

**PARASITE COMPLEX OF THE SUGAR BEET MINING MOTH,
SCROBIPALPA OCELLATELLA BOYD.
(LEPIDOPTERA: GELECHIIDAE)
ON SUGAR BEET IN EGYPT**

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Abstract

During 2005, sugar beet leaves infested with *Scrobipalpa ocellatella* Boyd (Lepidoptera: Gelechiidae) were collected from untreated fields at Sakha (Kafr El-Sheikh Governorate), at Shirbin (Daqahlyia Governorate) and at Fayoum (Fayoum Governorate). In this work, five parasitoid species (Hymenoptera: Chalcidoidea) were identified: the predominant species *Agathis* sp. (Braconidae) and the four newly recorded species: *Opius* sp., *Alysia* sp. (Braconidae), *Diadegma oranginator* Aub. (Ichneumonidae) and *Pachycrepoideus vindemmiae* (Rondani) (Pteromalidae).

Parasitism activity, in general, started at the second half of April and continued till the first of December. In the same time, the first records for *Agathis* sp. at Sakha followed with those of *P. vindemmiae* at the fourth week of the same month then those of *Opius* sp. and *D. oranginator* species at the second week of May. The last records were for *Alysia* sp. at 4th week of May.

Level of parasitism, regardless of species, fluctuated clearly according to the region, with a mean of 17.9% and range 10- 50% at Sakha, a mean of 16.3% and range 27.3- 45.5% at Shirbin and 8.4% at Fayoum. Also, Sakha represented the most favorable environment for the host as well as the parasitoids. While total number of *S. ocellatella* was 951 moths and that of wasps was 208, these numbers were 41 & 8 and 65 & 6 only at Shirbin and Fayoum, respectively. Synchronization was found between timing of moths and wasps peaks.

Agathis sp., especially at Sakha was the most abundant, represented 51.3% of the total populations of all parasitoids followed by *D. oranginator* (21.2%) and *P. vindemmiae* (19.8%). The parasite complex completed by the lowest numbers of *Alysia* sp. (1.4%) and *Opius* sp. (6.3%).

Agathis sp. was the most promising parasitoid as a biological agent for controlling the sugar beet moth in Egypt.

INTRODUCTION

The sugar beet mining moth, *Scrobipalpa ocellatella* Boyd., became one of the most important pests attacking sugar beet, *Beta vulgaris* L., since it was recorded in Egypt by Willcocks (1922). The first two instars larvae attack the succulent heart leaves causing puncture holes, longitudinal slits and short tunnels. These leaves where appeared crinkled, wilt and attached together with a silken web, whereas leaf mid-

ribs infested by the last instars become soft, black and breakable (El-Sufty *et al*, 1987). The infestation by this pest resulted a higher weight reduction of roots and sugar content than those caused by the beet fly, *Pegomya mixta* Vill. or *Caccida vittata* and reached about 38 and 52% under severe infestation (Metwally *et al*, 1987a and Abo-Saied Ahmed, 1987). Several authors contributed to its ecology and biology (Hammad *et al*, 1968, Metwally *et al*, 1987b, Awadalla *et al*, 1991 and El-Agamy *et al*, 1996). In Egypt, it had seven annual overlapping generations, the shortest and longest generations occurred during June- July and November- early March, respectively, whereas 4-5 generations were found on sugar beet in Serbia (El-Sufty *et al*, 1987, Abd El-Ghany, 1994 and ^amprag *et al*, 1998). The average number of the parasitized larvae was about 44 per female of *Agathis* sp. (Braconidae), whereas it recorded 7 and 10% in September and December plantations respectively, reaching a maximum of about 10% in April and ranged 11- 15% in May and June on late one. However, rates of parasitism ranged 2- 8% on puparia reared from sugar beet and 4- 6% on those of chard (Abd El-Ghany, 1994 and El-Agamy *et al*, 1994a and 1994b). To achieve a sustainable control of this pest, research studies were initiated to determine the parasitoid complex of *S. ocellatella* and role of each species in regulation its population to select the best candidate which will be used as biological control agents in this respect.

MATERIALS AND METHODS

Sugar beet, fields untreated with pesticides, were selected during 2005 at three Governorates, Kafr El-Sheikh (at Sakha), Daqahlyia (at Shirbin) and Fayoum (at Fayoum). Infested sugar beet leaves by the beet moth, *S. ocellatella*, were detached weekly from April 6 to May 25 at Sakha. Four samples were taken at 10 days interval from May 15 to June 14 at Shirbin, whereas one sample only was taken on April 24 at Fayoum.

On each collection date, the infested leaves were placed into circular plastic containers (each measured 50 cm diameter x 15 cm height) and provided with a sandy layer at the bottom. The pupae were collected and placed into petri-dishes, 10 cm in diameter each. The dried leaves were kept in plastic sacs fitted with rubber bands. Daily inspection was made and the emerged moths and parasitoids were collected, identified and recorded. At the end of the emergence season, puparia were dissected and healthy (emerged or failed moths) or parasitized ones (emerged parasitoids from pores or failed emerged parasitoids) were counted.

RESULTS AND DISCUSSION

Data in Table 1 show that, the overall mean of parasitism was 17.4%. There was a marked fluctuation in parasitism rate of *S. ocellatella* at the different localities, 8.4% at Fayoum, 16.3% at Shirbin and the highest rate (17.9%) was recorded at Sakha. Parasitoids activities started at high (50%) in early April, declined to 10% in the next week and again increased gradually to reach 20.3% in early May. The rate lowered to 14.9% in the third week of May 2005 at Sakha, but increased to 21.4% on the 25th in this month. Two rates of 27.3 and 45.5% were recorded in mid May and June at Shirbin, whereas 8.4% only was attained in late April at Fayoum.

Five parasitoid species (Hymenoptera: Chalcidoidea) were identified: *Agathis* sp., *Opius* sp. (new record), *Alysia* sp. (new record) (Braconidae), *Diadegma oranginator* Aub.(new record) (Ichneumonidae) and *Pachycrepoideus vindemmiae* (Rondani) (new record) (Pteromalidae). Wasps and fore wings of these species are illustrated at Photos 1- 5 (A & B), respectively.

During the course of this study, the rate of parasitism, distribution and activities of these parasitoids fluctuated greatly. *Agathis* sp. was the most abundant species and resulted in the highest general rate of 8.9% comparing with the other parasitoids. This species represented as 12.2% at Shirbin, 8.9% at Sakha and 7% at Fayoum (Table 2). The first emergence of its wasps started in third week of April and continued until the same week of June with a peak of 29 individuals in early June at Sakha, but two individuals were emerged later in early December (Table 3). Little emerged wasps of *Agathis* sp. (1-4) were recorded. during the first half of May only at Fayoum but continued from the third week of May to mid June (1-3 wasps) at Shirbin. The two species, *D. oranginator* and *P. vindemmiae* had low general parasitism rates of 3.7 and 3.4%, respectively with rates of 3.7- 4% at Sakha opposed to 2.0% for both at Shirbin (Table 2). At Sakha, emergencies of the pteromalid and the ichneumonid began in late April and mid May, respectively and continued until the third week of June with a distinct peak in their populations at early June (Table 3). A number 13 of *P. vindemmiae* wasps was recorded later in early October (Table 3). The two parasitoids were represented with one wasp only in late and mid of June at Shirbin, respectively. *Opius* and *Alysia* spp. showed the least rate of parasitism, 0.2- 1.1% only, Table (2). Their emergencies began in mid May at Sakha and Fayoum and continued until mid June (Table (3).

These results indicate that, the parasitism was generally higher with a general mean of 17.9% (range 10.0-50.0%) at Sakha when compared to 16.3% (range 27.3-45.5%) at Shirbin and a mean of 8.4% at Fayoum. The highest recorded rates were

(50.0%) in early April at Sakha and (27.3 - 45.5%) in mid May and June at Shirbin coincides with low population of the host. Monthly rate of parasitism at Sakha, increased from 15.9% in April to 18.5% in May. The most abundant species was *Agathis* sp. which represented 51.3% of the total wasps emerged in this study. It is a widely distributed species resulted in parasitism rates ranged between about 9- 12% at Shirbin and Sakha and about 7% at Fayoum . In this respect, different researchers had reported that, rates of parasitism were about 7 and 10% in September and December plantations, respectively reaching their highest values 11- 15% in May and June on late one, however, the parasitism ranged 2- 8% on puparia reared from sugar beet and 4- 6% on those from chard (Abd El-Ghany, 1994 and El-Agamy *et al*, 1994b) . Each of *D. oranginator* and *P. vindemmiae* represented about 20-21% of the total beneficials collected and the parasitism was about two times greater at Sakha than at Shirbin. In Egypt, species belongs to genus *Diadegma* i. e. *D. molliplum* Himgrn was recorded on *Phthorimaea operculella* (Zeller) (Gelechiidae) infested potato, *Ipomoea batatas* Lam. , whereas *P. vindemmiae* is a generalist pupal parasitoid resulted in 16% on puparia of the sugar beet fly, *Pegomya mixta* Vill. (Hassanein *et al*, 1985 and El-Serwy, 2007). *Opius* sp. represented 6.3% of the total parasitoid population with a rate of 1.1-1.4% at Sakha and Fayoum. In general, the emergence of the parasitoids began in the third week of April and terminated in early December with a distinct peak in the populations in early June.

With regard to moths, data in Table (4) revealed that, the emergence started firstly in the third week of *S. ocellatella* April (2 moths) and continued until late August with a distinct peak (288 moths) in early June at Sakha. Emergencies began in early and mid May and continued relatively in very few numbers until late May and June with a peak at mid May (53 moths) and late June (16 moths) at Fayoum and Shirbin , respectively.

In general, undetected infestation by the sugar beet moth was observed in mid March and continued until mid June with a peak in the population in the third week of May. The first emergence of moths begins in the third week of April and ends in late August with a distinct peak in early June. Several authors reported before that, the three important overlapping generations occurred the period from during early March to late June and the larvae reached a maximum number in June, whereas the moth's peak was during June- August (El-Sufty *et al*, 1987, Abd El-Gany, 1994 and El-Agamy *et al*, 1996).

In conclusion, parasite complex and parasitism on *S. ocellatella* fluctuated highly with region. The five identified parasitoids were recorded at Sakha, while the abundant species *Agathis* sp. was found with *D. oranginator* and *P. vindemmiae* at

Shirbin and with *Opius* sp. at Fayoum with general rates of parasitism about 18, 16 and 8%, respectively. The highest general rates of parasitism (in order of prevalence) were: 8.9% by *Agathis* sp., 3.7% by *D. oringinator* and 3.4% by *P. vindemmiae*. Parasitism by *Agathis* sp. was somewhat higher at Shirbin than at Fayoum or Sakha, whereas parasitism by the ichneumonid or the pteromalid species was two times greater at Sakha than Shirbin. Synchronization was found between the timing or peaks of emerged parasitoids and moths.

As a result of this study, parasite complex was markedly fluctuated at the different localities. The most common and abundant parasitoid species of the sugar beet mining moth in Egypt is *Agathis* sp. represented more than 50% of the total parasitism by all recorded parasitoids. It seems to be the most promising parasitoid to be used as biological control agent against the sugar beet mining moth in Egypt, given that the species *Alabagrus stigma* (Brulle) [= *Agathis stigmatera* (Cresson)], had been known to be parasitizing *Diatraea* spp. in the Caribbean islands and South America since the 1920's and introduced from Peru into the United States against *Eoreuma loftini* (Dayr) (Lepidoptera: Crambidae) infested sugar cane and rice.

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Table 1. Collected alive pupae and parasitized puparia of *S. ocellatella* at Sakha, Shirbin and Fayoum during April- June, 2005.

Region	Date of collection		Alive pupae	Parasitized pupae	Parasitism (%)	Monthly parasitism (%)
	Month	Day				
Sakha	April	6	4	2	50.0	15.9
		13	110	11	10.0	
		20	21	3	14.5	
		27	129	26	20.2	
	May	4	62	12	19.4	18.5
		11	207	42	20.3	
		18	336	50	14.9	
		25	290	62	21.4	
	Total		1159	208		17.9
	Shirbin	May	15	11	3	27.3
25			26	0	0.0	
June		4	1	0	0.0	41.7
		14	11	5	45.5	
Total		49	8		16.3	
%					16.3	
Fayoum	April	24	71	6	8.4	8.4
Grand Total			1279	222		17.4

Table 2. Weekly emergences of five parasitoids at Sakha (SK), Shirbin (SH) and Fayoum (FY) regions during April- December, 2005.

Month	Week	Agathis sp.			Opilus sp.			Alysia sp.			D. oranginator			P. vindemize			General total	% Progress			
		SK	SH	FY	Total	SK	SH	FY	Total	SK	SH	FY	Total	SK	SH	FY			Total		
April	1 st	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	4.0		
	2 nd	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
	3 rd	2	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0				
	4 th	4	0	0	4	0	0	0	0	0	0	0	0	3	0	0	3				
May	1 st	3	0	4	7	0	0	0	0	0	0	0	0	0	0	0	0	91	41.0		
	2 nd	15	0	1	16	1	1	2	0	0	4	0	4	0	0	0	0				
	3 rd	12	1	0	13	0	0	0	0	0	5	0	5	0	0	0	0				
	4 th	21	2	0	23	4	0	4	1	13	0	13	2	0	0	2	0				
June	1 st	29	0	0	29	6	0	6	0	20	0	20	18	0	18	0	18	107	48.2		
	2 nd	11	3	0	14	2	0	2	1	2	1	3	0	0	0	0	0				
	3 rd	4	0	0	4	0	0	0	1	2	0	2	6	0	6	0	6				
	4 th	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1				
October	1 st	0	0	0	0	0	0	0	0	0	0	0	0	13	0	13	13	5.9			
December	1 st	2	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2	0.9		
Total		103	6	5	114	13	1	14	3	46	1	47	43	1	44	222					
%		51.3															6.3	1.4	21.2	19.8	

Table 3. Percentages of parasitism* in *S. ocellatella* puparia by the different parasitoids at Sakha, Shirbin and Fayoum, 2005.

Parasitoid species	Mean rate of parasitism at:			General rate**%
	Sakha	Shirbin	Fayoum	
<i>Agathis</i> sp.	8.9 (103)	12.2 (6)	7.0 (5)	8.9 (114)
<i>Diadegma oringinator</i> Aub.	4.0 (46)	2.0 (1)	-	3.7 (47)
<i>Pachycrepoides vindemmiae</i> (Rondani)	3.7 (43)	2.1 (1)	-	3.4 (44)
<i>Opius</i> sp.	1.1 (13)	-	1.4 (1)	1.1 (14)
<i>Alysia</i> sp.	0.2 (3)	-	-	0.2 (3)
Total	17.9 (208)	16.3 (8)	8.4 (6)	17.3 (222)

Number between brackets represent total emerged wasps.

*- Related to the total alive pupae in the region.

** - Related to the total alive pupae in all regions (1279).

Table 4. Weekly no. of *S. ocellatella* moths emerged at different regions during April-August, 2005.

Month	Week	Sakha	Shirbin	Fayoum	Total	% Progress
April	1 st	0	0	0	0	3.9
	2 nd	0	0	0	0	
	3 rd	2	0	0	2	
	4 th	39	0	0	39	
May	1 st	41	0	6	47	39.5
	2 nd	71	2	53	126	
	3 rd	103	1	4	108	
	4 th	130	5	2	137	
June	1 st	288	1	0	289	56.0
	2 nd	218	12	0	230	
	3 rd	51	4	0	55	
	4 th	2	16	0	18	
July	1 st	0	0	0	0	0.2
	2 nd	2	0	0	2	
	3 rd	0	0	0	0	
	4 th	0	0	0	0	
August	1 st	3	0	0	3	0.4
	4 th	1	0	0	1	
Total		951	41	65	1057	

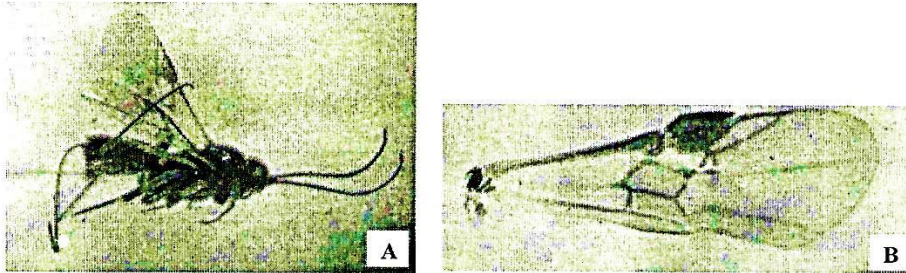


Photo 1- *Agathis* sp. (Braconidae: Agathidinae) (A) and fore wing (B).

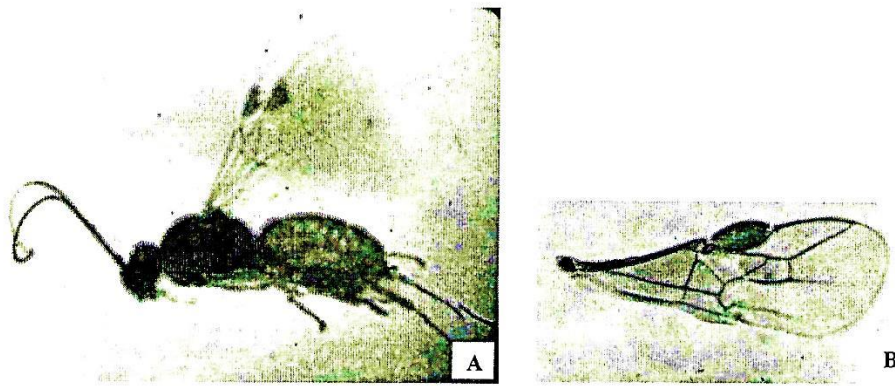


Photo 2: *Opius* sp. (Braconidae: Opiinae) (A) and fore wing (B).

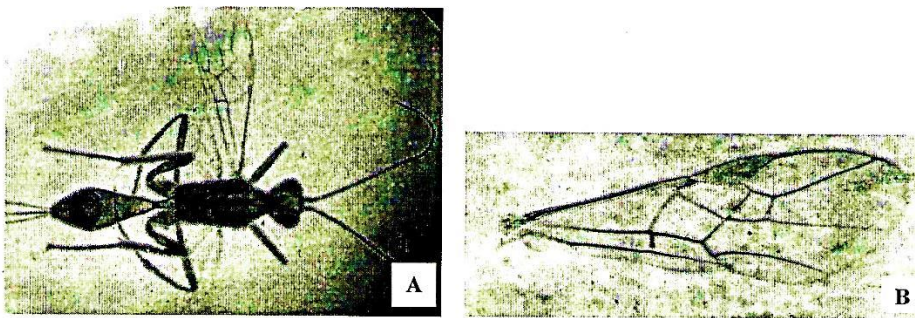


Photo 3: *Alysia* sp. (Braconidae: Alysiinae) (A) and fore wing (B).

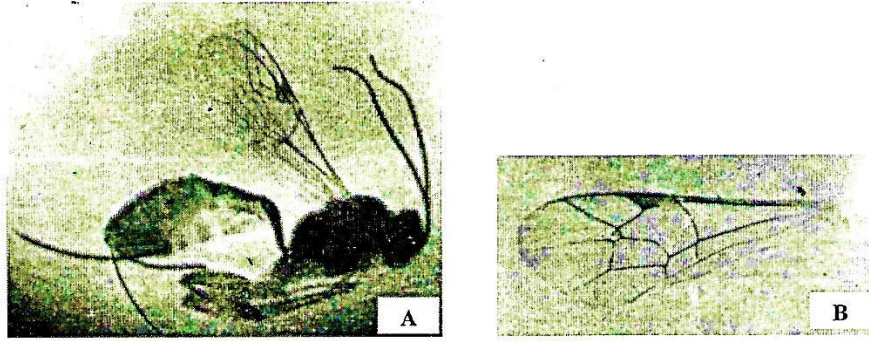


Photo 4. *Diadegma oranginator* Aub. (Ichneumonidae) (A) and fore wing (B).

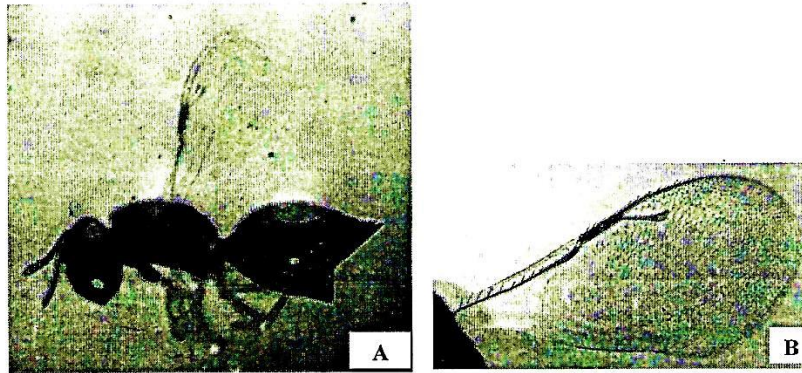


Photo 5: *Pachycrepoideus vindemmiae* (Rondani) (Pteromalidae) (A) and fore wing (B).

REFERENCES

- 1- Abd El-Ghany, M. A. 1994. Studies on the beet moth, *Scrobipalpa ocellatella* Boyd, at Kafr El-Sheikh region. M. Sc. Thesis, Fac. of Agric., Tanta Univ., :116 pp.
- 2- Abo-Saied Ahmed, A. M. B. 1987. Studies on the insects of sugar beet in Kafr El-Sheikh Governorate. Ph. D. Thesis, Fac. of Agric., Tanta Univ., : 152 pp.
- 3- Amprag, D., K. Tatjana, S. Radosav and J. Petar. 1998. Monitoring of pest population dynamics- A Cornerstone of integrated pest management in field crops. Proc. Vrnja~Ka Banja: 7- 12.
- 4- Awadalla, S. S., M. E. Ragab and H. M. Fathy. 1991. Interaction between injurious and predatory insects inhabiting sugar beet plants. Egypt. J. Biol. P. Cont. 1 (2): 25- 32.
- 5- El-Agamy, F. M., S. M. I. Metwally, R. El-Sufty and A. Youssef. 1994a. Preliminary biological studies of sugar- beet beetle, *Cassida vittata* de Villers, sugar- beet fly, *Pegomyia mixta* Villeneuve and sugar- beet moth, *Scrobipalpa ocellatella* Boyd . J. Agric. Res. Tanta Univ., 20(1): 530- 538.
- 6- El-Agamy, F. M., S. M. I. Metwally, R. El-Sufty and A. Youssef. 1994b. Incidence of parasitism in the sugar beet fly, *Pegomyia mixta* Villeneuve and the sugar beet moth, *Scrobipalpa ocellatella* Boyd in Kafr El-Sheikh Governorate. Egypt. J. Biol. Pest Control 4 (2): 27- 32.
- 7- El-Agamy, F. M., S. M. I. Metwally, R. El-Sufty and A. Youssef. 1996 . The relationship between population fluctuations of some important insect pests of sugar- beet and their insect predators at Kafr El-Sheikh region.. J. Agric. Res. Tanta Univ., 22 (1): 69- 76.
- 8- El-Serwy, S. A. 2007. *Pachycrepoideus vindemmiæ* (Rondani), a new record parasitoid (Hymenoptera, Pteromalidae) on pupae of the beet fly *Pegomyia mixta* Villeneuve (Diptera: Anthomyiidae), and the beet moth, *Scrobipalpa ocellatella* (Boyd) (Lepidoptera: Gelechiidae). Egypt. J. Agric. Res., : (In Press).
- 9- El-Sufty, R., S. M. I. Metwally and A. Youssef. 1987. Studies on the bionomics of the sugar- beet mining moth, *Scrobipalpa ocellatella* (Boyd) (Lepidoptera: Gelechiidae) at Kafr El-Sheikh, Egypt. J. Agric. Res. Tanta Univ., 13 (4): 1141- 1152.

- 10- Hammad. S. M., K. E. Youssef and M. A. Assem. 1968. The biology of the sugar-beet mining moth, *Scrobipalpa ocellatella* (Boyd) (Lepidoptera: Gelechiidae). Bull. Soc. ent. Egypt. LII: 49- 51.
- 11- Hassanein, F. A., A. H. El-Heneidy, M. S. T. Abbas and A. R. Hamed. 1985. Survey of the parasitoids of main lepidopterous pests in vegetable crop fields in Egypt. Bull. Soc. Ent. Egypte,65: 259- 265.
- 12- Meagher R. L. , J.W. Smith, H.W. Browning and R. R.. Saldana. 1998. Sugarcane stem borers and their parasites in southern Texas. Env. Ent. 27: 759-766.
- 13- Metwally, S. M. I., R. El-Sufty, N. El-Dakhakhny and A. Bassiouny. 1987a. Effect of infestations with certain insect pests on some sugar- beet properties. J. Agric. Res. Tanta Univ., 13 (4): 1119- 1128.
- 14- Metwally, S. M. I., R. El-Sufty, N. El-Dakhakhny and A. Bassiouny. 1987b. Survey and seasonal abundance of insects associated with sugar- beet at Kafr El-Sheikh, Egypt. J. Agric. Res. Tanta Univ., 13 (4): 1129-1140.
- 15- Willcocks, F. C. 1922. A survey of the more important and economic insects and mites of Egypt. Bull. Sult. Agric. Tech. Sec. No. 1, Cairo: 482 pp.

تعدد طفيليات صانعة أنفاق أوراق بنجر السكر

Scrobipalpa ocellatella Boyd.

على بنجر السكر في مصر

سمير عوض السروي.

معهد بحوث وقاية النباتات-مركز البحوث الزراعية-الدقى- حيزة.

تم جمع أوراق مصابة بصانعة أنفاق أوراق البنجر *Scrobipalpa ocellatella* من رتبة حرشفية الأجنحة وعائلة Gelechiidae عام ٢٠٠٥ من حقول بنجر السكر غير معاملة بالمبيدات بمناطق سخا (محافظة كفر الشيخ)، شربين (محافظة الدقهلية) والفيوم (محافظة الفيوم).

في هذا البحث تم تعريف خمسة أنواع من الطفيليات على عذارى تلك الحشرة من رتبة غشائية الأجنحة وفوق فصيلة Chalcidoidea وهى النوع الدائم *Agathis sp.* من عائلة (Braconidae) وكذلك أربعة أنواع كتسجيل جديد وهى: *Opius sp.* و *Alysia sp.* من عائلة (Braconidae)، *Diadegma oranginator* Aub. من عائلة (Ichneumonidae) و *Pachycrepoideus vindemmiae* (Rondani) من عائلة (Pteromalidae).

بدأ نشاط هذه الطفيليات بصفة عامة في النصف الثاني من شهر أبريل وأستمر حتى أوائل ديسمبر- وكان أول تواجد قد سجل لطفيل *Agathis sp.* فى سخا ثم لطفيل *P. vindemmiae* فى رابع أسبوع من أبريل ثم ظهر بعد ذلك كل من طفيل ال *Opius sp.* و *D. oranginator* فى الأسبوع الثاني لمايو. أما طفيل *Alysia sp.* فكان آخرها تواجداً حيث سجل فى الأسبوع الرابع لمايو.

تذبذب درجة التطفل بصفة عامة بصورة واضحة تبعاً للمنطقة، وبمتوسط عام ١٧،٩% ومدى ١٠-٥٠% فى سخا، ومتوسط عام ١٦،٣% ومدى ٢٧،٣-٤٥،٥% فى شربين ومتوسط ٨،٤% فى الفيوم. كذلك كانت سخا أكثر المناطق تفضيلاً سواءاً للحشرة أو الطفيل، فبلغت الأعداد بها ٩٥١ فراشة، ٢٠٨ للطفيل بينما كانت ٤١، ٨ فى شربين و ٦، ٦٥ فى الفيوم، على التوالي. هذا وظهر من النتائج وجود توافق زمنى بين ذروات خروج كل من العائل والطفيل.

كان طفيل ال *Agathis sp.* أكثر الطفيليات تواجداً (خاصة بسخا) حيث مثل ٥١،٣% من مجموع تعداد الطفيليات تم تبعه طفيل *D. oranginator* بنسبة ٢١،٢% ثم طفيل *P. vindemmiae* بنسبة ١٩،٨% ثم أكتمل المعقد الطفيلي بأقل النسب تمثيلاً وهى ٦،٣% للطفيل *Opius sp.* و ١٤،٤% للطفيل *Alysia sp.*. يتضح من النتائج أن طفيل ال *Agathis sp.* يعتبر عنصراً حيويًا هاماً فى المكافحة الحيوية لفراشة أوراق البنجر فى مصر.