PARASITOIDS OF LEAFMINER (*HYDRELLIA PROSTERNALIS* DEEMING), LEAFHOPPERS AND PLANTHOPPERS OCCURRING IN RICE FIELDS

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Abstract

This study was carried out at the experimental farm and Entomology laboratory of Rice Research and Training Center (RRTC), Sakha, Agricultural Research Center for three successive rice seasons, 2000, 2001 and 2002. The study aimed to surveying and monitoring population fluctuation of parasitoids attacking rice leafminer, *Hydrellia prosternalis* Deeming, leafhoppers and planthoppers.

Specimens of parasitoids emerging from *H. prosternalis* pupae were preliminary identified as *Opius* sp. The further identification conducted by systematic laboratory at International Rice Research Institute (IRRI) revealed that the surveyed parasitoid was *Opius hedquisti* Fischer which is considered a first record for the species in Egypt. Monitoring population fluctuation of *Opius hedquisti* showed that the parasitoid occurred in rice fields throughout the rice season, and the parasitism was particularly high during July and August. Thus, insecticides applied in rice fields should be minimized, and wisely used if needed to keep this parasitoid acts efficiently against the rice leafminer.

In 2001, water pan traps were used to survey two egg-parasitoids attacking rice leafhoppers and planthoppers, *Anagrus* sp. and *Gonatocerus* sp. *Anagrus* sp. peaked on 23 May (10 individuals / 5 traps), and on 12 June (9 indiv.) which synchronized with the peak of leafhoppers and planthoppers. The third peak (17 indiv.) was detected three days later than the peak of hoppers, however, the highest peak of the parasitoid (56 individuals) occurred one week after the peak of hoppers. *Gonatocerus* parasitoid was detected in the water pan traps in few numbers along the rice season. Relatively, its numbers were notable during the second week of June.

INTRODUCTION

Rice plants, in Egypt, are liable to be attacked by several insect pests, specially the rice leafminer (Hydrellia prosternalis Deem), leafhoppers and planthoppers. These insects contribute to losses in rice yield, and may act as vectors to virus diseases. These losses are particularly notable in large areas of southeast Asia as the widespread use of insecticides has frequently killed the natural enemies of leafhoppers and planthoppers (Heinrichs *et al.* 1982, Reising *et al.* 1982).

In many rice ecosystems, the growers get worried about the attacks of insects, regardless of insect economic importance, and tend to use insecticides. Heong

et al. (1994) pointed out that misuse of pesticides is common among rice growers, due to the application of insecticides at improper times or pesticides wrong application. However, the integrated management of rice insects should be emphasized to avoid the hazardous effects of the insecticides and conserve the natural enemies. El-Metwally (1977) surveyed three parasitoids attacking *H. prosternalis* larvae, but emerging from the pupal stage, one of these was *Opius* sp. Hendawy (2001) recorded five hymenopterous species of egg-parasitoids attacking rice leafhoppers and planthoppers. Some of which were *Anagrus* spp. and *Gonatocerus* spp which are belonging to Mymaridae.

The current study was undertaken throughout 2000-2002 rice seasons at the experimental farm and laboratory of Entomology Department of Rice Research and Training Center (RRTC), Kafr El-Sheikh Governorate to survey and monitor the population fluctuations of *H. prosternalis*, leafhoppers and planthoppers parasitoids.

MATERIALS AND METHODS

1. Parasitoids of rice leafminer, *Hydrellia prosternalis*:

a) Survey:

Rice leaves infested with *H. prosternalis* larvae were picked up in 2000 rice season from the plants having the identical symptoms. The samples were kept into paper bags, and transferred to Rice Research and Training Center laboratory till the harboured larvae turned into pupae outside mines. The leafminer pupae were collected and kept into moistened petri dishes till the emergence of parasitoids. Preliminary examinations indicated that the collected parasitoids are only one species. The specimens were confined in 70 % ethyl alcohol provided with few drops of glycerin to keep the insect tissues soft for easy examination. The parasitoids were identified as *Opius* sp., and sent to the systematic laboratory of International Rice Research Institute (IRRI), the Philippines, for further identification.

b) Population fluctuation of *Opius* sp.:

The population fluctuation of the parasitoid was studied for three successive rice seasons, 2000, 2001 and 2002. Since the rice leafminer attacks rice plants mainly for about one month after transplanting (El-Habashy, 1997), it was necessary to sow rice in successive plantations throughout the rice season to get a continuous surplus of *H. prosternalis* pupae, from which the parasitoid could be detected. A bulk of leaves were taken 5 days after transplanting and continued, almost, twice a week. The leaves were kept into paper bags to collect the rice leafminer pupae. For each sample, the obtained pupae were counted, and kept into moistened petri dishes. The emerging

adults of both rice leafminer and *Opius* were counted to calculate the percentage of *Opius* parasitism for each sampling date.

2. Survey and population fluctuation of leafhoppers and planthoppers and their parasitoids:

This study was carried out during 2001 rice season to investigate the population fluctuation of common parasitoids of leafhoppers and planthoppers. Leafhoppers and planthoppers occurring in rice fields were sampled Per 50 double strokes of the sweep net from 21 May up to 25 September.

To survey the associated parasitoids, five water pan traps (aluminum-made, 20 cm diameter and 3 cm deep) were located among rice hills in rice nurseries and paddy fields. Sampling started from the third week of May up to late September. The pan was provided with som drops of Tween 80 that acts as a detergent to minimize the water surface tension to avoid the escape of trapped insects that become unable to walk on water surface. Thus, the trapped insects should sink in the water, and thus could be collected at 3-4 day intervals screened through fine textile. Under the binocular microscope, the most common parasitoids were preliminary identified as *Anagrus* spp and *Gonatocerus* spp. by systematic specialists at Plant Protection Research Institute, Egypt.

RESULTS AND DISCUSSION

1- Parasitoids of rice leafminer, *Hydrellia prosternalis*

1.1. *Opius hedquisti* Fischer, a primary parasitoid of *H. prosternalis* larvae:

Specimens of a primary parasitoid that emerged from *Hydrellia prosternalis* pupae were collected and kept for identification. The tentative identification revealed that the specimen was *Opius* sp. For further identification, the specimen was sent to the Systematic Laboratory of International Rice Research Institute (IRRI), the Philippines. Dr. Alberto Barrion confirmed the primary identification and further identified the *Opius* to the species *hedquisti* Fischer.

1.2. Population fluctuation of *Opius hedquisti* Fischer:

The parasitism status of *Opius hedquisti* was investigated in 2000, 2001 and 2002 rice seasons (Tables 1, 2 and 3).

In 2000, *Opius* parasitism on rice leafminer larvae (Table 1) was detected on 26 June where parasitism percentage constituted 16.67 % and increased 7 days later to 22.22 %. The levels of parasitism decreased gradually, to be absent on 27 July. However, considerable rates of parasitism were obtained on 17 August (32.73 %), the parasitism steadily increased to perform the maximum (54.55 %) on 29 August. In

September, the rice leafminer rarely attacked rice plants having then stiff leaves, and thus there were not preferred for the insect infestation. Accordingly, only one *Hydrellia prosternalis* pupa was detected, and was found parasitized by *Opius hedquisti*.

Results of parasitism of *Opius* during 2001 rice season are presented in Table (2). Rice leafminer pupae collected during June were free from the parasitoid. During the first half of July, the parasitism ranged between 8.33 and 13.33 %. Then, the parasitism decreased, in general, towards the end of July. Sampling of rice leafminer pupae, during August, revealed that *Opius* parasitism on rice leafminer larvae increased steadily to exhibit a peak (17.24 %) on 9 August, and another peak (50.00 %) on 23 August. Furthermore, rice leafminer pupae collected in 30 August, and throughout September were completely parasitized by *Opius*.

Data of parasitism of *Opius* during 2002 rice season are presented in Table (3). The first sample, taken on 22 June, was free from the parasitoid. The parasitism ranged between 18.18 and 20.00 % from 1st July up to 10 July. Then, the parasitism remarkably decreased up to the end of July. By early August, the parasitism was enhanced (9.80 %), and increased continuously towards the end of August reaching 91.67 % on 31 August. Rice leafminer pupae, collected during September, were all parasitized by *O. hedquisti*.

Over the three years of study, most of rice leafminer pupae sampled during June had low levels of *O. hedquisti* parasitism. A tendency to increase in parasitism was clearly observed during the first half of July. During the second half of July, the parasitism was sharply decreased, may be due to the end of a parasitoid generation. A build-up of parasitoid population was detected during early August, and increased obviously throughout August to reach maximum levels of parasitism by late August. Furthermore, specimens of rice leafminer pupae collected during September were all, in general, parasitized by *Opius*.

The current study clearly showed that this braconid parasitoid was active allthroughout rice season, particularly by late July, and during August. This fact should put limitations on the application of pesticides, particularly insecticides, on rice plants. To conserve this valuable natural enemy, rice leafminer should be managed away from insecticides as possible. Since only late rice cultivation are subject to high rice leafminer attacks (El-Habashy, 1997), the insecticides should be avoided on rice plants sown on recommended dates.

Several authors reported that *Opius* spp. are effective in regulating the populations of *Hydrellia* spp. In USA, Stiling *et al.* (1982) suggested that gradients in leafminer densities had been caused by differences in parasite abundance including *Opius*. At IRRI (1986), it was surveyed nine larval-pupal parasites from the whorl

maggot, *Hydrellia philippina*, but the most abundant one was *Opius* sp. The role played by *Opius* sp in regulating *Hydrellia wirthi* was more profound with integrated pest management (28 %parasitism) with chemical control (23 % parasitism) (Moreno *et al.* 1994). This reveals the importance of minimizing chemical control to conserve this natural enemy and others.

The relatively high parasitism recorded in the current investigation had been previously obtained by Godfrey (1999) in USA who encountered 70-80 % parasitism by *Opius hydrelliae* on the second and third generations of rice leafminer, *Hydrellia griseola*.

2. Parasitoids of rice leafhoppers and planthoppers:

The populations of rice leafhoppers and planthoppers were monitored in rice fields during 2001 season. The population of the hoppers (Table 4) seemed relatively low up to late May, and then increased by the beginning of June to exhibit a peak (48 indiv.) on 5 June. One week later, another hopper peak (60 idiv.) was formed. In general, the numbers of leafhoppers and planthoppers decreased towards the end of June. The third peak of the hoppers (58 indiv.) was detected on 4 July. Remarkable increase in the hopper population (93 indiv.) appeared on 6 August, and constituted the highest peak (222 indiv.) on 20 August, followed by another high peak (185 indiv.) on 3 September.

Population fluctuations of the two egg-parasitoids are presented in Table (4). Number of *Anagrus* spp. peaked on 23 May (10 indiv. / 5 water pan traps). Another peak (9 indiv.) occurred on 12 June, which coincided with a peak o. hoppers. Population of *Anagrus* spp. exhibited a peak of 17 individuals that came only three days later than the peak of hoppers. The highest peak of this egg parasitoid was detected on 27 August (56 indiv.)which was one week later than the highest peak of hoppers.

The second egg parasitoid, *Gonatocerus* spp was trapped, in the water pans, in few numbers allthroughout the rice season. However, relatively high numbers of the parasitoid were obtained during the second week of June.

The two parasitoids encountered in the current study were also encountered in Thailand by Yasumatsu *et al.* (1975), when both parasitoids, *Anagrus optabilis* and *Gonatocerus* sp. contributed much to the reduction of planthoppers and leafhoppers. In Egypt, Hendawy (2001) reported that *Anagrus* spp was the most important parasitoid on hopper eggs, representing 50.7 % of total parasitism, while *Gonatocerus* spp. contributed 8.40 %. Preap *et al.* (2001) confirmed the role of *Gonatocerus* sp, *Anagrus optabilis* and *A. flaveolus* in regulating numbers of brown planthopper. They found that the insect pest survival decreased from 24 to 2 % when the natural enemies increased from 2 to 12 insects per hill. Three egg parasitoids were included.

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Table 1. Population fluctuation of *Opius hedquisti* on rice leafminer, *Hydrellia prosternalis* larvae in 2000 rice season.

Date of Collection		Rice leafminer		No. of emerging parasitoids	Parasitism %
		No. of collected pupae	No. of emerging adults		
June	20	3	3	0	0
	26	6	5	1	16.67
July	3	9	7	2	22.22
	9	25	21	4	16.00
	15	95	93	2	2.11
	22	69	67	2	2.90
	27	51	51	0	0.00
	30	98	91	7	7.14
Aug.	5	40	36	4	10.00
	8	145	127	18	12.41
	13	11	11	0	0.00
	17	55	37	18	32.73
	21	75	51	24	32.00
	26	24	15	9	37.50
	29	11	5	6	54.55
Sept.	3	1	0	1	100.00
	8	0	0	0	0.00

Table 2. Population fluctuation of *Opius hedquisti* on rice leafminer, *Hydrellia prosternalis* larvae in 2001 rice season.

Date of Collection		Rice leafminer		No. of emerging parasitoids	Parasitism %
		No. of collected pupae	No. of emerging adults		
June	20	2	2	0	0.00
	26	4	4	0	0.00
July	2	15	13	2	13.33
	8	23	20	3	13.04
	14	12	11	1	8.33
	19	87	84	3	3.45
	23	78	76	2	2.56
	26	93	89	4	4.30
	30	120	114	6	5.00
Aug.	2	104	96	8	7.69
	6	69	61	8	11.59
	9	29	24	5	17.24
	13	10	9	1	10.00
	16	40	27	13	32.50
	20	72	46	26	36.11
	23	10	5	5	50.00
	25	46	29	17	36.96
	27	18	1	17	94.44
	30	17	0	17	100.00
Sept.	3	7	0	7	100.00
	6	10	0	10	100.00
	9	3	0	3	100.00
	13	11	0	11	100.00

Table 3. Population fluctuation of *Opius hedquisti* on rice leafminer, *Hydrellia prosternalis* larvae in 2002 rice season.

Date of Collection		Rice leafminer		No. of emerging parasitiods	Parasitism %
		No. of collected Pupae	No. of emerging adults		
June	22	3	3	0	0.00
	27	7	6	1	14.29
July	1	10	8	2	20.00
	6	16	13	3	18.75
	10	22	18	4	18.18
	15	105	100	5	4.76
	21	74	70	4	5.41
	29	135	127	8	5.93
Aug.	3	102	92	10	9.80
	6	67	56	11	16.42
	10	37	30	7	18.92
	13	8	6	2	25.00
	17	47	31	16	34.04
	21	88	56	32	36.36
	25	54	33	21	38.89
	27	27	3	24	88.89
	31	12	1	11	91.67
Sept.	3	10	0	10	100.00
	7	5	0	5	100.00
	10	2	0	2	100.00
	14	14	0	14	100.00

Table 4. Population fluctuation of leafhoppers and planthoppers, inhabiting rice nurseries and paddies, and certain egg-parasitoids (2001 season).

Date of collection		Number / 50 double strokes		Total	Number per 5 water pan traps	
		Leafhopper	Planthopper		*Anagrus* spp	*Gonatocerus* spp
May	21	5	0	5	0	0
	23	14	0	14	10	2
	27	23	0	23	6	0
	29	20	0	20	3	1
June	2	32	15	47	5	1
	5	32	16	48	6	7
	9	25	13	38	2	3
	12	41	19	60	9	12
	16	19	9	28	2	5
	18	13	7	20	13	2
	20	0	0	0	0	0
	24	0	0	0	3	0
	26	11	6	17	4	0
	30	6	4	10	6	0
July	2	20	10	30	1	0
	4	38	20	58	11	0
	7	0	0	0	17	0
	9	12	12	24	0	0
	16	27	26	53	1	0
	22	11	8	19	2	0
	30	5	7	12	5	0
August	6	32	61	93	2	0
	14	51	95	156	23	2
	20	82	140	222	42	3
	27	35	70	105	56	2
September	3	65	120	185	19	2
	10	46	90	136	22	3
	18	20	80	100	15	1
	25	45	65	110	22	3

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الحشرات المتطفلة على صانعة أنفاق أوراق الأرز ونطاطات الأوراق ونطاطات النباتات فى حقول الأرز

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١. *قسم الحشرات الإقتصادية-كلية الزراعة بكفر الشيخ-جامعة طنطا-مصر*
٢. *مركز بحوث الأرز بسخا-مركز البحوث الزراعية- مصر*

أجريت هذه الدراسة بالمزرعة البحثية ومعمل الحشرات بمركز بحوث الأرز بسخا ، وذلك لحصر ومتابعة تعداد الحشرات المتطفلة على صانعة أنفاق أوراق الأرز ، ونطاطات الأوراق ونطاطات النباتات خلال ثلاثة مواسم متتالية: ٢٠٠٠، ٢٠٠١ ، ٢٠٠٢.

أولا : الطفيليات الحشرية لصانعة أنفاق أوراق الأرز *Hydrellia prosternalis*

١- **الحصر** : تم تجميع عينات من طفيل أولى ناتج من عذارى صانعة أنفاق أوراق الأرز وحُفظت للتعريف . أوضح التعريف المبدئى لهذه العينات بأنها لجنس *Opius* sp. ، وللتأكد من التعريف ، أرسلت هذه العينات لمعمل التصنيف بمعهد بحوث الأرز الدولى بالفلبين **(IRRI)** . وبمساعدة الدكتور/ ألبرتو باريون تم تعريف هذا الطفيل على أنه *Opius hedquisti* Fischer . وهذا يعتبر أول تسجيل لهذا النوع فى مصر .

٢- **التذبذب الموسمى لطفيل *Opius hedquisti* :**

تمت دراسة التذبذب الموسمى لهذا الطفيل فى مواسم ٢٠٠٠ ، ٢٠٠١ و ٢٠٠٢. أمكن حصر الطفيل خلال شهور يونيو ويوليو وأغسطس وسبتمبر ، وكانت نسبة التطفل عالية خلال شهرى يوليو وأغسطس . وعلى هذا ، يجب وضع حدود لاستعمال المبيدات خلال هذه الفترة . وللحفاظ على هذا الطفيل ، فإنه يجب مكافحة صانعة الأنفاق بطرق مختلفة وعدم استخدام المبيدات إلا فى حالات الضرورة القصوى فقط .

ثانيا : الطفيليات الحشرية لنطاطات الأوراق leafhoppers ونطاطات النباتات planthoppers:

فى خلال موسم ٢٠٠١ استخدمت المصائد المائية الطافية فى حصر طفيليات *Anagrus* sp. & *Gonatocerus* sp. سجلت ذروة لطفيل *Anagrus* sp. فى ٢٣ مايو (١٠ أفراد/٥ مصائد مائية) كما وجدت ذروة أخرى (٩ أفراد) فى ١٢ يونيو والتى توافقت مع تواجد ذروة لنطاطات النباتات والأوراق . كما ظهرت ذروة ثالثة لطفيل ***Anagrus*** (١٧ فرداً) بعد ٣ أيام فقط من وجود ذروة لنطاطات النبات والأوراق . وكانت أعلى ذروة لهذا الطفيل فى ٢٧ أغسطس (٥٦ طفيل) ، حيث ظهرت بعد أسبوع من ظهور ذروة لنطاطات النبات والأوراق . وبالنسبة لطفيل ***Gonatocerus*** ، فلقد تم الحصول عليه فى المصائد المائية ولكن بأعداد قليلة خلال الموسم . وعلى أية حال ، فلقد سُجلت منه أعداد أكبر نسبياً خلال الأسبوع الثانى من يونيو .