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Role of the Rove Beetle, *Paederus memnonius* (Erichson) (Coleoptera : Staphylinidae) in Controlling Certain Sugar Beet Pests for the First Time in Egypt

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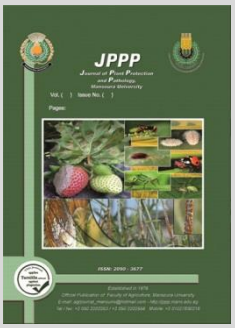

ABSTRACT

Pest predators are gaining more importance in pest management programme since pesticides lead to many serious problems like air and water pollution, health hazards, killing of beneficial organisms, pest resistance, pest resurgence, secondary pest outbreak, interruption in ecocycles ect. Thus, this study was performed at the farm of Sakha Agricultural Research Station in Kafr El-Sheikh Governorate throughout two successive seasons 2018/2019 and 2019/2020 to find out the efficacy of the staphylinid, *P.memnonius* as an important predator in regulating the population of sugar beet pests. Results proved that highly significant positive correlations were attained between *P. memnonius* and cotton leaf worms, *Agrotis ipsilon* (Hufnagel) , Cicadellidae, aphids, *Pegomyia mixta* (Villeneuve), *Scrobipalpa ocellatella* (Boyd), *Cassida vittata* (Viller), *Lixus junci* (Boheman) and snails (*Monacha* spp.) with values; 0.601**, 0.711**, 0.602**, 0.731**, 0.612**, 0.733**, 0.811**, 0.831** and 0.611**, respectively during 2018/2019 season. 0.602**, 0.613**, 0.610**, 0.701**, 0.634**, 0.702**, 0.801**, 0.802** and 0.633** respectively during 2019/2020 seasons. The common prey of this predator were; leaf cotton worms, *A.ipsilon*, Cicadellidae, aphids. *P.mixta* , *S.ocellatella*, *C.vittata*, *L.junci* and snails with 4.00, 2.66, 8.57, 6.66, 16.00, 17.33, 24.00, 13.33 and 8.00%, respectively, throughout 2018/2019 season, 2.85, 1.42, 5.71, 8.57, 20.00, 21.42, 22.85, 12.85 and 4.28%, respectively during 2019/2020. In conclusion this study is a necessary step to know the role of this predator in biological control to some sugar beet pests.

Keywords: sugar beet pests, predator, *Paederus memnonius*, biological control.

INTRODUCTION

Rove beetles are one of the most abundant polyphagous predators of insects and other vertebrates in agricultural fields (Luff, 1989; Andersen, 1992; Tamutis 1999 and Tamutis 2002). They can find the prey early when pests are not numerous. These beetles are quite active and abundant when pests' populations are in the beginning of their development and they can prevent the pest outbreaks in agrobiocoenoses (Tichomirova, 1973 and Tamutis *et al.* 2004).

Most of Staphylinidae are predators of insects and other invertebrates (Tukaram and Bhosale, 2001; Frank and Ahn, 2011)

They live in vegetable debris and under stones and other materials such as leaf litter. They are predaceous on insect and other arthropods. The adult beetles feed on various herbivorous insects (Krinsky, 2019)

In Egyptian sugar beet fields, many investigators studied the role of *Paederus alfierii* (L.) in managing sugar beet pests such as ; Guirguis (1985), Awadalla *et al.*(1992), Mesbah (1991), Zawrah (2000), Bazazo (2010) and El-Dessouki *et al.* (2014). They found that *P.alfierii* prey on aphids, *C. vittata* larvae, *P.mixta* Larvae, *S.oellatella* larvae and Cicadellidae.

As the author aware, no papers about predacious activity of *P.memnonius* in sugar beet fields.

Therefore, this study was carried out to know the role of *P.memnonius* in controlling sugar beet pests.

MATERIALS AND METHODS

1.Population dynamics of *P.memnonius* and some sugar beet pests:

This study was done at a farm assigned by Sakha Agricultural Research station in Kafr El-Sheikh Governorate throughout two successive seasons; 2018/2019 and 2019/2020. The experimental area was 1/2 feddan planted with sugar beet cultivar (sultan) on 10 November for both seasons. All recommended agricultural practices were achieved during the growing season without insecticides applications.

Sampling procedures were started 20 days after sowing at biweekly intervals until the harvest time the pests were examined by visual record every 5 plants / sample in the field.

As, *P.memnonius* populations were inspected by pitfall traps (5 traps / sample) according to Kos *et al.* (2013). The samples were taken from 30 November to 30 May during 2018/2019, and from 29 November to 29 May 2019/2020.

2.Identification the prey of *P. memnonius*:

Visual examination was used to identify *P. memnonius* Fig.(1) and its prey on the same abovementioned dates of population fluctuations.

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Fig 1. *Paederus memnonius* (Erichson) (Coleoptera : Staphylinidae)

Four hours for each sample from 9.00 a.m to 13.00 p.m prey were recorded and counted every sampling date. *P. memnonius* individuals were identified by aid prof Dr. Ashraf Torky (Plant Protection Research Institute, Egypt)

3. Statistical analysis:

Simple correlation coefficient values between sugar beet pests and *P.memnonius* numbers during the two seasons were calculated, considering population fluctuations of 2018/2019 and 2019/2020 seasons according to Snedecor and Cochram (1989).

RESULTS AND DISCUSSION

1.Population fluctuations of *P.memnonius* associated with some sugar beet pests:

In general, data presented in Tables (1 and 2) show that the high population densities of P. memnonius recorded during April and May during the two seasons 2018/2019 and 2019/2020, which synchronized with main sugar beet pests. Also, very low numbers, or absent during January and February in both seasons.

Table 1. Population fluctuations of *P.memnonius* associated with certain sugar beet pests during 2018/2019 seasons, using pit-fall traps and visual inspection methods.

Date	*P. memnonius*	Pests								
		Cotton leaf worms	*A.ipsilon*	leafhoppers	Aphids	*P.mixta*	*S.ocellatella*	*C.vittata*	*L.junci*	snails
30/11	3	3	2	1	0	3	0	0	0	0
15/12	7	4	3	2	0	6	0	0	0	0
30/12	11	5	3	2	0	8	0	0	0	0
15/1	2	0	1	1	0	10	0	0	0	0
30/1	3	0	1	0	0	11	0	0	0	0
15/2	2	1	0	0	1	7	1	0	0	0
28/2	2	1	0	0	0	6	1	1	0	1
15/3	22	2	1	4	3	13	2	4	0	3
30/3	31	1	2	6	2	16	4	8	1	4
15/4	38	0	1	6	3	21	6	12	2	4
30/4	41	0	1	7	1	26	8	18	3	5
15/5	49	1	0	8	0	30	9	23	4	6
30/5	53	0	0	8	0	33	9	32	8	6
Total	264	18	15	45	10	190	40	98	18	29

Table 2. Population fluctuations of *P.memnoninus* associated with certain sugar beet pests during 2019/2020 season, using pit-fall traps and visual inspection methods.

Date	*P. memnonius*	Pests								
		Cotton leaf worms	*A.ipsilon*	leafhoppers	Aphids	*P.mixta*	*S.ocellatella*	*C.vittata*	*L.juni*	snails
29/11	4	2	1	2	0	1	0	0	0	0
14/12	8	0	2	3	0	2	0	0	0	0
29/12	12	0	2	3	0	6	0	0	0	0
14/1	0	0	3	0	0	8	0	0	0	0
29/1	0	0	4	0	0	10	0	0	0	0
14/2	1	0	0	0	0	11	0	2	1	1
28/2	1	0	0	0	0	11	2	3	1	2
14/3	19	1	0	3	1	12	3	9	2	3
29/3	23	2	0	4	1	14	6	13	3	5
14/4	39	3	1	5	2	18	8	18	3	6
29/4	39	0	1	5	3	23	12	26	5	6
14/5	42	0	3	7	0	29	16	32	7	8
29/5	43	0	0	7	0	36	20	37	7	8
Total	231	8	17	39	7	181	67	140	29	39

Table(3) indicate that simple correlation coefficient values between sugar beet pests and its associated predator, *P.memnonius* during the two seasons were calculated, considering population dynamics of 2018/2019 and 2019/2020 seasons according to Snedecor and Cochram (1989).

Highly significant positive correlations were attained between *P.memnonius* and cotton leaf worms, *A.ipsilon*, Cicadellidae, aphids, *P.mixta*, *S.ocellatella*, *C.vittata*, *L.junci* and snails (*Monacha* spp.) with values; 0.601**, 0.711**, 0.602**, 0.731**, 0.612**, 0.733**, 0.811**, 0.831** and 0.611**, respectively during 2018/2019 season. 0.602**, 0.613**, 0.610**, 0.701**, 0.634**, 0.702**, 0.801**, 0.802** and 0.633** respectively during 2019/2020 seasons.

Table 3. Correlation coefficient values between certain sugar beet pests and its associated *P.memnonius* during 2018/2019 and 2019/2020 seasons

Relationship	2018/2019		2019/2020	
	"r "values	Status of significance	"r" values	Status of significance
P.memnonius x Cotton leaf worms	0.601**	Highly	0.602**	Highly
P.memnonius x *A.ipsilon*	0.711**	Highly	0.613**	Highly
P.memnonius x leafhopper	0.602**	Highly	0.610**	Highly
P.memnonius x A.phids	0.731**	Highly	0.701**	Highly
P.memnonius x *P.mixta*	0.612**	Highly	0.634**	Highly
P.memnonius x *S.ocellatella*	0.733**	Highly	0.702**	Highly
P.memnonius x *C.vittata*	0.811**	Highly	0.801**	Highly
P.memnonius x *L.junci*	0.831**	Highly	0.802**	Highly
P.memnonius x snails (*Monacha* spp.)	0.611**	Highly	0.633**	Highly

Table (4) elucidate that the dominant trapped pests by *P.memnonius* were leaf cotton worms, *A.ipsilon*, Cicadellidae, aphids. *P.mixta* , *S.ocellatella*, *C.vittata*, *L.junci* and snails with 4.00, 2.66, 8.57, 6.66, 16.00, 17.33, 24.00, 13.33 and 8.00%, respectively, throughout 2018/2019 season, 2.85, 1.42, 5.71, 8.57, 20.00, 21.42, 22.85, 12.85 and 4.28%, respectively during 2019/2020.

As the author aware, none of the Egyptian investigators have previously studied the predatory efficiency of this insect predator in sugar beet fields.

On the other hand, *P.alfierii* reported by many authors e.g. Awadallah *etal.* 1992, El-Agamy *et al.* 1996; Bazazo, 2010, Khalifa, 2017, Khalifa, 2018 and El-Dessouki, 2019.

They demonstrated that the highest occurrence of *P.alfierii* populations in sugar beet fields coincided with major sugar beet pests; cotton leaf worms, *P.mixta*, *S.ocellatella*, *L.junci*, aphids and *C.vittata.*

These results show that *P.memnonius* is effective biocontrol agent against sugar beet pests.

Table 4. Certain prey of *P.memnonius* in sugar beet fields, using visual examination method.

Taxa	Stage	2018/2019		2019/2020	
		No.	%	No.	%
cotton leaf worms	Larvae	3	4.00	2	2.85
A.ipsilon	Larvae	2	2.66	1	1.42
Cicadellidae	Nymph	6	8.57	4	5.71
Aphids	Adult + Nymph	5	6.66	6	8.57
P.mixta	Larvae	12	16.00	14	20.00
S.ocellatella	Larvae	13	17.33	15	21.42
C.vittata	Larvae	18	24.00	16	22.85
L.junci	Larvae	10	13.33	9	12.85
Snails (*Monacha* spp.)	Adult	6	8.00	3	4.28
Total		75	--	70	--

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دور المفترس *Paederus memnonius* (Erichson) (Coleoptera : Staphylinidae) في مكافحة بعض افات بنجر السكر وذلك لأول مرة في مصر

هاني محمد حسن

قسم الحشرات الاقتصادية – كلية الزراعة – جامعة كفرالشيخ – مصر

اكتسبت مفترسات الأفات – كأحد عناصر المكافحة الحيوية – اهتماماً كبيراً في برامج المكافحة المتكاملة، خاصه بعد ظهور الأضرار الجانبية المتعددة والخطيرة للمبيدات الحشرية مثل تلوث المياه والهواء، الأخطار علي صحة الإنسان، قتل الكائنات النافعة، ظهور صفه المقاومه عند الحشرات، إعادة الخطورة لبعض الافات، تغيير سلوك الأفات الثانوية (الفوران) لتصبح أفات خطيرة والاضطراب في دورات الحياة البيئية. لذلك، اجريت الدراسة الحالية بالمزرعة البحثية لمحطة البحوث الزراعة بسخا – محافظة كفرالشيخ خلال موسمي ٢٠١٨/٢٠١٩ و ٢٠١٩/٢٠٢٠ بهدف معرفة كفاءة المفترس *Paederus memnonius* (Erichson) (Coleoptera : Staphylinidae) في مكافحة بعض افات بنجر السكر. واسفرت النتائج عن:- من خلال مراقبة التذبذب الموسمي للافات والمفترس، اوضح التحليل الاحصائي وجود علاقة عالية المعنوية بين هذا المفترس وكلاً من يرقات دودة ورق القطن، يرقات الدودة القارضه، نطاطات الأوراق، المن، يرقات ذبابة البنجر، يرقات فراشة البنجر، يرقات خنفساء البنجر، يرقات سوسة جذور البنجر و القوقع (*Monacha* spp.) وذلك بقيم ٠,٦٠١** ٠,٧١١** ٠,٦٠٢** ٠,٧٣١** ٠,٦١٢** ٠,٧٣٣** ٠,٨١١** ٠,٨٣١** و ٠,٦١١** علي التوالي خلال موسم ٢٠١٨/٢٠١٩. ٠,٦٠٢** ٠,٦١٣** ٠,٦١٠** ٠,٧٠١** ٠,٦٣٤** ٠,٧٠٢** ٠,٨٠١** ٠,٨٠٢** و ٠,٦٣٣** علي التوالي خلال موسم ٢٠١٩/٢٠٢٠. بواسطة الفحص اليدوي المباشر في الحقل، تبين أن هذا المفترس يتغذي علي يرقات دودة ورق القطن، يرقات الدودة القارضه، نطاطات الأوراق، المن، يرقات ذبابة البنجر، يرقات فراشة البنجر، يرقات خنفساء البنجر، يرقات سوسة جذور البنجر والقوقع بنسب ٤,٠٠ ، ٢,٦٦ ، ٨,٥٧ ، ٦,٦٦ ، ١٦,٠٠ ، ١٧,٣٣ ، ٢٤,٠٠ ، ١٣,٣٣ و ٨,٠٠% علي التوالي خلال موسم ٢٠١٨/٢٠١٩. ٢,٨٥ ، ١,٤٢ ، ٥،٧١ ، ٨,٥٧ ، ٢٠,٠٠ ، ٢١,٤٢ ، ٢٢,٨٥ ، ١٢,٨٥ و ٤,٢٨% علي التوالي خلال موسم ٢٠١٩/٢٠٢٠. في النهاية، تعتبر هذه الدراسة خطوه هامة لمعرفة الدور الذي يقوم به هذا المفترس في المكافحة الحيوية لبعض افات بنجر السكر.