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**EGG AND NYMPHAL PARASITES OF RICE LEAFHOPPERS AND
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IN TAIWAN IN 1979 (PART 1)^{1) 2) 3)}**

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Abstract

Results of field studies on egg parasites of rice leaf- and planthoppers made in Taiwan in 1979 are presented. *Anagrus optabilis* was reared from the eggs of *Sogatella furcifera*, *Paracentrobia andoi* and *Anagrus optabilis* from *Nilaparvata lugens*, *Anagrus optabilis* and *Oligosita* sp. from *Laodelphax striatellus*, and *Paracentrobia andoi* and *Gonatocerus* sp. from the *Nephotettix cincticeps* complex. The egg densities of these rice hoppers and the percentage parasitisms of these parasitic wasps are discussed.

This paper reports one of the results of our field studies on the natural enemies of rice leafhoppers and planthoppers made in Taiwan from August to November, 1979 (Hirashima, 1981). Only the egg parasites of rice leaf- and planthoppers are dealt with in the present report (Part 1).

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Material and Methods

Egg and nymphal parasites of the rice leaf- and planthoppers were sampled by the following methods.

(1) Method I. Hill cutting

Ten hills of rice were chosen at random in one paddy field. These hills were cut at the water level or just above the soil when there was no water in the field. Number of stalks of each rice hill was used as a crop situation index. Examinations of eggs of rice hoppers were made on these material. It should be noted here that the smaller brown planthopper, *Laodelphax striatellus*, oviposites not only on stalks but also on leaves (along veins) when its population becomes denser. An egg-mass of rice hoppers was kept in a small glass tube for rearing egg-parasites for two weeks (cf. Miura et al., 1979, p. 23, Fig. 1). It is very probable that the period of two weeks is more than enough to rear the egg parasites at room temperature. The emerged parasites were put in alcohol (75 %) and brought back to Japan for further examination.

(2) Method II

Method IIA: Sweeping in a paddy field

Sweeping was employed for collecting adults of parasites and their hosts together with other paddy insects and spiders, by using a 42×80 cm insect net with a handle of 90 cm in length. Forty sweeps were made for one unit. Three units of sweepings were made for one paddy field, one at the center and two at the periphery.

Method IIB: Sweeping on the ridge of the paddy field

One unit of sweeping was made in order to collect rice hoppers and their parasites from weeds on the ridge of the paddy field.

AREAS SURVEYED

From August 9 to September 23, 1979, 23 localities were visited and investigations were made for 25 paddy fields, as shown in Fig. 1 and Table 1.

Paddy plants at Taichung, Nantou, Yunlin and many other localities in Chiai Pref.

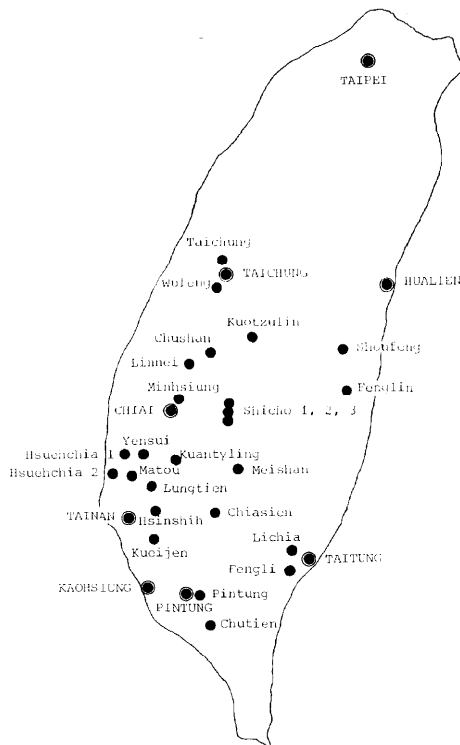


Fig. 1. Map of Taiwan showing the location of areas surveyed.

were in the vegetative stage, while those in Linnei (Yunlin Pref.) were in the flowering stage. Paddy fields (1)–(3) at Shicho (Chiai Pref.) were found at the elevation of 1,400 m. At Taichung District Agricultural Improvement Station, Taichung, surveys were made on the paddy of the japonica variety. In Tainan Pref., paddy was found to be in the flowering (75 %) and ripening (25 %) stages of growth. At Meishan (Kaohsiung Pref.), about 864 m above the sea level, paddy was in the vegetative stage. Severe damage of paddy by the brown planthopper was noticed in Chutien and Pintung, southern Taiwan. Paddy was found to be in the ripening stage there. In eastern Taiwan, paddy at Taitung and 4 localities in Hualien Pref. was in the vegetative stage,

Results

I. EGG PARASITES OF RICE LEAFHOPPERS AND PLANTHOPPERS

1. Egg-density of the hoppers

Fig. 2 shows the number of eggs of 5 species of rice hoppers per hill of rice collected from 23 localities (25 paddy fields). The figure was calculated from the results of samplings by the method I.

(a) *Sogatella furcifera*, the white-backed planthopper

Eggs of the white-backed planthopper were collected from 15 localities (15 paddy fields). Total number of egg-masses was 148, and that of individual eggs was 948. The average number of egg-masses and that of individual eggs per hill of rice was 0.99 and 6.32, respectively.

Table 1. Field study areas, dates and sampling methods employed.

Prefecture	Locality	Date	Growth stage of rice	No. of stems per hill of rice	Sampling method		
					I	II	
					A	B	
Taichung	Taichung	Aug. 13	Re*	27.2	0	0	0
	Wufeng	11	Ve*	25.0	0	0	—
Nantou	Kuotzulin	19	Ve	18.0	0	0	0
	Chushan	22	Ve	24.6	0	0	
Yunlin	Linnei	27	Re	18.2	0	0	0
Chiai	Min hsiung	25	Ve	18.2	0	0	
	Shicho (1)	Sep. 1	Ve	13.4	0	0	0
Tainan	Shicho (2)	1	Ve	13.3	0	0	0
	Shicho (3)	1	Ve	13.4	0	0	0
	Yensui	5	Re	12.8	0	0	0
	Hsuehchia (1)	5	Re	22.6	0	0	0
	Hsuehchia (2)	11	Ri*	13.8	0	0	0
	Matou	Aug. 26	Re	22.6	0	0	—
	Kuantyiling	28	Re	13.6	0	0	0
	Lungtien	26	Re	17.6	0	0	—
Kaohsiung	Hsinshih	Sep. 11	Ri	16.4	0	0	—
	Kueijen	12	Re	15.4	0	0	0
	Meishan	8	Ve	14.5	0	0	0
	Chiasien	10	Re	20.2	0	0	0
Pintung	Chutien	15	Ri	17.2	0	0	0
	Pintung	15	Ri	26.8	○	○	○
Taitung	Fengli	19	Ve	12.8	0	0	○
	Lichia	19	Ve	22.6	0	0	0
Hualie n	Fenglin	22	Ve	18.2	0	0	0
	Shoufeng	22	Ve	18.1	0	0	0

* Ve: Vegetative stage. Re: Reproductive (or flowering) stage, Ri: Ripening stage.

The densities of eggs of the white-backed planthopper were observed to be high at Kueijen (Tainan Pref.), Hsuehchia (1) (Tainan Pref.), Linnei (Yunlin Pref.) and Fengli (Taitung Pref.), moderate at Matou (Tainan Pref.), Lungtien (Tainan Pref.), Pintung (Pintung Pref.), Lichia (Taitung Pref.), Fenglin (Hualien Pref.) and Shoufeng (Hualien Pref.), and low at Shicho (3) (Chiai Pref.), Yensui (Tainan Pref.), Hsuehchia (2) (Tainan Pref.) and Meishan (Kaohsiung Pref.), while none of egg of this species was found at Taichung (Taichung Pref.), Wufeng (Taichung Pref.), Kuotzulin (Nantou Pref.), Chushan (Nantou Pref.), Minhsiung (Chiai Pref.), Shicho (1) and (2) (Chiai Pref.), Kuantyiling (Tainan Pref.), Hsinshih (Tainan Pref.) and Chutien (Pintung Pref.).

(b) *Nilaparvata lugens*, the brown planthopper

Eggs of the brown planthopper were detected from 11 localities (11 paddy fields). There were 323 egg-masses and 2,573 individual eggs. Thus, the average numbers of egg-masses and individual eggs per hill of rice were 2.94 and 23.39, respectively.

The densities of eggs of the brown planthopper were found to be high at Hsuehchia (1) and (2), Hsinshih, Kueijen, Meishan and Pintung. moderate at Linnei, Yensui and

Chiasien (Kaohsiung Pref.), and low at Lungtien and Lichia, while no eggs of this species were found at Taichung, Wufeng, Kuotzulin, Chushan, Minhsiung, Shicho (1), (2) and (3), Matou, Kuantyling, Chutien, Fengli, Fenglin and Shoufeng.

(c) *Laodelphax striatellus*, the smaller brown planthopper

Eggs of the smaller brown planthopper were collected from 15 localities (15 paddy fields). Altogether there were 1,822 egg-masses containing 10,719 individual eggs. Thus, the average numbers of egg-masses and individual eggs per hill of rice were 12.5 and 71.46, respectively.

The densities of eggs of the smaller brown planthopper were found to be high at Taichung, Linnei, Yensui, Hsuehchia (1) and (2), Hsinshih, Kueijen, Meishan, Chiasien, Chutien and Pintung, medium at Shicho (3), Matou and Lichia, and low at Shicho (1). On the other hand, not a single egg was detected at Wufeng, Kuotzulin, Chushan, Minhsiung, Shicho (2), Kuantyling, Chutien, Fengli, Fenglin and Shoufeng.

(d) *Nephotettix* spp., the green rice leafhoppers

Three species of *Nephotettix*, i. e., *N. cincticeps* (Uhler), *N. virescens* (Distant) (= *N. impicticeps* Ishihara, 1964) and *N. nigropictus* (Stål) (= *N. apicalis* Motschulsky *sensu* Ishihara, 1964), are found in Taiwan. According to Chen (1972), *N. cincticeps* commonly occurs throughout Taiwan but *N. virescens* sparsely occurs in Kaohsiung Pref. (southern Taiwan) and Pintung Pref. (eastern Taiwan) only, while *N. nigropictus* is found in low density at Taichung, Nantou, Changhua (central Taiwan), Yunlin, Chiayi, Tainan, Kaohsiung, Pintung (southern Taiwan), Taitung and Hualien Pref. (eastern Taiwan).

Based on the data presented by Chen (1972), the following fact is made clear.

In 1970, the rate of occurrence of the three species, from June to July (1st cropping of rice) was 88.89 % for *cincticeps*, 0.31 % for *virescens* and 10.81 % for *nigropictus*, while from October to December (2nd cropping) it was 86.13 % for *cincticeps*, 0.16 % for *virescens* and 10.81 % for *nigropictus*.

Table 2. Summary of samplings of eggs of *Sogatella furcifera* by the method I.

Locality	Date	No. of egg masses found	No. of eggs found	Parasite species	No. of prtzd [†] egg masses	% parasitism	No. of prtzd [†] eggs	% parasitism
Linnei	Aug. 27	16	180	A"	7	43.75	48	26.67
Shicho(3)	Sep. 1	2	10		—	—	—	—
Yensui	Sep. 5	2	8		—	—	—	—
Hsuehchia(1)	Sep. 5	17	131	A	7	41.18	31	23.66
Hsuehchia(2)	Sep. 11	1	8		—	—	—	—
Matou	Aug. 26	5	38	A	5	100	15	39.47
Lungtien	Aug. 26	12	46	A	10	83.33	26	56.52
Kueijen	Sep. 12	33	208	A	7	21.21	29	13.94
Meishan	Sep. 8	1	6	—	—	—	—	—
Chiasien	Sep. 10	2	10	—	—	—	—	—
Pintung	Sep. 15	4	28	A	4	100	28	100
Fengli	Sep. 19	28	146	A	4	14.29	11	7.53
Lichia	Sep. 19	8	45			—	—	—
Fenglin	Sep. 22	5	25	A	1	20.00	1	4.00
Shoufeng	Sep. 22	12	59	A	4	33.33	8	13.56

* *Anagrus optabilis*.

† prtzd = parasitized.

It is noted from the above record that *N.cincticeps* is by far common in Taiwan. Eggs of the three rice green leafhoppers are not distinguishable morphologically. The younger nymphs of these species are also very similar to each other, so that no attempt was made to separate them in this study.

We collected the eggs of the green rice leafhoppers from 8 localities (8 paddy fields). Total numbers of egg-masses and individual eggs were 44 and 664, respectively. Thus, the average number of egg-masses was calculated to be 0.55 and that of individual eggs was 8.30 per hill of rice. Chen (1978) reported that in August and September the green rice leafhopper becomes fewer in its presence.

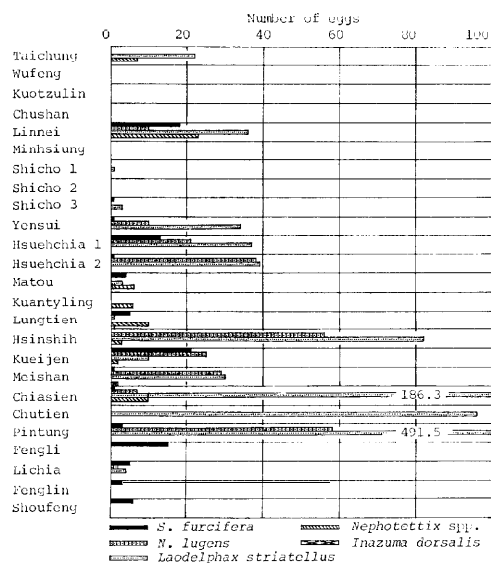


Fig. 2. Number of eggs of rice hoppers per hill of rice plant.

The density of eggs of the green rice leafhoppers was found to be high at Linnei, Lungtien and Chiasien, medium at Taichung, Matou, Kuanyling and Hsinshih, and low at Kueijen, while no eggs were found at Wufeng, Kuotzulín, Chushan, Minhsiung, Shicho (1), (2) and (3), Yensui, Hsuehchia (1) and (2), Meishan, Chutien, Pintung, Fengli, Lichia, Fenglin and Shoufeng.

2. Egg parasites collected afield

Egg parasites of rice hoppers ever recorded in Taiwan were listed by Chu and Hirashima (1981). Comprehensive systematic studies on these parasites are necessary not only in Taiwan but also in any other country in Asia including Japan.

We were able to rear four species, *Paracentrobia nndoi*, *Oligosita* sp., *Anagrus optabilis* and *Gonatocerus* sp., from the eggs of rice hoppers, as mentioned below.

Besides these 4 species many other parasitic wasps belonging to Trichogrammatidae and Mymaridae were collected by the method II but the hosts of them remain to be studied.

3. Egg parasites of the white-backed planthopper

Anagrus optabilis (Perkins) was obtained from the eggs of the white-backed planthopper, *Sogatella furcifera*. According to Yasumatsu et al. (1975) and Miura et al. (1979),

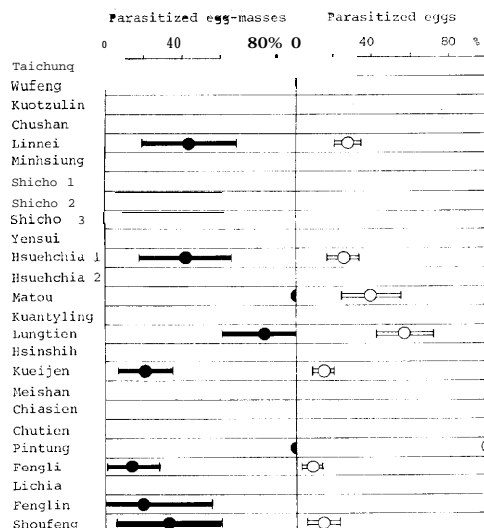


Fig. 3. Percentage parasitism of *Anagrus optabilis* to *Sogatella furcifera* (August to September, 1979, Taiwan), with confidence limit at 95 % level.

Anagrus optabilis is one of the most important egg parasites of the white-backed planthopper in Thailand. Table 2 shows the result of our rearing of this species out of the eggs of the hopper collected in the paddy fields from 9 localities. From these figures the percentage parasitism was calculated as follows: the highest one for egg-masses, 100 %, was observed at Matou and Pintung, but the lowest, 14.29 %, was at Fengli, while the highest one for individual eggs, 100 %, was obtained at Pintung but the lowest, 34.00 %, was at Fenglin. Accordingly, the mean percentage parasitism of egg-masses was 37.12 % and that of individual eggs was 31.71 %, calculated from the total parasitisms obtained from 9 localities. As the egg-masses and individual eggs collected were few in number, the confidence limit at 95 % level was shown in Fig. 3. The percentage parasitism of *A. optabilis* for the individual eggs of the white-backed planthopper was more than 40 % at Matou, Lungtien and Pintung, 20–40 % at Linnei and Hsuehchia (1), and less than 20% at Kueijen, Fengli, Fenglin and Shouteng.

4. Egg parasites of the brown planthopper

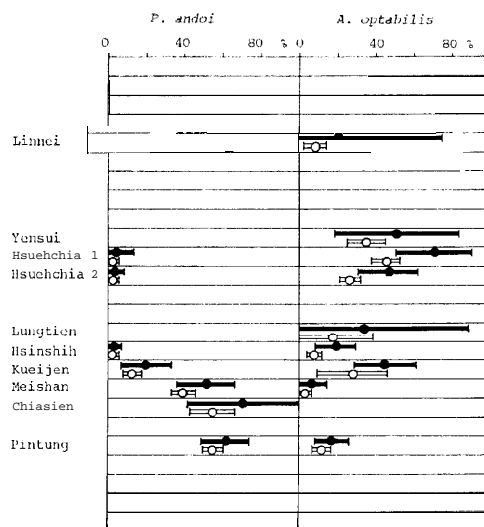
Two species of parasitic wasps, *Paracentrobia andoi* (Ishii) and *Anagrus optabilis*, were detected from the eggs of the brown planthopper. Esaki et al. (1937) and Ishii (1938) already stated that *Paracentrobia andoi* parasitizes the brown planthopper. Lin (1974) reported on the natural enemies of the brown planthopper in Taiwan. Otake (1977) dealt with the natural enemies of this hopper. Miura (1976, 77, 78) and Vungsilabutr (1978) provided informations on the biology of *Paracentrobia andoi*.

(a) *Paracentrobia andoi*

Table 3 shows the results of our rearing of *Paracentrobia andoi* from the eggs of the brown planthopper collected from 7 localities. The highest percentage parasitism of egg-masses was 70.00 % at Chiasien and the lowest was 2.56 % at Hsuehchia (2), while the highest one for individual eggs was 53.6 % at Chiasien and the lowest was 0.71% at Hsinshih. Thus, the mean percentage parasitism of egg-masses was 30.16 % and that of individual eggs was 23.41 %, calculated from the total parasitisms obtained from 7 localities. Fig. 5 shows the relation between parasitized and unparasitized eggs in one egg-mass of

Table 3. Summary of samplings of eggs of *Nilaparvata lugens* by the method I.

Locality	Date	No. of egg masses found	No. of eggs found	Parasite species	No. of prtzd egg masses	% parasitism	No. of prtzd eggs	% parasitism
Linnei	Aug. 27	10	99	A*	2	20.00		7.07
Yensui	Sep. 5	10	96	A	5	50.00	33	34.38
Hsue hchia (1)	Sep. 5	23	212	P*		4.35		1.89
				{ A	16	69.56	93	43.87
Hsuehchia (2)	Sep. 11	39	379	{ P	1	2.56		1.58
				{ A	18	46.15	99	26.12
Lungtien	Aug. 26	3	12	A	1	33.33	2	16.67
Hsinshih	Sep. 11	69	562	{ P	2	2.90		0.71
				{ A	13	18.84	42	7.47
Kueijen	Sep. 12	36	249	{ P	7	19.44	31	12.45
				{ A	16	44.44	67	26.91
Meishan	Sep. 8	47	294	{ P	24	51.06	115	39.12
				{ A	3	6.38		2.38
Chiasien	Sep. 10	10	69	P	7	70.00	37	53.62
Pintung	Sep. 15	74	582	{ P	45	60.81	317	54.47
				{ A	12	16.22	65	11.17
Lichia	Sep. 19	2	19		—	—		—

* A: *Anagrus optabilis*. P: *Paracentrobia andoi*.**Fig. 4.** Percentage parasitism of *Paracentrobia andoi* and *Anagrus optabilis* to *Nilaparvata lugens* (August to September, 1979, Taiwan). Black circle : parasitized egg-masses, white circle : parasitized eggs, with confidence limit at 95 % level.

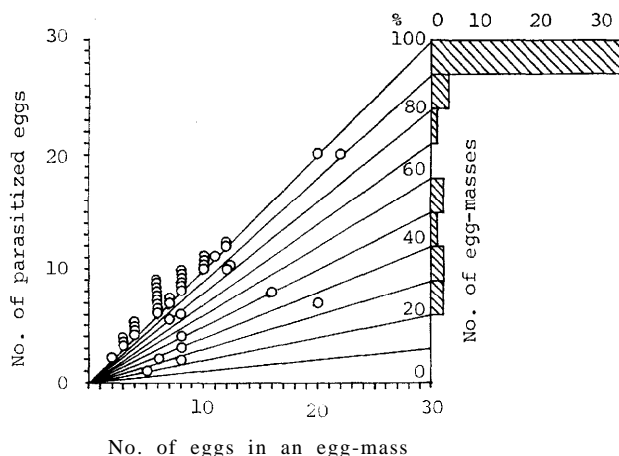


Fig. 5. Relation between the parasitized eggs and the number of eggs in an egg-mass of *Nilaparvata lugens*. Parasite: *Paracentrobia andoi*. Date: Sep. 15, 1979. Locality: Pintung.

the brown planthopper. It is observed from Fig. 5 that the female of *Paracentrobia andoi* attacks almost all the eggs when she comes in contact with an egg-mass of the hopper.

(b) *Anagrus optabilis*

As shown in Table 3, *Anagrus optabilis* was reared from the eggs of the brown planthopper collected from 9 localities. The highest percentage parasitism of this wasp for egg-masses of the hopper was 69.56 % at Hsuehchia (1), and the lowest was 6.38 % at Meishan, while the highest percentage parasitism for individual eggs was 43.87% at Hsuehchia (1) and the lowest was 2.38% at Meishan, as can be seen in Fig. 4. Thus, the mean percentage Parasitism was 33.88% for egg-masses and 19.56 % for individual eggs, calculated from the total percentage parasitisms obtained from 9 localities. The percentage parasitism of *Anagrus optabilis* for individual eggs of the brown planthopper was more than 40 % at Hsuehchia (1), 20-40 % at Yensui, Hsuehchia (2) and Kueijen, and less than 20% at Linnei, Lungtien, Hsinshih, Meishan and Pintung.

5. Egg parasites of the smaller brown planthopper

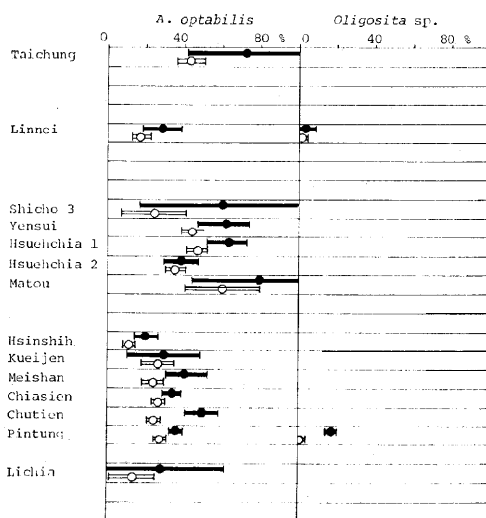
Anagrus optabilis and *Oligosita* sp. were detected as the egg parasites of the smaller brown planthopper.

(a) *Anagrus optabilis*

This species was obtained from 14 localities (Table 4). The highest percentage parasitism of *Anagrus optabilis* to the egg-masses of the smaller brown planthopper was 80.00 % at Matou and the lowest was 20.13 % at Hsinshih, while for individual eggs the highest was 60.00 % at Matou and the lowest was 12.44 % at Hsinshih. The mean percentage parasitism of egg-masses was 45.90% and that of individual eggs was 30.54 % calculating from the total percentage parasitisms obtained from 14 localities. Fig. 6 shows the confidence limit of the percentage parasitism of *A. optabilis* at 95 % level. The percentage parasitism of *A. optabilis* to individual eggs was more than 40 % at Taichung, Yensui, Hsuehchia (1) and Matou, around 30 % at Shicho (3), Hsuehchia (2), Kueijen, Meishan, Chiasien, Chutien and Pintung, and less than 20 % at Linnei, Hsinshih and Lichia. Fig. 7 shows the relation between the parasitized and unparasitized eggs in one egg-mass of the smaller brown planthopper. It is seen from Fig. 7 that the mode of oviposition of *A. optabilis* differs according to the size of the egg-mass.

Table 4. Summary of samplings of eggs of *Laodelphax striatellus* by the method I.

Locality	Date	No. of egg masses found	No. of eggs found	Parasite species	No. of prtzd egg masses	% parasitism	No. of prtzd eggs	% parasitism
Taichung	Aug. 13	29	218	A"	21	72.41	94	43.12
Linnei	Aug. 27	70	358	{ 0 "	2	2.86	5	1.40
					20	28.57	62	17.32
Shicho(1)	Sep. 1	1	3		—	—	—	—
Shicho(2)	Sep. 1	5	25	A	3	60.00	6	24.00
Yensui	Sep. 5	51	336	A	31	60.78	147	43.75
Hsuehchia(1)	Sep. 5	80	373	A	50	62.50	174	46.65
Hsuehchia(2)	Sep. 11	82	389	A	31	37.80	140	35.99
Matou	Aug. 26	5	25	A		80.00	15	60.00
Hsinshih	Sep. 11	154	820	A	31	20.13	102	12.44
Kueijen	Sep. 12	23	101	A	7	30.43	27	26.73
Meishan	Sep. 8	73	295	A	30	41.09	70	23.73
Chiasien	Sep. 10	386	1863	A	131	33.94	502	26.95
Chutien	Sep. 15	120	963	A	60	50.00	241	25.03
Pintung	Sep. 15	736	4915	{ 0 "	13	17.66	63	1.28
					268	36.41	1356	27.59
Lichia	Sep. 19	7	35	A	2	28.57	5	14.29

* A: *Anagrus optabilis*. 0: *Oligosita* sp.**Fig. 6.** Percentage parasitism of *Anagrus optabilis* and *Oligosita* sp. to *Laodelphax striatellus* (August to September, 1979, Taiwan). Black circle: parasitized egg-masses, white circle: parasitized eggs, with confidence limit at 95 % level.

(b) *Oligosita* sp.

This species was only detected in few numbers from 2 localities, Linnei and Pingtung.

6. Egg parasites of the green rice leafhoppers

Two species of egg parasites, *Paracentrobia andoi* and *Gonatocerus* sp., were detected from the green rice leafhoppers.

Table 5. Summary of samplings of eggs of the *Nephotettix cincticeps*-complex by the method I.

Locality	Date	No. of egg masses found	No. of eggs found	Parasite species	No. of prtzd egg masses	% parasitism	No. of prtzd eggs	% parasitism
Taichung	Aug. 13	6	69	P*	4	66.67	42	60.87
Linnei	Aug. 27	15	227	{ P	9	60.00	99	43.61
				{ G*	3	20.00	34	14.98
	Aug. 26	4	56	{ P	1	25.00	8	14.29
				{ G	3	75.00	34	60.71
Kuantyling	Aug. 28	3	60	G	2	66.67	34	56.67
Lungtien	Aug. 26	7	101	{ P	3	42.86	37	36.63
				{ G	2	28.57	32	31.68
Hsinshih	Sep. 11	2	31	G	1	50.00	16	51.61
Kueijen	Sep. 12	1	18	G	1	100	18	100
Chiasien	Sep. 10	6	102	{ P	2	33.33	20	19.61
				{ G	3	50.00	21	20.59

* P: *Paracentrobia andoi*. G: *Gonatocerus* sp.

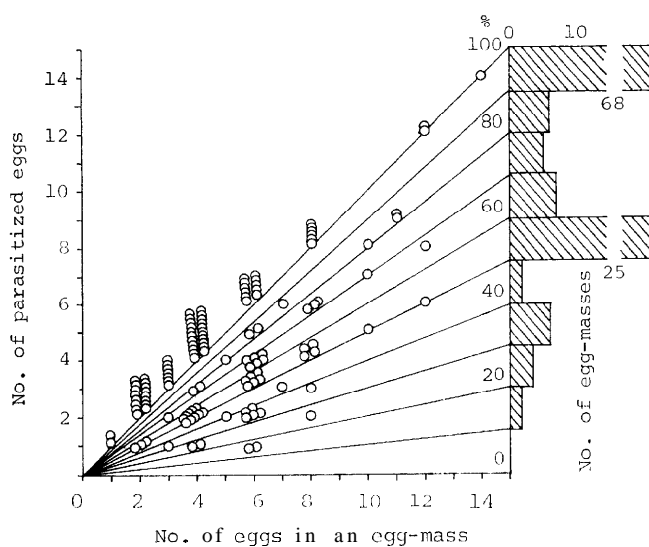


Fig. 7. Relation between the parasitized eggs and the number of eggs in an egg-mass of *Laodelphax striatellus*. Parasite: *Anagrus optabilis*. Date: Sept. 10, 1979. Locality: Chiasien.

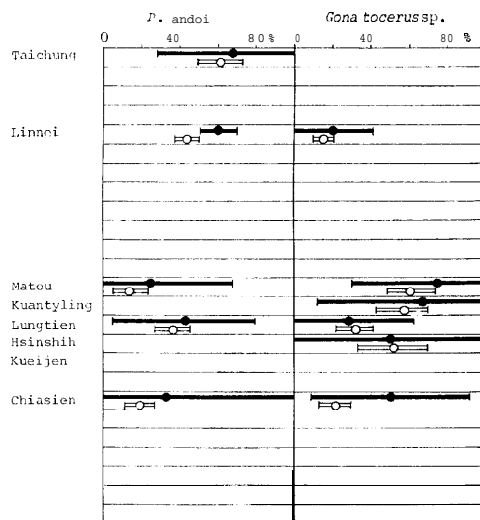


Fig. 8. Percentage parasitism of *Paracentrobia andoi* and *Gonatocerus* sp. to the *Nephotettix cincticeps*-complex (August to September, 1979, Taiwan). Black circle : parasitized egg-masses, white circle : parasitized eggs, with confidence limit at 95 % level.

(a) *Paracentrobia andoi*

The parasitic habits of *P. andoi* has already been reported by Lin (1974) in Taiwan and by Orita (1972) and Miura (1976, 77, 78) in Japan. Table 5 shows the result of our collecting of *P. andoi* from 5 localities. The percentage parasitism of *P. andoi* to egg-masses was highest (66.67 %) at Taichung, and lowest (25.00%) at Matou, while for individual eggs it was highest (60.87 %) at Taichung and lowest (14.29 %) at Matou. Calculating from the results obtained from 5 localities the means of the percentage parasitisms of egg-masses and individual eggs were 45.57% and 35.00 %, respectively. Fig. 8 shows the confidence limit of the percentage parasitism of *P. andoi* at 95% level. The percentage parasitism of *P. andoi* to individual eggs was more than 40 % at Taichung and Linnei, 20-40 % at Lungtien and Chiasien, and less than 20% at Matou.

(b) *Gonatocerus* sp.

This species was reared from the eggs of the green rice leafhoppers collected from 7 localities, as shown in Table 5. The percentage parasitism of egg-masses was highest (100 %) at Kueijen and lowest (20.00 %) at Linnei, while that of individual eggs was highest (100%) at Kueijen and lowest (14.98%) at Linnei. The means of the percentage parasitism, as calculated from the results obtained from 7 localities, were 55.75 % and 48.03 % for egg-masses and individual eggs, respectively. The confidence limit of the parasitism of *Gonatocerus* sp. at 95 % level was shown in Fig. 8. The percentage parasitism of *Gonatocerus* sp. to individual eggs of the green rice leafhopper was more than 50 % at Matou, Kuantyling, Hsinshih and Kueijen, 30 % or so at Lungtien, and less than 20 % at Linnei and Chiasien.