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Diadegma aegyptiator Shaumer 1966 (Hymenoptera: Ichneumonidae): New Record Parasitoid on the Rib Miner, *Scrobipalpa ocellatella* Boyd. (Lepidoptera: Gelechiidae) in Egyptian Sugar Beet Fields

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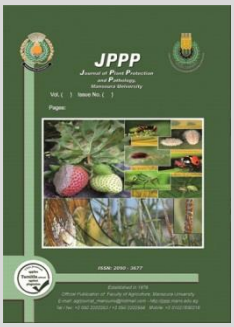

ABSTRACT

The larvae of the rib miner,*Scrobipalpa ocellatella Boyd* feed on the sugar beet leaves and roots causing huge damage in such a way that the root rot and thus it caused a reduction in the yield of roots and the sugar content in the roots. Parasitoids are the most effective natural enemies for insect biological control. In nature, several parasitoids were observed to be potential bio-agents of serious crop pests. The future of "insecticide-less" pest management will be driven by a bouquet of parasitoids and predators complimented by entomopathogens. The reduction in insecticide residues in food - sugar beet is a food crop - is desirable for public health. The present study was carried out at the experimental farm of Sakha Agricultural Research Station, Kafr El-Sheikh Governorate-Egypt throughout two successive seasons 2018/2019 and 2019/2020. New parasitoid was recorded from the rib miner pupae. It was identified as *Diadegma aegyptiator* on *S.ocellatella* for the first time in Egypt. The Overall of parasitism were 24.52 and 31.03% in the two seasons, respectively. As well as, statistical analysis proved that a highly positive significant correlation coefficient values between *S.ocellatella* and its parasitoid in two seasons, respectively.These results elucidate that this parasitoid is a promising tool in reducing *S.ocellatella* populations.

Keywords: *Diadegma aegyptiator*, parasitoid, *Scrobipalpa ocellatella*, Egyptian sugar beet

INTRODUCTION

The Sugar beet, *Beta vulgaris* L. is the second and only major source of the world's sugar production. It is grown exclusively in temperate zones, in contrast to sugar cane, which grown in tropical and subtropical zones. The roots of sugar beet contain high levels of sucrose. Sugar is formed by photosynthesis in the leaves and is then stored in the root. Around 37% of the world's sugar comes from sugar beet (Robson and Littetrick, 2002).

Scrobipalpa ocellatella (Boyd.) (Lepidoptera : Gelechiidae) is one of the most key pests of sugar beet that causes quantitative and qualitative yield loss (Ahmadi *et al., 2018* and Ganji and Moharramipour, *2015).* Among all natural enemies, perhaps, no other group is more important to maintain pest numbers below damaging levels than parasitoids. They are the natural enemies most used around the world for bio control of insects (Sampaio *et al.* 2010).

In sugar beet fields, many investigators recorded various species of parasitoids on *S. ocellatella*. They demonstrated the efficiency of these parasitoids in managing this insect populations such as ; *Trichogramma evanescans* West. (Marie, 2004 and Mesbah *et al.*, 2004), *Pachycrepoideus vinedemmiae* (Rondani) (El-Serway, 2008), *Agathis* sp. (Bazazo, 2010), *Microchelonus subcontracts* and *Bracon intercessor* Nees (Abbasipour, 2012), *Diadegma Pusio* (Abbasipour, 2013) *Diadegma* sp. (Khalifa, 2018) and *Diadegma oranginator* Aubert. (Bazazo and Ibrahim, 2019).

Thus, this study was done for identifying more species of parasitoids against this vital insect pest.These parasitoids are able to regulate *S.ocellatella* numbers in sugar beet fields without using insecticides.

MATERIALS AND METHODS

This work was carried out at the Experimental Farm of Sakha Agricultural Research Station, Kafr El-Sheikh Governorate, Egypt and Laboratory of Sugar Crops Research Department during 2018/2019 and 2019/2020 seasons. The experimental area (about 3 feddans) was planted with Karm variety on 10th October and 15th October during the two seasons, respectively. Recommended agricultural practices were achieved, but chemical control by insecticides was avoided.

Samples were started on 25th December to 4th April and 26th December to 5th April during the two seasons, respectively. Samples were collected every ten days. Each sample consisted of forty sugar beet leaves or petioles infested with *S.ocellatella* and were enclosed in 3 paper bags and transferred to laboratory. After that, they were put into 5 petri dishes (9cm), containing filter papers till pupation under laboratory conditions (25 ± 2 c^{o}, 60-70% R.H.). Then, pupae were put into other petri dishes till adult stage emergence (moth or parasitoid).

The individuals of parasitoids were counted and the percentages of parasitism were calculated in every sampling date. The parasitoids were collected by a fine brush and put into small vials containing ethyl alcohol 70% The parasotoids were transferred to Insect Identificantion Unit (IIU), Plant Protection Research Institute-Giza, Egypt for identification. The percentages of parasitism were calculated according to the following equation:

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% parasitism = (No. parasitoid ÷ No. pupae) × 100

Statistical analysis:

- Simple correlation coefficient values between *S.ocellatella* and its parasitoid were calculated according to Snedecor and Cochran (1989), considering data in Tables (1 and 2).

RESULTS AND DISCUSSION

As shown in Fig. (1), the parasitoid was identified as *Diadegma aegyptiator* Shaumer 1966 (Hymenoptera: Ichneumonidae). It is a larval- pupal parasitoid.

Data illustrated in Tables (1 and 2) clarify that the overall of parasitism was 24.52 and 31.03% during the whole season in 2018/2019 and 2019/2020, respectively. Also, parasitism (%) ranged between (0.00 to 33.33%) and (0.00 to 39.39%) in the two seasons, respectively. In addition to table (3) show that a highly significant correlation coefficient values between *S. ocellatella* and its parasitoid. "r" Values were 0.912** and 0.901** during.the two seasons, respectively.

Fig. 1. Diadegma aegyptiator Shaumer 1966 (Hymenoptera: Ichneumonidae)

These results demonstrate that the strong correlation between this parasitoid and its host. Because, parasitoids are very selective and only attack a particular life stage of one or several closely related species. Parasitoids are specialized, while predators are generalized. Parasitoids life cycle are closely synchronized with that of their hosts (Gullan and Cranston, 2004). Marie (2004) indicated that using the egg parasitoid T.evanescans suppressed the infestation with *S.ocellatella* by 57.90 to 97%. Also Mesbah *etal*. (2004) evaluated the effectiveness of the egg parasitoid reductions in infestation ranged between 13.96 to 58.29%. In Romania,, *T. evanescens* in reducing *S.ocellatella* populations. The Anonymous (2006) reported that releasing *Trichogramma* spp. has the same efficiency of insecticides against *S.ocellatella* in sugar beet fields. El-Serway (2008) showed that the overall of parasitism by *P.vinedemmiae* on larvae *of S.ocellatella* about 40.11%. Khalifa (2018) reported that larvae of *S.ocelltella* were parasitized by *Diadegma* sp. Seasonal means were 9.37 ± 3.52 and 11.15 ± 3.68 in the first and second season, respectively.

In Iran, Abbasipour *et al*. (2012 and 2013) demonstrated that the parssitoid wasps; *D. Pusio*, *M. Subcontracts* and *B. Interessor* .are effective in reducing *S. ocellatella* larvae numbers. Mahmudi *et al*. (2013) identified two parasitoids braconids on *S. ocelltella* in sugar beet fields. *B. intercessor* is larval parasitoid and *M. subcontractus* is - **larval- pupal** parasitoid. They play an important role in reducing *S. ocellatella* .infestations. Bazazo and Ibrahim (2019) indicated that the mean of parasitism by *D. oranginator* were; 55.17, 60.46 and 68.91% at the three cultivations, respectively. In Britain sugar beet fields, Pitkin *et al*. (2019) emphasized four species parasitoids on *S. ocellatella*; *Copidosoma filicorne* (Dalman) (Hymenoptera : Encyrtidae) , *Agathis fuscipennis* (zetlerstedt), *Therophilus mediator* (Nees), *Orgilus pimpinellae* Niezabitowski (Hymenoptera : Braconidae). In conclusion, this current investigation showed that *D. aegyptiator* a vital element in integrated pest management (IPM) of this insect.

Table 1. Numbers of pupe, parasitoid and percentages of parasitism caused by D.aegyptiator on S.ocellatella during 2018/2019 season.

Date	No.Pupae	No. *D.aegyptiator*	Parasitism %
25/12	2	0	0.00
4/1	3	1	33.33
14/1	8	2	25.00
24/1	11	2	18.18
3/2	12	3	25.00
13/2	19	4	21.05
23/2	26	6	23.07
5/3	30	6	20.00
15/3	31	9	29.03
24/3	34	8	23.52
4/4	36	11	30.55
Overall of parasitism	212	52	24.52
Mean/Sample	19.27	4.72	22.61
Mean±SE	19.27±3.82	4.73±1.07	22.61±2.65

Table 2. Numbers of pupe, parasitoid and percentages of parasitism caused by *D.aegyptiator* on *S.ocellatella* during 2019/2020 season

Date	No.Pupae	No, *D.aegyptiator*	Parasitism %
26/12	0	0	0.00
5/1	1	0	0.00
15/1	2	0	0.00
25/1	4	1	25.00
4/2	6	2	33.33
14/2	6	1	16.66
24/2	9	3	33.33
6/3	11	3	27.27
16/3	16	5	31.25
26/3	28	8	28.57
5/4	33	13	39.39
Overall of parasitism	116	36	31.03
Mean/Sample	10.54	3.27	21.34
Mean±SE	10.55±3.30	3.27±1.22	21.35±4.47

Table 3. Correlation coefficient values between *S.ocellatella* and its parasitoid, *D.aegyptiator*

Seasons	"r" Value	Status of Significance
2018/2019	0.912**	Highly Significant P < 0.01
2019/2020	0.901**	Highly Significant P < 0.01

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تسجيل جديد للطفيل *Diadegma aegyptiator* علي فراشة البنجر *Scrobipalpa ocellatella* في حقول بنجر السكر المصرية

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اجريت الدراسة الحالية بمحطة البحوث الزراعية بسخا – محافظة كفرالشيخ – مصر خلال موسمين متتاليين 2019/2018 و 2020/2019. تتغذي يرقات فراشة البنجر علي أوراق وجذور بنجر السكر وبالتالي تسبب انخفاضاً كبيراً في محصول السكر وكذالك الجذور. تعتبر الطفيليات الحشرية من اكفأ عناصر الاعداء الحيوية للمكافحة البيولوجية للحشرات . في الطبيعة ، تم رصد العديد من الطفيليات الناجحة في مكافحة العديد من الافات الحشرية. من المهم جدا ، تقليل متبقيات المبيدات في الغذاء - خاصة ان بنجر السكر من المحاصيل الغذائية - وذلك للحفاظ علي الصحة العامة. نجحت الدراسة في تسجيل طفيل جديد وهو *Diadegma aegyptiator* من فراشة البنجر (يرقة – عذراء) لأول مرة في مصر وذلك في التجربة المقامة بالمزرعة البحثية لمحطة البحوث الزراعية بسخا خلال موسمي 2018/ 2019و2019 /2020 سجل المتوسط العام للتطفل طوال الموسم هو 24.52و 31.03 خلال الموسمين علي التوالي. أيضا ، اثبت التحليل الاحصائي وجود علاقة موجبة وعالية المعنوية بين تعداد هذا الطفيل وفراشة البنجر في الموسمين علي التوالي. توكد هذه النتائج أن هذا الطفيل احد الادوات الواعدة في تقليل تعداد هذه الافة الخطيرة.