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VOL. 3, NO. 2

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LING NAN AGRICULTURAL COLLEGE
CANTON CHRISTIAN COLLEGE
CANTON, CHINA
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The Lingnaam Agricultural Review is published twice each year by the Ling Nan Agricultural College, Canton Christian College, Canton, China. The publications of this college are issued chiefly in the Chinese language. It is the purpose of this publication to give a review of the activities of the college in the field of agriculture, and especially to record the findings of its experimental and research work.

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THE EFFECT OF TREATMENT OF PERSONS INFECTED WITH HOOKWORM AS CHECKED BY EGG COUNTS.

By Wm. W. Cadbury. M.D.

Canton Christian College, Canton, China.

Early in 1924 we (1) published a report on the results of treatment of workmen infected with hookworm. The examinations before and after treatment were made by the salt-flotation method and either oil of chenopodium or carbon tetrachloride was used for the treatment. It was found that by one treatment with oil of chenopodium 58 per cent of cases were cured, as judged by subsequent fecal examination. Of those who received only one treatment with carbon tetrachloride. 3 to 6 cc., only 36 per cent were freed of worms.

The disadvantage of this method of procedure is that one can get no idea of the relative improvement in cases not completely rid of the parasite. It was therefore suggested to the writer by Drs. W. W. Cort and N. R. Stoll that a study be made of the effect of treatment in reducing the egg count in the stool of persons harboring hookworms.

During Dr. Cort's visit to the Canton Christian College in connection with the survey of the China Hookworm Commission, a large number of egg counts were made. These included workmen on the College campus, some villagers from nearby, and several village school children. Advantage was taken of these counts and three or four months later treatments were given and subsequent counts were made in order to determine what proportion had been wholly rid of the parasite and in the remaining what was the percentage reduction of ova in the stool.

The method of making egg-counts is that worked out by Stoll (2). A specimen of stool is carefully weighed to five grams. This is then diluted with decinormal sodium hydroxide solution to 75 cc. The specimen is mixed with glass beads, thoroughly shaken, and .15cc. is removed by a graduated pipette and placed under a cover glass measuring 24 x 50 mm. All eggs are counted from two slides and the average noted. For a diarrhoea stool multiply this average by 4, for a mushy stool multiply by 2 and for a formed specimen take the number of ova as counted. In any case by this method one determines the number of ova per .01 gram of stool. Therefore if one multiplies the result by 100 one has the number of ova per gram of stool.

By reference to the attached table one may note the results in each case. Altogether 45 of the subjects who had an egg count made were treated at the Ling Naam Hospital, and were subsequently again

examined for ova by the count method. Of these forty-five cases 39 were male and 6 female, 39 were laborers or servants, one was a soldier and five were village school children. One of the cases, No. D 112, was treated twice with an interval of six months and egg counts were made before and after each treatment. There was thus a total of 46 treatments.

Medicine was given early in the morning on a fasting stomach. A mixture composed of carbon tetrachloride eleven parts and oil of chenopodium one part was used. Of this mixture .2 cc. was given for each year of age up to a maximum of 3 cc. (3). At the same time a saturated solution of magnesium sulphate was given (4).

As the result of treatment the following was the outcome:

Total cures—25 (54 per cent)

Improved —20 (43 per cent)

Stationary— 1 (2 per cent)

The cures compare favorably with the results previously obtained by using oil of chenopodium. The advantage of the method here employed is that it gives one the opportunity to estimate the percentage improvement in cases that were not completely cured

If now we take the sum of ova counted per .01 gram of feces for all the 45 cases, before they were treated, we get the figure 900. The sum after treatment is 179.3, leaving an actual reduction of 720.7. This figure stands for the actual reduction of ova per .01 gram of feces for the whole series or an average of 80 per cent. The same results may be arrived at by taking the average of all the per cent reductions of the cases as indicated in the last column of the table. While only 54 per cent were completely rid of ova, there was 26 per cent more than this of reduction in the number of ova counted.

It is unfortunate that such a long interval elapsed from the time of treatment to the final count. In the 18 cases in which this interval was less than one month there were 67 per cent in which all ova disappeared and the percentage reduction for the whole number was 88 per cent. For the 27 cases in which a period of one and a half to five months elapsed between the treatment and the final examination there were only 48 per cent of cures indicated and the reduction in the egg counts was only 77 per cent. There was undoubtedly an opportunity in this series for a reinfection. This is also borne out by reference to the table. In the fourth and fifth columns it is noted that 16 of the patients had been previously found infected with hookworm. Moreover they received from one to three treatments following which twelve, at least, of them were found to be free of ova by the salt-flotation method. This was in 1922 or 1923. In spite of this result all the sixteen were found to be infected when egg counts were made in April or later in 1924. It seems likely that reinfection had occurred during the year or more that had elapsed.

We have compared the results of treatment of these cases with the results in those not previously treated. Of the 16 who received medicine in 1923, only 6 (37 per cent) were freed of ova by the 1924 treatment. There was a reduction of 69 per cent in the egg counts. Of the 29 who had not been previously treated 19 (66 per cent) were completely cured and there was 89 per cent reduction in the egg count. This compares favorably with our figures for the whole group—54 per cent of cures and 80 per cent reduction in the counts. May we not conclude that those cases which had previously received medication had become or were before more resistant to treatment than those which had not formerly taken any medicine?

Summary.

The "egg count" method is a satisfactory basis for estimating the degree of improvement following treatment of cases infected with hookworm.

A reduction of the infection by eighty per cent may be expected by employing the carbon tetrachloride-oil of chenopodium mixture, together with a dose of magnesium sulphate.

References.

1. Cadbury, W. W. Amer. Jour. Trop. Med., 1924, 4, P. 13.
2. Stoll, N. R. Amer. Jour. Hyg., 1923. 3, 59-70.
3. Lambert, S. M. Jour. Am. Med. Ass. 1923. 80,526.
4. Note. Jour. Am. Med. Ass. 1923. 81, 1553.

TABLE SHOWING THE RESULT OF TREATMENT
ON THE NUMBER OF HOOKWORM OVA COUNTED IN THE STOOL.

Hosp. No.	Sex	Age	No. Prev. Tr.	Result Prev. Tr. 1922-1923	Count of Ova before Tr.		Count of Ova after Tr.		Date Tr.	Time after first Exam.	Time betw. Tr. and second Exam.	Per cent. Hw. Reduction.
					Date 1924	No.	Date 1924	No.	1924			
5	M	35	2	Cure	Apr.	65	Oct. 6	43	Jul.	3 mos.	2 1/2 mos.	34
8	F	12	0		Apr.	2	Jul. 21	0	Jul. 15	3 mos.	6 day	100
20	M	9	0		Apr.	8	Nov. 22	0	Jul. 22	3 mos.	4 mos.	100
21	M	11	0		Apr.	14	Nov. 27	8	Jul. 22	3 mos.	4 mos.	43
22	M	15	0		Apr.	8	Jul. 31	0	Jul. 23	3 mos.	8 days	100
24	M	49	2	Cure	Apr.	44	Sept. 18	8	Jul. 24	3 mos.	2 mos.	82
25	M	30	3	Cure	Apr.	36	Jul. 28	15	Jul. 24	3 mos.	4 days	58
26	M	23	3	Cure	Apr.	81	Dec. 14	22	Jul. 25	3 mos.	5 mos.	73
27	M	33	2	not cured	Apr.	7	Sept. 30	3	Jul. 25	3 mos.	2 mos.	57
29	M	21	0		Apr.	8	Dec. 27	3	Jul. 25	3 mos.	5 mos.	63
30	M	42	0		Apr.	24	Sept. 26	0	Jul. 26	3 mos.	2 mos.	100
32	M	43	0		Apr.	70	Sept. 29	11	Jul. 26	3 mos.	2 mos.	84
33	M	25	3	Cure	Apr.	10	Sept. 26	8	Jul. 26	3 mos.	2 mos.	20
37	M	52	2	Cure	Apr.	4	Sept. 29	3	Jul. 28	3 mos.	2 mos.	25
39	M	15	0		Jul. 21 22 23 Av.	47 11 47 35	Nov. 25	0	Jul. 25	2 days	4 mos.	100
40	M	27	0		Jul. 21 22 23 Av.	0 3 5 3	Sept. 29 Oct. 1 Oct. 2 Av.	1 0 0 .3	Jul. 28	5 days	2 mos.	88
42	M	27	1	Cure	Apr.	11	Dec. 3	0	Jul.	3 mos.	4 mos.	100
43	M	31	1	Cure	Apr.	1	Sept. 19	0	Jul. 29	3 mos	2 mos.	100
44	M	33	3	Cure	Apr.	2	Jan. 4	1	Sept. 8	5 mos.	4 mos.	50
45	M	22	1	?	Apr.	14	Nov. 30	8	Jul. 29	3 mos.	4 mos.	43

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42	M	27	1	Cure	Apr.	11	Dec. 3	0	Jul.	3 mos.	4 mos.	100
43	M	31	1	Cure	Apr.	1	Sept. 19	0	Jul. 29	3 mos	2 mos.	100
44	M	33	3	Cure	Apr.	2	Jan. 4	1	Sept. 8	5 mos.	4 mos.	50
45	M	22	1	?	Apr.	14	Nov. 30	8	Jul. 29	3 mos.	4 mos.	43
52	M	21	0		Apr.	18	Sept. 29	0	Aug. 6	4 mos.	1 1/2 mos.	100
53	M	31	0		Apr.	14	Sept. 29	0	Aug. 6	4 mos.	1 1/2 mos.	100
54	M	35	1	?	Apr.	2	Sept. 29	0	Aug. 6	4 mos.	1 1/2 mos.	100
55	M	25	0		Apr.	11	Nov. 30	0	Aug. 6	4 mos.	4 mos.	100
56	M	52	0		Apr.	19	Sept. 13	0	Aug. 6	4 mos.	1 mo.	100
57	M	20	0		Apr.	46	Sept. 20	10	Aug. 6	4 mos.	1 mo.	78
58	M	40	0		Apr.	11	Sept. 13	0	Aug. 6	4 mos.	1 mo.	100
59	M	50	0		Apr.	1	Sept. 20	0	Aug. 6	4 mos.	1 1/2 mos.	100
60	M	25	1	Cure	Apr.	1	Jan.4.'25	0	Sept. 8	5 mos.	4 mos.	100
61	M	29	0		Apr.	10	Sept. 29	0	Sept. 8	5 mos.	3 wks.	100
62	M	22	0		Apr.	6	Sept 18	0	Sept. 8	5 mos.	10 days	100
63	M	22	0		Apr.	15	Sept. 18	0	Sept. 8	5 mos.	10 days	100
67	M	28	1	Cure	Apr.	13	Sept. 19	5	Sept. 9	5 mos.	10 days	62
68	M	30	0		Apr.	16	Sept. 18	11	Sept. 9	5 mos.	9 days	31
70	M	37	2	Cure	Apr.	10	Jan. 5.25	0	Sept. 10	5 mos.	4 mos.	100
79	M	45	0		Apr.	11	Oct. 7	5	Sept. 26	5 mos.	11 days	53
85	M	20	1	?	Oct.	6	Nov. 26	0	Nov. 20	1 mo.	6 days	100
D 112	F	40	0		May	16	Nov. 27	4	Jun.	1 mo.	5 mos.	75
"	"	"			Nov.	4	Dec. 27	4	Dec. 14	7 days	23 days	0
120	M	39	0		Nov. 22	16	Nov. 26	0	Nov. 23	1 day	3 days	100
140	M	34	0		Nov. 10	12	Jan. 5	0	Dec. 29	1 mo.	7 days	100
D 154	F	50	0		Apr.	183	Jun. 16	2	May 28	2 mos.	1 mo.	99
D 294	F	12	0		Apr.	2	Jul. 19	0	Jun. 10	2 mos.	1 mo.	100
D 366	F	21	0		Jul. 24	12	Nov. 18	5	Jul. 28	4 days	4 mos.	58
D 378	F	27	0		Jul. 24	2	Sept. 29	0	Jul. 25	1 day	2 mos.	100
D 934	M	25	0		Oct. 23	7	Nov. 24	0	Nov. 15	7 days	9 days.	100
					Nov. 3	5	Nov. 25	0				
					Nov. 7	5	Nov. 26	0				
					Nov. 8	7	Av.	0				
					Av.	6						

TREATMENT OF ASCARIS AND TRICHURIS INFECTION CHECKED BY EGG COUNTS.

By Wm. W. Cadbury, M.D.

Canton Christian College, Canton, China.

In the preceding paper the writer has analyzed the egg counts of 45 subjects whose stools were counted before and after treatment and in all of whom hookworm ova were demonstrated before treatment. Medicine was given early in the morning on a fasting stomach. A mixture composed of carbon tetrachloride eleven parts and oil of chenopodium one part, was used. Two tenths of a cubic centimeter of this mixture were given for each year of age up to a maximum of three cubic centimeters for adults. At the same time a saturated solution of magnesium sulphate was given. As the result of this treatment 54 per cent of the cases were rendered negative for hookworm ova. In 43 per cent there was a decrease in the egg-count and in 2 per cent there was no change. For the whole series there was a reduction in the count of hookworm ova of 80 per cent.

In making the counts for hookworm the ova of Ascaris and Trichuris were also always counted and among the 45 hookworm cases which were treated there were 33 in which Ascaris or Trichuris ova, or both, were found at the first examination.

No. of cases with both Ascaris and Trichuris ova—20 (61 per cent)
No. of cases with Ascaris ova only ..... —27 (82 „)
No. of cases with Ascaris ova only ..... —27 (82 „)

Taking first the 27 cases of Ascaris infection it may be noted that in No. 52 there was an increase from 2 to 67 ova after treatment, although the Trichuris count showed a reduction of 92 per cent. Since five months had elapsed between the two counts a reinfection might easily have occurred. The same is true of Case No. 60 in which nine months elapsed between the two examinations and an increase of Ascaris ova was found after the treatment.

Eliminating these two cases there remain 25 in whom there was a decrease in the egg-count following the treatment. Whether we take the sum total of ova counted before treatment and compare with the total counted after treatment or whether we take the average of the percentage reductions in all the cases the result is the same, namely a total reduction of 95 per cent of the ova. In 19 (76 per cent) no ova at all were demonstrated after treatment, thus constituting a cure in this number of cases. The improvement here noted followed upon one

treatment only, but it must be admitted that opportunity for reinfection occurred both between the time of first examination and that of treatment as well as between the time of treatment and the second examination in several of the cases.

Taking up next the cases that showed infection with ***Trichuris trichiura***, we may note that there were 27 in which ova were found in the first examination. Following treatment the number was reduced in all but one. In this one case, No. 45, there were counted four ova before the treatment and 14 after, with a lapse of seven months in between. Thus there remain 26 cases which showed an improvement. In these the average of all the percentage reductions for all the cases was 84 per cent. In 12 (46 per cent) there was apparently complete removal of the parasite from the intestinal tract, since no ova at all were found in the second count, after the one treatment.

Conclusions.

The use of a carbon tetrachloride-oil of chenopodium mixture in the treatment of patients infected with ***Ascaris lumbricoides*** and ***Trichuris trichiura***, combined with a dose of magnesium sulphate, is highly efficient.

In cases of Ascaris infection a complete cure may be brought about in 76 per cent of cases and the average reduction in the number of ova counted in all the cases is 95 per cent.

In cases of Trichuris infection there may be a complete cure in 46 per cent and an average reduction in all cases of 48 per cent.

THE RESULTS OF TREATMENT UPON THE NUMBER OF OVA OF *ASCARIS LUMBBRICOIDES* AND *TRICHURIS TRICHIURA* AS COUNTED IN THE STOOL.

Case No.	Sex	Age	Date first count 1924	Ascaris ova counted	Tricuris ova counted	Date second count 1924	Asc. ova	Tric. ova	Date Treat. 1924	Per centage Reduction in count Asc.	Tric.
5	M	35	Apr.	5	56	Oct.	0	1	Jul. 24	100	98
8	F	12	Apr.	231	17	Jul. 21	22	10	Jul. 15	91	41
20	M	9	Apr.	596	24	Nov. 22	16	4	Jul. 22	97	83
21	M	11	Apr.	240	47	Nov. 27	33	35	Jul. 22	86	26
24	M	49	Apr.	0	2	Sept. 18	0	1	Jul. 24	0	50
26	M	23	Apr.	281	26	Dec. 14	60	0	Jul. 25	78	100
29	M	21	Apr.	7	0	Dec. 27	0	0	Jul. 25	100	0
32	M	43	Apr.	97	6	Sept. 29	0	0	Jul. 26	100	100
33	M	25	Apr.	12	7	Sept. 26	0	2	Jul. 26	100	71
37	M	52	Apr.	0	16	Sept. 29	0	0	Jul. 28	0	100
39	M	15	Jul. 21	392	20						
			,, 22	233	10						
			,, 23	486	24						
			Av.	371	18	Nov. 25	0	2	Jul. 25	100	89
40	M	27	Jul. 21	7.5	0						
			,, 22	18.5	0						
			,, 23	11	0						
			Av.	12	0	Oct. 2	0	0	Jul. 28	100	0
42	M	27	Apr.	0	1	Dec. 3	0	0	Jul. 21	0	100
45	M	22	Apr.	11	4	Nov. 30	0	14	Jul. 29	100	*
52	M	21	Apr.	2	12	Sept. 29	67	1	Aug. 6	*	92
53	M	31	Apr.	933	21	Sept. 29	23	0	Aug. 6	98	100
54	M	35	Apr.	0	3	Sept. 29	0	0	Aug. 6	0	100
55	M	25	Apr.	74	0	Nov. 30	0	0	Aug. 6	100	0
57	M	20	Apr.	0	23	Sept. 20	0	14	Aug. 6	0	39
58	M	40	Apr.	33	6	Sept. 13	0	0	Aug. 6	100	100
59	M	50	Apr.	14	0	Sept. 20	0	0	Aug. 6	100	0
60	M	25	Apr.	0	2	Jan. 4. 1925	4	0	Sept. 8	*	100

55	M	25	Apr.	74	0	Nov. 30	0	0	Aug. 6	100	0
57	M	20	Apr.	0	23	Sept. 20	0	14	Aug. 6	0	39
58	M	40	Apr.	33	6	Sept. 13	0	0	Aug. 6	100	100
59	M	50	Apr.	14	0	Sept. 20	0	0	Aug. 6	100	0
60	M	25	Apr.	0	2	Jan. 4. 1925	4	0	Sept. 8	*	100
62	M	22	Apr.	0	7	Sept 18	0	0	Sept. 8	0	100
63	M	22	Apr.	171	11	Sept. 18	0	0	Sept. 8	100	100
67	M	28	Apr.	54	3	Sept. 19	28	0	Sept. 9	48	100
68	M	36	Apr.	1	0	Sept. 18	0	0	Sept. 9	100	0
79	M	45	Apr.	103	0	Oct. 7	0	0	Sept. 26	100	0
D 112	F	40	May	92	14	Nov. 27	0	0	June	100	100
140	M	34	Nov.	2	28	Jan. 5 1925	0	4	Dec. 29	100	86
D 154	F	50	Apr.	32	46	Jun. 16	0	10	May 28	100	78
D 294	F	12	Apr.	535	11	Jul. 19	0	3	Jun. 10	100	73
D 366	F	21	Jul. 24	14	6	Nov. 18	0	3	Jul. 28	100	50
D 934	M	25	Oct. 23	25	1						
			Nov. 3	56	2						
			Nov. 7	41	1						
			Nov. 8	15	1	Nov. 26	0	0	Nov. 15	100	100
			Av.	31	1						

*Increase of ova counted, probably due to fresh infection.

SOME PRELIMINARY NOTES ON PERSIMMONS IN KWANGTUNG.*

By F. A. McClure

Agricultural Explorer, U.S.D.A., Assistant Professor of Botany, Canton Christian College.

The persimmon, *Diospyros kaki* L., belongs to the Ebony family, other members of which produce woods of commercial importance because of their extreme hardness and striking color. Other species of this genus produce fruits of value, both as esculents and as sources of dyes.

Diospyros kaki L., hereinafter spoken of as the persimmon, is said to be native to China (Popenoe, Manual of Tropical and Subtropical Fruits, p. 355). A great number of horticultural varieties have been developed here which are as yet little known and very imperfectly distinguished. It is with the idea of making a beginning at standardizing the varieties found in this province that this paper is written.

Cultural Notes

The persimmon is grafted on its own stock entirely, seedlings of any variety being used without preference. Grafting is done in February or March, the stock having previously been set in the desired location and usually allowed to reach a diameter of about 1.5 to 2 cm. or an age of 2 or 3 years. The stock is cut back to a height of three or four inches and the scion, which is usually of 2-year-old wood, is inserted by means of a cleft graft. The graft is then covered with clay which is bound on with straw and watered at sufficiently frequent intervals to keep it moist for about twenty days, after which time the fate of the scion is evident. Trees are sometimes grafted when as much as six or eight years old, in which case the union is made at a height of 1 to 1.5 m.

Growing trees are sometimes manured in the spring, but as a rule mature trees are not fertilized. The orchards at Liu Tsoi (蓼才) receive a heavy dressing of pond mud every year.

The trees come into bearing one or two years after being grafted, depending upon the age of the stock. One hundred and fifty to two hundred catties is considered to be a fair yield for a mature tree.

The culture of persimmons is widely distributed in the province. For the most part the trees are not grown under regular orchard conditions, but singly, or in twos or threes on the village commons, at

*Contribution from the Biological Laboratory.

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the edge of a pond or canal, or distributed irregularly among other fruit trees. However, in the vicinity of Liu Tsoi (寥才), upper Poon Ue (番禺) District, one finds orchards composed solely of persimmon trees, up to 150 in number, planted at regular intervals in straight rows. These orchards are one of the important sources of the persimmons which appear on the Canton markets. The trees there are very long-lived, and one finds among them some of the largest and most shapely specimens to be found in the province. One tree measured 60 cm. in diameter 1.5 m. above ground, and 10 m. in height, and had a spread of 12 m. For the most part, however, the persimmon trees which one sees about the province are rather small and ill-shaped, probably due in part to the extreme predilection which certain parasitic plants (species of Loranthus and Viscum) have for this tree, which results in serious mutilation either through the death of the branches attacked or their removal by trimming, and partly to heavy bearing which results in very serious pruning both by natural breakage and by carelessness in picking the fruits.

Persimmon trees are also commonly attacked by two scale insects, *Tachardia fici* Green and *Aulacaspis pentagona* (Targ.) The extent of the damage done by these is not known. A yellowish brown ant is often found inhabiting cavities in the branches and even the small twigs. Their presence is usually revealed by a slight swelling in the affected part, and by an inconspicuous small round aperture which is the entrance to the hollow. The wood immediately surrounding the cavity is black, in contrast to the light color of the normal wood of the tree. The bark shows no special difference in color.

Ants are said by the farmers commonly to effect entrance into the twigs or branches through injuries which occasion the excretion of a gum which the ants like. Following the gum-saturated tissue they soon eat out a cavity. For this reason thoughtful farmers, when they trim their persimmon trees, plaster the wounds with mud to keep away the ants.

Harvesting Notes

The persimmon season usually begins early in August. The first variety to appear on the market is the small one known as *Kai Sam Tsz* (蟹心柿). The season lasts, as a rule, until the end of October, and a few fruits may be found on the market as late as the middle of November.

The fruits of a given tree do not all ripen at once. On the contrary, they may ripen a few at a time over a period of a month or two. This is true of *Taai Hung Tsz* (大紅柿) at Liu Tsoi (寥才). The fruits are taken from the trees when they have begun to turn yellow but while they are still quite firm. This is necessary in order that they may ship or keep well. If intended for the large markets, like Canton, they are packed in bamboo baskets of open weave, of about

a bushel capacity, which are lined top and bottom with persimmon leaves in order to prevent the fruits from being bruised in shipping. The sides are left open for ventilation. They are then transported to the nearest railroad or navigable stream by wheelbarrow or carrier and thence to the large markets by train or boat. For local use the persimmons are stored temporarily in a cool, well-ventilated place. Anything that prevents proper ventilation or raises the temperature of the fruits tends to soften them.

The Ripening Process

All the persimmons thus far investigated, with the exception of the fruits from one tree of *Sz Man Chuen* (No. 9) at Loh Kong Tung, must be ripened artificially in order to remove the astringent quality due to the presence of tannin, which would otherwise make them inedible. This artificial ripening is accomplished by one of two general methods. One is the lime-water method, and all persimmons ripened by this method are known as *Ngaang Tsz* (硬柿), that is, Hard Persimmons, or *Shui Tsz* (水柿), that is, Water Persimmons. The other is the smothering method, called in Chinese, *Kuk* (殼). The persimmons ripened by this method are known as *Nam Tsz* (稔子), that is, Soft Persimmons. This classification is very generally followed, certain varieties being spoken of as hard, or water persimmons, and others being spoken of as soft persimmons. However, by actual experiment, the writer has found that this classification does not hold, for it is possible to ripen a given persimmon by either method. Whether or not certain varieties are especially adapted to one or the other of these two methods has not been determined.

In the lime-water method the fruits are simply placed in large earthen jars or wooden tubs in water to which lime has been added at the rate of one catty to ten catties of water. The process takes from two or three days to more than a week, depending upon the variety, the state of ripeness of the fruits when harvested, and the length of time which has expired between harvesting and treating. Water Persimmons are readily recognized in the markets by the white bloom-like coating of lime with which they are covered. The merchants handle them very carefully in order not to mar this covering. The skin of water persimmons is golden yellow until allowed to become over-ripe, when it takes on a deep, orange-red hue. In the condition in which they are usually consumed, the flesh of water persimmons is firm, slightly juicy to mellow, depending upon the stage of ripeness, and mildly sweet. It becomes soft and mushy if the fruits are allowed to become over-ripe. They do not reach this stage as quickly as do the fruits ripened by the smothering method and by virtue of this better keeping quality they usually bring a little better price in the market.

A modification of the lime-water method used in the Tung On (東安) region consists in substituting for the lime an equal portion of the juice from the macerated stems of Hon Laat Liu (旱辣蓼) *Polygonum spp.*

The smothering method of ripening persimmons may be carried out in any one of several ways. The one most commonly used in the wholesale fruit markets in Canton is to place the fruits in a large, covered earthen jar in the middle of which is an upright bamboo cylinder of open weave. A large stick of incense is burned in this central chamber and the smoke, penetrating the spaces between the fruits is said to effect, or assist in, the ripening process. This is the most rapid method, being said to require only one or two days. Persimmons ripened by this process are deep orange-red in color, with golden yellow flesh, which is almost custard-like in its consistency, with the exception of the tougher, clear, almost jelly-like seed pocket, and may be eaten readily with a spoon. The fruits ripened by this method must be consumed promptly as they are very perishable.

The method most commonly used in the villages, where small quantities of persimmons are ripened for home consumption, is to place the fruits in a covered earthen jar, the bottom of which has first been covered with a thick layer of fresh banyan leaves. Another thick layer of fresh banyan leaves is then placed over the fruits and the jar covered. This process takes four days to a week or so.

The village boys sometimes ripen fruits for their own consumption by burying them in the mud for a few days!

Other Methods of Treatment

Among the Hakkas of Kwangtung persimmons are often dried for winter consumption. For this purpose the fruits are not ripened, but are picked while still firm, but turning yellow. They are then peeled, tied by their stems into long strings, and hung in the sun. As the surface gets dry enough so that the fruits may be handled, they are rubbed between the hands, presumably to assist in the expulsion of the moisture, and finally pressed flat. This product is known as *Tsz Peng* (柿餅), that is, Persimmon Cakes. The flavor is rich and pleasant, and not too sweet. There is usually no trace of astringency.

The Hakkas somtimes soak the freshly gathered fruits in salt water for about a week. This removes the astringency and imparts an unusual, but not altogether unpleasant flavor.

Other Uses of Persimmons in Kwangtung

A large portion of the persimmon crop, particularly of the smaller varieties, is never allowed to reach complete maturity, but is picked at the age of about three months and used as a source of two commercial products which are locally very important, namely, a black dye for dyeing silk, paper fans and fish nets, and a waterproofing material for paper umbrellas. The processes by which these products are made have not yet been investigated. The fruits of *Diospyros lotus* L., known locally as *Kaau Tsai* (膠仔), are used solely for these

two purposes. This species is found wild in many parts of Kwangtung. It is cultivated at Loh Kong Tung, (羅崗洞) where it also occurs in the wild state. The seedlings which spring up spontaneously, both in the wild and on the cultivated hillsides, are grafted when about 1.5 to 2 cm. in diameter, with a strain which produces larger fruits than those borne by seedling trees. The fruits are small (up to 2 cm. in diameter), globose, very hard and seedy, with little flesh; yellow in color when ripe. See Figure 17.

Description of Varieties

1. *Kai Sam Tsz* (雞心柿)

Reported from Loh Kong Tung (羅崗洞), Lung Ngaan Tung (龍眼洞), Liu Tsoi (寥才), and Honam Island (河南) at Pak Shaan (北山) and Sheung Ch'ung (上涌). *Kai Tsz* (雞柿) and *Tsz Tsai* (柿仔), are also names sometimes applied to this variety. This is one of the most common varieties. In fact, it is a group of forms more or less similar in appearance. Some of the forms are distinguished by special names, while others, equally distinctive, are known only by the general name, *Kai Sam Tsz*. Figure 1 shows a very unusual, pointed form found on the market in Canton during October. It is said to come from Kaang Koo Lau (更鼓樓) and Ma P'oon (馬盤). Figure 2 shows a form secured at T'in Ha Village, (田下村) Honam Island (河南) which is marked by a constriction about its middle. *Kwai Fa Tsz* (桂花柿) (Figure 3) is a seedless form found at Pak Shaan, Honam Island (北山,河南). *Man Tsz* (文柿) (Figure 4) is a seedy form found at Loh Kong Tung (羅崗洞). *Kai Ngaan Tsz* (雞眼柿) (Figure 5) is a globular, rather seedy form, also from Loh Kong Tung (羅崗洞) (Shui Sai 水西). *Ah P'oh Tuet* (亞婆啐) is a very small, seedless form found at at Foh Ts'uen (火村) Loh Kong Tung (羅洞洞).

Often a tree bears both seedless and seedy fruits. The seedy fruits are always larger than the seedless, and are said to ripen earlier. The farmers call them the female (Na 哪) fruits. The seedless fruits are called male (Kung 公).

As a rule the fruits of this group begin to ripen about a month earlier than those of the other varieties, appearing on the market early in August.

2. *Ngau Sam Tsz* (牛心柿)

Reported from Lung Ngaan Tung (龍眼洞) and Loh Kong Tung (羅崗洞).

One of the largest varieties. Fruits cardiform, squarish in cross-section, apex flattened, calyx markedly depressed, skin and flesh light yellow. Astringent until ripened artificially. Seedless to few-seeded. Often with a slender tubular cavity at the core of the fruits. Figure 6.

3. *Taai Hung Tsz* (大紅柿)

Reported from Liu Tsoi (寥才), Lung Ngaan Tung(龍眼洞), and from Loh Kong Tung as *Taai Yuk Tsz* (大肉柿). One of the large varieties, being 5 to 6 cm. in diameter. The most common variety on the market in Canton. Fruits cardiform, apex somewhat pointed, round in cross-section. Skin bright red when ripe, flesh golden yellow. Seedless to few-seeded. Must be ripened artificially. Known in the wholesale markets as *Taai Tsz* (大柿) and *Fuk Tsz* (福柿). Season very long, extending from the latter part of August into November, long after all other varieties have disappeared from the markets. Flesh very rich and sweet when ripe, and almost of the consistency of custard when ripened by the smothering method. Figure 7.

4. *Fong Tsz* (方柿)

Seen in the market at Cheung Chow (長洲) New Territories, Hongkong. Reported also from Koon Laan (觀欄) in Tung Koon District (東莞) where it is known as *Hop Loh Tsz* (盒羅柿). Found near Ch'eung Kong (長江) where it is known as *Pin Tsz* (扁柿).

Fruits markedly oblate, squarish in cross section, up to 5 cm. in diameter. Stem attached in slight depression. Skin bright red, flesh golden yellow, sweet, of excellent flavor and quality. Seedless. Must be artificially ripened. Figure 8.

5. *Shai Tsz* (晒柿)

Reported from the vicinity of Tak Hing (德慶) and adjacent territory, including the Tung On region (東安).

Known in the Canton markets as *Tung On Shui Tsz* (東安水柿), *Taai Hung Shui Tsz* (大紅水柿), *Taai Tsz* (大柿) and *Shui Tsz* (水柿). The name *Shai Tsz* (晒柿) comes from the fact that these persimmons are commonly dried for winter consumption.

This is one of the largest varieties, attaining a diameter of 7.3 cm. and a length of 6.3 cm. Fruits oblong-conical, the apex flattened and sometimes with a slight depression. Somewhat squarish in cross-section. Calyx only slightly depressed, calyx lobes lying flat, never reflexed. Fruits seedless or nearly so. Usually ripened by the lime-water method, which results in a fruit with a most delicious, rich, moderately sweet flavor and a mellow texture. This is by far the best variety found by the writer. Skin and flesh a rich golden yellow to orange. Figure 9.

6. *Sha Hok Tsz* (沙壳柿)

Reported from Loh Kong Tung (羅崗洞). Known at *Foh Ts'uen* (火村) also as *Taai Tsz* (大柿).

Fruits oblong, cylindrical, round in cross section, calyx slightly cupped, calyx lobes usually sharply reflexed. Seedless to few-seeded. Characterized by a granular deposit (presumably of calcium pectinate) just under the skin, which gives a slight grating sound when the skin is cut with a knife, and which is the basis for the name *Sha Hok Tsz* (沙壳柿). Skin red-orange to orange-red when ripe. Flesh golden yellow; of excellent quality and flavor after artificial ripening, which is usually done by the smothering method. Figure 10.

7. *Shui Tsz* (水柿)

Reported from Loh Kong Tung (羅崗洞), Chuk Liu (竹寮) and Ch'eung Kong (長江) West River.

Fruits squarish in cross section, oblate, to sub-globular, with a marked depression running down the middle of each side. Seedless to few seeded. Seeds large, surrounded by a very thick, jelly-like pocket. Said always to be ripened by the lime-water method. Sold in the Canton wholesale markets under the names *Shui Tsz* (水柿) and *Cham T'au* (浸透). Skin and flesh golden yellow. Figure 11.

8. *Sz Man Chuen* (斯文傳)

Reported from Loh Kong Tung (羅崗洞).

Fruits sub-globular to cylindrical in form, round in cross section, the apex sometimes slightly conical. Characterized by a slight constriction just below the calyx, forming a sort of collar. Calyx slightly depressed, calyx lobes sometimes, but not always, reflexed. Skin red-orange in color when the fruit is ripe; flesh golden yellow.

A rather seedy variety, some fruits having as many as four or five seeds. Seedless fruits are often found, however. Generally speaking, the fruits of this variety must be ripened artificially, which is usually done by the smothering method, in order to remove the astringency. There is one tree near Loh Fung Monastery (羅峯寺), however, whose fruits, when ripened on the tree, are sweet and palatable without further processing. Figure 12.

9. *Taai Paat Sin Tsz* (大八仙柿)

Reported from Pak Shaan, Honam Island (北山,河南).

Fruits oblong-cylindrical to globular, round in cross section, of medium size (about 4 cm. in diameter). Few-seeded to rather seedy. Skin deep orange when ripe, flesh golden yellow. Usually ripened by one of the smothering methods. The season extends from late August to early October. Figure 13.

10. *Sai Paat Sin Tsz* (細八仙柿)

Reported from Pak Shaan, Honam Island (北山,河南).

Fruits medium-small, (3.5 cm. in diameter) sub globose. Calyx slightly cupped, with lobes spreading the width of the fruits. Seedy to few-seeded. Skin deep orange when ripe, flesh golden yellow. Ripened by smothering. Figure 14.

11. Kaau Tsai (膠仔)

Found at Kam Ngau Haang (金牛坑).

A seedling variety with seedy fruits. Used as stock for the grafted varieties. An unusually strong and healthy strain, with smooth, fine-grained bark which, when it peels off, leaves the trunk of the tree light grey. The leaves of this variety are unusually large, (commonly 25 cm. long and 13 cm. wide) ovate, acuminate, both surfaces with a soft, inconspicuous but persistent tomentum.

Fruits slightly elongated, sub-globular in shape. Calyx smooth, covered with a dense, short tomentum which is deciduous above and persistent below; edges rolled. This variety seems to differ from the other varieties here considered, in having 10 to 12 seed cavities instead of eight. Fruits not eaten. Figure 16.

12. Ye Tsz Tsai (野柿仔)

Reported to be spontaneous in northern Kwangtung.

A small, seedy globular fruit. If this is a wild form, it may be the ancestor of some or all of the varieties herein considered. Figure 16.

Species of Diospyros other than *D. Kaki* found in Kwangtung

D. cardiophylla Merr., D. eriantha Champ., D. hainanensis Merr., D. lotus L., D. maclurei Merr., D. morrisiana Hance, and D. sinensis Hemsl.

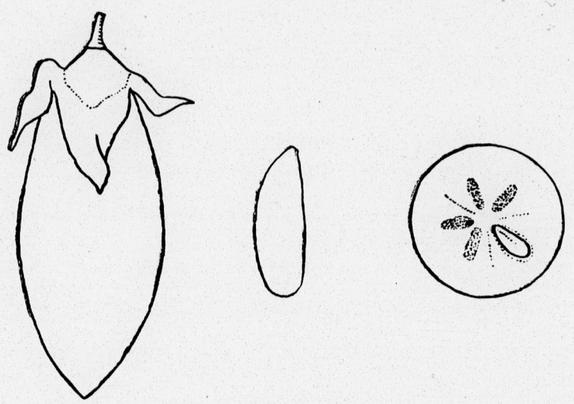

Fig 1~ Kai Sam Tsz 雞心柿

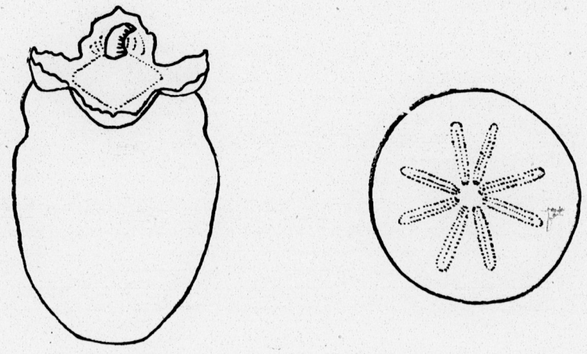

Fig 2~ Kai Sam Tsz 雞心柿

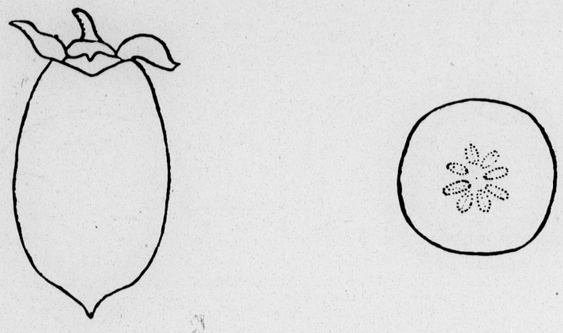

Fig 3 ~ Kwai Fa Tsz 桂花柿

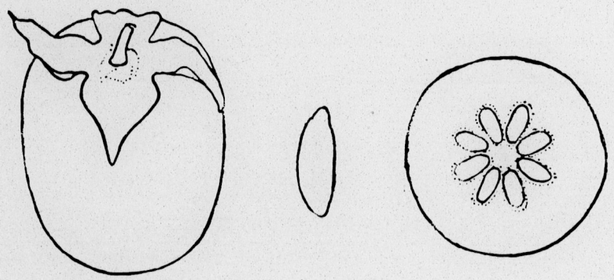

Fig 4 ~ Man Tsz 文柿

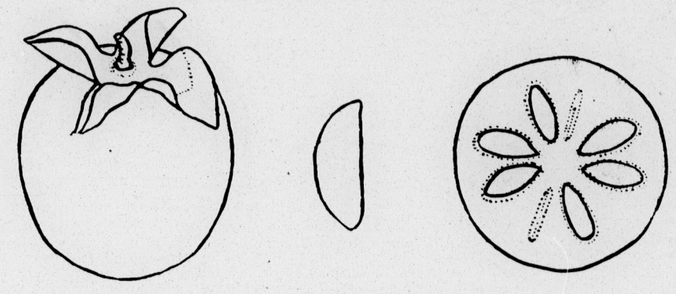

Fig 5 ~ Kai Ngaan Tsz 雞眼柿

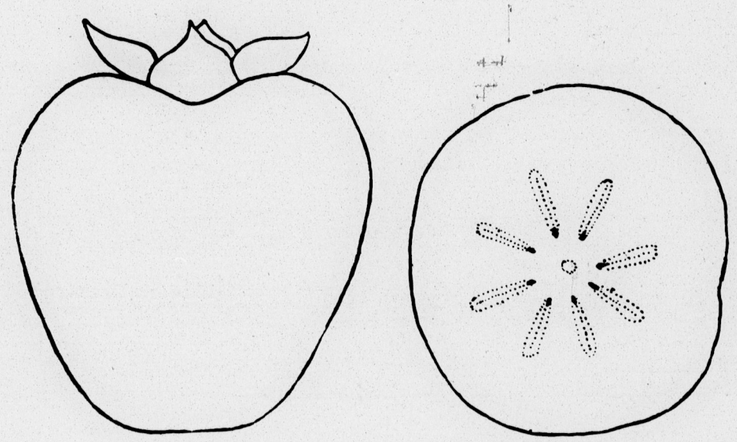

Fig 6 ~ Ngau Sam Tsz 牛心柿

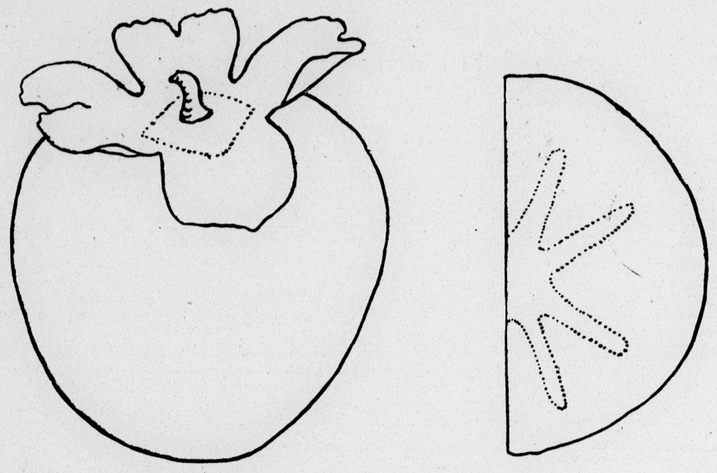

Fig 7 Taai Hung Tsz 大紅柿

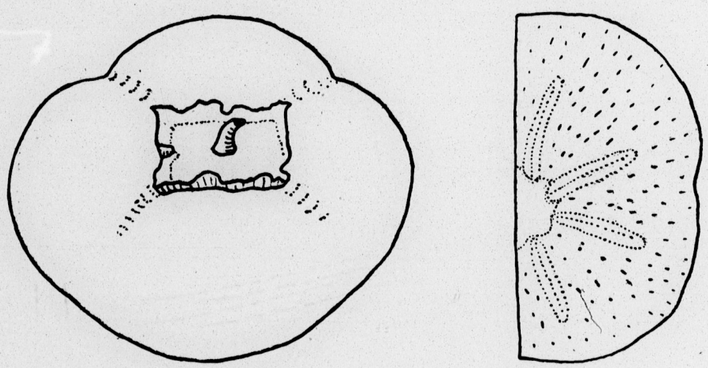

Fig 8~Fong Tsz 方柿

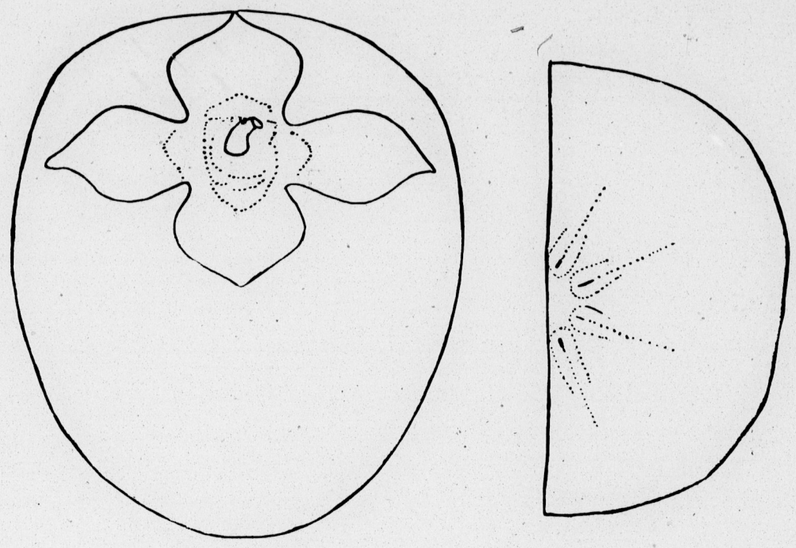

Fig 9~ Shai Tsz ~ Tung On Shui Tsz
晒柿　　東安水柿

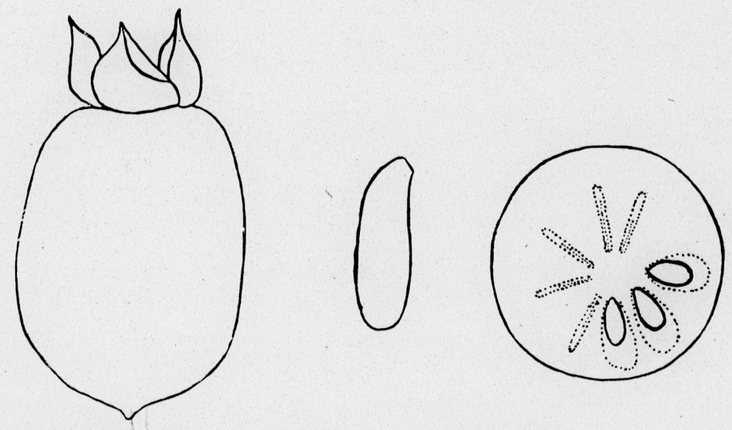

Fig 10~Sha Hok Tsz 沙殼柿

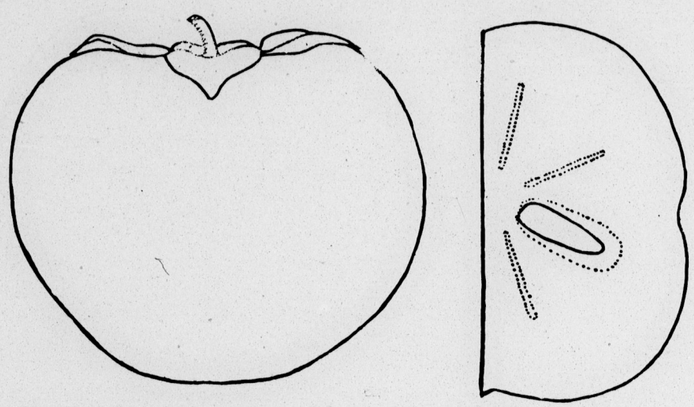

Fig 11 ~ Shui Tsz 水柿

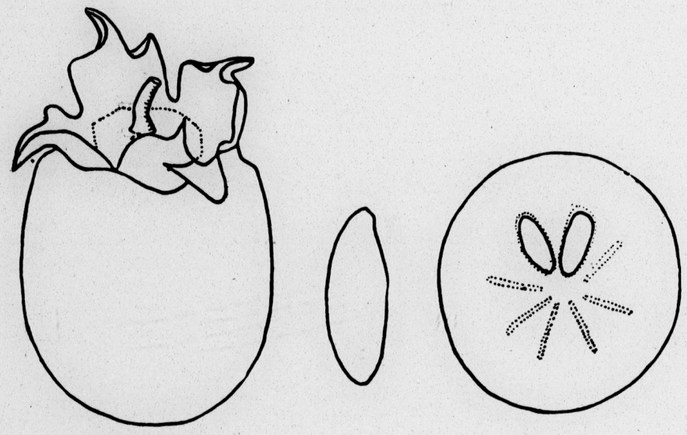

Fig 12 - Sz Man Chuen 斯文傳

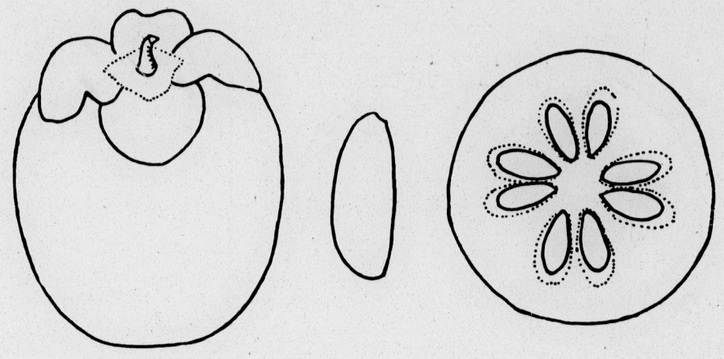

Fig 13 ~ Taai Paat SinTsz 大八仙柿

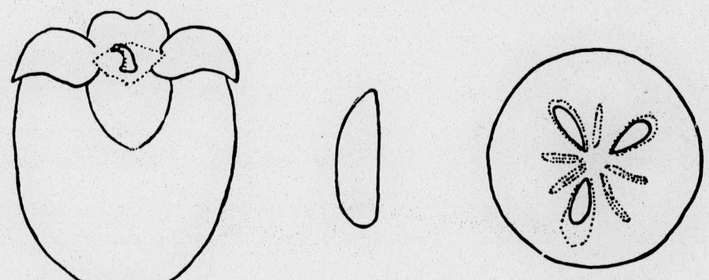

Fig 14 ~ Sai Paat SinTsz 細八仙柿

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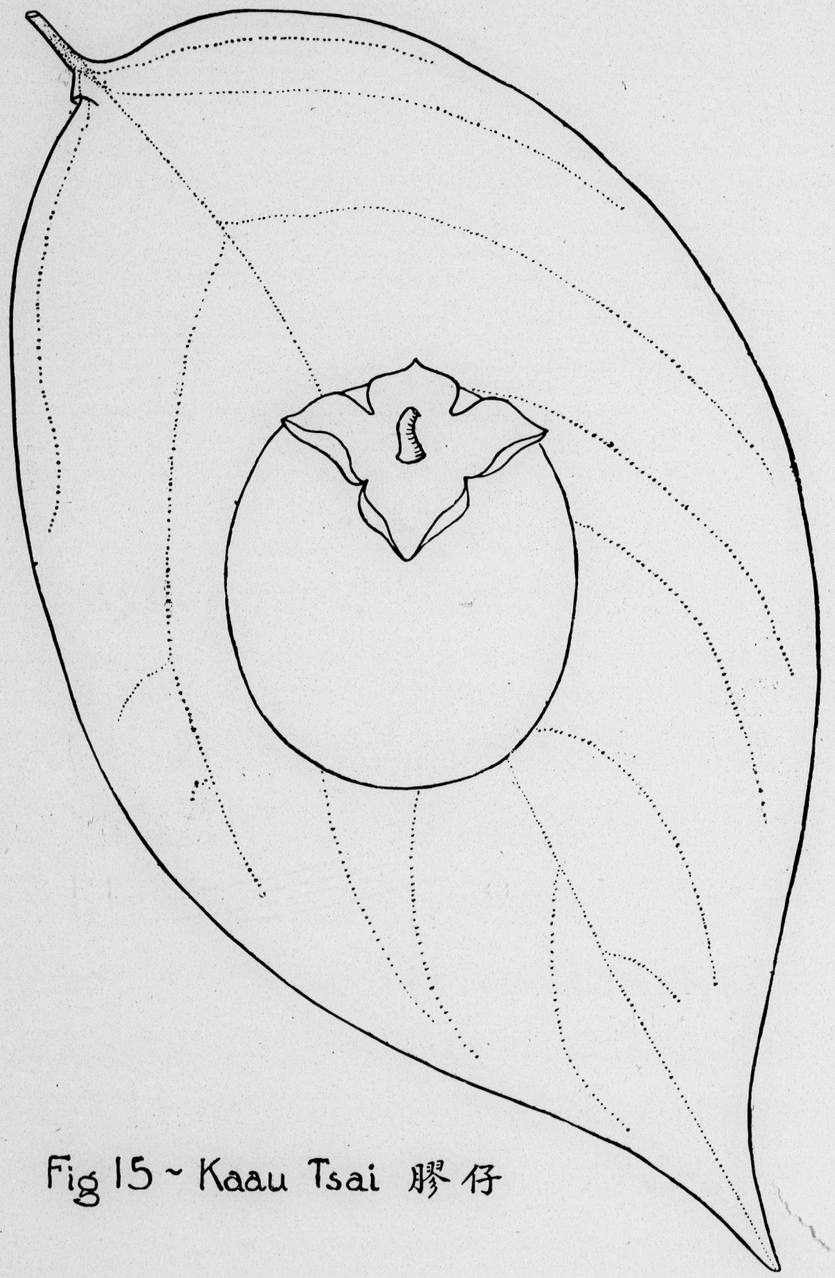

Fig 15 ~ Kaau Tsai 膠仔



Fig 16 ~ Ye Tsz Tsai 野柿仔

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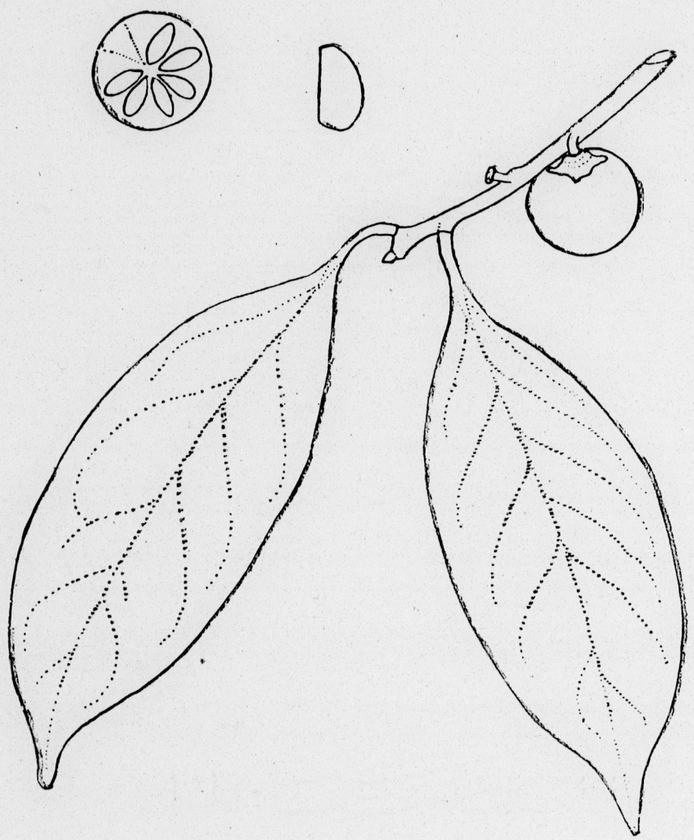

Fig 17 ~ Kaau Tsai 膠仔 Diospyros lotus L

POULTRY FEEDING EXPERIMENTS.*

By L. Hoh 何亮 and Y. T. Kam 甘汝登

Canton Christian College.

In China nearly everybody raises chickens. Very rare indeed is a home without at least a few chickens. Even the boat people, of whom there are some 200,000 within the confines of Canton city alone, do not let the fact that they have a limited space within their small water craft prevent them from keeping a few chickens in a crate which they attach high on the stern of the boat.

While most of the chickens in the Canton region are raised in the village homes in small flocks, there are a number of shops in Canton that make some attempts at commercial feeding. Experiments were undertaken in 1922 and 1923, at Canton Christian College (1) in order to determine the rate of gain in weight of chickens on different combinations of foods, (2) to compare the economy of certain rations, and (3) to find out if possible the most economical length of the feeding period in commercial fattening. These experiments consisted of fattening tests with various available feeds. The birds used were the common market chicken of Canton, which is a small buff colored chicken. This variety is commonly known in the Philippine Islands, where it has been much improved by breeding and selection as the Cantonese chicken.

Feeding Tests Made in 1922

In the experiments conducted in 1922 forty-eight pullets were used in each of two feeding tests extending over a period of 21 days. These birds were brought from the west chicken market of Canton on Luen Hing Street (聯興街). Chickens in this market come mostly from the North River region, which is a region that has a reputation for producing chickens of excellent quality. Those used were about four and one-half months old, and their average weight was a little more than one and two-thirds pounds per head at the time of purchase. The price was 49 cents Canton currency † a pound.

When the pullets were chosen, careful attention was given to select healthy, vigorous birds, uniform in type and of a conformation that seemed best suited for fattening.

*No attempt is made in this paper to describe the common methods of feeding chickens in Canton since this was presented in a paper by W. L. Funkhouser and L. Hoh in Vol. 1. No. 2, pp. 1-6, this publication.

†One dollar Canton currency is generally equal to about 50 cents United States currency.

Experimental Feeds Used

The rations used contained rice bran, wheat bran, cooked rice, and ground peanut cake. In each test four different rations were used and fed to four different lots of 12 pullets each. The rations and lots were numbered 1, 2, 3 and 4. The proportions of feeds in each of the four rations are shown in Table I. The amount of experimental feed allowed each lot of 12 pullets was fixed at 3.25 pounds a day.

The cost of feeds per 100 pounds was as follows: rice bran $2.55, wheat bran $3.23, polished rice $4.80 and peanut cake $5.25.

TABLE I.

RATIONS USED

Lot 1	Lot 2	Lot 3	Lot 4
Rice bran only	Rice bran 3 parts, wheat bran 1 part	Rice bran 2 parts, cooked polished rice 1 part	Rice bran 4 parts, cooked polished rice 2 parts, peanut cake 1 part

Supplementary Feeds

Green vegetables, usually cabbage or lettuce leaves, and grit in the form of sand, were given twice a week. Two days of each week each pen had access to ground charcoal for 20 minutes. No records were kept of the amount of green vegetables or charcoal consumed. Drinking water, to which a few drops of potassium permanganate were added was supplied daily.

The pullets, crates, house and equipment were all washed thoroughly in kerosene emulsion before the beginning of each test. Twelve fattening crates with four pullets each were used in each test. Three crates comprised one lot of twelve chickens.

All the pullets were put through a fasting period of twenty-four hours before the beginning of the tests so that the digestive tract would be fairly empty before starting on the experimental rations. They were weighed in lots at the beginning of each test, and every second day thereafter throughout the test. The final weighing was done early in the morning following the 21st day of the period.

Tables II and III show the gains or losses in weight for each lot for each of the two tests. The lots were weighed every other day. Table II is for the first, and Table III for the second test.

Table II shows that the peak of gain for lots 1 and 2 occurred with the weighing on the 14th day. In lot 3 in both tests losses occurred after weighing on the 16th day, while in lot 2 in both tests gains continued until the 18th day after which losses began.

Table III shows no increase in lots 1, 3 and 4 after weighing on the 16th day. With lot 2, gains ceased with the weighing on the 18th day.

The results in each of the four lots are in the same position in both tests and are in the order of lot 4, lot 2, and lot 1. Although the ration consisting of rice bran and cooked rice is shown to be the best of the four rations used in this experiment, the results are far from satisfactory since the gain in twenty-one days was only about 25 per cent of the original weight, while in commercial feedings this percentage would be considered very low for the usual feeding period of 14 days.

The extremely small gains made by all the lots in the first test (see Table II) are probably due to the serious attack of an eye nematode which has been discussed in the Lingnaam Agricultural Review, Vol. 3, No. 1, pp. 15 & 16.

TABLE II.

GAINS IN WEIGHT FOR FIRST TEST

(FIGURES IN POUNDS)

Date of weighing pullets		Lot 1 Total wt.	Lot 2 Total wt.	Lot 3 Total wt.	Lot 4 Total wt.
March	14	19.20	19.10	19.30	19.00
,,	16	20.10	20.20	20.50	20.20
,,	18	20.30	20.55	20.30	20.35
,,	20	19.90	20.20	21.20	20.30
,,	22	20.10	20.30	21.00	20.70
,,	24	20.00	20.60	21.00	20.70
,,	26	20.60	20.70	21.20	20.90
,,	28	20.20	20.40	21.50	20.90
,,	30	19.19	20.50	21.60	20.80
April	1	19.40	20.50	21.40	20.40
,,	3	19.40	20.20	21.20	20.20
,,	4	18.90	20.10	21.20	20.20
		Total gain 0.30	Total gain 1.10	Total gain 1.90	Total gain 1.20
		Greatest " 1.40	Greatest " 1.60	Greatest " 2.30	Greatest " 1.90

TABLE III.

GAINS IN WEIGHT FOR SECOND TEST

(FIGURES IN POUNDS)

April	9	16.6	16.7	16.6	16.6
„	11	18.9	19.8	20.1	19.8
„	13	19.5	20.0	20.1	19.8
„	15	19.4	20.4	20.1	19.8
„	17	19.3	20.1	20.1	20.0
„	19	19.3	20.0	20.1	20.1
„	21	19.3	19.6	20.1	20.2
„	23	19.2	19.6	20.7	20.3
„	25	19.5	19.8	20.7	20.3
„	27	19.7	19.8	20.8	20.5
„	29	19.7	19.8	20.8	20.5
„	30	19.7	19.8	20.9	20.4
		Total gain 3.10	Total gain 3.10	Total gain 4.3	Total gain 3.8
		Greatest " 3.10	Greatest " 3.70	Greatest " 4.3	Greatest " 3.9

Perhaps small gains are characteristic of the Cantonese chickens but it will require further work to confirm this hypothesis. Since the chickens were limited to 2.25 pounds of feed per day in each lot, they may not have had all they could consume every day of the test although in most of the lots, especially after two weeks of feeding, the chickens left some feed in the troughs at each feeding. Lot I in both tests did not eat as much as the other lots, owing no doubt to the fact that rice bran fed by itself alone is unpalatable.

Financial Results from Different Rations

At the close of the tests the chickens were all sold through the Business Division of the Ling Nan Agricultural College of Canton Christian College. For the fowls in the first test the price received was 91 cents and for those in the second it was 96 cents Canton currency per pound.

Table IV shows that losses occurred in lots 1 and 2 in the first test. The results with lots 3 and 4, test 1, and with all the lots in the second test, show slight gains. Ration 3 consisting of rice bran and cooked rice fed to lot 3, was the most economical ration, while ration 1 consisting of rice bran alone, fed to lot 1, not only made the least gains in weight but made them with the greatest cost. The ration consisting of a combination of rice bran and cooked rice, while

*Labor was figured at five cents an hour and the time required was about one-half hour each day.

TABLE IV.

GAINS IN WEIGHT, COST OF PRODUCTION AND NET LOSS OR GAIN

	Total gain or loss in pounds.	Price per pound received	Cost of feeds consumed	Gain or loss	Labor *	Net gain or loss.
Lot 1 1st test	-0.3	$0.91	$1.34	-$0.150	$0.325	-1.815
2nd „	3.1	0.96	1.34	1.630	0 325	0.025
Lot 2 1st „	1.1	0.91	1.34	0.553	0 325	-1.112
2nd „	3.1	0.96	1 34	1.680	0.325	0.025
Lot 3 1st „	1.9	0.91	1.17	0 951	0.325	0.546
2nd „	4.3	0.96	1.17	2.329	0.325	0.834
Lot 4 1st „	1.2	0 91	1.43	0.501	0.325	1.254
2nd „	3.9	0.96	1.43	2.134	0.325	0.379

making the greatest gain at the lowest cost was far from satisfactory since both gains in weight and return were low. In commercial feeding, interest on the investment would also be added to the cost of production and if this were done the net profit from these rations would be still less. This ration has also the widest nutritive ratio and if it were made a little narrower by adding to it some feed like distillers' waste, the results might be more satisfactory.

The losses or small gains in lots 1 and 2 in both tests were very likely on account of the unpalatableness of rice bran. In the latter part of the tests, birds in these two lots were not at all eager for their feed and considerable feed was frequently left in the feeding troughs. At the time the tests were finished the birds in these two lots were very thin. Six of them had extremely weak legs and could not stand up, and all the others of these two lots appeared to be weak and dull, being an indication of improper proportions of nutrients in the ration or lack of sufficient nutrients or vitamines.

Summary of Tests 1 and 2 (1922)

1. Out of the four rations used in the tests, No. 4 which consisted of rice bran 2 parts and cooked rice 1 part by weight, made a gain of 1.90 pounds in test 1 and 4.3 lbs. in test 2 in 21 days, which were the greatest gains in both tests.

2. The ration composed of 4 parts of rice bran and 1 part of wheat bran, and the one consisting only of rice bran were unpalatable and gave the least satisfactory results.

3. There is no doubt a limit to the most economical length of time for crate fattening. In the first test it was reached on the 14th to the 18th day, and in the second test on the 16th to the 18th day of feeding.

4. The relative gains for the different rations are shown in the following table:

TABLE V.

RELATIVE GAINS FOR DIFFERENT RATIONS

	Length of period	Greatest gain during the period		Final gain		Average gain per head	
		1st test	2nd test	1st test	2nd test	1st test	2nd test
Lot I	21 days	1.40	3.1	-0.30	3.1	-0.025	-0.258
Lot II	„ „	1.60	3.7	1.10	3.1	0.091	0.308
Lot III	„ „	2.30	4.3	1.90	4.3	0.158	0.358
Lot IV	„ „	1.90	3.9	1.20	3.8	0.100	0.325

5. In both tests lot 1 was fed at a financial loss. In the second test all lots made a net profit, the greatest gain, $0.834, being made on the ration of rice bran and cooked rice in the proportion of 1 to 2. The gains in the two tests, however, were not satisfactory for if housing, interest and other items were considered the results even in test 2 might show a loss.

6. If the feeding had closed at the end of 16 to 18 days both tests would have given better financial returns.

7. These tests, though unsatisfactory in some details, do show the relative position of the different rations used and suggest the degree of palatability of each, and indicate approximately the number of days for economic fattening.

Feeding Test No. 3 (Conducted in 1923)

Feeding tests were made in the spring of 1923 in order to check the results of tests 1 and 2 made in 1922. Forty-eight pullets were again used and divided into 4 lots of 12 each, care being taken as in previous tests to make the lots as equal as possible in weight, condition and other respects. The rations fed and the procedure throughout was the same as in the previous tests except that at each feeding the feed left in the feed troughs from the previous feeding was removed, air-dried, and deducted from total feed given in calculating feed consumption.

The chickens for this test were purchased at $1.00 and at the end of the test sold for $1.20 a pound. The cost of feeds per 100 pounds was as follows: rice bran $3.00, wheat bran $4.50, polished rice $6.26. These prices were considerably higher, due to the civil war still in progress, than they were when tests 1 and 2 were made.

In this test greater gains in weight were made in all lots than resulted in tests 1 and 2. The greater gains were no doubt due to the fact that no trouble with the eye nematode infection was experienced either before or during the test.

TABLE VI.

WEIGHT OF EACH LOT EVERY TWO DAYS

	Lot I	Lot II	Lot III	Lot IV
Days Feeding	Wt. of birds	Wt. of birds	Wt. of birds	Wt. of birds
Initial weighing	22.0	22.2	23.0	22.2
2	23.8	24.0	23.4	24.5
4	23.5	24.4	23.5	25.3
6	24.0	24.3	23.8	25 5
8	24.2	24.5	23.5	26.0
10	24.3	24 7	23.5	26.7
12	24.7	24.8	25.5	26.6
14	24.7	24.8	25.6	26.3
16	24.5	24.4	25.9	26.0
18	24.6	24.5	26.2	26.2
20	24.3	24.0	26.2	26.0
22	23.7	23.2	25.7	25.3

	Total gain	Greatest gain
Lot I	1.7 lbs.	2.7 lbs. (end of 12th day)
Lot II	1.0 „	2.6 „ („ „ „ „)
Lot III	2.7 „	3.2 „ („ „ „ „)
Lot IV	3.1 „	4.5 „ („ „ „ „)

As in tests 1 and 2, it was found that rations 1 and 2, consisting entirely or largely of rice bran, were unpalatable and the birds ate much less and made smaller gains compared with those on rations 3 and 4.

The greatest gain was with lot 4 which received a ration of 4 parts of rice bran, 2 parts cooked polished rice, and one part ground peanut cake, by weight. One chicken in lot 2, four in lot 3, and one in lot 4, for some unaccountable reason, became lame and went off feed during the test. The poor showing of lot 3 as compared with lot 4 in this test was no doubt partly due to this trouble, since this lot was most affected with the lameness.

The greatest gain in this test occurred about the 14th day, after which day lots 1, 2 and 4 lost very rapidly in weight. The chickens in lot 3 continued to gain until the 17th day, when they also began to lose rapidly in weight.

Due largely to feeds being very high priced in 1923, every lot showed a financial loss at the end of 21 days. However, if feeding had stopped on the 14th day every lot would have showed a net profit, ranking in the following order, lots 4, 3, 1, 2. (see table VI).

Table VI indicates that a much greater net profit would have been secured had the birds been sold on the 12th or 14th day, since after the 14th day all lots except No. 3 lost in weight, and No. 3 made no gains after the weighing on the 18th day.

TABLE VII.

TOTAL GAIN IN WEIGHT FOR 21 DAYS, AMOUNT RECEIVED FOR CHICKENS, TOTAL COST, AND NET LOSS

Lots	Total gain in lbs.	Cost of feed consumed	Cost of labor*	Price received per lb.	Value of gain	Net loss	Total grain consumed in pound
Lot 1	1.7	$1.580	$0.131	$1.20	$1.02	$0.691	47.25
Lot 2	1.0	1.758	0.131	1.20	0.60	1.289	47.25
Lot 3	2.7	1.414	0.131	1.20	1.62	0.075	41.00
Lot 4	3.1	1.254	0.131	1.20	1.86	0.475	47.00
Total	8.5	$6.006	$0.524		$5.10	$1.430	182.50

* Labor is figured at five cents an hour and the time required was about one-half hour each day.

Table VIII shows the net profit in case the chickens had been sold on the 14th day. In this table the results show up in the same order with the four lots as in tests 1 and 2. The net profit for lot 4 is much greater than with the other lots, being 245 per cent higher than the net profit in lot 3. Lot 3 gave considerably better results than lots 1 and 2.

TABLE VIII.

NET PROFIT AT END OF 14 DAYS' FEEDING

	Total gain lbs.	Cost of feed consumed	Cost of labor	Price received per pound	Value of gain	Net profit	Total grain consumed in pounds
Lot 1	2.7	$1.05	$0.09	$1.20	$1.62	0.48	31.50
Lot 2	2.6	1.17	0.09	1.20	1.56	0.30	31.50
Lot 3	2.6	0.94	0.09	1.20	1.56	0.62	27.33
Lot 4	4.1	0.84	0.09	1.20	2.46	1.53	31.33

Summary of Test 3

1. Ration 4, consisting of four parts rice bran, two parts cooked polished rice, one part ground peanut cake, gave 245 per cent greater net returns than ration 3 which was second highest in net returns, and which consisted of rice bran two parts and cooked polished rice one part.

2. Ration 3, in which the net returns were next to that of ration 4, would no doubt have given more favorable returns except for a severe attack of lameness in four birds which caused them to go off feed for several days.

3. As in tests 1 and 2 unfavorable results were secured with rice bran only (ration 1), or chiefly will rice bran, (ration 2). In this test the poor returns could not have been due to the unpalatableness of the rice bran and insufficient consumption since the total amount of feed consumed was as great as with lot 4.

4. From the standpoint of economical fattening intensive crate feeding should not continue more than fourteen to sixteen days.

5. The net profits from the various rations when the pullets were purchased at $1.00 Canton currency per pound, fed for fourteen days and sold for $1.20 a pound, with cost of feeds as follows: rice bran $3.00, wheat bran $4.50, polished rice $6.25, on 48 pullets is as follows:

Lot 1, consisting of rice bran only, 48 cents; lot 2, consisting of three parts rice bran and one part wheat bran, 30 cents; lot 3, consisting of rice bran two parts, cooked polished rice, one part, 62 cents; lot 4, consisting of four parts rice bran, two parts cooked polished rice and one part peanut cake, $1.53.

6. If broken rice had been used instead of polished rice the net returns would probably be slightly higher since broken rice is similar in feeding value to polished rice and is about forty per cent cheaper.

REPORT ON A STEAM FILATURE IN KWANGTUNG.*†

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INTRODUCTION

The silk industry in South China may be divided into two main branches; the production of cocoons from the eggs, and the preparation of raw silk from the cocoons. The former deals primarily with the silk-worm rearing farmers and the egg producers, the latter deals with the filatures. Only the latter will be treated here.

This report is a result of the writers' one month investigation in Shun-tak (順德), the silk center of South China, aiming to reveal all the processes involved in the business. It traces, as detailed and accurately as possible, all the steps beginning with the purchasing of cocoons to the exporting of the finished product. The by-products including the waste silk and the pupae are included in the report. The management and financing, which are of no less importance and interest, are also treated.

The data were obtained from a typical steam-power filature of average capacity. It would have been much better if the writers could have obtained admission into several filatures and secured accurate data on each of them before presenting the report, but there is the handicap that most of the filatures do not welcome strangers to learn their business. The writers, however, succeeded in getting into one which is very representative of the filatures of South China, because of their acquaintance with the managers, one of whom is a stock holder in the filature. Understanding this, it is hoped that the readers may have a better appreciation as to the accuracy of the report.

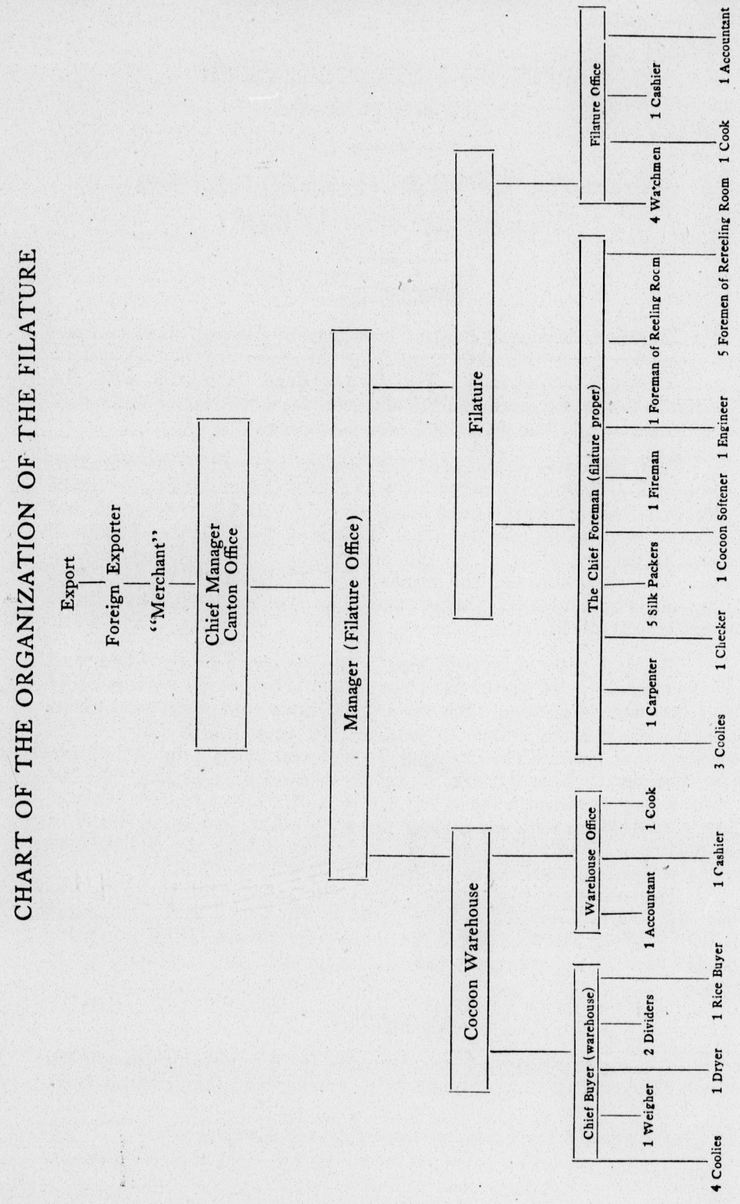
The name of the filature from which most of the data was obtained is Kung-hang (公亨) located in Sui-tang (水藤) Shun-tak District. We gratefully thank the managers, Messrs. Lei Fung Kong and Lei Siu Ching, who gave the writers material aid in obtaining the data.

ORGANIZATION

The organization of the filatures in Kwangtung is complex. Due to the great volume of business every year and the great territory

*Contribution No. 1 from the Department of Sericulture.
†A paper submitted as partial fulfillment for credit in farm experience

CHART OF THE ORGANIZATION OF THE FILATURE



of land devoted to the silk industry, the filature people have devised many complicated systems in buying and selling, as well as in management, all of which are very convenient to them.

While some of the filatures are privately owned, most of them are organized on a stock basis, capital being secured by the sale of shares. For systematic presentation of the organization, the writers have prepared a chart in which the details are clearly shown. Explanations of the details will follow the order of the chart.

The Canton Head Office

The Canton head office of every filature is a part of another larger office known as the Silk Commission House (絲莊). An explanation of the latter is necessary.

There are about twenty silk commission houses (絲莊) in Canton, all of which are located in Shaa-kei (沙基). The reason for such a location is nearness to Shameen where all the exported silk is sold to foreign agents. These silk commission houses are organized for the convenience of the filatures and may be privately owned or organized on a stock company basis. Four or five filatures may join together and establish an office. The capital required is about $50,000 which sum may be obtained by assessing it equally among the filatures. The commission house provides a building which is used to accommodate the managers of the filatures and space for temporary storage of the silk as it comes from the country. Silk is sent from the filatures in the country to the commission house in Canton on special boats called "silk boats." The commission house sees that the silk is properly carried from the boat to the house and stored.

Each trip a silk boat may carry as much as half a million dollars of cash or its equivalent in silk. The silk boats are run exclusively for the convenience of the silk business and all of them are self-protected.

Before the silk reaches the commission house, it must go through the Local Tax Office (西稅衙) where it is examined and the tax asessed. The unit upon which to tax is the picul weight. There is no difference of taxation between fine and coarse silks, nor good or poor quality silks, etc. The taxes per picul are as follows:

Canton import tax (from country to Canton) ..... $1+38%*	$1.38
Fort Tax (once a fort needed repair; money for the repair was secured by a tax on raw silk. Finally it became a permanent tax under the name as such) ..... $5.105+61% ..	$8.219
Likin ..... $6.8025+38%* ..	$9.393
Total	$18.992

The commission house pays these taxes to the Local Tax Office the next day after the silk arrives at Canton. Besides these, there are two more payments that the commission house has to make for the filature.

Freight to silk boat, per picul.....$1.20

Export tax .....$12.679+38%* $17.498
(paid when silk is exported)

The above amounts are expressed in Canton currency, the total amount of tax is $37.68 for each picul of silk. The filature pays back this amount to the commission house after the silk is sold.

The commission house furnishes board to all the men living in the house.

To sell the silk, the commission house secures a "merchant", who has had some training in English, to deal with the foreign exporters in Shameen. The "merchant" was formerly paid by a percentage on the silk sold, but this system has been abandoned. He is now hired and is paid a fixed amount per year ranging from $1000 to $2000, depending upon the number and size of filatures forming the commission house. Usually the "merchant" is one of the stock holders of the house.

Each day the "merchant" visits the offices of the foreign exporters who are not always confined to the exporting of raw silk only. Each silk exporting office usually employs a compradore whose duty it is to employ and pay a group of men for testing the silk in the process of buying. The compradore is paid $1.50 from every $1000 worth of goods sold, from which he takes his own salary as well as paying the wages of the men employed in the testing.

The offices of the foreign exporting companies are opened every day between 10:00 A. M. and 3:00 P.M. The "merchant" of the commission houses ascertains whether any orders have been received abroad and whether exporters wish to buy any silk The amount as well as the price offered for each order is noted and reported to the commission house. If the manager of the filature wishes to sell his silk at that price, he instructs the "merchant" to make the sale. The foreign exporter, after testing the silk, pays cash to the seller. The commission house charges the filature $8 to $9 commission on each $1000 worth of silk sold.

*The taxes are assessed in Haikwan taels but collected in dollars, one Haikwan tael being considered by the tax office as equal to $1.38 Canton money.

The chief manager of each filature, as above stated, lives in the Commission House. Besides seeing that the "merchant" is selling his silk properly, he supervises and finances the filature in the country. He watches the market very carefully and determines which size and quality of silk is to be prepared in the filature, and how many cocoons should be bought in the ware house. Such determinations often mean success or failure to the filature.

The amount of money a steam filature handles in a year is very great. The capital, usually one hundred taels a basin, is a small amount compared with the total which the filature pays out every year. Every crop, of which there are seven a year, a filature will buy $20,000 to $60,000 worth of cocoons. In certain crops when the conditions seem especially favorable to the manager, a filature may buy as much as $100,000 worth of cocoons. Kung-hang, a filature of 504 basins, can consume 1800 to 2000 piculs of cocoons a year, depending on the size of silk produced. If the cocoons were purchased at the low estimate of $2 a catty, it would mean that $360,000 to $400,000 would be needed to buy the cocoons alone. Roughly it takes five catties of cocoons to prepare a catty of silk, 2000 piculs of cocoons would produce 400 piculs of silk. If $340 were required for labor, fuel, rent, etc, to produce a picul of silk, 400 piculs would require $136,000. The total amount of money which the filature would handle in a year would be about $536,000. This gives a general idea as to the needs of a filature, some of the details of which will be discussed again under the cost of production. No fixed figure can be given because the value of the cocoons varies greatly with crop and season.

To secure this great sum of money, the chief manager borrows from the money shops (銀舖), as it is needed. All the money shops are in Canton. It must not be understood that this great sum is needed at one time, or during the entire year; only a part, as it is needed, is borrowed at one time, and returned as soon as there is money available from the sale of the raw silk. The rate of interest is variable, ranging from 8% to 15%, and depending much upon the market conditions. From May to November (Chinese Calendar) the filature borrows fixed date loans. This is due to the fact that a great quantity of cocoons have to be purchased for reeling in the latter part of the year. After this period, the filature borrows for current expenses to pay the wages, board, etc.

All the females employed in the filature, including the reeling and rereeling girls, are paid twice a month. Their wages are computed on the 15th and 30th of every Chinese month and paid on the 20th and 5th of the month, respectively. All the male employees are paid once a month in advance.

In short, the chief manager in the Canton head office supervises and finances the filature; his success depends upon his ability to foresee the market and use the money economically.

THE WAREHOUSE DEPARTMENT

Most of the filatures have one or more warehouses through which to buy cocoons. A big filature may have more than one warehouse, each located in a different part of the silk district. This has a decided advantage in that the price and quality of cocoons may vary in the various silk centers. On the other hand, a small sized filature cannot afford to have a warehouse of its own, so several filatures will combine to own one warehouse. In general, however, each steam filature owns one warehouse.

Practically all the warehouses are located in Yung-kei and Kwai-chow, the two cities being separated from each other by a canal. Formally the cocoon warehouses, found their homes in Taai-leung (大眞) a town not very far from Yung-kwai. Owing to the better transportation facilities of the latter, most of the warehouses have moved to that place and only a few are now left in Taai-leung.

There are about one hundred and thirty warehouses in Yung-kwai, the total of which is much increased every year. These warehouses are either located near the river bank or beside the canal. If one should visit Yung-kwai, he could not help seeing the warehouses as they occupy a large portion of the area of the two cities. They are built so near each other that one sees nothing so prominent as the warehouses.

Yung-kwai, the present silk center of Kwangtung, was formerly of little commercial importance. It has become prosperous because the warehouses have centered there, filatures have been established, and many other kinds of business that depend on the warehouses and filatures, have moved to it.

The Construction of the Warehouse

The function of the warehouse is to buy cocoons for its filature. In connection with buying, the warehouse has to dry and bale the cocoons if the latter are to be stored for some time before reeling. These processes take up a great deal of space, and the construction of the warehouse is such as will fit these conditions.

Most of the warehouses, if space permits, are more or less square, being 100 feet square in the larger ones, but less in the smaller ones. They are two story buildings, the ground floor of which is used for buying and baling of the cocoons, while the second floor is used for drying, and temporary storage. Both floors are covered with bamboo matting so that cocoons poured on them will not get dirty. In one corner of the building, on the ground floor, there are several ovens for drying the cocoons. These ovens are built of brick, and are about fifteen feet square. Into them may be put charcoal fires for the heating. Above the charcoal fires are bamboo mats on which cocoons are placed in the process of drying. The temperature is not fixed and cannot be absolutely controlled.

Sources of Buying

Although there are many big cocoon markets in these two cities or towns, the filature warehouse does not buy cocoons there, but only buys in the warehouse. This is primarily due to the fact that buying in the public market is very crude and is simply guessing. The details of the public market will be presented under a separate heading.

Cocoons sold in the warehouse may come from one of the following three sources:

Direct from Farmers.—Farmers who feel that the method of buying in the public market is unreliable, or who are afraid of being cheated by the dishonest men in the market or who have a special grade of cocoons on hand, or who are not willing to pay a comparatively high commission to the market, will find the cocoon warehouse the best place for their product. The warehouse and the farmer may be mutually known, and while the warehouse buys cocoons for its own consumption, no commission will be charged the farmers. Many warehouses, however, do not want to buy cocoons from the farmers directly, as each farmer has but a few bales to sell and this means more work and the cocoons bought are likely to be of mixed grades. The warehouse also has to board the farmers about a day, if they come to sell the cocoons.

Through a Middleman.—The second method of buying is through the middleman, called "Chue-chai-tau" (猪仔頭). The middleman brings the farmers to the warehouse to have their product sold. The farmers themselves are a little afraid of the warehouse buyers, fearing that they may cheat them. They will trust the middleman with their bargains. The warehouse, on the other hand, knows the middleman very well and trusts him to bring more farmers to the warehouse. The middleman receives a commission when a bargain is made; usually it is 0.3 per cent of the value of the cocoons bought from the farmer.

In many filature warehouses, money is loaned to the farmers through the middleman. It must be understood that the warehouse, through the buyer, knows many of these middlemen. Money is loaned to the middleman, and he in turn distributes it among his farmer acquaintances who may be in need of money for buying mulberry leaves, charcoal, etc. The farmers, receiving such aid, will be able to rear their worms to maturity which they could not do otherwise. The middleman makes all the farmers who receive loans from him bring their cocoons to the warehouse. A farmer receiving a loan from a particular warehouee is supposed to give that warehouse the first chance to buy his cocoons. He is willing to sell at a little lower price to the warehouse because he receives aid from it, and moreover, he hopes that the warehouse may give him aid again in the future.

When a bargain is made, the middleman is in a position to effect a compromise between the two parties, not so much for getting the commission if the bargain is made, but mainly to help the warehouse to get cheaper cocoons which means more business through him in the future.

The advantage and disadvantage of making loans to the farmers cannot be overlooked. It is beyond doubt a decided advantage to the farmer as he could not have reared the worms to maturity had he not received aid from such a source. On the other hand, it is also a good means for the warehouse to get more, if not cheaper cocoons. The disadvantage equals the advantage which accounts for the fact that such a practice is restricted to only a few warehouses. When conditions are bad, as during the falling of prices of raw silk or poor harvest, it is not uncommon for the farmers to lose money. If such is the case, the farmer will not dare to bring his cocoons to the warehouse from which he has received aid. Of course, the warehouse will withhold what it has loaned to him if he comes, and consquently the farmer will not have enough cash left for his next crop or even to buy food for the family. He naturally sells his product to some one else and leaves his debts unpaid. Another disadvantage which may be mentioned is that the warehouse has to board the farmers when they come to sell their cocoons.

The amount a warehouse loans out is variable. If it has excess money or if the buyer knows certain middlemen that will help him to get cheaper and better cocoons, it will loan out more. The amount seldom exceeds ten thousand dollars a year however. This sum may be distributed to twenty or thirty middlemen. The farmers who receive the aid are known as "Chue-chai" (猪仔).

From the Speculators.—The third method of buying is from the speculators. They are called "shui-tau" (水斗).* There are many men who make their living by speculating in cocoons. They all buy in the public markets and resell to the warehouses after sorting the cocoons, aiming at realizing a margin. Sometimes they even make bargains with the farmers when the worms have just "ripened" (ready to spin) for so much per rack of cocoons. They have partners among themselves and may work cooperatively.

Most of the warehouses like to get cocoons from such a source because they can be secured in large quantities in a comparatively short time.

The public market is another place for getting cocoons. But this is not used; the warehouse thinks that it is too risky.

*The Chinese words literally mean "a bucket". It is used as a name for the speculators because the latter try to get a profit by reselling the cocoons, and is comparable to a bucket getting wet when water is poured into it.

There are a few shops that handle cocoons from the North River. Farmers in that region ship cocoons to these shops in bales and trust these shops to sell for them. The shop acts as a commission house and charges a profit of so much per bale. Warehouses often go to this source if the other available sources are exhausted.

Method of Buying

The function of the warehouse, as above stated, is to buy cocoons for the filature. The number of men employed in the process has been given in the chart under the warehouse department.

When cocoons are brought to the warehouse for sale, the seller must pour out the contents of each bale on the bamboo matting on the floor and thoroughly mix the cocoons with a wooden shovel. When mixed, the cocoons are put back into the bales and labeled for sampling. There may be many selling at the same time, as is the case in the heavy buying season. To prevent confusion, bamboo checks are used to distinguish the respective bales. These checks are numbered 1, 2, 3, 4, etc, and two kinds of checks bearing such numbers are used. One kind is long while the other is more or less rectangular. The registered number of the bales of cocoons is written on each bale with lime.

All the warehouses follow a similar method of buying cocoons. The method consists of sampling and the price is based on the sample.

To take the sample the buyer or his assistant takes a bamboo basket, with the long check lying on it, and going to the corresponding bales, takes several handfuls of cocoons from the various parts of each bale. These cocoons are subjected to the unwinding test to find out the winding qualities of the cocoons. The reason for so doing needs explanation.

The quality of cocoons as to color, shape and the amount of silk can be more or less readily determined by the appearance or by feeling them, but the winding qualities, which the warehouse must know, cannot be accurately found except by actually reeling them. To do this, the warehouse employs several reeling girls, usually three or four, to carry out the tests Foot power reeling machines are used; these machines differ from those used in the steam power filatures in that the reels of the former are turned by foot treadles. A special room is partitioned off for the purpose. During the heavy buying season, these women have to work all day long. They receive a daily wage of fifty cents each.

A definite procedure is followed in testing the reeling qualities of the cocoons. Out of the basket of cocoons only 150 cocoons are reeled. The rest, about half a catty is not returned to the seller, but belongs to the warehouse.

These 150 cocoons are softened and reeled; the cocoons with the thread broken off will be picked out and put into a basket. After all the cocoons are reeled, the cocoons in the basket are counted. The number is recorded. Then the ends of the cocoons in the basket are found and reeled again. The number broken off is again recorded. The process is repeated once more. The following table gives the reeling quality of one lot of cocoons:

Unwindings	No. of cocoons unwound	No. of cocoons broken off
1st	150	40
2nd	40	13
3rd	13	4

The cocoons that are of good reeling quality will unwind continuously to the end without breaking. But the Cantonese cocoons prepared in the fashion described have at least some breaks. The above table illustrates the reeling quality of a lot of medium grade cocoons. It should be noted that special attention is given to the last two unwindings rather than the first, as the tensile strength of the silk in that part of the cocoon is apt to be weak. If it reels well, the cocoons will yield more silk in proportion to silk waste.

After the girl finishes unwinding the cocoons, she jots down the data obtained. The number of cocoons unsuitable for reeling is also counted and reported. Based on this, the buyer claims that he knows 95% of the reeling qualities of the cocoons.

The next step in the process of buying is to determine the amount of silk in the cocoons. This process is known as "dividing the four taels" (分四兩). This is the work of the dividers.

After the sample for testing the reeling qualities of a lot of cocoons is taken, another sample for finding the amount of silk in the cocoons is taken. This sample is taken with more care than the former as the price given for the cocoons depends more on this.

To secure the sample, the divider takes a flat-bottomed circular basket about 2½ feet in diameter, and takes about four catties of cocoons from all parts of the bales. The rectangular check bearing the number corresponding to the registered number of the bales of cocoons is put into the basket. Out of these cocoons four taels are weighed, the rest is returned to the seller. The number of cocoons in these four taels is counted, and from which the number of cocoons per catty (16 taels) may be calculated by multiplying by four. Cocoons are generally sold at so much per 10,000 though sometimes at so much per catty.

The number of cocoons in four taels varies from 250 to 400, depending upon the quality and degree of dryness of the cocoons. In counting the cocoons, if there are defective ones, four or five of these are taken as one. Now, if we take for illustration, that there are 354 cocoons in the four taels, the number for a catty is 1,416 cocoons.

The next step in the process of dividing the four taels is to disregard the 54 old cocoons in the 354 cocoons, and ask the seller to take one hundred, of the three hundreds, to represent his cocoons. Of course, the seller will choose the hundred that seems to him to be the best. This he judges by pressing the cocoons with palm and the fingers. The "divider" then takes the hundred cocoons which the seller has chosen and again divides them evenly into five parts each with twenty cocoons. It takes experience and skill to do this accurately and quickly. Each divider has his own method which enables him to do this efficiently. The most common method consists of picking the cocoons in groups of five, from the best to the most inferior, and them a cocoon from each group is taken to form the five groups. When the "divider" thinks that he has sorted the cocoons evenly, he asks the seller to choose the group which will represent his cocoons. The seller chooses the group that he thinks best. This time he is more careful, as these twenty cocoons will be the basis for determining the amount of silk in his cocoons.

When the seller has chosen the group that he thinks best, the buyer or his assistant takes these twenty sample cocoons and removes the pupae. The cocoons are then thoroughly dried over a charcoal stove. When perfectly dried, the cocoons are weighed. The weight found is the weight of the twenty dried cocoons minus the pupae.

With the reeling test and this "dividing the four tael" process, the buyer knows the actual amount of silk in the cocoons as well as their reeling qualities.

The price paid for the cocoons, or in other words the value of the cocoons, depends on the selling price of raw silk. The method of estimating deserves mention.

Let us suppose that raw silk is selling at $1500 H K. currency, the currency in which the quotations for Canton silk are expressed; the cost of manufacture for a picul of raw silk is 250 taels (the unit used in the filature for the estimations).

$1500 H.K. (at 1.26 exchange)	$1890 Canton currency.
$1890 L. S. ($1.00=0.72 tael)	1350 taels
Price of a picul of raw silk	1350 taels
Cost of manufacture per picul	250 taels
Balance.....	1100 taels

1100 taels could be invested to buy cocoons to produce a hundred catties of raw silk, or 11 taels for cocoons to produce a catty of raw silk, but the filature would not gain or lose any money from such an investment. To derive a profit, a filature, of course, pays less than 11 taels, unless the price of raw silk is going higher.

It must be recalled that not all the silk in the cocoon is turned into raw silk, some goes into waste. It is estimated for the average cocoons that 25 taels of cocoons (dried and minus pupae) are required to prepare a catty (16 taels) of raw silk, and 9 taels of waste. Based on this, 11 silver taels are necessary to buy 25 taels of cocoons, or 0.44 silver taels for each tael weight of cocoons.

Now, if we take for illustration, that the weight of the average cocoon, in the 20 sample cocoons, is .002 taels, 10,000 of them will weigh 20 taels. At 0.44 taels per tael they would be worth 9.2 silver taels per 10.000 cocoons or 13.927 taels per catty.

To be accurate the cocoons must be thoroughly dried in the oven before weighing. Cocoons have the power of taking up much moisture and the buyer is always very careful about this.

The buying period lasts ten to fifteen days each crop. During the beginning or end of each buying period, a warehouse buys only a few lots a day or a few hundred dollars worth of cocoons a day. But in the heavy buying days, usually five or six days after the commencement of buying, every one in the warehouse seems so much engaged in the buying that he can hardly find time to eat. A warehouse may buy as much as $10,000 worth of cocoons a day.

It is beyond doubt that the buyer is the most important man in the warehouse. He must be so trained that he can estimate accurately the necessary amount of cocoons to prepare a catty of silk, and be so expert that he will never be cheated by the sellers. The "four tael dividers" are his assistants, and they in turn must divide the cocoons evenly.

Drying and Baling of Cocoons

When the warehouse has bought ten or fifteen bales of cocoons, the latter are put into the ovens and dried with charcoal fires. The degree to which the cocoons should be dried depends on the length of time the cocoons are to be stored. If cocoons are to be stored for more than three months, they should be as dry as possible. Cocoons pressed and stored should be absolutely dry.

If cocoons are insufficiently dried, or stored in a damp place the pupae will ferment, and a brownish yellow fluid, the result of fermentation, will render the silk useless. Such cocoons can be pulled apart easily. They are known as "Ai-ngon-kaan" (挨蠹繭) and cannot be reeled.

The Cocoon Market in Yung-Kwai

All of the markets are situated near the river bank. Their construction is simple. The front part is an empty hall for the farmers to display their cocoons at marketing time; the back part is divided into many small pens for the "shui-tau" to keep their cocoons temporarily. At both corners of the front there is a weighing place, and at the left corner an office.

The markets are owned by companies and operated on a commission basis. They employ two groups of men: one group takes charge of the market and attends to such work as weighing, recording, accounting and paying out cash; the other takes charge of the launches and boats which the market rents for transporting cocoons from the country.

The function of the market is to provide a suitable place for marketing large quantities of cocoons in a short period of time and to buy, indirectly, cocoons for the cocoon warehouses. The market pays the money to the farmers immediately after a bargain is made but receives the money from the "shui-tau" after the latter has disposed of the cocoons to the warehouse. The market realizes its profit in the following ways: (as the following data were obtained from a buyer, its accuracy should be verified by further investigation)

1. The market collects 1.5% of the gross price from both the seller and the buyer as commission.

2. The market pays 98.6% of the gross price to the farmer, (this percentage varies with the interest on money at the market time) but receives 99.8% from the "shui-tau".

3. The market adds 0.3% of the gross price and this amount is charged to the "shui-tau".

4. For every 100 taels of cocoons marketed, 2 taels are deducted for taxes to be paid to the government.

It should be mentioned that the above data are not absolutely reliable because the information obtained from different persons varies a great deal. The writers, however, have actually copied from the green papers on which the actual deduction by the market can be figured out:

	(1)	(2)
Net weight of cocoons	53.5 taels	85 catties
Price per catty	.95 taels	1.47 taels
Sale price	50.82 taels	124.95 taels
Deducted for commission, etc,	2.465 taels	5.94 taels
Net	48.335 taels	118.91 taels
Percentage of deduction	4.8%	4.8%

From the above calculation it is evident that from every 100 taels of cocoons sold, the market deducts 4.8 taels; the farmer receives 95.2 taels as the net price.

There are seven crops in the year, for each crop the market opens about fifteen days and buys from 300,000 to 500,000 taels worth of cocoons.

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During recent years the competition between the markets has been very keen. In order to have more business the markets send out launches and boats to the country to transport the cocoons to the market for the farmers free of charge, and in addition thirty to forty cents is paid to the farmer for each bale of cocoons sold in the market. Each bale of cocoons weighs about 10 catties only.

A few days before the market opens, notices are posted in the country, informing the farmers when the launches will come to transport cocoons. One launch tugs about ten boats and arrives at the market at about 7:00 A.M. The farmers then carry their cocoons to the market and the speculators, or "shui-tau", come and examine the cocoons and bargain with the farmers.

The ways in which the "shui-tau" determines the price of the cocoons are as follows:

1. To know the general conditions of the crop. The "shui-tau" should know the rearing conditions of the locality from which the lot of cocoons comes, especially the weather conditions at spinning time. If the weather is warm and fine at spinning time the cocoons will have good continuous fibers, and vice versa. Generally the weather condition of the second crop is mostly unfavorable while that of the sixth crop is the best.

2. The pulling test. To test the quality of the fiber of the cocoon the "shui-tau" takes a sample cocoon in his mouth and chews it for one or two minutes in order to thoroughly soften the gum with the saliva. He then holds one end of the cocoon with his teeth and pulls the other end with his hand to the length of about one foot. If the cocoon is good the fibers will continue unbroken, forming a beautiful continuous layer. With bad cocoons many of the fibers will break when being pulled to the length of one foot.

3. To determine the thickness and uniformity of the cocoon. The next thing for the "shui-tau" to do is to take a handful of cocoons at random from the package, feel their thickness by pressing them between his fingers, and find out the proportion of poor cocoons. They prefer small, compact and more or less pointed cocoons, to the large loose ones. Uniformity of grade is greatly emphasized.

4. To determine the moisture content of cocoons. In the market cocoons are sold by weight. Since the water absorbing power of the cocoons is very great the degree of dryness is an important factor in determining the price. The "shui-tau" determines the moisture content simply by feeling the cocoons with his hands.

Although the process is described at some length, it takes only a few minutes for an experienced "shui-tau" to determine the quality of a lot of cocoons and fix the price. There are several hundred speculators in the market. A number of them may form a group and buy

cooperatively. Each member of the group will come along and offer a lower price than the previous one, in an attempt to compel the farmer to sell at a low price. But an experienced farmer knows their tricks. When a bargain is made the lot of cocoons is immediately weighed. The scales used in the market are usually about three per cent incorrect.

When a buyer or a "shui-tau" comes to the market he must first register in the office. He is then given a registration card, on the outside of which is written his name. After each lot of cocoons is weighed the buyer hands in his card for recording the weight. The farmer, on the other hand, receives a check on which is printed a large number, the date, the name of the market and the statement that the money must be drawn within ten days after selling. The detailed data are recorded by the market in the following way: inside the office there are three recording clerks; one records the weight and price on a green paper, another records on a red paper, while the third records the same, with the name of the buyer or "shui-tau", in a book. The red and green papers are then turned in to the accountant who figures out the gross and net prices of the lot of cocoons. The green paper is then turned in to the cashier who will prepare the money which, together with the green paper, is given to the farmer. The red paper is kept for the buyer when closing the account with him. The data on the books are retained by the market itself.

After weighing, the cocoons are poured out on the matting in one of the pens, where several women are employed to pick out the very poor and discolored cocoons, before sending the consignment to the warehouse. The farmer then takes the empty bales to another weighing place, next to the place where he weighed the cocoons at first, and has them weighed. The weight is recorded on the check and a stamp is put on it. At the same time the recorders in the office make the same record. After this the farmer may draw the money immediately if he wishes to do so. The market closes about 12:00 noon.

THE FILATURE DEPARTMENT

There are one hundred and sixty seven steam-power filatures in South China, most of which are located in the silk centers of Shuntak. Kung-hang, the filature which the writers investigated, is located at Sui-tang (水塘), a town in Shuntak. There are thirteen filatures in this place, Kung-hang being one of the prominent ones.

Most of the filatures in Sui-tang are built by the clans. Each clan builds one or sometimes two filatures and rents them out, usually at the rate of ten per cent of the investment. The clans take great interest and pride in seeing that every girl or woman bearing their surname finds work, and is accumulating wealth. Many clans have become prosperous because of the filatures in their vicinity.

The cost of building a filature varies in different places. To build a filature of 500 basins about $60,000 is required.

The construction of all of the filatures is very similar. A detailed description of Kung-hang will be given.

The arrangement of rooms is also very similar in all the filatures. The area under roof is about three Chinese mow. This includes an office building, the cocoon storage and softening building, the reeling and rereeling buildings, and the engine and cocoon distributing rooms. Each building or room, together with the work carried out in it, will be discussed under a separate heading.

The Office Building

The office building has two stories. The ground floor is used as a reception room. There is a little room known as the Cheung Fong (帳房) on the ground floor in which all the money and record books are kept. The second floor is used for bedrooms for the men employed in the filature. There is nothing in this building which deserves special mention.

The Storing and Softening of Cocoons

The Storing and Softening Building.—This is a three story building tightly constructed of brick, with a few small windows in the wall. The second and third floors are used mainly for storing cocoons; while the ground floor, being kept dark and damp, is used solely for softening cocoons for reeling.

The Storing of Cocoons.—Cocoons bought for future consumption, when the price is low, or for winter reeling, are tightly pressed and packed in cloth wrapped bales. Those for immediate use are loosely packed in mat packages without pressing. With proper handling the pressed cocoons may be stored for five to six months without much damage; while improper storage will cause the cocoons to become moldy, the pupae to decay, and consequently greatly depreciate the value of the cocoons. It is said that even with proper care in storage, the pressed cocoons usually give rise to more broken ends in the cocoons, and hence require comparatively more cocoons to finish a catty of silk.

The Softening of Cocoons

The process of softening cocoons is the first important step in preparing cocoons for reeling. Its success or failure exerts a vital influence upon the reeling process. If softening is properly done, subsequent soaking in the hot water basin will dissolve the gum in the right amount of time. The cocoons will then be smoothly unwound; there will be fewer breaks of the threads, and less waste of silk. On the other hand, if the cocoons are over or under softened,

subsequent soaking cannot dissolve the gum in the proper amount of time, and the following troubles will occur: under softening will cause the cocoons to jump in the reeling process because the threads, unwound from the cocoons, have not had the gum thoroughly dissolved; over softening will make the cocoons too heavy with moisture, hence they will soon sink to the bottom of the basin. Either will increase the difficulty of reeling, and give rise to frequent breaks of the thread as well as much more waste of silk.

The softening process is an art. Its success depends much upon the skill and judgment of the softener. He must take into consideration a number of factors. Cocoons stored for future use have at least been partially softened through the long periods of storage, hence either no treatment or only a little softening is necessary.

Green cocoons, or cocoons just off the spinning racks without stifling, may be reeled at once without softening, and generally give better results, but this is rarely done in Kwangtung.

Slightly stifled cocoons may be softened by keeping them loosely in mat packages for several days. The room in which the packages are kept should be cold and damp.

Stifled cocoons should go through the following processes, which are modified according to the crop in which they were produced, the season of the year, and the temperature and humidity of the day.

During the first, second, and third crops, when the moist south wind is prevalent, the process takes only one or two days. Hot water is poured upon the tile floor once a day to make it wet (if the weather is sufficiently damp this step may be omitted.) Hot water is used instead of cold because the former evaporates more quickly, and the vapor thus liberated is therefore more readily absorbed by the cocoons. The heat generated from the hot water also helps somewhat in softening. The cocoons are then evenly spread on the tile floor, one foot deep, and thoroughly mixed with a wooden shovel twice a day. After about two days they are piled up into a heap to be warmed a little for about twelve hours. The heat is generated from the fermentation of the pupae. They are transferred to mat packages in which the warming process continues for another twelve hours, and are then ready for use.

During the fourth, fifth, sixth, and seventh crops, and especially the last three, when the dry north winds are prevalent, the process takes a much longer time, and is somewhat modified. The spreading and mixing process takes three to four days, the piling up process takes two days and the warming process in the mat packages takes another two days. In addition, hot water is poured upon the ground as well as on the cocoons, which are then covered with wet mats to prevent rapid evaporation.

When a heap of cocoons is properly softened, it will feel slightly warm and moist to a trained hand, and fairly soft when a handful of them is pressed with the fingers. The "burning smell" which is very characteristic of the dried cocoons is greatly reduced. The pupae inside also become somewhat soft as compared with the brittle, hard ones in the dry cocoons.

The Reeling Room and the Reeling of Cocoons

The reeling of cocoons plays the principal role in the filature. It consists of unwinding the cocoons into skeins of silk suitable for weaving. In practically all the filatures there is a provision for a rereeling room in which the skeins are rereeled into the size to fit the American reels. Silk exported to France is not rereeled. As this is the principal part of a filature, the data regarding reeling will be presented under sub-headings.

Construction of the Reeling Room.—This room, occupying half of the space of the plant, is built of brick and tile. The floor is covered with square tile which gives a dry surface all the time. The roof is built of tile supported on brick columns at twenty feet intervals each way.

Kung-hang, built a few months ago, is somewhat better in construction, in certain respects, than the older ones. There is a better provision for light and ventilation. In the older types the roof is very low; the walls are tight with only small windows on the side. In Kung-hang there are big ventilators on the roof, and wooden shutters between the brick columns on the side. The steam from the basins can be carried away through the ventilators on the roof, and light and fresh air can be admitted from the side. In spite of this, the room is very hot in the summer time.

The main entrance divides the room into two parts. Each half has eight rows of basins known in their terminology as "boats" (船). Between the "boats" are narrow paths through which the foremen walk in supervising the work of the reelers.

The Equipment.—Practically all the equipment used in the filature is made locally. With the exception of certain articles, such as belts and measuring devices, the rest are manufactured either in Shun-tak or in or near Canton.

Power is secured from coal, a steam engine being used. The boiler is made in Honaam (河南), located on the south side of the Pearl River from Canton. The cost of building a boiler which will give enough steam to propel a 500 basin filature is $7,000. Two and a half tons of coal are required daily. The steam generated from the boiler is piped to the engine. The pipes are not covered and no doubt there is a great deal of heat lost by radiation.

The engine is made in Lok-chung (樂從), a town in Shun-tak. A water pump is attached to the engine on the other side of the fly wheel. The fly wheel is six feet in diameter. The cost of the engine is $1,300 to $1,400; the cost of the pump is $170. Power is transmitted to the other parts of the plant by means of belts and steam pipes.

The reeling equipment is made of wood and bamboo. Much of the timber is imported but the bamboo is grown locally.

Each girl occupies about two feet by six feet, or twelve square feet of space.

When a new filature is built, after the roof is completed, about twenty or thirty carpenters are hired to make the reeling equipment. With such a company of men it takes more than three months to finish making the reeling equipment. The cost of wood and labor to build a basin is $7.00. In practice, the builder makes a contract with certain experts to have it done for him. Such a practice has been found more economical.

Each "boat" has two parts to it, the front and the rear, between which the reeling girls sit. The hemispherical basin is made of clay one foot four inches in diameter and six inches deep. Into it is placed a circular metallic plate through which the steam pipe conducts the steam. Such an arrangement enables the heat from the steam to be evenly distributed in the basin. If the water in the basin is too hot, it may be regulated by opening a cold water faucet which is located in front of the reeling girl.

The hind part of the "boat" contains the reels on which the silk is to be wound. Formerly, these hind reels were turned by the foot, and the filature using such was called a foot-power filature. There are about seventy such filatures in existence in Yung-kwai. Products from such filatures are mostly used for local consumption though they may occasionally be exported. The steam-power filatures differ from the foot-power ones, in having the hind reels turned by a belt connected with the engine, and the speed is more uniform and more easily controlled.

There are three types of reels used in the steam power filatures. The French reel from which the silk is not rereeled, has a circumference of 80 inches. All the silk exported to America is rereeled. In this case the first reel has four sides; the circumference is 26 inches; the rereel has six sides, with a circumference of 56 inches. All the reels are made of hard wood and are very durable. Except for the smallest one, the circumference of each reel can be adjusted.

Aside from the equipment mentioned above, there is a denier testing machine (sizing reel). The reel of this machine is six sided and has a circumference of 46 inches. To test the denier of a skein of silk in question, the tester winds the silk on the reel, turning it 400 rev-

olutions. The sample skein is dried and weighed. A special Chinese scale (厘等) is used, the latter is accurate to two tenths of a denier.

Method of Reeling.—The *Chambon* system of reeling is used in all the filatures in South China. This method is an older one than the *Tavelle* system. It is claimed that the latter can not be used on the soft and fine Canton Silk, and only the former method can be used, but such a statement has not been experimentally proven, it is only a theory. We are in great need of experiments from which conclusions can be drawn.

With the *Chambon* system, the reeling girl can manage two ends at one time.

The cocoon, as the worm spins it, consists of three layers of silk much different in quality and structure. The first layer is called the floss and is irregular in structure and is loosely attached to the cocoon. Then comes the second layer which is the good silk. The fibers of the third layer are flattened and the whole layer looks papery. Envoloped in the third layer is the pupa. Only the middle layer should be unwound to form the skein silk. The rest goes to form waste products of the industry and will be treated under waste silk pupae respectively.

In the reeling of the cocoons, the girl first puts several handfulls of cocoons into the basin and subjects them to a boiling temperature for five to ten minutes. Then she takes a brush made of twigs and beats the cocoons. The floss, being soft and loose, is caught by the brush and part of it is removed with the latter. About two taels of cocoons is softened at one time; if more than this amount is put into the basin, the girl will receive a fine of five cents each time. The reason for such a fine is that cocoons will absorb more water than they should if boiled too long and consquently will sink to the bottom of the basin. Sunken cocoons make reeling difficult. Usually the reeling girl will reject all sunken cocoons because they break too often. The second reason is that the fibers of the cocoons will loose their tensile strength if boiled too long. The water is not clean since dirt and parts of the pupae may be dissolved in it. Such water may have a harmful effect upon the silk.

The brush cannot remove all the floss. The girl next takes a pair of chopsticks and stirs the cocoons again. This operation enables her to remove the remaining floss as well as to find the ends of the cocoons. To make a thread, the size of which depends on the denier of silk to be prepared, fibers of several cocoons have to be used.

The following table gives the number of cocoons used to prepare silk of various deniers:

Deniers	No. of new Cocoons *	No. of half-reeled cocoons *
14/16	7	8
13/15	6	7
20/22	11	12

The above table, giving the number of cocoons required to prepare silk of various sizes, is only approximate. Cocoons of various crops have fibers of slightly different sizes. The following table gives the number of deniers of each cocoon fiber of each crop of the year.

No. of the crop	Average deniers of the cocoon fiber
1	2.2
2	1.8
3	1.9
4	1.9
5	1.95
6	2.00
7	1.85
8	1.80

The minimum denier of the Canton cocoon is 1.75; the maximum is 2.4. The above table is also a rough guide for the filatures in the determination of how many cocoons should be used to prepare a thread of a certain denier. Quality of cocoons is greatly influenced by weather and mulberry leaves, and care given to the worms. For this reason, the filature tests the size of their cocoon fiber before reeling.

To test the size of the fiber of a new lot of cocoons, the tester uses the sizing machine. A sample of the cocoons is taken and subjected to the same processes as if for reeling. Every filature has one or two girls who are specially trained to carry out the test with the tester. Only with especially trained girls can the test be carried out smoothly and accurately.

The threads, instead of going to the hind reel, are wound onto the machine. To be accurate, it is very essential that the girl keep a fixed number of cocoons to a thread all the time. In practice six cocoons are unwound for a thread. The tester turns the denier machine slowly at a rate just fast enough to unwind the cocoons smoothly. The girl throws in new cocoons as soon as those being reeled become a little translucent. This step is most important; for the translucent cocoons must be immediately replaced by new cocoons. The result

* The fiber of a cocoon gets thinner toward the inner layers. In practice, the filature calculates that silk other than from the first part of the middle layer has .4 denier less.

found is the denier of the new cocoons only. Four hundred revolutions of the machine prepare two sample skeins, each from six cocoons. To insure greater accuracy, the tester repeats the above process and gets two more skeins, making a total of four sample skeins. These skeins are then dried near the engine and weighed. For illustration let us say that these four skeins weigh 48 deniers. As each skein is prepared by unwinding six cocoons all the time, four skeins would be from 24 cocoons. This meams that each cocoon has a fiber which averages two deniers.

Based on each cocoon having a fiber of two deniers, a 14/16 denier silk would require 7½ of these cocoons. It must be recalled, however, that only the outer middle layer of each cocoon is unwound throughout the test. To compensate for this, it is the practice to assume that silk, other than from this part of the cocoon, has a size of 0.4 denier less. The conclusion from the above test would be:

14/16 silk use { 4 new cocoons..(4 X 2 deniers) .....8 / 4 half-reeled ...(4 X 2, minus 0.4 D.)..6.4 } Total ..14.4 Deniers

The total 14.4 deniers is from four new cocoons and four half-reeled cocoons. It is the nearest to 14/16 silk one can get, based on each new cocoon having two deniers. If at the beginning, only new cocoons with a fiber of two deniers, as tested, are available, the reeling girl would use seven cocoons to start the reeling. In practice, seven cocoons would be recommended instead of eight because they think that under size is better than over size.

When the number of cocoons for preparing a certain size of silk has been determined, there is posted a notice to inform every girl that a certain number of new cocoons and of half-reeled cocoons should be used. The reeling girls should follow this strictly as the size of the silk depends upon it.

Having discussed the way to determine the number of cocoons which should be used to make up the thread, let us continue with the method of reeling. Each of the two threads first passes through a hole in a button and then passes to a hook above. Before going up to the hooks above, however, the two threads are twisted around each other. Twisting is very essential; it gives cohesion and tensile strength to the threads. The device for twisting consists of an arrangement of gears and wheels which gives 200 twists when its handle is turned once. A bell rings when the handle has made one turn. After the threads pass over the hooks, they are again twisted, and pass to the reel to be wound into skeins. The reeling girl has to very carefully watch the cocoons that are unwinding. She must maintain the same number of cocoons to a thread all the time. To do this, she uses her left hand to hold the ends of the cocoon fibers, and uses her right hand, with the aid of the chopsticks, to throw the fibers of the cocoons into the thread. Defects of raw silk mostly come from an improper method of reeling or are simply due to carelessness of the reeling girl, and will be taken up under the defects of raw silk.

System of Checking.—It is very necessary that there should be a system for checking every woman's work. If even one or two dozen out of a few hundred workers are dishonest or careless, which is very often the case, it will mean a large loss to the filature. Silk, unlike other bulky products, is very expensive and is easily stolen, while its quality is easily lowered by a few individuals producing defective silk all the time. If these girls cannot be detected and properly taken care of, it will be fatal to the filature.

The filatures in South China have a very simple, inexpensive, and yet efficient way of checking every woman's work, the origin of which the writers have not been able to find.

Each "boat" is given a Chinese character and the characters generally used are 天 地 玄 黃. In Kung-hang the "boats" have 30 and 33 basins respectively. The basins of each "boat" are numbered 1, 2, 3, 4, 5, etc. under the Chinese character of the "boat". These numbers are written on the basin, and the girl using that basin is called the same. Four large bamboo checks and four small ones are provided for each basin. These checks are numbered the same as the basin. The four large ones are hung on the upper beam of each basin while the four small ones are given to the checker. The latter has a table of his own which is located near the cocoon distributing room. With these eight bamboo checks for each basin, four large and four small, it is possible to check every woman's work in the filature. Before going further, it is necessary to explain the functions of the cocoon distribution room which plays a large part in checking.

In preparing raw silk for export, it is required that every "book" of raw silk should weigh eight catties and contain about the same number of skeins. The foreign exporter will refuse to buy if there are too many or too few skeins to each "book". For coarse silk (20/22) a "book" should have 55 to 56 skeins; for fine silk (14/16) a "book" should have 60 to 61 skeins. Silk sent to France (13/15) has no such requirement as to the number of skeins to a "book". Let us recall that the girl reels two threads at one time, these two skeins are formed on the reel. Later these two skeins are rereeled into one single skein, twisted, packed into bales and exported, so this skein, in order to be just right, must weigh 1/55 to 1/56 (for 20/22) etc. of a book. The function of the cocoon distribution room is, therefore, to furnish a place where the cocoons are weighed and divided into separate baskets sufficient to produce a skein of silk of the desired weight. The amount of cocoons in each basket varies from twelve to fourteen taels, depending on its quality.

Another advantage of giving a fixed quantity of cocoons to each woman, which is done in the cocoon distribution room, is to test the efficiency of each reeling girl. This will be referred to later.

Let us go on with the system of checking. When the reeling girl wants cocoons, she gives one of the big bamboo checks to the checker. The latter receives the big check and gives back a corresponding small one to the girl. With this small check, the reeling girl can get a basket of cocoons which has been previously weighed out for her. The checker, on the other hand records on a printed sheet that that basin has taken a basket of cocoons. This is done by putting a red mark on the number of that basin, on the printed sheet. When the girl finishes reeling the basket of cocoons, she attaches the small check to the reel on which the two skeins are wound; the reel, with the check attached, is returned to the checker. The latter, seeing that the basket of cocoons previously sent out is reeled and not stolen, puts a cross mark on the previously made red mark, specifying that the basket of cocoons has been reeled.

The girl, in turn, takes another large bamboo check, of which she has four, and exchanges for another basket of cocoons. Most of the filatures have women specially provided for doing this for the reeling girls, so that the latter need not run around in the filature and waste time. The women employed for such purpose are called "Tei-sha-po" in the local dialect (地沙婆).

The checking system does not end here. After the reel with the check on it is handed to the checker, the reel is brought to the room in which the silk is rereeled. The silk to France is not rereeled and the check will remain with the skein until packed. After rereeling, the rereeling girl transfers the checks from the small reels to the skeins reeled from them. The rereel reels four skeins of silk at one time. When the four skeins in the rereel are finished, the rereeling girl puts one of her checks, of which she has four for each rereel, on the rereel. This fifth check, different from the rest, checks the rereeling girl's work.

After the silk is rereeled, the skeins are dried on the reel. After drying, the silk twister takes the skeins off the reel and weighs each skein separately. The weight of each skein is recorded in the following way. There is a box specially made for this purpose. There are many compartments to the box, and on each compartment, there is written a weight. The weights range from 1.5 taels to as many taels as the weights of the skeins will vary. The twister, after weighing a skein, puts the attached check into the compartment corresponding to the weight of the skein. By reference to the checks in the compartments, the checker can get the weight of each skein which is recorded after the day's work is over. It must be understood that each skein is from the same quantity and quality of cocoons and should be very much alike in quality and quantity. The difference in weight of a skein from the average shows the ability of each reeler. If anything is wrong with the rereeler, she can be checked by the fifth check attached to the rereel.

To prevent mixing of one day's work with another day's, the filature provides three sets of small checks. Each set has a color of its own, and the sets are used alternately, one set each day.

This system enables the filature to check every woman's work until the silk is packed.

Having considered the general sub-headings of the reeling of cocoons, let us consider the work of the different individuals separately.

The Reeling Girls.—Most of the reeling girls, as well as the rereeling girls, live in their homes. In many filatures there is a dormitory provided for the girls who come from other parts of the district.

The dormitory is two stories and is large enough to accommodate about 200 women. There are twenty-eight rooms, eight persons to a room. The filature provides all the fuel they burn; there is no charge for rent.

Work begins at half past six every morning and stops at the same hour in the evening. They work seven days a week. From 9:30 A.M. to 10:30 A.M. there is a recess for the noon meal. For those who live in the dormitory, there is only half an hour recess They have to work half an hour more each day in order to compensate for the cost of fuel which the filature furnishes to them.

The wages of the women vary. In Yung-kei, where labor is comparatively high, a woman can get a dollar a day. In Kung-hang the wages average about fifty cents a day.

The ages of the women range from 13 to 45 years, 20 to 30 being the most common. A woman will get her best wage when she is 25 to 30 years of age, if she was trained when young.

The women get their training by watching others do the work. The filature does not have special facilities for training them.

The Foremen.—The duty of the foremen is to supervise the women's work. Besides knowing the art of reeling cocoons, of which they usually have at least eight or ten years of experience, they must be very wise in judgment. A good foreman should know each girl individually and treat her with suitable methods. Sometimes it is very necessary to use round about methods to settle difficulties.

There is a great difference in the ability of the reeling girls to use the *Chambon* system of reeling. With some girls the threads break all the time. The skilful worker is always busy; she keeps the threads going all the time, and while something is going on, which she still has to keep her eyes upon, she prepares for something else. She wastes no time. The writers have watched them work for hours and found many have bad habits, while some of them are very sluggish in their work.

To judge a woman's work, upon which her wage is determined, the foreman takes into consideration many factors.

Firstly, the age of the woman.

Secondly, the temperament and disposition, which they can judge by her behavior and the appearance of her face.

Thirdly, cleanliness and orderliness of work.

Fourthly, the quantity of cocoons a woman puts into the basin at one time. This becomes a habit and the women are slow to change when told to put in less.

Fifthly, the amount of pulling and motion which the reeling girl exerts with her left hand on the ends of the cocoon fibers. The less pulling the better.

Sixthly, the quantity and quality of silk a girl can finish from a given quantity of cocoons in a day.

There is a head foreman known as the "big bookkeeper (掌人部). He determines the amount of wages paid to the girls. He is the head of the filature proper and has power to direct the fireman and engineer. The success of a filature depends very much upon his ability to supervise the work.

The Engineer and the Fireman.—The engineer and the fireman must regulate the speed of the engine to suit the reeling of the cocoons. Good cocoons will unwind easier; the fibers are stronger and consequently there are less breaks. With a good quality of cocoons the engine may be made to run faster with just as good results. On the other hand, if the cocoons are of poor quality and if the engine is running faster than it should, the reeler will find it hard to maintain a sufficient supply of ends of cocoons to be thrown to the thread, and consequently, the thread will be thin and irregular which will give rise to defective silk.

The engineers are locally trained. They get their skill by practice and observation. They know practically nothing about the theoretical side of the engines though they understand the use of them. This is generally very true of the local machinists in China. As a matter of fact, there is a great deal of energy lost by friction in the gears and belts which is due to their improper arrangement and adjustment.

The Rereeling of Silk for American Consumption

Function of the Rereeling Room.—America demands quality silk; this makes the rereeling process necessary. With the tremendous difference of wages in the two countries, it goes without question that the rereeling process should be done here. Every modern filature is now provided with a rereeling room in which the 14/16 and 20/22 denier silk prepared to meet the American demand are rereeled, while the 13/15 denier silk for French consumption is sold without rereeling.

Construction of the Rereeling Room.—This room is provided with a better system of ventilation and lighting than the reeling room. There are more windows in the walls as well as in the roof. Moreover there are no hot water basins in this room and consequently the temperature and humidity are not so high as in the reeling room. In fact, the women work much more energetically here than in the reeling room.

The Equipment of the Rereeling Room.—A small engine of similar type to the main engine is placed at one end of the room. It is operated with steam pipes from the boiler. There are four rows of rereeling machines each having 22 reels, making a total of 88 reels. The four rows are divided into two pairs, or in other words there are two double rows. Between these double rows as well as near the side of the walls of the room, there are lightly constructed wooden shelves on which to place the small reels as they come from the reeling room. At about ten foot intervals between these shelves are placed basins of cold water for wetting the silk before rereeling.

The Rereeling Process.—In the rereeling process silk from four small reels is transferred to four standard skeins on the rereel. The four reels of silk are first wet with a little water to soften the gum spots and prevent breaking and then placed on a board lying on the ground in front of the rereeling machine. The woman then finds the end of the thread from each reel of silk and rolls it together into a large thread to be passed through the button hole. After each thread passes through its respective button hole, the rereeling girl ties the ends of the four threads to the axel of the reel, and lets down the lever of the machine and the rereeling process begins. One girl can take charge of sixteen to twenty threads. Although the rules regulating the rereeling room require that every woman should watch, report, and remove every defect she comes across, she seldom follows strictly while the foreman often neglects to see that the regulations are properly carried out.

When the rereeling of the silk from each small reel is about half done, a small piece of paper bearing the trade mark of the filature is put into the skein of silk.

It takes about three and one half hours to complete the rereeling of the silk from a small reel. When the four skeins on the rereel are finished, the girl ties the ends of the four threads to one corner of the reel and attaches one of her bamboo checks to the hook on the reel. The bamboo checks of each of the four small reels are put on a hook under their respective skeins. After this, the cover of the rereeling machine is opened and this means that the rereeling is finished. There are women especially employed to remove the reel, the skeins of silk will then be dried and packed. Another reel is immediately put into the vacant place and the girl starts the rereeling process again.

The Rereeling Girls and their Working Conditions.—There are twenty rereeling girls most of whom are young. It seems to be a distinct advantage to be employed in the rereeling room. On the other hand, it is a decided advantage to employ young girls, for they are more sensitive to the warning and criticism of the foreman. They will, therefore, take better care of their work. About a third of the rereeling employees determine not to be married and are called "chue-soh-mui" (自梳妹), this being very common in the silk districts of Kwangtung. They work to support themselves. The rest are young girls, and married women who work, as most of them do, to help to finance their homes. It is not uncommon to find all the women of a family working in a filature. The reeling and rereeling girls, especially the latter, are nicely dressed. Their daily wages, which are highest during the summer months, vary from fifty cents to $1.00. This includes rewards for full attendance. It may be reduced to one half or even less in early spring or late winter when only a few of the filatures are running.

All the rereeling girls know how to reel cocoons as well. When the rereeling department of a filature stops working, the girls have either to go to another filature or work in the reeling room. This often happens when 13/15 silk is reeled.

It is extremely interesting to study the opinion of the rereeling as well as the reeling girls. When they are asked, "Are you tired of your work?" The answer is always very simple, "No, we are making money, how can one be tired if one is making money?" The workers in the rereeling room are quite satisfied with their work and few of them have ever made complaints.

Contented as they are, their work is by no means pleasant. Though, comparatively speaking, working in this room is more comfortable than in the reeling room, yet due to the uncovered steam pipes and its nearness to the reeling room, the room temperature usually exceeds 90° F. in the hot summer afternoons.

The work in the rereeling room continues from 6:30 A.M. to 6:30 P.M. with only half an hour of rest between 9:30 and 10:00 A.M. As stated above, each girl takes care of from sixteen to twenty threads. The writers have observed that the threads can not continue to be rereeled unbroken for longer than one minute when rereeling the silk from a poor lot of cocoons. This means that the girl has to work all the time without stopping.

The Foreman of the Rereeling Room.—There is only one foreman in the rereeling room. He is usually an experienced man who has climbed to his present position from the very bottom of the filature as an office boy. He is supposed to know all the defects in the silk, and the tricks which the reeling and rereeling girls have. His duty is to see that the rereeling room is running in good order and

check every defect that the rereeling girls find during the rereeling. When 13/15 silk is to be prepared, this foreman acts as a foreman in the reeling room.

After the silk is rereeled, it is dried on the reel and later packed.

Packing

The Packing Room.—This is a small room located at the end of the rereeling building. It is equipped with a drying shelf, twisting apparatus, pressing machines and other packing outfit.

The Packing Process.—The packing process may be divided into the following steps:

Lacing: The silk on the rereel is first given to the lacing girl who ties together the two loose ends of each skein, and laces four rounds of cotton threads through each skein of silk in order to prevent it from becoming tangled during the process of twisting and opening up the skeins when used. It takes a few minutes to complete lacing a rereel of four skeins. Kung-hang has four lacing girls.

The Drying: After lacing, the silk on the rereel is dried. The rereel is put on the drying shelf which may be closed off by a canvas curtain. This shelf is five by ten feet. It is heated with three charcoal stoves underneath and the temperature is about 150°F. The time of drying varies from fifteen to thirty minutes according to the amount of moisture in the silk. After drying, the silk is cooled to room temperature for about ten minutes before it is taken off for weighing.

The Weighing: The weighing, as has been explained previously, is primarily for checking each woman's work. Each skein of silk is accurately weighed and its bamboo check is thrown into the box labelled with the same weight as that of the skein of silk.

Twisting: This is done by two men. The equipment used is a pair of bamboo tubes and a brass fork. The method is simple but it requires skill and practice to do it nicely. There are four twisters in Kung-hang.

Pressing: A number of skeins of silk weighing eight catties are placed in the press. After putting the skeins in the right position, a position which will give the book the best appearance, the presser screws down the cover and presses the "book" into one half its volume and ties it tightly with cotton cords.

Wrapping: The book of silk is first wrapped with white paper, then with cotton cloth, and finally with water proof oiled cloth. The latter is taken off when the silk arrives at the main office in Canton. These eight catties of silk, packed and prepared in the above way, constitute a "book". Eight "books" form a bale.

Defects in Raw Silk and their Dectection in the Filature

The uses of Canton silk are greatly handicapped by its defects. Nearly all the defects are made in the reeling room and will reveal themselves in the rereeling process. The fundamental improvement in the filature so far as defects are concerned is therefore in the reeling room. As a matter of fact, if the equipment and management in the rereeling room were efficient so that no defects could escape detection, the reeling women would be forced to do good work. Unfortunately this is not so in most of the filatures. Only a few of the defects are detected and still fewer of them are removed even when detected. There are always a number of rules posted on the wall requiring the women to report and remove every defect in the silk, but these rules are not rigidly enforced. Thus defective silk is the result. The following are the most common defects found in the Canton Silk:

1. Inaccurate Size. When there are too many or not enough cocoons used to form a thread, over or under size will result. The way in which the sizing machine is used has been presented under equipment. It takes about fifteen minutes to test two women's work. The operator can arrange to wind two women's silk on the machine and thus can reduce the amount of work by one half. There is only one machine in the whole filature and the number of women tested each day is limited to from forty to sixty.

When a woman is found to be producing over or under size silk, she receives a fine, the amount of which is proportionate to the number of denier variation, from the required size. The following list of fines is copied from the Kung-hang filature.

Table for 20/22 Silk

Excess deniers	Fine	Under deniers
21.5	5c.	19
22	10c.	18.5
22.5	½D*	18
23	1D	17.5
23.5	2D	17
24	4D	16.5
24.5	6D	16
25	8D	15.5
25.5	10D	15
26	X†	15—

*D is the amount of payment the girl receives daily.

†X means that all the wages the filature should pay to the girl is withheld. It must be understood that the wage of every girl is calculated the 1st and 15th of each month and paid on the 1st and 20th of each month. If the girl prepares silk with either 26 or more, and 15 or less deniers, she cannot work in the filature any more; all of the amount the filature should pay to her, had she not prepared such inaccurately sized silk, will not be given to her.

The list for 13/15 silk is approximately the same and for that reason is omitted.

When a girl is found to produce inaccurately sized silk (either under or over) she may occasionally quarrel with the foreman saying that she is following the directions and is always using so many cocoons. To settle cases like this, the foreman takes a few inches of her silk, that seem to be inaccurate, and puts them on a mirror. He adds a few drops of water to the silk thread to soften the gum and by using a needle, he separates the thread into its component fibers. The number of fibers may now be counted and shown to the girl. After this, the girl can have nothing to say.

2. Double Thread. This is one of the most common defects. When either one of the two threads in the crossing breaks, and is not attended to promptly, such a defect will occur. If the break is in the lower crossing, it can be easily seen and adjusted, but if the break is at the upper crossing, it will pass over with the other thread and they will be wound on the reel as one thread. If the reeling goes on undisturbed, the double thread may continue for a great length without being detected. If the break is in the lower crossing, it will be followed by a break in the upper crossing as well; this is characterized by the formation of two slugs about one foot apart. The break on the upper crossing does not disturb the lower one and it is characterized by a very long double thread and a loose slug at the end nearest to the reel. This defect can be easily detected in the rereeling process, as the loose second thread cannot pass through the button hole and therefore causes a break. When this is the case, the rereeling girl has to report such a fact to the foreman and the reeler receives a fine of five cents. If the rereeler finds such a defect and does not report it, she will receive a fine of fifty cents. This often occurs when the rereeling girl knows the reeler personally.

3. Double Thread Knot. This differs from No. 2 in that there is a knot at the end of the double thread. This knot shows that the reeler has noticed the defect, but being too lazy to adjust it, she simply breaks the double thread and connects it to a single one and then continues with the reeling. It is characterized by a slug at the point of breaking and a knot at the connecting point showing that it is consciously done. If such is the case, there will be no loose end, the double thread may pass through the button hole easily in the rereeling process and thus escape detection. The chance of being caught is very small. The fine for this is fifty cents, ten times as great as for a double thread. Girls who do this will give a very bad impression to the foreman and are often dismissed from the filature.

4. Slugs due to Adding of too Many Cocoons at a Time. In the reeling process when the thread of a cocoon is broken, it is immediately replaced by another one so as to keep the number of cocoons to the thread constant. In order to have evenness of the thread, only

one cocoon should be thrown in at one time, but sometimes if the woman is lazy or careless about her work, she may let the number of cocoons run down to one half or even less; consequently she will add many cocoons at one time in order to start right again. When more than two cocoons are thrown in at one time, a slug is sure to be formed. This is one of the most common defects in the reeling process. A "bad throw" will also give rise to a small slug. Slugs, unless especially large, are not removed in the rereeling process.

5. Screw-like Thread due to Adding by Hand too Many Cocoons at one Time. This is similar to No. 4 except that in the former case the cocoons are added to the thread by twisting the thread and the ends of the cocoon fibers together with the fingers. It is characterized by having a very thin thread on the one end of the screw thread, and a number of very loosely twisted threads joined to it.

6. Large Threads or Waste. Before adding a cocoon to a thread its floss should be previously removed; only cocoons with a single unwinding end should be thrown in. If this is not observed, floss may be added to the thread and a very large thread will result. Large thread is usually removed in the rereeling process.

7. Long Knots and Unevenly Cut Knots. A well cut knot should not be longer than 2 mm. But due to the carelessness of the woman, a knot may be cut too long or only one thread is cut while the other remains. The latter is known to them as "triangular silk".

8. Broken Threads. Broken threads in the reeling process are usually connected in the rereeling, but careless handling in the packing process may break the thread.

9. Gum Spots. This is partly due to wetting the silk with too much water in the rereeling process, and partly due to the sharpness of the edges of the reels. Skeins with gum spots will have more breaks in the winding tests.

The By-products of the Filature

The Pupae.—In Kung-hang, a filature of 504 basins, there are about 640 catties of pupae produced every day. The pupae are used exclusively for feeding fish in the fish ponds. The price for pupae is 3 taels silver per picul. In many of the older filatures they only receive 30 per cent of the receipts from the sale of pupae, while the other 70 per cent is given to the clan which owns the filature. This practice originated from the fact that rent was formerly lower and the clan claimed 70 per cent of the value of the pupae as an addition to the rent. Formerly the pupae were very low in price and the request was thus granted. Now, in many of the newly established filatures, a fixed amount is given to the clan annually instead of giving 70 per cent of the receipts from the pupae. Kung-hang pays 1300 silver

taels annually to the clan for pupae alone. If 70 per cent of the price of the pupa were given it would mean about 3500 silver taels.

Waste Silk.—There are two main kinds of waste silk, namely, the "entangled silk" and the "silk waste". These two terms are technical and need explanation. The entangled silk is of little importance as it amounts only to about a picul a year. It is accumulated in the reeling and rereeling rooms in the process of tying knots and finding ends of skeins, etc. It is sold at $1.00 a picul. When the price of the silk waste is high the filature is tempted to mix it with the silk waste. Such a practice spoils the quality of the silk waste as will be shown later.

The silk waste is different from the "entangled silk" in that it is accumulated in the process of reeling only. When the cocoons are prepared for reeling the floss is removed with the brush and chop sticks. This part of the cocoon, the floss, is one of the components of the silk waste. Again, in the process of reeling, the reeling girl has her left hand constantly holding and pulling the ends of the cocoon fibers. This is absolutely necessary in order that she may have a good supply of ends of cocoons to be thrown into the threads whenever needed. She often winds these cocoon ends into circles. The latter makes the process of manufacture difficult as this by-product is the raw material for the manufacture of spun silk; it breaks the needles of the combing machine. For the same reason the "entangled silk" should not be mixed with the silk waste.

Kung-hang produces about 80 catties of silk waste a day, the quality of which depends upon the quality of cocoons used and the skilfulness of the reeling and rereeling girls. For every catty of silk prepared, about nine to thirteen taels of silk waste is produced. The price of the silk waste also fluctuates the same as raw silk itself. It ranges from $100 to $180 a picul.

When ten or fifteen bales of silk waste have accumulated in the filature, they are sent to the Canton head office, on the silk boats. There are shops that collect the silk waste and sell it to the foreign exporters in Shameen.

Cocoons Unsuitable for Reeling.— Another by-product of the industry is the cocoons unsuitable for reeling, that is, the cocoons bitten by mice, cocoons with fly maggot holes, pierced cocoons, and sunken cocoons. All these cocoons are termed "kaan-hou" (繭口). They are sold to the villagers in Lung-kong (龍江) where they are unwound into very coarse threads known as "kaan-sha" (繭沙). The selling price of these cocoons is fifteen cents a catty (wet).

The method of unwinding is very simple; it consists of using a big hand turned reel on which the silk is to be wound, and a small wheel by which the twisting for cohesion is obtained.

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The method of unwinding may be the original method devised for the unwinding of silk cocoons.

Kung-hang produces 60 catties of this kind of cocoons daily. In many of the filatures, such a by-product is given to the workmen as a bonus known as "Tei-sha" (地沙), which may amount to a few thousand dollars a year. Filatures with such a bonus will have a much lower monthly wage for the workmen.

A woman can prepare about five taels of "kaan-sha" a day. She receives about eight cents silver for every tael of it prepared. The selling price of the "kaan-sha" is fifty cents a tael. Most of it is used locally and woven into a kind of coarse cloth known as "kaan-chou" (蔴紬). Much of it, however, is exported to Bombay India, where it is known as "punjum".

Reward and Fine System

In order to encourage the women to do good work and to be regular in attendance, a complex system of rewards and fines is worked out in each filature. The system adopted by all filatures is similar. The rules of the system are subject to change at any time at the disposal of the foreman who will offer more rewards when the supply of labor is scarce, and vice versa. As has been stated above, the wages of the women are computed every fifteen days. At times when labor is scarce, if a woman has fifteen days of regular attendance, she will receive a payment of four days extra; if she has fourteen days of regular attendance, she will receive an extra payment of two days. There is no extra payment if she attends thirteen days out of the fifteen days. The extra payment is called "kan-kung" (勤工).

There are a number of rules regarding lateness, leaving the filature without permission, quarreling, etc., but the most important ones are those regarding the reeling, rereeling, and lacing of silk. A complete list will be presented.

1. Inaccurate size (this has been presented above).

2. High and low quantity of silk. It has been mentioned in connection with the checking system that it is possible to trace out the reeler of each skein of silk. If the weight of a skein is 0.3 taels under the required weight, a fine of ten cents will be imposed on the reeler. On the other hand, a reward of two cents is offered for each one-tenth tael more than the requirement. If the extra quantity of silk reeled by a woman exceeds 3.3 taels in a period of fifteen days, one additional cent is given for each one-tenth of a tael increase.

3. The reeling of double threads receives a fine of five cents each.

4. The reeling of double thread knots receives a fine of fifty cents.

Rereeling Room. The rereeling girl should watch and report every defect to the foreman who in turn punishes the reeling girl. According to the regulations, failure to do this will be subjected to the following fines :

1.	Double threads	$.50
2.	Double thread knot	.50
3.	Double thread removed secretly without reporting to the foreman	1.00
4.	Removing defective silk without reporting to the foreman	.50
5.	"taan-chin-ngan-poh" (單錢眼泡)	.20
6.	Broken thread	.30 each
7.	Hairy silk not reported	.10
8.	Connecting a broken end to the wrong reel	.10 each
9.	Large thread	.10
10.	Passing a thread through the wrong button	.10
11.	Uneven thread	.10
12.	Stained silk	.10
13.	Gum spot due to too much wetting with water	.10
14.	Placing the bamboo checks under the wrong skein of silk	.10
15.	Uneven cutting of knot	.10
16.	Forgetting to put on the rereeler's own check	.10
17.	Forgetting to stick together the loose ends of the threads after the rereeling is finished	.10
18.	Loose threads on the side of the reel	.10

Lacing :

1.	Breaking the threads due to careless lacing	.10
2.	Forgetting to tie together the two ends of the skeins	.10
3.	Prominent defects on the surface of the skein not reported	.10
4.	Coarse threads, loose threads, not removed or adjusted	.10

The Water Supply in the Filature

The water used in the filature has a great influence upon the color of the product. Every filature filters the water before using it. A large pond is made in which is built a brick filter. The brick filter usually consists of three compartments, each of the latter being separated from the other by a brick wall. In this way the water is filtered three times through the bricks before it is pumped to the basins.

A compressed air pump is used, connected to the engine on the other side of the flywheel. Water is first pumped up to a tank where it is again filtered. In this filter, sponge is used, as it will remove all the suspended mud in the water. With such an arrangement, the water should be very suitable for reeling.

The Coal Supply

Japanese coal is used throughout the district. There are coal merchants who buy in Hongkong and resell in the silk districts. A filature of five hundred basins consumes about two and one half tons of coal a day. There are 167 filatures which will burn a total of about four hundred tons of coal a day. The coal is unloaded in Yung-kei and then reshipped to the other parts of the district. The cost of labor in loading or unloading a ton of coal is thirty cents. The duty for a ton of coal is about sixty cents. So if coal is selling at $15.00 HK., in Hongkong, its selling price in the silk districts will be $25.00 local currency. The furnaces of most of the older filatures are poorly constructed, and a great deal of fuel is wasted. It is believed that if the reeling and rereeling, especially the former, were properly geared, the amount of fuel used could be reduced from one quarter to one half.

The Cost of Manufacture

This topic is presented with a view of giving a general idea of the cost of manufacturing raw silk. Due to insufficient data the writers have not been able to present a complete calculation on the yearly basis, but from the actual data obtained, a general view of the subject can be presented. Before going into the subject, it is necessary to consider some of the factors that cause the fluctuation in the cost of producing raw silk.

1. *The Number of Manufacturing Days in the Year.*—Because of the scarcity of cocoons in the late winter and in early spring, many filatures have to stop running from one to three months in the year The number of working days in a year varies from 250 to 300 or a little. more. But during the time when the filature is not running, is has to pay nearly all the expenses as if it were running, except the wages of the women. Naturally the fewer the number of working days, the greater would be the cost of production in that year, and vice versa.

2. *Fluctuation of the Price of Cocoons.*—The price of the cocoons is more than seventy per cent of the cost of producing raw silk. But the price of cocoons fluctuates so widely that it is impossible to make a reliable estimate before hand.

3. *The Variation in the Quality of the Cocoons.*—The quality of the cocoons varies widely even in the same crop, from the same vicinity. A study of the records in the filature will show that twice as much waste silk is produced from the poor grade cocoons as from the good ones. As a matter of fact, the price of waste silk is only one-fifteenth that of raw silk. Consequently the cost of manufacture with poor grade cocoons will be much higher.

4. *The Fluctuation in the Wages of the Reeling Women.*—The wages of the same woman doing the same kind of work varies greatly during the year. Generally the wages are at their highest in the summer and autumn months. At this time there is the maximum supply of cocoons to be reeled; every filature is looking for reeling and rereeling girls. In late winter and early spring only a few of the filatures will have enough stored cocoons to keep them running and the demand for reeling and rereeling girls is descreased to the minimum. At this time the wages may be cut down to one half or even less, and all the rewards (but not the fines) will be discontinued.

5. *Size of Silk to be Produced.*—There are three main sizes of silk manufactured in the filatures, i.e., 13/15, 14/16, and 20/22 deniers. The cost of preparing each is different; the first, which is exported to France, needs no rereeling so the process costs about $50.00 per picul less.

A study of the above mentioned factors will show that the cost of manufacture is subjected to high fluctuations. Moreover, the Kung-hang filature, in which the writers carried out their investigation, is a new one, and had only two months of full data. We will not attempt to present any definite figures on the cost of manufacture. A rough estimate, however, will be attempted.

The average cost of manufacturing coarse silk throughout the year is 210 to 220 taels silver per picul; for fine silk it is 300 taels per picul. These figures agree with those of the many filatures in the district for this year.

SUGGESTED IMPROVEMENT IN THE FILATURE

The filature industry in South China is very strongly organized. Even with the present political disturbances and local disorder, the business goes on with little friction. Nevertheless, the present condition of the filatures is far from being satisfactory or perfect. Although the industry has a long history and changes can be effected slowly only, some reformation must be carried out sooner or later if the Canton silk is to retain its market. An outline of suggested improvements will be given below.

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The Reeling and Rereeling Room.—When entering a filature the first thing that strikes one will be the high temperature and humidity. The fundamental cause of this lies in the steam pipes and the hot water; but with a better ventilation system, this intolerable condition can be improved. In the reeling and rereeling rooms there are windows in the walls as well as in the roof, but those in the roof have to be closed when there is bright sun shine or rain. Hence the combined effect of the accumulated heat and moisture makes the reeling of cocoons an almost intolerable job. With proper construction of the roof, the ventilation can be greatly improved. The side windows should be opened all the time to let out the rising steam and a continuous air current will be set up in the room. As a matter of fact this construction of the roof has already been adopted by a few of the best filatures in Yung-kei. It should be followed by other filatures also.

The Store Room.—The store room is subject to two criticisms. First, there are only a few small windows to admit air and they are often closed; hence there is practically no ventilation. Second, its ground floor is usually kept damp for softening cocoons, consequently the humidity in the building is very high. This dampness and poor ventilation will cause the stored cocoons to become moldy. The store room should be provided with better ventilation and separated from the softening room.

Equipment

Steam Pipes and Belts.—There is a total of more than a thousand feet of steam pipe running to all parts of the filature. Many of the pipes are over one hundred feet away from the boiler. Strange to say the pipes are uncovered and the loss of heat through radiation is very great. Figuring on the basis that two and one half tons of coal are burned each day, at $25.00 Canton currency, per ton, the yearly loss of energy will amount to $45.00 Canton currency, assuming that twenty per cent of the energy is lost by radiation. This sum will be increased by the loss of energy through the poor arrangement of the belts, some of which are loosely fixed and others so badly twisted that the waste of energy through friction must indeed be tremendous. The steam pipes should be covered with asbestos and the belts should be arranged to give the maximum mechanical efficiency. Besides saving power, the covering of the steam pipes would prevent the heat from the steam pipes radiating into the rooms and making them hotter.

The Basins.—The basins have no outlet at the bottom. The superfluous water runs off from the sides of the basins, while the dirt or residue in the water, being much heavier, settles down to the bottom of the basin. So merely letting clean water into the basin cannot make the water cleaner. There should be an outlet of some sort near the bottom of the basin to remove the accumulated residue.

The Sizing Machine.—A filature has only one or two sizing machines which can test the work of two women at one time. Hence the number of women's work so tested daily is very limited. The women, knowing that their work is only occasionally tested, will take the risk of doing imperfect work as the chance of escaping detection is considerable. With more machines and a little more labor it would be quite possible to test each woman's work every day or every two days. Regular testing of the women's work is strongly recommended. In the sample taken, not only should the number of deniers be correct, but the detection of other defects in the raw silk should be equally emphasized.

Water Supply.—Water, as has been mentioned above, is the essential factor for producing silk of superior color, but many of the filatures are a little careless about their water supply. During the time of the writers' investigation, the filatures had special trouble with the flood, which comes every year during the summer months. Some of the filatures stopped running for weeks, partly due to the fact that clean water was not available for the reeling. With proper construction of the filatures, such trouble can be avoided.

The Reels.—The circumference of the reels is not uniform. The writers measured many of them and found that they varied commonly from one half inch to one inch. The edges of the reels are too sharp, giving rise to gum spots in the silk.

The Rereeling Machine.—In the rereeling process the thread passes from the small reel to the standard reel. There is nothing on the glass rod to break the thread if the latter has defects in it. Nor is the hole in the button, through which it passes, small enough to do this. In fact, in the rereeling process, any defect except very thin thread or under sized silk will pass onto the rereel without being detected at all. As a matter of fact, the function of rereeling is to prepare a better quality of silk. It increases the cost of production to rereel the silk, and if a better quality cannot be obtained, the process seems superfluous. To remedy this, the hole in the guide button should be made small, and there should be a device of some sort that will make it impossible for the defects in the silk thread to pass onto the rereeled skein. This of course means more labor. It would be much better, however, not to rereel at all if better quality of silk cannot be obtained.

The Grading of Cocoons.—When first bought in the warehouse the very poor cocoons have been sorted. But the cocoons used in the filature are still not very uniform in quality. They can be profitably graded into at least two grades, and then reeled by two classes of women into two different grades of silk, which, according to the principles of marketing, will bring better prices. One of the greatest handicaps of Canton silk is that it has no grade. The silk produced in any filature may vary widly in quality from time to time, yet the producers always claim that their silk is of the same superior quality in order to make a sale. As a result, the consumer knows nothing about what he is going to get. The grading of cocoons, which is the first step in preparing graded silk, is an essential process.

The Softening and Soaking of Cocoons.—Although the workmen take great pride in their art, the softening process is neither scientific nor economical, as it takes days to complete the process, while the success depends solely upon judgment. With the present method of preparing cocoons, the temperature of the water for soaking is as high as 195°F. Even with this high temperature the white gum spots on the cocoons, which are an indication of insufficient soaking, do not disappear. As a result of this, the women have to reel the cocoons under great difficulties, and accomplish comparatively less work each day, the cocoon fibers breaking so frequently and having to be rebrushed to find the ends again. This is one of the chief causes that gives rise to the large quantity of waste silk in preparing a given quantity of raw silk. Sometimes the amount of waste silk exceeds one catty when a catty of raw silk is prepared. If the cocoons could be properly prepared before delivering to the women for reeling, as is practiced in Japan, there would be less trouble in reeling them, and fewer breaks of the fibers which means less waste of silk. Also the temperature of the reeling basin could be greatly reduced.

Method of Reeling.—The present method of reeling in South China is the *Chambon* system. With this system one woman can take charge of only two threads. When one thread goes wrong both threads have to stop immediately. In other parts of the world the *Tavelle* system is used with each thread runing independently. It is claimed, however, by the filature men that due to the special fineness of the Canton silk, the *Tavelle* system, although very efficient, cannot be used. If such is the case, the present method should be retained and perfected. But this statement should be proved experimentally.

The Method of Holding the Ends.—Due to the frequent breaking of the fibers of the cocoons, the women have to keep a large supply of ends of cocoons in their left hands to be thrown in when necessary. Their methods of pulling differ and should receive a full discussion. Some hold their left hand very high with much to and fro motion. Of course the higher the hand and the greater the motion, the more the silk will be pulled off the cocoons. Silk thus formed can be sold only as waste silk, although it is good middle layer silk. The reelers who hold their hands high and employ much motion should be classified as poor workers, and should be eliminated if possible. After pulling the silk off the cocoons in order to maintain a number of ends of cocoons in her hand, the girl sometimes folds the silk in her hand, while another one may twist it around her fingers forming circles. The latter turns the waste silk into badly tangled loops which will greatly handicap the process of combing out the waste silk in the process of manufacture. So if good quality waste silk is to be obtained, no twisting of the silk into loops or circles should be allowed.

The Changing of Water in the Basin.—Although it takes only a few minutes to change the water in the basin, the water is never changed until the end of each day's work. With more frequent changes to clean water, silk of better color could be obtained.

The Drying of the Waste Silk.—The waste silk is first put into a specially constructed container in which the water content is squeezed out by a screw press. After the water is removed the waste silk is dried by hanging it over the boiler, the temperature of which is extremely high. With such a temperature, the waste silk is often burned and becomes what is known as dead silk. Such a method of drying should be discontinued.

The Employees

The Working Hours.—With eleven and a half hours of work per day, (eight hours of continuous work after the second meal at 9:30 A.M.), and seven days of work every week, in a room the temperature of which usually exceeds 90°F., one cannot help wondering how it is possible for a human being to work under such conditions throughout the entire year without breaking down in health. A glance at their attendance record reveals the truth. The irregular attendance indicates very clearly that many of the working women are compelled to stop working on account of sickness. The month in which the writers investigated was the month in which the wages are the highest, yet the attendance was very irregular.

The reward for full attendance, which has been mentioned above, is another factor which drives them to exhaust themselves to the utmost.

There is no doctor and no hospital in the filature. The only help that the filature can give in case of accidents is to provide a few common medicines which are supposed to be helpful for all kinds of diseases. In a factory of more than five hundred employees working under such conditions, at least a nurse, if not a doctor and hospital, should be provided. If the welfare of the employees is not attended to, mere improvement and enlargement of the industry will mean greater suffering to the unfortunate girls of the district, as more of them will work in the filatures if the industry is enlarged.

The dormitory for the girls should be better ventilated and there should be playgrounds around the place so that the workers can find some recreation after working. Under the present treatment there is no possibility of any social activity, because time and place are not provided.

Child labor is another serious problem in the filature; due to scarcity of labor, large numbers of young girls are employed even in the best filatures. They receive only about one third of the wages, but work just as hard as the full grown women. Child labor should be restricted, or at least the working hours should be shortened.

The filatures do not train their women. It would pay, in the long run, to have a laboratory in the filature for training their own women, and at the same time testing the daily product of the filature.

The above suggested improvements are very practical and can be effectively carried out with little difficulty and expense. Another side of improvement of the industry that is of no less importance is the improvement of the quality of cocoons. This subject, however, is too large to be discussed here.

THE FILATURES IN YUNG-KWAI

The best steam filatures of South China are found in Yung-kwai. Generally they may be grouped into three classes. The first class consists of those the price of whose silk per bale is about $150.00 HK. higher than the third class. The silk from the second class is about $50.00 HK. higher than the third class. The third class contains the majority of the filatures.

The construction, organization, and management of all the filatures are similar, but the first and second class filatures owe their superiority to the following points:

1. They have a better construction of roof of the reeling room, with side windows which admit more light and reduce the temperature and humidity. This means a better place for the women to work, and consequently better work.

2. The reels rotate at a slower and more uniform speed. The women are therefore not forced to hurry their work.

3. The steam pipes are kept open during reeling, with steam at a definite pressure. The temperature of the water in the basin is more uniform and yet somewhat lower than that in the third class filature. Hence the cocoons are well softened and easily unwound.

4. The waste of the cocoons is more completely removed before reeling. This, of course, gives a better quality of silk, but a little higher percentage of waste.

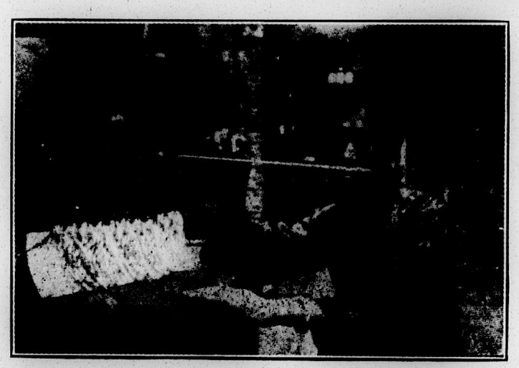
5. The water used for reeling is clean because they have a better filter.

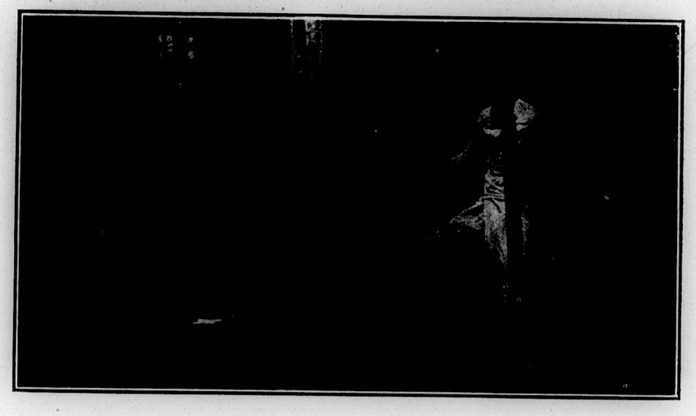
6. The rules for reward and fine are strict. The fine for incorrect size is very heavy so the women are forced to do careful work.

7. The upper and lower crossings are uniform and long, the lower one being nine inches and the upper one twelve inches.

8. Most important of all, however, is the type of women reelers. The women in Yung-kwai are said to be much more skilful. They are very obedient and follow the instructions of the foremen closely.







1. WOMEN SORTING COCOONS IN A COCOON MARKET.
2. SIZING SKEINS BEING WEIGHED, IN A STEAM FILATURE, ON A LOCAL MADE DENIER SCALE.
3. REELING SIZING SKEINS, IN A STEAM FILATURE, TO TEST THE WORK OF THE REELING WOMEN.

PHOTOS BY Y. W. LEI AND H. K. LEI

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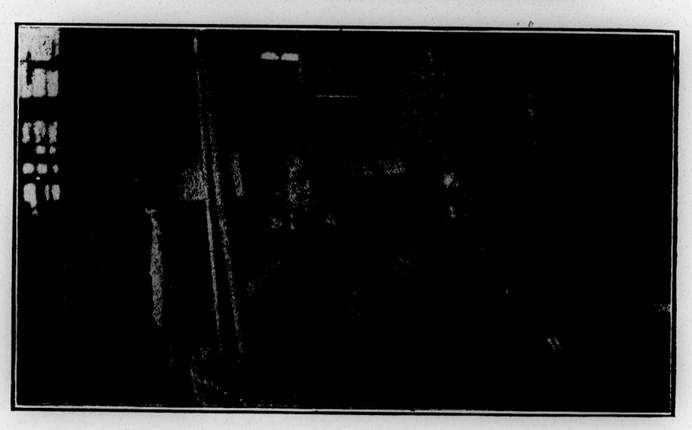

1. GENERAL VIEW IN A STEAM FILATURE IN KWANGTUNG.
2. TESTING COCOONS, IN A STEAM FILATURE, TO SEE HOW MANY SHOULD BE USED FOR REELING A GIVEN SIZE OF THREAD.
3. WOMEN AT THE BASINS IN A STEAM FILATURE.

PHOTOS BY Y. W. LEI AND H. K. LEI

A LIST OF SOME SOOCHOW AND NINGPO DIATOMS.

By N. Gist Gee

China Medical Board, Peking, China.

Achnanthes brevipes Ag. .. ..Nimrod Sound
Achnanthes lanceolata (Breh.) Grun .. ..Soochow
Achnanthes marginulata Grun. .. .. ..Nimrod Sound
Achnantes subsessilis Ktz. .. ..Nimrod Sound
Achnantes subsellis var. *enervis* Fauv. ..Nimrod Sound
Achnantes javanica Grun. .. ..Soochow
Actinocyclus ehrenbergu Ralfs. .. .. ..Ningpo
Actinoptychus undulatus Ktz. .. .. ..Nimrod Sound
Amphipleura pellucida Ktz. .. ..Soochow
Amphiprora alata Greg. .. ..Nimrod Sound
Amphora costata W. Sm. .. ..Ningpo
Amphora cymbelloides Grun... .. .. ..Nimrod Sound
Amphora cymbifera Greg. .. ..Nimrod Sound
Amphora ergadensis Greg. .. ..Nimrod Sound
Amphora Hemicolor Grun.? .. ..Soochow
Amphora lineata Greg. .. ..Nimrod Sound
Amphora ovalis (Breb.) Ktz... .. .. ..Soochow
Amphora ovalis var. *gracilis* .. ..Soochow
Anomoeoneis sphaerophora (Kuts.) Cleve ..Soochow
Arachniodiscus ehrenbergii Bail .. .. ..Nimrod Sound
Biddulphia aurita (Lyng.) Breh. .. .. ..Nimrod Sound
Calcneis Silicula (Ehrenb.) Cleve.. .. ..Soochow
Chaetoceros bacillaria Bail. .. ..Ningpo
Cocconeis lineata (Ehr.) Grun. .. .. ..Soochow
Cocconeis ningpoensis Fauv. .. ..Ningpo
Cocconeis placentula Ehr. .. ..Soochow
Cocconeis scutellum Ehr. .. ..Soochow
Cocconema gracile (Rab.) .. ..Ningpo
Coscinodiscus concinnus W. Sm. .. .. ..Nimrod Sound

Coscinodiscus excentriscus Ehr. .. .. ..Ningpo
Coscinodiscus gigas Ehr.? .. ..Ningpo
Coscinodiscus heteroporus Ehr. .. .. ..Nimrod Sound
Coscinodiscus lineatus Ehr. .. ..Ningpo
Coscinodiscus lineatus oculatus Fauv. ..Ningpo
Coscinodiscus minor Ehr. .. ..Ningpo
Coscinodiscus nodulifer A. S... .. .. ..Nimrod Sound
Coscinodiscus oculus iridis Ehr. .. .. ..Ningpo
Coscinodiscus radiolatus Ehr. .. .. ..Ningpo
Coscinodiscus subtilis Ehr. .. ..Ningpo
Cyclotella operculata Ktz. .. ..Soochow
Cyclotella rotula (Ehr.) Ktz. .. .. ..Ningpo
Cyclotella sinensis Ehr. .. ..Ningpo
Cyclotella meneghinian Ktz. .. ..Soochow
Cyclotella punctata W. S. (*Coscinodiscus lacustris* Grun). .. ..Soochow
Cyclotella striata (Ktz.) Grun. .. .. ..Soochow
Cymatopleura Solea (Breb.) W. Smith ..Soochow
Cymbella affinis Kutz. .. ..Soochow
Cymbella lunata Rab. .. ..Soochow
Cymbella obtusa Greg. .. ..Ningpo
Cymbella stomatophora Grun. .. .. ..Soochow
Cymbella tumida Breb. .. ..Soochow
Cymbella turgida (Greg.) Cleve.. .. ..Soochow
Epithemia gibba Ktz. .. ..Soochow
Epithemia westermanni Ktz... .. .. ..Nimrod Sound
Epithemia zebra (Ehr.) Ktz... .. .. ..Ningpo
Eunotia pectinalis (Kutz.) Rab. and varieties Soochow
Frustulia styriaca (Grun.) D. T. .. .. ..Soochow
Gomphonema acuminatum Ehr. with vars...Soochow
Gomphonema acuminatus coronatum (Ehr.) Cleve.. .. ..Soochow
Gomphonema acuminatum Turris (Ehr.) Cleve .. ..Soochow
Gomphonema angustatum Kutz. .. .. ..Soochow
Gomphonema augur Ehr. .. ..Soochow

Gomphonema capitatum Ehr. .. .. ..Ningpo Soochow
Gomphonema constrictum Ehr. .. .. ..Soochow
Gomphonema intricatum Ktz. .. .. ..Soochow
Gomphonema lanceolatum Kuts. .. .. ..Soochow
Gomphonema micropus .. ..Soochow
Gomphonema montanum Schumann .. ..Soochow
Gomphonema parvulum Kutz. .. .. ..Soochow
Gomphonema sphaerophorum Ehrenb.. .. ..Soochow
Hantzschia amphioxys Grun... .. .. ..Soochow
Hantzschia elongata (Hantzsch.) Grun. ..Soochow
Hyalodiscus subtilis Bail. .. ..Nimrod Sound
Lysigonium varians (Ag.) De-Toni .. ..Soochow
Melosira crenulata Ktz. .. ..Soochow
Melosira sulcata (Ehr.) Ktz... .. .. ..Ningpo
Melosira varians Ag. .. ..Soochow
Melosira costata Grev. .. ..Ningpo
Navicula ambigua Ehr. .. ..Soochow
Navicula americana minor M. Perag. and Heribaud.. .. ..Soochow
Navicula amphirhynchus Ehr. .. .. ..Soochow
Navicula appendiculata Ktz. .. ..Soochow
Navicula bisulcata Lag. .. ..Soochow
Navicula Braunu Grun. .. ..Soochow
Navicula Brebissonii Ktz. with varieties ..Soochow
Navicula cuspidata Kutz.. .. ..Soochow
Navicula elliptica W. Sm. .. ..Ningpo Soochow
Navicula elongata Grun. .. ..Ningpo
Navicula gemina Ehr. .. ..Ningpo
Navicula gracilis Ehr. .. ..Nimrod Sound
Navicula graeffii Grun. .. ..Ningpo
Navicula limosa Kutz. .. ..Soochow
Navicula longa Greg. .. ..Ningpo Nimrod Sound
Navicula parca A. S. .. ..Ningpo
Navicula pupula Grun. .. ..Soochow
Navicula major Grun. .. ..Soochow
Navicula smithii Breb. .. ..Ningpo

Navicula sp. .. ..Nimrod Sound
Neidium affine (Ehrenb.) Pfitzer .. .. ..Soochow
Neidium amphigomphus (Ehrenb.) Pfitzer..Soochow
Nitzchia acutiuscula Grun. .. ..Soochow
Nitzchia amphibia Grun... .. ..Soochow
Nitzchia angustata (W. S.) .. ..Soochow
Nitzchia compressa (Bail.) .. ..Ningpo
Nitzchia distans Greg. .. ..Nimrod Sound
Nitzchia macilenta Greg... .. ..Ningpo
Nitzchia minuta Bleisch... .. ..Nimrod Sound
Nitzchia Palea (Ktz.) W. S. .. ..Soochow
Nitzchia panduriformis Greg. .. .. ..Ningpo
Nitzchia sigma (Ktz.) W. S. .. ..Ningpo
Nitzchia thermalis (Ktz.) Grun. .. .. ..Soochow
Nitzchia tubicula Grun. doubtful .. .. ..Soochow
Nitzchia (Homaocladis) *vidovichii* Grun. ..Nimrod Sound
Pinnularia borealis Ehrenb. .. ..Soochow
Pinnularia gibba (Kutz.) Van Heurck ..Soochow
Pinnularia hemiptera (Kutz.) Cleve .. ..Soochow
Pinnularia major (Kutz.) W. Smith .. ..Soochow
Pinnularia Viridis Nitzsch. .. ..Soochow
Pleurosigma affine Grun... .. ..Nimrod Sound
Pleurosigma acuminatum W. S. .. .. ..Ningpo
Pleurosigma formosum W. S... .. .. ..Nimrod Sound
Raphoneis fasciolata Ehr. .. ..Ningpo
Raphoneis scutellnm Ehr. .. ..Ningpo
Rhoicosphania curvata Grun. .. .. ..Soochow Nimrod Sound
Rhoikoneis bolleana Grun. .. ..Nimrod Sound
Rhopalodia gibba (Kutz.) Muller .. .. ..Soochow
Podosira nummuloides Ehr. .. ..Nimrod Souud
Stauroneis acuta W. Smith .. ..Soochow
Stauroneis anceps gracilis (Ehrenb.) Cleve..Soochow
Stauroneis phoenicenteron Ehr. .. .. ..Soochow
Stephanodiscus sinensis Ehr... .. .. ..Ningpo
Surirella angusta Kutz. .. ..Soochow
Surirella fastuosa Ehr. Type .. ..Ningpo Nimrod Sound

Surirella fastuosa, many forms .. .. ..Ningpo
Surirella gemma Ehr. abundant .. .. ..Nimrod Sound
Surirella linearis W. Smith .. ..Soochow
Surirella ovalis Breb. .. ..Soochow
Surirella ovata Kutz. .. ..Soochow
Surirella pinnata W. S. .. ..Soochow
Surirella pinnata minuta Grun. .. .. ..Soochow
Synedra danica Kutz. .. ..Soochow
Synedra pulchella (Ralfs.) Ktz. .. .. ..Soochow
Synedra rumpens Ktz. .. ..Soochow
Synedra sp.? (Similar to *S. tabulata*) Ktz. which is brackish).. .. ..Soochow
Synedra ulna var. amphirhynchus (Ehr.) ..Soochow
Synedra elma (Nitzsch.) Ehrenb. and varieties .. ..Soochow
Sgringidium daemon Grev. .. ..Ningpo
Triceratium rostratum Fauv... .. .. ..Ningpo
Triceratium sineuse Schw. .. ..Nimrod Sound

TENTATIVE LIST OF CHINESE DECAPOD CRUSTACEA

Including those Represented in the Collections of the United States National Museum (Marked with an*) with Localities at which Collected.

By N. Gist Gee

China Medical Board, Peking, China.

Foreword

For some years we have been endeavoring to get together for those who are working on the natural history of China lists of the various groups of plant and animal life. We have always found the most sympathetic cooperation on the part of specialists and institutions. We have felt that the determination and naming of the various forms should be done only by those who are specialists in the group concerned. This is most necessary in order to avoid errors and consequent difficulties in the future. With this view in mind we have always submitted our lists to those who were competent to express a final opinion on the list as a whole. It is very evident that these lists cannot be complete, for we know so little of the occurrence of the various forms, but in order to make it possible for workers to have a beginning, we have held that it was best to publish *preliminary* or tentative lists which might serve as a starting point for more nearly complete lists later.

The following list, has been kindly compiled for us by friends in the United States National Museum at Washington. It makes no claim to being a complete one, but gives us most of the records of this group from China. It will serve as an excellent basis for further work.

PENEIDAE

Penaeopsis mogiensis (Rathbun)	Hongkong
**Penaeopsis monoceros* (Fabr.)	Hongkong; *Wen-chow,
Parapeneopsis hungerfordi Alcock	Hongkong
Parapeneopsis sculptilis (Heller)	Hongkong
Penaeopsis joyneri (Miers)	China
Penaeopsis novae-guineae (Haswell)	Hongkong
Peneus affinis Heller	Hongkong

?*Peneus podophthalmus* Stimpson	Hongkong
Peneus semisulcatus de Haan	Hongkong
?*Peneus stenodactylus* Stimpson	Hongkong
**Peneus* sp.	*Pei-tai Ho, Chihli; on the north coast of the Pechili Gulf, China.
Sicyonia ocellata Stimpson	China Sea; Hongkong
**Trachypeneus curvirostris* (Stimpson)	*Wen-chow, China.

SERGESTIDAE

Acetes chinensis Hansen	China Sea
Acetes serrulatus Kryer	Indo-Chinese Sea
Acetes spiniger Hansen	Indo-Chinese Sea
Lucifer hanseni Nobili	China Sea
Lucifer intermedius Hansen	China Sea; Hongkong; Shanghai.
Lucifer penicillifer Hansen	China Sea; Hongkong; Shanghai.
Sergestes orientalis Hansen	China Sea

PASIPHAEIDAE

Leptochela robusta Stimpson	China Sea

ATYIDAE

Caridina davidi Bouv.	Peking
**Caridina denticulata* de Haan	*Near Yen-Ping Fu, Fukien
Caridina denticulata subsp. *sinensis* Kemp	Tai Hu Lake, Kiangsu.
Caridina nilotica subsp. *gracilipes* de Man	Shanghai; Whangpoo River.
Caridina serrata Stimpson	The Peak, Hongkong

CRANGONIDAE

Arete dorsalis Stimpson	Hongkong
Crangon (*Alpheus*) *avarus* (Fabr.)	Hongkong
Crangon (*Alpheus*) *distinguendus* (de Man)	China
Crangon (*Alpheus*) *hoplocheles* (Coutiere)	Amoy
Crangon (*Alpheus*) *neptunus* (Dana)	Hongkong
Crangon (*Alpheus*) *strenuus* (Dana)	China
Ogyris orientalis Stimpson	China Sea

HIPPOLYTIDAE

Hippolysmata vittata Stimpson.. .. ..Hongkong
Latreutes Mucronatus Stimp. .. .. ..Hongkong
Tozeuma lanceolatum Stimpson.. .. ..Hongkong

PROCESSIDAE

Processa macrognatha (Stimpson) .. ..Hongkong

CRAGONIDAE (Crangonidae)

Pontophilus carinicauda Stimpson .. ..Hongkong

PALAEMONIDAE

**Macrobrachium asperulus* (von Martens) *Yen-ping Fu; Foochow; Tai Hu Lake, Kiangsu.
Macrobrachium hainanense Parisi .. ..Hainan
**Macrobrachium nipponensis* (de Haan)..Canton; Min River, Fukien; *Wenchow; Shansi; Yangtse-Kiang; Shanghai; Tai Hu Lake, Kiangsu; Peking; Pei-tai Ho.
Macrobrachium superbus (Heller) .. ..Shanghai
Macrobrachium venustus (Parisi) .. ..Hainan
Palaemon (Leander) carinatus (Ortmann) Shanghai; Tsingtau.
Palaemon (Leander) annandalei (Kemp) Shanghai; Whangpoo River
**Palaemon (Leander) japonicus* (Ortmann) .. ..*Foochow; Fukien; Hankow.
Palaemon (Leander) longicarpus (Stimpson) .. ..China
Palaemon (Leander) modestus (Heller)..Shanghai; Whangpoo River; Tai Hu Lake Kiangsu.
Palaemon (Leander) pacificus (Stimpson) Hongkong
**Palaemon (Leander) serrifer* (Stimpson) Hongkong; Amoy; *Wenchow; Hankow.
**Palaemon (Leander) paucidens* de Haan *Shanghai; Foochow.
Palaemon sinensis (Sollaud) .. .. ..Shanghai; Whangpoo River

PALINURIDAE

?Linuparus trijonus (Siebold) .. .. ..Ningpo
Panulirus ornatus (Fabr.) .. ..Hongkong; Amoy; Swatow.

SCYLLARIDAE

Ibacus novemdentatus Gibbes .. .. ..Hongkong
Scyllarus sordidus (Stimpson) .. .. ..Hongkong

ASTACIDAE

**Cambaroides dauricus* (Pallas) .. ..*Crater Lake, Kirin Forest, Manchuria.

GALATHEIDAE

Galathea orientalis Stimpson .. .. ..China Sea?

PORCELLANIDAE

Pachycheles pectinicarpus Stimpson.. ..Near Hongkong
Petrolisthes japonicus (de Haan) Stimpson .. ..Hongkong
**Petrolisthes speciosus* (Dana) Stimpson Hongkong Island; ? Amoy.
Porcellana latifrons Stimpson .. .. ..Hongkong
Porcellana ornata Stimpson .. .. ..Hongkong
Porcellana pulchra Stimpson .. .. ..Hongkong
**Porcellana serratifrons* Stimpson .. ..Hongkong; *Amoy
Raphidopus ciliatus Stimpson .. .. ..Near Hongkong

CALLIANASSIDAE

Gebia carinicauda Stimpson .. .. ..Hongkong

PAGURIDAE

Clibanarius clibanarius (Herbst) .. ..Hongkong
**Clibanarius infraspinatus* Hilgendorf ..*Toofue, and Amoy; -Amoy.
Clibanarius virescens (Krauss) Heller ..Hongkong
Dardanus arrosor (Herbst) .. .. ..China
Dardanus diogenes (Fabr.) .. .. ..China
Diogenes edwardsii (de Haan) Stimpson Hongkong; China Sea
Pagurus brachiomastus Thallwitz .. ..China
Pagurus megalops (Stimpson) .. .. ..North China Sea

Pagurus seriespinosus Thallwitz .. ..China?
Spiropagurus spiriger (de Haan) Stimpson .. ..Near Hongkong

HIPPIDAE
?Albunca sp. .. ..Ningpo
Mastigochirus gracilis Stimpson .. ..China Sea

DROMIIDAE
Conchoecetes artificiosus (Herbst) Stimpson .. ..Off Hongkong
**Dromia dehaani* Rathbun .. ..*Hongkong

DORIPPIDAE
Dorippe dorsipes (Linnaeus) .. .. ..Hongkong
Dorippe granulata de Haan .. .. ..Chinese Seas
Dorippe sima M. E. .. ..Ningpo
Dorippe facchino (Herbst).. .. .. ..*Foochow

CALAPPIDAE
Calappa lophos (Herbst) .. ..China
**Calappa philargius* (L.) .. ..*Hongkong; Foochow
Cryptosoma granulosus de Haan .. ..Chinese Seas
**Matuta lunaris* (Forskal) .. .. ..China Sea; *Hainan
**Matuta planipes* Weber .. ..Chefoo; *Pei-tai Ho, Chihli.
Mursia armata de Haan .. ..China
**Orithyia sinica* (Linnaeus) .. .. ..Swatow; Amoy; Ningpo; Hankow: *Pei-tai Ho, Chihli; *Foochow.

LEUCOSIIDAE
Arcania globata Stimpson .. ..Near Soon-Koo? and Hongkong Islands; North China Sea.
Arcania septemspinosa (Fabricius) .. ..Near Hongkong
Iphiculus spongiosus Adams and White ..Near Hongkong
Leucosia rhomboidalis de Haan.. .. ..Hongkong
Leucosia obtusifrons unidentata de Haan Hongkong
Leucosides rhomboidalis (de Haan).. ..Near Hongkong
Leucosides vittata (Stimpson) .. .. ..Near Hongkong

Myra fugax (Fabricius) .. ..Hongkong Harbor
Nursia hardwickii Leach .. ..Hongkong
Onychomorpha lamelligera Stimpson ..Hongkong
**Philyra pisum* de Haan .. ..*Foochow; *Chefoo; Pei-tai Ho; Chihli; *Chin Bey.
Philyra platycheira de Haan .. .. ..Hongkong
Philyra tuberculosa Stimpson .. .. ..Near Hongkong
Philyra unidentata Stimpson .. .. ..China Sea

PORTUNIDAE
Charybdis anisodon de Haan .. .. ..Near Hongkong; Shanghai
Charybdis callianassa (Herbst) .. ..Ningpo
**Charybdis cruciata* (Herbst) .. .. ..Hongkong; -Foochow
**Charybdis japonica* (A. Milne Edwards) Macao; near Hongkong; *Chefoo; *Pei-tai Ho, Chihli; *Amoy.
Charybdis miles de Haan .. ..Hongkong
Charybdis natator (Herbst) .. .. ..Hongkong
Charybdis truncata (Fabricius) Stimpson Hongkong
**Charybdis variegata* (Fabricius) de Haan China Sea; Hongkong; *Amoy
Portunus (*Achelous*) *galdiator* (Fabricius) China Sea
Portunus (*Lupocycloporus*) *gracilimanus* Stimpson .. ..Hongkong
Portunus (*Achelous*) *hastatoides* (Fabricius).. .. ..Hongkong Island; Hankow
**Portunus pelagicus* (Linnaeus) .. ..China Sea; Hongkong; Ningpo; *Hoichow
Portunus sanguinolentus (Linnaeus) ..Hongkong
**Portunus trituberculatus* (Miers) .. ..Tsingtau; Chefoo; *Pei-tai Ho, Chihli; *Amoy
**Scylla serrata* (Forskal) .. ..*Amoy; Hankow; Shanghai
Thalamita danae Stimpson.. .. .. ..Hongkong
Thalamita sima Milne Edwards (?) .. ..Near Hongkong

POTAMONIDAE
Potamon (*Potamon*) *anacoluthon* Kemp The Peak, Hongkong.

**Potamon (Geothelphusa) dehaanii* (White) .. ..*Kuling (near Kiukiang)
**Potamon (Potamon) denticulatus* (Milne Edwards) .. ..*Near Yen-ping Fu; Tai Hu Lake, Kiangsu
**Potamon (Potamon) shensiensis* Rathbun *Inkiaphou, Shensi
Potamon (Potamon) lansi Doflein .. ..Upper Yangtse-Kiang
**Potamon (Potamon) davidi* Rathbun ..*Han-Tchong Fou, and *Siufu, Szechuen
**Parathelphusa (Parathelphusa) sinensis* (Milne Edwards) .. ..Canton; Hongkong; Whampoa; *Amoy; *Foochow; *Hainan
**Potamon (Potamoneutes) hainanense* Parisi .. ..*Hainan
Potamon (Potamon) koatenensis Rathbun Koaten
**Potamon (Potamon) tumidus* (Wood-Mason) .. ..*Yunnan
Potamon (Potamon) whiteheadi Parisi ..Hainan
Potamon (Potamon) orientale Parisi ..Hainan

ATELECYCLIDAE

Kraussie nitida Stimpson .. ..China Sea

CANCRIDAE

Cancer gibbosulus (de Haan) ... ...China Sea

XANTHIDAE

Actaea granulata (Audouin) ... .China Sea; Hongkong
Actaea pilosa Stimpson ... ...Hongkong
**Actaea obesa?* A. Milne Edwards ... ...*Kulungsu Id.
Actaea rufopunctata Milne Edwards... ..China Sea
Actaea (?Banareia) subglobosa Stimpson ...Hongkong
Actaea tomentosa (Milne Edwards) ... ...Hongkong
Actumnus squamosus (de Haan) ... ...China Sea
Atergatis dilatatus de Haan ... ...China Sea
Atergatis integerrimus (Lamarck) ... ...Hongkong
Atergatis ocyroe (Herbst) ... ...China
Cymo memanodactylus de Haan... ... ...Hongkong Island
Epixanthus frontalis (Milne Edwards) ...Hongkong

Eriphia sebana smithii Macleay... ... ...Near Hongkong
Galene bispinosa (Herbst) ... ...Hongkong
Halimede fragifer de Haan ... ...Near Hongkong
Halimede ochtodes (Herbst) .. ..Hongkong
Halimede thurstoni Henderson ... ...Hongkong
Heteropahope eucratoides Stimpson ... ...Hongkong
Heteropanope glabra Stimpson ... ...Hongkong
**Leptodius exaratus* M. E. ... ...Hankow; *Amoy
Leptodius exaratus var. granulosus (Stimpson) ... ...Hongkong
Leptodius gracilis Dana ... ...Near Hongkong
Liagore rubromaculata de Haan ... ...China Sea; Hongkong
Lophoxanthus scaberrimus Walker ... ...Hongkong
Menippe convexa Rathbun ... ...Swatow; Kulungsu Id.
Ozius lobatus Heller ... ...Shanghai
Pilodius granulatus Stimpson ... ...Hongkong Is'and
Pilumnus dorsipes Stimpson ... ...Hongkong
Pilumnus hirsutus Stimpson ... ...Northern China Sea
Pilumnus lapillimanus Stimpson ... ...China Sea
Polycremnus verrucifer Stimpson ... ...Near Hongkong
Pseudozius sinensis M. Edw. ... ...China
Sphaerozius nitidus Stimpson ... ...Hongkong
Tetralia glaberrima Dana ... ...Hongkong Island

GONOPLACIDAE

**Carcinoplax longimanus* (de Haan)... ...China. *Foochow
Heteroplax dentata Stimpson ... ...Near Hongkong
Heteroplax transversa Stimpson ... ...Hongkong
Pilumnoplax sulcatifrons Stimpson ... ...Hongkong
Rhynchoplax introversus Kemp... ... ...Tai Hu Lake, Kiangsu
Rhynchoplax setirostris Stimpson ... ...Hongkong
Scalopidia leucochirus Richters ... ...China?

PINNOTHERIDAE

Pinnixa penultipedalis Stimpson ... ...Hongkong
Pinnotheres boninensis ... ...China Sea
Pinnotheres obscurus Stimpson ... ...Hongkong
Pinnotheres parvulus Stimpson ... ...China Sea

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Xenophthalmus pinnotheroides White ...Hongkong

GRAPSIDAE

**Chasmagnathus convexus* de Haan ... ...Hongkong ; Kiao-chou ; Foochow

Cyclograpsus punctatus Milne Edwards ...Hongkong

Eriocheir leptognathus Rathbun ... ...Shanghai ; Whangpoo River

Eriocheir rectus Stimpson ... ...Near Macao

Eriocheir sinensis Milne Edwards ... ...Foochow ; Shasi ; Shanghai ; Whangpoo River ; Antung ; Tai Hu Lake, Kiangsu ; Market Changchu ; Amoy

Goetice depressus (de Haan) ... ...Hongkong

Grapsus strigosus (Herbst) Latreille ... ...Hongkong

Helice tridens de Haan... ... ...Hongkong ; Hankow ; Kiao-chau, Tsingtau

**Helice latimera* Parisi... ... ...*Pei-tai Ho, Chihli ; *Formosa

**Hemigrapsus sanguineus* (de Haan)... ...Near Hongkong; Chefoo, *Pei-tai Ho, Chihli

**Hemigrapsus penicillatus* (de Haan) ...Near Hongkong; *Amoy

**Metaplax longipes* Stimpson ... ...Hongkong ; *Chin Bey

**Metopograpsus quadridentatus* Stimpson Cum-sing-moon, near Macao; *Amoy; *Chin Bey.

Plagusia depressa (Fabr.) Latr. ... ...Hongkong

Plagusia tuberculata Lamarck ... ...Hongkong

Sesarma affinis (de Haan) Heller ... ...Shanghai

**Sesarma bidens* (de Haan) Dana ... ...Hongkong ; *Amoy

**Sesarma bidens* (de Haan) Dana ... ...Hongkong ; *Amoy

**Sesarma dehaani* Milne Edwards ... ...Whampoa ; Foochow ; Yangtse-Kiang; Shanghai; Whangpoo River

**Sesarma haematocheir* (de Haan) ... ...Hongkong ; Amoy ; Tsingtau; *Chin Bey

**Sesarma intermedium* (de Haan) Milne Edw. ... ...Hongkong ; *Foochow ; Hankow ; Shanghai ; Whangpoo River

**Sesarma lanatum* Alcock ... ...*Amoy

**Sesarma neglectum* de Man ... ...*Foochow ; Shanghai ; Wu-Soon

**Sesarma minutum* de Man ... ...*Kulungsu Id.

Sesarma plicata Latr. ... ...China; Hongkong

Sesarma sinensis Milne Edwards ... ...Hongkong ; Ningpo

Utica sinensis Parisi ... ...China

**Varuna litterata* (Fabr.) M. Edw. ... ...Hongkong; Canton River; Shanghai ; *Foochow

OCYPODIDAE

Camptandrium sexdentatum Stimpson ...Near Hongkong

Cleistostoma dilatatum de Haan ... ... Pei-tai Ho, Chihli

Ilyoplax deschampsi (Rathbun) ... ...Shanghai ; Whangpoo River

Ilyoplax stapletoni (de Man) ... ...Chung-ming

Ilyoplax tenella Stimpson ... ...Canton River (brackish water) ; Whampoa

Macrophthalmus dentatus Stimpson ... ...Near Hongkong

**Macrophthalmus dilatatus* de Haan ...Swatow; *Chin Bey

**Macrophthalmus erato* de Man ... ...*Chin Bey; *Amoy

**Macrophthalmus japonicus* de Haan ...*Fing-hsien ; *Pei-tai Ho, Chihli

Macrophthalmus serratus White ... ...Hongkong

Myctiris brevidactylus Stimpson ... ...Hongkong

**Ocypode ceratophthalma* (Pallas) ... ...*Pei-tai Ho, Chihli.

**Ocypode cordimana* Desmarest... ... ...Hongkong ; Swatow ; Foochow ; Chin Bey

Ocypode stimpsonii Ortmann ... ...Tsingtau

**Paracleistostoma cristatum* de Man ...*Pei-tai Ho, Chihli

Scopimera globosa de Haan ... ...Hongkong

**Uca demani* Ortmann ... ...*Amoy

**Uca dussumieri* (Milne Edwards) ... ...Macao. *Chin Bey

**Uca lactea* (de Haan) ... ...*Cum-sing-moon; Macao; Hongkong. *Chin Bey; Amoy

**Uca manii* Rathbun ... ...*Chin Bey

**Uca marionis* (Desmarest) ... ...Hongkong ; *Chin Bey

Uca splendida (Stimpson) ... ...Hongkong

Uca brevipes Milne Edwards ... ...China

MAJIDAE

Achaeus japonicus de Haan... ... ...Hongkong
**Doclea canalifera* Stimpson ... ...Off Tamtoo Island, near Hongkong; *Foochow
Doclea gracilipes Stimpson ... ...Hongkong
Huenia proteus de Haan ... ...China
**Hyas coarctatus* Leach ... ...Amoy; *Shanghai
Hyastenus planasius Adams and White ...China Sea
**Hyastenus elongatus* Ortmann .. ..*Kulungsu Id., Amoy
Hyastenus diacantha (de Haan) ... ...Hongkong
Menaethius monoceros (Latreille) ... ...Hongkong
Phalangipus (Egeria) herbstii (Edw.) ...Hongkong
Phalangipus longipes (Linnaeus)... ... ...Hongkong
**Pugettia quadridens* (de Haan) Stimpson...Near Hongkong; *Chefoo

PARTHENOPIDAE

Cryptopodia contracta Stimpson ... ...China Sea
Cryptopodia fornicata (Fabricius) Milne Edwards ... ...China Sea; Hongkong
Harrovia albolineata Adams and White ...Hongkong
Parthenope carinatus (M. Edw.) ... ...China Sea
Parthenope harpax Adams and White ...China Sea
**Parthenope laxciniata* (de Haan) ... ...Northern China; *Chin Bey
Parthenope tuberculosa (Stimpson) ... ...Near Hongkong
Parthenope validus (de Haan) ... ...Hongkong

HYMENOSOMIDAE

**Elamena sinensis* Alcock ... ...*Chin Bey

STOMATOPODA

Chloridella fasciata (de Haan) ... ...China Sea
**Chloridella oratoria* (de Haan) ... ...Hongkong; *Wen-chow; *Pei-tai Ho, Chihli
Gonodactylus edwardsii Berthold ... ...China
Gonodactylus japonicus de Haan ... ...China

THE LIFE HISTORY OF *SPHAERODEMA RUSTICUS* FABR. (HEMIPTERA, BELOSTOMATIDAE) *

BY WILLIAM E. HOFFMANN

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Introductory Statement.—*Sphaerodema* belongs to the family Belostomatidae of the order Hemiptera, the true bugs. The family is represented in South China, as far as our present knowledge goes, by only two species, a species of *Lethocerus* and the present species. *S. rusticus* has been known for well over a century, being described by Fabricius in 1803. In the literature it has also been called *Diplonychus, Appasus* and *Nervinops. Sphaerodema* has a wide distribution, being found in the Ethiopian, Oriental, and Australasian Regions, and Southern and Eastern Palaearctic Regions. *S. rusticus* has been reported from Bombay, Ceylon, Burma, Siam, Sumatra, Java, Philippines, China, and Australia, and no doubt future collecting will extend its distribution considerably. Like its relatives of the genera *Belosotoma* and *Abedus, Sphaerodema* carries its eggs on its back. Because of this habit it is called, in Chinese, *Foo Tsz Ch'ung* (負子蟲). There seems to be no name for the bug in the Cantonese dialect, which goes to show that it is not commonly observed in Kwangtung although it is much more common than its gigantic relative, *Lethocerus*, which is known as *Kwai Fa Shim* (桂花蟬), and is considered a food delicacy.

Habitat.—Found commonly in pools and ponds in Kwangtung, clinging to vegetation or other support in the water. They seem to prefer shallow water up to three feet deep, which is liberally supplied with plant growth and trash. A brush lying among growing plants, in shallow water at the edge of a pond is sure to have a big *Sphaerodema* population.

They are not particular in regard to the cleanliness of the water. When dredged up with algae, grass, and trash they immediately scurry to the bottom of the net. They cling to vegetation so closely that they are easily overlooked.

Hibernation.—Adults have been taken in winter collecting in the vicinity of Canton. They showed no signs of hibernation. Adults kept over winter in a laboratory of about the same temperature as the outside, not only remained active all winter but took food from time to time when the weather warmed up a little. They were kept in a small aquarium, however, in which no dirt or trash was provided for hibernation. Specimens of *Lethocerus* kept under the same condi-

* Contribution from the Biological Laboratory.

tion remained active and occasionally took food, while those given an opportunity to hibernate left the water and remained beneath the dead grass upon damp sand, in a semi-torpid condition. Undoubtedly there is a very high mortality of *Sphaerodema* during late fall and early winter when ponds dry up. Many of these ponds have no places whatever that might afford hibernation.

Mating.—Mating, which takes place in the water, has not been closely observed although these bugs have been kept under observation a long time. They cling together and also hide among the supports so that observation is very difficult.

Preoviposition.—The preoviposition period, in the one isolated case observed, was found to be 38 days. Bugs that matured July 11th were left isolated until August 17th, when they were placed together. Thenext day by nine in the morning the male had 47 eggs upon his back. It is probable that these eggs would have been deposited much sooner had the female had a mate. A number of bugs that matured early in July, in isolated jars, were placed together in a common container about July 10th. By the 30th there were eggs present.

Oviposition.—Actual egg-laying was not observed; all eggs laid in captivity have been laid at night. No doubt oviposition is similar to that in *Belostoma,* where after a struggle of varying intensity the male becomes quiet and submits to the performance of the female. The female mounts upon the back of the male with her legs clasped around him, and shifts her position from time to time as occasion demands. The eggs are fastened on with glue which forms a gelatinous pad upon the back. When an egg mass is removed and inverted the glue appears as a thick layer, with the ends of the eggs visible through it. When viewed from above, the glue is not visible, but upon the removal of one or more eggs it becomes apparent that the lower end of each egg is surrounded by glue, in addition to that upon which the egg is placed. With a number of eggs removed their empty places appear not unlike the cells of a honeycomb. The eggs in a given batch are not always laid during a single deposition period, for sometimes a few eggs have been observed early in the evening and by morning many more would be present. This is also shown by the fact that hatching of a given batch often extends over two days. The empty egg masses are no doubt removed by the females when they are ready to deposit more eggs, for the old masses usually remain until a new batch is deposited. The last batch of the season, in the case of one pair, remained on the back for over two months, but perhaps in nature the bug would crawl among trash and push them off. Several batches are deposited by the same female during the same season. Oviposition evidently extends over a period of at least eight months, for a fifth instar was collected on March 20th, and allowing five weeks for nymphal development, oviposition would have been about the middle of February. It is probable that a longer period would be necessary for development at this time of the year. Adults with eggs have been taken as late as the

middle of October, and teneral specimens have been collected late in November. Both the early and late records could probably be extended inasmuch as they were made at times when very little field work was being done.

Fecundity.—Extensive data on fecundity were not obtained, but one female deposited 166 eggs during a period of 34 days. This female became an adult July 11th but was not given an opportunity to mate until the afternoon of August 17th. By the next morning she had burdened her mate with 47 eggs. She gave him 52 more on August 26th, 21 on August 29th, 35 on September 7th, and 11 on September 21st. No eggs have been deposited during the last four months but it is expected that egg-laying will be resumed in the spring, the egg-laying thus taking place during two successive seasons. The writer once kept specimens of *Velia watsoni* Drake for a period of over eighteen months. They deposited eggs over a period of eight months one year and again deposited eggs the second season. This will no doubt obtain for a great many of our water-bugs.

Incubation.—During September eggs hatched after an incubation period of seven and eight days. A given batch of eggs often hatches over a period of two days. This is due, in part, to a difference in time of deposition, and in part, to a difference in time required for incubation.

Hatching.—At hatching time a circular break occurs on the upper end of the egg. This break occurs on three fourths the circumference of the egg, making a little cap or lid. The cap is pushed upward and to the side by the emerging nymph, which makes several conspicuous lurches upward. The head of the unhatched bug is well forward, thus making the prothorax the part next the egg cap. The legs are stretched out along the ventral side of the bug, the posterior ones being longer than the body, bending in near the tip of the abdomen, crossing and extending anteriorly on the opposite side of the body. The entire hatching process takes place rapidly.

Behavior of Newly Hatched.—Upon hatching, the nymphs are of course very pale. They swim rapidly about until they find a support, and there rest in their characteristic position with the tip of the abdomen in contact with the surface film of the water. They are gregarious, and if no supports are available they are inclined to use each other for that purpose. Their appetites soon develop and the first meal is likely to consist of their own kind—the last ones to hatch from a given batch of eggs.

Number of Instars.—There are five nymphal instars, and in the tables below is given the duration of each stadium.

Molting.—Nymphs usually lose interest in food the day before molting, although occasionally they will feed within a few hours of molting time. Because of their habit of spending most of the time

resting upon some support in the water, molting time can not be predicted by decreased activity or sluggishness, as in the case of Gerrids, Velias, and some other water-bugs. In molting, the skin splits medianly for the entire length of the thorax. This split extends to the head where, near the posterior margin, it forks into a broad y-shape, each fork or branch extending laterally and anteriorly to the anterior margin of the eye. The bug comes forth through this split, the aperture being made much larger by considerable stretching where the body segments fuse. The newly molted bug is ready for a meal as soon as it colors up. The molted skin remains entire except for the split, and that often can not be seen unless closely scrutinized. Measurements and color-markings can be studied as well in the cast skin as in the nymph itself. Mortality at molting time seems to be less heavy than with many water-bugs, such as *Gerris, Ranatra,* etc. Only seven deaths occurred in our rearings, two probably due to inability to molt, a third death may or may not have been due to this cause.

Maturity.—Complete data have not been obtained concerning sexual maturity. Fertile eggs were laid in less than a month's time by some individuals, but they probably reached maturity in less time than this.

Longevity.—Records are being kept now which will throw light on the span of life of these bugs. One bug which matured last May 21st, is still alive (January 1926), and may give us a record of longlivedness. A number of bugs which matured late in June and early in July are alive at this time. The writer had kept specimens of the American *Belostoma fluminea* in captivity for fourteen months when he was obliged to discontinue the observation.

Number of Generations.—The data at hand indicate that at least three generations a year would be possible. There are reasons to believe, however, that there may be more than three generations. In the first place, very few field observations were made in the spring and the record of March 20th may not have been the earliest by any means. Even fewer observations were made in the fall. In the second place, the preoviposition period was counted to be the same as that found in the laboratory, although as pointed out above, the bugs were not mated for some time after becoming adults. In the third place, the temperature in the laboratory was lower than out in the ponds, and that would slow up development. There are still other factors to be taken into consideration, namely, food and habitat selection, and enemies. In their natural environment the nymphs could move about to find their optimum temperature, while in the laboratory they had no choice. In nature they would have a wider food selection, and more varieties to choose from than under laboratory conditions. On the other hand, they had all the food they could consume in the laboratory while those in the wild state had competition, from their fellows, as well as from a multitude of other aquatic carnivors. In the ponds *Sphaerodema* has enemies, while the same is not true in the laboratory.

In the field there is a greater difference in day and night temperatures than is the case in the laboratory. It would be interesting to run a set of experiments to determine the difference in effect on the rate of development, of insects kept at a constant temperature, and insects kept in a fluctuating temperature the mean of which would be the same as that of the constant temperature.

Food Habits.—It is next to impossible to make any observations on the feeding of this species in its natural habitat. In the laboratory the nymphs fed on a large variety of foods including maggots of aquatic and terrestrial flies, adult flies, leaf hopper nymphs and adults, mosquito larvae and pupae, water-boatmen nymphs and adults, backswimmer nymphs, tadpoles, small fish, snails, and raw beef. The nymphs showed food preference when several kinds of food were offered at the same time, especially was this true if they were not too hungry. When very hungry they grabbed the first available food morsel. When very hungry they also showed more bravery and resourcefulness in attacking live food. At such times they would attack tadpoles several times their own size, and although the tadpoles would race around the dish and even turn over on top of the small nymphs, the latter would hold fast. If not very hungry the nymphs would lose their holds when the victim struggled. Ordinarily, they lie in wait for their food, grabbing it when it comes along, but if very hungry they persue their intended victims. Mosquito larvae, backswimmers of the genus *Buenoa*, maggots, and tadpoles, in the order named, are the preferred foods. They cared least of all for raw meat and ate it only when very hungry. They preferred mosquito larvae to the pupae, probably due largely to the fact that the larvae were easier to manage. They showed a preference for *Buenoa* over tadpoles, but that may have been due, in part, to the fact that the *Buenoa* were always killed or injured before being given, and also because their size and shape made them easier to manipulate. Everything else being equal, *Sphaerodema* nymphs prefer food that comes into the water to that which remains on the surface. When hungry, the nymphs respond with outstretched fore-legs to any impact on the water, whether made by mechanical means or by a prospective food item.

Behavior.—In the turbid ponds, among vegetation and trash, these bugs are so well concealed that observations on their behavior are quite impossible. In the laboratory, if kept in petri dishes with no vegetation, they may be observed satisfactorily, but aside from food reactions little can be learned. If kept in larger aquaria and supplied with vegetation (a condition more like they would have in nature) they remain out of sight so that observation is difficult.

Enemies.—*Sphaerodema* is probably quite free from enemies. It is attacked, as many water insects are, by the larvae of *Hydrachnid* mites, and is probably eaten to some extent by certain carnivorous fish. It is eaten also by frogs, and no doubt the nymphs are subject to the attack of giant water-bugs, water-scorpions and predacious beetle larvae.

Description of Stages

Egg.—Somewhat variable in size. Perhaps an average size is 1.543 mm. long by .908 to .976 mm. wide (in greatest diameter). There is considerable increase in the size of eggs as incubation goes on. The shape is oblong oval with very obtuse ends. The top or micropylar end is more pointed than the opposite end. If the long axis of the egg be viewed in one plane the edges appear straight, the greatest diameter to be near the bottom of the egg, and the part of the egg in direct line with the eyes to be either convex or straight, as the case may be. If what might be termed a side view is taken, one edge of the eggs will appear about straight and the other very much rounded, and the greater diameter of the egg will be near its middle. The color is yellowish brown. The surface of the egg appears smooth when viewed with the unaided eye or hand lens. With a binocular microscope, however, a pattern may be discerned. This pattern is revealed by the compound microscope to consist of a network of very small and imperfectly formed hexagons.

First Instar.—A nymph about one day old measured dorsally along medius as follows: length of body 4.086 mm.; length of head .681 mm.; length of pronotum .431 mm.; length of mesonotum .408 mm.; length of metanotum .272 mm.; length of posterior tibia along inner margin 1.203 mm.; width of head across base of eyes 1.362 mm.; width between anterior margins of eyes .635 mm.; width posterior margin of pronotum 1.679 mm.; width hind angles of mesonotum 2.088 mm.; width posterior margin of metanotum 2.201 mm.; greatest width of abdomen 2.247 mm.

General Appearance.—Brown, mottled with many irregular blotches, some pale, others dark brown.

Head.—Median pale line branches near posterior margin, the branches extending laterad and forward, and terminating at the anterior margins of the eyes. Three longitudinal, irregular, pale areas may be seen, one medial, the others midway between this spot and the inner margins of the eyes. Tylus slightly elevated, darker, marked off by two impressed lines which flare out anteriorly.

Thorax.—Pale median line for entire length; margins somewhat explanate; segments not fused. Irregular pale and dark brown areas give mottled effect as on head. Lateral margins of pronotum subparallel, those of meso- and metanotum rounded. Pronotum longest, posterior margin tumid and straight except near lateral margins where it bends forward. Mesonotum intermediate in length, posterior margins sinuated. Metanotum shortest; posterior margin curved forward along middle one third. The lateral margins of each thoracic segment have a brown spot near the middle. These brown spots are bordered on either side by pale areas.

Abdomen.—Brown with small indistinct, pale specks. Anterior and lateral margins speckled, the latter with seven brown spots. The

brown spots in turn have pale spots in them. Short, pale median line at anterior margin—a prolongation of thoracic one.

Legs.—Anterior ones banded, intermediate and posterior ones indistinctly speckled. All legs liberally supplied with hairs and spines; tarsi with two claws.

Beneath.—Head, thorax, and legs of motley appearance; abdomen more uniformly brown, with spots on lateral margins the same as seen from above, but less distinct. Flat, blade-like, backward projections of metasternum (which appear like coxal plates) fringed with long, slender, closely-set hairs. These projections, as well as rostrum a shade darker than rest of ventral surface. Abdomen extremely hairy.

Second Instar.—A nymph three days old measured dorsally along medius as follows: length of body 5.652 mm.; length of head .771 mm.; length of pronotum .590 mm.; length of mesonotum .635 mm.; length of metanotum .385 mm.; length of posterior tibia 1.702 mm.; width head across base of eyes 1.747 mm.; width between anterior margins of eyes .681 mm.; width posterior margin of pronotum 2.315 mm.; width hind angles of mesonotum 3.041 mm.; width posterior margin of metanotum 2.996 mm.; greatest abdominal width 2.996 mm.

General appearance much the same as in the first instar except paler; mottled effect less pronounced, entirely absent on legs. Tylus more definitely set off. Abdominal spiracles apparent; lateral abdominal margins fringed with long fine hairs; caudal tip darker, perhaps slightly chitinized; few hairs on upper surface of abdomen.

Ventral aspect similar to that of first instar, but paler; motley appearance no longer present; spiracles very distinct; venter more hairy, especially along median line.

Third Instar.—Nymph three days old measured dorsally along medius as follows: length of body 7.309 mm.; length of head 1.021 mm.; length of pronotum .885 mm.; length of mesonotum .930 mm.; length of metanotum .476 mm.; length of posterior tibia 2.088 mm.; width head across base of eyes 2.111 mm.; width between anterior margins of eyes .839 mm.; width posterior margin of pronotum 2.860 mm.; width posterior margin of mesonotum 3.722 mm.; width hind angles of metanotum 3.904 mm.; greatest abdominal width 4.244 mm.

Appearance has changed very little from that of the preceding instar. Lateral margins of prothorax, and anterior one-half of lateral margins of mesothorax darker, more pronounced in prothorax, all markings less distinct. Caudal tip darker; possesses spines and hairs, tracheae in addition to spiracles can be seen. Anterior tarsal claws reduced.

Fourth Instar.—Measured dorsally along medius as follows: length of body 9.942 mm.; length of head 1.135 mm.; length of pronotum 1.089 mm.; length of mesonotum 1.520 mm.; length of meta-

notum .590 mm.; length of posterior tibia 2.837 mm.; width head across base of eyes 2.905 mm.; width between anterior margins of eyes 1.089 mm.; width posterior margin of pronotum 4.313 mm.; width across hind angles of mesonotum 5.538 mm.; width posterior margin of metanotum 5.493 mm.; greatest abdominal width 5.765 mm.

Color paler and more uniform. Mottled appearance gone. Lines marking off tylus have punctures at their posterior ends. Anterior margin of pronotum less sinuate; roundish spot on either side of pronotum, midway between front and rear margins, and 1.271 mm. apart; diameter of spots, .158 mm. Hind angles of mesonotum thickened, and might well be called wing rudiments. Spiracles from above appear as indistinct, darker spots. Anterior tarsal claws proportionately small. Ventrally, nymph is pale yellowish brown; spiracles appear as black rings; tracheae visible for a short distance.

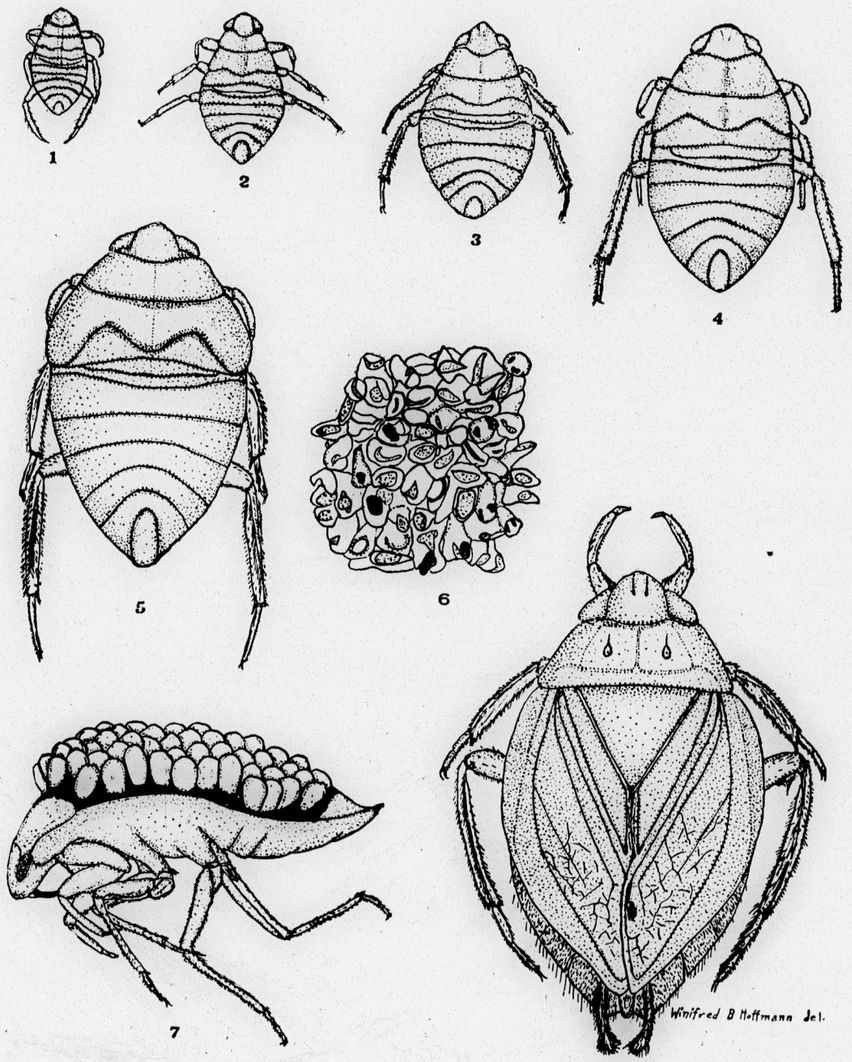
Fifth Instar.—Measured dorsally along medius as follows: length of body 12.371 mm.; length of head .976 mm. (head very much rounded); length of pronotum 1.362 mm.; length of mesonotum 2.383 mm.; length of metanotum .658 mm.; length of posterior tibia 3.972 mm.; width head across base of eyes 3.745 mm.; width between anterior margins of eyes 1.452 mm.; width posterior margin of pronotum 5.629 mm.; width across hind angles of mesonotum 7.945 mm.; width posterior margin of metanotum 7.808 mm.; greatest abdominal width 7.718 mm.

Nymph is very pale. Roundish spots still present on pronotum. Hind angles of mesonotum extend as far back as the posterior margin of metanotum. Very fine line along middle of thorax still persists. Anterior tarsal claws very short. Head and thorax finely punctured. Five indistinct, irregular, pale spots on right and left halves of abdomen, about midway between middle line of body and lateral margins. Lateral margins of abdomen clothed with short, thick, closely-set hairs, in addition to the longer ones already noted.

Rearing Methods

Rearing was a relatively simple matter as these bugs lend themselves to life in captivity. Most of the nymphs were kept in petri dishes, some were kept in larger dishes to ascertain if size of container materially affected size of bug. A bit of vegetation was kept in the containers to provide supports on which the nymphs could rest. Only one bug was kept in each container, however it would be possible to rear several nymphs together. When well fed they are not so very cannibalistic, and if nymphs of the same age are kept together cannibalism at molting time is reduced, for all would be molting about the same time. A few nymhps were reared in containers only one and three fourths inches in diameter, yet they were the normal size.

The nymphs were given all the food they cared for once each day. On a few occasions they were fed two times in one day but the



following day they fed reluctantly, if at all, so the practice was discontinued. Foods used and the food preference shown has been given under *Food Habits.* Each day the dead food from the previous day's feeding was removed; the water in the containers was changed from time to time when it became stagnant. Some nymphs, not in the regular set of rearings, were fed irregularly, often skipping a day or two, but no difference was noted in the size or growth rate. One adult was accidentally left in a very small container from June 19th to July 13th without food, but aside from a ravenous appetite seemed none the worse for the experience.

Summary

The results of the rearings are shown in Tables I. and II. These data have been placed in two tables because they represent two different sets of rearings, carried on three months apart. The nymphs enumerated in Table No. I were the progeny of the same pair of bugs, while those of the second table are from several batches of eggs. Many nymphs were killed in the second set of rearings as it was desired to have preserved specimens of each instar, from one day old up to the maximum number of days for a given instar.

From Table No. I it may be observed that twenty-four specimens were reared to maturity. Of this number two were known to be males and two to be females, the sex was not determined in the case of the remaining twenty. While it is occasionally possible to determine the sex by the size and shape, often it is not, and specimens must be very carefully examined to determine the sex. There were five stadia. The average duration of the first stadium for twenty-five specimens was 7.2 days (minimum 5, maximum 23 days); the average duration of the second stadium was 5+days (minimum 4, maximum 6 days); the average duration of the third stadium was 5.2 days (minimum 4, maximum 8 days); the nymphs were in the fourth stadium 7.7 days (minimum 4, maximum 13 days); the fifth stadium was of 38.2 days duration (minimum 30, maximum 49 days). In the second, third, fourth and fifth stadia the averages were secured from 24 nymphs.

By reference to the second table we see that 40 nymphs spent an average of 4.6 (minimum 4, maximum 5) days in the first stadium; 36 nymphs spent 6+ (minimum 3, maximum 11) days in the second stadium; the average duration of the third stadium was 7+ (minimum 4, maximum 14) days for 23 specimens; the average duration of the fourth stadium for 17 bugs was 7.6 (minimum 6, maximum 12) days; the average duration of the fifth stadium was 11.3 (minimum 8, maximum 21) days for 9 specimens.

In the first set of rearings, with twenty-four specimens reaching maturity, the average length of nymphal life was 38.2, the minimum 30, and the maximum 49 days. In the second set, the average nymphal existence was 39.8, the minimum 32 and the maximum 61 days.

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The rate of development is dependent more upon temperature than any other one factor, granting of course, livable conditions as far as food and other factors are concerned. This has been discussed more at length under *Number of Generations*. Fish and frogs have not been examined to determine the extent to which these bugs enter into their diet. Undoubtedly this species is more detrimental than helpful from the fish culturist's viewpoint. The value of the species as fish food would more than be offset by the fish food it would consume itself. As a predator on fish it does some damage also, but it is far out-distanced in this respect by its relative, the Giant Water-Bug which will be reported on in a later paper. *Sphaerodema* could be used practically, on a limited scale, in mosquito-control work.

Explanation of Plate

Drawings of *Sphaerodema rusticus* Fabr. Magnification four times natural size.

1 to 5. First to fifth instars respectively.

6. Eggs from back of No. 8; all but four have hatched. Note eye-spots in the unhatched eggs.

7. Lateral view of male showing eggs on back. Note liberal use of glue.

8. Dorsal view of male, with retractile appendages extended.

TABLE I.

TABLE OF REARINGS OF *Sphaerodema rusticus* FABR.

Rearing Number	First instar	Second instar	Third instar	Fourth instar	Fifth instar	Total Days	Sex	Date
								1925
5-71	19	6	7	7	10	49		May 21
5-73	23	3 d						
5-252	6	5	5	9	15	40		Jul. 5
5-253	7	4	5	8	13	37		Jul. 2
5-254	6	5	4	5	10	30		June 25
5-255	6	6	5	10	12	39		Jul. 4
5-256	5	6	6	12	13	42		Jul. 7
5-257	7	5	7	4	13	36	m	Jul. 1
5-258	5	6	4	8	13	36	f	Jul. 1
5-259	6	5	4	7	12	34	m	June 29
5-260	7	4	6	8	13	38		Jul. 3
5-261	5	6	5	7	12	35		June 30
5-262	7	4	6	6	12	35		June 30
5-263	7	4	4	6	11	32		June 27
5-264	7	5	5	8	11	36		Jul. 1
5-265	5	6	5	6	15	37	f	Jul. 2
5-266	6	5	6	10	15	42		Jul. 7
5-267	7	5	8	8	14	42		Jul. 7
5-268	7	4	6	6	13	36		Jul. 1
5-269	5	6	5	5	19	40		Jul. 5
5-270	5	5	5	7	13	35		June 30
5-271	6	5	5	13	17	46		Jul. 11
5-272	5	5	4	8	11	33		June 28
5-273	8	4	6	9	19	46		Jul. 11
5-274	5	6	4	8	19	42		Jul. 7
Average	7.2 (25)	5 + (24)	5.2 (24)	7.7 (24)	13.5 (24)	38.2 (24)		
Minimum	5	4	4	4	10	30		
Maximum	23	6	8	13	19	49		

d = died. m = male f = female

TABLE II.

TABLE OF REARINGS OF *Sphaerodema rusticus* FABR.

Rearing Number	First instar	Second instar	Third instar	Fourth instar	Fifth instar	Total Days	Sex	Date
								1925
5-554	4	3 k						
5-555	5	4	3 k					
5-556	5	9	8	6	6 k			
5-557	4	5	7	11	4 k			
5-558	4	5	3 k					
5-559	5	k						
5-560	4	5	3 k					
5-561	4	5	6	1 k				
5-562	5	5	6 k					
5-563	5	3	5	3 k				
5-564	4	5	4	6 k				
5-565	4	7	3 d					
5-566	5	9	14	12	21	61		Oct. 25
5-567	5	5	7 k					
5-568	5	4	6	8	5 k			Sept. 22
5-569	5	10	1 k					
5-570	5	16 d						
5-571	4	11	11 d					
5-572	5	7	4 k					
5-573	5	4	8	2 k				
5-574	5	4	4	4 k				
5-575	5	1 d						
5-576	4	4	5	5 k				
5-577	4	10	2 k					
5-578	4	8	5 k					
5-641	4	5	7	7	7 k			
5-642	4	5	5	8	2 k			
5-643	4	6	9	7	9	35		Oct. 3
5-657	5	4	6	7	3 k			
5-658	5	5	7	6	8 k			
5-659	5	6	5 d					
5-660	5	6	2 d					
5-661	5	4	6	8	1 k			
5-662	5	4	8	7	9	33	m	Oct. 1
5-701	5	5	8	7	9	34	m	Oct. 2
5-723	5	6	6	7	8	32	f	Sept. 30
5-724	5	6	5	7	9	32		Sept. 30
5-733	5	7	10	6	11	39		Oct. 7
5-734	5	10	7	6	9			
5-760	4	10	12	10	17	53		Oct. 18
Average	4.6 (40)	6.+ (36)	7.+ (23)	7.6 (17)	11.3 (9)	39.8 (8)		
Minimum	4	3	4	6	8	32		
Maximum	5	11	14	12	21	61		

k = killed for specimen
m = male
d = died
f = female

A Correction

The name William M. Porterfield, Vol. III, No. 1, page 35 should be corrected to read Williard M. Porterfield.

Notice

It was necessary to omit the Abstracts and Reviews in the present issue but it is planned to continue the service in future issues.

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NOTE ON A CHINESE VEGETABLE DYE

BY

F. A. McCLURE

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* Names arranged alphabetically.

NOTE ON A CHINESE VEGETABLE DYE*

By F. A. McCLURE

Agricultural Explorer, U.S.D.A., Assistant Professor of Botany, Lingnan University.

There is in use in a number of centers in this province, namely at Tung Koon (東莞), Shek Lung (石龍), near Kowloon (九龍) in Hongkong Territory, and in several villages near Canton, including Ng Ngaan K'iu (五眼橋) and Im Po (黶步), a very interesting brown dye known locally as *shue leung* (薯莨). It comes from the tubers of *Dioscorea rhipogonoides* Oliv., a congener of the true yams. This plant is a twining vine with smooth, shiny, leathery, ovate leaves and slender, tough stems which bear short, sharp hooks. The tubers are subglobose in shape, often with a constriction about the middle, and very rough, being covered with a corky bark which increases in thickness with age.

Dioscorea rhipogonoides Oliv. is native to the hills of Kwangtung (廣東) and Kwangsai (廣西). The supply of its tubers for the local dyeing industry comes largely from the West River district of the two provinces. These are not only collected from the wild, but are also cultivated on the hillsides. Seeds are sometimes planted, but the usual practice is to plant small tubers for the sake of economy of time in the development of a marketable product. This is said to take at least three years. Luk To (六都) is the most popular market for these tubers in this province, and representatives from the dye houses near Canton go there personally and buy the tubers in great quantities. It is interesting to note, however, that most dyers advertise their output as having been dyed only with tubers from Lung Chow (龍洲) in Kwangsai province.

The tubers are sold by the picul[1] and the price per picul varies from $1.00 or $2.00 to $11.00 or 12.00,[2] depending upon the quality of the tubers and the balance of supply and demand. The quality of the tubers is judged upon the basis of their yield of the dark brown, sticky sap which contains the dye principle. Generally speaking, this yield is higher per given weight with mature tubers than with young ones. They must be used while fresh, however, in order te get the maximum yield.

Shue leung is used to dye a great variety of things, including chopsticks, fish nets, and plain cotton cloth, but the process as here described deals with the dyeing of silk, for which purpose by far the

* Contribution from the Biological Laboratory.

1 One picul equals 100 catties or 133 English pounds.

2 $1.00 Local Currency is approximately equivalent to $0.50 U. S. Currency.

greater part of the supply consumed is used. The product, which is often spoken of as "Coolie Cloth," is usually black on the right side and buff to dark brown on the reverse. However, in some cases both sides may be black, and in others both sides may be brown. The general name applied by the Chinese to silk dyed by this process is *shue leung ch'au* (薯莨綢). Silk of a wide variety of weaves is used, each being known by a distinctive name. The patterns in those of fancy weave are formed by crossing the threads of the warp.

The silk for dyeing by the process herein described comes most commonly in strips about 60cm. in width and 18.6m. in length[3]. Certain kinds come in strips about 68cm. wide and 16m. long. They are put up in tight, cylindrical rolls called, in Chinese, *p'at* (疋). Each strip is marked with the name of the maker, either by means of a wooden stamp and red or black ink, or by means of characters woven into the cloth. When the wholesale dealer secures the silk in the raw, undyed state he affixes to the strips the stamp of his shop. He may have his own dye establishment, but often the work is done by independent houses.

The preparation of the dye is all done by hand in a very primitive manner. By means of a coarse grater, consisting of a heavy board to which is attached a thin piece of sheet iron so perforated as to be provided with vertical teeth, the tubers are reduced to a pulp which is allowed to fall directly into large tubs of cold water. When the suspension reaches the consistency of thin batter the pulp is thoroughly mixed and rubbed by hand in order to assist in the extraction of the dye. The pulp is then strained from the liquid by means of a bamboo basket into which the contents of the vat are dipped, the liquid being allowed to flow into a second wooden vessel. The liquid is then diluted to the desired concentration and heated in a large, shallow, brass vessel.

The dye rapidly loses its effectiveness and a fresh solution must be prepared each day in order to get the best results. That which has been used is given or sold at a low rate to housewives who wish to dye small pieces of cloth for themselves, or to fishermen for dyeing their nets. The residue of grated tubers is dried in the sun and used as fuel.

In preparing the strips of silk for dyeing, the dyer first boils them in soda, either a refined product composed of transparent crystals or the unrefined form being used. This treatment is common to all processes by which cloth is dyed, and its purpose is the removal of the fat which would interfere with the action of the dye. Loops of coarse linen cloth are then sewed on to either end of the strips, and along each side, at intervals of 9 or 10cm., loops of strong linen thread

3 The Chinese dimensions of these standard strips are: width, 1 ft. 7 in., and length, 48 ft.

are attached for the purpose of stretching the strips during the early stages of the process. This being done the whole strips are placed, singly, into an oblong wooden vessel with low sides and with a horizontal wooden bar supported at a height of about one meter upon staves, of appropriate length, at either end. The warm solution is then poured in and when the silk has become thoroughly wetted the strip is drawn over into an empty vessel, being pulled progressively from end to end across the horizontal bar, which causes the excess liquid to drain back into the dipping vat. The strip is then stretched immediately upon the sunning field by means of stout sticks placed horizontally thru the linen loops at either end, and stout stakes driven into the ground. Having been stretched lengthwise to a moderate tightness, the strip is then further stretched laterally by means of small bamboo stakes inserted in the loops of thread at the edges.

At this point a few words about the sunning field are in order. It is a smooth, level expanse of turf, carpeted with some low-growing grass, commonly Bermuda grass (*Cynodon dactylon* Pers.), which is kept in remarkably pure stand by the constant weeding out of any other grasses that spring up.

Owing to the fact that it is not possible to stretch the cloth perfectly level, tiny puddles of the dyeing liquid tend to collect in the slight depressions, particularly if the drying weather is not ideal, and it is often necessary, in order to prevent spotting, to disperse this lipuid. This is done by means of passing over the surface a soft, trailing, moplike brush made of the long, slender, tapering segments of the leaves of the fan palm (*Livistona chinensis* Mart.).

Exposure to the sunlight and air causes the dye gradually to turn from straw color to reddish brown. But one application is not sufficient to secure the desired shade. As soon as the strips are dry they sre again dipped in the manner described above. After the first few times it is not necessary to stretch the cloth by means of stakes, since it becomes increasingly stiff with each application of the dye. Bamboo poles laid crosswise of the strips prevent their being overturned by the wind. The same side of the cloth is exposed to the light each time, with the result that this side becomes much darker in hue than the under side. When, after repeated dippings, which sometimes number thirty or more, the silk has reached the desired shade, it is ready for the next step in the process, which consists of the application of mud to the side which has been sxposed to the sun.

When a considerable number of strips have reached this stage they are spread full length, upon a level strip of paving, one upon another, with the darker side of each uppermost. With a man at either end to prevent the strips from being disarranged, six men, each armed with a soft broom made of coconut fiber, quickly smear the uppermost surface with mud from large earthen jars conveniently located. The mud used is the ordinary river mud, called by the Chinese, *hai nai* (海坭), which,

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in dried form, is so commonly used by Chinese gardeners for potting flowers. It is mixed with water until it is of a thin, smooth consistency. Care is taken, however, that it shall not contain so much water that it will penetrate the closewoven silk, but will remain merely a surface coating. The mud contains some chemical compound which acts as a mordant, reacting with the dye with which the silk has been impregnated and turning it jet black. Care is exerted to prevent the mud from coming into contact with the reverse side of the cloth.

The strips are smeared with mud in rapid succession and spread out upon an adjacent expanse of clean sand where they are allowed to remain for ten or fifteen minutes, after which they are washed in a nearby canal or stream. Having been spread upon the grass and dried they are dipped for the last time in the hot dye solution and again dried. Finally they are allowed to become slightly moist with dew and while in this condition are rolled into tight rolls.

The next step consists of softening the cloth and correcting any variations in its width which may have resulted from the rough process through which the strips have been put. This work is done at small, smooth-topped wooden tables of convenient height, at each of which one worker stands. Each strip is gradually unrolled, being stretched in a diagonal direction every few inches. It is then reversed and stretched in the opposite direction. This stretching process breaks up the network of dried mucilaginous dye material with which the fibers of the cloth have become surrounded. The worker then begins at one end and makes the strip into a tight, even roll, measuring its width at frepuent intervals and correcting any variations from the original width by stretching the cloth laterally or longitudinally as the case requires. This completes the process and the rolls are now ready to be returned to the wholesaler. The approximate charges levied in local currency for dyeing each strip of silk are indicated in the table belw.

	Application of the Dye	*Application of the Mordant*	*Total Charge per Strip*
Silk of plain weave	$4.00	$0.50	$4.50
Silk of fancy weave	$5.00	$0.50	$5.50

Excessively dry weather being unfavorable to the satisfactory carrying out of the process, work is usually discontinued during the latter part of the dry season and is not resumed until after the Chinese New Year Holiday. The off season thus extends approximately from the end of November to the first of March.

Garments made from the different grades and varieties of this silk are worn in Canton and throughout this province by Chinese in all strata of society. It is at once easily laundered, requiring no ironing,

and very durable. A number of instances of the remarkable wearing qualities of this cloth have been called to my attention. I saw recently a jacket made of it which was said to have been in use for fifteen years. Another quality of this material, one which makes it popular for hot weather wear, is its smooth, stiff texture, somewhat similar to that imparted by a slight application of starch, which causes it to keep its shape well and keeps it from adhering to the skin.

There is a widespread and very curious belief with regard to the proper treatment of newly made garments made of silk dyed with *shue leung*, in order to insure the best possible service from them. The treatment prescribed is as follows: Wear the garment at strenuous work, or by other means saturate it with perspiration. Wad it up (do not fold it) and lay it aside until it molds thoroughly. Saturate it with fresh lard, working it in well. Wash it in warm soft water to which has been added the juice of boiled garlic. This treatment is said not only to add greatly to the durability of the fibers, but to increase the fastness of the color. Certain varieties of this cloth are sold without having been blackened by the application of mud. These are said to turn black slowly under the action of perspiration.

The retail price of the different varieties and grades of this silk ranges from $0.30 per Chinese foot for the poorest, to about $1.00 for the best. This is equivalent to about $0.15 to $0.50, U. S. Currency, per yard.

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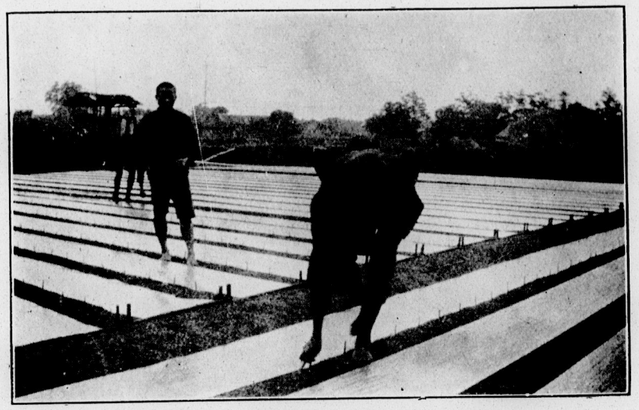

Fig. 1. Staking down the strips of silk at the beginning of the process.

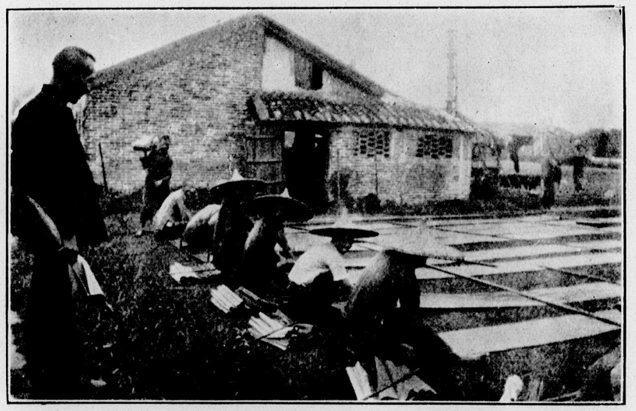

Fig. 2. Later stage in the process; taking up the strips for further dipping. At this stage the strips are not staked down, but are held in place by bamboo poles.



Fig. 3. Applying mud to the strips of silk. In the foreground the strips may be seen spread out upon the sand.

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COCCIDAE FROM CHINA

BY

William E. Hoffmann

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*Names arranged alphabetically.

COCCIDAE FROM CHINA*

With a List of Host Plants

By WILLIAM E. HOFFMANN

Professor of Biology, Lingnan University, Canton, China.

In the preceding pages Dr. Kuwana has given a list of the Coccidae or Scale Insects from China as known to him. In checking over the list in the insect collection of Lingnan University the writer found a number of species, 21 to be exact, that were not included in Dr. Kuwana's list. Those 21 species are listed in Part I of the following notes along with the plants on which they were found. This material was collected by Professor C. W. Howard and identified by Mr. Harold Morrison.

In a compiled list of all the Coccids which have been reported from China according to the records of the Bureau of Entomlogy of the United States Deparement of Agriculture, kindly furnished to the writer some months ago by Mr. Harold Morrison of the Bureau, are to be found 40 species not recorded by Kuwana nor represented in our collections. Part II of the present list contains the names of the 40 additional species. Data relative to the host plants of these species are not at hand and therefore can not be included.

The Coccid fauna of China as recorded is certainly very much less extensive than one would expect. Undoubtedly this is due to the fact that comparatively little collecting has been done in this interesting group. The great economic importance of some of the scale insects as well as the ease with which they are introduced from one place to another makes it highly desirable that we get acquainted with our Coccid fauna as rapidly as possible. It is with the idea of aiding in this undertaking even in a slight measure that the present list has been prepared.

Part I

MONOPHLEBINAE

Genus ICERYA Sign.

Icerya aegyptiaca (Dougl.) ..... *Litsea glutinosa*

,, *jacobsoni* Green ..... *Canarium pimela*

TACHARDIINAE

Genus TACHARDIA Blanchard.

Tachardia fici Green ..... *Ficus benjamina* and *Gironnura nitida*

Tachardia theae (Green & Mann).... Persimmon

*Contribution from the Biological Laboratory.

PSEUDOCOCCINAE

Genus PHENACOCCUS Ckll.

Phenacoccus hirsutus Green ..... *Ahelemoschus esculentus*

COCCINAE

Genus PULVINARIA Targ.

Pulvinaria polygonata Ckll. ..... Orange

Genus SAISSETIA Desplanches.

Saissetia nigra (Nietn.) ..... Guava, *Muchelenfickia platycladoo*, and *Lysimachia decurrens*

DIASPINAE

Genus ASPIDIOTUS Bouché

Aspidiotus cocotiphagus Marl. ..... *Melia azedorack*, Guava, and Willow

Aspidiotus lataniae Sign. ..... *Acacia sp.*

,, *transparens* Green ..... *Litsea glutinosa*, *Ficus pumila*, and Guava

Genus MORGANELLA Ckll.

Morganella longispina (Morg.) ..... *Pinus messoniana*

OTHER SUBFAMILIES

Genus AULACASPIS Ckll.

Aulacaspis pentagona (Targ.) ..... *Prunus mume*, *Prunus persica*, *Litsea glutinosa*, *Gomprena globosa*, and *Pittsporum panciflorum*

Genus CHIONASPIS Sign.

Chionaspis acuminatus Green ..... *Severinia buxifolia*

,, *elongatus* Green ..... *Bambusa multiplex*

,, *graminis* var. *divergens* Green ..... *Paspalum scrobiculatum*

,, *subcorticalis* Green ..... *Rhodomyrtus tomentosa*

Genus FIORINIA Targ.

Fiorinia theae Green ..... Gardenia (cultivated)

Genus HEMICHIONASPIS Ckll.

Hemichionaspis minor (Mask.) ..... *Pinus messoniana*

Genus LEPIDOSAPHES Shimer

Lepidosaphes tubulorum Ferris ..... *Sapium sebiferum*

Genus PARLATORIA Targ.

Parlatoria pergandii camelliae Comst. *Jasminium undulatum*, *Photinia pruniflora*, & *Cinnamoneum cassia*

Genus PHENACASPIS Cooley & Ckll.

Phenacaspis thoracica Robinson ..... *Litsea glutinosa* and *Uvaria miscrocorpa*

Part II

MONOPHLEBINAE

Genus DROSICHA Walker

Drosicha corpulenta (Kuwana)

ASTEROLECANIINAE

Genus ASTEROLECANIUM Targ.

Asterolecanium bambusa Bdv.

,, *miliaris* Bdv.

,, *pseudomiliaris* Green

PSEUDOCOCCINAE

Genus *Chaetococcus* Mask.

Chaetococcus bambusae (Mask.)

Genus PSEUDOCOCCUS Westw.

Pseudococcus comstocki Kuw.

Genus ERIOCCUS Targ.

Erioccus onukii Kuw.

COCCINAE

Genus CEROPLASTES Gray

Ceroplastes rubens minor Mask.

Genus COCCUS Linn.

Coccus elongatus (Sign.)

Genus LECANIUM Burm.

Lecanium corni Bouché

,, *excrescens* Ferris

,, *kunoensis* Kuw.

,, *prunastri* Fonsc.

Genus PULVINARIA Targ.

Pulvinaria aurantii Ckll.

PROTOPULVINARIA

Protopulvinaria pyriformis Ckll.

Genus ASPIDIOTUS Bouché

Aspidiotus bilobis Mask.

„ *cryptomeriae* Kuw.

„ *cryptoxanthus* Ckll.

„ *excisus* Green

„ *palmae* Morg.

Genus CHRYSOMPHALUS Ashm.

Chrysomphalus aurantii var. *citrinus* Coq.

Genus ODONASPIS Leon.

Odonaspis inusitata (Green)

„ *pencillata* (Green)

Genus PSEUDAONIDIA Ckll.

Pseudaonidia duplex (Ckll.)

„ *paeoniae* (Ckll.)

„ *trilobitiformis* (Green)

Genus AULACASPIS Ckll.

Aulacaspis major (Ckll.)

Genus CHIONASPIS Sign.

Chionaspis citri Comst.

„ *euonymi* Comst.

„ *micropori* Marl.

„ *salicis* (Linn.)

„ *yanonensis* (Kuw.)

Genus DIASPIS Costa

Diaspis boisduvalii Sign.

Genus FIORINIA Targ.

Fiorinia minor Mask.

Genus LEPIDOSAPHES Shimer

Lepidosaphes bambusae Kuw.

„ *conchiformis* (Gmel.)

„ *ulmi* (Linn.)

Genus PHENACASPIS Cooley & Ckll.

Phenacaspis latissimus (Ckll.)

Genus PINNASPIS Ckll.

Pinnacaspis buxi (Bouché)

Genus POLIASPIS Mask.

Poliaspis pini Mask.

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BIOLOGICAL NOTES ON *LACCOTREPHES*

BY

WILLIAM E. HOFFMANN

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* Names arranged alphabetically.

BIOLOGICAL NOTES ON *LACCOTREPHES* (Hemiptera, Nepidae)*

By WILLIAM E. HOFFMANN

Professor of Biology, Lingnan University, Canton, China.

The aquatic bug discussed in this paper is a water-scorpion belonging to the family Nepidae and the order Hemiptera. It is the species known in literature as *Laccotrephes ruber* Linn. or *L. grossus* F. but according to a recent paper by Dr. Teiso Esaki(1) this species should be called *L. Kohlii* (Ferrari) having been described as new by Ferrari in 1888 under the name "*Nepa Kohlii*." The genus is characterized by Distant(2) as follows: "Body oblong or elongately subovate; pronotum about as long as broad, sometimes a little shorter than broad, a little sinuately narrowed anteriorly, where it is about twice as broad as head and behind which it is profoundly concavely sinuate, its base in front of scutellum also strongly concavely sinuate, transversely constricted behind middle, between which and anterior margin are two discal longitudinal rugosities; scutellum slightly longer than broad; membrane complete, reticulately veined; legs of moderate length, anterior femora incrassate and beneath longitudinally sulcate, the anterior tibiae a little shorter than the femora," and is found in the Ethiopian, Oriental and Australasian Regions. The species is described as: "A smaller and narrower species than *L. robustus*, in colour generally fuscous, sometimes piceous; abdomen above reddish-ochraceous, usually with a central longitudinal fuliginous fascia, the apex brownish-ochraceous, sometimes, but rarely, with the whole disk suffused with fuliginous; wings vitreous; abdominal appendages a little longer than the body; hemelytra subparallel. Length 30 to 35; breadth between post. pronotal angles 7 to 9 millim." by Distant and has been reported from India, Ceylon, Burma, Formosa, Japan, and China.

The family Nepidae is represented in Kwangtung province, according to our collections, by two species of *Ranatra*, one species of *Cercotmetus*, one species of *Nepa*, and the species of *Laccotrephes* herein discussed. Although common in Kwangtung this bug is not well known to the natives only a few of whom have a name for it. This testifies to the bug's ability to render itself inconspicuous which it does by covering

* Contribution from the Biological Laboratory.

(1) Bull. Brooklyn Ent. Soc. Vol. XXI, No. 5.

(2) Faun. Brit. Ind. Rhynchota. Vol. III.

its back with mud. The bug is called *Shui ha maau* (水下猫) in the Cantonese dialect, which translated literally means" under water cat."

Habitat.—Found commonly in pools, ponds, ditches, and small streams. It it essentially a mud-loving bug and apparently pays little or no attention to vegetation. It is usually found in shallow water near the edge and sometimes out on the bank. In the water they usually have the head pointed in the direction of deeper water to which they hasten when disturbed.

They are not fastidious about their environment for they are found in water varying in temperature from that which obtains in a small unshaded puddle to that found in a mountain stream, and varying in cleanliness from distinctly polluted and filthy to that clean enough for drinking purposes. They seem to prefer, however, bodies of water that are about midway between these extremes, although it is likely that the food is the determining factor rather than temperature or degree of pollution.

Hibernation.—These bugs have been taken at frequent intervals, during the past three winters, by ordinary collecting methods and showed no signs of hibernation. They are more difficult to find during the colder weather and are less active at this time.

During the winter of 1924-25 the writer kept some specimens in a small aquarium. Three specimens, one male and two females, were collected October 3, and about three weeks later they worked themselves into the mud in the shallow water and remained quiet. They took food which was so placed that they could get it without moving from their position but ignored any not so conveniently placed. Food was offered every four or five days but by the last of November the bugs were entirely covered with mud excepting the caudal one third of their respiratory tubes and they could no longer be tempted with food. One of the specimens was then removed from its chosen place and placed on the wet earth at one end of the aquarium. It made its way immediately into the water and by the next morning was again hidden except for the respiratory tube which was in contact with the surface film of the water. A glass lid was then placed on the aquarium to reduce the amount of water lost by evaporation and no more attention paid to the bugs.

During the following spring the writer was very busy owing to a heavy teaching schedule and neglected to observe when the bugs came out of hibernation. The last recorded observation was on the fifth of February at which time the bugs were still hibernating. How much longer they remained in their winter sleep can only be conjectured. Eggs were not deposited, however, until July 12 by one female and a few days later by the other. This is very late and perhaps was due to the fact that the bugs had remained a long time in hibernation.

The aquarium in question had been placed in a cold sub-basement room on the north side of a building. During the winter months the average temperature in the room was lower then the average outside temperature while during the spring the difference in temperature was still greater.

During the winter of 1925-26 some more adults were kept over winter. These did not show any evidence of a desire to hibernate but the conditions were not so favorable for hibernation as in the first experiment and the results cannot, therefore, be compared directly. These bugs were kept in an aquarium made from a Standard Oil tin in one end of which was placed a bank of sandy soil. The rest of the vessel contained shallow water but there was not the layer of mud that the first aquarium contained. The bugs were not fed during the months November to January (inclusive).

The bugs in this aquarium, as said above, did not hibernate but they did become less active during the colder days (of which there were only a few at a time). There are three possible reasons why these bugs did not hibernate: (1) the dirt bank was steep and fairly hard with the result that there was not present a quantity of mud into which the bugs could easily bury themselves; (2) the room although in a sub-basement had both an east and a south exposure and received warmth from the sun; (3) the bugs were ones that had been reared in the laboratory and used to lower temperatures than would be in the case of bugs out in nature.

In both of the above cases the bugs were not kept over the winter for a study of hibernation but for other reasons. These notes on hibernation are, then, simply a result of gleanings make from records kept for another purpose. It was planned to carry out definite hibernation experiments during the winter of 1926-27 but time did not permit.

Courtship.—Just before mating there are some antics that might well be considered as constituting courtship. Hewitt (Ent. Soc. Lond. Trans. 1906, p. 87) says of *Nepa* "there are no preliminary amorous passages in the courtship of *Nepa*" and goes on to explain that the reason may be that the antennae are too short for any 'caressing of antennae.' He further states that the antennae appear not to be used for discovering the presence of the female.

In the observation under discussion the female *Laccotrephes* was in a horizontal position on a bit of vegetation while the male was above her but not holding to her. He was manipulating his anterior legs in a rapid and excited manner, movements suggestive of a boxer at sparring or shadow boxing, a part of the time just making motions and a part of the time touching the female on the back or legs. During this time the female remained perfectly quiet.

Mating.—After several minutes of courting the male grasped the anterior femora of the female, they being directed at right angles to her body. The female holding on to the vegetation with her intermediate

legs attempted to kick the male off using her posterior legs. The intermediate legs of the male were placed against the basal one third of the female's posterior legs, while his hind legs were placed against the middle of her posterior tibiae thus rendering her posterior legs ineffective in the struggle. The vegetation was very unstable and their footing rather insecure. For an instant they were connected but in the next instant the female got the advantage in the struggle and their genitalia were disconnected. The writer then put his hand under them and removed the bugs to a shallow dish, they remaining in embrace while he did so. A moment before the above mentioned connection was effected the male gradually worked backward on the female. To accomplish this he pulled her anterior legs back until the femora and the thorax formed an acute angle, and then suddenly gave up his hold on her anterior legs and grasped her by the thorax.

As the male attempted to effect a connection in the shallow vessel he grasped the anterior portion of the female's thorax. As he did so the female reached back with her anterior legs, grasped the distal portion of his anterior femora, thus attempting to prevent the male from moving backward far enough to connect their genital organs. Nine minutes from the time they were first connected he attempted it again, but the female reached back with her right anterior leg, caught his right anterior leg and pulled him loose. The female then maneuvered backward and sideward to capture a tadpole, the male still upon her back. He then left her of his own accord, frantically described a circle of about three inches in diameter, suddenly returned at right angles to her right side and mounted. He made no attempt however, to connect, left her again, swam nervously about, then awkwardly and half-heartedly chased a tadpole (they had not been fed for several days and no doubt were very hungry). Then he attempted to feed on the same tadpole with the female but was not permitted to and swam away to the left. Soon he turned and swam rapidly toward her left side (at right angles to her middle), mounted wrong end to, quickly turned around and attempted to copulate from the left side. Failing this (through no fault of the female) he shifted and effected an entrance from the right. In this position his thorax was forward and downward. Then they remained :—

connected for 3½ minutes, disconnected for 15 seconds
„ „ 2½ „ , „ „ „ „
„ „ 3 „ , „ „ 5½ minutes
„ „ 5½ „ , „ „ 4½ „

The third time they disconnected it was her wish as she scrambled until the separation was accomplished.

During copulation the female continued feeding on the tadpole. Just prior to connecting, the male rhythmically shifted the posterior legs. After the fourth rest, of four and one half minutes duration, the male half-heartedly attempted another connection.

This pair of bugs was taken from a common container of six specimens which had been collected in May. Whether they had mated before cannot be said. This observation was made on July 26 a little after ten o'clock in the morning. The next day at noon the bugs were in copulation and the male was again mounted to the right.

On the 23rd of July another mating pair was observed. The female was reared in the laboratory becoming an adult on the first day of July. A male was placed with her on the twenty-second of July. When observed at noon the next day they were in copula, the male mounted to the left. His right anterior leg was over the right front angle of her thorax, the right intermediate leg grasping her right side just back of her intermediate leg. The left legs were holding to vegetation, a tangled mat of which the bugs were on, touching the female lightly and not really grasping. The right posterior leg was not used at all. The right wing of the male overlapped the left of the female, but the tip of his abdomen was bent downward and to the right so as to come underneath the tip of the abdomen of the female. The respiratory tubes of the male were slightly parted at their base, allowing the genital organs to extend upward and connect with the female genital organs immediately above. The respiratory tubes of the male, then, were directly under those of the female at their base and then directed to the left, thus forming an obtuse angle. This was at ten o'clock in the morning. When an attempt was made to observe them with a hand-lens they discontinued mating. The next morning at nine they were mating again. At noon they were placed in an oil-tin squarium which was provided with a dirt bank and on the following day a big batch of eggs was laid.

In some mating pairs the male is mounted more to the side, the venter being almost at right angles to the lateral edge of the female. There is also some variation in the position of the respiratory tubes during mating. In some cases those of the male are pushed under and beyond those of the female at the base, and then instead of pointing back toward the male they remain on the side of, and parallel to those of the female. The respiratory tubes of the two bugs are parallel then but crossed at their proximal ends.

In a given pair the male is usually consistent in effecting a connection always from the same side, but exceptions have been noted in one or two cases.

Preoviposition.—A female which became an adult on July 1 in the laboratory appeared gravid by July 22 and a male was introduced into the aquarium on this date at noon. They were mating the next day at noon and probably had also mated the day they were placed together. July 24 dirt was provided for egg-laying and the next day eggs were laid, thus laying eggs on the 25th day. Undoubtedly the

preoviposition period would have been shorter had this bug been kept in a place where the average temperature was equal to that of the outside temperature, instead, the temperature of the room was considerably lower. Perhaps the presence of a male earlier might have shortened the preoviposition period. The one record, of course, only gives an idea as to the duration of the preoviposition period; more observations will need to be made to determine the normal or average.

Oviposition and Fecundity—Oviposition in the laboratory was observed with a reading glass. In the oil-tin aquaria slanting mud banks had been prepared. Sometimes the eggs were laid on a flat area on the uppermost part of the artificial bank but more often where the bank was steep. In the latter case the female takes a position of head downward. The ovipositor is bent far forward so its juncture with the body forms an acute angle. The eggs are placed on end and are smeared over with mud leaving only the filaments protruding. A place where the eggs have been laid is plainly visible as a smooth, more or less spherical area. A closer inspection reveals the distal ends of the egg filaments which instead of being in a regular circle as is the case with the eggs of *Nepa* usually are in no regular order (fig. 9). Only occasionally does a single egg at the edge of the mass have its filaments placed in a regular manner. One cannot tell the exact location of eggs within the mass by the appearance of the filaments. The egg mass of *Ranatra chinensis* when in place is similar to that of *Laccotrephes*, but in the case of *Nepa* the exact location as well as the number of eggs can be determined simply by counting the crowns of filaments. *Nepa* eggs are usually more or less scattered and further the fact that the filaments are quite short accounts for their regular arrangement.

One female was timed while depositing eggs and found to require 2½ hours to deposit twelve eggs. This particular individual commenced egg-laying at 8.15 p.m. During the afternoon she had escaped but was recaptured. Apparently she wanted to return to nature to lay her eggs.

She was collected May 7 and appeared gravid at the time. Three days later she dropped three eggs to the bottom of the aquarium. Mud was purposely not provided in order to ascertain if she could be induced to deposit in either green or dead plant stems. During the night of May 15 she dropped eight more eggs although she had been removed during the day to an aquarium containing dirt. On May 22 she laid 12 eggs. Later her aquarium was needed and she was transferred to a battery jar containing water only. On June 11 she appeared gravid and was returned to her original home where she laid 25 eggs during the night. On June 19 she laid 23 eggs, later four more eggs were laid (exact date not known), and on July 9 she laid 24, making a total of 99 eggs during an interval of 61 days.

One female collected July 19 laid a batch of eggs late in August, another September 5, another on the 10th of September and still another on September 19. The first batch contained 25 and the last one 19 eggs. Those in the second and third batches were not counted. As many as 35 eggs have been deposited at one time by one female but about 2 dozen seems to be the average number.

The female referred to under *Preoviposition* molted to an adult July 1 and laid eggs on July 25 and again July 31. She died September 1.

Egg-laying always took place at night. The eggs are deposited in mud as they are in the case of *Ranatra chinensis*, *Curicta drakei* and at least two species of *Nepa*. Occasionally the eggs are pushed into the mud until the upper ends are just flush with the dirt, leaving the filaments exposed for thir full length, but more often the eggs are covered with about a millimeter of dirt. (fig. 9).

Incubation—Eggs laid in the laboratory May 22 required 13 days for hatching; eggs laid during July and August required 12 days. Out in nature where the temperature would be higher the incubation period would no doubt be shorter.

Hatching.—One morning about nine o'clock the writer had the good fortune to observe eight eggs hatch. He had patiently watched one small area of earth on a slanting bank for three hours when suddenly he noticed it move. A hand-lens was quickly brought in focus and every detail carefully noted. The little roundish area of soil, conspicuous with the whitish egg filaments, was pushed straight up until it fell forward and revealed the head the anterior margin of the thorax of eight little nymphs, whose ventral sides were facing down the slope. Some remained accurately upright until they were entirely out of the egg capsule, others leaned forward before they were entirely hatched. Some were free from the egg and had fallen over on their ventral sides before the legs (which were directed downward and closely appressed to the body) moved out and away from the body, while in others the legs were being vigorously kicked in freeing the nymphs from the eggs. In one or two cases the nymphs were standing exactly vertical and nothing but the respiratory tubes remained within the egg capsule. When these were out the nymphs fell forward and crawled away. Hatching from the time the earth cap was moved upward required about five minutes.

Behavior of the Newly Hatched.—The little nymphs are quite active immediately upon hatching and move down the sloping earth to the water which they enter without much loss of time. Upon hatching the nymphs are bright red with jet black eyes. During the first hour no perceptible color change takes place but within the next hour and a half they become wine-colored. The change takes place so gradually that one looking at them continuously can hardly detect it. Upon entering the water the nymphs find a suitable depth and bring the

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respiratory tubes in contact with the surface film. They are fully colored within four or five hours and are ready for mosquito larvae within 10 or 12 hours.

Number of Instars.—There are five nymphal stages. The duration of the several stadia is indicated in the table of rearings.

Molting.—Nymphs lose interest in food for a period varying from a few hours to a day before molting. Experiments seem to point to the fact that hunger is the deciding factor, for those which had less food than they desired fed up to within a few hours of molting time. The fifth stage nymphs usually refuse food for a longer period before molting than do the other stages. The period of rest before molting is probably long in some cases because molting in delayed. Nymphs are usually ready for food as soon after molting as they are fully colored, which requires from four to five hours. This period is also subject to variation and apparently depends upon the vitality, those individuals in which molting seems to be easily and quickly accomplished seem to be stronger and take food earlier. The actual molting time, which requires only a few minutes, also varies with different specimens. Some are out of the skin except for a leg or two and then give up the struggle. If they receive help at this time they often live but if the aid is not given at just the right time the leg will be deformed. If the deformity is slight it will disappear with the next molt. Occasionally a nymph will molt unaided but will die immediately upon completion of the task, probably of exhaustion. If death occurs at molting time it is usually before the skin has split. In this respect *Laccotrephes* differs widely from *Lethocerus* for in the latter many nymphs die after the skin has split preparatory to molting.

Previous to molting the nymphs become less active and somewhat bloated in appearance. The skin is tightly stretched and the bug becomes unshapely. The thorax especially looks elongated and unnatural and as if the three regions were going to separate. In the fifth stage the wing pads become dark one day before molting. Mortality at molting time, at least under laboratory conditions, is not high.

Sexual Maturity.—Very little data are at hand regarding this point. Female No. 5-215 was not given a male until the 22nd day after she became an adult. They probably mated the same day but it was not convenient to observe them on this occasion. The next day, however, they were seen mating. How much earlier the female would have mated cannot be said. She was gravid at that time, however, showing that she was sexually mature some days earlier. She deposited eggs on the 25th day of adult life. This was during July and the female was one that had been reared from the egg.

Fertility.—But few data were obtained relative to fertility. In the above case the female laid fertile eggs the third day after mating for the the first time. A few data were secured on the duration of time a

female remained fertile after mating. A gravid female was collected May 7. She was never given an opportunity to mate, but the eggs she laid during the rest of the month, and up to and including June 19 hatched. Eggs laid July 9, however, did not hatch.

Longevity.—Two specimens collected October 3, 1924 lived over until the following fall, one dying September 3, the other October 11, making a total of one year and eight days for the latter. The bugs laid eggs in July and August. They were probably of the late summer brood of 1924. Some specimens reared September 1925 lived over until late August 1926 when the work was discontinued. In spite of the fact that they were not fed sometimes for days at a time, even during the summer, and their water allowed to get extremely foul, several were still alive, and as late as the middle of August one pair was observed mating. There is no doubt but that these insects would have gone well over the year mark if properly cared for.

The longevity of water bugs is a subject of much interest to the writer and one on which we have comparatively little data. The writer has not had time to keep Chinese aquatics for longevity records, but a few years ago was able to secure some data on the longevity of American water–bugs. One of the most interesting records was that of *Velia watsoni* Drake observed in Minnesota from specimens collected in Kansas. These lived for eighteen months and reproduced during two different seasons (Canadian Entomologist, May, 1925. p. 109).

Number of Generations.—Adults that live over the winter deposit eggs the following spring and summer over a considerable period. Some commence egg–laying rather early, others much later. Because of this it is impossible to check up on the number of generations from field observations alone. Field and laboratory observations thus far seem to indicate one generation and a partial second. In other words the adults maturing from the eggs laid early in May themselves lay eggs during the summer and the bugs hatching from these reach maturity in the fall and live over the winter as adults. Bugs becoming adults in July and August do not lay eggs until the following spring.

Food Habits.—*Laccotrephes* is carnivorous, feeding upon terrestrial and aquatic insects, tadpoles, and small frogs. They undoubtedly would feed upon small fish if they had an opportunity. In the laboratory they fed upon a great variety of land and water insects. The earlier instars apparently preferred mosquito larvae and pupae while the later instars showed a preference for tadpoles. The adults seemed not to show any particular food preference. Field and laboratory observations indicated that both nymphs and adults were very fond of mosquitoes. It is surprising to note what large tadpoles a very small nymph will attack and manage, and equally surprising to observe an adult capture and eat insects as small as *Drosophila*, a leaf hopper, or an adult mosquito. An adult *Laccotrephes* was once observed to capture an agile *Rhagadotarsus* but it apparently did not like it and soon released it.

While this water-scorpion consumes great quantities of food, the adults at least, can survive with a surprisingly small amount of food. In the laboratory the 4th and 5th instar nymphs would manage a large tadpole every day. When very hungry both nymphs and adults pursue their victims, but at other times they lie in wait, partially buried in the mud, with the strong anterior legs spread out in readiness. When an unwary insect or tadpole happens to pass over or near these sharp grapple hooks, there is a swift simultaneous closing in of the front legs, and the unsuspecting victim is doomed. The prey is held tightly between the fore legs while its juices are sucked.

Behavior.—Adults spend some of the time out of the water but nymphs have never been found on the bank. Adults found on land were always near the water's edge and facing toward the water. The few specimens found out of the water have always been found in the late afternoon.

Enemies.—Hydracnid mites are parasitic on the nymphs and adults of *Laccotrephes* and as many as a dozen or more are sometimes found on one bug. They are found on almost any part of the body and sometimes are so numerous and so placed as to hinder locomotion and other functions. The remains of *Laccotrephes* have been found in the stomachs of toads and fish. In the laboratory water snakes and turtles have fed upon them. Frogs probably eat them when they can catch them. The adults, when on the bank, might possibly fall prey to lizards of the genus *Eumences*, although such has not been observed. The lizards are often found at the water's edge of pools frequented by *Laccotrephes*; they of ten catch very large specimens of praying mantis and grasshoppers, and in the laboratory will feed on any insect offered. Ducks undoubtedly eat them for pools frequented by ducks are often absolutely devoid of insect life. The writer is of the opinion that *Laccotrephes* does not have serious inroads made upon it by predacious enemies.

Use in Mosquito Control.—As mentioned under *Food Habits* the nymphs and adults are very fond of mosquito larvae and pupae. Individual specimens of *Laccotrephes* have been observed to consume tremendous numbers of immature mosquitoes in a day. The writer used this species along with a number of other aquatic Hemiptera in mosquito-eradication work on the campus of Lingnan University with very gratifying results. With the coming of the spring rains innumerable temporary aquatic environments are formed, and while these are eventually populated with mosquito-destroying insects, often it is not until after a generation or so of mosquitoes have been bred. The method of utilizing these bugs in control work consisted of collecting them from the permanent ponds and streams and causing them to be more evenly and rapidly distributed. This was largely a matter of speeding up a natural course of events but not entirely so inasmuch as bugs were introduced into places where they would not go of their own accord.

A number of different insects were successfully used in this way, but *Laccotrephes* and *Sphaerodema* proved the most successful. There are several reasons why this method of combatting mosquitoes, in this locality at least, is practical. They are: (1) the use of fish, oil, or poison as methods of control is impractical; (2) the bugs are abundant and easily secured; (3) no particular skill is required (the children of a community may be engaged to do it as a part of their recreation); and, (4) it is an effective, yet inexpensive method.

Economic Status.—This species is decidedly a beneficial insect in this region. It not only normally destroys many mosquitoes but can be used successfully in anti-mosquito work. In some of the smaller fish ponds it of course eats insects that would serve as fish food, but the greater number of *Laccotrephes* are found in bodies of water where there are no fish. Our observations indicate that the good this species does overbalances by far the harm, and it should therefore be considered a beneficial insect of considerable importance.

Description of Stages

Egg.—The whitish eggs (fig.7) are 3.53 to 3.72 mm. in length and 1.35 to 1.39 mm. in width (in greatest diameter). The filaments, 5 to 9 in number, are 2.55 to 2.79 mm. in length and usually curved. If the long axis of the egg be viewed in one plane the sides are more or less parallel, if in another plane it becomes evident that the egg is quite rounded on one side and more or less straight on the other. The lower end tapers considerably. the upper or micropylar end somewhat. The filaments are arranged in a circle .4 to .6 mm. in diameter and nearer the straight side of the egg. In hatching the upper ends of the eggs, with the filaments, come off. Figure 10 shows the inside appearance of the egg-caps in place in the crust of earth. By the asterisk-like design one can determine the number of filaments by looking at the inside of the cap. Figure 11 shows the appearance of the egg mass after hatching, the black spots being the empty eggs which appear to be only holes in the earth until one looks more closely and sees the empty egg capsules lining the holes.

The variation in the number of egg filaments in certain water-scorpions is very interesting. The eggs of *Curicta drakei* have from 12 to 17 filaments, the eggs of *Nepa cinerea* are said to have 6 and 7 filaments, *Nepa chinesis* has 10-14, and *Nepa apiculata* has 9 to 13. Hungerford (Kansas University Science Bulletin, Vol. XI, p. 157) saya *N. apiculata* lays eggs bearing 11 filaments, but the writer found the number to vary from 9 to 13.

In *Laccotrephes* the number varies from 5 to 9, the average for 203 eggs being 6.47. Table I shows the variation in detail. It is interesting to note that the number never varies more than 2 in a given batch of eggs as for example 5 to 7 in No. 1, or 7 to 9 in No. 6.

TABLE I.

Variation in the Number of Filaments of Laccotrephes Eggs

EGG BATCH	NO. OF EGGS	NO. OF FILAMENTS	TOTAL NO. OF EGGS	AV. NO. OF FILAMENTS PER EGG
No. 1	2 14 9	5 6 7	25	6.28
No. 2	1 16 6	5 6 7	23	6.21
No. 3	19 5	6 7	24	6.20
Nos. 4 & 5*	30 11 1	7 6 8	42	6.73
No. 6	9 4 3	7 8 9	16	7.62
No. 7	1 13 2	5 6 7	16	6.06
Nos. 8 & 9*	14 8	6 7	22	6.36
No. 10	1 22 12	5 6 7	35	6.31

*2 batches of eggs by same ♀.

First Instar.—Nymphs measured dorsally (longitudinal measurements made along median line, beak is not included). Length including respiratory tubes 7.90 to 8.97 mm.; length of head, .97 to 1.06 mm.; length of pronotum .60 to .69 mm.; length of mesonotum .37 to .46 mm.; length of metanotum .23 mm.; length of posterior tibia 2.46 to 2.55 mm.; width of head across eyes 1.20 to 1.25 mm.; width of head between eyes .51 mm.; width posterior margin of pronotum 1.53 to 1.81 mm.; width posterior margin of mesonotum 1.86 to 2.27 mm.; width of posterior margin of metanotum 1.95 to 2.37 mm.; greatest width of abdomen 2.32 to 2.51 mm.

Newly hatched nymphs are reddish with black eyes. Faint, paler areas near center of anterior and intermediate femora; pale median line on thorax. Beneath brighter red.

Older nymphs brownish gray, faintly dappled. Whitish specks near base of anterior tibiae, irregular whitish or pale area near middle of anterior femora. The same markings, but less distinct, on intermediate and posterior legs, the femora of the latter seem to have two

such spots. Pale median dorsal line through thorax and half of first abodminal segment, extending to base of head where it forks into a broad U and changes from pale to dark after it reaches anterior margin of eyes (skin separates along this pale line in molting). Middle and hind tarsi each have two long claws. From below abdominal spiracles can be seen, also a wide fringe on the abdomen.

Second Instar.—Very young nymph measured as for first instar. Length of body and respiratory tubes 12.27 mm.: length of head 2.18 mm.; length of pronotum .97 mm.; length of mesonotum .88 mm.; length of metanotum .23 mm.; length of posterior tibiae 3.44 mm.; width across eyes 1.53 mm.; width between eyes .65 mm.; width posterior margin of pronotum 2.51 mm.; width posterior margin of mesonotum 3.11 mm.; width posterior margin of metanotum 3.25 mm.; greatest width of abdomen 3.39 mm.

Legs more dappled than in first instar, anterior ones darker. Abdominal spiracles can be seen from above as well as from below. The tips of the hind angles of the meso and metanotal angles are .69 mm. apart.

Third Instar—Length including respiratory tubes 20.40 mm.; length of head 1.53 mm.; length of pronotum 1.72 mm.; length of mesonotum 2.27 mm.; length of metanotum .37 mm.; length of posterior tibia 4.88 mm; width head across eyes 1.99 mm.; width between eyes .74 mm.; width posterior margin of pronotum 3.62 mm.; width posterior margin of mesonotum 4.83 mm.; width posterior margin of metanotum 4.92 mm.; greatest abdominal width 5.20 mm.

Similar to preceding instar. Hind angles of mesonotum prolonged and suggestive of wing pads. Tips of mesonotal and metanotal angles .79 mm. apart.

Fourth Instar.—Length of body including respiratory tubes 29.06 mm.; length of head, 1.86 mm.; length of pronotum 2.51 mm.; length of mesonotum 2.32 mm.; length of metanotum .18 mm.; length of posterior tibiae 6.64 mm.; width head across eyes 2.51 mm.; width between eyes .97 mm.; width posterior margin of pronotum 4.74 mm.; width across tips of mesonotal wing pads 6.32 mm.; greatest width of mesonotum 6.69 mm.; width across tips of wing pads of metanotum 6.78 mm.; greatest abdominal width 6.88 mm.

Hind angles of metanotum look quite a little like wing pads and those of the mesonotum decidedly so. The mesonotum now covers up more of the metanotum. The tips of the wing pads of the mesonotum are only .65 mm. from the tips of the hind angles of the metanotum.

Fifth Instar.—Length 42.22 mm.: length of head 2.79 mm.; length or pronotum 3.48 mm.; length of mesonotum 3.62 mm; length of posterior tibia 9.43 mm.; width head across eyes 3.16 mm.; width between eyes 1.30 mm.; width posterior margin of pronotum 7.53 mm.; width across tips of mesonotal wing pads 8.64 mm.; greatest width of mesonotum 10.69 mm.; greatest abdominal width 9.48 mm.

The tips of the mesonotal wing pads now cover those of the metanotum, in fact all of the metanotum is now covered by the mesonotum excepting a small triangular area on either side. In this instar the posterior margin of the metanotum and none of the first abdominal segment split in molting. Wing pads turn dark one day before molting to adult.

Method of Rearing

Adults were collected and placed in battery jars, aquarium jars, oil tins, and other available containers, the number of bugs in each vessel depending upon its size. When mating pairs or gravid females were found they were isolated in containers suitable for egg-laying. These latter containers were prepared by cutting out one side of a Standard oil tin, thus making aquaria 14 inches long, 9 inches wide and 9 inches deep. These were given two coats of white paint, inside and out, which not only prevented rusting but provided a place to write the life history number and other data. Permanent data were, of course, placed on cards but this enabled one to make temporary notes which facilitated observation. Such notes as "expected to hatch Fri. p.m.," "record first observed mating" and "observe and time entire molting process" facilitate the work when one in caring for 150 or 200 containers and must make frequent observations in order so get exact detailed data on particular happenings. In each container an artificial bank was constructed in one end by placing first a layer of sand and then dirt. In the rest of the container the water was about 2 inches deep. The sand being higher than the water level kept the water from becoming muddy.

Nymphs, as they hatched frem eggs in these containers, or were collected from pools and ditches, were isolated. The vessels used varied in size from smaller than a petri dish to dishes eight inches in diameter. One specimen was reared to maturity in a dish $\frac{3}{4}$ inch deep and $2\frac{3}{4}$ inches in diameter. Most of them were kept in petri dishes until they reached the 4th instar and then were transferred to larger dishes. The petri dishes were covered with the regular lids, the larger containers covered with wire screen. The size of the container seemed not to alter the size or well being of the individual, the amount of food, however, did.

Food was given once each day and each day the remains of the previous day's feeding were removed. They were given all the food they cared for; water was changed frequently enough to prevent it from getting foul. In the larger containers where the water was deeper some vegetation was introduced for support. Each container was given a number and on 4×6 cards bearing the same number, important data were recorded. One or two nymphs were reared on much less food than the rest with the result that they were much smaller in size. The nymphs can be reared collectively but the mortality rate is then slightly higher.

Summary of Life History Studies

The accompanying table shows the data obtained in the rearing experiments. By reference to the table we see that nine specimens were reared from the moment of hatching to maturity. The sex was determined for six of the nine specimens showing 2 males and 4 females. Of the 38 life histories attempted, 9 died, five were killed for specimens, 1 escaped, while the records for three were lost. Many of the nymphs were not isolated at hatching time but just after molting. In the cases where nymphs of unknown ages were isolated an asterisk appears after the number of days indicating incomplete record. The sex was recorded in the case of fifteen specimens of which 7 were males and 8 females. In computing the average, minimum, and maximum duration of a given stage of development, or of total nymphal development, only complete figures were used, for instance, if a nymph died in the fifth stage only the duration of the first four stages was taken into consideration. Averages were not secured by considering always the same number of individuals. It thus happens that we determine the time required for development of the first stage by taking the average time required for 20 individuals, for the second stage by 27 and so on, the number of individuals being shown by the number in parentheses.

Data are shown for partial rearings as well as for complete ones in order to show the mortality rate, the relation of death to molting time, etc. The dates on which the specimens reached the adult state are given in order that one may know the rate of development for a given time of the year*.

The average duration of the first stadium for twenty specimens was 4.5 days (minimum 4, maximum 7 days); the average duration of the second stadium for twenty-seven specimens was 4.9 days (minimum 4, maximum 6 days); the average duration of the third stadium for twenty-four specimens was 6.4 days (minimum 5, maximum 9 days); the average duration of twenty-three fourth stage nymphs was 13.9 days (minimum 11, maximum 15 days). The time required for development increases with the later instars until in the last instar it is more than three times as great as that for the first instar.

The nine specimens carried through from hatching to maturity required an average of 39.4 days (minimum 36, maximum 41 days) for nymphal development. Adding 12 days for incubation we have a total of 48 days from egg to adult. There appears to be no difference between the sexes in the length of time required for development. The amount of food seemed not to alter the length of time required for maturity but did cause a marked decrease in size. Temperature is an important factor and no doubt these bugs in nature, owing to an average temperature higher than that of the laboratory where these rearings were conducted, would have a shorter development period.

By reference to "Daily Meterological Record, Freeman Meterological Observatory" issued quarterly by Lingnan University, one can get some data on the temperature for any given period of the year. Thermograph records were kept while the rearings on *Laccotrephes* were in progress but these are not available now.

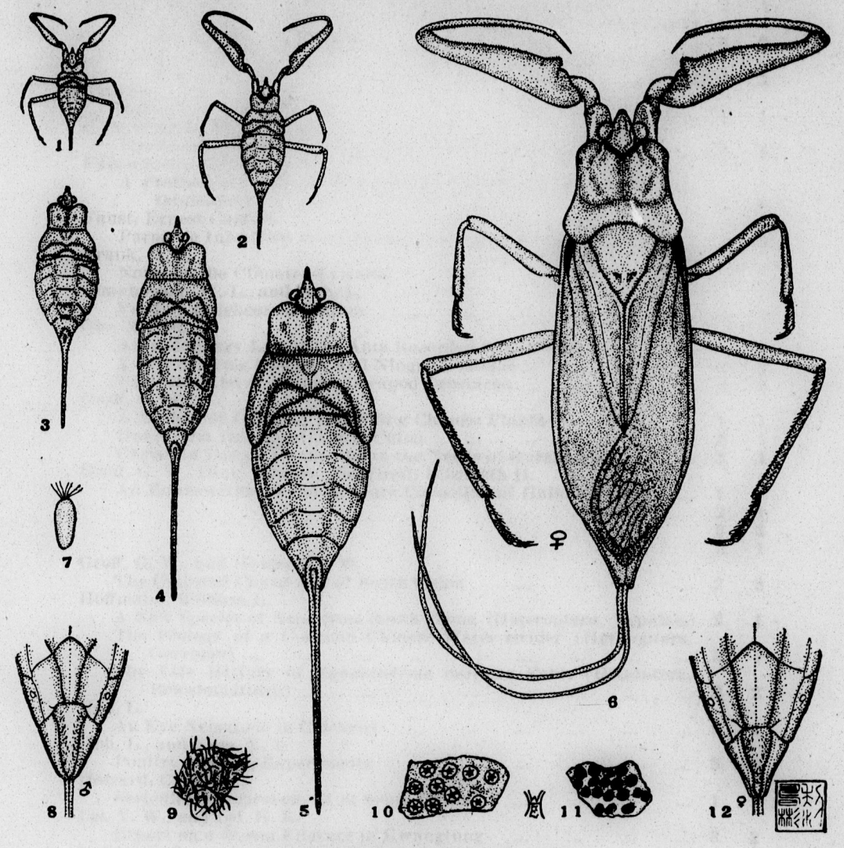
Table II.

Table of Rearings of Laccotrephes

REARING NUMBER	FIRST INSTAR	SECOND INSTAR	THIRD INSTAR	FOURTH INSTAR	FIFTH INSTAR	TOTAL DAYS	SEX	DATE OF MATURITY
								1925
5-213	5*	5	rl	—	—	—	—	—
5-214	—	—	—	9*	1d	—	—	May 27
5-215	4*	6	7	7	15	—	♀	July 1
5-218	—	—	7*	10	3k	—	—	June 2
5-251	7	6	2d	—	—	—	—	May 31
5-294	4	5	7	10	15	41	—	July 5
5-295	5d	—	—	—	—	—	—	June 9
5-296	5	5	7	rl	—	—	—	—
5-297	5	5	8	10	15	43	—	July 17
5-298	rl	—	—	—	—	—	—	—
5-299	1c	—	—	—	—	—	—	—
5-300	4	5	6	10	15	40	—	July 17
5-301	4	5	7	10	16d	—	—	July 16
5-302	4	rl	—	—	—	—	—	—
5-309	5	k	—	—	—	—	—	June 20
5-496	—	6*	5	3k	—	—	—	Aug. 26
5-497	—	6*	5	7	14	—	♀	Sept. 13
5-499	—	6	8	8	1d	—	—	Sept. 5
5-500	—	6	6	8	15	—	♂	Sept. 17
5-501	—	4	7	8	11d	—	—	Sept. 13
5-502	—	5	8	9	15	—	♀	Sept. 20
5-503	—	4	5	7	14	—	♂	Aug. 30
5-504	—	4	5	8	11	—	♀	Sept. 11
5-505	—	6	5	8	12	—	♂	Sept. 16
5-506	—	5	5	7	14	—	♂	Sept. 16
5-507	4	6	8dm	—	—	—	—	—
5-508	4	6	9	9	13	41	♂	Sept. 24
5-509	5	6	8	8	14	41	♀	Sept. 24
5-510	6	3k	—	—	—	—	—	Aug. 23
5-511	6	4	3k	—	—	—	—	—
5-512	4	4	6	8	15	37	♀	Sept. 18
5-513	4	4	5	7dm	—	—	—	Sept. 1
5-514	4	4	5	9	1d	—	—	Sept. 4
5-515	4	4	5	8	15	36	♀	Sept. 17
5-516	4	4	5dm	—	—	—	—	Aug. 25
5-517	4	4	7	10	15	40	♀	Sept. 21
5-696	—	—	—	11	12	—	—	Sept. 2
5-918	4	6	8	6	12	36	♂♀	Oct. 4
AVERAGE	4.55(20)	4.92(27)	6.41(24)	8.52(23)	13.94(18)	39.44(9)	—	—
MINIMUM	4	4	5	6	11	36	—	—
MAXIMUM	7	6	9	11	15	41	—	—

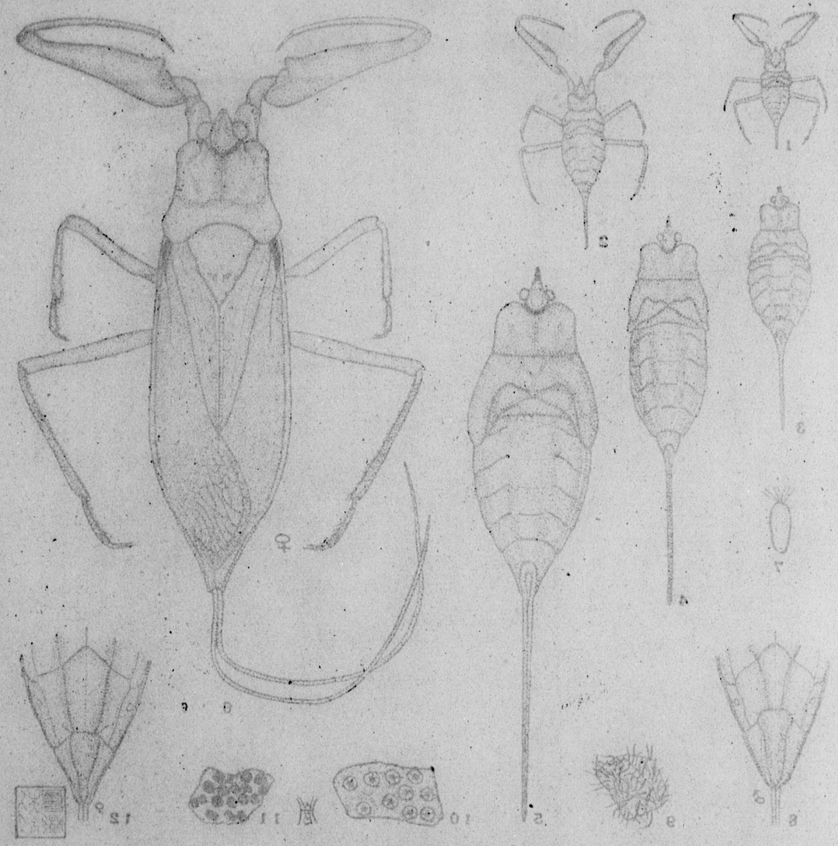
*—incomplete. rl—record lost. d—died. k—killed for specimen.
♂—male. ♀—female. dm—died molting.
Proportion of sexes: Males 7, Females 8.

HOFFMANN: BIOLOGICAL NOTES ON LACCOTREPHES LING. AGRI. REV., VOL. IV, PLATE VII.



LACCOTREPHES KOHLII (Ferrari)
(Magnification 2 ×)

Figs. 1-5—Instars one to five, respectively.
Fig. 6—Adult female.
Fig. 7—Egg.
Fig. 8—Ventral aspect, tip of abdomen, male.
Fig. 9—Eggs *in situ*, filaments only visible.
Fig. 10—Ventral aspect of Fig. 9, showing inside view of egg-caps.
Fig. 11—Empty egg-capsules after crust of earth with egg-caps has been removed.
Fig. 12—Ventral aspect, tip of abdomen, female.



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0093

UNRECORDED PLANTS FOR KWANGTUNG PROVINCE

BY

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UNRECORDED PLANTS FOR KWANGTUNG PROVINCE

By E. D. MERRILL

University of California.

While most of the species listed below have been reported from some part of China, I have found Kwangtung records for but few of them. As a matter of record I have, however, included in the paper a few additions to the Chinese flora which do not occur in Kwangtung. These are *Titanotrichum oldhamii*, *Phalaris canariensis*, *Nuphar minimum*, *Isachne polygonoides*, *Conandron ramondioides*, and *Brachyelytrum erectum*, with a note on *Ardisia japonica* Blume. The genera *Titanotrichum*, *Conandron*, and *Brachyelytrum* have hitherto not been recorded from China proper.

Messrs. Dunn and Tutcher* have urged the publication of new Kwangtung records, which is the *rasion d'etre* of this paper. In reference to publications on the Chinese flora as a whole, the Kwangtung-Hongkong region stands out as the one region that is reasonably well covered by a published flora, although there are of course numerous published lists of the floras of other provinces; many of these are, however, very unsatisfactory and most of them are very incomplete. It has seemed therefore worth while to list the species enumerated below because it adds twenty-one genera and sixty species to the list of those previously reported from Kwangtung Province. Genera new to the province are *Tricholaena* (introduced and naturalized), *Carpinus*, *Betula*, *Aphananthe*, *Bocconia*, *Bucklandia*, *Schizophragma*, *Malus*, *Erythroxylum*, *Euscaphis*, *Anneslea*, *Idesia*, *Lythrum*, *Nyssa*, *Monotropa*, *Gaultheria*, *Myrsine*, *Pycnostelma*, *Elscholtzia*, *Scrophularia*, and *Melampyrum*.

These new records are for the most part based on rather extensive collections made by the National Geographic Society Central China Expedition under the direction of F. R. Wulsin. The Kwangtung collections were made in collaboration with the Canton Christian College (now Ling Nan University), the actual collectors being To Kang Peng, Ts'ang Wai Tak, and Ts'ang Un Kin. The Wulsin Expedition material was all collected in the North River region, chiefly on Lung

*Dunn, S. T. and W. J. Tutcher. Flora of Kwangtung and Hongkong (China). Kew Bull. Add series 10 (1912) 1-370.

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T'au Mountain, near Iu. From the numerous additions to the Kwangtung flora it is evident that previous to this trip comparatively little collecting had been done in that particular region. The collections were divided between the Canton Christian College and the United States National Herbarium, half of the duplicates of each number being retained for distribution by the former institution and half by the latter. The largest and most complete sets are accordingly filed in the United States National Herbarium and in the herbarium of the Canton Christian College. The study set on which this paper is based is deposited in the herbarium of the University of California.

POLYPODIACEAE

LOXOGRAMME (Blume) Presl

LOXOGRAMME LANCEOLATA (Sw.) Presl Tent. Pterid. (1836) 215.

Grammitis lanceolata Sw. in Schrad. Journ. **1800**[2] (1801) 18.
Polypodium loxogramme Mett. Polypod. (1857) 112, *pl. 3, f. 25.*

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12271, 12294* (Wulsin Expedition). On rocks in forests. Tropical Africa and Asia, its Malaysian and Polynesian distribution doubtful.

This seems clearly to be the form figured by Copeland* as representing the typical form of this species. Matthew records *Polypodium loxogramme* Mett. from Fokien, Hupeh, Formosa, and Korea, but undoubtedly more than one species is included, certainly *Loxogramme fauriei* Copel. The specimens cited above have the few, short, stout, costular sori characteristic of the species as originally described.

ASPLENIUM Linnaeus

ASPLENIUM BILLETII Christ in Bull. Sci. France et Belg. **23** (1898) 267 *t. 12, f. 4-5.*

Kwangtung Province, Fung Wan Hu, North River region, *Canton Christian College 12829, 12920* (Wulsin Expedition), July, 1924, among rocks. Yunnan and Kweichau Provinces, and northern Indo-China, new to Kwangtung Province.

POLYPODIUM Linnaeus

POLYPODIUM PEDUNCULATUM (Hook. et Grev.) Mett. ex Salmon Nomencl. Gefäss Krypt. (1883) 312.

Ceterach pedunculata Hook. et Grev. Ic. Fil. (1827) *t. 5.*

Kwangtung Province, Cha Uen Shaan, Chuck Tsz Haang, North River region, *F. A. McClure 13776*, January, 1926. In moist forested ravines. Northern India to Hupeh, Anhwei, Chekiang, and Kweichau Provinces in China, but not previously reported from Kwangtung.

*Copeland, E. B. The genus Loxogramme. Philip. Journ. Sci. **11** (1916) Bot. 43-47, *pl. 1-4.*

GRAMINEAE

PHALARIS Linnaeus

PHALARIS CANARIENSIS Linn. Sp. Pl. (1753) 54.

Fukien Province, near Foochow, *F. P. Metcalf and T. C. Chang 953*, without notes. Certainly introduced, perhaps cultivated, but at any rate not previously recorded from China. A native of Europe, now widely distributed in temperate regions. Canary grass.

BRACHYELYTRUM Beauvois

BRACHYELYTRUM ERECTUM (Schreb.) Beauv. Agrost. (1812) 39.

Muhlenbergia erecta Schreb. Besch. Gras. **2** (1872-79) 139. *pl. 50.*

Anhwei Province, Huang Shan, *R. C. Ching 8558*, (det. Hitchcock), July 12, 1925, in forests at an altitude of about 1000 m.

The genus and species new to China. This is a record of special interest as it adds another species to the list of those common to north-eastern Asia and north-eastern North America.

ISACHNE R. Brown

ISACHNE POLYGONOIDES (Lam.) Doell in Mart. Fl. Bras. **2**[2] (1877) 273.

Panicum polygonoides Lam. Encycl. **4** (1797) 472.

Chekiang Province, Suer Shan, Kei Hwa, *R. C. Ching 8974*, Sept. 1925. In open sandy places along streams at 650 m. altitude. New to China.

The specimen was identified by Prof. Hitchcock who considers this species to be distinct from the oriental *Isachne miliacea* Roth. to which it was reduced by Hooker. f. In any case Lamarck's specific name is the older. The species is widely distributed in tropical America, and Prof. Hitchcock states that the specimen cited above and *Merrill 462* from Culion, Philippines are the only oriental representatives of it that he has seen, and expresses the opinion that it is an introduced species in the Old World.

TRICHOLAENA Schrader

TRICHOLAENA ROSEA Nees Cat. Sem. Hort. Vratisl. (1835), Linnaea **11** (1837) Lit. Ber. 129, p.p., Fl. Afr. Austr. (1841) 17, p.p; Stapf in Dyer Fl. Capensis **7** (1899) 443.

Kwangtung Province, Chuenchow, Hongkong territory, *Canton Christian College 13156 Mackenzie*, "introduced, growing on open hillsides." Natal grass, widely distributed in tropical and south Africa, now rapidly becoming naturalized in other tropical and subtropical countries where it has been introduced for forage purposes.

LILIACEAE

SMILAX Linnaeus

SMILAX PERFOLIATA Lour. Fl. Cochinch. (1790) 622; Chevalier in Bull. Econ. Indochine **21** (1918) 327.

Smilax ochreata C.DC. Monog. Phan. **1** (1878) 191. Norton in Sargent Pl. Wils. **3** (1917) 11.

Kwangtung, near Fung Wan, North River region, *Canton Christian College 12876* (Wulsin Expedition), July 15, 1924, with the local name *ma kap lak*. India to Yunnan, Indo-China, and Hainan, not previously recorded from Kwangtung proper.

The specimen is with mature fruit and clearly represents this species. Chevalier has given an ample description of Loureiro's species, and I believe that *S. ochreata* C.DC. represents the same species.

BETULACEAE

CARPINUS Linnaeus

CARPINUS LAXIFLORA (Sieb. et Zucc.) Blume var. **MACROSTACHYA** Oliv. in Hook. Ic. **20** (1891) *t. 1989*.

Kwangtung Province, Lung T'au Mountain, North River region, *Canton Christian College 12414* (Wulsin Expedition), June, 1924, local name *shan ap kung ts'ing*. The species in Japan, the variety in Hupeh and Szchuen Provinces, and if my identification is correct, also in Hainan.

No representative of the Betulaceae is recorded from Kwangtung Province by Dunn and Tutcher. What I take to be the same form as that recorded above has also been collected in Hainan, *McClure 9548, Chun 6590, 6726, 6755*. I also collected sterile material of an *Alnus* on Loh Fau Mountain.

BETULA Linnaeus

BETULA LUMINIFERA H. Winkl. in Engl. Pflanzenreich **19** (1904) 91.

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12354*, June 4, 1924. In forests, local name *chu yuk pi*.

The identification is by Mr. Rehder. The species was previously recorded from Hupeh, Szechuan, and Kweichow. The genus is new to Kwangtung Province.

FAGACEAE

CASTANOPSIS Spach

CASTANOPSIS HYSTRIX A.DC. in Journ. Bot. **1** (1863) 182.

Kwangtung Province, Kam Ngau Haang, *Canton Christian College 13617 F. A. McClure*, November, 1925. A tree 6 to 8 m. high on dry slopes, local names *yui tsai, chui tsai*.

Eastern Himalayan region and the Khasia Mountains to Burma, Yunnan, Szechuen, and Fukien Provinces, China, but not previously recorded from Kwangtung.

CASTANOPSIS CAUDATA Franch. in Nuov. Arch. Mus. Paris II **7** (1884) 87 (Pl. David. 277).

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12036, 12547*. (Wulsin Expedition), May and June, 1924, that the local names *ma mi so* and *chau shu*. Kiangsi, Anhwei, and Chekiang Provinces; new to Kwangtung.

ULMACEAE

APHANANTHE Planchon

APHANANTHE ASPERA (Thunb.) Planch. in DC. Prodr. **17** (1873) 208.

Prunus aspera Thunb. Fl. Jap. (1784) 201.

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12458* (Wulsin Expedition), June, 1924. In forests on the lower slopes of the mountain. Local name *tai ngau lak*.

No representative of the genus is credited to Kwangtung by Dunn and Tutcher* although Chung† records this species from the province. Japan and China, recorded from the provinces of Shantung, Kiangsu, Chekiang, Kiangsi, Hupeh, Szechuan, Kwangtung, and Yunnan.

CELTIS Linnaeus

CELTIS BIONDII Pamp. in Nuov. Giorn. Bot. Ital. n. s. **17** (1910) 252, *fig. 3*.

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12451* (Wulsin Expedition), June, 1924. A tree about 10 m. high, in forests, local name *sai hung ngau lak*. Kiangsi, Kiangsu, Szechuan, Chekiang and Anhwei Provinces, with varieties in Fukien, Yunnan and Kweichow, but not previously recorded from Kwangtung. This was identified by me as representing Pampanini's species, and Mr. Rehder concurs. It differs from the common *C. sinensis* Pers., in its longer pedicels and narrower nearly entire leaves.

NYMPHAEACEAE

NUPHAR Smith

NUPHAR MINIMUM (Willd.) Sm. Engl. Bot. (1790-1816) pl. 2292.

Nymphaea lutea Linn. var. *minima* Willd. Sp. Pl. **2** (1799) 1151.
Nuphar pumilum DC. Syst. **2** (1821) 61.

*Dunn S.T. and W.J. Tutcher. Flora of Kwangtung and Hongkong (China). Kew Bull. Add. Series **10** (1912) 1370.
†Chung H.H. A catalogue of trees and shrubs of China (1924) 32.

Anhwei Province, Tsi Chi, Wu Yuan, *R. C. Ching 4601, (Nanking Univ. 8989)*, Sept. 4, 1925. In streams at an altitude of about 700 m. Northern Europe across Asia to Manchuria, but hitherto not recorded from China. *Nuphar borneti* Lév. and Van. from Kweichau is so inadequately described that no intellegent disposition of it can be made from the description alone.

LAURACEAE

NEOLITSEA (Bentham) Merrill

NEOLITSEA AURATA (Hayata) comb. nov.

Litsea aurata Hayata Mater. Fl. Formosa (1911) 246.
Tetradenia aurata Hayata Ic. Pl. Formosanrum **3** (1913) 167, **5** (1915) 174, *fig. 61 c.*

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12519* (Wulsin Expedition). In forested ravines. Formosa.

The specimen has very immature fruits, and at least closely approximates Hayata's Formosan species, the leaves being larger then described and rather slenderly acuminate.

MACHILUS Ness

MACHILUS ICHANGENSIS Rehd. & Wils. in Sargent Pl. Wils. **2** (1916) 621.

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12261* (Wulsin Expedition). A tree about 12 m. high in forests.

This species has been recorded from Chekiang, Hupeh, Fukien, and Kwangtung Provinces, to which may be added Kiangsi *(Ip 1112)* and Anhwei *(Ling 7820)*. Other specimens, originally identified by me as *Machilus longifolia* Blume, are *Merrill 11297* Hang Chow, and *R. C. Ching 1806, 2368, 2467*, all from Chekiang Province.

PAPAVARACEAE

BOCCONIA Linnaeus

BOCCONIA CORDATA Willd. Sp. Pl. **2** (1799) 841.

Macleaya cordata R. Br. in App. Denh. and Clapp Trav. (1826) 218, in note.

Kwangtung Province, Lung T'au mountain, near Iu, North River region, *Canton Christian College 12602* (Wulsin Expedition), June, 1924. In ravines near streams.

This is recorded here merely as an additional genus and species to the Kwangtung flora. The species is common in central China.

HAMAMELIDACEAE

BUCKLANDIA R. Brown

BUCKLANDIA POPULNEA R. Br. in Wall. List (1832) no. 7414, Hook f. Fl. Brit. Ind. **2** (1878) 429.

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12180* (Wulsin Expedition), in forested ravines, local name *ma t'ai ling*; Kau Haang-Taai, Chun Wong Mountain, *McClure 13384*, in ravines, local name *ma t'ai fa shue*. India to Yunnan, southward to Sumatra and Java, although Hallier f. maintains the Malayan form as specifically distinct under the name *Bucklandia tricuspis* (Miq.) Hall. f.

This is a large eastward extension of range for the genus, its only other Chinese record being Yunnan on the basis of specimens collected by Henry.

SAXAFRAGACEAE

HYDRANGEA Linnaeus

HYDRANGEA PANICULATA Sieb. in Nov. Act. Acad. Leop. Carol. **14** (1829) 490.

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12173, 12631*, (Wulsin Expedition), May and July, 1924. In forested ravines, local name *pak fa tau*.

Recorded from Kiangsi, Fukien, Hunan, Kweichow, Chekiang and Anhwei provinces, and in Japan, but hitherto unknown from as far south as Kwangtung.

SCHIZOPHRAGMA Siebold et Zuccarini

SCHIZOPHRAGMA INTEGRIFOLIA Oliv. in Hook. Ic. **20** (1890) *pl. 1934*.

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12518* (Wulsin Expedition), June, 1924. A vine in forested ravines. Kiangsi, Hupeh, Szechuan, Hunan, and Kweichow Provinces, but no representative of the genus previously known from Kwangtung.

ROSACEAE

MALUS Linnaeus

MALUS FORMOSANA Kawakami in Bot. Mag. Tokyo **25** (1911) 145. *t. 4.* 1911.

Pirus formosana Kawakami et Koidzumi in Journ. Coll. Sci. Tokyo **30**[1]: 100. 1911 (Hayata, Materials Fl. Formosa 100).

Kiangsi, Lu Shan, *Steward 4704*, det. Rehder; Anhwei, Wang Shan, *Ling 7727;* Chekiang, Chen Chiong, *Ching 1784, 1789;* Kwangtung, Mung Haang, *McClure 13400*. April, 1925, here cultivated for its edible fruits, local name *shaan cha*. Formosa.

Not previously recorded from China. All the specimens cited above are in fruit, and differ slightly among themselves as well as slightly from Formosan material representing the typical form of the species.

SORBUS Linnaeus.

SORBUS CALONEURA (Stapf) Rehder in Sargent Pl. Wils. **2** (1915) 269.

Micromeles caloneura Stapf in Kew Bull. (1910) 192, Curtis's Bot. Mag. **136** (1910) *pl. 8335.*

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12413,* June 7, 1924, near the summit of the mountain. Local name *shan tong li.*

Previously reported from Hupeh and Szechuan. On first studying this material I was inclined to consider it an undescribed form, but Mr. Rehder identified it with Stapf's species.

RUBUS Linnaeus

RUBUS ASPER D. Don Prodr. Fl. Nepal. (1825) 234.

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12102* (Wulsin Expedition), May, 1924, with the local name *she p'au lak. McClure 12291* from Shaan Haang, with the local name *shaan p'o* is the same.

This species has been sunk as a synonym of *Rubus rosaefolius* Sm., but appears to be sufficiently distinct to warrant retaining it as a valid species. It is apparently of wide distribution in central and western China, as I have specimens from Chekiang, Fukien, and Kiangsi Provinces. India, Indo-China.

ROSA Linnaeus

ROSA GENTILIANA Lév. et Van. in Bull. Soc. Bot. France **55** (1908) 55.

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12171, 12437* (Wulsin Expedition), May and June, 1924, with the local names *ma han lak* and *shan yat yat hung.* Hupeh, Szechuan, Kweichow, Chekiang, and Fukien Provinces, but not hitherto recorded from Kwangtung.

PRUNUS Linnaeus

PRUNUS SALICINA Lindl. in Trans. Hort. Soc. **7** (1830) 239.

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12118* (Wulsin Expedition), May 26, 1924, cultivated. Identification by Mr. Rehder. Honan, Hunan, Hupeh, Szechuan, and Yunnan in China; India. More commonly known as *Prunus triflora* Roxb., which is a synonym of Lindley's species, the latter's specific name being the valid one.

LEGUMINOSAE

BAUHINIA Linnaeus

BAUHINIA HUPEANA Craib in Sargent Pl. Wils. **2** (1914) 89.

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12335* (Wulsin Expedition), June 3, 1924. In forested ravines; local name *pak mak t'ang.*

I originally referred this to Craib's species but later placed it under *Bauhinia glauca* Wall.; Mr. Rehder, however, identified it as *Bauhinia hupeana* Craib. Previously recorded from Hupeh and Szechuan.

ERYTHROXYLACEAE

ERYTHROXYLUM P. Browne

ERYTHROXYLUM KUNTHIANUM (Wall.) Kurz in Journ. As. Soc. Bengal **41**[2] (1872) 294, **43**[2] (1874) 135; Schulz in Pflanzenreich **29** (1907)160, *fig. 31.*

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12287, 12528* (Wulsin Expedition), May and June, 1924. In forested ravines, local name *man li muk.*

This species extends from the Khasia Mountains and eastern Bengal to Burma, Tenasserim, and Yunnan *(Henry 10695, 12048, 12849).* The Kwangtung specimens cited above differ from this species as described in their relatively stouter, shorter fruits, the largest I have seen (immature) being but 8 mm. in length (11 to 14 mm. in Schulz's description). Unfortunately there are no flowers on my material, and the styles are fallen from the immature fruits. The stipule characters are those of this species. The genus is new to Kwangtung Province.

The only other species hitherto recorded from China is *Erythroxylum monogynum* Roxb., currently credited to China on the basis of an unlocalized specimen collected by Beechey. There is probably an error either as to the identification or as to the region cited, "China," as Schulz confines the species to India and Ceylon.

RUTACEAE

CLAUSENA Burman f.

CLAUSENA DENTATA (Willd.) M. Roem. Syn. **1** (1846) 44.

Amyris dentata Willd. Sp. Pl. **2** 1 (1799) 337.
Clausena willdenovii Wight et Arn. Prodr. (1834) 96.

Kwangtung Province, near Fung Wan, North River region, *Canton Christian College 12880,* (Wulsin Expedition), July, 1924. India to western China and (?) Malaysia.

This species, as *Clausena willdenovii* Wight et Arn. has been reported from Yunnan. The Kwangtung specimen cited above agrees closely with the published descriptions and with Wight's figure which

apparently represents the typical glabrous form. Willdenow's specific name is unfortunate, the leaflets being crenate or crenulate rather than dentate.

POLYGALACEAE

POLYGALA Linnaeus

POLYGALA LONGIFOLIA Poir. in Lam. Encycl. **5** (1804) 501.

Polygala leptalea DC. Prodr. **1** (1824) 325.

Kwangtung Province, without locality, *Tsoong 1083.* India to Indo-China, through Malasiya to Australia. This has been recorded by Dunn from China on the basis of *Henry 11244,* but the locality is not indicated and I have not seen Henry's specimen.

ANACARDIACEAE

RHUS Linnaeus

RHUS DELAVAYI Franch. in Bull. Soc. Bot. France **33** (1886) 466.

Kwangtung Province, near Fung Wan, North River region, *Canton Christian College 12883* (Wulsin Expedition), July 15, 1924, det. Rehder. Previously recorded only from Szechuan and Yunnan Provinces.

RHUS SYLVESTRIS Sieb. et Zucc. Fl. Jap. Fam. Nat. **2** (1846) 32.

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12119* (Wulsin Expedition), May, 1924. On slopes, local name *ts'at tsz shu.*

A new record for Kwangtung Province, except for Engler's doubtful one "Canton (d'Yvan in herb. Deless.)?" Japan and Korea to Kiangsu, Chekiang, Kiangsi, Hupeh, and Fukien Provinces in China.

STAPHYLEACEAE

EUSCAPHIS Siebold and Zuccarini

EUSCAPHIS JAPONICA (Thunb.) Dipp. Handb. Laubholzk. **2** (1892) 480, *fig. 229.*

Sambucus japonica Thunb. Fl. Jap. (1784) 125.

Kwangtung Province, Lung T'au Mountain, near Iu and Yueng Uk, North River region, *Canton Christian College 12596, 12779,* (Wulsin Expedition), June and July, 1924. In forests near streams, local name *ts'at tai pak shu.*

Japan and Korea to Szechuan, Kweichow and Fukien, but not previously recorded from Kwangtung Province. Hayata, however, has described *Euscaphis konishii* Hay. from Hainan, although it is by no means certian that this Hainan form is specifically distinct from *E. japonica* Dipp.; I have seen no Hainan specimens.

SABIACEAE

MELIOSMA Blume

MELIOSMA SINENSIS Nakai in Journ. Arnold Arb. **5** (1924) 80.

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12256, 12572, 12673* (Wulsin Expedition), May to July, 1924. On forested slopes, local name *shan ts'at.*

Not previously recorded from Kwangtung Province. In making the preliminary identifications I referred this material to the closely allied *Meliosma oldhamii* Miq., but the specimens manifestly agree more closely with Nakai's species, if this is to be retained as distinct from *M. oldhamii* Miq.

VITACEAE

VITIS Linnaeus

VITIS PENTAGONA Diels and Gilg in Engl. Bot. Jahrb. **29** (1900) 460.

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12299* (Wulsin Expedition), May 31, 1924. In forested ravines.

The determination is by Mr. Rehder, the species being previously recorded from Kiangsi, Hupeh, and Yunnan. On first studying the material I was inclined to refer it to *Vitis lanata* Roxb., as recorded from Kwangtung Province by Dunn and Tutcher. Gagnepain,* however, confines Roxburgh's species to British India and states that the Kwangtung specimens referred to *Vitis lanata* Roxb. represent *Vitis retordi* Rom.

VITIS PIASEZKII Maxim. in Bull. Acad. Pétersb. **27** (1881) 461.

Kwangtung Province, Shiu chau, North River region, *Canton Christian College 12008* (Wulsin Expedition), July 21, 1924, in forests. Shensi, Honan, Hupeh, and Szechuan.

The determination is by Mr. Rehder who refers the Kwangtung specimen to the var. *pagnuccii* (Rom.) *(Vitis pagnuccii* Rom.) Gagnepain† reduces *Vitis pagnuccii* to *V. piasezkii* Maxim. as a straight synonym.

TETRASTIGMA Planchon

TETRASTIGMA OBTECTUM (Wall.) Planch. in DC. Monog. Phan. **5** (1887) 434.

Vitis obtecta Wall. List (1831-32) no. 6026.

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*Bull. Soc. Hist Nat. Autun **24** (1911) 30.
†Bull. Soc. Hist. Nat Autun **24** (1911) 29.

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12086* (Wulsin Expedition), May 24, 1924, local name *lat li tang.*

Not previously recorded from Kwangtung Province, the species extending from India to Indo-China to Yunnan, Kweichow, Hupeh, and Szechuen. The number cited apparently represents the typical form approaching var. *glabrum* Gagnep.

No. 12152 from the same locality was originally identified by me as also representing this species, which it rather closely resembles, but the leaves are constantly trifoliolate, while the inflorescences are compound and cymose, not simply umbellate. Unfortunately only very immature fruits are available.

PARTHENOCISSUS Planchon

PARTHENOCISSUS LAETEVIRENS Rehder in Mitt. Deutsch. Dendr. Ges. **21** (1912) 190, Pl. Wils. **1** (1913) 590.

Kwangtung Province, Hau T'ung Mountain, North River region, *Canton Christian College 12905* (Wulsin Expedition), July 16, 1924. Previously known from Hupeh, Szechuan, and Kweichow. Identification by Mr. Rehder.

ELAEOCARPACEAE

ELAEOCARPUS Linnaeus

ELAEOCARPUS YENTANGENSIS Hu in Journ. Arnold Arb. **5** (1924) 230.

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12262* (Wulsin Expedition), May, 1924. A tree in forests, local name *yeung shu fu.*

The specimen is just past the flowering stage, but agrees with a cotype of Hu's species in all essential characters. Previously known only from Kiangsi Province.

No. 12361 from the same locality possibly represents an undescribed species, but unfortunately the flowers are too young to warrant its further study at this time.

THEACEAE

ANNESLEA Wallich

ANNESLEA FRAGRANS Wall. List (1829) no. 598, *nomen nudum*, Pl. As. Rar. **1** (1830) 5. pl. 5.

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12238* (Wulsin Expedition), May, 1924. In forested ravines, local name *chuk tsit kwo.* Burma to the Malay Peninsula, Indo-China, and Formosa, but although recorded from China, by Dunn *(Henry 11591 c)* the locality not given; not previously recorded from Kwangtung Province.

FLACOURTIACEAE

IDESIA Maxim

IDESIA POLYCARPA Maxim. in Bull. Acad. Sci. St. Pétersb. III **10** (1866) 19. Hook. f. in Curtis' Bot. Mag. 111 (1885) pl. 6794.

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12495, 12591, 12611* (Wulsin Expedition), June, 1924. In ravines near streams, locally known as *ma lang shu.*

A considerable southern extention of its range in China proper, the genus being previously unknown in Kwangtung Province. The species extends from Japan and Korea to Formosa, and in China is now known from the Provinces of Chekiang, Kiangsi, Hupeh, Honan, Szechuan, and Yunnan.

BEGONIACEAE

BEGONIA Linnaeus

BEGONIA PEDATIFIDA H. Lecomte in Fedde Repert. **7** (1909) 21.

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12482* (Wulsin Expedition), in damp forests. Local name *shan hung in.*

A new record for Kwangtung Province, previously known from Kweichow, Szechuen, and Yunnan Provinces in China, and in Tonkin, French Indo-China.

LYTHRACEAE

LYTHRUM Linnaeus

LYTHRUM SALICARIA Linn. Sp.Pl. (1753) 446.

Kwangtung Province, near Fung Wan, North River Region *Canton Christian College 12828* (Wulsin Expedition), July, 1924. On rocky river banks.

This is a considerable southern extension of range, the species being widely distributed in central and northern China. The genus is new to Kwangtung Province.

NYSSACEAE

NYSSA Linnaeus

NYSSA SINENSIS Oliver in Hook. Ic. **20** (1891) pl. 1964; Wang. in Engl. Pflanzenreich **42**[2] (1910) 10.

Kwangtung Province, Ling T'au Mountain, near Iu, North River region, *Canton Christian College 21508, 12651* (Wulsin Expedition) June and July, 1924. In forests. Local names *tai shui li* and *shui to it li.*

The genus is new to Kwangtung Province, this being a considerable southward extension of range. Kiangsi, Anhwei Hupeh, Szechuan?, and Yunnan Provinces.

PIROLACEAE

MONOTROPA Linnaeus

MONOTROPA UNIFLORA Linn. Sp. Pl. (1753) 387.

Kwangtung Province, Cha Uen Shaan, Wai Chung Peng, North River region, *F. A. McClure 13792*, January, 1926.

Widely distributed in the North Temperate Zone, but from China hitherto recorded only from Hupeh Province, although it is doubtless of very wide distribution in the republic.

ERICACEAE

RHODODENDRON Linnaeus

PHODODENDRON HOULSTONII Hemsl. and Wils. in Kew Bull. (1910) 110.

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12667*, (Wulsin Expedition), July 5, 1924. In forested ravines. Identification by E. H. Wilson.

Rehder and Wilson, Pl. Wils. **1** (1913) 541, place this as a variety of *Rhododendron fortunei* Lindl., of Kiangsi; the species, or variety, here recorded from Kwangtung, was previously reported from Hupeh and Szechuan.

GAULTHERIA Kalm

GAULTHERIA CUMINGIANA Vidal Phan. Cuming. Philip. (1885) 184; Merr. Enum. Philip. Pl. **3** (1923) 246.

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12577* (Wulsin Expedition), June, 1924. On slopes and in ravines. Formosa and the Philippines (Luzon to Mindanao).

This species has hitherto not been recorded from China although it is common at higher altitudes in the Philippines and occurs in Formosa. It seems to me to be very doubtful if this should be retained as specifically distinct from the Indo-Malaysian *Gaultheria leucocarpa* Blume *(G. punctata* Blume*)*.

MYRSINACEAE

MYRSINE Linnaeus

MYRSINE MARGINATA Mez in Pflanzenreich **9** (1902) 338.

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 10273, 12570* (Wulsin Expedition), May and June, 1924. In forested ravines.

The type of this species was material collected by Faber "Prov. Kwang-Tung in den Ningpoo-Bergen," but the genus and species is not admitted by Dunn and Tutcher in their Flora of Kwangtung and Hongkong probably because the true locality is Ningpo, Chekiang Province; the specimens cited above agree closely with the description, the leaves however attaining a larger size than in the type, the largest being about 10 cm. long and 3 cm. wide.

ARDISIA Swartz

ARDISIA JAPONICA (Thunb.) Blume Bijdr. (1826) 690.

Kiangsi, Lu Shan, *Steward 4703;* Kiangsu, Bau Hwa Shan, *Steward 612;* Chekiang, Hangchow, *Steward 2898;* Anhwei. *Tsoong 1133*.

The specimens agree rather closely with each other and with the original description and figure of *Bladhia japonica* Thunb. The form figured by Mez, Pflanzenreich **9** (1902) 152, *fig. 23 A.-E*, at least as to the habit sketch is remote from Thunberg's species, presenting little in common with it. The habit sketch is manifestly taken from *plate 1892* of the Botanical Register supposed to represent *Ardisia odontophylla* Lindl. non Wall. Whether it represents *Ardisia odontophylla* Wall or not I cannot state, but it certainly does not represent *Ardisia japonica* (Thunb.) Blume.

SYMPLOCACEAE

SYMPLOCOS Jacquin

SYMPLOCOS MYRIANTHA Rehder in Sargent Pl. Wils. **2** (1916) 596.

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12264* (Wulsin Expedition), May, 1924. A tree 5 m. high in forests. Western Szechuan.

The specimen above cited is in fruit and is hence not directly comparable with *Wilson 2550*, the type of Rehder's species which is in flower. The leaves are proportionally somewhat longer and narrower than in the type, while the lateral nerves are more deeply impressed on the upper surface and are distinctly more elevated on the lower surface. Flowering material may show that the Kwangtung form is specifically distinct.

STYRACEAE

ALNIPHYLLUM Matsumura

ALNIPHYLLUM FORTUNEI (Hemsl.) Perk. in Pflanzenreich **30** (1907) 91. *fig. 14*.

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12255* (Wulsin Expedition), May 29, 1924. A tree about 8 m. high in forests. Local name *tung t'o*.

A species previously know from Fukien, Szechuan, Kweichow, and Yunnan Provinces, the species in this small genus are not clearly defined. *Alniphyllum pterospermum* Mats. is recorded from Kwangtung Province, but the specimen cited above, although in fruit, clearly represents *A. fortunei* Perk.

ASCLEPIADACEAE

PYCNOSTELMA Bunge

PYCNOSTELMA CHINENSE Bunge in DC. Prodr. **8** (1844) 512.

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12819* (Wulsin Expedition), July 11, 1924, without habitat notes but with the local name *liu tiu chuk*. Widely distributed in Japan and northern Asia (Manchuria to Dahuria) but hitherto not recorded from farther south than Hupeh Province. The genus is new to Kwangtung.

APOCYNACEAE

TRACHELOSPERMUM Lamaire

TRACHELOSPERMUM GRACILIPES Hook. f. Fl. Brit. Ind. **3** (1882) 668.

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12309* (Wulsin Expedition), June 3, 1924. In forests, flowers white. India to Japan (fide Hooker). Not previously recorded from Kwangtung Province.

The specimen cited apparently represents a variety or form of Hooker's species. The flowers are slightly smaller than in *T. gracilipes* Hook. f. var. *cavalerici* Schneider, but the vegetative characters conform closely and the tips of the anthers are somewhat exserted. Schneider's variety is recorded from Hupeh and Kweichow Provinces.

LABIATAE

ELSCHOLTZIA Willdenow

ELSCHOLTZIA CRISTATA Willd. Sp. Pl. **3** (1800) 29.

Kwangtung Province, Lung T'iu, *McClure 13145,* December 5, 1924. Along roadsides. India to Siberia and Japan naturalized in northern Europe, widely distributed in central and northern China, this record being a large southern extension of its known range. The genus is new to Kwangtung Province.

GESNERACEAE

TITANOTRICHUM Solerader

TITANOTRICHUM OLDHAMII (Hemsl.) Solerader in Ber. Deutsch. Bot. Gesellsch. **27** (Sept. 1909) 393, 400 ; Stapf in Hook. Ic. **30** (1911) *t. 2936.*

Rehmannia? oldhamii Hemsl. in Journ. Linn. Soc. Bot. **26** (1890) 194.
Matsumuria oldhamii Hemsl. in Kew Bull. (Nov. 1909) 361.

Fukien Province, Yenping, *H. H. Chung 2910,* August, 1924. In shaded ravines. The genus is new to China proper.

A duplicate of this was sent to Kew and was reported upon by Mr. Hutchinson as follows: "It agrees with the genus *Titanotrichum,* Solereder, figured in Hooker's Icones Plantarum *t. 2936.* It comes remarkably close to the only known species, *T. oldhamii* Solereder, hitherto recorded only from Formosa and is perhaps not distinghishable from that plant. It is very interesting to find the species in the province immediately opposite to the island."

A rather critical comparison of the specimen with the figure and descriptions, and with Formosa material *(Nakahara 124)* convinces me that this Fokien form is not specifically distinct from the Formosan one.

CONANDRON Siebold et Zuccarini

CONANDRON RAMONDIOIDES Sieb. et Zucc. in Abhandl. Akad. München **3** (1840) 730, *t. 3. f. 1* (Fl. Jap. Nat. **2**: 730.); Clarke in DC. Monog. Phan. **5** (1883) 61.

Anhwei Province, Wu Yuan, *R. C. Ching 8853,* August 16, 1925 on shaded water dripping cliffs at 800 m. altitude, common. The first record of this monotypic genus from China, it previously being known only from Japan and Formosa.

SCROPHULARIACEAE

VERONICA Linnaeus

VERONICA JAVANICA Blume. Bijdr (1826) 742.

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12012* (Wulsin Expedition), May 22, 1924. Northern India to the Riu Kiu Archipelago and Java, not hitherto recorded from China proper. The identification is by Mr. S. T. Dunn at Kew.

SCROPHULARIA Linnaeus

SCROPHULARIA NINGPOENSIS Hemsl. in Journ. Linn. Soc. Bot. **26** (1890) 178.

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12910* (Wulsin Expedition), July, 1924, with the local name *tai po she.*

No representative of the genus has hitherto been recorded from Kwangtung Province. The specimen conforms closely with the description, type from Ningpo, Chekiang Province, and with specimens from Anhwei and northern Fukien.

MELAMPYRUM Linnaeus

MELAMPYRUM ROSEUM Maxim. Prim. Fl. Amur. (1859) 210, 475.

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12415* (Wulsin Expedition), June, 1924. On grassy slopes.

The genus is new to Kwangtung Province, the species being of very wide distribution, extending from Japan and Korea to Manchuria, southward and westward to Chekiang and Yunnan.

COMPOSITAE

CONYZA Linnaeus

CONYZA VISCIDULA Wall. List (1831) no. 3006, *nomen nudum*, DC. Prodr. 5 (1836) 383.

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12440* (Wulsin Expedition), June, 1924, in ravines near villages. India to Formosa, through Malaysia to tropical Australia and New Caledonia, but not hitherto recorded from China.

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A FURTHER NOTE ON A COMMON CHINESE WATER-STRIDER

BY

WILLIAM E. HOFFMANN



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*Names arranged alphabetically.

A FURTHER NOTE ON A COMMON CHINESE WATER-STRIDER (Hemiptera, Gerridae)*

By WILLIAM E. HOFFMANN

Professor of Biology, Lingnan University, Canton, China.

In Volume III, Number 1 (pp. 48-63, Oct., 1925) of the *Lingnaam Agricultural Review* the writer gave an account of the life history and biology of one of the common Chinese water-striders. At that time the identity of the gerrid was unknown to the writer but in the meantime it has been identified for him through the kind services of Mr. W. E. China as *Gerris paludum* Fabr.

The writer recently received typed copies of three references to this species. These are here reproduced for the convenience of those who do not have access to the original references.

Gerris paludum Fabr. 1794.

Joh. Christ. Fabricii. Entomologia Systematica, Tome IV, p.188, 1794:

Niger subtus argentatus abdominis margine subferrugineo.
Habitat in Galliae aquis stagnantibus.

Affinis certe praecedenti at duplo fere major. Corpus totum supra striatum, nigrum, subtus, holofericeum, argenteum. Margo abdominis parum ferrugineus. Pedes quatuor postici elongati.

Douglas and Scott. The British Hemiptera, Vol. I, p. 559, gives the following:

Above brown-black; beneath blueish-gray. silvery in certain aspects slightly shining. *Head* with a whitish line at the sides. *Antennae* black; 1st joint almost as long as all the others together. *Pronotum* slightly widened to the hinder angles, the sides there raised into a dwarf, obtuse tubercle; disk nearly flat, with a fine central raised line; scutellar process convex; the under-curved sides of the middle region yellow. *Elytra* brown-black; nerves black; *Connexivum* narrowly yellow-brown on the margin, the long terminal spines reaching rather beyond the genital segments, directed upwards, the sides projecting at the base, the points slightly convergent.

Head long; sides with a whitish line; base with a short transverse yellow line going obliquely from the middle towards the middle of each eye. *Antennae* black; 1st joint almost as long as all the others together; 4th rather shorter than the 2nd. *Eyes* black, shining. *Ocelli* and *Rostrum* black.

Thorax.—Pronotum; anterior region flat, with a short, yellow, longitudinal line in front; middle region slightly widened to the hinder angles, sides sharply defined, at the hinder angles raised into a dwarf, obtuse tubercle; the under-curved margins with a yellow line of equal width throughout; disk slightly convex, finely crenate punctate, obscured by the pile, and with a fine central raised line; scutellar process convex, the margins narrowly flattened. *Elytra* brown-black, as long as the abdomen (sometimes abbreviated); nerves black, at the base with yellow hairs. *Sternum: Prosternum* depressed, yellow, with a fuscous shade in the middle; *Mesosternum* in front, between the coxae, with a narrow longitudinal channel, which is widened and shallow posteriorly; on the side of the coxal sheaths a silvery line; sides

*Contribution from the Biological Laboratory.

next the pronotum dull black, the colour divided into 2 lines by a silvery streak; sheath of the 2nd and 3rd pairs of coxae black above, pale yellowish beneath. *Legs*; 2nd pair slightly the longest; *coxae* black, the ends yellow-brown; *fulcra* yellow brown, blackish in the centre; *thighs* black above, gray-brown beneath; 1st pair slightly yellow at the base; 2nd pair shorter than the 3rd; *tibiae;* 2nd pair longer than the 3rd; *tarsi* 2nd pair, 1st joint 3 times longer than the 2nd; 3rd pair, 1st joint nearly twice as long as the 2nd.

Abdomen beneath, in the middle almost keeled, the sides of each segment, except the last, on the posterior margin, with a short silvery streak or spot; the posterior margin of the 6th segment in the ♂ with a somewhat right-angled excision; in the ♀ only slightly concave; *Connexivum* on the margin narrowly yellow-brown; the terminal spine black, directed obliquely upwards, subequal in thickness throughout, outwardly convex, inwardly concave, reaching rather beyond the genital segments in both sexes; in the ♀ a little curved outwards at the base, but converging at the apex, which is suddenly acute. *Genital segments* beneath ; in the ♂, the 1st with a tubercle; 2nd long, semioval; 3rd short, rounded; in the ♀, the 1st yellow-brown, subtrapezoidal, the base convex; the sides much compressed, hollow, with a subangulated prominence near each basal angle; 2nd black, semioval.

Length, 5¾—6½ lines.

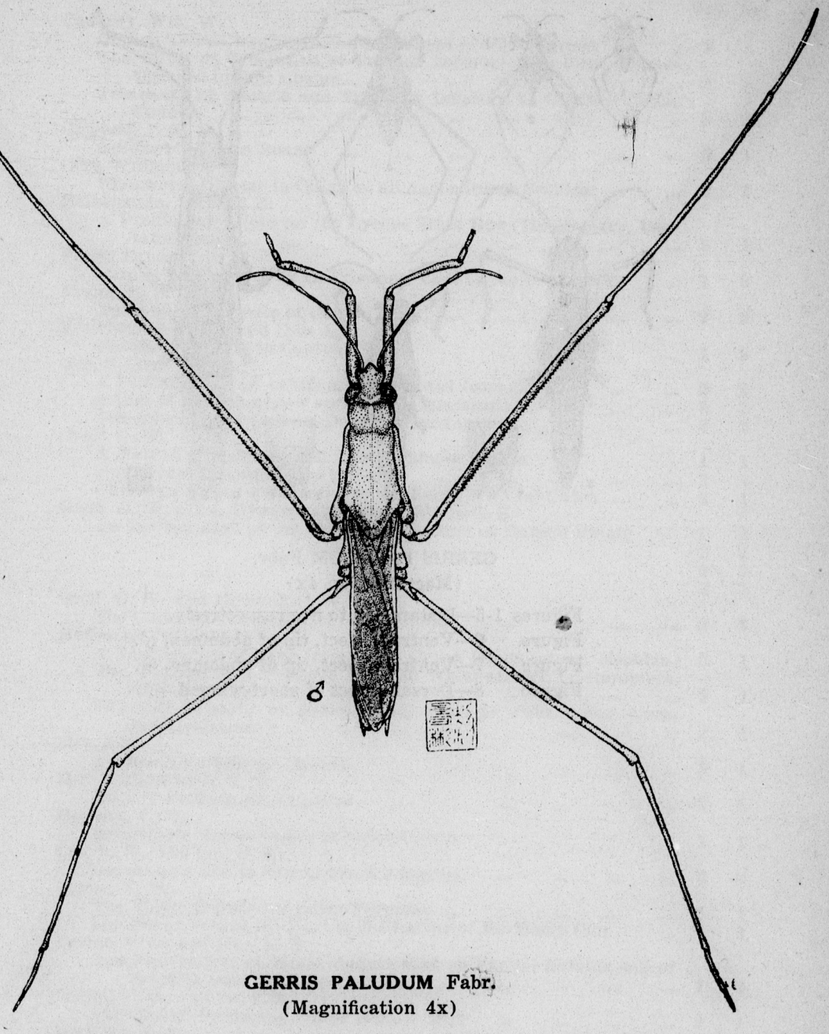
Distant, Fauna British India. Rhynchota, Vol.II, P. 180:

Black, opaque; body beneath silvery-grey, pubescent; base of rostrum, coxae, trochanters and extreme bases of femora very pale fulvous; pronotum with a strong central longitudinal carinate line; hemelytra with the veins very strong and prominent; legs fuscous; antennae with the basal joint very long, about as long as the other three joints taken together.

Length 12-13 millim.

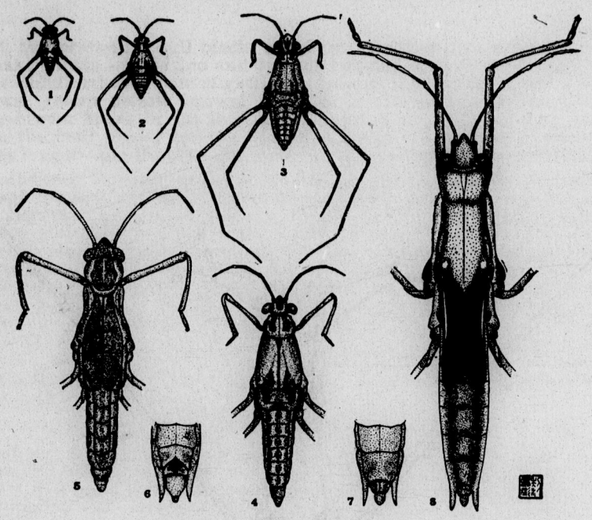
E.A. Butler in his "A Biology of The British Hemiptera-Heteroptera" pp. 246 & 247 (London 1923) discusses this species. In regard to the wings he says, "It is always fully winged, at least, in Britain; Puton says that examples have been found in France with the hemielytra extending only half-way down the abdomen." In China, as pointed our before, short-winged forms are commonly taken and sometimes all of the specimens collected at one time in a given habitat are brachypterous. Concerning distribution Mr. Butler says *G. paludum* is not so widely spread as *G. rufoscutellatus* Latr., although much commoner in Britain. "It occurs over Northern and Central Europe; it also passes into Turkestan and Siberia."

The writer has often witnessed an interesting performance staged by these gerrids and a common species of dragon fly. The dragon fly alights upon a stick or pole projecting a few inches out of the water while water-striders come from all directions and vie with each other for a position nearest the prospective victim. They drive one another away in order to better their own position and often leap into the air in an attempt to reach the dragon fly. Every few minutes the dragon fly leaves its perch, flies for a short distance (flying very low) and returns. As the dragon fly flies away the gerrids scatter, skating in the same direction; when it returns to its perch, they also return and the whole performance is repeated. It may be that the presence of great numbers of the gerrids annoys the dragon fly and that the periodic flights are an attempt to evade them; on the other hand it appears very much as though our aerial friend was having a bit of sport at their expense.



GERRIS PALUDUM Fabr.
(Magnification 4x)

Dorsal aspect of long-winged male; characteristic position when at rest upon the surface of the water.



GERRIS PALUDUM Fabr.
(Magnification 4x)

Figures 1-5—Instars one to five respectively.
Figure 6—Ventral aspect, tip of abdomen, ♂.
Figure 7—Ventral aspect, tip of abdomen, ♀.
Figure 8—Dorsal aspect of short-winged ♀.

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CHARLES FULLER BAKER

BY

WILLIAM E. HOFFMANN



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THE LINGNAAM AGRICULTURAL REVIEW

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WILLIAM E. HOFFMANN, M.A., Editor.

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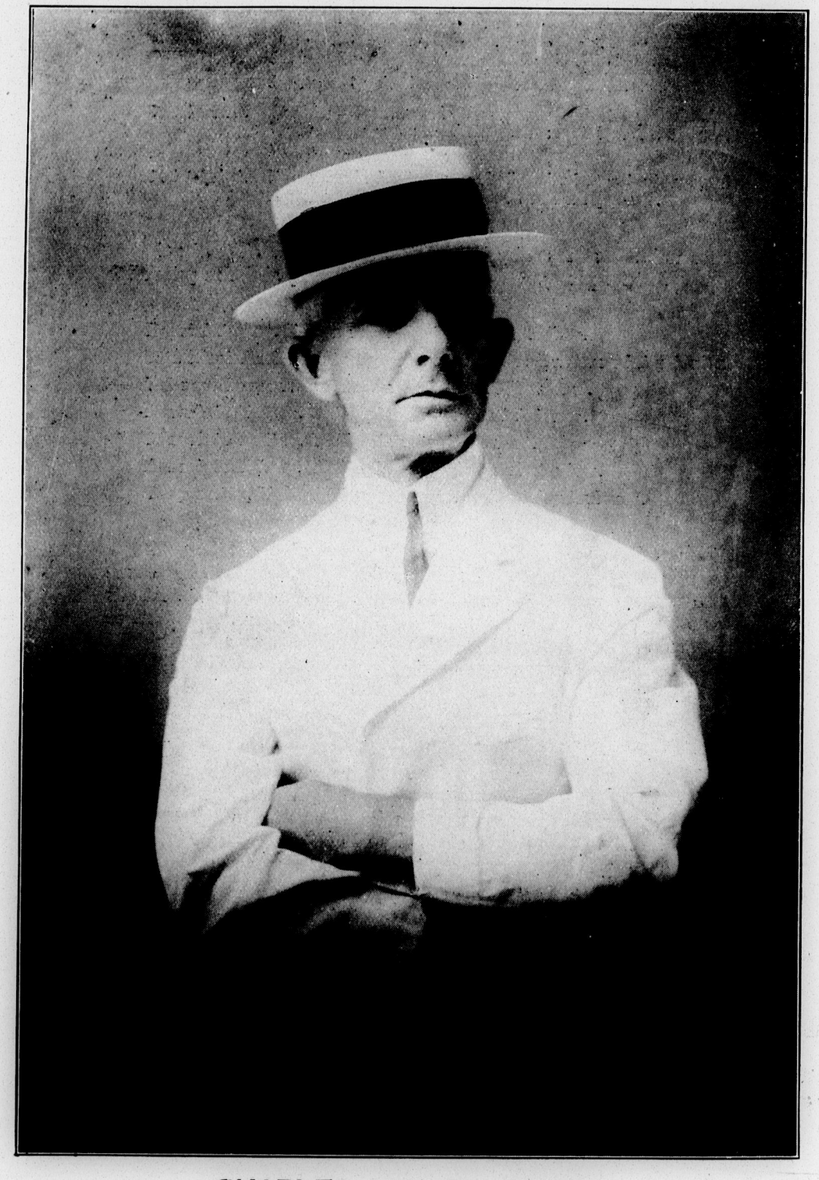

CHARLES FULLER BAKER

CHARLES FULLER BAKER

(PORTRAIT, PLATE XVIII)

On the twenty-second of July the Orient lost a distinguished scientist and educator, Dean Charles Fuller Baker. His death was caused by chronic dysentery. He had been in poor health for several years. Funeral services were held July 24, one service in the morning at the College of Agriculture of the University of the Philippines at Los Banos, the other in the afternoon at the Union Church in Manila.

Dean Baker was born in Lansing Michigan on March 22, 1872. He was of English ancestry, the son of Major Joseph Stannard Baker and Alice Potter Baker, and the brother of Ray Stannard Baker, noted magazine writer and publicist. He received the degree of Bachelor of Science from the Michigan Agricultural College in 1892 and his Master of Arts degree from Stanford University in 1903. He was married in 1894 to Ninette Evans of Fort Collins, Colorado.

During the thirty-six years of his professional activity Dean Baker held the following positions:

1891-1892.	Laboratory Assistant in the Michigan Agricultural College.
1893.	In charge, Colorado Forestry and Zoology exhibit, Columbian Exposition.
1892-1897.	Laboratory Assistant in the Colorado Agricultural College, principally field control of pests and diseases.
1897-1899.	Biologist to the Alabama Polytechnic Institute and Experiment Station.
1899-1901.	Head Teacher of Biology, Central High School, St. Louis.
1903-1904.	Assistant Professor of Biology, Pomona College, California.
1904-1907.	Chief, Department of Botany, Estacion Agronomica de Cuba, in charge plant breeding, acclimatization, forestry—Investigations and Botanical Survey.
1907-1908.	Curator, Botanic Gardens and Herbarium, Museum Gaeldi, Para, Brazil.
1908.	Director-elect, Campo de Cultura Experimental Paraense.
1908-1912.	Associate Professor and Professor of biology, Pomona College, California.
1910.	Founder of Laguna Marine Laboratory, California (Summer Vacation Activity).

1912-1918. Professor of Tropical Agronomy, College of Agriculture, University of the Philippines.

1917. Assistant Director, Botanic Gardens, Singapore (Vicarius war Service). (Appointed Dean, College of Agriculture, University of the Philippines, September 27, 1917).

1918-1919. Acting Dean and Professor of Tropical Agriculture, University of the Philippines (did not accept Dean-ship when first offered).

1919-1927. Dean and Professor of Tropical Agriculture, College of Agriculture, University of the Philippines.

During his residence in the Philippines Dean Baker served in the following subsidiary, advisory, and consultory capacities:

Special Agent, Bureau of Non-Christian Tribes.
Technical Assistant to the Director of the Bureau of Agriculture.
Tobacco Inspector, Bureau of Internal Revenue.
Associate Editor, Philippine Journal of Science.
Associate Editor, Philippine Agriculturist.
Associate Editor, Philippine Agricultural Review.
Cooperator, United States Department of Agriculture.

Dean Baker conducted or took part in many field expeditions and surveys, largely through private enterprise. In 1897-8 he accompanied the H. H. Smith Exploring Expedition into the mountains of Colombia as the botanist of the party. He had also been on expeditions to Cuba, Nicaragua, Brazil and Malaya, as well as the main islands of the Philippine group. In the United States he had conducted field explorations in southern Illinois, Wisconsin, Colorado, New Mexico, Nevada, and California.

The most important work of a survey nature was his *Malayan Entomological and Mycological Survey*, consisting of comprehensive field work carried on during the decade and a half that he lived in the Orient. This work was carried on in all the larger islands of the Philippines and extended to North Borneo, Singapore, and Penang. Dean Baker had secured the effective cooperation of 115 of the best specialists in the world to work up the several taxonomic groups.

Over 400 important scientific papers have already been contributed by these workers and many others are in preparation. Contributions based on the materials collected by Dean Baker will be coming out at a steady rate for many years to come. Many hundreds of thousands of specimens have been collected, sorted, and shipped to specialists, all at personal expense and on extra-official time.

Dean Baker made many direct contributions to museum development. Some of those known to the writer are as follows:

1. In 1899 he presented to the United States National Museum a collection of American Hemiptera and Hymenoptera, including some 60,000 specimens.
2. In 1912 he presented to Pomona College a collection of American insects, including some 75,000 specimens and a herbarium of about 200,000 sheets, as well as a considerable biological library.
3. In 1921 he made a gift to the department of pathology of the College of Agriculture of the University of the Philippines of a collection of Malayan Fungi of some 15,000 specimens.
4. In 1922 he gave to the department of botany, College of Agriculture, University of the Philippines, an herbarium of Malayan plants of about 5,000 sheets.
5. Numerous lesser contributions to many institutions including a donation of Coleoptera of Para to the Hamburg Museum.

In addition to these collections, oriental material (mycological and entomological) has been placed in the hands of the hundred and more specialists to the extent of several hundred thousand specimens, while the specimens in the present *Baker Collection* probably run well above a quarter million in number.

A very significant fact about this great oriental collection is that it has been made and cared for exclusively by private enterprise and the consistent utilization of extra-official time and opportunity. The creed of the late dean according to a colleague was that gigantic tasks may be accomplished by the utilization of odd moments.

According to the terms of the will of the late dean, drawn up several years ago, his entire collection of insects (1,459 boxes), his manuscripts and indices, and his correspondence are to go to the Smithsonian Institution, which institution agreed to send out a man from America to properly pack and ship the collection. Characteristic of the dean's foresight and thoroughness a special sealed envelope, containing instructions to the packer, was left among his effects.

The miscellaneous collections such as mollusca, fungi, etc., according to the will are to go to the College of Agriculture of the University of the Philippines as does also his biological library. His collecting paraphenalia and work instruments and also alcoholic specimens are to go to Dr. L. B. Uichanco of the department of entomology of the College of Agriculture, University of the Philippines.

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A very important part of the dean's collection is his *Bibliography of Indo-Malayan Entomology*, which consists of two large stacks of manuscript and 35 trays of 3 by 5 cards. These cards probably number somewhere in the neighborhood of 100,000, each card bearing from one to three entries in his own handwriting.

Dean Baker's very high standing in the museum world is attested by the fact that when several years ago he decided to leave the Philippines because of poor health he sent a circular letter to several individuals and institutions in which he stated that he was in a position to consider a position in a less enervating climate, and as a result of this letter several attractive positions were offered to him. In this connection it is of interest to relate a recommendation which was once given concerning Dean Baker. It said, "If you have an impossible position in an impossible place, get Baker."

The Philippines would soon have lost Dean Baker, temporarily at least, even if his untimely death had not occurred for he had tendered his resignation, effective November 30, 1927. At this time he was to have become Dean Emeritus, and Director Emeritus of the College Experiment Station, according to action taken by the Board of Regents of the University.

The new position to which Dean Baker was called was that of scientific head of an *Entomological Survey of the Pacific*, a project planned by a group in Hawaii (See *Science* for June 10, 1927) and supported in part by the Bishop Museum and the Hawaiian Sugar Planters Association.

Dean Baker (before being appointed dean he was always known as "Dr. Baker") was very much loved in the Philippines where he was one of the builders of the College of Agriculture of the University of the Philippines, a beautiful and efficient plant developed from a jungle during the short period from 1909.

The high esteem in which Docter Baker was held was everywhere voiced. We quote below a few of the many statements made.

Acting President Jorge Bocobo of the University of the Philippines said:

I feel a deep sense of personal loss over the death of Dean Charles F. Baker who was a very dear friend of mine. These many years I have admired his high ideals of service, his enthusiasm for scientific research. He was one of the founders of the Agricultural College at Los Banos, facing all manner of difficulties attendant upon his pioneering tasks. For fifteen years he devoted his utmost to the growth of the college whose standards he and his co-workers have greatly elevated.

His death is an irreparable loss to the University of the Philippines, to scientific agriculture in the Islands, and to science in general. His researches on botany, entomology, and tropical agriculture are known all over the world. His faculty and students at Los Banos loved him, for he always inspired them to give of their best to their allotted work.

Dr. William H. Brown, Director of the Bureau of Science, said:

Dean Baker meant much to the Philippine Islands. Money could not have hired a man to do the work he has done, and which he did for pleasure. I understand that he worked consistently every night on his collections after he had worked all day at the agricultural college. Men of his caliber are always better known [and better appreciated] in other parts of the world than they are at home.

Professor Emma S. Yule, head of the Department of English at the College of Agriculture, spoke of Docter Baker as a man of many facets and said, "There is no one like the Dean." She said:

Dean Baker was the most inspiring force I have ever known. It was, indeed, a sluggish lump which he could not fire with a zeal to do-or to make an effort, at least. This force plus his own unparalleled energy and industry directed by unusual mentality made him a tremendous power in achievement as an educator, a citizen, as well as in his special field. Life had hit Dean Baker hard at times, bodily pain had long been his constant companion, yet his friends and colleagues will always see his gay and humorous smile, hear his spontaneous laugh. He met life with so gallant a spirit. 'Such a man might be a copy to these younger times.'

Dean Baker belonged to the following scientific associations and societies: American Association for the Advancement of Science (fellow), American Association of Economic Entomologists, Entomological Society of America, Entomological Society of Washington, New York Entomological Society, Southern California Academy of Sciences, Hawaiian Academy of Sciences, Linnean Society, Lyon, Entomological Society of France, Entomological Society of Italy, Deutsche Entomologische Gesellschaft, Entomogical Society of Belgium. He was listed in *American Men of Science* and *Who's Who in America*.

Dean Baker was very active in the field of scientific publication. He edited "Invertebrata Pacifica," First Report Laguna Marine Laboratory, Exsiccati of West American Plants (through many years), Fungi Malayana (Exsiccati), Pomona Journal Economic Entomology, Pomona Journal Economic Botany, served as Associate Editor of The Philippine Journal of Science, The Philippine Agricultural Review, and the Philippine Agriculturist. He was author of many papers on botanical, entomological and tropical agricultural subjects and we hope to include a list of them in a later issue.

In the field of taxonomy Dean Baker specialized in the following groups: Braconidae (part), Cercopoidea (part), Machaerotidae, Jassoidea, Fulgoridae s. str., Lophopidae, Issidae, Tettigometridae, and Trophiduchidae.

Dean Baker always lived simply and for many years before his death he lived in a *Swali* house in which was his personal laboratory and storage rooms for his collections. For the last eight years he gave half of his salary to fellow-scientists in Europe who had been reduced to poverty as a result of the war. His whole career was one of loyalty to his work and service to mankind. While his contributions to science through scientific research are well known his ability as a teacher was of no less importance. It is said of him that he often took students who were thought incapable of learning and made of them worthy scholars.

At the funeral services, the memmorial service, in the press and in conversations only the highest tributes were paid to the late dean. "Dean Charles F. Baker was one of the best gifts of America to the Philippines" said Rev. Orwyn E. Cook in the funeral address in which he characterized the dean as a scientist who poured out his being in sacrifice for the advancement of science and a man possessed of a brilliant mind and a great soul. In expressing regret that Dean Baker should die when he hardly had passed middle age, Reverend Cook called attention to the fact that he put as much into every day as most persons put into two, and in fact accomplished far more in a relatively short life than most persons accomplish in a much longer one. It might be pointed out in this connection that Dean Baker had not been out of the tropics for fifteen years and had taken no real vacation during that period. His vacation leave from College was spent in arduous investigational trips in the Philippines for the College or for the Philippine Government in connection with Agriculture, or in intensified work in his own laboratory. His life was "Without haste, but without rest."

WILLIAM E. HOFFMANN.

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FURTHER NOTE ON PERSIMMONS IN KWANGTUNG

BY

F. A. McCLURE



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*Names arranged alphabetically.

FURTHER NOTE ON PERSIMMONS IN KWANGTUNG*

By F. A. MC CLURE

Agricultural Explorer, U. S. D. A., Assistant Professor of Botany, Lingnan University, Canton, China.

In a paper on persimmons in Kwangtung which appeared in a recent number of the Lingnaam Agricultural Review (Vol. 3, No. 2) the writer called attention to the fact that the persimmon, *Diospyros kaki* L., is said to occur spontaneously in northern Kwangtung. A fruiting branch oft his wild form was figured (Lingnan Herb. No. 12785) but the exact locality of its occurrence was not known. The writer has since had an opportunity to visit the region in question and was able to locate the source of the specimens seen and to confirm the fact that the plants are wild. Some fruits were found on the trees at Leng Pui (嶺背) near Yeung Uk (揚屋) in the immediate vicinity of Dragon Head Mountain, (Lung T'au Shan 龍頭山), as late as the fourteenth of January (1926). They are orange-red in color, round to slightly oblong in shape, and uniformly small, not exceeding 3.25 cm. in diameter. The point of attachment of the stem to the fruit is elevated and not depressed as it is in most cultivated varieties of *Diospyros kaki*. This is somewhat overemphasized in the illustration (Fig. 16) of this fruit in the above-mentioned paper, owing to the fact that the specimen used was a slightly immature one, dried as an herbarium specimen. The tree is said to attain a height of at least 7 meters where it is allowed to develop undisturbed, but most of the trees seen were small, rarely exceeding 4 m. in height, due to the periodic cutting over of the hillsides.

The question arises as to whether or not this may be an escape from cultivation. A number of points may be observed which seem to indicate clearly that the tree is native to this region. In the first place, it is rather common in this particular locality. In the second place, the fruits are uniformly small and seedy, and of a uniform shape, which would scarcely be the case were the trees to have come from the seeds of cultivated varieties. Further, persimmons are not cultivated in the immediate region in which the wild form was observed.

Another form, possibly a distinct species, was seen. Neither flowers nor fruits were available, but the persistent pubescence of the mature leaves, and the curious scaling off of large patches of the bark of the trunk, leaving light grey, sometimes almost white, areas, are characteristic.

*Contribution from the Biological Laboratory.

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