

## Natural Enemies of Certain Insect Pests Attacking Sugar Beet Plants at Kafr El-Sheikh Governorate

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### ABSTRACT

For two successive seasons; 2015/16 and 2016/17, the current study was undertaken at Sidi Salem District, Kafr El-Sheikh Governorate to monitor population fluctuation of the most important insect pests attacking the early (August) plantation of sugar beet and their associated predators. Also, the parasitoids of major sugar beet insects were investigated in the late (October) plantation. In 2015/16 season, the population density of *Spodoptera littoralis* was relatively high, especially during September and October, the average number in September was 12.4 larvae/25 sugar beet plants, that increased to 15.5 larvae in October. As for aphids, the highest monthly average occurred in October with 18.5 nymphs and adults/25 sugar beet plants, followed by 11.0 individuals in November. Regarding to *Empoasca lybica*, the insect pest was found all the season round, with the highest occurrence in November. Seasonal means of *S. littoralis*, *Aphis* spp. and *E. lybica* were  $5.28 \pm 2.79$  &  $7.47 \pm 5.40$ ,  $9.02 \pm 2.43$  &  $26.55 \pm 6.17$  and  $18.07 \pm 4.42$  &  $20.05 \pm 3.45$  individuals/25 sugar beet plants in the first and second seasons, respectively. The most occurring predators were coccinellids, *Paederus alfieri* and *Chrysoperla carnea*. Their seasonal means were  $5.20 \pm 1.33$  &  $14.82 \pm 5.13$ ,  $1.17 \pm 0.40$  &  $1.60 \pm 0.56$  and  $2.45 \pm 0.50$  &  $4.58 \pm 1.00$  in the first and second seasons, respectively. Three parasitoids were recorded attacking major sugar beet insects. *Cassida vittata* eggs were parasitized by *Monorthochaeta nigra* (Trichogrammatidae) and larvae-pupae were parasitized by *Aprostocetus* sp (Eulophidae). *Pegomyia mixta* larvae were parasitized by *Opius nitidulator* (Braconidae), and larvae of *Scrobipalpa ocellatella* were parasitized by *Diadegma* sp (Ichneumonidae). Seasonal means were  $6.97 \pm 2.80$  &  $8.46 \pm 3.35$  for *Monorthochaeta nigra*,  $5.69 \pm 1.94$  &  $6.61 \pm 2.17$  for *Aprostocetus* sp,  $8.87 \pm 3.17$  &  $7.76 \pm 1.94$  for *Opius nitidulator* and  $9.37 \pm 3.52$  &  $11.15 \pm 3.68$  for *Diadegma* sp in the first and second seasons, respectively.

### INTRODUCTION

Sugar beet, *Beta vulgaris* L. is an important food crop in Egypt and all over the world, representing a main source for sugar production. The total area cultivated in 2016 sugar beet season was 560,000 feddans, from which 100,000 feddans were cultivated at Kafr El-Sheikh Governorate, and 17,000 feddans at Sidi Salem district.

Sugar beet plants are subjected to infestations of several insect pests causing considerable damage (Metwally *et al.*, 2004). In the early (August) sugar beet plantation, *Spodoptera littoralis* was the most destructive insect accompanied with coccinellids and *Chrysoperla carnea* (Shalaby and El-Samahy, 2010). The leafhoppers, *Empoasca* spp. were found with a relatively high population density during September, October and May (Shalaby and Hendawy, 2007). Sherif *et al.* (2013) recorded the aphid, *Myzus persicae* with a high population density in September and November, associated with coccinellids and *Chrysoperla carnea* during November, while *Paederus alfieri* peaked in January, and *Cassida vittata* peaked by late April until mid-June. Hendawy and El-Fakharany (2014) encountered *C. vittata* with high densities by the late sugar beet season, associated with activity of some parasitoids.

In Iran, Abbasipour *et al.* (2013) recorded *Scrobipalpa ocellatella* with a high activity representing much damage to sugar beet plants in the hotter zones, particularly by late sugar beet season.

The author (in press), surveyed *Spodoptera littoralis*, aphids and *Empoasca lybica* as the most dominant insect pests in the early (August) plantation. The current study aimed to monitor population fluctuation of the most important insect pests attacking the early plantation of sugar beet and their associated predators. Also, the parasitoids of major sugar beet insects were investigated in the late (October) plantation.

### MATERIALS AND METHODS

The current study was carried out at Sidi Salem district, Kafr El-Sheikh Governorate for two successive

sugar beet seasons; 2015/16 and 2016/17. The experimental area measured about one feddan, split into two halves. The first half was cultivated by the first week of August in both seasons and assigned to investigate the common insect pests and their associated predators. The second half was cultivated by the first week of October in both seasons, and assigned to investigate the occurring parasitoids of three major insect pests; *Cassida vittata*, *Pegomyia mixta* and *Scrobipalpa ocellatella*. Sugar beet cultivar, Kawemira was sown in both plantations, and all cultural practices were followed as recommended, but without any pesticide applications.

#### 1. Population fluctuation of insect pests and their associated predators:

One month after sowing, 25 sugar beet plants were examined every two weeks. Larvae of *Spodoptera littoralis*, nymphs and adults of each of aphids and *Empoasca lybica* were counted. In addition, number of adults of each of coccinellids and *Paederus alfieri* and larvae of *Chrysoperla carnea* were recorded. This experiment was conducted in 2015/16 and 2016/17 sugar beet seasons.

#### 2. Parasitoids of major insect pests of sugar beet: *Cassida vittata*:

Sugar beet leaves infested with *Cassida vittata* were collected from the field beginning from December up to May in 2015/2016 and 2016/2017 seasons. The leaves were examined in the laboratory and the leaf parts having *C. vittata* eggs were cut, and cleaned from any other insects or insect stages. In addition, larvae and pupae of *C. vittata* were excluded. Collected eggs, larvae and pupae were incubated till the emergence of parasitoids or following insect stages. The incubation was done by confining 10 eggs, five larvae or five pupae in a 9 cm Petri dish each. The dishes were incubated at room condition ( $25 \pm 2^\circ\text{C}$ , 60-70% R.H.).

#### *Scrobipalpa ocellatella*:

Larvae of *S. ocellatella* were collected from infested sugar beet plants in the field. The larvae were introduced into Petri dishes with a piece of sugar beet leaf till the emergence of the parasitoids, or turning to pupae.

**Pegomyia mixta:**

The sugar beet leaves having the blotches containing the larvae of *P. mixta*, were collected from the field. The larvae of the pest were excluded and put inside Petri dishes till completion of the life cycle, or the emergence of the parasitoids.

The collected parasitoids were preserved as specimens in glass vials containing 70% ethyl alcohol, with few drops of glycerin. The specimens were identified by the Systemic Department, Plant Protection Research Institute, Dokki, Cairo.

**RESULTS AND DISCUSSION**

**1. Major insect pests:**

Data in Table (1) show the population fluctuation of some insect pests on sugar beet plants in August plantation, during 2015/2016 and 2016/2017 seasons.

**In 2015/16 season:**

The monthly mean number of *Spodoptera littoralis* was relatively high, especially during September and October (Table 1). The mean number in September was 12.4 larvae/25 sugar beet plants, that increased to 15.5 larvae in October. There was no considerable occurrence of the pest until February, that was recorded as 2.7 larvae/25 sugar beet plants, with a seasonal mean of 5.28± 2.79 larvae/25 plants.

**Table 1. Monthly mean number of the main insect pests attacking sugar beet in August plantation, at Kafr El- Sheikh region**

Month	2015/2016 Season			2016/2017 Season		
	<i>S littoralis</i>	<i>Aphis spp</i>	<i>E lybica</i>	<i>S littoralis</i>	<i>Aphis spp</i>	<i>E lybica</i>
September	12.4	8.8	16.0	33.3	17.5	31.3
October	15.5	18.5	23.3	10.0	40.8	34.5
November	0.5	11.0	30.5	0.0	50.2	20.2
December	0.6	0.0	27.4	0.0	13.3	12.3
January	0.0	7.8	6.5	0.0	19.5	26.0
February	2.7	8.0	4.7	1.5	18.0	32.0
Mean± S.E.	5.28± 2.79	9.02± 2.43	18.07± 4.42	7.47± 5.40	26.55± 6.17	20.05± 3.45

As for aphids, data in Table (1) show that the highest monthly mean was in October with 18.5 nymphs and adults/25 sugar beet plants, followed by 11.0 individuals in December. The seasonal mean was 9.02± 2.43 individuals /25 sugar beet plants.

**Table 2. Monthly mean number of the main associated insect predators in sugar beet fields in August plantation, at Kafr El- Sheikh region**

Month	2015/2016 Season			2016/2017 Season		
	Coccinellids	<i>Paederus alfieri</i>	<i>C. Carnea</i>	Coccinellids	<i>Paederus alfieri</i>	<i>C. Carnea</i>
September	4.8	2.2	3.0	20.5	3.8	4.2
October	11.0	1.8	4.4	32.5	2.6	6.9
November	6.0	1.0	2.8	23.6	1.1	8.2
December	1.4	0.0	1.0	2.8	1.1	3.5
January	3.3	0.0	2.0	8.0	0.0	2.8
February	4.7	2.0	1.5	1.5	1.0	1.9
Mean± S.E.	5.20± 1.33	1.17± 0.40	2.45± 0.50	14.82± 5.13	1.6± 0.56	4.58± 1.00

**In 2016/2017 season:**

The coccinellid predators firstly appeared in September with a monthly average of 20.5 predators/25 plants, while the highest mean number was recorded in October (32.5 predators/25 plants). The seasonal mean of this predator was 14.82 ± 5.13 individuals/25 plants. It was found

Regarding to *Empoasca lybica* (Table 1), the insect pest was found all the season round, with the highest occurrence in November, as represented by 30.5 nymphs and adults/25 plants. The seasonal mean was 18.07± 4.5 individuals /25 sugar beet plants.

**In 2016/17 season:**

As in the first season, the monthly mean number of *Spodoptera littoralis* was relatively high, especially during September and October (Table 1). The mean number in September was the highest (33.3 larvae/25 sugar beet plants), that decreased to 10.0 larvae in October. The insect was not recorded up to January, and appeared very rarely in February. The seasonal mean was 7.47 ± 5.40 larvae/25 plants.

Concerning aphids, data in Table (1) show that the highest monthly mean was in November with 50.2 nymphs and adults/25 sugar beet plants, followed by 40.8 individuals in October. The seasonal mean was 26.55± 6.17 individuals /25 sugar beet plants.

As for, *Empoasca lybica* (Table 1), the insect pest was found all the season round, with the highest occurrence in October, as represented by 34.5 nymphs and adults/25 plants. The seasonal mean was 20.05± 3.45 individuals /25 sugar beet plants.

**2. Major insect predators:**

**In 2015/2016 season:**

The surveyed insect predators, related to major sugar beet insect pests, were coccinellids, *Paederus alfieri* and *Chrysoperla carnea*. Data in Table (2) show that coccinellids were mostly detected throughout the season, however, the active periods were in October and November. The highest peak of coccinellids was in October with 11.0 predators/25 plants. Thus, the highest peak of these predators coincided with that of aphids. The seasonal mean was 5.20 ± 1.33 individuals/25 plants.

*P. alfieri* (Table 2) peaked in September and February coinciding with the peaks of *S. littoralis* larvae, with a seasonal mean of 1.17 ± 0.40 individuals/25 plants.

Similar data were found with *Chrysoperla carnea*, when the active periods of occurrence were in September, October and November. Also, the highest peak of this predator coincided with those of aphids and cotton leafworm in October. The seasonal mean was 2.45 ± 0.50 individuals/25 plants.

that the highest population densities of coccinellid predators synchronized with those of *Aphis spp.* and *E. lybica*.

On the other hand, *P. alfieri* was slightly detected, with a relative high population density during September, coinciding with the considerable occurrence of *S. littoralis*.

*Chrysoperla carnea* was recorded with considerable numbers during October and November only; 6.9 and 8.2 larvae/25 plants, respectively. These peaks synchronized with the peaks of *Aphis* spp and *E. lybica*. The seasonal mean of *C. carnea* was  $4.58 \pm 1.00$  chrysopids/25 sugar beet plants.

The current data agree with those of Metwally *et al.* (1987) who found that the sugar beet pests, *Scrobipalpa ocellatella*, *Pegomia mixta* and *Cassida vittata* were the most abundant insect pests in sugar beet fields at Kafr El-Sheikh region. On the other hand, Shalaby and Hendawy (2007) surveyed 13 species of leafhoppers on sugar beet plants at Kafr El-Sheikh and Gharbia Governorates and these pests exhibited four peaks of occurrence (on 15 Oct., 15 Jan, 15 March and 15 May). In this regard, Mesbah and El-Husseini (2009) recorded four insects pests; jassids, aphids, *Spodoptera littoralis* and *Cassida vittata* and three predators, *Coccinella undecimpunctata*, *Scymnus* spp. and *Paedrus alferii* on both sugar beet plants and their weed borders. They also found significant correlation between *Scymnus* spp. on weeds and jassids on sugar beet and the weed border served as dwelling for the predators especially in winter.

The presented data agree also with those of Shalaby and El-Samahy (2010) and Shalaby *et al.* (2011) who found that August plantation of sugar beet was greatly attacked by cotton leafworm, *Spodoptera littoralis* which caused great damage, and added that the highest population density of the pest larvae was recorded in September and October, also there was a highly positive correlation between the coccinellids and *Chrysoperla carnea* and the pest larvae. Sherief *et al.* (2013) mentioned that the highest occurrence of *Cassida vittata* larvae was in the fourth week of April, and the third week of June, while the adult pests occurred in the first week of May and June. As for, *Pegomia mixta*, they found that the first peak occurred in the first week of December, while the highest occurrence of the pest was found by the end of February and April. Regarding to *Aphis*, *Myzus persicae*, they recorded only one peak on sugar beet plants during the two seasons.

The current data are in correspondence with those of El-Dessouki *et al.* (2014) who recorded three main insect pests on sugar beet plants at Kafr El-Sheikh region; *Cassida vittata*, *Pegomyia mixta* and *Scrobipalpa ocellatella* and four predatory species were associated with former pests; *Coccinella undecimpunctata*, *Scymnus* sp., *Paedrus alferii* and *Chrysoperla carnea*. Their results revealed that the highest infestation level of these pests occurred during March and April in both seasons. In this regard, Amal *et al.* (2014), at Sharkia Governorate, were studied the ecology of certain piercing and sucking pests infesting sugar beet plants and found that the first peak of *Myzus persicae* occurred in the 2<sup>nd</sup> week of December and the second peak was recorded in the 4<sup>th</sup> week of January, while the leafhopper, *Empoasca* spp. constituted two peaks in the second week of November and first week of January.

### 3. Parasitism of major sugar beet insects in October plantation:

#### *Cassida vittata*:

In 2015/16 season, the first parasitism of *Cassida vittata* eggs caused by *Monorthochaeta nigra* was recorded in February with a monthly mean of 5.56% (Table 3), and increased gradually to reach a peak of 17.22% in May, with

a seasonal mean of  $6.97 \pm 2.80\%$ . In 2016/17 season, egg parasitism of *C. vittata* was high during April and May, with values of 16.17 and 19.72%, respectively and the seasonal mean in the second season was  $8.46 \pm 3.35\%$ .

In 2015/16 season, larval pupal parasitism of *C. vittata* by *Aprostocetus* sp (Table 4) started in February with a rate of 5.26%, reaching the maximum (10.88%) in April. The seasonal mean of larval pupal parasitism was  $5.69\% \pm 1.94\%$  in the first season, and  $6.61 \pm 2.17\%$  in the second one.

**Table 3. Percentage of *Cassida vittata* parasitism caused by the egg parasitoid *Monorthochaeta nigra* in sugar beet October plantation fields at at Kafr El- Sheikh region**

Month	2015/2016 season	2016/2017 season
December	0.0	0.0
January	0.0	0.0
February	5.56	6.38
March	6.51	8.51
April	12.50	16.17
May	17.22	19.72
Mean±S.E.	$6.97 \pm 2.80$	$8.46 \pm 3.35$

**Table 4. Percentage of *Cassida vittata* parasitism caused by the larval-pupal parasitoid *Aprostocetus* sp in sugar beet October plantation fields at at Kafr El- Sheikh region**

Month	2015/2016 season	2016/2017 season
December	0.0	0.0
January	0.0	0.0
February	5.26	7.40
March	8.14	10.42
April	10.88	11.66
May	9.85	10.19
Mean±S.E.	$5.69 \pm 1.94$	$6.61 \pm 2.17$

#### *Pegomyia mixta*

In 2015/16 season, larval parasitism of *Pegomyia mixta* by *Opius nitidulator* (Table 5), appeared firstly as 16.67% in February, and increased gradually to exhibit a peak parasitism of 17.74% in March. The parasitism decreased to 8.00% in May, while the seasonal mean was  $8.87 \pm 3.17\%$ . Similar trend was observed in the second season, with a seasonal mean of  $7.76 \pm 1.94\%$ .

**Table 5. Percentage of *Pegomyia mixta* larval-pupal parasitism caused by *Opius nitidulator* in sugar beet October plantation fields at at Kafr El- Sheikh region**

Month	2015/2016 season	2016/2017 season
December	0.0	0.0
January	0.0	11.11
February	16.67	10.71
March	17.74	12.50
April	6.06	7.69
May	8.00	4.55
Mean±S.E.	$8.87 \pm 3.17$	$7.76 \pm 1.94$

#### *Scrobipalpa ocellatella*

*Scrobipalpa ocellatella* parasitism, by *Diadegma* sp in late sugar beet plantation (Table 6), was recorded initially as 11.11% in February and increased to 12.59% in March, exhibiting the highest peak of 22.92% in May. The seasonal mean of *S. ocellatella* parasitism was  $9.37 \pm 3.52\%$ . Also, the peak of parasitism of this insect pest, by this larval-pupal parasitoid, in the second season, was detected in May (22.41%), with a seasonal mean of  $11.15 \pm 3.68\%$ .

**Table 6. Percentage of *Scrobipalpa ocellatella mixta* larval parasitism caused by *Diadegma* sp in sugar beet October plantation fields at at Kafr El- Sheikh region**

Month	2015/2016 season	2016/2017 season
December	0.0	0.0
January	0.0	0.0
February	11.11	11.11
March	12.50	15.22
April	9.68	15.22
May	22.92	22.41
Mean±S.E.	9.37 ± 3.52	11.15± 3.68

As first record in Iran, Abbasipour *et al.* (2010b) recorded *Microchelonus subcontractus* and *Bracon intercessor* (Braconidae) and *Diadegma pusio* (Icheumonidae) as parasitoids of *Scrobipalpa ocellatella* larvae. The parasitoid wasp, *Agathis fuscipennis* (Braconidae) was recorded as a domestic species on ..... in Italy (Loni *et al.*, 2011). El-Samahy and Shalaby (2011) at Kafr El-Sheikh region, studied the seasonal abundance of the braconid parasitoids on *Scrobipalpa ocellatella* and *Pegomyia mixta* during three sugar beet plantations and found that, in the first and second plantations, numbers of *Opius nitidulator* on *Pegomyia mixta* increased to reach their maximum by the end of the season and in the third plantation, the parasitoid recorded maximum numbers in April and May. They also found that the third (December) plantation had the highest population density of *O. nitidulator* numbers. The authors also found the highest population density of *Agathis sp.* on *Scrobipalpa ocellatella* was recorded on the third sugar beet plantation, that started with low population and gradually increased to reach its maximum in June.

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## الأعداء الطبيعية المرتبطة ببعض حشرات بنجر السكر في محافظة كفر الشيخ أمانى عبد الحكيم خليفة قسم بحوث مكافحة الحويوية – معهد بحوث وقاية النباتات – مركز البحوث الزراعية – مصر

أجريت الدراسة الحالية في مركز سيدى سالم - محفظة كفر الشيخ ، موسمى 2016/2015 ، 2017/2016 لدراسة تقلبات تعداد أهم الآفات الحشرية والمقرسات المرتبطة بها فى العروة المبكرة (أغسطس). كما تم حصر الطفيليات وتقلبات تعدادها خلال العروة المتأخرة (أكتوبر) فى الموسم الأول (2016/2015) ، كانت الكثافة العددية لدودة ورق القطن مرتفعة نسبيا ، خصوصا خلال شهرى سبتمبر وأكتوبر (15.5-12.4 يرقة/25 نبات بنجر). وكنت كثافة تعداد المن 18.5 حورية نوفمبر. كانت متوسطات الأعداد الموسمية لكل من دودة ورق القطن والمن ونطاطات الأوراق هى 2,79 ± 5,28 & 5,40±7,47 ، 2,43±9,02 & 2,65±6,17 ، 4,42 ± 18,07 & 20,05 ± 3,45 فردا / 25 نبات فى كل من السنة الأولى والثانية على التوالي. كانت أكثر المقرسات تواجدا أنواع أبو العيد والحشرة الرواعة وأسد المن . كنت المتوسطات الموسمية لهذه المقرسات هى 1,33 ± 5,20 & 5,13±14,82 ، 0,40±1,17 & 0,56 ± 1,60 ، 0,50 ± 2,45 & 1,00 ± 4,58 فردا / 25 نبات فى كل من السنة الأولى والثانية على التوالي. تم تسجيل طفيلين على *Cassida vittata* الأول هو *Monorthochaeta nigra* وطفيل (*Trichgrammatidae*) ويتطفل على بيض الحشرة والثانى هو *Aprostocetus* sp (*Eulophidae*) على يرقات *Diadegma sp* وطفيل *Pegomyia mixta* ، وطفيل *Scrobipalpa ocellatella*. كنت متوسطات التطفل الموسمية لطفيل *Monorthochaeta nigra* هى 2,80 ± 6,97 & 3,35 ± 8,46 وطفيل *Aprostocetus* sp هى 1,94 ± 5,69 & 2,17 ± 6,61 ، وطفيل *Opius nitidulator* هى 1,94 ± 7,96 & 3,17 ± 8,87 وطفيل *Diadegma sp* هى 3,52 ± 9,37 & 3,68 ± 11,15 فى كل من الموسم الأول والثانى على التوالي.