradication.

Filaria bancrofti, the threadworm which causes elephantiasis and lymphangitis, is a relatively common disease in South China. Protection of the skin from mosquitoes and anti-mosquito campaigns constitute the control methods in the disease.

Relapsing fever, due to a spirochaetal organism, has not been reported from Canton but is common farther south in Kwangtung Province. The human louse is undoubtedly the infective agent. Human cleanliness is, therefore, a means of reducing the incidence of this disease.

While little has been said regarding the infection of domestic animals, it may be said that they harbor many infections including both those kinds transmissible to man and those kinds not known to infect man. Further study is necessary, however, before the economic loss which such infections entail is definitely known.

AN ENUMERATION OF THE McCLURE COLLECTION
OF HAINAN PLANTS

by

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The island of Hainan, off the south-east coast of China and belonging to the province of Kwangtung, has been ever an inviting field for the student of natural history. It is situated only just within the tropics and has high, heavily wooded mountain ranges in the central and southern portions. These facts, together with its close proximity to the neighboring regions of the China and French Indo-China mainland, Formosa and the Philippines, all of which are known to have rich floras, make Hainan especially attractive to the botanist.

In 1921-22 Mr. F. A. McClure directed into Hainan, from Canton, one fall and one spring expedition. On each of these trips Mr. McClure and his party penetrated the island, over different routes, as far as the Five Finger range, making the first successful ascent of that mountain on the second trip and reaching the summit with some of his party April 30, 1922. The objects of these trips were a preliminary agricultural survey of the island and the assemblage of botanical material. And Mr. McClure has brought back a rare collection of plants as this compilation discloses. He has fully described his trips and the regions traversed, in an illustrated article, *Notes on the Island of Hainan*¹, which appeared in the first issue of this Review.

The Herbarium of the Canton Christian College is most fortunate in its relationship with Mr. E. D. Merrill, Director of the Bureau of Science of the Philippine Islands, who organized our botanical work in 1916 and who since that time has identified all our material. With the exception of the *Gramineae* and *Orchidaceae* all of the material of this collection has been identified by Mr. Merrill to whom we are indebted for his prompt and painstaking efforts to make the knowledge of the McClure collection quickly available. Original determinations of the species of grasses were first made by Prof. A. S. Hitchcock, custodian of the section of grasses in the U. S. National Museum, who accompanied Mr. McClure on a portion of his first trip. But certain changes in nomenclature have been made in order to conform with the international code which we follow. The orchids were all forwarded for identification to Prof. Oakes Ames of

1.—McClure F.A., Notes on the island of Hainan, in *Lingnaam agricultural review*, v. 1 (1922), No. 1, pp. 66-79, pl. 5, map.

Bussey Institute, Harvard University and the determinations have not yet been reported. A few of Mr. Merrill's preliminary determinations are indicated in this list and we hope later to publish Prof. Ames' list.

In the Philippine Journal of Science, October, 1922², Mr. Merrill presented thirty-seven presumably hitherto undescribed species of plants, all but two of which were based, at least partially, upon the McClure material collected on the first trip. In November, 1922³, Mr. Merrill published in the same journal two new species, *Elaeocarpus glabripetalus*, based upon material first collected by Mr. McClure in northern Kwangtung and *Pentaphragma spicatum* collected first by Prof. K. K. Tsoong (鍾觀光) and later by Mr. McClure in Hainan. Both of these will be found in this enumeration. In a forthcoming issue of the Journal⁴, advance sheets of which we have seen, Mr. Merrill is presenting his second paper, *Diagnoses of Hainan Plants*, in which he describes fifty-one additional forms based largely upon material collected on Mr. McClure's second trip. Mr. Merrill records that previous to Mr. McClure's explorations in Hainan about three hundred and seventy-five species had been definitely recorded from the island in botanical literature. Some of the early collectors in Hainan were Messrs. Bullock, Dahl, Delavay, Faber, Farr, Hance, Hancock, A. Henry, B. C. Henry, Katsumada, Konishi, Lamont and Swinhoe; and more recently Miss Margaret M. Moninger and Miss K. L. Schaeffer of the American Presbyterian Mission in Hainan. The latter organization also rendered much assistance to Mr. McClure in his studies. Several years ago Prof. W. Y. Chun, now associated with the College of Agriculture, National Southeastern University, Nanking, China, but then in collaboration with Harvard University, spent considerable time in Hainan and collected quite widely, also exploring in the region of the Five Finger Mountains. A report of his collections is not yet available. In connection with the work of identifying Mr. McClure's botanical collection Mr. Merrill has prepared a manuscript enumeration of Hainan plants. Mr. Merrill and Mr. Chun have recently been in consultation regarding the joint publication of a complete enumeration of the known flora of Hainan. It is hoped that this will shortly be available and that the present paper will serve as a step in that direction.

Mr. Merrill, in his second paper, records that Mr. McClure's collections have increased the list of known Hainan species to approximately one thousand three hundred and seventy-five, including the ferns and fern allies. In addition to the eighty-eight newly described species which appear in Mr. Merrill's *Diagnoses of Hainan Plants* there are eleven species which are apparently new but which have not been fully recorded

2.—Merrill, E. D., *Diagnoses of Hainan plants in Philippine journal of science*, v. 21 (1922), No. 4, pp. 337-355.

3.—Merrill, E. D., *Notes on the flora of southeastern China in Philippine journal of science*, v. 21 (1922), No. 5, pp. 491-512.

4.—Merrill, E. D., *Diagnoses of Hainan plants in Philippine journal of science* v. 23 (1923), No. 3, pp. 237-268.

and described because of lack of complete specimens, additional collections being desirable. These we indicate as new species (n. sp.) without publishing Mr. Merrill's naked names. In a similar manner Mr. Merrill has indicated six varieties as possibly new and these we also list in the enumeration. A study of Mr. Merrill's manuscript reveals one family *Ochnaceae*, as new to China. Genera, new to China, recorded are as follows: *Cyclopeltis*, *Scelroglossum*, *Arthropteris*, *Mapania*, *Arenga*, *Plomele*, *Plagiostachys*, *Hedyosmum*, *Olax*, *Arcangelisia*, *Mitrephora*, *Polyosma*, *Ellipanthus*, *Luwunga*, *Azadirachta*, *Xanthophyllum*, *Heynea*, *Baccaurea*, *Cleistanthus*, *Trewia*, *Ostodes*, *Gonocaryum*, *Xerospermum*, *Arytera*, *Pedicellia* (*Mischocarpus*), *Ochna*, *Taractogenos*, *Flacourtia*, *Decaspermum*, *Epigynum*, *Fagraea*, *Kopsia*, *Micrechites*, *Rhynchodia*, *Curanga*,* *Rhynchotechum*, *Litsanthes*, and *Erechtites*.

In his second paper Mr. Merrill describes one new genus in the family *Verbenaceae* based upon material first collected by Prof. K. K. Tsoong (Chung Kwan Kwong-鍾觀光), of Peking Government University, in Yam Chow (欽洲), Kwangtung and numbered 1908. Mr. McClure collected the same species at Yik Tsok Mau, Hainan, under his number 9692. Mr. Merrill has dedicated the genus to the first collector and named it *Tsoongia*. The species he has named *Tsoongia axillariflora*. An even more interesting find is McClure's No. 9387 which Mr. Merrill tentatively concludes is apparently a new genus of the family *Pentaphragmaceae*, which at present contains a single genus and only two known species.

A study of Mr. Merrill's manuscript reveals the following species new to China: *Microlepia proxima* (Blume) Presl., *Polypodium congenerum* (Blume) Presl., *Polypodium heterocarpum* Bl. (*P. zollingerianum* Kze.), *Polypodium zippelii* Blume, *Cyclophorus acrostichoides* (Forst) Presl., *Podocarpus nankensis* Hayata, *Pinus merkusii* De Vriese, *Panicum cordatum* Buese, *Panicum crassipiculatum* Merr., *Panicum pilipes* Neer., *Panicum tonkinense* Balansa, *Panicum tuberculatum* Presl., *Cynodon arcuatus* Presl., *Chloris tener* (Presl.) Scribn., *Scleria sumatrensis* Retz., *Epipremnum pinnatum* (L.) Engl., *Pollia aclisia* Hassk., *Stemona parviflora* C. H. Wright, *Chionographis japonica* (Willd.) Max., *Piper boehmeriaetolium* Wall., *Peperomia harmandii* C. DC., *Peperomia leptostachya* H. & A. var. *cambodiana* C. DC., *Ficus scandens* Roxb., *Laportea crenulata* Gaudich., *Oreonide sylvatica* Bl., *Pittosporum ferrugineum* Ait., *Aglaia tetrapetala* Lour., *Aglaia roxburghiana* Miq., *Glochidion breynioides* C. B. Rob., *Glochidion coccineum* Muell., *Elaeocarpus apiculatus* Mast., *Grewia eriocarpa* Juss., *Decaspermum fruticosum* Forst., *Olea brachiata* (Lour.) Merr., *Aganosma acuminata* (Roxb.) G. Don., *Ipomoea stahylina* R. & S., *Stictocardia campanulata* (Linn.) Merr., *Premna harbacea* Roxb., *Pogostemon glaber* Benth., and *Psychotria ixoroides* Barth.

The complete collection contains approximately 2231 numbers which are distributed into about 150 families, 660 genera and 1118 species. There are more than a hundred numbers still undetermined and

* New except for Loureiro's record.

a very few that, from the material available, cannot be placed in their proper genera. Considerable duplicate material was collected of many of the numbers and moderately complete sets are available for distribution. The plants have all been poisoned and are now being assembled for shipment to herbaria throughout the world. The most complete set is of course with Mr. Merrill in the Bureau of Science, Manila, P.I. A set, beautifully mounted by well-trained Chinese women, has been forwarded to Dr. Walter T. Swingle of the Office of Crop Physiology and Breeding Investigations of the United States Department of Agriculture, Washington, D.C., with whom we have been in collaboration for many years. Prof. Oakes Ames of Bussey Institute, Harvard University, Boston, Mass., has received a similarly mounted set of all numbers to which we have been able to link economic data. Prof. Ames requested us to collect as much material of museum interest as possible. All such objects, including samples of many valuable Hainan woods and poisons used for stupefying fish, have been carefully linked to Prof. Ames' specimens. More or less complete sets will subsequently be found in the United States at The Bishop Museum, Honolulu, Hawaii, Brooklyn Botanic Gardens, Brooklyn, N. Y., California Academy of Science, San Francisco, Cal., Missouri Botanical Garden, St. Louis, Mo.; in Europe, at the Universitetes Botaniske Museum, Copenhagen, Denmark, British Museum, London, England, Royal Botanic Gardens, Kew, England, Royal Botanic Gardens, Edinburgh, Scotland, Museum d' Histoire Naturelle, Paris, France, Botanical Museum, University of Lund, Sweden, and Jardin Botaniques, Geneva, Switzerland; and in Asia, Dr. Tyozaburo Tanaka, Kobe, Japan, Botanical and Forestry Department, Hongkong and Institute Scientifique de l' Indochine, Saigon, Indochina. The Arnold Arboretum, Harvard University, Jamaica Plain, Mass. has secured the woody plants; Dr. P. Jansen, Amsterdam, Holland, the grasses; and Bibliotheque du Prince Bonaparte, Paris, France, the ferns.

The object of the compilation presented in this paper has been not only to list the collection but primarily to prepare identification labels which will contain all the field notes and economic data. These will be attached to the specimens distributed and should prove valuable notes for those who may from time to time refer to the plants in the various herbaria where they will be found. The order of arrangement herein followed is a phylogenetic one, established by the use of Engler and Prantl family numbers found to the left of the decimal, and Dalla Torre and Harms genera numbers to the right, as described in *A Method of Filing and Indexing Chinese Plants*⁵.

In the case of the ferns and fern allies the Engler and Prantl roman numerals were used with a system of letters for the families and tribes which was worked out jointly by Mr. A. S. Campbell and the senior writer in an article, *Pteridophyta of Kwangtung*, which the former has prepared

5.—Groff, George Weldman, A method of filing and indexing Chinese plants, illustrated by a systematic enumeration of the plants of the Canton Christian College campus, in *Lingnaam agricultural review*, v. 1 (1922), No. 1, pp. 47-65.

and which will be published in a subsequent issue of this review. In addition to assembling all of Mr. McClure's economic data, and linking the same to the species, Miss Elizabeth H. Groff made a survey of the Canton markets in order to obtain as much additional economic material and data, concerning the most common uses of these plants, as possible. In addition to the acquisition numbers used for the plant specimens, Miss Groff has incorporated a Canton Christian College acquisition number for the economic material. These are designated as C.C.C. Ec. No., while all the McClure economic material is recorded as McClure Ec. No. All Chinese names of plants recorded are inserted in Chinese character and Eitel-Genähr Cantonese romanization. It may possibly be found advisable later to build up a character and romanized index of Chinese names, as also an alphabetical generic one, thereby making the materi a more useful to Chinese students and investigators.

PTERIDOPHYTA

IIIA.1-Hymenophyllaceae

IIIA.1—TRICHOMANES AURICULATUM Blume

Five Finger Mt., (五指嶺), 9327, Apr. 26, 1922 and 9427, May 4, 1922; in wooded ravine on trunk of tree; fern; ht., 3-5 m.; insufficient fruiting fronds.

IIIA. 1-Cyatheaceae

IIIA.2—CYATHEA CONTAMINANS (Wall.) Copel.

*T'a Hon** (他寒), 8342, Dec. 5, 1921 and *Shui Mun* (水門), 9599, May 14, 1922; hillside thicket, on wooded mountain side; alt., 350 m.; tree; ht., 2-5 m.; dia., 8 cm.; fl., spores brown; Chinese name reported, *Long ki* (狼基).

IIIA.2—CYATHEA GLABRA (Blume) Copel.

Five Finger Mt., (五指嶺), 8644, Dec. 19, 1921 and 9465, May 6, 1922; wooded ravine; fern; ht., 1½ m.

IIIA.2—CYATHEA SP. NOV. Merr.

T'a Hon (他寒), 8344, Dec. 5, 1921, *Five Finger Mt.*, (五指嶺), 9311, Apr. 28, 1922 and 9509, May 9, 1922; wooded ravine and edge of stream; alt., 350 m.; tree; ht., 1-2½ m.; dia., 2-10 cm.; Chinese name reported, *Shan mong* (山芒).

*The romanization of Chinese names followed in this work is usually that appearing in "A Chinese-English dictionary in the Cantonese dialect by Dr. Ernest John Eitel; revised and enlarged by Immanuel Gottlieb Genähr of the Rhenish missionary society. Hongkong: Kelly and Walsh, Ltd., 1910. For names of places appearing in the official Chinese Postal Guide the spelling therein found is followed. It was found impossible to print the Eitel-Genähr tone marks.

** Sufficient material for only one specimen was collected of all numbers marked ** and this one will be found in the Philippine Bureau of Science.

*** *Nodoa* is usually spelled in this way but the correct Cantonese romanization is *No Tai*.

IIIA.3-Polypodiaceae

IIIA.3-a—LEPTOCHILUS CUSPIDATUS (Presl.) C. Chr.

Five Finger Mt., (五指嶺), 8725** and 9346, Apr. 28, 1922, 9370, Apr. 29, 1922 and 9436, May 4, 1922; on moist rocky surface in wooded ravine; fern; ht., 2/3 m.; fruiting frond separate spores brown.

IIIA.3-a—LEPTOCHILUS DECURRENS Blume

Five Finger Mt., (五指嶺), 8515, Dec. 22, 1921, wooded ravine; alt., 900 m.

IIIA.3-a—LEPTOCHILUS ZEYLANICUS (Houtt.) C. Chr.

Nodoa, (那大), 7860, Nov. 1, 1921; moist shady bank; alt., 250 m.

IIIA.3-a—PLAGIOGYRIA ADNATA (Blume) Bedd.

Five Finger Mt., (五指嶺), 9385, May 1, 1922; in rich loose soil; fern; spores juvenile.

IIIA.3-b—DAVALLIA DENTICULATA (Burm. f.) Mett.

Lin Fa Ling (蓮花嶺), 7919, Nov. 3, 1921; in dense thicket on hillside; alt., 400 m.; ht., 1 m.

IIIA.3-b—DAVALLIA DIVARICATA Blume

Yik Tsok Mau (亦作茂), 9717, May 19, 1922; growing on rock in shady ravine; fern; ht., 1 m.

IIIA.3-b—MICROLEPIA HOOKERIANA (Wall.) Presl.

Five Finger Mt., (五指嶺), 8509, Dec. 22, 1921; wooded ravine; alt., 900 m.; fern; ht., 1/2 m.

IIIA.3-b—MICROLEPIA MARGINATA (Houtt.) C. Chr.

Five Finger Mt., *Fan Ya* (五指嶺, 番也), 8395, Dec. 9, 1921, 8412 and 8439, Dec. 17, 1921; wooded ravine, village commons; alt., 600-1000 m.

IIIA.3-b—MICROLEPIA PROXIMA (Blume) Presl.

Five Finger Mt., (五指嶺), 9480, May 7, 1922; edge of stream in wooded ravine; fern; ht., 1 1/2 m.; new to China.

IIIA.3-b—MONACHOSORUM SUBDIGITATUM (Blume) Kuhn.

Five Finger Mt., (五指嶺), 9398, May 1, 1922; on moist shady cliff; fern; ht., 1 m.; a curious gall is found on nearly every mature frond.

IIIA.3-b—POLYPODIUM CONGENERUM (Blume) Presl.

Five Finger Mt., (五指嶺), 9377, May 1, 1922; on trunks of trees in thicket; fl., brown; new to China.

IIIA.3-b—POLYPODIUM CORONANS Wall.

Nodoa, *Lin Fa Ling* (那大, 蓮花嶺), 8102, Nov. 4, 1921, *Five Finger Mt.*, *Fan Ya*, (五指嶺, 番也), 8382, Dec. 10, 1921 and *Five Finger Mt.*, (五指嶺), 8574, Dec. 23, 1921; on dry rock, shady moist ravine on tree; alt., 450 m.; fern; ht. 1-1 1/2 m.

IIIA.3-b—POLYPODIUM SP. AFF. CRYPTOSORUM C. Chr.

Five Finger Mt., (五指嶺), 8477, Dec. 23, 1921; wooded ravine on rock; alt., 700 m.

IIIA.3-b—POLYPODIUM ELLIPTICUM Thunb.

Nodoa, *Lin Fa Ling* (那大, 蓮花嶺), 8080, Nov. 3, 1921, *Five Finger Mt.*, (五指嶺), 8508, Dec. 15, 1921, 8623, Dec. 21, 1921, 9376, Apr. 29, 1922 and *Yik Tsok Mau* (亦作茂), 9667, May 17, 1922; moist shady ravine on rocks, on rocks along stream; alt., 250-1200 m.; fern; ht., 1/2-1 m.; spores, yellowish brown.

IIIA.3-b—POLYPODIUM SP. aff. ELLIPTICUM Thunb.

Nodoa, *Pat Ka Ling* (那大, 筆架嶺), 8023, Oct. 28, 1921, *Five Finger Mt.*, *Yik Tsok Mau* (五指嶺, 亦作茂), 8472, Dec. 1921 and *Five Finger Mt.*, (五指嶺), 8552, Dec. 20, 1921; moist shady ravine on rock; fern; alt., 250-600 m.

IIIA.3-b—POLYPODIUM HEMIONITIDEUM Wall.

Five Finger Mt., (五指嶺), 9342, Apr. 28, 1922; on wet rock in wooded ravine; herb; fr., brown.

IIIA.3-b—POLYPODIUM HETEROCARPUM Blume

(P. ZOLLINGERIANUM Kze.)

Five Finger Mt., (五指嶺), 9423, May 4, 1922; in wooded ravine on moist rock; fern; immature spores, white.

IIIA.3-b—POLYPODIUM LONGISSIMUM Blume

Nodoa, *Lin Fa Ling* (那大, 蓮花嶺), 8100, Nov. 4, 1921 and *Five Finger Mt.*, (五指嶺), 8528, Dec. 1921; wet hillside among tall grasses on fence; alt., 400-600 m.; fern; no. 8528, an imperfect specimen, may represent a form of this species.

IIIA.3-b—POLYPODIUM OLIGOLEPIDEUM Bak.

(P. KAWAKAMII Hayata, P. ARISINENSE Rosenst.)

Five Finger Mt., (五指嶺), 9504, May 9, 1922; on trunk of tree in wooded ravine.

IIIA.3-b—POLYPODIUM SCOLOPENDRUM Burm. f.

(P. PHYMATODES Linn.)

Mai Kun Tsun (米欄村), 7663, Oct. 25, 1921, *Nodoa*, *Sha Po Ling* (那大, 沙坡嶺), 8137, 8146, Nov. 10, 1921, *Five Finger Mt.*, (五指嶺), 8484, Dec. 23, 1921, *Ka Tsik*, (嘉積), 8793, Oct. 12, 1922 and *Yik Tsok Mau* (亦作茂), 9669, May 17, 1922; roadside among volcanic rocks, in thicket on mt. top, growing on tree, wooded ravine on rock face, growing on stones of bridge and on loose soil and on moist rocks in shady ravine; fern; alt., 800-900 m.; ht., 1/3-2/3 m.

IIIA.3-b—POLYPODIUM SUBROSTRATUM C. Chr. (C. ROSTRATUM Hook.)

Five Finger Mt., (五指嶺), 8676, Dec. 13, 1921; wooded ravine; alt., 1400 m.; vine.

IIIA.3-b—POLYPODIUM ZIPPELII Blume

Five Finger Mt., (五指嶺), 8648, Dec. 20, 1921; on moist rock in shady ravine; alt., 600 m.

IIIA.3-b—POLYPODIUM SP.

Nodoa, Lin Fa Ling (那大蓮花嶺), 8056, Nov. 2, 1921; moist shady ravine; alt., 300-400 m.; fern.

IIIA.3-b—POLYSTICHUM CARVIFOLIUM (Kze.) C. Chr.

Five Finger Mt., (五指嶺), 8556, Dec. 20, 1921 and *Yik Tsok Mau* (亦作茂), 9680, May 18, 1922; moist shady ravine between rock under shrubs in wooded ravine; tree; ht., 1/3 m.; dia., 20-30 m.; alt., 600 m.; spores, brown.

IIIA.3-b—POLYSTICHUM SP.

Five Finger Mt., (五指嶺), 9330, Apr. 28, 1922; wooded mt. side in rich soil; fr., brown; near *P. ARISANUM* Rosenst.

IIIA.3-c—CYCLOPHORUS ADNASCENS (Sw.) Desv.

On Yan (An Zin) (安仁), 7683, Oct. 25, 1921, *Nodoa* (那大), 7706, Oct. 31, 1921, *Nodoa, Five Finger Mt.*, (那大, 五指嶺), 7908, Oct. 3, 1921 and *Yik Tsok Mau* (亦作茂), 9344, May 17, 1922; on old stone wall, on rock near stream, on trunk of trunk, on dry rock face; alt., 250-300 m.; fr., brown.

IIIA.3-c—CYCLOPHORUS LINEARIFOLIUS (Hook.) C. Chr.

Yik Tsok Mau (亦作茂), 9725, May 19, 1922; on dry rock surface in ravine; fl., brown.

IIIA.3-c—CYCLOPHORUS LINGUA (Thunb.) C. Chr.

Five Finger Mt., (五指嶺), 9441, May 5, 1922; in wooded ravine growing tight to bark of dead tree; ht., 1-10 m.; vine; leaves greenish brown on under surface.

IIIA.3-c—CYCLOPHORUS STICTICUS C. Chr.

Five Finger Mt., Fan Ya (五指嶺, 番也), 8427, Dec. 9 1921; on dry rock; alt., 1000 m.; fr., brown.

IIIA.3-c—CYCLOPELTIS PRESLIANA J. Sm.

Sha Po Ling (沙煲嶺), 8164 Nov. 11, 1921 and *Nodoa, Sha Po Ling* (那大, 沙煲嶺), 8168, and 8196** Nov. 11, 1921; moist shady ravine at water edge; alt., 400-500 m.; ht., 2/3 m.

IIIA.3-d—POLYBOTRYA APPENDICULATA (Willd.) J. Sm.

Five Finger Mt., (五指嶺), 8687, 8697, Dec. 14, 1921; wooded ravine; alt., 1000-1200 m.

IIIA.3-d—VITTARIA ELONGATA Sw.

Five Finger Mt., (五指嶺), 8543, Dec. 20, 1921, 8599, Dec. 16, 1921 and 9386, May 1, 1922; moist shady ravine growing in fork of a tree, wooded mt. side on moist rock, in rich loose soil; alt., 600-1400 m.; fl., spores, brown.

IIIA.3-d—SCLEROGLOSSUM SULCATUM (Mett.) v.A.v.R.

Five Finger Mt., (五指嶺), 8691**; on tree trunks; alt., about 1000 m.; the genus is new to China.

IIIA.3-e—ADIANTUM CAUDATUM Linn.

Tai Un (大園), 7741, Oct. 26, 1921; under big banyan tree.

IIIA.3-e—ADIANTUM DIAPHANUM Blume

Five Finger Mt., (五指嶺), 8653, Dec. 20, 1921 and *Yik Tsok Mau* (亦作茂), 9751, May 19, 1922; moist shady ravine, on rock; alt., 600 m.; fern; fr. black-brown.

IIIA.3-e—ADIANTUM FLABELLULATUM Linn.

Nodoa (那大), 7697 Nov. 1, 1921 and 7769, Oct. 28, 1921 and *Pat Ka Ling (Nodoa)* (筆架嶺, 那大), 7727, Nov. 1 1921; moist shady edge of stream and of thicket, shady bank near stream; alt., 250 m.

IIIA.3-e—ARTHROPTERIS OBLITERATA (R. Br.) J. Sm.

Nodoa, Sha Po Ling (那大, 沙煲嶺), 8157, Nov. 10, 1921; thicket in ravine growing on small tree; alt., 700 m.; the genus is new to China.

IIIA.3-e—CHEILANTHES TENUIFOLIA (Burm. f.) Sw.

Nodoa (那大), 7716, 7849**, Oct. 28, 1921; edge of thicket on bank; alt., 250 m.; fern.

IIIA.3-e—DRYOPTERIS CALCARATA (Blume) O. Ktz.

Nodoa, Lin Fa Ling (那大, 蓮花嶺), 8054, Nov. 2, 1921 and *Nodoa Sha Po Ling* (那大, 沙煲嶺), 8163, Nov. 11, 1921; edge of stream, moist shady ravine, on rock at water's edge; alt., 400 m.

IIIA.3-e—DRYOPTERIS EATONII (Baker) O. Ktz.

Five Finger Mt., (五指嶺), 8673, Dec. 13, 1921 and 9476, May 7, 1922; wooded ravine in rich loose soil; alt., 1400 m.; fern; ht., 1/3-1 m.

IIIA.3-e—DRYOPTERIS GONGYLODES (Schkuhr.) O. Ktz.

Nodoa, (那大), 8212, Nov. 21, 1921; edge of pond; alt., 250 m.; fern; ht., 1/2 m.

IIIA.3-e—DRYOPTERIS HETEROCARPA (Blume) O. Ktz.

Nodoa, Sha Po Ling (那大, 沙煲嶺), 8153, Nov. 10, 1921 and *Hong Ma Tsun* (康馬村), 8309, Dec. 3, 1921; mt. side grassy places, edge of stream in thicket; alt., 400-650 m.; ht., 2/3 m.; fr., black when ripe.

IIIA.3-e—DRYOPTERIS MOULMEINENSIS (Bedd.) C. Chr.

Nodoa, Lin Fa Ling (那大, 蓮花嶺), 8095, Nov. 3, 1921, *Nodoa, Sha Po Ling* (那大, 沙煲嶺), 8169, Nov. 11, 1921 and *Five Finger Mt., Fan Ya* (五指嶺, 番也), 8457, Dec. 7, 1921; shady moist ravine, roadside; alt., 250-1000 m.; fern; ht., 2/3 m.; fr., blue when ripe.

IIIA.3-e—DRYOPTERIS OCHTHODES (Kze.) C. Chr.

Shui Mun (水門), 9609, May, 14, 1922; on rock in shade along stream; fern; ht., 1/3-2/3 m.; spores, dark brown.

IIIA.3-e—DRYOPTERIS PARASITICA (Linn.) O. Ktz.
(NEPHRODIUM MOLLE R. Br.)

Mai Kun (米綱), 7775, Oct. 25, 1921, *Nodoa, Lin Fa Ling* (那大, 蓮花嶺), 8090, Nov. 3, 1921, *Ting On River* (定安河), 8851, Apr. 6, 1922 and *Yik Tsok Mau*, (亦作茂), 9746, May 19, 1922; roadside, moist, shady ravine, at foot of tree, on rock in wooded ravine; alt., 40-300 m.; fern; ht., 1/3 m.

IIIA.3-e—DRYOPTERIS SIMPLEX (Hook.) C. Chr.

Nodoa, Lin Fa Ling (那大, 蓮花嶺), 8079, Nov. 3, 1921 and *Five Finger Mt.*, (五指嶺), 9328, Apr. 28, 1922 and 9469, May 6, 1922; moist shady ravine, wooded mt. side in rich earth; alt., 300 m.; ht. 1/3 m.

IIIA.3-e—DRYOPTERIS SOPHOROIDES (Thunb.) O. Ktz.

Nodoa, Yau Ma Wo (那大, 油麻和), 8126, Nov. 11, 1921; near small stream; alt., 300 m.; ht., 1 m.

IIIA.3-e—DRYOPTERIS SP.

Five Finger Mt., (五指嶺), 8654, Dec. 20, 1921, 9523, May 9, 1922 and *Yik Tsok Mau* (亦作茂), 9664, May 17, 1922; edge of stream, moist shady ravine on rocks at water edge, wooded ravine; alt., 400-600 m.; ht., 1/3-1 m.

IIIA.3-e—LINDSAYA DECOMPOSITA (Willd.)

Five Finger Mt., (五指嶺), 9482, May 7, 1922; on rock in moist, wooded, ravine; fern.

IIIA.3-e—LINDSAYA ORBICULATA (Lam.) Mett.

Fin Si (?), 7786, Oct. 28, 1921 and *Nodoa, Lin Fa Ling* (那大, 蓮花嶺), 7914, Nov. 3, 1921; edge of thicket, under shrubs at roadside; alt., 300 m.

IIIA.3-e—PTERIS BIAURITA Linn.

Five Finger Mt., (五指嶺), 8712, Dec. 20, 1921; near stream in moist shady ravine; alt., 600 m.; fern; ht., 1 m.

IIIA.3-e—PTERIS ENSIFORMIS Burm. f.

Nodoa, Pat Ka Ling (那大, 摩架嶺), 8027, Nov. 1, 1921, *Five Finger Mt.*, *Yik Tsok Mau* (五指嶺, 亦作茂), 8473, Dec. 1921 and *Yik Tsok Mau* (亦作茂), 9720, May 19, 1922; edge of thicket, moist shady ravine; alt., 250-800 m.; fern; dia.; 30 cm.

IIIA.3-e—PTERIS FLAVA Goldem.

Hong Ma Tsun (康馬村), 8310, Dec. 3, 1921 and *Five Finger Mt., Fan Ya* (五指嶺, 番也), 8376, Dec. 10, 1921; thicket, open ravine; alt., 400-1000 m.; fern; ht., 2/3 m.

IIIA.3-e—PTERIS GREVILLEARA Wall.

Five Finger Mt., (五指嶺), 8496, Dec. 23, 1921; in forested ravines; alt., 800 m.

IIIA.3-e—PTERIS SEMIPINNATA Linn.

Nodoa, (那大), 7939, Oct. 31, 1921; along dry stream.

IIIA.3-e—BLECHNUM ORIENTALE Linn.

Nodoa (那大), 7937, Oct. 31, 1921, and *Five Finger Mt., Fan Ya* (五指嶺, 番也), 8418, Dec. 9, 1921; bank of stream, wooded ravine; alt., 250-1000 m.; ht., 1 m.; fr., brown.

IIIA.3-g—ANTROPHYUM RETICULATUM (Forst.) Kaulf.

Five Finger Mt., Fan Ya (五指嶺, 番也), 8373, Dec. 10, 1921, *Five Finger Mt., Yik Tsok Mau* (五指嶺, 亦作茂), 8468, Dec. 20, 1921 and *Yik Tsok Mau* (亦作茂), 9726, May 19, 1922; on fig tree in mt. ravine, on dry rock face in wooded ravine; alt., 700-1200 m.; fern; fl., brown

IIIA.3-g—ASPLENIUM CARDIOPHYLLUM (Hance.) Baker

Five Finger Mt., (五指嶺), 8487, Dec. 23, 1921; wooded ravine; alt. 800 m.

IIIA.3-g—ASPLENIUM CHEILOSORUM Kunze
(A. HETEROCARPUM Wall.)

Five Finger Mt., (五指嶺), 8379, Dec. 13, 1921, 8388, Dec. 14, 1921 and 9312, Apr. 28, 1922; wooded ravine, on moist rocks and in soil near stream; alt., 1200-1400 m.

IIIA.3-g—ASPLENIUM IRIDIPHYLLUM Hayata

Five Finger Mt., (五指嶺), 9429; ** on trees in forested ravines.

IIIA.3-g—ASPLENIUM LASERPITHIFOLIUM Lam.

Five Finger Mt., (五指嶺), 8636, Dec. 17, 1921, 8666, 8667, Dec. 13, 1921, 9357, 9372, Apr. 29, 1922 and 9400, May 9, 1922; wooded ravine on tree and on moist rock; alt., 1200-1400 m.; fern; ht., 1/3-1 m.; stems black.

IIIA.3-g—ASPLENIUM MACROPHYLLUM Sw.

Hong Ma Tsun (康馬村), 8318, Dec. 3, 1921; thicket near village; alt., 350 m.

IIIA.3-g—ASPLENIUM NIDUS Linn.

Yik Tsok Mau (亦作茂), 9675, May 18, 1922; on tree and rocks, in rich soil, in wooded ravine; fern; ht., 1 m.; spores, brown.

IIIA.3-g—ASPLENIUM NORMALE Don

Five Finger Mt., (五指嶺), 8669, Dec. 15, 1921; wooded ravine, on moist rock; alt., 1200 m.

IIIA.3-g—ASPLENIUM PHYLLITIDIS Don

Lin Fa Ling (蓮花嶺), 8084, Nov. 3, 1921; bank of stream in shady ravine; alt., 300 m.

IIIA.3-g—ASPLENIUM TENUISSIMUM Hayata

Five Finger Mt., (五指嶺), 9397, May 1, 1922; on mossy trunk of pine tree, on moist shady rock cliff; fern.

IIIA.3-g—ASPLENIUM UNILATERALE Lam. forma RAHAOENSE
(Yabe.) Merr.

Five Finger Mt., (五指嶺), 9371, Apr. 29, 1922; wooded ravine on moist rock.

IIIA.3-g—ASPLENIUM WIGHTIANUM Wall.

Five Finger Mt., *Fan Ya* (五指嶺, 番也), 8406, Dec. 13, 1921 and *Five Finger Mt.*, (五指嶺), 8554, Dec. 20 1921; moist shady ravine, on moist rock; alt., 600-800 m.; fern.

IIIA.3-g—ASPLENIUM WRIGHTII Eaton

Five Finger Mt., (五指嶺), 8680, Dec. 21, 1921 and *Yik Tsok Mau* (亦作茂), 9713, May 19, 1922; moist wooded ravine; alt., 650 m.; fern; ht., 1/3-1/2 m.; fl., brown.

IIIA.3-g—ATHYRIUM BANTAMENSE (Blume) Milde

Five Finger Mt., (五指嶺), 8566, Dec. 15, 1921; wooded ravine; alt., 1200 m.; ht., 1/2 m.

IIIA.3-g—ATHYRIUM DELTOIDEUM (Presl.) Milde

Five Finger Mt., (五指嶺), 9500, May 9, 1922; wooded ravine; fern; ht., 1/3-1/2 m.

IIIA.3-g—ATHYRIUM ESCULENTUM (Retz.) Copel.

Pat Ka Ling (筆架嶺), 7730, Nov. 1, 1921; edge of river; fern; ht., 1 m.

IIIA.3-g—ATHYRIUM MAXIMUM (Don) Milde

Five Finger Mt., (五指嶺), 8520, Dec. 22, 1921, 8686, Dec. 14, 1921, 8703, Dec. 20, 1921 and 9375, Apr. 29, 1922; wooded ravine, moist shady ravine near water, wooded ravine on moist rock; alt., 600-1200 m.; fern; ht., 1/2-1 m.

IIIA.3-g—ATHYRIUM SYLVATICUM (Bory.) Milde

Nodoa, Sha Po Ling (那大, 沙煲嶺), 8138, Nov. 10, 1921 and *Five Finger Mt.*, (五指嶺), 8517, Dec. 22, 1921; in thicket, in wooded ravine; alt., 950 m.; fern; ht., 2/3-1 m.

IIIA.3-g—ATHYRIUM TABACINUM Copel

Five Finger Mt., (五指嶺), 9435, May 4, 1922; wooded ravine; fern; ht., 1 m.; fruiting frond separate, spores brown.

IIIA.3-g—CONIOGRAMME FRAXINEA (Don) Diels var. CORIACEA Merr.
var. nov.

Five Finger Mt., (五指嶺), 8518, Dec. 22, 1921; wooded ravine; alt., 900 m.; ht., 1 m.

IIIA.3-h—HUMATA REPENS (Linn. f.) Diels

Five Finger Mt., (五指嶺), 8678, Dec. 13, 1921 and 9463, May 6, 1922; wooded ravine on dead wood and on trunk of tree; alt., 1400 m.

IIIA.3-h—HYPOLEPIS PUNCTATA (Thunb.) Mett.

Fan Ya (番也), 9293, Apr. 26, 1922; on moist, shady bank; ht., 1-1 1/2 m.

IIIA.3-h—NEPHROLEPIS BISERRATA (Sw.) Schott.

Five Finger Mt., (五指嶺) 8631, Dec. 24, 1921; wooded ravine on rock wall; ht., 1-2 m.

IIIA.3-h—NEPHROLEPIS CORDIFOLIA (Linn.) Presl.

Nodoa, Sha Po Ling (那大, 沙煲嶺), 8151 Nov. 10, 1921, *Five Finger Mt.*, (五指嶺), 8544, Dec. 20, 1921 and *Ting On River* (定安河), 8869, Apr. 6, 1922; growing between rocks on mt. side, moist shady ravine on dead wood in rock crevice, grows best on volcanic soil among rocks; alt., 40-600 m.; ht., 1/3-1 m.; ornamental plant; Name reported, Shan mong (山芒).

IIIA.3-h—NEPHROLEPIS EXALTATA (Linn.) Schott.

Tai Un (大園), 7746, 7883**, Oct. 26, 1921, *Nodoa, Yau Ma Wo* (那大, 油麻和), 8124, Nov. 11, 1921 and *Five Finger Mt., Fan Ya* (五指嶺, 番也), 8435 Dec. 11, 1921; roadside, village commons near wall; alt., 250-1000 m.; fern; ht., 2/3-1 m.

IIIA.3-h—TECTARIA CIRCUTARIA (Linn.) Copel.

Pat Ka Ling, Nodoa (筆架嶺, 那大), 7726** 8020, Nov. 1, 1921, *Five Finger Mt., Fan Ya* (五指嶺, 番也), 8430, Dec. 8, 1921 and *Five Finger Mt.*, (五指嶺) 9462, May 6, 1922; edge of thicket in moist shady places, in rich soil in dense forest; alt., 250-900 m.; fern.

IIIA.3-h—TECTARIA DECURRENS (Presl.) Copel.

Nodoa, Sha Po Ling, (那大, 沙煲嶺), 8165, Nov. 11, 1921 and *Five Finger Mt.*, (五指嶺), 8519, Dec. 22, 1921; moist shady ravine, wooded ravine; alt., 450-900 m.; ht., 1 m.

IIIA.3-h—TECTARIA LEUZEANA (Gaudich.) Copel.

Sha Po Ling (沙煲嶺), 8201, Nov. 11, 1921; moist shady ravine; alt. 500 m.; ht., 1 m.

IIIA.3-h—TECTARIA MELANOCAULON (Blume) Copel.

Nodoa, Sha Po Ling (那大, 沙煲嶺), 8135 and 8202 Nov. 10, 1921; in thicket in moist shady ravine; alt., 450 m.; no. 8135 possibly represents only a form of this species.

IIIA.3-h—TECTARIA CF. SUBCONFUENS Copel.

Five Finger Mt., (五指嶺), 8491, Dec. 23, 1921; wooded ravine; alt., 600 m.

IIIA.6-Gleicheniaceae

IIIA.6—GLEICHENIA LINEARIS (Burm. f.) C. B. Clarke

Sha Po Ling (沙煲嶺), 8129, Nov. 1921; grassy waste land; alt., 250 m.; fern; ht., 1/3-1 m.

IIIA.7-Schizaeaceae

IIIA.7—LYGODIUM JAPONICUM (Thunb.) Sw.

Yik Tsok Mau (亦作茂), 9745, May 19, 1922; growing on grass and shrubs on hillside; vine; ht., 1-1½ m.; Chinese name reported, *Lo mong t'ang* (羅網藤).

IIIA.7—LYGODIUM SCANDENS (Linn.) Sw.

Nodoa (那大), 7711, Oct. 28, 1921; on bushes near stream; alt., 250 m. vine.

IIIA.10-Salviniaceae

IIIA.10—AZOLLA PINNATA R. Br.

Nodoa (那大), 8211**, floating on still water; alt., 250 m.

IIIA.11-Marattiaceae

IIIA.11—ANGIOPTERIS SP.

Nodoa, Sha Po Ling (那大, 沙煲嶺), 8161, Nov. 11, 1921, and *Five Finger Mt.*, (五指嶺), 8563, Dec. 15, 1921; shady moist ravine, wooded ravine; alt., 450-1200 m.; ht., 1½ m.; certainly not *A. evecta* Hoffm.; the specimens are imperfect.

???-ARCHANGIOPTERIS SP.

Five Finger Mt., (五指嶺), 9470**, in forested ravines; a single specimen which represents neither *A. henryi* Christ. & Geislenh. nor *A. somsi* Hayata.

IIIC.1-Lycopodiaceae

IIIC.1—LYCOPODIUM CARINATUM Desv.

Nodoa, Lin Fa Ling (那大, 蓮花嶺), 8082, Nov. 3, 1921; shady ravine; alt., 300 m.; vine.

IIIC.1—LYCOPODIUM PHLEGMARIA Linn.

Nodoa, Lin Fa Ling (那大, 蓮花嶺), 8083, 8381**, Nov. 3, 1921 and *Five Finger Mt.*, (五指嶺), 9473, 9474, May 7, 1922; moist shady and wooded ravine; vine.

IIIC.2-Selaginellaceae

IIIC.2—SELAGINELLA CAULESCENS (Wall.) Spring

Ta Hon (他寒), 8336, Dec. 5, 1921; bank of stream; alt., 350 m.; bush.

IIIC.2—SELAGINELLA PLANA (Desv.) Hieron.

Lin Fa Ling (蓮花嶺), 8072, Nov. 3, 1921; moist shady ravine; alt., 300 m.; prostrate.

IIIC.2—SELAGINELLA SP.

Ka Tsik (嘉積), 8794, Oct. 11, 1921; dry roadside; prostrate; fl., green.

IIIC.3-Psilotaceae

IIIC.3—PSILOTUM TRIQUETEUM Sw.

Nodoa, Sha Po Ling (那大, 沙煲嶺), 8170, Nov. 11, 1921 and *Fan Ya* (番也), 9301, Apr. 26, 1922; ravine on tree trunk, growing in fork of banyan tree; alt., 450 m.; fl., yellowish.

SPERMATOPHYTA

5-Taxaceae

5.13—PODOCARPUS JAVANICUS (Burm. f.) Merr.

(*P. IMBRICATUS* Blume, *P. CUPRESSINA* R. Br.)

Five Finger Mt., Fan Ya (五指嶺, 番也), 8403, Dec. 9, 1921 and *Five Finger Mt.*, (五指嶺), 8705, Dec. 20, 1921; in forest on mountain side; alt., 700-1000 m.; tree; ht., 4-40 m.; dia., 3-100 cm.; no fls. or frs. at this season; name reported, *Yat pun ts'ung* (日本松).

5.13—PODOCARPUS NANKOENSIS Hayata

Nodoa, Sha Po Ling (那大, 沙煲嶺), 8131, Nov. 10, 1921; in thicket on mountain side; alt., 800 m.; tree; ht., 12 m.; dia., 30 cm.; this species, which is very closely allied to the Japanese *P. nagi* (Thunb.) Pilger, was previously known only from Formosa.

5.16—CEPHALOTAXUS DRUPACEAE S. & Z.

var. *sinensis* Rehd. and Wils.

Five Finger Mt., (五指嶺), 8633, Dec. 24, 1921 and 9361, Apr. 29, 1922; open ravine and in wooded ravine; alt., 600 m.; tree; ht., 7-15 m.; dia., 10-15 cm.; very straight; no fls. or frs. at this season; this tree would make splendid poles, masts, etc. The specimens are sterile but in vegetative characters agree very closely with this variety.

6-Pinaceae

6.22—PINUS MERKUSII Jungh. and De Vriese.

Enroute to *Wong Chuk, Tung Ngai* (?), 9805, June 2, 1922; growing on a well-drained slope; tree; ht., 8-15 m.; evidently planted, not volunteer; name reported, *Ts'ung shu* (松樹). New to China.

6.22—PINUS MORRISONICOLA Hayata

Five Finger Mt., (五指嶺), 8693, Dec. 14, 1921 and 9393, May 1, 1922; summit of thump, in rich loose soil; alt., 1600 m.; tree; ht., 8 m.; dia., 25-30 cm.; names reported, *Ts'ung shu* (松樹), *Ma mi ts'ung* (馬尾松).

7-Gnetaceae

7.47—GNETUM INDICUM (Lour.) Merr.

West of Nodoa (西那大), 8978, Apr. 11, 1922 and *North of Fan Ya* (北番也), 9139, Apr. 18, 1922; on shrub in waste land, on trees in wooded ravine; vine; ht., 3-18 m., fls. green with yellow and black stamens; seeds roasted and eaten by natives; name reported, *Mai ma t'ang* (買藤藤).

8-Typhaceae

8.49—TYPHA CAPENSIS Rohrb.

(scarcely *T. ANGUSTIFOLIA*)

Nodoa—Hau Laau Tong (那大—?), 8210, Nov. 21, 1921; edge of pond; alt., 250 m.; name reported, *Shui lap chuk* (水臘竹).

9-Pandanaceae

9.51—PANDANUS FORCEPS Martelli.

Nodoa, (那大), 7983, Nov. 15, 1921 and *Ooi Diok*, (?), 8790, Oct. 12, 1921; roadside; alt., 250 m.; ht., 1-2 m.; name reported, *Lak ku tsz* (勒古子).

9.51—PANDANUS SP. NOV? Merr.

Enroute to *Ka Tsik*, (*Kachek*), *Tung Ngai* 9784, June 1, 1922 and 9806, June 2, 1922; distributed along boundaries between fields; ht., 1-1½ m.; cylindrical, borne in clusters of three; name reported, *Lo tau lak* (路兜勒), *Lak kok* (𠵼角).

Economic specimen of this secured on the Canton market by E. H. Groff under the name of *Lo tau lak* (路兜勒), C. C. C. Ec. No. 124. The price is about 35 c. per catty L. S. It is reported as coming from the mountains of Kwangtung as well as Hainan, and is said to be boiled and used for fever.

9.50—PANDANUS TECTORIUS Sol.

(*P. ODORATISSIMUS* Linn. f.)

Ting On River (定安河), 8872, Apr. 6, 1922 and enroute *Tung Ngai—Hoihow* (海口), 9807, June 3, 1922; in waste places and on river bank; alt., 40 m.; ht., 2-4 m.; dia., 7-8 cm.; frs., solitary, round, 20 cm. in dia., deep yellow in color, flesh edible; leaves of this plant used to make matting, a use of which is to make sails for some of the river boats. The Lo is use the leaves to make an eight-sided, conical hat which is worn by both men and women. The leaves are prepared by first stripping off the sharp hooks from the edge and midrib and then rolling the strips into rolls like ribbon. These when cured are ready to use; names reported, *Lo tau lak* (路兜勒), *Lak kok* (𠵼角).

Economic specimen of this secured on the Canton market by E. H. Groff under the name of *Lo tau lak* (路兜勒), C. C. C. Ec. No. 124. The price is about 35 c. per catty L. S. It is reported as also coming from the mountains of Kwangtung and is said to be boiled and used for fever.

15—Alismaceae

15.78—SAGITTARIA SAGITTAEFOLIA Linn.

Nodoa, Lin Fa Ling (那大, 蓮花嶺), 7903, Nov. 2, 1921 and *Nodoa*, (那大), 7921, Nov. 1, 1921; in water at edge of rice field; alt., 250 m.; herb; fls., white and deep blue.

17—Hydrocharitaceae

17.90—BLYXA OCTANDRA (Roxb.) Planch.

Nodoa, (那大), 7932, Oct. 30, 1921; in water at edge of rice field; alt., 250 m.; fls., white.

16—Gramineae*

19.104—POLYTOCA HETEROCLITA (Roxb.) Merr.

Nodoa, Pat Ka Ling (那大, 筆架嶺), 7795, Nov. 1, 1921; roadside; grass; fls., red pistil.

19.107—COIX LACHRYMA-JOBI Linn.

Nodoa, Lin Fa Ling (那大, 蓮花嶺), 8105, Nov. 21, 1921, *Nodoa, Yau Ma Wo* (那大, 油麻和), 8117, Nov. 9, 1921, *Five Finger Mt., Yik Tsok Mau* (五指嶺, 亦作茂), 8461, Dec. 24, 1921 and *Fan Ya* (番也), 9338, May 14, 1922; edge of dry cultivated hillside field, bank of stream, cultivated by Lo is in wet places along stream; alt 250-600 m.; herb; ht., 1 m.; fls., green with yellow stamens, greenish-black, edible; drug plant, used by Lo is as food; names reported *I mai* (薑米), *Ka I mai* (假薑米).

Economic specimens of this secured on the Canton market by E. H. Groff, under the name of *I mai* (薑米), C. C. C. Ec. No. 126. The price was about 20 c. per catty L.S. It is made into a broth with rice for indigestion.

19.109—IMPERATA CYLINDRICA (Linn.) Beauv.

On Yan (安仁), 7872, Oct. 25, 1921, South of *Nam Fung* (南風), 8266, Dec. 2, 1921, *Nam Fung, Hong Ma Ts'un* (南風, 康馬村) 8304, Dec. 1921 and *Fan Lun* (番倫), 9170, Apr. 19, 1922; hillside, burned over every spring; alt., 300-400 m.; grass; ht., 1/3-2/3 m.; fls., white with yellow anthers; drug plant, also used as thatch grass; names reported, *Mau ts'o* (茅草), *Mau kan ts'o* (茅根草).

Economic specimen of this secured on the Canton market by E. H. Groff, C. C. C. Ec. No. 103, under the name of *Mau kan ts'o* (茅根草). It is said to be used to make a tea taken internally for pain in the bone.

19.110—MISCANTHUS SINENSIS Anders.

Enroute *Hoihow-Tai Tsing* (海口, 大井), 7807, Oct. 24, 1921 and *Nodoa*, (那大), 8119, Nov. 12, 1921; roadside among volcanic rocks; shrubs; grass; ht., 1-3 m.

19.111—SACCHARUM ARUNDINACEUM Retz.

Pat Ka Ling (Nodoa) (筆架嶺, (那大)), 7791, Nov. 1, 1921, *Ma On Shan* (馬安山), 7836, Oct. 25, 1921, *Nodoa, Ha Kung Ling* (那大, 蝦公嶺), 8221, Nov. 21, 1921, *Nam Fung* (南風), 8281, Nov. 3, 1921 and *Tsioh Biah* (?), 10522, Oct. 14, 1921; dry rolling country, on small land in middle of river, hillside, edge of forest near cultivated field, dry rocky hillside, edge of hot spring, roadside in waste land; alt., 200-800 m.; grass; ht., 1-3 m.; fls., white, brown, grayish brown, and light yellow; No. 7791 probably is referable here, a greatly reduced form. 10522=Hitchcock 19638, SACCHARUM sp.

19.111—SACCHARUM SPONTANEUM Linn.

Pat Ka Ling (Nodoa) (筆架嶺, (那大)), 7788, 7986**, Nov. 1, 1921; edge of river; grass; fls., white.

19.112—ERIANTHUS CHRYSOTHRIX Hack.

Pat Ka Ling (Nodoa) (筆架嶺, (那大)), 7790, Nov. 1, 1921, *Kam Kong* (金江), 7808, Oct. 27, 1921 *Five Finger Mt., Hop Lo Ts'un* (五指嶺, 合羅村), 8147**, 8337, Dec. 6, 1921; dry rolling and wild grassy country and on hillside; alt., 800 m.; grass; ht., 1½-3 m.; fls., brown; the species is very close to *Saccharum*, but is technically an *Erianthus*.

*The original determinations of the species of grasses were made by Prof. A. S. Hitchcock. Certain changes in nomenclature have been made in conformity with the international code, while generally speaking the generic concept adopted in this paper is that followed by most authors on the flora of tropical Asia and China. Specimens also collected by Prof. Hitchcock are recorded by his numbers and his determinations are clearly indicated where changes have been made.

**Only one specimen collected by F. A. McClure and sent to Philippine Bureau of Science where it will now be found.

- 19.113—*POLLINIA CILIATA* Trin.
On Yan (安仁), 7843, 7879, Oct. 25, 1921, *Nodoa*, near *Pat Ka Ling* (那大, 近筆架嶺), 8047, date?, *Nodoa, Sha Po Ling* (那大, 沙煲嶺), 8208, Nov. 11, 1921 and *Tsioh Biah* (?), 10531, Oct. 14, 1921; among *Pandanus* at roadside, grassy hillside, shady forest path; alt., 250 m.; grass; ht., 1/3-2 m.; fls., maroon.
- 19.113—*POLLINIA CONTORTA* (Brongn.) Merr.
 (P. *ARTICULATA* Trin.)
Nodoa (那大), 7964, Nov. 2, 1921; dry, abandoned field.
- 19.113—*POLLINIA SPECIOSA* Hack.
Nodoa, Sha Po Ling (那大, 沙煲嶺), 8143, Nov. 10, 1921; grassy hillside; alt., 500 m.; ht., 2 m.; fls., brown.
- 19.117—*POGONATHERUM PANICEUM* (Lam.) Hack.
Nodoa (那大), 7955, Nov. 9 1921, *Ka La* (加拉), 9181, Apr. 20, 1922 and *Tung Ngai* (?), 10465, date?; edge of thick, shaded bank, on terraces between rice field; grass; fls., light brown; name reported, *Kam sz ts'o* (金絲草).
- 19.118—*APLU DA MUTICA* Linn.
Kingchow (瓊州), 10311, Oct. 17, 1921 and 10312, date?; dry land among grass; ht., 1 1/2 m.
- 19.119—*ISCHAEMUM ARISTATUM* Linn. var. *BARBATUM* (Retz.) Hack.
Tung Ngai (?), 10474, 1921.
- 19.119—*ISCHAEMUM CILIARE* Retz.
On Yan (安仁), 7876, Oct. 25, 1921 and *Hoihow* (海口), 10300, date?; dry roadside; grass.
- 19.119—*ISCHAEMUM RUGOSUM* Salisb.
Nodoa (那大), 7920, Oct. 31, 1921; edge of rice paddy; alt., 250 m.; grass.
- 19.119—*ISCHAEMUM SIEBOLDII* Miq.
Hoihow (海口), 10329, 1921; among brush near pond.
- 19.121—*APOCOPSIS ROYLEANUS* Nees
South of Fan Ta (番打之南), 9167, Apr. 19 1922; dry hill land; grass; ht., 1/3 m.; fls., black to brown.
- 19.122—*EREMOCHLOA OPHIUROIDES* (Munro) Hack.
On Yan (安仁), 7875, 10320, Oct. 25, 1921; abandoned field; grass; fls., maroon.
- 19.127—*ROTTBOELLIA COMPRESSA* Linn. f.
Hoihow (海口), 10295, 10296, 10297, 1922; along rice field.=Hitchcock 19175 a. b. c.=*MANISURUS COMPRESSA* (L. f.) Kuntze.

- 19.127—*ROTTBOELLIA MOLLICOMA* Hance
Nodoa, Sha Po Ling (那大, 沙煲嶺), 8207, Nov. 11, 1921, and S. of *Ooi Tenk* (?), 10485, 10486, date?; edge of ravine, brush land and along *Pandanus* hedges; alt., 400 m.; grass.
- 19.128—*RYTILIX GRANULARIS* (Linn.) Skeels
 (MANISURUS *GRANULARIS* Linn. f., *HACKELOCHLOA GRANULARIS* O. Ktze.)
Tsioh Biah (?), 10519**, date?
- 19.133—*ARTHRA XON HISPIDUS* (Thunb.) Merr.
Kam Kong (金江), 7804, Oct. 28, 1921; roadside; grass.
- 19.134—*ANDROPOGON ACICULATUS* Retz.
Fan Ya (番也), 9648, May 17, 1922 and *Hoihow* (海口), 10335, 1921; roadside and pastured hills; grass; ht., 20-25 m.; fls., yellow, heads red; name reported, *Chuk tsit ts'o* (竹節草).
 10335=Hitchcock 19208: *RHAPHIS ACICULATUS* (Retz.) Desv.
- 19.134—*ANDROPOGON ARISTULATUS* Steud.
Hoihow (海口), 10313, 10350**, 1921; sand hills.
 Hitchcock 19187, 19239: *RHAPHIS ARISTULATUS*.
- 19.134—*ANDROPOGON BREVIFOLIUS* Sw.
Tsioh Biah (?), 10520, Oct. 14, 1921; edge of path among tall grass.
- 19.134—*ANDROPOGON CHINENSE* (Nees) Merr.
Tai Un (大園), 7800, Oct. 26, 1921 and *Nodoa, Lin Fa Ling* (那大, 蓮花嶺), 8071, Nov. 3, 1921; edge of shrubby plain, open grassy hillside; alt., 350 m.; grass; ht., 1 m.
- 19.134—*ANDROPOGON CONTORTUS* Linn.
Kam Kong (金江), 7806, Oct. 26, 1921, *Mi Ting* (美亭), 7868, Oct. 25, 1921, *Nodoa*, (那大), 7965, Nov. 2, 1921 and *Kingchow* (瓊州), 10536, Oct. 17, 1921; dry roadside, dry, open grassy places; grass; ht., 1/3 m.
 10536=Hitchcock 19652; *HETEROPOGON CONTORTUS* Beauv.
- 19.134—*ANDROPOGON FASTIGIATUS* Sw.
Nodoa, Lin Fa Ling (那大, 蓮花嶺), 7915, Nov. 2, 1921 and *Nodoa, Ha Kung Ling* (那大, 蝦公嶺), 8218, Nov. 21, 1921; open grassy hillside; alt., 300 m.; grass; ht., 1-2 m.
- 19.134—*ANDROPOGON HALEPENSIS* (Linn.) Brot. var. *PROPINQUA* (Kunth) Merr.
On Yan (安仁), 7880, Oct. 25, 1921 and *Fan Ta* (番打), 9136, Apr. 18, 1922; roadside, in moist place; grass; ht., 2-3 m.; fls., red; name reported, *Shek mau* (石茅).

- 19.134—ANDROPOGON INTERMEDIUS R. Br.
Hainan (海南), 10453**.
- 19.134—ANDROPOGON ISCHAEMUM Linn.
Hoihow (海口), 10450, Oct. 17, 1921; sand plat with blue clay mixture, moist; grass.
- 19.134—ANDROPOGON MICRANTHUS Kunth.
Tung Ngai (?), 10480.
- 19.134—ANDROPOGON NARDUS Linn. var. TORTILIS (Presl.) Merr.
(A. HAMATULUS Nees).
Kam Kong (金江), 7836, Oct. 23, 1921 and Hoihow (海口), 10302, 1921; dry roadside; grass.
10320=Hitchcock 19180: CYMBOPOGON HAMATULUS (Nees) A. Camus.
- 19.134—ANDROPOGON SANGUINEUS (Retz.) Merr.
Nodoa (那大), 7801, Oct. 23, 1921, *Nodoa, Pat Ka Ling* (那大筆架嶺), 8019, Oct. 23, 1921 and *Tung Ngai* (?), 10473, 1921; shrubby waste land, dry clay; alt., 250 m.; grass.
- 19.134—ANDROPOGON SORGHUM (Linn.) Brot.
Ting On River, (定安河), 8874, Apr. 6, 1922; cultivated in sandy soil; ht., 1½-2½ m.; fls., green; food for natives; name reported *Ko leung suk* (高粱粟).
- 19.134—ANDROPOGON SP.
Nodoa (那大), 7969, Nov. 4, 1921; roadside among grass and weeds; alt., 250 m.; grass.
- 19.136—THEMEDA GIGANTEA (Cav.) Hack. subsp. SUBVILLOSA Hack.
Enroute to *Ka La, T'a Hon* (加拉他寒), 9214, Apr. 21, 1922 and *Tsioh Biah* (?), 10505, Oct. 14, 1921; wooded ravine, sandy bank of river; grass; ht., 1½-3 m.; frs., orange-yellow when ripe.
- 19.136—THEMEDA TRIANDRA Forsk.
San Hu (新墟), 7802, Oct. 28, 1921; roadside; grass.
- 19.148—PEROTIS LATIFOLIA Ait.
(P. INDICA (Linn.) O. Ktz.
Hoihow (海口), 10322, 1921; sand hills.
- 19.150—ZOISIA MATRELLA (Linn.) Merr.
Hoihow (海口), 10299, 1921; 10299=Hitchcock 19177: OSTERDAMIA MATRELLA (L.) Kuntze.
- 19.153—ARUNDINELLA ANOMALA Steud.
North of *On Yan* (北安仁), 7877, Oct. 25, 1921; in tall grass at edge of road; grass; ht., 1 1/3 m.

- 19.153—ARUNDINELLA NEPALENSIS Trin.
Kam Kong (金江), 7809, Oct. 27, 1921 and *Tsioh Biah* (?), 10513, Oct. 14, 1921; among tall grass and shrub; grass; ht., 2 m.
- 19.158—THYSANOLAENA MAXIMA (Roxb.) O. Ktze.
(T. AGROSTIS Nees).
Five Finger Mt., (五指嶺), 8607, Dec. 23, 1921 and *Ting On River* (定安河), 8924, Apr. 8, 1922; open grassy hillside, steep bank among bushes; alt., 60-500 m.; grass; ht., 2-2½ m.; fls.; stems used to make brooms; the heads are collected by the Lois, the seeds stripped off and the remains made into brooms; also called *Tsung ip ts'o* (棕葉草), because the leaves are used to wrap a Chinese delicacy made of glutinous rice; names reported, *Long ts'o* (稗草), *Mong ts'o* (蔞草). McClure obtained specimen of broom, C.C.C. Ec. No. 127 (McClure Ec. No. 48).
- 19.161—PASPALUM CARTILAGINEUM Presl.
Tsioh Biah (?), 10327, 10328, Oct. 14, 1921; side of forest path, open, moist; grass.
- 19.161—PASPALUM CONJUGATUM Berg.
Nam Fung, Hong Ma Ts'un (南風康馬村), 8303, Dec. 2, 1921 and *Tsioh Biah, Ma Tsik* (?), 10540, Oct. 14, 1921; in moist ravine; alt., 350 m.; grass.
- 19.161—PASPALUM LONGIFOLIUM Roxb.
Tsioh Biah (?), 10512, Oct. 14, 1921; moist roadside; grass.
- 19.161—PASPALUM VAGINATUM Swartz.
Hoihow 10325, 1922; near sea along inlet.
- 19.164—ERIOCHLOA RAMOSA (Retz.) O. Ktze.
(E. ANNULATA Kunth).
S. of *Ooi Tenk* (?), 10488, 1921; wet places.
- 19.165—ISACHNE GLOBOSA (Thunb.) O. Ktze.
(I. AUSTRALIS R. Br.)
Hoihow (海口), 10304, 10456, 1921; rice field in water and edge of pond.
- 19.165—ISACHNE SP. (near SYLVESTRIS Ridl.)
Tsioh Biah (?), 10528, Oct. 14, 1921; moist, shady.
- 19.166—ALLOTROPSIS SEMIALATA (R. Br.) Hitch.
Without Locality, 10470**.
- 19.166—DIGITARIA CHINENSIS Nees
On Yan (安仁), 7878, Oct. 25, 1921 and S. of *Ooi Tenk* (?), 10482, 1921; roadside; grass.
- 19.166—DIGITARIA COROMBOSA (Roxb.) Merr.
Hoihow (海口), 10340; along stone wall.
10340=Hitchcock 19213: SYNTHESISMA SP.

- 19.166—DIGITARIA HETERANTHA (Nees & Mey.) Merr.
Hoihow (海口), 10317; sand hills.
 10317=Hitchcock 19191: SYNTHESISMA HETERANTHA (PANICUM HETERANTHUM).
- 19.166—DIGITARIA LONGIFLORA (Retz.) Pers.
On Yan (安仁), 7874, Oct. 25, 1921, *Hoihow* (海口), 10315, and *Tung Ngai* (?), 10469; grass.
 10315, 10469=Hitchcock 19189, 19537 respectively: SYNTHESISMA LONGIFLORA (Retz.) Skeels.
- 19.166—DIGITARIA SANGUINALIS (Linn.) Scop. var.
 (PASPALUM SANGUINALE var. DEBILE Hook. f.)
 Enroute *Hoihow*, *Tai Tsing* (海口, 大井), 7871**, 7890, Oct. 24, 1921 and *Hoihow* (海口), 10333, 1921; dry roadside; shady soil; grass.
 10333=Hitchcock 19203: SYNTHESISMA SANGUINALIS var. DEBILIS (PASPALUM SANGUINALE var. DEBILIS Hook.)
- 19.166—DIGITARIA SP.
Tsioh Biah (?), 10507, Oct. 14, 1921; side of fresh path.
- 19.166—PANICUM AMBIGUUM Trin.
 10484 **.
- 19.166—PANICUM AMPLEXICAULE Rudge
Kingchow (瓊州), 10460, 1921; sandy mud banks along river.
 10460=Hitchcock 19557: HYMENACHNE AMPLEXICAULES (Rudge) Nees.
- 19.166—PANICUM AURITUM Presl.
Tsioh Biah (?), 10490, 1921; edge of moist forest path; grass; ht., 1 m.
- 19.166—PANICUM BREVIFOLIUM Linn.
Tung Ngai (?), 10434, 1921; along hedge.
- 19.166—PANICUM COLONUM Linn.
Nodoa (那大), 7978, 10534, Nov. 15, 1921; moist place near road; alt., 250 m.; grass; ht., 1 m.; fls., maroon; name reported, *Hin j pai tsz* (紅棒子).
 10534=Hitchcock 19350: ECHINOCHLOA COLONUM (Linn.) Link.
- 19.166—PANICUM CORDATUM Buse.
Tsioh Biah (?), 10492, 1921; sandy, moist region; alt., 100 m.; grass. New to China.
- 19.166—PANICUM CRASSIAPICULATUM Merr.
Tsioh Biah (?), 10500, Oct. 14, 1921; side of path. New to China.
 10500=Hitchcock 19606: BRACHIARIA CRASSIAPICULATUM.

- 19.166—PANICUM CRUSGALLI Linn.
Kingchow (瓊州), 10459, Oct. 17, 1921 and *Tsioh Biah* (?), 10530, Oct. 14, 1921; edge of canal, edge of forest in moist, shady regions; grass; ht., 1 m.
 10459, 10530=Hitchcock 19556b, 19646 respectively: ECHINOCHLOA CRUSGALLI (L.) Beauv.
- 19.166—PANICUM CRUS-PAVONIS HBK.
Hoihow (海口), 10330, 1921 and *Tsioh Biah* (?), 10458, Oct. 14, 1921; edge of canal.
 10330, 10458=Hitchcock 19202, 19556a respectively: ECHINOCHLOA CRUS-PAVONIS (Humb. & Bonpl.) Schultz.
- 19.166—PANICUM DISTACHYUM Linn.
Hoihow (海口), 10336, 1921 and *Tung Ngai* (?), 10477; among weeds in lawn, along road in shady place.
 10336, 10477=Hitchcock 19209, 19576 respectively: BRACHIARIA DISTACHYA.
- 19.166—PANICUM HUMILE Nees
Tung Ngai (?), 10468, weed in old rice field.
- 19.166—PANICUM INDICUM Linn.
Tung Ngai (?), 10305, Oct. 10, 1921 and *Hoihow* (海口), 10306, 10307, 1921; river bank, edge of pond; grass.
 10305, 10306, 10307=Hitchcock 19183a, 19183b, 19183c respectively: SACCOLEPIS INDICA (L.) Chase.
- 19.166—PANICUM MYOSUROIDES R. Br.
Nodoa (那大), 7977, Nov. 15, 1921 and *Nam Fung* (南風), 8278, Nov. 30, 1921; edge of rice paddy; alt., 250 m.; grass.
- 19.166—PANICUM NODOSUM Kunth.
Tsioh Biah (?), 10466, Oct. 14, 1921; moist shady places; alt., 100 m.; grass.
- 19.166—PANICUM PATENS Linn.
Ooi Dick (?), 10535, Oct. 12, 1921; shady roadside; grass.
- 19.166—PANICUM PILIPES Nees
Five Finger Mt., (五指嶺), 8379, Dec. 10, 1921; moist shady ravine among rocks; alt., 1200 m.; fls., brown. Not recorded from China.
- 19.166—PANICUM REPENS Linn.
Hoihow (海口), 10337; low ground near inlet.

- 19.166—*PANICUM SARMENTOSUM* Roxb.
Nam Fung (南風), 8273, Nov. 28, 1921 and *Five Finger Mt.*, (五指嶺), 8580, Dec. 21, 1921; hedges by roadside, wooded ravine; alt., 200-700 m.; grass; ht. 12 m.; name reported, *Chuk ko ts'o* (竹篙草).
- 19.166—*PANICUM TONKINENSE* Balansa (P. RIDLEYI Hack.)
Tsioh Biah (?), 10518, 1921; along moist path among other grasses. New to China.
- 19.166—*PANICUM TRYPHERON* Schultes.
Tung Ngai (?), 10471, 1922; sandy grass land; grass.
- 19.166—*PANICUM TUBERCULATUM* Presl. Rel. Haenk.
Tsioh Biah (?), 10511, 10515, Oct. 14, 1921 and *Tsioh Biah*, near *Ka Tsik* (嘉積), 10539, Oct. 14, 1921; moist roadside among other grasses; cultivated field. New to China.
- 19.167—*ICHNANTHUS VICINUS* (F. M. Ball.) Merr. (I. PALLENS Munro).
Tung Ngai (?), 10475, 1922 and *Tsioh Biah* (?), 10516, Oct. 14, 1921; shady damp place.
- 19.169—*OPLISMENUS COMPOSITUS* (Linn.) Beauv.
 Enroute *Hoihow*, *Tai Tsing* (海口, 大井), 7887, Oct. 24, 1921 and *Tsioh Biah* (?), 10509, Oct. 14, 1921; moist, shady places; grass; fls., red and green.
- 19.169—*OPLISMENUS UNDULATIFOLIUS* (Ard.) Beauv.
Five Finger Mt., (五指嶺), 8440, Dec. 17, 1921; village commons; alt., 600 m.; grass.
- 19.171—*SETARIA GENICULATA* (Lam.) Beauv.
Nodoa, *Lin Fa Ling* (那大, 蓮花嶺), 7911, Nov. 3, 1921; grassy hillside; alt., 450 m.; grass; ht., 1 m.
- 19.171—*SETARIA ITALICA* (L.) Beauv.
Ting On River (定安河), 8876, Apr. 6, 1922; cultivated in sandy field; alt., 40 m.; ht., 2/3-1 m.; seed used by natives as food; name reported, *Kau mi suk* (狗尾粟).
- 19.171—*SETARIA PALMIFOLIA* (Koenig) Stapf.
 (*PANICUM PALMAEFOLIUM* Koenig).
Ka Tsik, (*Kachek*) (嘉積), 10496, Oct. 13, 1921; side of street, shady, moist.
 10496=Hitchcock 19601: *CHAETOCHELOA PALMIFOLIA* (Willd.) Hitch. & Chase.
- 19.175—*PENNISETUM ALOPECUROIDES* (Linn.) Spreng.
 (*P. COMPRESSUM* R. Br.)
Hoihow (海口), 10326, 1921 and *Ka Tsik*, (*Kachek*) (嘉積), 7030, Sept. 19, 1921; low ground near inlet.

- 19.180—*STENOTAPHRUM HELFERI* Munro.
Pat Ka Ling (*Nodoa*) (寧架嶺, 那大), 7789, Nov. 1, 1921 and *Ka Tsik*, (*Kachek*) (嘉積), 10498, Oct. 13, 1921; shady roadside, moist river bank; alt., 250 m.; grass.
- 19.193—*ORYZA SATIVA* Linn.
Tai Tsing (大井), 7805, 7891, Oct. 24, 1921, *Kam Kong* (金江), 7834, Oct. 26, 1921, *Mi Ting* (美亭), 7867, 7869, Oct. 25, 1921, *Nodoa*, *Lin Fa Ling* (那大, 蓮花嶺), 8104, Nov. 21, 1921, *Nodoa*, *Ha Kung Ling* (那大, 蝦公嶺), 8219, 8220, Nov. 21, 1921, *Ooi Diok* (?), 8787, Oct. 11, 1921 and 8789, Oct. 12, 1921, *Sai Ching Ling Mun* (?), 9765, May 24, 1922 and *Ooi Tenk* (?), 10483, 1921; dry field, wet paddy, cultivated field on hillside, near hot spring, rice paddy in warm water, 102° F., from hot spring; alt., 450 m.; grass; ht., 1-2 m.; fls., maroon and red bearded; names reported, *Sham shui wo* (深水禾), *Wong lau chim kuk* (黃樓粘谷), *Hung so kuk* (紅樓穀).
- 19.194—*LEERSIA HEXANDRA* Sw.
Hoihow (海口), 10454, 1922; rice field.
 10454=Hitchcock 19551: *HOMALOCENCHRUS HEXANDRUS* (Sw.) Kuntze.
- 19.230—*SPOROBOLUS INDICUS* (Linn.) R. Br.
Hoihow (海口), 10339, 1921; low ground near inlet.
- 19.230—*SPOROBOLUS VIRGINICUS* (Linn.) Kunth.
Hoihow (海口), 10452, Oct. 17, 1921; salt, sand flats; grass.
- 19.234—*GARNOTIA PATULA* Munro.
Tsioh Biah (?), 10514, Oct. 14, 1921; edge of forest in moist, shady places; grass.
- 19.282—*CYNODON ARCUATUS* Presl.
Tung Ngai (?), 10462, 1921; along edge of cane field. New to China.
- 19.282—*CYNODON DACTYLON* (Linn.) Pers.
Hoihow (海口), 10323, 1921; low ground near waste.
 10323=Hitchcock 19196: *CAPRIOEA DACTYLON* (L.) Kuntze.
- 19.288—*CHLORIS INCOMPLETA* Roth.
Five Finger Mt., (五指嶺), 8609, Dec. 23, 1921; edge of cultivated field; alt., 600 m.
- 19.288—*CHLORIS TENER* (Presl.) Scribn.
Tung Ngai (?), 10467, 1921 and *Tsioh Biah* (?), 10504, 10525, Oct. 14, 1921; sandy river bank, side of forest path; grass. New to China.

- 19.288—CHLORIS VIRGATA Sw.
Hoihow (海口), 10451, Oct. 18, 1921; edge of road in sandy, dry places; grass.
- 19.304—ELEUSINE COROCANA (Linn.) Gaertn.
Oo Po (?), 9768, May 27, 1922 and Ooi Diok (?), 10533, Oct. 15, 1921; cultivated field; grass; ht., 1/3-1 m.; seeds used as food; name reported, Ap keuk suk (鴨脚粟).
McClure collected economic specimen, C. C. C. Ec. No. 128 (McClure Ec. No. 6).
- 19.304—ELEUSINE INDICA (Linn.) Gaertn.
Hoihow (海口), 10332, 1921; weed in lawn.
- 19.305—DACTYLOCTENIUM AEGYPTIUM (Linn.) Richter.
Nodoa, Yau Ma Wo (那大, 油麻和), 8110, Nov. 9 1921 and Hoihow (海口), 10334, 1921; roadside field, weed in lawn; alt., 250 m.; fls., maroon.
- 19.307—LEPTOCHLOA CHINENSIS (Linn.) Nees
Kam Kong (金江), 7833, Oct. 26, 1921; edge of rice field; grass.
- 19.307—LEPTOCHLOA FILIFORMIS (Lam.) Beauv.
Hoihow (海口), 10338, 1921; weed in garden.
- 19.331—ARUNDO DONAX Linn.
Kingchow (瓊州), 10538, Oct. 17, 1921; roadside; grass; ht., 3 m.
- 19.332—NEYRAUDIA MADAGASCARIENSIS (Kunth.) Hook. f.
On Yan (仁安), 7870, Oct. 25, 1921, Nam Fung (南風), 8275, Nov. 28, 1921 and Ooi Diok, enroute Ka Tsik (Kachek), Hoihow (嘉積, 海口), 10481, Oct. 15, 1921; roadside among Pandanus; grass; alt., 250 m.; ht. 2-3 m.; name reported, Mong tung ts'o (望冬草).
- 19.333—PHRAGMITES VULGARIS (Lam.) Trin.
(P. COMMUNIS Trin.)
Kam Kong (金江), 7837, Oct. 26, 1921, Nodoa (那大), 7857, Oct. 31, 1921 and Kingchow (瓊州), 10537, Oct. 17, 1921; dry roadside, thicket along stream, in edge of canal; grass; ht., 1½-4 m.; fls., maroon.
10537=Hitchcock 19653: PHRAGMITES PHRAGMITES (L.) Karst.
- 19.341—ERAGROSTIS AMABILIS (Linn.) W. & A.
(E. PLUMOSA Link, E. TENELLA R. & S.)
Hoihow (海口), 10318, 10319, 1921 and Ka Tsik (Kachek) (嘉積), 10502, Oct. 13, 1921; shade of hedge, sandy river bank; grass.
- 19.341—ERAGROSTIS ELEGANTULA Steud.
Hoihow (海口), 10316, 1921, Tung Ngai (?), 10479, 1921, Tung Ngai & Ooi Diok (?), 10491, Oct. 12, 1921 and Tsiok Biah (?), 10510, Oct. 14, 1921; low ground along path, sandy grass land, dry roadside; grass.

- 19.341—ERAGROSTIS ELONGATA (Willd.) Jacq.
Hoihow (海口), 10308, 1921; sand hills.
- 19.341—ERAGROSTIS GENICULATA Nees.
Ting On River (定安河), 8923, Apr. 8, 1922, Hoihow (海口), 10309, 10321, 1921; growing in sand, sand hills; alt., 60 m.
- 19.341—ERAGROSTIS UNIOLOIDES (Retz.) Nees.
(E. AMABILIS Auctt.)
Ooi Diok (?), 10461, Oct. 12, 1921; dry roadside; grass.
- 19.357—CENTOTHECA LATIFOLIA (Osbeck) Trin.
Tai Un (大園), 7797, Oct. 27, 1921 and Tsiok Biah (?), 10523 Oct. 14, 1921; moist, shady regions; grass.
- 19.360—LOPHATHERUM GRACILE Brongn.
Ooi Diok (?), 10487, Oct. 12, 1921 and Tsiok Biah (?), 10526, Oct. 14, 1921; moist, shady roadside, edge of forest; grass; ht., 1 m.
- 19.424—BAMBUSA MULTIPLEX (Lour.) Raeusch.
(B. NANA Roxb.)
W. of Tai Wan San Hui (?), 8951, Apr. 10, 1922; ht., 1-2 m.; used to make brooms for home use; name reported, So pa chuk (掃把竹).
- 19.424—BAMBUSA OLDHAMI Munro.
Five Finger Mt., Fan Ya (五指嶺, 香也), 8417, Dec. 9, 1921 and Enroute, Ka Tsik (Kachek), Wong Chuk (嘉積, ?), 9779, June 1, 1922; village commons; alt., 1000 m.; bamboo; ht., 7-8 m.; dia., 4-8 cm.; fls., maroon; names reported, Nai chuk (坭竹), Shek chuk (石竹). Reported by McClure as thin walled and used commonly by the villagers for bamboo screens, matting, etc.
- 19.424—BAMBUSA SPINOSA Roxb.
(B. BLUMEANA Schultes)
Nam Fung, U Tau Tei (南風, 烏豆地), 8293, Nov. 30, 1921, W. of Tai Wan San Hui (?), 8940, Apr. 19, 1922, Enroute Tai Wan San Hui to Notia (? 和舍), 8941 and Notia (Wo She) (和舍 ?), 8986, Apr. 11, 1922; village commons, roadside in waste land, in very dense clump; thorny; alt., 250 m.; bamboo; ht., 4-10 m.; dia., 2-7 cm.; fls., maroon and yellowish, green, walls of large stems very thick; seeds are eaten and considered to have medicinal value; young leaves which have not yet unfolded steeped to make "tea" for medicine; used also in making screens, houses, baskets etc.; names reported Nai chuk (坭竹), Shek chuk (石竹), Shui chuk (水竹), Lak chuk (勒竹).
- 19.424—BAMBUSA STENOSTACHYA Hack.
Notia (Wo She) (和舍), 7803, Oct. 28, 1921, Kam Kong (金江), 7810, Oct. 27, 1921 and Ka Tsik (Kachek) Wong Chuk (嘉積, ?), 9785, June 1, 1922; village commons, roadside; grass; ht., 4-8 m.; dia., 1½-8 cm.; fls., pale green; names reported, Tsz chuk, (刺竹), Wat chuk (斃竹).

19.424—BAMBUSA SP.

Pat Ka Ling (*Nodoa*) (筆架嶺, 那大), 7792, 8040, Nov. 1, 1921, *Tai Un* (大園), 7811, Oct. 27, 1921, *Nodoa, Lin Fa Ling* (那大, 蓮花嶺), 7812, 7813, Nov. 3, 1921, *Nodoa* (那大), 8010, Nov. 21, 1921, *Nodoa, Yau Ma Wo* (那大, 油麻和), 8116, 8724, Nov. 9, 1921, *Nodoa, Sha Po Ling* (那大, 沙婆嶺), 8156, Nov. 10, 1921, *Five Finger Mt., Fan Ya* (五指嶺, 番也), 8397, 8416, Dec. 9, 1921, *Five Finger Mt., (五指嶺)*, 8698, Dec. 14, 1921 and *S. of Ooi Tenk* (?), 10494, 1922; dry, shrubby places, grassy plain, moist forested ravine, thicket, sandy soil, beside stream; alt., 250-1600 m.; grass; ht., 1-20 m.; dia., 2½-5 cm.; very useful for weaving, matting and screens; said by natives to be especially durable; names reported *Tang chuk* (藤竹), *Sha lo chuk* (沙羅竹), *King chuk* (荆竹), *Tai ngan chuk* (大眼竹), *Wong chuk* (黃竹).

With regard to these numbers Mr. E. D. Merrill writes: "There are seven or eight other species of Bambusae represented in McClure's collection by sterile material, one *Schizostachyum* (No. 8189), the remainder apparently belonging mostly in the genus *Bambusa*. Nos. 8698, 8397, 8156 strongly resemble *B. Multiplex* (Lour.) Raeusch., but have tessellated leaves; local name *Wong chuk*; Nos. 7792, 8416, 8116 and 8040 apparently represent a single species, known locally as *Tai ngan chuk*. Other species are represented by No. 8010, *King chuk*, No. 7813, *Sha lo chuk*, No. 7811 and 8724, without local names."

19.433—DENDROCALAMUS LATIFLORUS Nees.

Nam Fung, U Tau Ti (南風, 烏豆地), 8294, Nov. 30, 1921, *Five Finger Mt., Fan Ya* (五指嶺, 番也), 8377, Dec. 10, 1921 and *Five Finger Mt., (五指嶺)*, 8411, Dec. 1921; village commons, rice field near stream and on slope; alt., 250-1000 m.; shrub; ht., 10-13 m.; dia., 7-12 cm.; fls., maroon with yellow stamens; frs., edible; walls of this bamboo are 3" thick and are used for building houses; names reported, *Ching ma chuk* (正麻竹), *Ma chuk* (馬竹), *Nai chuk* (坭竹).

19.439—SCHIZOSTACHYUM SP. NOV. Merr.

T'a Hon (他寒), 8345, Dec. 6, 1921, *Five Finger Mt., Fan Ya* (五指嶺, 番也), 8398, Dec. 9, 1921 and *Five Finger Mt., (五指嶺)*, 9464, May 6, 1922; wooded ravine, mt. forest, climbing among tall tree; alt., 600-1200 m.; bamboo; ht., 10-30 m.; dia., 3-4 cm.; leaves and flowering branches borne mostly near the small end in very dense clusters at each node; a very useful bamboo with long internodes and rather thin walls; name reported, *Tang chuk* (藤竹).

19.439—SCHIZOSTACHYUM SP.

Nodoa, Sha Po Ling (那大, 沙婆嶺), 8189, Nov. 11, 1921; moist, shady ravine; alt., 450 m.; climbing bamboo; ht., 8-20 m.

20—Cyperaceae

20.455—HYPOLYTRUM LATIFOLIUM L. C. Rich.

T'a Hon, Nga Wan (他寒, 牙環), 9238, Apr. 22, 1922 and *O. P'o—Shuen P'o* (?), 9778, May, 1922; hillside forest in dry earth and in moist shady places; herb; ht., 1/3-½ m.; fls., brown, juvenile.

20.459—CYPERUS DIFFORMIS Linn.

Ooi Diok (?), 8785, Oct. 11, 1921; moist rice field; sedge; fls., brown, yellow.

20.459—CYPERUS ELEUSINOIDES Kunth.

Nodoa (那大), 8205, Nov. 11, 1921; edge of stream; alt., 400 m.

20.459—CYPERUS HASPAN Linn.

Nodoa (那大), 7794, Oct. 31, 1921 and *Ting On River* (定安河), 8930, Apr. 9, 1922; edge of rice paddy, sandy waste; alt., 70-250 m.; fls., green, brown; name reported, *Yau ts'o* (油草).

20.459—CYPERUS IRIA Linn.

Nodoa (那大), 7864, Oct. 30, 1921; edge of wet rice paddy; alt., 250 m.; sedge.

20.459—CYPERUS PILOSUS Vahl.

Nodoa (那大), 7865, Oct. 31, 1921; edge of rice paddy; alt., 250 m.

20.459—CYPERUS PROCERUS Roxb.

Tung Ngai (東崖), 8778, Oct. 10, 1921; edge of rice field; sedge; fls., brown.

20.459—CYPERUS RADIANS Nees.

Tsioh Biah (?), 7660, Oct. 14, 1921; on sand near river; fls., reddish brown and green; sedge.

20.459—CYPERUS ROTUNDUS Linn.

Tsioh Biah (?), 7659, Oct. 14, 1921; sandy river bank; fls., reddish brown; sedge.

20.459—CYPERUS TEGETIFORMIS Roxb.

Nodoa (那大), 7922, Oct. 26, 1921 and *Five Finger Mt., (五指嶺)*, 8592, Dec. 27, 1921; edge of stream in sands, river side; alt., 500 m.; ht., 2/3-1 m.; flower stems dried and used by the Lois to weave matting.

20.459—CYPERUS SP.

Kingchow (瓊州), 8777, Oct. 10, 1921 and *Ting On River* (定安河), 8909, Apr. 7, 1922; cultivated in sandy field, sandy moist soil; alt., 50 m.; sedge; fls., not yet opened; this plant is used to weave matting; names reported, *Sam kok ts'o* (三角草).

20.459—MARISCUS DILUTUS (Vahl.) Nees.

Tsioh Biah (?), 8798, Oct. 14, 1921; in moist place among weeds at path side.

20.459—PYCREUS ODORATUS (Linn.) Urb.

Tai Wai, San Hui (? , 新墟), 8994, Apr. 9, 1922; in moist field; fls., greenish, yellowish.

- 20.462—*KYLLINGA BREVIFOLIA* Rottb.
Nodoa (那大), 7954, Nov. 9, 1921; bank of stream grazed by cattle; alt., 250 m.; grass; fls., green.
- 20.467—*FUIRENA CILIARIS* (Linn.) Roxb.
Nodoa (那大), 7844, Oct. 31, 1921; edge of rice paddy; sedge; fls., green.
- 20.469—*HELEOCHARIS FISTULOSA* (Poir.) Link.
Nodoa (那大), 7793, Oct. 31, 1921; edge of rice paddy; alt., 250 m.; sedge; fls., green.
- 20.471—*FIMBRISTYLIS AESTIVALIS* (Retz.) Vahl.
Ka Lai, T'a Hon (加拉他寒), 9218, Apr. 21, 1922; edge of rice field; fls., brownish green; name reported, *Pat* (不).
- 20.471—*FIMBRISTYLIS ANNUA* (All.) R. & S.
Nodoa (那大), 7862, Oct. 31, 1921; edge of rice paddy; alt., 250 m.
- 20.471—*FIMBRISTYLIS MILIACEA* (Linn.) Vahl.
Ooi Diok (?), 8788, Oct. 12, 1921; moist rice field; sedge.
- 20.471—*FIMBRISTYLIS SCHOENOIDES* (Retz.) Vahl.
Nodoa (那大), 7863**; borders of rice fields.
- 20.492—*RYNCHOSPORA CORYMBOSA* (Linn.) Britton.
Nam Fung (南風), 8280, Nov. 30, 1921 and near *Fan T'a* (近番打), 9149, Apr. 18, 1922; swampy, shady and moist places; alt., 275 m.; ht., 1 m.; fls., brownish; name reported, *Sam lin ts'o* (三散草).
- 20.503—*MAPANIA LONGA* Ridl.
Five Finger Mt., (五指嶺), 8663, Dec. 19, 1921 and 9404, May 3, 1922; wooded mt. side, heavily wooded ravine; alt., 1000 m.; ht., 1 m.; lvs., 1½ cm.; fls., green.
- 20.515—*SCLERIA HEBECARPA* Nees.
Ooi Diok (?), 7658, Oct. 12, 1921 and *Tsich Biah* (?), 8797, Oct. 14, 1921; moist, shady roadside, rich earth; sedge; No. 7658 had insufficient fruit and is questionable.
- 20.515—*SCLERIA LAEVIS* Retz.
Nodoa (那大), 9236, Nov. 21, 1921; in hillside forest; ht., 2 m.; fls., brown and black.
- 20.515—*SCLERIA SUMATRENSIS* Retz.
T'a Hon Nga Wan (他寒牙環), 7997, Apr. 22, 1922; edge of stream; alt., 250 m.; frs., red.

- 20.517—*DIPLACRUM CARICINUM* R. Br.
Tung Ngai (東崖), 8780, Oct. 11, 1921; moist roadside; sedge; prostrate; fls., green.
- 20.525—*CAREX BACCANS* Nees.
Five Finger Mt., (五指嶺), 8426, Dec. 9, 1921 and 8524, Dec. 18, 1921; wooded ravine, edge of stream; alt., 600-1000 m.; sedge; ht., 2/3-1 m. frs., brownish red.
- 20.525—*CAREX CRYPTOSTACHYS* Brongn.
Five Finger Mt., (五指嶺), 8330, Dec. 9, 1921; moist wooded mt. side; fls., greenish.
- 20.525—*CAREX NEMOSTACHYS* Steud.
T'a Hon (他寒), 8332, Dec. 5, 1921; edge of stream; alt., 350 m.; fls., yellowish.
- 20.525—*CAREX SP. NOV.* Merr.
Five Finger Mt., (五指嶺), 8532, Dec. 13, 1921, 8627, Dec. 13, 1921, 9318, Apr. 28, 1922 and *Yik Tsok Mau*, (亦作茂), 9676, May 18, 1922; wooded ravine, moist, shady ravine near stream; alt., 350-1400 m.; ht., 1/2-2/3 m.; fls., white.

21—Palmae

- 21.528—*PHOENIX HANCEANA* Naud.
Nodoa (那大), 8038, Nov. 1, 1921. in thickets in open dry places.
- 21.539—*LICUALA SP. NOV.* Merr.
Nodoa, Lin Fa Ling (那大蓮花嶺), 8974, Nov. 3, 1921 and *Nodoa, Sha Po Ling* (那大沙灣嶺), 8133, Nov. 10, 1921 and 9230, Apr. 22, 1922; moist shady ravine, side thicket; alt., 400-800 m.; shrub; ht., 1-3 m.; fls., pinkish white; frs., berries, reddish yellow; leaves, collected, dried and used to make rain-coats; names reported, *Tsung shuc* (棕樹).
- 21.539—*LICUALA SP. AFF. ROBINSONIANA* Becc.
Nodoa, Lin Fa Ling (那大蓮花嶺), 8030, Nov. 3, 1921; dense wooded mt. ravine; alt., 600 m.; bush; ht., 1-1½ m.; frs., red; leaves used by natives to make rain coats.
- 21.539—*LICUALA SP.*
Five Finger Mt., (五指嶺), 9585, May 14, 1922; in wooded ravine; ht., 1½-2 m.; fls., yellowish white; name reported, *Tsung ip* (樓葉).
- 21.573—*CALAMUS TETRADACTYLUS* Hance.
Kingchow (瓊州), 7549, Oct. 14, 1921 and *Nodoa, San Ts'un* (那大新村), 8003, Nov. 16, 1921 and *Hainan, Ka chek, Wong chuk* (海南嘉積, ?) 9793, June 1, 1922; in thicket, half shrub covering rolling plain; alt., 250 m.; vine; fls. or immature frs., yellowish; a rattan of commerce; names reported, *Pak tang* (白藤), *Kai tang* (雞藤).

21.573—CALAMUS THYSANOLEPIS Hance.

Five Finger Mt., (五指嶺), 8674, Dec. 15, 1921, 9362, Apr. 29, 1922 and 9433, May 4, 1922; in wooded ravine; vine, stiff, nearly self supporting; ht., 6-7 m.; dia., 3 m.; frs., light yellow, edible; names reported *Wong t'ang* (黃藤).

An economic specimen was collected under C. C. C. Ec. No. 128a. To Kang Peng, the Chinese collector, reports this economic specimen as *Wong t'ang* (黃藤).

21.574—CARYOTA MITIS Lour.

Nodoa, Pat Ka Ling (那大筆架嶺), 8035, Nov. 1, 1921; roadside; palm; ht., 4 m.; dia., 10 cm.; fls., yellow and maroon.

21.575—ARENCA PINNATA (Wurmb.) Merr.

(A. SACCHARIFLORA Lab.)

Hainan (海南), 9761, May, 24, 1922; ht., 8 m.; dia., fls., brownish yellow; the fibers which grow under the base of the leaves are used to make small rope. The thorn-like growth at the base of the leaves are used by the "Miaos" (aborigenes) to make arrows. The Hakkas in the southern part of Hainan, where this tree is common, pound a kind of flour out of the tree; names reported, *Shan ye tsz* (山椰子).

21.653—PINANGA BAVIENSIS Becc.

Nodoa, Lin Fa Ling (蓮花嶺, 那大), 8096, Nov. 3, 1921 and *Hainan, Nam Fung, Fan Ta* (海南南風, 番打), 9150, Apr. 18, 1922 and 9231, Apr. 22, 1922 and *Five Finger Mt.*, (五指嶺), 9315, Apr. 28, 1922; in moist shady ravine, thicket; alt., 450 m.; ht., 2-3 m.; dia., 1-3 cm.; fls., first white, then brown; frs., red; names reported, *Ka shan chuk* (家山竹), *Shan pan long* (山板榔).

21.654—ARECA CATECHU Linn.

Hainan, Hoihow (海南海口), 9808, June, 5, 1922; compound of Amer. Presby. Mission; tree; ht., 3-6 m.; fls., white, very fragrant; frs., rich yellow when ripe; this tree is cultivated most abundantly in central eastern *Hainan* between *Kachek* and *Ling Mun*. The fruit yields a drug and stimulant. Sandals are made of the bud sheath and a part of the petiole of the leaf of the palm. These materials are very tough and durable and are used commonly to make a great variety of household utensils such as dustpans, dippers, etc.; name reported; *Pan long* (板榔).

Economic specimen of sandals secured by McClure, C. C. C. Ec. No. 129 (McClure Ec. No. 30), and specimen of dipper, C. C. C. Ec. 129a (McClure Ec. No. 30a).

21.663—COCOS NUCIFERA Linn.

Nodoa (那大), 7996, Nov. 20, 1921; Presby. Mission compound; alt., 200 m.; tree; ht., 7 m.; fls., white; frs., edible; name reported: *Ye tsz* (椰子).

23—Araceae

23.684—POTHOS REPENS (Lour.) Merr.

(P. LOUREIRI H. & A.)

Five Finger Mt., (五指嶺), 8577, Dec. 21, 1921, *Hainan, Tai Wan, San Hu* (海南, 大環, 新墟), 8947, Apr. 10, 1922 and *Hainan, Fan Ya* (海南, 番也), 9543, May, 13, 1922; on tree at edge of stream and in waste land; alt., 600 m.; vine; ht., 5-8 m.; fls., yellowish green, fragrant; frs., bright red when ripe.

23.684—POTHOS SEEMANNI Schott.

Five Finger Mt., (五指嶺), 8646, Dec. 20, 1921, 9428, May, 4, 1922 and 9478, May 7, 1922; moist, shady ravine, growing on trunk of tree in wooded ravine; alt., 600 m.; vine; ht., 2-5 m.; fls., buds only; frs., green fruits, only, yellowish red.

23.694—ACORUS GRAMINEUS Ait.

Nodoa, Lin Fa Ling (那大, 蓮花嶺), 8107, Nov. 11, 1921, *Hainan, Fan Ta* (海南, 番打), 9137, Apr. 18, 1922; edge of stream, on wet rocks in small stream; alt., 400 m., fls., yellowish when discharging pollen; drug plant; name reported, *Shek cheung po* (石菖蒲).

Economic specimen of this secured on the Canton market by E. H. Groff under the name of *Shek cheung po* (石菖蒲), C. C. C. Ec. No. 130. The price is about 40 cents per catty L. S. It is said to be used as a medicine taken internally with other herbs and wine for broken bones.

23.699—RHAPHIDOPHORA HONGKONGENSIS Schott.

Hainan, Yik Tsok Mau (海南, 亦作茂), 9655, May, 17, 1922; on shrubs and trees in wooded ravine; vine; ht., 7-8 m.; fls., light yellow.

23.699—RHAPHIDOPHORA MACLUREI Merr.

SP. NOV. in PHILIP. JOURN. SCI. 21 (1922) 337.

Five Finger Mt., (五指嶺), 8714, Dec. 20, 1922; in ravine on top of large boulder; alt., 600 m.; stem, prostrate; fls., brown.

23.702—EPIPHEMNUM PINNATUM Linn.

Hainan, Ting On River (海南, 定安河), 8925, Apr. 8, 1922; on tree; alt., 10 m.; vine; ht., 10 m.; dia., 3-4 cm.; fls., cream white; name reported, *Ki lun ip* (麒麟葉).

23.723—AMORPHOPHALLUS SP.

Five Finger Mt., (五指嶺), 9507, May 9, 1922; wooded ravine; shrub; ht., 1½ m.

23.752—ALOCASIA SP.

Ting On River (定安河), 8853b, Apr. 5, 1922 and *Hainan* (海南), 9348, Apr. 28, 1922; on moist rock face in wooded ravine; herb; ht., 1/3 m.; fls., white with yellow stamens at base, green sheath.

23.786—ARISAEMA SP.

Five Finger Mt., (五指嶺), 8659, 9345**, Dec. 14, 1921 and 9422, May 4, 1922; wooded ravine near stream; herb; ht., 1 m.; fls., brown and green; frs., red; name reported, *Lai p'o fa* (黎婆花).

29—Xyridaceae

29.826—XYRIS PAUCIFLORA Willd.

Nodoa (那大), 7952, Nov. 9, 1921; roadside, near edge of rice paddy; alt., 250 m.; fls., yellow; name reported, *Chung tso* (葱草).

30—Eriocaulonaceae

30.828—ERIOCAULON SIEBOLDIANUM S. & Z.

Tung Ngai (?), 8779, Oct. 11, 1921; moist rice field; sedge; fls., gray.

30.828—ERIOCAULON WALLICHIANUM Mart.

Tai Wan, San Hu (? 新墟), 9827, Apr. 9, 1922; sandy waste; alt., 70 m.; fls., white; name reported, *Shui suen* (水蓴).

33—Commelinaceae

33.893—POLLIA ACLISIA Hassk.

Five Finger Mt., (五指嶺), 9359, Apr. 29, 1922; herb; ht., 1 m.

33.893—POLLIA SORZOGONENSIS (E. Mey.) Steud.

Nodoa, Lin Fa Ling (那大, 蓮花嶺), 8076, Nov. 3, 1921 and *Five Finger Mt.*, (五指嶺) 8540, Dec. 19, 1921; shady steep hillside, moist shady, ravine; alt., 600 m.; herb; frs., blue.

33.896—COMMELINA NUDIFLORA Linn.

Mai Kun Tsun (米觀村), 7753**.

33.896—COMMELINA OBLIQUA Ham.

Nodoa (那大), 8167, Nov. 11, 1921 and *Yik Tsok Mau* (亦作茂), 9719, May 19, 1923; at water edge in shady ravine; alt., 400 m.; herb; ht., 1 m.; fls., light blue.

33.899—ANEILEMA MALABARICUM (Linn.) Merr.

Hoihow (海口), 8229, Oct. 24, 1921; between stones in old wall; herb; fls., pink.

33.899—ANEILEMA SPIRATUM R. Br.

Nodoa (那大), 7737, 7935, Oct. 31, 1921 and 7931, 8387**, Oct. 30, 1921, *Ka Tsik* (嘉積), 8795, Oct. 12, 1921 and *Ting On River* (定安河), 8892, Apr. 7, 1922; between stones on bridge, also on bank of stream; herb; fls., faint pink.

33.902—FORRESTIA CHINENSIS N. E. Br.

Lin Fa Ling (蓮花嶺), 8049, Nov. 2, 1921; thick forested ravine; alt., 400 m.; herb; frs., red.

33.904—CYANOTIS CRISTATA R. & S. var. GRIFFITHII C. B. Clarke

Tsiok Biah near Kachek (? 嘉積), 8792, Oct. 14, 1921; in cultivated field; prostrate; fls., light blue.

33.904—CYANOTIS LAUREIRIANA (R. & S.) Merr.

Hoihow (海口), 8226, Oct. 24, 1921; sandy waste; fls., pink.

33.908—FLOSCOPA SCANDENS Lour.

Nodoa (那大), 7928, Oct. 31, 1921 and 9284, *Hainan*, near *Pan Ya* (海南, 番也), Apr. 25, 1922; shady edge of stream; herb; fls., lavender.

34—Pontederiaceae

34.920—MONOCHORIA HASTATA (Linn.) Solms.

Kingchow (瓊州), 7650, Oct. 14, 1921; edge of pond; herb; fls., blue.

34.920—MONOCHORIA VAGINALIS (Burm. f.) Presl.

Hoihow (海口), 7534, Oct. 10, 1921; wet field; herb; fls., blue.

34.920—MONOCHORIA VAGINALIS Presl. var. PAUCIFLORA (Blume) Merr. (M. VAGINALIS Presl. var. PLANTAGINEA Solms)

Nodoa, Tai Un (那大, 大園), 7754**, 7768**; in rice paddies.

36—Juncaceae

36.936—JUNCUS PRISMATOCARPUS R. Br. var. LESCHENAULTII Buchen.

Tai Hon (他寒), 9224, Apr. 21, 1922; along road at edge of rice fields; fls., brownish; name reported, *Sai* (使).

38—Liliaceae

38.951—CHIONOGRAPHIS JAPONICA (Willd.) Max.

Five Finger Mt., (五指嶺), 9392, May 1, 1922; in thicket in rich soil; herb; fls., greenish white.

38.1017—DIANELLA ENSIFOLIA (L.) DC.

Fan Ta (番打), 9142, Apr. 18, 1922.

38.1109—PLEOMELE ANGUSTIFOLIA (Roxb.) N. E. Br.

Nodoa, Pat Ka Ling (那大, 筆架嶺), 8030, Nov. 1, 1921; thicket; alt., 250 m.; shrub; ht., 3 m.

38.1113—ASPAGUS COCHINCHINENSIS (Lour.) Merr.

(A. LUCIDUS Lind.)

Hoihow (海口), 7592, Oct. 10, 1921; *Ta Hon, Nga Wan* (他寒, 牙環), 9254, Apr. 22, 1922 and *Ka Tsik, Wong Chuk* (嘉積, ?), 9797, June 1, 1922; edge of thicket, on tree in forest, vine on shrubs by roadside; vine; ht., 3-12 m.; fls., white; tubers used in Chinese medicine; name reported, *T'in mun t'ang* (天門藤), *T'in t'an?* (天藤).

- 38.1120—DISPORUM HAINANENSE Merr. SP. NOV.
in PHILIP. JOURN. SCI. 21 (1922) 338
Five Finger Mt., (五指嶺), 8585, Dec. 21, 1921 and 9505, May 9, 1922; in forest on mt. side on stony cliff, in wooded ravine; alt., 800 m.; herb; ht., 2/3-1 m.; fls., yellow and maroon, fragrant.
- 38.1123—POLYGONATUM SP.
Five Finger Mt., (五指嶺), 8642, Dec. 16, 1921; wooded mt. side growing in fork of large tree; alt., 1400 m.; herb; frs., red.
- 38.1137—PARIS HAINANENSIS Merr. SP. NOV.
in PHILIP. JOURN. SCI. 23 (1923) 238.
Five Finger Mt., (五指嶺), 9213**, 9347, Apr. 28, 1922; on moist rock face in wooded ravine; herb; fls., green, purple, and yellow; frs., orange yellow; ht., 2 m.; tuber used as medicine, seeds saved; name reported, *Tsat ip yat chi fa* (七葉一枝花).
- 38.1139—LIRIOPE GRAMINIFOLIA (Linn.) Baker
Five Finger Mt., (五指嶺), 8492, Dec. 23, 1921; wooded ravine; frs., blue black.
- 38.1140—OPHIOPOGON JAPONICUS (L. f.) Ker.
Ka La, Yik Tsok Mau (加拉, 亦作茂), 8326, Dec. 4, 1921; on rock wall near stream; alt., 350 m.
- 38.1141—PELIOSANTHES MACROSTEGIA Hance.
Five Finger Mt., Yik Tsok Mau (五指嶺, 亦作茂), 8475, 8619, Dec. 28, 1921; wooded ravine in leaf mold; alt., 1200 m.; frs., blue.
- 38.1141—PELIOSANTHES STENOPHYLLA Merr.
Five Finger Mt., (五指嶺), 9334, Apr. 23, 1922; wooded ravine; fls., light blue, lavender and white; frs., blue.
- 38.1151—SMILAX CHINA Linn.
Lin Fa Ling (蓮花嶺), 7701, Nov. 4, 1921; on shrubs at roadside; vine; fls., maroon and white; frs., red when ripe; name reported, *Ma kap* (馬甲).
- 38.1151—SMILAX GLABRA Roxb.
Five Finger Mt., (五指嶺), 8393, Dec. 9, 1921 and *Yik Tsok Mau, Fan Ya* (亦作茂, 番也), 9276, Apr. 25, 1922; mt. side thicket, growing on shrub in ravine; alt., 1000 m.; vine; ht., 4-5 m.; fls., yellow; name reported, *Laan faan t'ang* (冷飯頭).
- 38.1151—SMILAX OPACA (C. DC.) Norton
Five Finger Mt., (五指嶺), 9559, May 13, 1922; on shrubs at edge of clearing; vine; ht., 5-6 m.; name reported, *Ma kap* (馬甲).
- 38.1151—SMILAX OVALIFOLIA Roxb.
Five Finger Mt., Fan Ya (五指嶺, 番也), 8446, Dec. 7, 1921; in thicket on shrub; vine; ht., 6-8 m.; name reported, *Ma kap* (馬甲).

- 38.1151—SMILAX SP.
North of Fan Ta (番打之北), 9133, Apr. 18, 1922; *South of Fan Ta* (番打之南), 9157, Apr. 19, 1922; on bushes by roadside, in thicket on shrub; vine; ht., 2-8 m.; fls., yellowish-green, fragrant; name reported, *Ma mi kit* (馬尾結).
- 38.1152—HETEROSMILAX GAUDICHAUDIANA (Kunth) Maxim.
Near Nodaa (近那大), 7684**; along trails clambering over shrubs.

40—Amaryllidaceae

- 40.1189—CRIMUM ASIATICUM Linn. var. SINICUM Baker
Near Ting On River (近定安河), 8880, Apr. 7, 1922; on grassy bank; ht., 1/3-1/2 m.; fls., white, very fragrant, filaments lavender, anthers brown; drug plant; name reported, *Man lan* (文蘭).
- 40.1189—CRIMUM SP.
Kingchow (瓊州), 8838, Apr. 5, 1922; roadside; alt., 10 m.; ht., 2/3 m.; fls., salmon; very good as ornamental plant.
- 40.1229—CURCULIGO CAPITULATA (Lour.) O. Ktze.
Ka La, Ta Hon (加拉, 他寒), 9210, Apr. 21, 1922 and *Five Finger Mt.*, (五指嶺), 9343, Apr. 28, 1922; on rock surface of wooded mt. side; herb; ht., 2/3-1 m.; fls., yellow.
- 40.1229—CURCULIGO GLABRESCENS (Ridl.) Merr.
Nodaa, Lin Fa Ling (那大, 蓮花嶺), 8068, Nov. 3-5, 1921; moist, shady ravine; alt., 250 m.; herb; ht., 1/2 m.

42—Dioscoreaceae

- 43.1251—DIOSCOREA GLABRA Roxb.
Nodaa, Sha Po Ling (那大, 沙煲嶺), 8199, Nov. 11, 1921; moist, shady ravine; alt., 400 m.; vine.
- 43.1252—DIOSCOREA HISPIDA Dennst.
(D. DAEMONA Roxb.)
Kachek, Wong Chuk (嘉積, ?), 9798, June 1, 1922; on shrubs at roadside; vine; ht., 4-5 m.; fls., white, slightly fragrant; name reported, *Pak shu leung* (白薯蕷).
- 43.1252—DIOSCOREA PENTAPHYLLA Linn.
Nodaa (那大), 7960, Nov. 2, 1921; on bushes near roadside; alt., 250 m.; vine.
- 43.1252—DIOSCOREA PERSIMILIS Brain & Burkill
Near Notia (Wo She—和舍), 7841 Oct. 26, 1921; dry roadside; vine.

43.1252—DIOSCOREA SP.

S. slope of Five Finger Mt., (五指嶺之南麓), 9494, May 9, 1922; wooded ravine; vine; ht., 5-10 m.; tubers hunted and eaten by the Loïs; name reported, *Shu leung* (薯蕷).

Economic specimen of tuber secured by McClure, C. C. C. Ec. No. 131 (McClure Ec. No. 1.).

44—Iridaceae

44.1285—BELAMCANDA CHINENSIS Linn. DC.

Kingchow (瓊州), 7536, Oct. 14, 1921 and *Ting On River* (定安河), 8856, Apr. 6, 1922; dry, grassy regions and sandy banks near hedges; alt., 10-15 m.; herb; ht., 1 m.; fls., yellow mottled with red, orange dotted with reddish spots; name reported, *Kau tsin ts'o* (稜莖草).

45—Musaceae

45.1318—MUSA PARADISIACEA Linn.

(subsp. SEMINIFERA (Lour) Baker)

Nodoa, Yau Ma Wo (那大, 油麻和), 7995, *Nodoa, Sha Po Ling* (那大, 沙煲嶺), 8125, 8204, *Nodoa, Yau Ma Wo* (那大, 油麻和), Nov. 11-20, 1921 and *Five Finger Mt.*, (五指嶺), 8715, Dec. 20, 1921 and 9497, May 9, 1922; moist shady ravine near stream; alt., 450 m.; tree: ht., 4 m.; dia., 6-10 cm.; fls., yellow; frs., very seedy; name reported, *Shan pa tsiu* (山芭蕉)

McClure reported that the heart of this wild banana plant is eaten by the Loïs as vegetable. "I have tried it and it is quite palatable, provided it has the stringy fibres removed and is cooked with some fat."

46—Zingiberaceae

46.1324—ZINGIBER CORROLLINUM Hance.

Nodoa, Pat Ka Ling (那大, 筆架嶺), 8045, Nov. 1, 1921 and *Five Finger Mt.*, (五指嶺), 9510, May 9, 1922; edge of thicket and in wooded ravine; alt., 250 m.; herb; ht., 1-2 m.; fls., yellow; frs., receptacle; name reported, *Hung shan keung* (紅山薑).

46.1328—LANGUAS CHINENSIS (Rosc.) Merr.

(ALPINIA CHINENSIS Rosc.)

Five Finger Mt., *Fan Ya Ts'un* (五指嶺, 番也村), 8413, Dec. 11, 1921 and *Five Finger Mt.*, (五指嶺), 9495, May 9, 1922 and 9556, May 13, 1922; alt., 800 m.; herb; ht., 1 m.; frs., brownish red, only immature fruits at this season.

46.1328—LANGUAS KATSUMADAI (Hayata) Merr.

Five Finger Mt., (五指嶺), 8541, Dec. 19, 1921 and 9493, May 9, 1922; moist shady ravine; alt., 600 m.; grass; ht., 2½ m.; seeds have medicinal value. Hakkas hire the Loïs to collect the seeds, which are said to bring \$70 to \$100 a picul wholesale; name reported, *Ts'o yan* (草仁).

46.1328—LANGUAS MACLUREI Merr. (ALPINIA MACLUREI Merr.)

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Nodoa (那大), 7925, Oct. 27, 1921 and *West of Nodoo* (西那大), 8963, Apr. 11, 1922; among roadside bushes, among shrubs and undergrowth; ht., 1-2 m.; fls., yellow and red; drug plant; used in the treatment of itchy rash; name reported, *Shan keung* (山薑).

Economic specimen of *Shan keung* seeds purchased on the Canton market under the name of *Shan keung tsz* (山薑子), C.C.C. Ec. No. 16. The price is about 40 cents per catty. It is said to be made into a tea to stop vomiting.

46.1328—LANGUAS SPECIOSA (Wendl.) Merr.

Nodoa (那大), 7696**; in thicket along trail.

46.1328—LANGUAS SP.

Five Finger Mt., (五指嶺), 9493, May 9, 1922; in heavy forest; herb; ht., 1 m.; fls., yellowish.

46.1329—PLAGIOSTACHYS SP.

Near the summit of *Five Finger Mt.*, (近五指嶺頂), 9402, May 1, 1922; rocky soil; herb; ht., 1 m.; fls., juvenile—buds red; name reported, *Shan keung* (山薑).

46.1337—AMOMUM SP.

Five Finger Mt., (五指嶺), 8635, Dec. 17, 1921 and 8672, Dec. 15, 1921 and 9374, Apr. 29, 1922; wooded ravine; alt., 1300 m.; herb; ht., 2/3 m.; frs., seed container red; seeds black.

46.1351—CURCUMA ZEDOARIA (Berg.) Rosc.

Near *Fan Ta* (番打), 9155, Apr. 18, 1922; in thicket; herb; fls., yellow with pink to maroon calyx; with separate flower stems coming directly from root; would make a splendid ornamental; rhizomes secured for planting; name reported, *U sam keung* (烏心薑), *Hak sam keung* (黑心薑).

46.1357—COSTUS HIRSUTUS Blume

Near *Tai Un* (大園), 8255, Oct. 26, 1921; moist thicket; herb; ht., 1½ m.; fls., red and white.

47—Cannaceae

47.1363—CANNA INDICA Linn.

Kingchow (瓊州), 7640, Oct. 14, 1921; dry regions; vine; ht., 1 m.; fls., red; name reported, *Ka tsiu* (假蕉).

48—Marantaceae

48.1368—PHRYNIUM OLIGANTHUM Merr. SP. NOV.

in PHILIP. JOURN. SCI. 23 (1923) 239.

Five Finger Mt., (五指嶺), 9340, Apr. 28, 1922 and *S. E. of Shui Mun* (水門之東南), 9602, May 14, 1922; wooded mt. side; herb; ht., 1 m.; fls., yellow, borne in dense clusters in heavy green calyx about midway of the stem; names reported, *Tsung ip* (櫻葉) *Tung ip* (冬葉).

48.1368—PHRYNIUM PLACENTARIUM (Lour.) Merr.

Lin Fa Ling (蓮花嶺), 8087, Nov. 3, 1921 and *Nam Fung* (南風), 8270, Nov. 30, 1921; in shady moist ravine; alt., 450 m.; shrub; ht., 2 m.; dia., 3 cm.

9—Burmanniaceae

49.1382—BURMANNIA COELESTIS D. Don

Nodoa, Yau Ma Wo (那大, 油麻和), 8111, Nov. 9, 1921; in abandoned fields; alt., 250 m.; herb; fls., lavender.

50—Orchidaceae

50.1390—APOSTASIA WALLICHII R. Br.

9519**.

50.1504—GOODYERA PROCERA Hk. f.

Fan Ta (番打), 9144, Apr. 18, 1922 and *Shui Mun* (水門), 9603, May 14, 1922; growing on stones at edge of stream; herb; frs., brownish.

50.1552—MALAXIS SP.

Yik Tsok Mau (亦作茂), 9690, May 18, 1922; on rocks in shaded ravine; herb; fls., maroon and green.

50.1558—OBERONIA SP.

9484**.

50.1579—ARUNDINA CHINENSIS Blume.

T'a Hon, Nga Wan (他寒, 牙環), 9237, Apr. 22, 1922; in tall grass on open mt. side; herb; ht., 1/3-1/2 m.; fls., white and lavender.

50.1582—CERATOSTYLIS SP.

Five Finger Mt., (五指嶺), 9452, May 5, 1922; on trunk of tree in heavy forest; fls., poor, sterile only; frs., very few.

50.1631—CALANTHE VERATRIFOLIA R. Br.

Yik Tsok Mau (亦作茂), 9727, May 19, 1922; on moist rock in shady ravine; herb; fls., white.

50.1645—PACHYSTOMA PUBESCENS Blume.

Fan Lun, Ka La (番倫, 加拉), 9179, Apr. 20, 1922 and *Nga Wan* (牙環), 9269, Apr. 23, 1922; open grassy hillside; herb; ht., 1/2-1/3 m.; fls., lavender; name reported, *Sz kwan tsz* (司君子).

50.1648—EULOPHIA SP.

Near *Tau Ti Po* (?), 9123, Apr. 18, 1922; in open grassy waste land; herb; fls., yellow; name reported, *Kam cham shu* (金針樹).

50.1694—DENDROBIUM SP.

Near *Ka Lai* (近加拉), 9190, Apr. 20, 1922, *Five Finger Mt.*, (五指嶺), 9425, May 4, 1922, *Yik Tsok Mau* (亦作茂), 9722, May 19, 1922 and *San Hu, Ling Mun* (新墟, 嶺門), 9766, May 27, 1922; on *Eugenia* sp., *Shui Yung* tree, in wooded ravine on trunk of tree; ht., 1/3 to 30 m.; fls., petals lavender, center orange, cream with salmon pink throat, white, fragrant; aerial plants—two plants collected at different times.

50.1697—ERIA SP.

Near *Ka La* (近加拉), 9191, Apr. 20, 1922 and *Five Finger Mt.*, (五指嶺), 9409, May 3, 1922; growing on *Shui Yung* tree (*Eugenia* sp.) fls., green, red, yellow with light brown bract, grayish on outside—orange and maroon inside; epiphyte orchid.

50.1715—THELASIS SP.

Yik Tsok Mau (亦作茂), 9705, May 18, 1922; on rock surface in wooded ravine; herb; fls., greenish yellow.

50.1724—CUMBIDIUM SP.

Lin Fa Ling (蓮花嶺), 7907, Oct. 3, 1921; in hole of a tree; alt., 300 m.

50.1805—LUISIA SP.

Near *Ka La* (加拉), 9192, Apr. 20, 1922; on *Shui Yung* tree (*Eugenia* sp.) near stream; tree; fls., pale green with maroon center.

50.1814—SARCANTHUS SP.

Enroute *T'a Hon, Nga Wan* (他寒之道側, 牙環), 9246, Apr. 22, 1922 and *Yik Tsok Mau* (亦作茂), 9706, May 18, 1922; on "sweet gum" tree; ht., 1-1 1/2 m.; fls., lavender.

50.1827—VANDA SP.

9244**.

50.1844—THRIXSPERMUM SP.

Enroute *Yik Tsok Mau, Fan Ya* (亦作茂之道側, 番也), 9274, Apr. 24, 1922; growing on dead *Liquidambar formosana* tree trunk; fls., white with yellow and reddish center, very fragrant; living specimen taken.

50 ?

Nodoa (那大), 7962, Nov. 2, 1921, *Nodoa, Lin Fa Ling* (那大, 蓮花嶺), 8058, 8059, 8062, 8063, 8064, 8065, Oct. 3, 1921, *Nodoa, Sha Po Ling* (那大, 沙婆嶺), 8130, 8144, 8173, 8175, 8176, Nov. 10, 1921 and 8177, 8178, 8181, 8183, 8184, 8185, 8186, 8722, Nov. 11, 1921, *Mai Kun Ts'un* (米觀村), 8232, Oct. 25, 1921, *Five Finger Mt., Hop Lo Ts'un* (五指嶺, 合羅村), 8361, Dec. 6, 1921, *Five Finger Mt., Fan Ya* (五指嶺, 番也), 8370, 8372, 8374, 8387, Dec. 10, 1921 and 8394, 8422, Dec. 9, 1921 and *Five Finger Mt.*, (五指嶺), 8478, Dec. 23, 1921, 8527, Dec. 18, 1921, 8583, Dec. 21, 1921, 8601, 8615, 8620, Dec. 16, 1921, 8605, 8621, 8625, Dec. 10, 1921, 8650, Dec. 20, 1921, 8670, Dec. 13, 1921 and 8692, Dec. 14, 1921; roadside; herb; ht., 1 m.; fls., yellow, spotted with red; name reported, *Shek fuk* (石茯).

53-Piperaceae

53.1832—PIPER BOEHMERIAEFOLIUM Wam. var. TONKINENSE C. DC.
Five Finger Mt., (五指嶺), 8339 and 8711, Dec. 16, 1921 and 9506, May 9, 1922; moist, shady ravine; alt., 1000-1200 m.; bush; ht., 1½-2 m.; frs., yellowish red; name reported, *Shan ki* (山箕).

53.1832—PIPER HAINANENSE Hemsl.

Pat Ka Ling, Nodoo (筆架嶺, 那大), 7724, Nov. 1, 1921; on tree in dry place; vine.

53.1862—PIPER HANCEI Maxim.

Hong Ma Ts'un (康馬村), 8307, Dec. 3, 1921 and 9471, May 7, 1922; on tree in thicket; alt., 400 m.; vine; ht., 3 m.; fls., cream; name reported, *Shan lau* (山蔞).

53.1862—PIPER MACLUREI Merr. SP. NOV.

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Nam Fung (南風), 8282, Nov. 30, 1921, *Five Finger Mt.*, (五指嶺), 8531, Dec. 18, 1921 and *Yik Tsok Mau* (亦作茂), 9653b, May 17, 1922 and 9695, May 18, 1922; growing on a fig tree in a shady ravine, wooded ravine on large tree; alt., 300-600 m.; vine; ht., 2 to 10 m.; dia., 2 cm.; fls., yellow, white, brownish red, fragrant.

53.1862—PIPER SARMENTOSUM Roxb.

Hoihow (海口), 7596, Oct. 10, 1921 and *Nodoo* (那大), 8012, Oct. 10, 1921; dry grass, village commons; herb; fls., white, fragrant; names reported, *Ka lau* (假蔞), *Kop lau* (鷓鴣).

53.1866—PEPEROMIA HARMANDII C. DC.

Five Finger Mt., (五指嶺), 8548, Dec. 20, 1921; moist, shady ravine, on moist rocks; alt., 600 m.

53.1866—PEPEROMIA LEPTOSTACHYA Hook. & Arn. var.

CAMBODIANA C. DC.

Yik Tsok Mau (亦作茂), 9689, May 18, 1922; in moist loose soil on rocky bank; herb; fls., green.

54-Chloranthaceae

54.1868—CHLORANTHUS BRACHYSTACHYS Blume.

Lin Fa Ling, Nodoo (蓮花嶺, 那大), 8085, Nov. 3, 1921, *Sha Po Ling, Nodoo* (沙撈嶺, 那大), 8139, Nov. 10, 1921 and 8194, Nov. 11, 1921, *Five Finger Mt.*, *Fan Ya* (五指嶺, 香也), 8392, Dec. 9, 1921, Near *T'a Hon* (近嘴寒), 9220, Apr. 21, 1922 and *Five Finger Mt.*, (五指嶺), 9558, May 13, 1922; mt. side shady ravine, in thicket, in forest; alt., 400-1000 m.; bush; ht., 1-2 m.; fls., green and yellow, very fragrant, very inconspicuous; frs., red berries; ornamental and drug plant; names reported, *Tsau tsit ch'a* (酒節茶), *Chuk tsit ch'a* (竹節茶).

54.1870—HEDYOSMUM NUTONS Sw.?

Five Finger Mt., (五指嶺), 9414 and 9415, May 4, 1922; in heavily wooded ravine; herb; ht., 1-1½ m.; fls., yellow and green.

57-Myricaceae

57.1874—MYRICA ADENOPHERA Hance.

Near *Tin Si* (?), 7784, Oct. 23, 1921, *Nodoo* (那大), 8014, Jan. 2, 1922 and near *Tin Si, San Hu* (? , 新墟), 8970, Apr. 11, 1922; dry roadside, in wilderness; alt., 250 m.; shrub; ht., 1-2 m.; fls., brownish, maroon, yellow; frs., deep red when ripe; fruits are used by people at *Nodoo* to make a delicious, refreshing, unfermented drink resembling grapejuice; Chinese preserve the fruits in salt and use them; names reported, *Yeung mui* (楊梅), *Tsing mui* (青梅).

60-Juglandaceae

60.1878—ENGLEHARDTIA COLEBROOKIANA Lindl.

Near *Fan Ya* (近香也), 9627, May 15, 1922; on open hillside; tree; ht., 5-6 m.; dia., 15 cm.; frs., brown when ripe.

60.1878—ENGLEHARDTIA WALLICHIANA Lindl.

(var. CHRYSOLEPIS C. DC.)

Nodoo, Sha Po Ling (那大, 沙撈嶺), 8149, Nov. 10, 1921, *West of Tai Wan, San Hu* (大環之西部, 新墟), 8959, Apr. 10, 1922 and Enroute *Tai Hon, Nga Wan* (大環之道側, 牙環), 9241, Apr. 22, 1922; ravine, waste, shrubby land, on hillside in thicket; tree; ht., 10-15 m.; dia., 25-60 cm.; fls., brown, green; bark used in making incense; drug plant; Nov. 10, 1921, Apr. 10, 1922, name reported, *Ka yuk kwai* (假玉桂).

61-Betulaceae

61.1884—CARPINUS LAXIFLORA (S. & Z.) Blume var.

MACROSTACHYA Oliv.

Five Finger Mt., (五指嶺), 9548, May 13, 1922; s.w. side of forest; shrub; ht., 3 m.; dia., 10 cm.; fls., greenish.

62-Fagaceae

62.1891—CASTANOPSIS FORMOSANA Hayata Ic. Blume.

Laan Mek (?), 8257, Jan. 3, 1921 and near *Tai Un* (大園), 7734, Oct. 27, 1921; waste land; tree; ht., 6 m.; dia., 12 m.; fls., yellowish white.

62.1891—CASTANOPSIS HAINANENSIS Merr. SP. NOV. in

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Nam Fung, Hong Ma Ts'un (南風, 康馬村), 8300, Dec. 3, 1921; in thicket near village; alt., 400 m.; tree; ht., 10 m.; name reported, *Chui muk* (錐木), Seeds secured by McClure, C. C. C. Ec. No. 132 (McClure Ec. No. 111).

62.1891—CASTANOPSIS SP.?

Nga Wan (牙環), 8353, Dec. 6, 1921; hillside; alt., 600 m.; tree; ht., 3 m.; fls., white, slightly fragrant.

62.1893—QUERCUS BLAKEI Skan var. PARVIFOLIA Merr.

Hainan, enroute *Fan Ya* to *Yik Tsok Mau* (海南, 香也, 亦作茂), 9651, May 17, 1922; in open ravine; tree; ht., 12 m.; dia., 50 cm.

62.1893—QUERCUS ELAEAGNIFOLIA Seem.

Five Finger Mt., Fan Ya Ts'un (五指嶺, 香也村), 8419, Dec. 9, 1921.

62.1893—QUERCUS HAINANENSIS Merr. SP. in

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Hainan, South of Fan Ya (海南, 南香也), 9158, Apr. 19, 1922, *South of Ka La (南加拉)*, 9202, Apr. 21, 1922. Enroute *Ta Hon, Nga Wan (唯寒, 牙環)*, 9255, Apr. 22, 1922, *Yik Tsok Mau (亦作茂)*, 9758, May 23, 1922 and *Sai Ching, Ling mun (? , 嶺門)*, 9764, May 24, 1922; along stream, hillside thicket, wooded ravine; shrub; ht., 2-7 m.; dia., 7-10 cm.; fls., brown and white, fragrant; names reported, *Shok tap shu (石踏樹)*, *Fu ch'ui (苦椎)*, *Pui kwo (杯菓)*.

62.1893—QUERCUS NAIADARUM Hance.

Mi Fing (美亭), 7686, Oct. 26, 1921 and *Ma On Shan (馬鞍山)*, 7777, Oct. 25, 1921; roadside, hillside; tree; ht., 4-7 m.; fls., yellowish white; Seeds secured by Mr. McClure, C. C. C. Ec. No. 133 (McClure Ec. No. 114).

62.1893—QUERCUS SILVICOLARUM Hance.

Five Finger Mt., Fan Ya (五指嶺, 香也), 8404, Dec. 9, 1921, 8596, Dec. 16, 1921, 9163, Apr. 19, 1922 and *Yik Tsok Mau (亦作茂)*, 9714, May 19, 1922; side thicket along stream, wooded ravine; alt., 1000-1300 m.; tree; ht., 8-30 m.; dia., 10-100 cm.; fls., brownish white; the wood of this tree is very tough, It is used by the Lois to make shovels, used also in buildings; names reported, *Pui kwok (杯菓)*, *Ch'ui shu (椎樹)*, *Heung nga shat (香牙刷)*.

62.1893—QUERCUS SPICATA Sm. var.

Near *Fan Ya (近香也)*, 9625, May 15, 1922; partially wooded hillside; shrub; ht., 7-8 m.; fls., brownish yellow; May 15, 1922.

62.1893—QUERCUS SP.

Five Finger Mt., (五指嶺), 9550, May 13, 1922; in forest; alt., 1000 m.; tree; ht., 12 m.; dia., 30 cm.; fls., cream.

63—Ulmaceae

63.1896—ULMUS PUMILA Linn.

Ta Hon (唯寒), 8343, Dec. 5, 1921; at edge of stream; alt., 350 m.; tree; ht., 6 m.; dia., 15 cm.

63.1898—CELTIS PHILIPPENSIS Blanco.

Along *Ting On River (定安河一帶)*, 8926, Apr. 9, 1922 and *Yik Tsok Mau (亦作茂)*, 9712, May 19, 1922; wooded ravine; alt., 70 m.; tree; ht., 5-8 m.; dia., 10 cm.; fls., brownish white and yellowish green; name report, *Ka yuk kwai (假玉桂)*.

63.1898—CELTIS SINENSIS Pers.

Yik Tsok Mau (亦作茂), 9666, May 17, 1922; partially wooded ravine; tree; ht., 10 m.; dia., 25 cm.; name reported, *Song tsai (桑仔)*.

63.1902—TREMA ORIENTALIS Linn. Blume

(T. AMBOINENSIS ANCTT., NON. (Willd.) Blume.

Yik Tsok Mau (亦作茂), 9684, May 18, 1922; wooded ravine; tree; ht., 8 m.; dia., 20 cm.

63.1905—GIRONNIERA SUBAEQUALIS Planch.

Nodoa, Lin Fa Ling (那大, 蓮花嶺), 8094, Nov. 3, 1921, west of *Tai Wan, San Hu (大環之西, 新墟)*, 8950, Apr. 10, 1922 and *South slope of Five Finger Mt., (五指嶺之南麓)*, 9354, Apr. 29, 1922; rocky hillside, shrubby waste land, wooded ravine; alt., 400 m.; ht., 4-10 m.; dia., 20 cm.; fls., yellow; frs., red-orange when ripe; name reported, *Pak ngan shu (白顏樹)*.

64—Moraceae

64.1922—MALAISIA SCANDENS (Lour.) Planch.

Nodoa (那大), 7949, Nov. 9, 1921 and *Sai Ching, Ling Mun (西正, 嶺門)*, 9762, May 24, 1922; on bushes by roadside, in partially wooded ravine; vine; ht., 3-5 m.; dia., 1-1 cm.; fls., white and green with light yellow stamens; names reported, *Ng ka t'ang (午加藤)*, *Ngau kan t'ang (午筋藤)*.

64.1923—BROUSSONETIA POPYRIFERA Vent.

Tau Ti Po (?), 9124, Apr. 18, 1922; in moist hollow by roadside; tree; ht., 6 m.; dia., 10 cm.; fls., yellowish white; wood is used to make paper; name reported, *Tsz pi ma (紫革麻)*.

64.1927—STREBLUS ASPER Lour.

Hoihow (海口), 7561, Oct. 10, 1921, 7820, Oct. 25, 1921, *Kam Kong (金江)*, 8250, Oct. 26, 1921, *On Ting On River (在定安河)*, 8906, Apr. 7, 1922 and Enroute *T'a Hon, Nga Wan (在他寒, 至牙環之道側)*, 9245, Apr. 22, 1922; dry place, on river bank; tree; alt., 50 m.; ht., 1-10 m.; dia., 30 cm.; fls., whitish yellow and green, fragrant; name reported, *Cheuk k'an shu (鵝腎樹)*.

64.1942—VANIERA (CUDRANIA) COCHINCHINENSIS Lour.

(CUDRANIA JAVANENSIS Trec.)

Tai Tsing (大井), 8227, Oct. 24, 1921 and *Fan Ya (香也)*, 9286, Apr. 25, 1922; roadside, bank of stream; shrub; ht., 2-5 m.; frs. orange yellow when ripe.

64.1946—ARTOCARPUS INTEGRALIS Thunb.

Nodoa, San Ts'un (那大, 新村), 8004 Nov. 15, 1921; village commons; alt., 250 m.; tree; ht., 10 m.; dia., 40 cm.; frs., edible; name reported, *Po lo mat (波羅蜜)*.

64.1956—ANTIARIS TOXICARIA (Pers.) Losch.

Ka Tsik (嘉積), 9770, May 1922; well drained sandy soil; tree; name reported, *Ka tuk (加獨)*.

Mr. McClure secured specimen of arrow poison, C. C. C. Ec. No. 134, (McClure Ec. No. 2). He reported "This name is merely a representation of the sound of the Miao name for this tree. The sap of this tree is one of the constituents of an arrow poison used by the Miao people of Hainan. Another constituent of the poison is the contents of the poison sac of a certain yellow wasp found there. The poison seems to work by quickly paralyzing the animal for it is commonly said (and was confirmed by the Miao man from whom I secured this information) that an animal can go but a few steps after having been wounded, however slightly. The meat of an animal so killed is invariably used and is said not to be dangerous to eat."

64.1961—FICUS ABELII Miq.

Near *Ting On River* (近定安河), 8883, Apr. 7, 1922 and *North of Fan Ta* (香打之北部), 9141, Apr. 18, 1922; on rocky bank, along stream near water; alt., 40 m.; bush; ht., 1½ m.; fls., purplish; names reported, *Ngau nai tsai* (牛奶仔), *shék yung kwó* (石榕菜).

64.1961—FICUS ALTISSIMA Blume

Nodoa (那大), 8991, Apr. 12, 1922; in well drained clay soil; ht., 10 m.; dia., 60 cm.; frs., yellow; name reported, *Tai ip yung* (大葉榕).

64.1961—FICUS BENJAMINA Linn.

Kingchow (瓊州), 7545, Oct. 14, 1921, *Kam Kong* (金江), 7832, Oct. 26, 1921 and *Fan Ya* (番也), 9642, May 16, 1922; thicket, dry roadside, village commons; tree; ht., 2-7 m.; dia., 3-15 cm.; fls., yellow; name reported, *Siu ip scung* (小菜常).

64.1961—FICUS CHLOROCARPA Benth.

Fan Ya (番也), 9287, Apr. 26, 1922; in garden; tree; ht., 5-6 m.; dia., 25 cm.; frs., eaten by Lois; name reported, *Ngau nai shu* (牛奶樹).

64.1931—FICUS ERECTA Thunb.

Five Finger Mt., *Yik Tsok Mau Ts'un* (五指嶺, 亦作茂村), 8471, Dec. 1921, and *South slope of Five Finger Mt.*, (五指嶺之南麓), 9322, Apr. 28, 1922 and 9460, May 6, 1922; wooded ravine; alt., 600 m.; tree; ht., 10 m.; dia., 15-20 cm.

64.1961—FICUS FORMOSANA Maxim.

Nodoa (那大), 7944, Nov. 9, 1921, *Nodoa, Ha Kung Ling* (那大, 蝦公嶺), 8224, Nov. 21, 1921, *Fan Ya* (番也), 9307, Apr. 26, 1922, 9515, May 9, 1922 and near *Shui Mun* (近水門), 9595, May 14, 1922; roadside in hedge, near hot spring, in thicket, half wooded ravine, in grass at edge of path; alt., 250-300 m.; shrub; ht., 1/3-2 m.; frs., red; name reported, *Ngau nai tsai* (牛奶仔).

64.1961—FICUS FULVA Dunn & Tutcher

Nodoa, Sha Po Ling (那大, 沙婆嶺), 8166, Nov. 11, 1921; ravine; alt., 400 m.; tree; ht., 8 m.; dia., 20 cm.

64.1961—FICUS GIBBOSA Blume

Hoihow (海口), 7609 Oct. 12, 1921 and *Nodoa* (那大), 7975, Nov. 15, 1921; on city wall, roadside; tree; alt., 250 m.; ht., 6-10 m.; dia., 12-60 cm.; names reported, *Tai ip yung* (大葉榕), *Tai yung shu* (大榕樹).

64.1961—FICUS HARLANDII Benth.

Five Finger Mt., (五指嶺), 8486, Dec. 23, 1921 and *South slope of Five Finger Mt.*, (五指嶺之南麓), 9430, May 4, 1922; wooded ravine, in forest; alt., 1000 m.; tree; ht., 3-8 m.; dia., 5-10 cm.

64.1961—FICUS HIRTA Vahl.

Nodoa, Pat Ka Ling (那大, 筆架嶺), 7690, Oct. 30, 1921, 7924 Oct. 28, 1921, *South slope of Ka La* (加拉之南麓), 9209, Apr. 21, 1922 and *South slope of Five Finger Mt.*, (五指嶺之南麓), 9432, May 4, 1922; edge of stream, edge of thicket, along stream on rock bank, in wooded ravine; alt., 250 m.; shrub; ht., 2-3 m.; dia., 1-2 cm.; frs., reddish when ripe, brownish with heavy pubescence; names reported, *Sam chau lung* (三爪龍), *Ngau nai tsai* (牛奶仔).

64.1961—FICUS HISPIDA Linn f.

Nodoa, Sha Po Ling (那大, 沙婆嶺), 8128, Nov. 9, 1921, near *Notia* (近和舍), 8238, Oct. 26, 1921, near *Tai Un* (大園), 8254, Oct. 26, 1921 and near *Fan Ya* (近番也), 9632, May 15, 1922; valley, near stream, moist roadside, on bank of stream; tree; ht., 5-6 m.; dia., 10-15 cm.; frs., yellow when ripe; name reported, *Ngau nai tsai* (牛奶仔).

64.1961—FICUS PALMATILOBA Merr. SP. NOV. in

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Nodoa, Lin Fa Ling (那大, 蓮花嶺), 8066, Nov. 3, 1921; among bushes on roadside, alt., 250 m.; ht., 2 m.; frs., red.

64.1961—FICUS PUMILA Linn.

Hoihow (海口), 7653, Oct. 11, 1921 and *Nodoa* (那大), 8990, Apr. 12, 1922; city wall, stone wall; vine; ht., 2-3 m.; seeds mixed with banana and ground fine and strained; the part that goes through the straining cloth is mixed with water and sugar and made into sweet cakes uncooked; name reported, *Man t'au kwó* (文頭果), *Man t'au long* (文頭繩).

64.1961—FICUS ROXBURGHII Wall.

Nodoa, Lin Fa Ling (那大, 蓮花嶺), 8053, Nov. 2, 1921 and *South slope of Five Finger Mt.*, (五指嶺之南麓), 9583, May 14, 1922; in forest on mt. side, in wooded ravine; alt., 300 m.; tree; ht., 6-8 m., dia., 15-20 cm.; frs., edible, red, yellow and green and borne in dense clusters on the trunk of the tree from the ground up; name reported, *Mo fa kwó* (無花果).

64.1961—FICUS SCANDENS Roxb.

Five Finger Mt., (五指嶺), 8455, Dec. 7, 1921 and *Yik Tsok Mau* (亦作茂), 9683, May 18, 1922; roadside, in wooded ravine; alt., 1000 m.; shrub; ht., 3-15 m.; dia., 3-6 cm.; frs., yellow; Lois use the small branches, pounding them when used as poultice for boils.

64.1961—FICUS STENOPHYLLA Hemsl.

Hainan (海南), 7947**, 9584, May 14, 1922; along stream on rocks at water edge; shrub; ht., 1/3 m., frs., reddish.

64.1961—FICUS SUBULATA Blume.

Lin Fa Ling (蓮花嶺), 8055, 8092, Nov. 2-3, 1921 and *S. slope of Five Finger Mt.*, (五指嶺之南麓), 9412, May 4, 1922 and *Yik Tsok Mau* (亦作茂), 9683, 9687, May 18, 1922; roadside, moist shady ravine, wooded ravine; alt., 300 m.; shrub; ht., 2-3 m.; frs., orange yellow.

64.1961—FICUS VASCULOSA Wall.

Nodoa, Sha Po Ling (那大, 沙勞嶺), 8159, Nov. 11, 1921 and *S. slope of Five Finger Mt.*, (五指嶺之南麓), 9365 Apr. 29, 1922; shady moist ravine, in wooded ravine; alt., 450 m.; tree; ht., 6-25 m.; dia., 10-90 cm.; frs., yellow.

64.1961—FICUS WIGHTIANA Benth.

Hoihow (海口), 7605, Oct. 12, 1921; tree; ht., 5 m.; dia., 12 cm.; name reported, *Pak kun shu* (筆管樹).

64.1961—FICUS SP.

Kingchow (瓊州), 7545**, 7620, Oct. 14, 1921 and *S. slope of Five Finger Mt.*, (五指嶺之南麓), 9483, 9573, May 7-17, 1922; in dry thicket, in moist wooded ravine near stream; shrub; ht., 1½-7 m.; dia., 2-6 cm.

65—Urticaceae

65.1980—LAPORTEA CRENULATA (Roxb.) Gaudich.

Ma On Shan (馬鞍山), 7747, Oct. 24, 1921; in bottom of crater; bush; ht., 3 m.; fls., white.

65.1984—PILEA SP.

Five Finger Mt., (五指嶺), 8389, Dec. 10, 1921; edge of mt. stream; alt., 1000 m.; herb; ht., 2/3 m.; fls., greenish.

65.1987—POLYCHROA (PELLIONIA) GRIFFITHIANA (Wedd.) Merr.

Five Finger Mt., (五指嶺), 8567, Dec. 12, 1921; wooded ravine; alt., 1400 m.; ht., 1/3 m.; fls., white.

65.1988—ELATOSTEMA EDULE C. B. Rob.

Five Finger Mt., Fan Ya (五指嶺, 番也), 8384, Dec. 10, 1921; edge of mt. stream; alt., 1100 m.; herb; ht., 2 m.; fls., white.

65.1989—PROCRIS WIGHTIANA Wedd.

Five Finger Mt., (五指嶺), 8649, Dec. 20, 1921; on moist rock in wooded ravine; alt., 700 m.; herb; ht., 1/3-½ m.; very succulent, almost impossible to cure.

65.1990—BOEHMERIA NIVEA (Linn.) Gaudich.

Nodoa, San Ts'un (那大, 新村), 8001, cultivated in field; herb; alt., 250 m.; ht., 1-1½ m.; fls., greenish yellow; the fibres of this plant are used to make cloth; name reported, *Pak ch'u ma* (白苧麻).

McClure secured economic specimen of this cloth, C. C. C. Ec. No. 135, (McClure Ec. No. 97).

65.1990—BOEHMERIA PLATYPHYLLA D. Don. var.

CLIDEMIOIDES Wedd.

Ma On Shan (馬鞍山), 7885, Oct. 24, 1921 and *Nodoa, Pat Ka Ling* (那大, 華架嶺), 7918, Oct. 28, 1921; on extinct volcano, shrubby hillside; alt., 250 m.; bush; ht., 1 1/3-2½ m.; fls., yellowish white.

65.1990—BOEHMERIA SIDAEOFOLIA Wedd.

North of Fan Ya (番打之北), 9146, Apr. 18, 1922 and 9114, May 15, 1922; in thicket, among rocks in ravine; shrub; ht., 1-2 m.; fls., yellowish green.

65.1990—BOEHMERIA SP.

Five Finger Mt., Fan Ya Tsun (五指嶺, 番也村), 8433, Dec. 11, 1921 and 8537, Dec. 19, 1921 and *Shui Mun* (水門), 9611, May 14, 1922; village commons, moist shady ravine, wooded ravine; alt., 600-1000 m.; vine; ht., 4-5 m.; dia., 2 cm.; fls., yellowish green.

65.1992—POUZOLZIA ZEYLANICA (Linn.) Benn.

Near *Ting On River* (定安河), 8904, Apr. 7, 1922; sandy waste; alt., 50 m.; fls., red; name reported, *Mo shui kot* (霧水葛).

65.2000—DEBREGEASIA SPICULIFERA Merr. SP. NOV.

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Five Finger Mt., (五指嶺), 8501, Dec. 22, 1921; wooded ravine; alt., 900 m.; bush; ht., 1½ m.; frs., orange yellow.

65.2001—OREOCNIDE FRUTESCENS (Thunb.) Miq.

Nam Fung (南風), 8289, Nov. 30, 1921 and *Five Finger Mt.*, (五指嶺), 8539, Dec. 19, 1921; mt. ravine, wooded ravine; alt., 350-600 m.; shrub; ht., 2-4 m.; dia., 9 cm.; fls., white; frs., white.

65.2001—OREOCNIDE SYLVATICA (Blume) Miq.

Nodoa, Lin Fa Ling (那大, 蓮花嶺), 8093, Nov. 3, 1921, and *S. slope of Five Finger Mt.*, (五指嶺之南麓), 9579, May 14, 1922; open hillside, wooded ravine; alt., 400 m.; vine; ht., 6 m.; dia., 3-4 cm.; fls., green and white.

66—Proteaceae

66.2045—GREVILLEA ROBUSTA A. Cunn.

Nodoa (那大), 9818, Apr. 15, 1922; sandy soil; tree; ht., 12-15 m.; dia., 20 cm.; fls., yellow and brownish red; name reported, *Ngan cheung shu* (銀槭樹).

66.2049—HELICIA COCHINCHINENSIS Lour.

Lin Fa Ling (蓮花嶺), 7817, 7909, Nov. 2-3, 1921 and *Five Finger Mt.*, (五指嶺), 8390, Dec. 9, 1921 and *Fan Ya* (番也), 9640, May 16, 1922; open shrubby hillside, edge of thicket, hillside forest; alt., 250-1000 m.; tree; ht., 4-7 m.; dia., 8-12 cm.; fls., cream white, fragrant; frs., bluish black.

66.2049—HELICIA HAINANENSIS Hayata.

Nodoa, Lin Fa Ling (那大, 蓮花嶺), 8069, Nov. 3, 1921, *Five Finger Mt., Fan Ya* (五指嶺, 番也), 8385, Dec. 10, 1921, *S. of Ka La* (加拉之南), 9206, Apr. 21, 1922, *Five Finger Mt., Fan Ya Ts'un* (五指嶺, 番也村), 8429, Dec. 8, 1921, *S. slope of Five Finger Mt.*, (五指嶺之南麓), 9563, May 13, 1922 and *Yik Tsok Mau* (亦作茂), 9716, May 19, 1922; in thicket, wooded stream, wooded ravine; alt., 400-1000 m.; shrub; ht., 2-15 m.; dia., 8-12 cm.; fls., yellow, red, green, white.

67-Loranthaceae

- 67.2072—ELYTRANTHE BIBRACTEOLATA (Hance) Lecomte var. ACUMINATISSIMA.
Five Finger Mt., (五指嶺), 8612, Dec. 1921; wooded ravine; alt., 1300 m.; vine; fls., red.
- 67.2072—ELYTRANTHE COCHINCHINENSIS (Lour.) G. Don (LORANTHUS AMPULLACENS Roxb.)
W. of Notia (和舍之西), 8983, Apr. 11, 1922 and Yik Tsok Mau (亦作茂), 9633, 9677, May 18, 1922; growing on Liquidamber formosana, wooded ravine; ht., 1-1 m.; fls., orange yellow; frs., yellow; name reported, Fung shu ki shang (風樹寄生).
- 67.2072—ELYTRANTHE TRICOLOR H. Lecomte.
Five Finger Mt., (五指嶺), 8643, Dec. 24, 1921; wooded ravine; parasite on tree; alt., 600 m.; vine; fls., red.
- 67.2074—LORANTHUS PARASITICUS (Linn.) Merr.
Nodoa (那大), 7818, Oct. 23, 1921 and 7963, Nov. 2, 1921, Shui Mun (水門), 9633, May 15, 1922; parasite on tree; alt., 250 m.; ht., 1 m.; dia., 1/3 m.; fls., maroon.
- 67.2074—LORANTHUS PENTAPETALUS Roxb.
Ka La, Ta Hon (加拉他寒), 9219, Apr. 21, 1922, S. slope of Five Finger Mt., (五指嶺之南麓), 9562, May 13, 1922 and Sai Ching, Ling Mun (西正嶺門), 9763, May 24, 1922; parasite on a tree, wooded ravine; vine; ht., 1/3 m.; fls., stems red, red with white and yellow stamens; names reported, Ka shang (家生), Ki Shang (寄生).
- 67.2087—BIVARIA (KORTHALSIELLA) OPUNTIA (Thunb.) Merr.
Summit of Five Finger Mt., (五指嶺之頂), 9382, May 1, 1922; parasite.
- 67.2093—VISCUM ARTICULATUM Burm. f.
Nodoa (那大), 7970, Nov. 4, 1921; on tree; alt., 250 m.; parasite.
- 67.2093—VISCUM ORIENTALE Willd.
Hainan (海南), 9265, Apr. 23, 1922; on pummelo tree near village; name reported, Luk yau ki shang (綠油寄生).
- 67.2093—VISCUM STIPITATUM H. Lecomte.
Five Finger Mt., (五指嶺), 9560, May 13, 1922; wooded ravine; ht., 2/3 m.; parasite on large tree.

69-Santalaceae

- 69.2102—HENSLOWIA FRUTESCENS Champ.
Lin Fa Ling (蓮花嶺), 7698, Nov. 4, 1921, S. slope of Five Finger Mt., (五指嶺之南麓), 9450, May 5, 1922 and Near Fan Ya (近番也), 9533, May 12, 1922; among shrubs, on tree in heavily wooded ravine; parasite on tree; alt., 400 m.; vine; ht., 1-10 m.; dia., 1-2 cm.; frs. red when ripe.

72-Olacaceae

- 72.2131—OLAX IMBRICATA Roxb.
Near Fan Ya (番也), 9545, May 13, 1912; in partially wooded ravine; shrubs; ht., 2 m.
- 72.2151—ERYTHROFALUM SCANDENS Blume.
Five Finger Mt., (五指嶺), 8647, Dec. 20, 1921 and Yik Tsok Mau (亦作茂), 9707, May 18, 1922; wooded ravine on tree, in clump of shrubs on hillside; alt., 600 m.; vine; ht., 6-8 m.
72. ?
Hong Ma Ts'un (廣馬村), 8316, Dec. 3, 1921; in thicket; alt., 400 m.; bush; ht., 1-1 1/2 m.; frs., reddish yellow, not certain, genus unknown.

73-Balanophoraceae

- 73.2166—BALANOPHORA SP.
Sha Po Ling (沙魯嶺), 8142, Nov. 10, 1921; on rock; alt., 800 m.

74-Aristolochiaceae

- 74.2174—ARISTOLOCHIA HAINANENSIS Merr. SP. NOV.
in PHILIP. JOURN. SCI. 21 (1922) 341.
Five Finger Mt., (五指嶺), 8630, Dec. 11, 1921 and S. slope of Five Finger Mt., (五指嶺之南麓), 9332, Apr. 28, 1922; alt., 1300 m.; vine; ht., 3-6 m.; fls., yellow; frs., come out from main body of the vine.
- 74.2174—ARISTOLOCHIA TAGALA Cham.
Ting On River (定安河), 8852, Apr. 6, 1922 and Shun Ngai (Tung Ngai) on the Ting On River (船崖(東崖)定安河), 8885, Apr. 7, 1922; growing on young "Hoi T'ong Kwo" trees on river bank, among the Pandanus, in sandy waste; alt., 40-50 m.; ht., 2-4 m.; fls., maroon and green.

77-Polygonaceae

- 77.2201—POLYGONUM BARBATUM Linn.
Shui Mun (水門), 9616, May 15, 1922; in gravel in shady ravine; herb; ht., 1 m.; fls., white.
- 77.2201—POLYGONUM CHINENSE Linn.
Shui Mun (水門), 9615, May 15, 1922; in gravel in shady ravine; vine; ht., 2-3 m.; fls., white; frs., blue-black; name reported, Lat liu (辣薯).
- 77.2201—POLYGONUM FLACCIDUM Meisn.
Kam Kong (金江), 7823, Oct. 26, 1921; village commons; herb; fls., white; name reported, Hon lat liu (旱辣薯).

77.2201—POLYGONUM GLABRUM Willd.

Ting On River (定安河), 8916, and 8917, Apr. 8, 1922; on sandy beach and waste near river; alt., 60 m.; ht., 1/3-1 m.; fls., light red, pinkish white; drug plant, the light red flower species prefers a little higher soil than a white flower species of the same genus collected also in this place; Apr. 8, 1920; names reported, *Hung lat liu* (紅辣蓼), *Pat lat liu* (白辣蓼).

Economic specimen of this secured on the Canton market by E. H. Groff under the name of *Pak lat liu* (白辣蓼), C. C. C. Ec. No. 136. The price is about 10 cents per catty L.S. It is reported as coming from Kwangtung proper as well as *Hainan*. It is said to be good for heat rash and relieves itching. An economic specimen of *Hung lat liu* (紅辣蓼), C. C. C. Ec. No. 137, was also secured on the Canton market. It has the same price per catty and the same use as *Pak lat liu* (白辣蓼).

77.2201—POLYGONUM ORIENTALE Linn.

Hoihow (海口), 7581, Oct. 11, 1921; edge of forest; herb; ht., 1 m.; fls., pink; name reported, *Tai lat liu* (大辣蓼).

77.2201—POLYGONUM PERFOLIATUM Linn.

Five Finger Mt., Fan Ya (五指嶺, 番也), 8448, Dec. 7, 1921; moist, shady regions; alt., 1000 m.; vine; fls., blue; leaves steeped in water used as medicine for fever; name reported, *Lo fu li* (老虎腳).

77.2201—POLYGONUM POSUMBU Ham.

T'a Hon (他寒), 9225, Apr. 21, 1922; in shady places along stream; herb; ht., 1/3-1 m.; fls., white; name reported, *Shui lat liu* (水辣蓼).

78—Chenopodiaceae

78.2261—SUAEDA AUSTRALIS (R. Br.) Moq.

Hoihow (海口), 7565, Oct. 12, 1921; sandy waste; herb; fls., yellow.

79—Amarantaceae

79.2289—DEERINGIA AMARANTHOIDES (Lam.) Merr.

Five Finger Mt., (五指嶺), 8538, Dec. 19, 1921; wooded ravine on tree; alt., 600 m.; vine; ht., 10 m.; dia., 3 cm.

79.2292—CELOSIA ARGENTEA Linn.

Nodoa (那大), 7976, Nov. 15, 1921 and *Ka La* (加拉), 9187, Apr. 20, 1922; roadside, along sand and gravel banks of stream; herb; alt., 250 m.; ht., 2/3-1 m.; fls., pink and white, pink when first open, later white to brown; drug plant, leaves used in treatment of boils; names reported, *To kau mi* (土狗尾), *Kau mi t'so* (狗尾草), *Pak yat hung* (百日紅).

79.2292—CELOSIA CRISTATA Linn.

Nga Wan (牙環), 8351, Dec. 7, 1921; in gardens; herb; ht., 1 m.; fls., and leaves, red; said by the Loists to be good for eye and stomach pains; Loist name reported, *Lung fa* (龍花).

79.2298—ALLMANIA NODIFLORA R. Br.

Hoihow (海口), 7526, Oct. 12, 1921 and near *Ting On River* (定安河), 8866, Apr. 6, 1922; sand flat, sand fields and waste places; alt., 40 m.; herb; fls., pink.

79.2299—AMARANTHUS SPINOSUS Linn.

Hoihow (海口), 7613, Oct. 9, 1921 and near *Ting On River* (定安河), 8887, Apr. 7, 1922; dry land, sandy waste; alt., 50 m.; ht., 1/3-20 m.; fls., brownish, grayish green; drug plant, root used in treatment of rheumatism; name reported, *Lak in ts'oi* (勒莧菜).

79.2299—AMARANTHUS VIRIDIS Linn.

Hoihow (海口), 7631, Oct. 9, 1921; roadside; herb; name reported, *Ma shi in ts'oi* (馬齒莧菜).

79.2312—CYATHULA PROSTRATA Linn. Blume.

Kingchow (瓊州), 7557, Oct. 14, 1921 and *Pat Ka Ling* (筆架嶺), 7858, Nov. 1, 1921; thicket, moist, shady roadside; alt., 250 m.; herb; fls., reddish, whitish.

79.2328—ACHYRANTHES ASPERA Linn.

Hoihow (海口), 7574, Oct. 10, 1921 and *Kingchow* (瓊州), 8819, Apr. 5, 1922; dry field, shady place; alt., 10 m.; herb; ht., 1/2-1 m.; fls. greenish, reddish; drug plant; name reported, *To kang t'so* (倒梗草).

79.2339—IRECINE HERBSTII Hook.

Five Finger Mt., Fan Ya (五指嶺, 番也), 8451, Dec. 7, 1921 and 9492, May 8, 1922; in Loist garden, on moist shady hillside; alt., 1000 m.; herb; ht., 1 m.; fls., greenish and leaves red; used sometimes by Loists as vegetable.

80—Nyctaginaceae

80.2347—MIRABILIS JALAPA Linn.

Kingchow (瓊州), 7535, Oct. 14, 1921; in dry thicket; herb; fls., red; name reported, *Shui fan* (水粉).

80.2349—BOERHAAVIA REPENS Linn.

Hoihow (海口), 7577, Oct. 11, 1922; on top of city wall; vine; fls., purple.

80.2354—PISONIA ACULEATA Linn.

Kingchow (瓊州), 7649, Oct. 14, 1921; edge of bamboo thicket, dry; vine; ht., 3 m.; fls., yellowish white.

84—Aizoaceae

84.2387—MOLLUGO OPPOSITIFOLIA Linn.
(M. SPERGULA Linn.)

Ting On River (定安河), 8897, Apr. 7, 1922; sandy waste; alt., 50 m.; fls., white.

84.2387—MOLLUGO PENTAPHYLLA Linn.
(M. STRICTA Linn.)

Ting On River (定安河), 8895, Apr. 7, 1922; sandy waste; herb; ht., 50 m.; fls., yellow.

85—Portulacaceae

85.2421—PORTULACA OLERACEA Linn.

Nam Fung (南風), 8258, Nov. 28, 1921; on rocks; alt., 275 m.; herb; name reported, *Kwa tsz t'soi* (瓜子菜).

86—Basellaceae

86.2424—BASELLA RUBRA Linn.

Hainan, Ting On River (海南, 定安河), 8914, Apr. 8, 1922; alt., 60 m.; ht., 2-3 m.; fls., white-tipped with pink lavender; frs., black, purple; drug plant, when the branches are young they are sometimes eaten by the natives as vegetable; names reported, *T'ang t'soi* (藤菜), *Shan t'soi* (潺菜).

87—Caryophyllaceae

87.2452—DRYMARIA CORDATA (Linn.) Willd.

Five Finger Mt., Fan Ya (五指嶺, 番也), 8422, Dec. 9, 1921, *Hainan, Ka La, T'a Hon* (海南, 加拉他寒), 9215, Apr. 21, 1922; moist edge of stream, in moist shady ravine; herb; ht., 20-25 cm.; fls., greenish; name reported, *Yau mai t'so* (有米菜).

87.2453—POLYCARPON INDICUM (Retz.) Merr.

(P. LOEFLINGIAE Edgw. & Hook. f.)

Hainan, Ting On River (海南, 定安河), 8898, Apr. 7, 1922; sandy waste; alt., 50 m.; fls., green.

87.2455—POLYCARPAEA CORYMBOSA (Linn.) Lam.

Hoihow (海口), 7564, Oct. 12, 1921, *Hainan, Ting On River* (海南, 定安河), 8858, Apr. 6, 1921; sandy waste; alt., 40 m.; herb; ht., 20 cm.; fls., pinkish white.

87.2490—SILENE FORTUNEI Vis.

Hoihow (海口), 7819, Oct. 24, 1921; sandy waste adjoining beach; herb; fls., pink.

88 Nymphaeaceae

88.2513—NYMPHAEA STELLATA Willd.

Hoihow (海口), 7603, Oct. 12, 1921; in pond; herb; fls., white; name reported, *Shui fau tin* (水浮蓮).

91 Ranunculaceae

91.2542—CLEMATIS LESCHENAUETH DC. var.

DENTICULATA Merr. var. nom. nud.

Five Finger Mt. (五指嶺), 8614, Dec. 22, 1921; wooded ravine; alt., 950 m.; vine; ht., 4 m.; dia., 1 cm.

91.2542—CLEMATIS MEYENIANA Walp.

Hainan, Wong chuk, Tung Ngai (海南, ? 東崖), 7776**, 9802, June 1, 1922; on shrubs at roadside; vine; ht., 2-3 m.; fls., white, fragrant.

91.2548—THALICTRUM PHILIPPINENSE C. B. Rob.

Five Finger Mt. (五指嶺), 9399, May 1, 1922; in moist shady nook on cliff; name reported, *Sun mi t'so* (酸味草).

94—Menispermaceae

94.2568—PERICAMPYLUS GLAUCUS (Lam.) Merr.

Hainan, Fan Ta (海南, 番打), 9184, Apr. 18, 1922; growing on bamboo at edge of ravine; vine; ht., 4-5 m.; fls., greenish; name reported, *Chu t'soi t'ang* (猪菜藤).

94.2572—STEPHANIA JAPONICA (Thunb.) Miers.

Five Finger Mt. (五指嶺), 9812, May 1922; growing on shrubs at roadside; vine; ht., 3-4 m.

94.2576—CYCLEA HAINANENSIS SP. NOV.

in PHILIP. JOURN. SCI. 23 (1923) 240.

Hainan, Yik Tsok Mau (海南, 亦作茂), 9698, May 18, 1922; on tree in wooded ravine; vine; ht., 5-6 m.; fls., white with pink stems.

94.2603—ARCANGELISIA LOUREIRI (Pierre.) Diels.

Hainan, Fan Ta (海南, 番打), 9159, Apr. 19, 1922; on shrub at edge of stream; vine; ht., 8-10 m.; fls., greenish yellow.

95—Magnoliaceae

95.2651—MANGLIETIA FORDIANA Oliv.

Hainan, Fan Ya to Yik Tsok Mau (海南, 番也至亦作茂), 9652, May 17, 1922; tree; ht., 8 m.; dia., 10 cm.; fls., white.

95.2653—MICHELIA MAUDIAE Dunn.

Five Finger Mt. (五指嶺), 8593, Dec. 16, 1921; tree; ht., 35 m., dia., 90 cm.; frs., seeds red.

95.2655—KADSURA HAINANENSIS Merr. SP. NOV.

in PHILIP. JOURN. SCI. 23 (1923) 240.

Fan Ya (番也), 9524a, May 10, 1922 and *Fan Ta* (番打), 9542, May 13, 1922; on shrubs at roadside and on tree in thicket; vine; ht., 10 m.; fls., immature, white edged with dark red fading into pink (some juvenile); frs., red; this vine used by the Lois to lead their water buffalo.

95.2655—KADSURA OBLONGIFOLIA Merr. SP. NOV.

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Nodoa, Pat Ka Ling (那大, 筆架嶺), 7866, Nov. 1, 1921 and *Nodoa* (那大), 7973, Nov. 15, 1921 and 8011, Nov. 21, 1921; edge of thicket on shrubs, moist roadside on bushes and shrubs; alt., 250 m.; vine; fls., red; fr. red.

95.2657—ILLICIAM CAMBODIANUM Hance.

Five Finger Mt., (五指嶺), 9383, May 1, 1922; in dense thicket; tree; ht., 5 m.; dia., 4 cm.; fls., white.

95.2657—ILLICIAM SP.

Five Finger Mt., (五指嶺), 9501, May 9, 1922 and 9535, May 11, 1922; wooded ravine; tree; ht., 5 m.; dia., 20 cm.; frs., greenish-yellow, some deformed; collected with galls.

95—Anonaceae

98.2673—UVARIA CALAMISTRATA Hance.

Five Finger Mt., (五指嶺), 8634, Dec. 24, 1921; wooded ravine on tree; alt., 600 m.; vine; ht., 20 m.; dia., 4 cm.

98.2673—UVARIA MICROCARPA Champ.

Nodoa (那大), 7695, Nov. 1, 1921, *Hainan, Yik Tsok Mau* (海南, 亦作茂), 9697, May 18, 1922; roadside, on large tree in wooded ravine; shrub; ht., 15 m.; dia., 5-8 cm.; fls., dark red with yellow center.

98.2673—UVARIA PURPUREA Blume.

Ting On River (定安河), 8922, Apr. 8, 1922 and *Hainan, Tai Wan, San Hu* (海南, 大環, 新墟), 8944, Apr. 10, 1922; grassy, shrubby waste; alt., 60 m.; ht., 1-3 m.; fls., deep red with yellow center, very fragrant; leaves used to make cakes and rice whisky; also makes a fine ornamental; names reported, *Sai Tang Chau Kung* (細藤周公), *Tai Tang Chau Kung* (大藤周公), *Kok Lok Tsz Tang* (各駱子藤), *Tai Kok Lok Tsz Tang* (大各駱子藤).

McClure reports, "Wine cakes are small; dry cakes of varied composition used in the manufacture of rice wine, their purpose being the same as that of yeast cakes added to bread dough, namely to encourage fermentation."

98.2673—UVARIA SP.

Hainan, Ooi Diok (海南, ?), 8784, Oct. 11, 1921; roadside; bush; ht., 1½ m.; dia., 3 cm.; fls., yellow and maroon.

98.2689—DESMOS COCHINCHINENSIS Lour.
(D. CHINENSIS Lour.)

Tai Tsing (大井), 7796, 7980**, Oct. 25, 1921, *Ting On River* (定安河), 8918, Apr. 8, 1922 and 8982, Apr. 9, 1922, *Fan Ya* (番也), 9296, Apr. 26, 1922 and 9298, Apr. 26, 1922; roadside, grassy rolling land among scanty shrub growth, edge of thicket, among shrubs on hillside; alt., 60-70 m.; bush; ht., 2/3-2½ m.; fls., green to yellow, very fragrant; frs., yellow when ripe, salmon pink; this plant is also cultivated in flower gardens by the Chinese; names reported, *Kau nga fa* (狗牙花), *Ka ying chau* (假鷹爪).

98.2690—POLYALTHIA CONSANGUINEA Merr. SP. NOV.
in PHILIP. JOURN. SCI. 23 (1923) 243.

Nodoa, Sha Po Ling (那大, 沙堡嶺), 8192, Nov. 11, 1921, *Five Finger Mt.*, (五指嶺), 9323, Apr. 28, 1922 and 9508, May 9, 1922; moist shady ravine; alt., 450 m.; tree; ht., 3-10 m.; dia., 3-20 cm.; fls., yellowish white.

98.2690—POLYALTHIA CRASSIPETALA Merr. SP. NOV.
in PHILIP. JOURN. SCI. 23 (1923) 243.

Hainan, Notia (海南, 和舍), 8976, Apr. 11, 1922; between deserted fields in dry land; ht., 5 m.; fls., greenish and yellow, very fragrant; frs., said to be edible; flowers collected for their fragrance; name reported, *Lo yan pi* (老人皮).

98.2690—POLYALTHIA SUBEROSA Hook f. & Thunb.

Hoihow (海口), 7584, Oct. 11, 1921, *Kingchow* (瓊州), 8845, Apr. 5, 1922; roadside; alt., 10 m.; bush; ht., 1-7 m.; dia., 20 cm.; fls., greenish and yellowish; frs., black when ripe; name reported, *Kai chau shu* (雞爪樹).

98.2712—MITREPHORA MAINGAYI Hook f. and Th.

Five Finger Mt., (五指嶺), 8499, Dec. 23, 1921, *Hainan near Shui Mun* (海南, 近水門), 9593, May 14, 1922; wooded ravine, on bank of stream; alt., 800 m.; tree ht., 7-10 m.; dia., 10-20 cm.; frs., white and lavender when fresh, yellow when old, very fragrant; fruits edible; name reported, *Shan tsiu* (山燕).

98.2724—ARTABOTRYS UNCIATUS (Lam.) Merr.

Hainan, Nga Wan, Yik Tsok Mau (海南, 牙環, 亦作茂), 9262, Apr. 23, 1922; on shrubs near stream; vine; ht., 4-5 m.; fls., green and yellow, very fragrant; name reported, *Ying chau* (鷹爪).

98.2725—FISSISTIGMA MACLUREI Merr. SP. NOV.
in PHILIP. JOURN. SCI. 21 (1922) 342.

Five Finger Mt., Fan Ya (五指嶺, 番也), 8420, Dec. 9, 1921, *Yik Tsok Mau* (亦作茂), 8460, Dec. 24, 1921, *Five Finger Mt.*, (五指嶺), 8512, Dec. 22, 1921, *Fan Ya* (番也), 9543, May 13, 1922; mt. forest, wooded ravine; alt., 600-1200 m.; vine; ht., 1½-3 m.; fls., yellow and maroon inside, black outside; frs., immature fruit covered with dark brown fur-like-pubesence.

98.2725—FISSISTIGMA OLDHAMII (Hemsl.) Merr.

Nam Fung (南風), 8290, Nov. 30, 1921; ravine on trees; alt., 275 m.; vine; ht., 10 m.

98.2725—FISSISTIGMA (MELODORUM) MACLUREI SP. NOV.
in PHILIP. JOURN. SCI. 23 (1923) 241.

Hainan, Yik Tsok Mau, (海南, 亦作茂), 9733, May 19, 1922; on bushes by roadside, in wooded ravine; vine; ht., 10-15 m.; dia., 30 cm.; fls., brown; frs. brown; name reported, *Shan tsiu* (山燕).

98.2725—FISSISTIGMA OBTUSIFOLIUM SP. NOV.
in PHILIP. JOURN. SCI. 23 (1923) 242.

Hainan, near Fan Ya (海南, 近番也), 9606, May 14, 1922.

102—Lauraceae

102.2782—CINNAMOMUM INERS Reinw.?

Hainan, Yik Tsok Mau (海南, 亦作茂) 9715, May 19, 1922; in wooded ravine; ht., 3 m.; dia., 4 cm.; grows to be a large tree, the wood is used by the Laos in building, and is considered by them very good.

102.2782—CINNAMOMUM PEDUNCULATUM Nees.

Nodoa, Lin Fa Ling (那大, 蓮花嶺), 7910, Nov. 3, 1921, *Nodoa* (那大), 7956, Nov. 9, 1921, *Hainan, Oo P'o to Shun P'O* (海南 ?), 9776, May 1922; ravine alt., 250-400 m.; ht., 4-8 m.; dia., 15-18 cm.; frs., blue; names reported, *Kwai shu* (桂樹).

102.2784—MACHILUS HAINANENSIS Merr. SP. NOV.

in PHILIP. JOURN. SCI. 21 (1922) 342.

Mi Ting (美亭), 7674, Oct. 26, 1921 and *Nodoa* (那大), 7957, Nov. 9, 1921; edge of thicket, roadside; alt., 250 m.; tree; ht., 1-3 m.; fls., brownish white, very fragrant; the sap is used by women on their hair, names reported, *Pau fa* (刨花), *Cha kau shu* (茶膠樹).

102.2784—MACHILUS ODORATISSIMA Nees.

Nam Fung (南風), 8284, Nov. 30, 1921, *Hainan, T'a Hon, Nga Wan* (海南, 他寒, 牙環), 9228, Apr. 22, 1922; along stream, in ravine; alt., 275 m.; tree; ht., 7-10 m.; dia., 15-35 cm.; fls., purplish black when ripe; name reported, *Ka cheung shu* (假樟樹).

102.2785—PHOEBE HAINANENSIS Merr. SP. NOV.

in PHILIP. JOURN. SCI. 21 (1922) 343.

Five Finger Mt., (五指嶺), 8589, Dec. 21, 1921; wooded ravine; alt., 700 m.; tree; ht., 7 m.; dia., 20 cm.

102.2798—LITSEA CUBEBA (Lour.) Pers.

Nodoa, Lin Fa Ling (那大, 蓮花嶺), 7815, Nov. 2, 1921 and *Five Finger Mt.*, (五指嶺), 9554, May 13, 1922; open hillside, in forest; tree or shrub; ht., 3 m.; dia., 8 cm.; fls., immature; roots used to make a medicine to be taken after child birth; name reported, *Shan ch'ong shu* (山蒼樹).

102.2798—LITSEA GLUTINOSA (Lour.) C. B. Rob.

Enroute *San Hu to Ling Mun* (新墟到嶺門), 9767, May 27, 1922; in ravine; ht., 5-6 m.; dia., 10 cm.; fls., brownish yellow; name reported, (野膠樹).

102.2798—LITSEA GLUTINOSA C. B. Rob. var.

BRIDELIFOLIA (Hayata.) Merr.

West of Notia (西和舍), 8984, Apr. 11, 1922; in waste land; ht., 2-3 m.; dia., 2-4 cm.; fls., yellow; bark used in making incense; name reported, *Ye kau Shu* (野膠樹).

102.2798—LITSEA LANCILIMBA Merr. SP. NOV.

in PHILIP. JOURN. SCI. 23 (1923) 244.

South slope of Five Finger Mt., (南斜之五指嶺), 9353, Apr. 29, 1922; wooded ravine; ht., 8 m.; dia., 20 m.; frs., purple; wood very tough, name reported, *Pat kok* (八角).

102.2798—LITSEA MACLUREI Merr. SP. NOV.

in PHILIP. JOURN. SCI. 23 (1923) 244.

Five Finger Mt., (五指嶺), 8658, Dec. 22, 1921, 9360, Apr. 29, 1922 and 9586, May 14, 1922; mountain side forest, in wooded ravine; alt., 900 m.; tree; ht., 5-10 m.; dia., 10-12 cm.; fls., white; frs., bluish.

102.2798—LITSEA POLYANTHA JUSS.

Nodoa, Pat Ka Ling (那大, 筆架嶺), 7814, Oct. 30, 1921, *Nodoa, San Ts'un* (那大, 新村), 8002, Nov. 15, 1921 and *Fan Ya* (番也), 9516, May 9, 1922; in thicket, roadside near village, in partially wooded ravine; alt., 250 m.; shrub, tree and vine; ht., 3-7 m.; dia., 8-20 cm.; frs., purplish; bark used by Lois as thongs in erecting buildings, the Lois say, "The juice of the tree causes violent itching if it comes into contact with the skin;" Chinese name reported, *Ye po lo* (野菠蘿).

102.2798—LITSEA SP.

Nodoa, Yau Ma Wo (那大, 油麻和) 8123, Nov. 11, 1921 and *Yik Tsok Mau* (亦作茂), 9730, May 19, 1922; roadside thicket, in wooded ravine; alt., 250 m.; tree; ht., 7 m.; dia., 10 cm.; fls., white, fragrant, immature; frs., immature.

102.2801—BEILSCHMIEDIA ERYTHROPHLOEA Hayata.

Nodoa, Sha Po Ling (那大, 沙婆嶺), 8158b, Nov. 10, 1921; mt. side thicket; alt., 800 m.; tree; ht., 12 m.; dia., 60 cm.; frs., black when ripe.

102.2813—CRYPTOCARYA HAINANENSIS Merr. SP. NOV.

in PHILIP. JOURN. SCI. 21 (1922) 343.

Five Finger Mt., (五指嶺), 8707, Dec. 20, 1921; mt. side forest; alt., 700 m.; tree; ht., 15 m.; dia., 35 cm.; the wood is said to be very hard, but is not yet put to any use.

102.2813—CRYPTOCARYA MACLUREI Merr. SP. NOV.

in PHILIP. JOURN. SCI. 21 (1922) 344.

Five Finger Mt., (五指嶺), 8508, Dec. 22, 1921 and 9557, May 13, 1922; wooded ravine; alt., 1000 m.; tree; ht., 10-20 m.; dia., 15-20 cm.; fls., greenish, inconspicuous.

102.2813—CRYPTOCARYA OBTUSIFOLIA Merr. SP. NOV.

in PHILIP. JOURN. SCI. 21 (1922) 344.

Five Finger Mt., (五指嶺), 8581, Dec. 21, 1921 and *Hainan, Yik Tsok Mau* (海南, 亦作茂), 9682, May 18, 1922; wooded ravine; alt., 700 m.; tree; ht., 8-10 m.; dia., 12-30 cm.; frs., black.

102.2813—CRYPTOCARYA SP.

Five Finger Mt., (五指嶺), 9553, May 13, 1922; in forest ravine; tree; ht., 12 m.; dia., 30 cm. Mr. Merrill reports: "Perhaps C. CAESIA Blume, but my specimen presents neither flowers nor fruits."

102.2825—CASSYTHA FILIFORMS Linn.

Tai Un (大園), 7842, Oct. 26, 1921; roadside, parasite; fls., white.

ERRATA, PAGES 27-85

- Page 31, third species. For 8644 read 8664,
 Page 33, eighth species. For *Mai Kun Tsun* read *Mai Kun Ts'un*.
 Page 35, tenth species. For *Hong Ma Tsun* read *Hong Ma Ts'un*.
 Page 36, tenth species. Same correction as above.
 Page 37, eighth species. Same correction as above.
 Page 39, fifth species. For TECTARIA CIRCUTARIA read
 TECTARIA CUCUTARIA
 Page 43, footnote * should appear at the foot of page 42.
 Page 56, fourth species. For *Ka Lai* read *Ka La*.
 Page 63, family 42 should read 43.
 Page 64, fifth species should read COMB. NOV.
 Page 65, first species should read COMB. NOV.
 Page 66, family 9 should read 49.
 Page 70, second species. For SP. read SP. NOV.
 Page 77, family 72, for OLACACEAE read OLEACEAE.

This Enumeration will be
 continued in the next
 issue of the Review.

REVIEWS AND ANNOUNCEMENTS

(RECEIVED FOR PUBLICATION DEC. 10, 1923)

A PRELIMINARY LIST OF THE ACRIDIDAE OF CHINA. H. S. Chong, China Journal of Arts and Sciences, Vol. 1, No. 5, Page 486. An attempt to gather together the names of all the species of acrididae that have been described or mentioned as occurring in China. This list includes 84 species. The article is continued.

GAME PRESERVATION IN CHINA. China Journal of Arts and Sciences, Vol. 1, No. 5, page 476. A very timely editorial on the necessity of adequate laws and enforcement of such laws for the protection of birds and mammals in China in order that many desirable species may not be exterminated.

TREES AND SHRUBS OF ST. JOHN'S UNIVERSITY CAMPUS. W. M. Poterfield, China Journal of Arts and Sciences, Vol. 1, No. 5, page 494. Chinese characters and romanization, as well as Latin and common names of 100 plants are given. Six excellent cuts of trees and shrubs accompany the article.

WHAT IS THE CHINA PONY? Barthan De C. Sowerby. China Journal of Arts and Sciences, Vol. 1, No. 6, page 582. In this paper, which contains four excellent cuts of the China or Mongolian pony and one chart, the author calls attention to the lack of general agreement as to just what is the "China Pony". Some of the characteristics of the China Pony are noted and measurements of ponies are suggested as a basis of definition.

THE LYCHEE AND LUNGAN. By George Weidman Groff, Orange Judd Company, New York City; Kegan Paul, Trench, Trubner & Co., London; Canton Christian College, Canton, China; 1921. \$5.00.

The lychee is one of the most popular fruits of China; and the lungan is its fascinating little brother, known by the Chinese as the "dragon eye." For sixteen years the writer has lived in the famous *Ling Nan* section, one of the two most famous lychee producing regions of China. This 188 page work represents the result of his investigations carried out during this period. The 68 illustrations and 1 color plate picture this interesting land, and the culture of these fruits, in an elegant manner.

The book is a comprehensive study of the botanical, horticultural and historical aspects of these fruits. The botanical position of the group is clearly defined and the species are accurately described. Lychee and lungan relatives of promise as stocks for grafting or of value in hybridizing are also considered. The discussion of soils, Chinese methods of propagation, enemies and varieties add greatly to our horticultural knowledge

of these fruits. And it is most interesting to find that the Chinese poets and writers who have sung praises to the lychee for centuries, or who have written of these fruits in the home, in medicine or in commerce, are frequently cited or quoted.

Travellers to China from the earliest times have reported the merits of the lychee. Many of these have been quoted in the body of the work or cited in the bibliography. The student of geography or world affairs will find much of interest regarding South China and its industrious people who have carried, in the dried form known as "Chinese or lychee nuts", the gospel of their favorite fruit to the ends of the earth. One of the most helpful features of the work is the accurate romanization of Chinese names in both Mandarin and Cantonese, and the Chinese characters which always follow in parenthesis.

The western horticulturist has had little acquaintance with the fruits of this family. It is a surprising fact that among the varied fruits of the Western Hemisphere one does not find a single cultivated species of this group which for centuries has provided the thickly populated regions of Southern Asia and the East Indies with several of their most delicious and refreshing fruits. Some of these would certainly be worthy additions to the fruits now on the markets of the western world. Problems in the introduction of the lychee and lungan into other lands is fully discussed as is also the history of these introductions. Climatic requirements are fully covered. One valuable suggestion is that of growing the lychee as a greenhouse ornamental all over the United States.

There has been considerable advance in the scientific study of the lychee. Credit is due Dr. Frederick V. Coville for the discovery of mycorrhizal fungi growing on the roots of the lychee. This suggests the probability that an acid soil is essential for successful culture. Chinese methods of propagating the lychee have never been highly satisfactory from a western point of view. Mr. Edward Goucher has finally worked out a most unusual process for rooting lychee cuttings by means of high temperature and high humidity. This may revolutionize the processes of propagating other sub-tropical and tropical fruits. These men have discussed their work in appendices. Here also will be found a statement by Dr. Walter T. Swingle of his observations on the Lack of Winter Dormancy and Low Zezo Point of Growth of the Lychee which should prove helpful in the culture of the lychee in Florida. Mr. Michael J. Hagerty's clear translation, recording the organization of a Lychee Club as early as the Ming Dynasty is of unusual interest. Sung Chio's account of this club was included in his treatise written on the lychee in 1608. There are cited no less than twelve standard Chinese monographs on the lychee including illustrations and quotations of the earliest, that of Ts'ai Hsiang composed in 1059.

The appendices also include bibliographies of Chinese and Western References, a Canton weather table, a list of present-day varieties of Kwangtung lychee and lungan and analyses of lychee and lungan fruits. The work is concluded by a detailed description of illustrations and by a very complete index.

AGRICULTURAL NOTES

(RECEIVED FOR PUBLICATION DEC. 20, 1923)

Agronomy

The Agronomy Department is giving special attention to the improvement of rice and to fertilizer experiments. The work in rice improvement began two years ago. It consists of variety tests, seed selection, fertilizer tests, and its botanical and agronomic study. Records are kept of all these experiments and will be published. In the first season of 1923, 31 Philippine, 8 American and 22 Chinese varieties were tried. In the second crop season of the same year, 22 Chinese, 52 Philippine, 9 American, 4 Java, and 1 Siam variety of rice were grown. All these are lowland types and a few are glutinous and beared. Many show striking differences in maturity and in botanical characteristics, especially the foreign varieties.

Commercial fertilizers are more and more being used in South China for crop production. Several large commercial fertilizer companies, both foreign and Chinese, are cooperating with the College for carrying on fertilizer tests. The Department of Agronomy, in cooperation with the American Cyanamid Co. of New York City, has just completed a test with ammo-phos fertilizer. Dodwell & Co. of Great Britain has given us Peruvian guano, fish guano and ammonium sulphate for testing. These have been tried on mulberry fields on a small scale, and the results will soon be reported. From the American Agricultural Chemical Company of New York we have received several packages of Bowker's lawn and garden dressing. Other companies have likewise furnished commercial fertilizers. Several experiments are now under way and plans are being made to greatly enlarge this important work.

The organization of a Fertilizer Testing Station is now being planned. The primary object of this Station will be to assist the Ling Naam Agricultural College in serving exporting and importing firms in the introduction and the farmers of South China in the use of commercial fertilizer. The prospectus of this Station will be sent to all firms interested in commercial fertilizers.

Of all leguminous crops tried out thus far, the most successful are the pigeon pea and the velvet bean, both of which are now grown on a comparatively large scale, the former by the Horticulture and the latter by Animal Husbandry Departments. The pigeon pea, also known as Porto Rican bean, is grown mainly as a forage crop for cows, and the velvet bean is used chiefly as a green manure crop.

Animal Husbandry

During the summer of 1923 a silo was built by the Animal Husbandry Department. This is the first silo in South China outside of Hongkong and the second in China, one being located near Peking. The College silo is 13 feet in diameter and 24 feet high, inside measure-

ments, and should contain 50 tons of silage. The first filling of the College silo has been made with guinea grass, pigeon pea (*Cajanus cajan* or *C. indicus*), and native grasses. The grass was all cut and chopped by hand.

The Papec Machine Co. of Shortsville, New York, are contributing to the work of this department an ensilage cutter which will be available for filling the silo in 1924.

Recently a herd of 22 Indian dairy buffaloes of the "Murra" or "ram's horn" breed, originally from Delhi, India, was secured by the College.

Contributions of four Holstein heifers to the College herd have recently been made through Dr. H. J. Waters of the Kansas City Weekly Star by the following prominent breeders of Holsteins in America: Mr. H. C. Barker, The Ona Company, Chardon, Ohio; Governor Frank O. Lowden, Oregon, Illinois; and John R. Bell, Pittsburg, Penn. The stock is expected to arrive in January, 1924.

Horticulture

The papaya introduced by the college from Hawaii some years ago is becoming well established on certain sections of Honam island and is rapidly spreading to other parts of the province. There is an increasing demand on local markets for the so-called "Lingnaam papaya."

The cape gooseberry, more recently introduced, is proving equally at home here and the College of Agriculture had an unusually large production last year which it used in the manufacture of jams and jellies. This and roselle, introduced some years ago, are valuable bush fruits of acid flavor which will be more and more appreciated by the Chinese in the years to come.

The citrus introduction station established several years ago in co-operation with the United States Department of Agriculture is still maintained at the college. The grove is in good condition and a reading on the trees, which heretofore have not been allowed to set their fruits, will be made during next year. One limequat tree, a citrus hybrid (48798 Limequat on *Citrus mitis*, 5-15-19) of the Office of Crop Physiology and Breeding Investigations has fruited most profusely this year and seems to be perfectly at home in this climate. The *Cb'iu chau sun kat* (潮州酸桔), which we brought to Canton from the Swatow region in 1918 is doing exceedingly well on our upland soil and may prove one of the best stocks for citrus culture on the hill lands of South China. Present studies indicate that this is possibly a form of *Citrus mitis* Blanco. The fact that it is very hardy makes it a promising stock for the colder regions of Kwantung. The Swatow orange growers apparently discovered this years ago and it is doubtless one of the secrets of their success with the famous so-called "Swatow" mandarin orange. Many other interesting forms of pummelo, orange, mandarin orange and citrus relatives will be found in the citrus introduction station and on the campus of the college. Southeastern China is the home of citrus fruits and this is doubtless one of the best places in the world for their study.

The Department of Horticulture in co-operation with the Business Division has recently issued a seed and nursery catalogue, listing most of the plants of the college campus under their Latin and Chinese names. The present publication does not attempt to describe the species and varieties but merely to list them as flowers, vegetables, fruits, potted ornamentals, trees, shrubs, and farm seeds. Following the lists of seeds and plants under this classification there is given a philogenetic classification according to the Engler and Prantl and Dalla Torre and Harms numbers as described in "A Method of Indexing and Filing Chinese Plants" in Vol. 1 No. 1, of the Lingnaam Agricultural Review. We are attempting to tag the plants of the Canton Christian College with these numbers, as also all plants and seeds going out from College. This will enable us to test the system under practical field conditions. It has already proven highly successful in the herbarium. This seed and nursery catalogue is Bulletin No. 8 of the Lingnaam Agricultural College series and will be sent by the Publication Office to those interested for 40 cents in stamps or currency.

The Department of Horticulture also wishes to announce the publication of Agricultural Bulletin No. 4, *A Garden Guide for South China* by Walter Leon Funkhouser. This deals with garden practices suitable for South China, garden pests and remedies. The vegetable and flower garden are also treated with cultural directions and calendars for this region. Some ornamental and forest trees are also considered. The bulletin is proving a very popular one to the home gardener. This publication is also available by addressing the Publication Office of the Lingnaam Agricultural College and sending 40 cents in stamps.

The department has prepared for the United States Consular Service a brief report on the 1923 fruit crop of the province. It is very difficult to secure accurate statistics of this nature and these are general observations of our staff. This year the *lychee* and *lungan* crops at time of flowering seemed exceedingly promising. At the opening of the typhoon season the crop was about 70% normal and a good year was expected. But the typhoons coming on just at the time of the ripening of the fruit reduced the income from the lychee crop to about half the normal. For a time prices were very low on local markets due to the difficulties of transporting the crops. The *Wai chi* (淮枝) variety at one time this year sold as low as \$3 and \$4 local silver per picul, an unusually low price. The *lungan* crop which appears a few weeks after the later varieties of lychee was damaged by the many typhoons even more than the lychee. *Carambola* (*Averrhoa carambola* Linn.) blossomed and fruited very poorly for the first crop but the second crop was better, about 70% normal. The production of *custard apples* (*Anona squamosa* Linn.) is increasing in the province. This year the fruiting was normal but the typhoons did much damage. The citrus industry is not making much progress in spite of the unusually high prices received for citrus fruits during the past few years. This year *oranges*, *pummelo*, *mandarin oranges* and

kumquats all seemed especially promising in the early season. But as these fruits do not mature until the fall they were affected by the eight or ten typhoons which visited the province. The result is a 50 to 60% normal crop. An unusually poor year is reported for *Chinese Olives* (*Canarium album* (Lour.) Raeich and *Canarium pimela* Koen.) the so-called *white* and *black olives*. *Chinese apricots* (*Prunus mume* S. & Z.) fruit in the spring and the yield this year was unusually heavy. The average price per picul is about \$12 local silver, but this year they brought only \$4 or \$5. There has been an exceedingly good crop of *persimmons* of all varieties this year. The yield of *sand pears* has been medium. *Peaches* bloomed and fruited well but in March a drought developed which caused many of the fruits to dry on the branches and the harvest was only about 30% normal. The crop of *plums* was only 40 to 50% normal. Kwangtung does not produce large quantities of good *mangoes*. This year the trees bloomed exceedingly well but the cold weather reduced the crop to below normal. Plantings of *pineapple* are increasing in the province. This year the crop was 80 to 90% normal. Due to the recurrence of typhoons during the summer the damage to *banana* was very great. The crop was especially weak in *Heung Shan* (香山) district. Prices have been very high. The province had about a 50% normal crop of *Wongpei* (*Clausena lansium* (Lour.) Skeels). There are doubtless few places in the world that produce as large crops of this fruit as South China and during the past year the prices have been very high. *Papaya* is now produced in the province in increasing quantities but suffers exceedingly from typhoons. This year the unusually fine crop was greatly damaged and many trees were completely destroyed.

For a number of years work in the introduction of foreign vegetables for commercial production has been carried on. In this work we have established a number of facts never published. *Sweet corn*, *tomato*, and *celery* should be mentioned as especially successful. With irrigation *sweet corn* can usually be grown in Kwangtung throughout the year. *Early Mammoth* is best for spring planting, *Country Gentleman* for summer and *Stowell's Evergreen* for winter. The last crop is the best of the year. Chinese vegetable gardeners, in this region, plant a spring crop only. The tomato is quite at home in this territory. The *Stone* variety seems to do the best in the College gardens, and the people prefer it to other varieties because the fruit does not crack at the stem end. The *Golden Self-blanching* variety of celery is doing fairly well at the College, although it does not blanch completely. Trenching does not always prove successful due to a tendency to cause rot. Lima beans, beets, kohlrabi and parsley succeed quite well when planted during the fall months.

One of the great difficulties we have in growing early vegetables is the control of weather conditions. During the latter part of September and October the weather is very favorable for starting early vegetables. But cold weather often comes before we can mature the crop, or young seedlings may be killed outright. At other times continuous warm

weather stunts the growth of seedlings of those vegetables which prefer a cooler climate. Again, warm climate favors the work of insects. Facilities for temperature control is one of the present great difficulties of the Department of Horticulture and greenhouses are badly needed.

Sericulture

The Department of Sericulture expects, early in the coming February, to begin the construction of a building to house a model filature for reeling cocoons. The building with its equipment is a gift from Mr. Eugene Atwood the former president of the Atwood Machine Co., Stonington, Conn., U.S.A. and will be called the Eugene Atwood Reeling Laboratory.

Besides a model filature of fifty basins where the most approved methods of unwinding cocoons will be investigated and demonstrated on a commercial bases, there will be rooms for the testing of raw silk, for the storage of cocoons and silk, class rooms, laboratories, offices and research rooms for advanced students.

In the basement will be a cold storage plant of two tons capacity for keeping silk worm eggs over the warm winters of South China at an even, temperature. This cold storage plant has been given by Mr. Edward E. Bradley, Vice-President of the Atwood Machine Co.

It is intended that this plant shall be a model not only as to methods of work which it will demonstrate but also as to construction and mechanical equipment which can be copied by those now owning filatures or those who may be planning to erect new filatures, in Kwangtung.

A general survey of the Sericulture of South China is at present being made by the Sericulture Department of the College. The Survey was made possible by Governor Liao Chung Hoi, who furnished the funds needed and has helped in every other possible way to make the Survey a success. For about a month eight men concentrated on an intensive survey of the silk industry of San Tak District which is the heart of South China's silk region. Then, for the next four months, several men made extensive trips into the outlying districts. In every district they met with hearty cooperation on the part of the magistrates, the postal officers and the farmers. The survey is now nearing completion and the complete report will be published at an early date.

The Civil Governor of Kwangtung Province has authorized the organization of a provincial bureau for assisting the people in the province in improving their sericultural industry. This bureau is to be known as the Kwangtung Provincial Bureau for the Improvement of Sericulture. The main offices are located on the campus of the Ling Naam Agricultural College, with the Head of the Department of Sericulture of that College as the Director of the Bureau. This close affiliation of the Bureau and the College will, it is thought, give a greater impetus to the work of sericulture improvement in as much as the Department of Sericulture of the College has been working on this problem for the past 5 years and has created a demand on the part of the farmers for the work

The Bureau has the power to supervise all the work of certified egg production in the province, even to the point of licensing all egg merchants, as well as to employ every effort for the improvement of mulberry production and filature practice. The Bureau is supported by appropriations from the Provincial Government and has as advisors a Board composed of representatives from the Government, the Ling Naam Agricultural College, and from several organisations of business men who are vitally interested in the silk industry.

Hookworm Investigations

The work in the study of hookworm disease reported in the last issue of the Review has continued. Dr. Frank Oldt of the United Brethern Mission and Canton Hospital is initiating this work and a Committee on Hookworm Investigation has been established within the Canton Christian College in order to encourage and facilitate the project. Last year's investigations revealed that a large percentage of farm laborers coming in from the districts to work on the college farm are infected with hookworm and other intestinal parasites. All farm hands have been treated by Dr. Oldt and Dr. Cadury. And the Hookworm Committee is encouraging further research. Tests are being made by the Agronomy Department to determine the effect of storing and mixing with earth, on the fertilizing value of night soil and of the effect on hookworm eggs and larva in night soil thus treated.

Dr. Ernest Carroll Faust of the Peking Union Medical College spent two weeks at the College last May and gave to students and Canton physicians a very helpful course in parasitology. He has also instructed the staff in methods of differentiation of hookworm larvae from free living nematodes and also concerning other animal parasites and their intermediate hosts. Dr. Faust has written a brief report of his findings which we publish in this issue of the Review.

Last summer a project for the investigation of hookworm disease in China was launched under the joint auspices of the Department of Pathology of the Peking Union Medical College and the International Health Board of the Rockefeller Foundation. Dr. W. W. Cort and Dr. J. B. Grant are co-operating in the direction of this work. Dr. Grant has already visited the College and we expect to have Dr. Cort with us early in 1924. The College of Agriculture is especially interested in this problem as the investigations center about the relation of methods employed in fertilizing the soil with reference to the spread of hookworm disease. The laboratory phase of our work is an attempt to follow the life of the hookworm eggs and larvae in night soil, stored under various conditions with the object of devising methods to prevent the spread of hookworm disease by the use of this material in fertilizing crops. It is also planned to extend the work by carrying studies into the country districts and working with the villages close at hand. More detailed reports of this work will be published in forthcoming issues of the Review.

Agricultural Manufacturing

This department started the canning of fruits and vegetables in 1920. Due to local climatic conditions, to differences in cultural methods in the production and handling of the raw materials, to the limited varieties of fruits and vegetables canned by local canneries and to the fact that a high percentage of their products spoil, the first and most urgent problem for the department is to experiment with the proper time of processing the different kinds of fruits and vegetables used locally. So far it can be generally stated that vegetables and fruits canned during the spring months need much longer processing than the same products canned in the winter months (vegetables are abundant during the winter but not as cheap as in spring months), and in summer months the raw products must not be very mature or much more time is necessary in processing and the quality will not be first class.

CANNED INTRODUCED FRUITS AND VEGETABLES: Introduced vegetables such as beets, celery, tomatoes, sweet corn, green peas, okra, string beans, lima beans, and fruits such as cape-gooseberry (native variety too small and not tasteful enough to be of economic importance) and strawberries are not canned by the local canneries, but the department finds that they can be easily canned and are of good quality.

COLOR EXPERIMENTS: Native raspberries, red plums and introduced strawberries canned in tins lose their red color after a time, and if their color is to be preserved they must be canned in glass jars. Tinned beets, locally grown, keep their red color for more than one year.

CANNED ORANGES: Canned oranges (in 190° F) become bitter in taste after three months, but on the other hand, tinned mandarin oranges retain their fresh fruit flavor for more than one year.

CANNING OTHER FRUITS AND VEGETABLES: The department has also experimented in canning other native fruits and vegetables such as lychee, lungan, carambola, pineapple, bamboo shoots, water chestnuts, bitter squash, etc. and they are found to be easily sterilized. Peach, pakchoy, wild rice, cabbage, chestnut, guava, because of their nature and perhaps due to certain technical difficulties in the handling of them, are not put up by local canneries. The department is gradually solving the difficulties in canning these products.

CANNED FISH: Local canneries prepare their fish and other game by first thoroughly frying them and then putting into cans. They sometimes become lignified and very hard. The general belief is that these products cannot be prepared in the same manner as that of preparing sardines and salmon. The department began to experiment on this problem last year and finds that it can be done with some modifications. Oysters and clams are not successfully canned by some local canneries and the department finds that the difficulty is due to the fact that insufficient pressure is used in processing for in using high pressure they can be safely kept for a long time.

TONIC FOODS: Foods designated to have special tonic and stimulating value to the different parts of the body are eagerly consumed by many older people and especially the oversea Chinese. They are prepared by cooking, for a long time, meats such as chicken, beef, game, etc., with certain drugs. The department has made some of these tonic foods in tins and expects to try out their real value.

CONDENSED MILK: Local condensed milk made from buffalo cow's milk has an oily taste. The department experimented with buffalo milk and made fairly good condensed milk with some butter fat removed. The comparatively small percent of milk sugar in the buffalo cows milk necessitates the use of a little more sugar. If sweet condensed milk is required, the danger of gritty milk is some-what less because of its low milk sugar content.

JAMS AND JELLIES: Jams and jellies from all the native fruits were made and tried out. Guava, kumquat, orange, lime, plum, Chinese apricot and grapes can be made into good jellies. Rose apple, carambola, if carefully made, and blended with sour fruits have good flavors. Rose apple can be made into delicious rose-flavored syrups. Introduced roselle and cape gooseberry can be made into excellent jams, jellies and fruit syrups.

JUICES: Fruit juices are not commonly made in Kwangtung on a commercial scale. Juices squeezed out from limes, which are to be used for preseving, are used as a mordant for drying and for cooking of hard candies. But lime juices properly made are very delicious. The juices of native raspberry and mulberry make good beverages.

CANDIED FRUITS AND VEGETABLES: Mrs. Cotta (formerly Miss Elizabeth H. Groff) has done a great deal of experimental and investigational work on candied fruits and vegetables. The department finds that most vegetables and fruits can be preserved by the native method except in the case of soft fruits which must be handled somewhat differently.

DRIED FRUITS AND VEGETABLES. The fruit season is also the rainy season, which makes it difficult to dry fruit other than in season of light rainfall. The drying of lychee and lungan is well worked out and there is no urgent need of experiments with these fruits. Dried pineapple and banana can appear be successfully produced, but peaches are difficult to be made into fine appearing and delicious dry products.

OTHER PRODUCTS: The department will take up pickling and other microbiological industries if opportunity permits. Courses in general agricultural manufacturing are being offered.

Division of Education

The Department of Sericulture is planning to offer a number of new courses which are not given in any institution in this part of China and which will form a nucleus of a sericulture school. These courses are: Anatomy of Silk Worm; Diseases of Silk Worm; Breeding of Silk

Worm; Study of Raw Silk; Filature Methods; Mulberry Culture; Sericulture Economics; and Problems of Sericulture. The department will be equipped to offer the first two courses next year. In addition, a course in general silk worm culture will be given. Quite a large number of students are deeply interested in the various phases of sericulture. The department is also conducting a short course in sericulture in connection with the one year course in Agriculture. This will take the place of the six months course formerly given.

The Animal Husbandry Department is offering for the first time courses in Dairy Bacteriology and Dairy Seminar. A veterinarian is expected for the second semester, when courses in Anatomy and Physiology will be given. Fifty per cent of the students in the College of Agriculture are specializing in this department.

The College of Agriculture has thus far turned out a small number of graduate students. Nevertheless, all these men with the exception of one are following the lines of work for which they have been trained. They are as follows:

Kwok Lam Shong, '21, B. A. Manager of Wing On Co., Hongkong.

Koo Kwai Fan, '22, B. S. Now a graduate student in America.

Hoh Leung, '22, B. S. Manager of a large farm near Hongkong.

Wong Chaak Po, '22, B. S. Assistant in Sericulture with the College.

To Shue Tsoi, '23, B. S. Instructor in Animal Husbandry with the College.

Hainan Explorations

The spring issue of the Hainan News Letter, a publication of the American Presbyterian Mission, Island of Hainan, Kwangtung reports:

"Visitors to Hainan are becoming more frequent. Evidently some people have learned that she is on the map and some few have come to find out just what sort of place Hainan is. Some are interested in her mountains, others in her people and still others in her fauna and flora. At present Mr. Pope, who is with the Roy Champan Andrews Mongolian Expedition, is at Nodoa collecting animals. Mr. Pope is a recent graduate of New York City College. He has spent several months in Nodoa and vicinity and his specimens now number in the thousand. One of the rare animals brought in is the flying fox. Mr. Andrews has written him commending him on his success. One of the interesting stunts staged by Mr. Pope was a battle royal between a mongoose and a cobra. The battle ended as expected."

"Dr. and Mrs. Malcolm Smith of Siam spent the month of January and part of February exploring the interior of Hainan. From Hoihow they proceeded to Kachek and thence to the Miao country and made the Five-Finger Mountains their objective. They did not reach the summit of the Five Fingers but camped at the height of 6000 ft. This is twice within a year that our Finger Mountains have been scaled by venturing white men."

The Ling Naam Agricultural College is extremely interested in the Island of Hainan as the Rev. B. C. Henry, one of the founders of the Canton Christian College and father of Mr. J. M. Henry, Vice-President, was one of the first missionaries to that island and he recorded some of the earliest scientific data reported from there. Moreover, the island belongs to the province of Kwangtung which our College serves. We believe it imperative to establish an agricultural sub-station in Hainan at an early date. As a preliminary step in that direction Mr. McClure was sent to the island by the College and his findings are being published in full in the Review.

The Herbarium Committee is now offering for sale Mr. F. A. McClure's collection of Hainan plants. Prior to Mr. McClure's explorations in Hainan only about 350 species of plants were recorded from that island. His collections have increased this number to about 1200 species of which we have about 1150. There are approximately 90 species new to science in Mr. McClure's collections. Mr. Merrill reports that Mr. McClure's No. 9387 is doubtless a new genus which probably can be best placed in the family *Pentaphylaceae* which at present contains a single genus with two known species segregated a few years ago from the family *Theaceae*. This is the second new genus that has been found in Kwangtung within the last few years, the other one having been collected by Prof. Chung Koon Kong in southern Kwangtung and which Mr. Merrill has named *Tsoongia*. In connection with the sale of the Hainan material the Herbarium Committee is issuing special identification labels with each plant. These not only give a brief description of the plant but include very interesting economic data regarding the local uses of the plants. Separates of "An Enumeration of the McClure Collection of Hainan Plants" are available. Address: Herbarium Committee, Canton Christian College, Canton, China.

Agricultural Library

The College of Agriculture is establishing one of the strongest agricultural libraries in South China. This is in connection with general college library where a complete card index is kept of all agricultural material. We are now receiving bulletins and reports from all parts of the world, many of which are in exchange for our own publications. We are very eager to strengthen the Chinese division and will be glad to receive Chinese books and publications dealing with agriculture.

In this connection it will be of interest to know that there is a very rare collection of Kwangtung gazetteers to be found on file in the Herbarium. All Chinese plant names from these publications have been indexed and the Herbarium Committee is seeking to locate specimens of these plants so as to have them identified by Mr. E. D. Merrill.

Colleges of Agriculture in China

An increased interest is taking place throughout China in agricultural education. In spite of political uncertainty and lack of funds for education there has been marked progress during recent years. Dr. Kenyon L. Butterfield of the China Educational Commission (1921-1922) handed over to both the national and Christian forces at work in China a comprehensive program for agricultural education. The most advantageous lines of procedure are clear but it is not always easy to bring about the co-ordination of interests that will assure the presentation to the nation of a unified system. Nanking should prove the center for such co-ordination as we find there leaders of thought and action in both national and missionary agricultural education.

Last June a six-year review (1917-1923) was issued in English by the College of Agriculture, National Southeastern University, Nanking, China. There has recently been a report current in news items that Southeastern has suffered serious loss through fire. Our sympathy is theirs and we are sure they will go forward with renewed effort in spite of such reverse. The scope of this college includes teaching, research and extension. Their underlying aim is to promote the agricultural welfare of the farming population of the southeastern provinces. They have a personnel of about twenty-six professors and more than twice as many assistants. For the fiscal year 1920-1921 the total funds available for operating expenses amounted to \$98,070 of which \$78,304 were apportioned to budgeted expenditures and \$19,766 for extraordinary expenditures. This college has been especially fortunate in the support it is receiving from business interests in China, including the Shanghai Flour Mill Association, the Chinese Cotton Mill Owners' Association, the International Committee for the Improvement of Sericulture in China, Tung-Tai Reclamation Company and bankers. It is also liberally supported by the Kiangsu provincial government. At the time of the report the college valued its equipment at approximately \$30,000 not including books and general museum material. This college has now been designated by the provincial government to act as the central agency for the control and promotion of agriculture in Kiangsu Province, and an annual grant of \$50,000 has been made for this important project. The college is organized into seven departments: Biology, Agronomy, Horticulture, Animal Husbandry, Sericulture, Plant Pathology, Entomology and Utilization of Farm Products. At present the college has one Central Experiment Station and at least nine Sub-stations, totalling about 3,800 mow (approximately 750 English acres) of land. The central station is located at Tashengkwan, about 15 miles west of Nanking City and has a total area of 1,800 mows of fertile land on the Yangtze river. Professor C. C. Yuen, formerly of the Kwangtung Experiment Station, is Director of this station. He has five assistants under his supervision. The sub-stations are designated for different experiments. The first is for animal husbandry and floriculture, the second for wheat, the third for fruit and vegetables, and the rest of the stations are all devoted to the growing of cotton.

Volume six, number twelve of the University of Nanking bulletins is a report of the College of Agriculture and Forestry and Experiment Station for 1922-1923. Nanking has also recently issued numbers one and two of agricultural and forestry notes. It is stated in the introduction of the report: "By means of institutes, exhibits, plays and demonstrations we have gotten out into and next to the rural communities much more than ever before. We are more surely and in more ways becoming linked up with general missionary interests in rural affairs." The opportunities before the University of Nanking in agricultural work are very real ones. They receive liberal grants from missions and recently they have had allocated to them a fund of \$700,000 gold for famine prevention work by the American Committee for the China Famine Fund. In their sericulture work they are receiving support from the Silk Association of America. Cornell University has recently decided to develop missionary work in China in co-operation with Nanking and this should be of great assistance to them. The time is right for the agricultural colleges of western countries to place men and money in the agricultural missionary field in China. Nanking has also instituted a One-Year Short Course in Agriculture and they are now inaugurating a special training course for rural teachers which will begin February 15. Their faculty has been greatly augmented during recent months and they are accomplishing much more research work than ever before. Nanking's College of Agriculture and Forestry has organized the following departments: Agricultural Economics and Farm Management, Agronomy, Bacteriology, Botany, Cotton Improvement, Forestry and Sericulture. This college, like most Colleges of Agriculture in China, is in need of more land. They have approximately seventy English acres under cultivation in the city of Nanking. Outside the city on their Tai Ping Men farm they own about thirty-five English acres, and in addition they rent three other tracts totalling about seventy English acres. The inventory of the College of Agriculture and Forestry totals \$38,507.61. The government co-operation which Nanking is receiving is in the form of scholarships: from Shansi Province, fourteen students, from Anhwei, eight, and from Shantung, three. The college lists a personnel of faculty and officers totalling thirty-eight of which twenty-seven are doing full time work in agriculture. They have recently had several additions to their staff including two men from the West, Mr. R. H. Porter from the Iowa State College of Agriculture and Mr. M. Leslie Hancock of the Ontario Agricultural College. Mr. Porter will carry work in plant pathology and Mr. Hancock work in horticulture.

These notes on the Colleges of Agriculture in China deal primarily with details of progress of the two colleges at Nanking. Peking is rapidly following in the footsteps of Nanking and Canton and within the next five or ten years we should find within the northern city efficient agricultural organization. About one year ago government agricultural college education was reorganized in Peking. Dean P. W. Tsou of the College of Agriculture of National Southeastern University helped with this reorganization. This College is known as the Peking National Agricultural College (國立北京農業大學) and started with a staff of about 40 men, ten or twelve of

whom were graduates of Western agricultural colleges. Mr. S. H. Taam was released by the Lingnaam Agricultural College, for a time, to help in the organization of the animal husbandry work and the Kwangtung College of Agriculture sent Mr. T. T. Chang and Mr. P. F. Shen. National Southeastern University also sent some of its men to Peking to assist in the developments there. We understand that this college has now been closed due to general unfavorable political conditions and lack of funds. But land has been secured and a yearly budget of about \$100,000 has been drawn up. There will be one main station and two sub-stations with a total area of land of about 5,000 mow (about 1,000 English acres).

At Peking the mission forces are also projecting a College of Agriculture in connection with Peking University. A professor of animal husbandry has been on the field for several years. With the help now received from the American Committee's China Famine Fund rapid progress should be made.

Canton is a third center in China where agricultural education, research and extension is projected and being developed. It is significant to note that the past missionary movement in Canton records: "in 1893 the Conference (Missionary) created a committee on the Farmers' Association to stimulate agricultural interests in China along Western lines. The engaging of an European professor of agricultural science to teach in mission institutions was advocated." Kwangtung was also one of the first provinces in China to establish a government agricultural experiment station which has continued under more or less adverse political conditions to the present time. This institution is known as the Kwangtung Agricultural College and Forestry Experiment Station (廣東地方農林試驗場). The men of this station, many of them graduates of Western and Japanese colleges, have striven nobly at great odds to maintain the experimental work established some years ago. Recently, however, most of the work has been discontinued, much of the land having been sold and the buildings occupied by soldiers. In connection with the Station, there has been established an agricultural school known as the Kwangtung Agricultural College (廣東公立農業專門學校) which has never attempted work of college grade, leading to a science degree in agriculture, but has admitted students from district schools. This institution offers courses in general agriculture and forestry. The instruction has always been entirely in Chinese. The Station had an annual budget of about \$50,000 and the College about \$20,000 local silver. Since the work of the Station has been discontinued, plans are being drawn to enlarge the College budget so as to include the Station. Steps are also being taken to raise the Agricultural College to strictly college grade. Formerly there were agricultural high schools at various places, but these have been discontinued.

The present situation in agriculture at Canton is somewhat different from that at Nanking and Peking. The College of Agriculture of the Canton Christian College, known as the Lingnaam Agricultural College (嶺南農科大學), is very largely an indigenous undertaking. It has

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been fostered and developed by the Cantonese and is not directly under western control. However, its affiliation with the Canton Christian College makes possible efficient co-operation with western business and missionary interests. We hope this unusual situation will make it unnecessary to develop in Canton two institutions of learning working in the field of agriculture but it is too early to foretell the future. We publish in this issue the photographs of the Board of Managers of the Lingnaam Agricultural College. The object of this Board, is with the sanction of the Trustees of the Canton Christian College, to organize a full College of Agriculture which shall maintain the highest standard of agricultural research and efficiency. This Board supervises the work of the College of Agriculture and plans for its necessary extension. It is responsible for its adequate maintenance and decides the annual budget. The Board of Managers of the Lingnaam Agricultural College has land holdings adjacent to the Canton Christian College upon which it is developing its college, through agreements which it has entered into with the Trustees of the Canton Christian College, in line with plans for a university federation at Canton. It also holds all land and property of sub-stations of the College of Agriculture which may be established on areas far removed from Honglok, the present site of the college.

The Lingnaam Agricultural College has outlined a definite agricultural program calling for desirable expenditures over a ten year period which it has presented to its Board of Managers. Several years ago the Kwangtung Government promised \$100,000 annually for current expenses and \$300,000 for land, buildings and equipment. After several payments the province was torn by political disorder and this source of income was cut off for the time being. It is a most encouraging fact, however, that the Board of Managers have provided the funds whereby it has been possible for the College of Agriculture to continue with a budget of approximately \$100,000 local silver for 1922-23 and \$87,000 for 1923-24.

The present purely agricultural staff consists of nine western graduates, two Lingnaam graduates in agriculture and two men trained at the Kwangtung Experiment Station. Much of the general science instruction is carried on by the staff of the College of Arts and Sciences. The college has more than one hundred acres of land under cultivation not including the general campus of the Canton Christian College upon which it is assembling a representative collection of plants. More than one hundred men are employed on the farm or in business undertakings connected with the college. For administrative purposes the college has been organized into four divisions: (1) Education, (2) Research, (3) Extension and (4) Business. Five departments have been organized to date: (1) Animal Husbandry, (2) Agronomy, (3) Horticulture, (4) Agricultural Manufacturing and (5) Sericulture. The activities of these departments and divisions appear elsewhere in these notes or in the articles of the Review. The college is receiving liberal support from both Chinese and Western interests.

The institutions above mentioned are not the only ones at work in China in the field of agriculture but are those which are most strategically located for the initial steps in a constructive all-China program. Ultimately each province will establish some agricultural work and advances have been made in this direction. In Shantung we know of the Shantung Pongee Silk Experiment Station (山東野蠶絲試驗場) at Cheefoo and the Shantung Agricultural School (山東農業學校) in Tsinanfu. Kansu province has three agricultural high schools closely affiliated with South-eastern University and Anhui has two. There is an agricultural technical school in Honan as also in a few other provinces.

West China offers tremendous possibilities in agriculture and in any comprehensive national program must not be forgotten. Chengtu is certainly in line with Nanking, Peking and Canton as an important center for agricultural education. Recent correspondence with Mr. F. Dickinson of the West China Christian University at Chengtu, Szechwan indicates that this University is also thinking and working with those rural interests so important to the very life of China. The report of the China Educational Commission of 1921-22 points out: "The province of Szechwan is in itself an empire, the bulk of its population are farmers, and it would seem inevitable that this dominant interest of the people should be recognized; but it might be wise to build a first-class middle school of agriculture before attempting work of college grade." Apparently climatic and general conditions in West China are not unlike those of Kwangtung. West China is producing crops very similar to those of South China and under methods not unlike those we find in the southern provinces. For example Szechwan is growing citrus fruits and even, to a limited extent, the lychee, a fruit whose range is very limited. This great country is lying in wait on the western frontier of China as we are bidding our time on the southern. With wide expanse of undeveloped land, fertile soil and climate that permit cultivation throughout the entire year both West and South China should be developed as rapidly as Central and North China.

China Famine Prevention Funds

Through the publications of the University of Nanking details with regard to funds allocated by the American Committee for China Famine Fund (New York City) for permanent famine relief in China are now available. After all relief commitments had been paid on account of the China famine of 1920-21 there remained in the hands of this committee an unexpended sum of \$900,000 gold. General opinion concerning the use of this fund was unanimous that it should be devoted to permanent famine prevention measures. In view of the preponderant part the churches of America played in raising these funds, as also the assistance christian missions gave to the relief projects in the field, the American Committee apparently accepted the recommendations laid before it in January, 1922 by the Trustees of the University of Nanking and Peking University, supported by the North American Conference of Foreign Missions through its Committee of Reference and Council. In

accord with these recommendations there has been given to a Trustee in trust for Nanking University \$675,000, and in trust for Peking University \$225,000, "to be used for the study and investigation of famine causes; prevention and (or) relief, and as a means thereto for the education of the Chinese in agriculture, forestry and such other activities as may relate to famine." There is reserved from these two grants in trust for five years an emergency fund of \$100,000 for use as a nucleus to start a national campaign in the United States for famine relief in China should such a campaign be necessary. At the end of ten years the Committee, created by the trust, may direct the trustee finally to surrender control of the funds to the two universities.

The American Committee has provided for a China Famine Fund Committee which shall administer the principal of these funds and shall approve or revise the budgets for expenditures out of the income. The following American citizens residing in China have been appointed to this committee: Mr. C. R. Bennett, General Manager Peking Branch, International Banking Corporation with Mr. Robert Coltman, Standard Oil Company, Peking as alternate; Mr. J. Harold Dollar, Vice-President and General Manager of Robert Dollar Company and President of the American Chamber of Commerce, Shanghai, with Major Arthur Basset of the British American Tobacco Company, Shanghai, as alternate; Rev. Charles E. Patton, Shanghai, secretary of the (Presbyterian) China Council with Rev. J. E. Shoemaker of Yu-yao, Chekiang, as alternate; and Bishop T. F. Keeney, Foochow, with Rev. Frank Rawlinson, Editor of the Chinese Recorder, Shanghai, as alternate; and Mr. Dwight H. Edwards of the Y. M. C. A., Peking, with Mr. J. B. Powell, Editor of the China Weekly Review, Shanghai, as alternate. This committee has held its first meeting and has approved the budgets of Peking and Nanking. The program to be carried out by the College of Agriculture and Forestry of the University of Nanking includes projects in forestry instruction, extension and research, improvement of farm crops, agricultural extension, co-operative extension projects, economic and farm management surveys, plant and animal disease control, agricultural education, etc.

The problem of famine prevention in China is a large one and permanent measures to be effective must not be restricted in scope or in regional activity. China possesses the oldest agriculture in the world with many highly developed products and practices worthy of western study before those changes take place which result from the introduction of western ideas. China's present famine conditions are not due to the inability of the Chinese farmer nor to over-population of the country, taken as a whole. They are due primarily to unorganized government, inadequate irrigation and drainage projects, lack of transportation, police protection, rural organization and rural finance. The colonization of unoccupied areas is one of the largest factors to be considered in permanent relief. In this connection we would call the attention of the China Famine Committee to South and West China as regions offering relief from

the more unfavorable agricultural region of North China. In years past thousands of Chinese families in Central, and North China have emigrated to these parts, establishing some of the most successful family lines of the southern Chinese people. Their success was due in large part to the favorable soil and climatic conditions in the south. The efficiency of the South China farmer is widely recognized, and the areas still open for expansion are evident to any student of the country.

One of the first agricultural bulletins published under missionary auspices in China was Bulletin No. 5 of the Canton Christian College series, "Agricultural Reciprocity between America and China—A Contribution toward Economic Development and Permanent Famine Relief" in which the very lines now accepted by the China Famine Fund Committee as best for permanent famine prevention were fully discussed. For many years President C. K. Edmunds of this college has been interested in the famine problem and he has written some very comprehensive articles on "Permanent Relief from Famine in China" in the Trans-Pacific Magazine, June to October, 1921. The Lingnaam Agricultural College will watch the work of the China Famine Relief Committee and the Universities of Peking and Nanking with keen interest. We shall always hold ourselves in readiness to co-operate in any studies or program they may wish to develop in South China.

Visitors

Mr. L. K. Elmhurst from Santiniketan, Bengal, visited the College in May and spoke on village work in India. Mr. Elmhurst is a graduate of Cornell University.

In March the College was favored with a visit from members of the American Silk Association who were in the Orient at that time studying the silk industry from the production side. The delegation included:

Mr. and Mrs. James A. Goldsmith, President, Hess, Goldsmith & Co., Inc., New York City.

Mr. and Mrs. D. E. Douty, Vice-President and General Manager, United States Testing Co., Inc., New York City.

Mr. Ray I. Swartz, United States Conditioning Co., Inc., New York City.

Mr. and Mrs. Austin Cheney, Mgr., Weaving Dept. Cheney Bros., South Manchester, Conn.

Mr. and Mrs. Eugene Atwood, Atwood Machine Co., Stonington, Conn.

Mr. and Mrs. Edward E. Bradley, Vice-Pres., Atwood Machine Co.

Mr. and Mrs. Carl Schoen., Pres., Carl Scheon Silk Corp., New York City.

Mr. Edward Bayer, Jr., Julins Kayser & Co., New York City.

November 8 to 15 Mr. Douty again visited the College with Mr. Chas. J. Huber who is the representative of the U. S. Testing Co. of China and Japan. Their visit was for the purpose of planning the model filature and reeling building given by Mr. Eugene Atwood (See Sericulture Notes).

Miss Anna E. Bayha, Associate Professor in Home Economics, Miss Elida Yakaley, Registrar and Dr. and Mrs. Ryder, all from the Michigan Agricultural College, visited the Canton Christian College on October 15, 1923.

Staff Items

Mr. F. A. McClure spent the past year in the United States where he has been associated with the Office of Foreign Seed and Plant Introduction of the United States Department of Agriculture in preparation for plant exploration work in South China. Mr. McClure spent much of his time in the plant propagating houses at Bell, Maryland and made one trip to southern Florida to study conditions there. He also spent several months in special botanical studies at Ohio State University. We expect Mr. and Mrs. McClure to return to Canton for the opening of the second semester.

During the past year Mr. P. S. Chung has traveled widely in the interests of the college. Last spring he went to Hawaii and from thence to Australia. After returning to the college in the early fall he and Mrs. Chung sailed for Indo-China. Mr. Chung has been very successful in interesting the Chinese living abroad in the work of our college and he carries back to us information very helpful in our work for South China.

Mr. K. P. Buswell, who devoted the past six months to the sericulture survey, sailed from Hongkong in December for home via India, the near East and Europe. Mr. Buswell will visit sericulture stations in these parts of the world and will send information to the Department of Sericulture.

Mr. Harvey House who was at work upon the soap manufacturing project in connection with our Department of Agricultural Manufacturing returned to the States for special medical treatment. The soap project has been discontinued until his return. Mr. House is much interested in industrial missions and is making a thorough study of the problems connected with them. He has secured special gifts for soap equipment which will be installed upon his return to the college.

Mr. W. L. Funkhouser, now on a farm in Ohio, was married in September. He has spent some time at the Pennsylvania State College in special campaign work for the Penn State Mission to China. It was our hope that the Penn State Mission could return Mr. Funkhouser to China but they have been unable to do so this year. We trust that next year they will find it possible.

Mr. G. W. Groff attended a meeting of the Committee on Rural Problems and the Country Church of the National Christian Council held in Shanghai in September. Mr. Groff is a member of this committee which is concerned with the task of the rural Church, and which is collecting information and outlining plans for improving the economic, social and religious condition of the peasants of China. Rev. K. T. Chung of the secretarial staff of the Council spent last summer in Kwangtung and has made some very interesting observations on the rural Church of this province.

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