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Biological Control of Certain Sugar Beet Insects by Two Salticid Spiders (Araneae: Salticidae) in Egyptian Sugar Beet Fields

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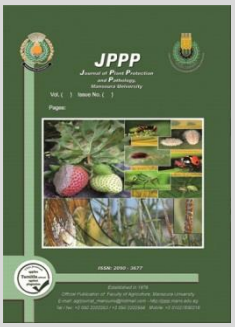

ABSTRACT

Recent studies in agriculture focusing on reducing insecticide uses which have lead to growing interest in spiders as potential biocontrol agents. Salticidae is the largest family of spiders, with over 5000 species. Many studies have demonstrated that spiders can significantly reduce insect pest densities. Thus, this current work was carried out at the Experimental Farm of Sakha Agricultural Research Station, Kafr El – Sheikh Governorate during 2021 / 2022 and 2022 / 2023 seasons.This study recorded two salticid species in Egyptian sugar beet fields; *Heliophanillus fulgens* (O.P. Cambridge) and *Neaetha cerussata* (Simon, 1868). In addition to, the findings demonstrated that the dominant prey to these salticid spiders were *Pegomyia mixta* Vill. (Diptera: Anthomyiidae) larvae, *Scrobipalpa ocellatella* (Boyd.) (Lepidotptera: Gelechiidae) larvae , *Cassidavittata* Vill. (Coleoptera: Chrysomelidae) larvae (different instars), *Spodoptera* spp.(Lepidotptera: Noctuidae) larvae , and aphid species (Homoptera: Aphididae) (nymph+adults). In the light of these results, spiders (Araneae) espically salticid species, may help reduce the population of sugar beet insects, without using insecticides.

Keywords: Biological, control, Salticidae, sugar beet, Egyptian.

INTRODUCTION

Spiders (order: Araneae) are highly efficient predators in sugar beet fields, as well as other crops (Riechert and Lawrence, 1997; Lang *et al*., 1999; Sunderland,1999). It is known that spiders rank seventh in the global diversity after Coleoptera, Hymenoptera, Lepidoptera, Diptera, Hemiptera, and the arachnid order, Acari (Kingdom: Animalia) (Nyffeler *et al*. 1994). Barrion and Litsinger (1995) pointed out the spiders are among the most omnipresent and numerous predators in both agricultural and natural ecosystems, averaging 50.000 individuals per acre in vegetated areas, and without spiders, insect pest populations would be out of control. In England, Brooks *et al*. (2003) estimated populations of Araneae in sugarbeet, maize and spring oilseed rape fields. They found that numbers of Araneae were greater in sugarbeet than in spring oilseed rape and maize. In the USA, Australia and China, spiders are effectively used in biocontrol programs .In China , the use of chemical insecticides has reduced by 70 - 90% because of existing spiders in the fields (Rajeswaran *et al*., 2005). Accordingly, the losses in sugarbeet yield were lower in the presence than absence of spiders. In such concern, Riechert and Bishop (1990) reported that spiders preyed upon insect pests of Homoptera, Diptera, Orthoptera, Hemiptera, Lepidoptera and Coleoptera (Curculionidae). Moreover, Schroder *et al*. (1999) concluded that the spiders have played an important role in controlling *Myzus persicae* (Homoptera: Aphididae) in sugarbeet fields. Furthermore, *Cassida vittata* and *C. viridis* were detected in the spider webs . The Salticidae considers the largest family in Araneae and currently represented by 5862 species belonging to 595 genera worldwide (Cosar and Varol, 2016). Numerous authors recorded the prey of salticid species e.g. Jackson (1977) in the USA, indicated that Diptera, Homoptera, Lepidoptera, Coleoptera are dominant prey to salticid species in Azerbaijan, Guseinov (2003) recorded that Diptera, Lepidoptera, Homoptera, Thysanoptera, Ephemeroptera and Collembola are prey to Satticidae. In Poland, Batros and Szczepko (2012) indicated that salticid species hunted three prey taxa (leafhopper, larvae of Lepidoptera and thrips). Thus, this study was carried out for studying the seasonal abundance of salticid species and determing the different prey insects that can be used by these salticid spiders in Egyptian sugar beet fields, for the first time.

MATERIALS AND METHODS

1. Seasonal abundance of certain saltitid spider species

The present trails were conducted at the Experimental Farm of Sakha Agricultural Research Station during two successive seasons (2021 / 2022 and 2022 / 2023). The experimental fields (≈half of feddan / cultivation) were sown with Nader cultivar during 15th August (Summer), 15th Septmber (Autumn) and 15th October (winter) for the three cultivations, respectively in the two seasons. Every experimental area was divided into three replicates. After thinning, 11 samples / cultivation were taken regularaly till harvest.On sampling , a plastic bag was converted on a sugar beet plant to harbour the whole plant which was cut at the soil surface. The bag was tightly tied at the bottom, and transferred to the laboratory for further investigations. At each sampling date, five bags were used to confine five sugar beet plants /

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replicate . In the laboratory, a piece of cotton saturated with chloroform was introduced into a bag for about 20 minutes to anethetize the confined arthropods. Then, the contents of the bag were dropped onto a white paper, and the arthropods were sorted, preliminary identified, counted and recorded. The spider species were kept into glass vials in 70% ethyl alcohol and some drops of glycerine for fruther identification. The samples of spiders were identified through insect identification unit (IIU), Plant Protection Research Institute, Agricultural Research Center, Egypt.

2. Surveying various prey species of the two salticid species:

By using transparent vials (5 cm length 1 cm width) every spider species of Salticidae and its prey were caught in the field by hand method, sampels were preserved in 70% ethyl alcohol to these cups till identifying the spider species and their prey. 11 samples / every cultivation, 15 plants every sampling date were used. The dates of the samples are the same for seasonal abundance for salticid species in the field. The collected arthropods were sorted using a stereoscope (4.8 – 56.0 x maginfication) for prelimary identifiction. The specimens of spiders were identified through insect identifiction unit (IIU).

Note, the authors have found numerous species and individuals of spiders . But, these sampels were neglected for focussing on the two meant spieces

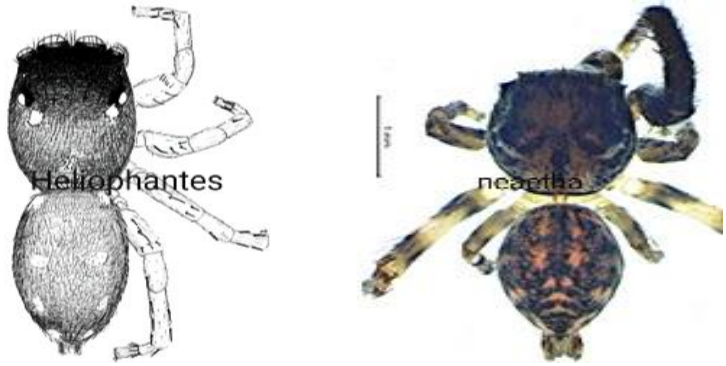
RESULTS AND DISCUSSION

1. Surveying of salticid Species during the three cultivations in two seasons:

Salticid species inhabiting sugar beet fields at the Experimental Farm of Sakha Agricultural Research Station were surveyed for two successive seasons; 2021/2022 and 2022/2023. The survey was carried out using bag and cut technique and hand collection with transparent vials. Using a variety of sampling methods was necessary to adapt behaviour and habitat of different spider species. The Survey revealed the occurrence of two salticid genera and species (Table 1) and Fig (1).

Table 1. Survey of Salticid Species at the Experimental Farm of Sakha Agricultural Research Station, during 2021 / 2022 and 2022 / 2023 Seasons.

Family	Common name	Species
Salticidae	Jumping spider	*Heliophanillus fulgens* (O. P. Cambridge, 1872)
		Neaetha cerussata (Simon 1868)



***Heliophanillus fulgens* (O.P. Cambridge)** ***Neaetha cerussata* (Simon, 1868).**

Fig. 1. The two salticid species during the two seasons (images from network) Anonymous (2019)

The two species are *Heliophanillus fulgens* (O. P. Cambridge, 1872) and *Neaetha cerussata* (Simon 1868). Anonymous (2019) reported that jumping spiders are a group of spiders that constitute the family, Salticidae. As of 2019, this family contained over 600 described genera and over 6.000 described species. Making it the largest family of spiders at 13% of all species. In such concern, Peng *etal*. (2002) indicated that jumping spiders have some of the best vision among arthropods, and use it in courtship, hunting and navigation. Although they normally move unobtrusively and fairly slowly, most species are capable of very agile jumps, notably when but sometimes a response to sudden threats or crossing long gaps. Also, Jackson *etal*. (2001) clarified that Salticidae are generally carnivorous. Salticids hunt diurnally as a rule , which is consistent with their highly developed visual system. Regarding the species of Salticids, Simon. (1885) demonstrated that *Neaetha* is a genus of jumping spiders that was first described by Eeugen Louis Simon in 1885. Moreover, as of January, 2022 it contains 13 species, found only in Asia, Europe and Africa (Anonymous, 2022), From these 13 species is *Neaetha cerussata* Simon, 1868. In addition to *Heliophanillus fulgens* is a jumping spider species in the genus *Heliophanillus* that can be found in a large distribution that extends from Greece to Central Asia and North Africa, including Iran, Libya and Turkey. The spider mainly lives in the area around the Eastern Mediterranean, but has also been identified as far east as Afghanistan (World spider Catalog, 2017).

2. Seasonal abundance of the two Salticid Species in the field during the three sugar beet plantations, 2021/2022 and 2022/2023 Seasons:

***N. cerussata* :**

The obtained data in Table (2) showed that the seasonal average number of *N. cerussata* individuals in different sugar beet plantations during season 2021/2022. It can be noticed that in August and September plantations the highest average number recorded in December 2021 represented by 4.33 and 5.66. Also 4.33 and 5.33 spider /5 plants on 29 December and 14 march respectively.while, the seasonal average numbers in October plantations were 5.66 and 8.00 on 29 March and 14 April , respectively. The highest mean was recorded on 29 December (first cultivation), 14 March (second cultivation) and 14 April during the three cultivations, respectively. Mean of numbers during the whole season were 1.75 ± 0.01, 1.69 ± 0.02 and 2.02 ± 0.03 for the three cultivation,respectively. Statistical analysis showed that insignificant differences among the three cultivations during the seasons.

Table 2. Seasonal fluctuations of *N. cerussata* throughout three cultivations, 2021/2022.

Date of examination	1st cultivation August	2nd cultivation September	3rd cultivation October
14 Sept.	0.33	--	--
29	0.66	--	--
14 Oct.	1.00	0.66	--
29	1.66	1.33	--
14 Nov.	2.33	2.00	1.66
29	3.00	2.00	0.66
14 Dec.	4.33	2.66	0.00
29	5.66	4.33	1.00
14 Jan.	0.33	0.00	0.00
29	0.00	0.00	1.33
14 Feb.	0.00	0.00	0.33
29	--	0.33	0.00
14 Mar.	--	5.33	3.66
29	--	--	5.66
14 Apr.	--	--	8.00
Mean ± SE	1.75 ± 0.01a	1.69 ± 0.02a	2.02 ± 0.03a

Means followed by different letters are significantly differences at level 5 % of probability.

AS, 2022/2023 data in Table (3) recorded that the highest mean was 6.33, 4.33 and 7.66 individuals /5 plants on 29 December, 14 March and 14 April to the three cultivations, respectively . Mean of numbers during the whole season were 2.27 ± 1.12, 1.96 ± 1.01 and 2.72 ± 1.13 for the three cultivations, respectively. Statistical analysis showed that insignificant differences among the three cultivations during the seasons.

Table 3. Seasonal fluctuations of *N. cerussata* during three cultivations, 2022 / 2023.

Date of examination	1st cultivation	2nd cultivation	3rd cultivation
14 Sept.	0.66	--	--
29	1.00	--	--
14 Oct.	1.33	1.00	--
29	2.00	1.00	--
14 Nov.	3.00	1.33	1.00
29	4.00	2.66	1.66
14 Dec.	5.33	3.25	3.33
29	6.33	4.00	4.00
14 Jan.	0.33	1.00	0.33
29	0.00	1.33	0.33
14 Feb.	1.00	1.66	0.00
29	--	0.00	0.00
14 Mar.	--	4.33	5.33
29	--	--	6.33
14 Apr.	--	--	7.66
Mean ± SE	2.27 ± 1.12a	1.96 ± 1.01a	2.72 ± 1.13a

Means followed by different letters are significantly differences at level 5 % of probability.

H. fulgens

Data arranged in Table (4) clarified that the highest mean was 11.0, 14.0 and 24.33 spider /5 plants on 29 December, 14 March and 14 April during the three cultivtions, respectively in 2021/2022. Average mean numbers during the season was 5.14 ± 1.12, 6.14 ± 2.12 and 9.60 ± 2.31 to the three cultivations, respectively. Statistical analysis demonstrated that significant differences among the three cultivations, whereas, Table (5) showed that the highest mean was 6.66 , 5.66 and 11.00 spider /5 plants on 29 December, 29 December and 14 April to the three cultivations, respectively in 2022/2023. Average mean numbers during the season was 2.60 ± 1.31, 2.42 ± 1.30 and 4.23 ± 1.22 to the three cultivations, respectively. Statistical analysis indicated that significant differences between the third cultivations to first & second ones. Moreover, non-significant differences between the first and second cultivations .

Table 4. Seasonal fluctuations of *H. fulgens* in three cultivations, 2021/ 2022.

Date of examination	1st cultivation	2nd cultivation	3rd cultivation
14 Sept.	1.00	--	--
29	2.33	--	--
14 Oct.	4.00	3.66	--
29	6.00	4.33	--
14 Nov.	7.66	6.66	6.33
29	9.33	8.00	7.00
14 Dec.	10.66	9.66	6.66
29	11.00	9.33	7.00
14 Jan.	1.00	1.66	5.33
29	1.33	4.33	6.33
14 Feb.	2.33	2.66	3.33
29	--	3.33	4.33
14 Mar.	--	14.00	20.00
29	--	--	22.00
14 Apr.	--	--	24.33
Mean ± SE	5.14 ± 1.12a	6.14 ± 2.12b	9.60 ± 2.31c

Means followed by different letters are significantly differences at level 5 % of probability.

Table 5. Seasonal fluctuations of *H. fulgens* in three cultivations, 2022/2023.

Date of examination	1st cultivation	2nd cultivation	3rd cultivation
14 Sept.	0.66	--	--
29	1.00	--	--
14 Oct.	2.33	1.33	--
29	1.66	1.66	--
14 Nov.	4.33	2.66	1.66
29	5.33	4.00	2.00
14 Dec.	5.66	5.33	3.33
29	6.66	5.66	5.33
14 Jan.	0.00	0.00	0.00
29	0.00	0.66	1.33
14 Feb.	1.00	1.00	1.66
29	--	0.00	2.00
14 Mar.	--	4.33	8.66
29	--	--	9.66
14 Apr.	--	--	11.00
Mean ± SE	2.60 ± 1.31a	2.42 ± 1.30a	4.23 ± 1.22b

Means followed by different letters are significantly differences at level 5 % of probability.

Bazazo (2010) reported that Salticidae was one of the most occurring families in sugar beet field. Regardless of families, the highest spider population densities was detected during March, April and May, while the lowest population densites occurred by late December upto late February. The high spider density in late season could by attributed to the high population densities, of insect prey. In such concern, Rahil *etal*. (2005) at El-Fayoum, surveyed 32 species in 24 genera in 10 families.Salticidae is dominant family in sugar beet fields. In general, all spider populations increased as the season progressed.

3. Number of individuals, percentages (%) and mean ± SE to each salticid species:

Total number of the two salticid species, collected in 11 samples in 2021/2022 and 2022/2023 seasons, are presented in Tables (6 and 7). In the first season (Table 6), the total number of both species was 225, 259 and 405 for the three cultivations, respectively. Numbers of *H. fulgens* were 170 individuals, with percentages (75.55% out of total) and 56.66 ± 9.21 during the first cultivation. 203 individuals and (78.37% out of total) and 67.66 ± 10.21 during the second cultivation. Also, 338 individuals, with (83.45 %) and 112.66 ± 14.22 for the third cultivation. The corresponding numbers of *N. cerussata* were 55, 24.44% and 18.33 ± 3.21 for first cultivation. 56, 21.62% and 18.66 ± 5.21 for second cultivation. In addition to, 67, 16.54% and 22.33 ± 7.33 for third cultivation. Statistical analysis proved that significant differences between the two salticid species during the three cultivations.

Table 6. Number of individuals, Percentages (%) and mean ± SE to each Salticid species in three cultivations, 2021/2022.

Species	First cultivation			Second cultivation			Third cultivation		
	No.	%	Mean ± SE	No.	%	Mean ± SE	No.	%	Mean ± SE
H. fulgens	170	75.55	56.66 ± 9.21a	203	78.37	67.66 ± 10.21	338	83.45	112.66 ± 14.22a
N. cerussata	55	24.44	18.33 ± 3.21b	56	21.62	18.66 ± 5.21	67	16.54	22.33 ± 7.33b
Total	225	--	--	259	--	--	405	--	--

In a column, mean followed by different letters are significantly differences.

In the second season (Table 7), the total number of both species was 161, 152 and 230 for the three cultivations, respectively. Numbers of *H. fulgens* were 86 individuals with percentage (53.41% out of total) and 28.66 ± 4.10 during the first cultivation. 80 individuals and (52.63% out of total) and 26.66 ± 6.32 for the second cultivation. Moreover, 140 individuals with (60.86%) and 46.66 ± 9.31 for the third cultivation .The corresponding numbers of *N. cerussata* were 75, 46.58% and 25 ± 3.21 for first cultivation, 72, 47.36% and 24.00 ± 5.38 for Second cultivation. Also, 90, 39.13% and 30.00 ± 8.73 for third cultivation. Statistical analysis demonstrated that significant differences between the two salticid species in first and third cultivations.

Table 7. Number of individuals, Percentages (%) and mean ± SE to each Salticid species in three cultivations, 2022/2023.

Species	First cultivation			Second cultivation			Third cultivation		
	No.	%	Mean ± SE	No.	%	Mean ± SE	No.	%	Mean ± SE
H. fulgens	86	53.41	28.66 ± 4.10a	80	52.63	26.66 ± 6.32a	140	60.86	46.66 ± 9.31a
N. cerussata	75	46.58	25 ± 3.21b	72	47.36	24.00 ± 5.38a	90	39.13	30.00 ± 8.73b
Total	161	--	--	152	--	--	230	--	--

In a column, mean followed by different letters are significantly differences.

On the other hand, insignificant differences between the two salticid species in second cultivation. These results indicate that numbers of the two salticid species are different during the three cultivations in two seasons, consequently, increasing the predacious cefficiency of these species. Marc (1989) reported that one more advantage for spiders is that same families such as Salticidae is of diurnal activity, while others such as Oxyopidae are active the day as well as night. These variations in times of spider activity enhance their efficiency in managing insect pest populations. In addition to, Jackson and Pollard (1996) indicated that recent studies have revealed a high diversity of predatory strategies in the Salticidae. Furthermore, Sunderland (1999) demonstrated that numerous researchers have stressed that an assemblage of spider species is more effective at reducing prey densities than a single species of spider. Different spiders feed on different insects at different times of the day is in the advantage of pest control.

4. Recording various prey species of the two salticid species in the field throughout the three cultivations, 2021/2022 and 2022/2023:

In 2021/2022 season, Table (8) indicated that the total number of insect prey to *H . fulgens* spider in the first cultivation was 67 individuals. The majority of collected insects were *S. ocellatella* larvae (20 individuals with 29.85% out of total), *P. mixta* larvae (19 individuals, with 28.35 %), *Spodoptera* spp. larvae (13 individuals, with 19.4%) *C. vittata* larvae (9 individuals, with 13.43%) and aphids nymph + adult (6 indiv., with 8.95). As, the total number of insect prey to *N. cerussata* spider, was. 71 individuals.The majority of collected insects were *P. mixta* larvae (23 indiv., with 32.39), *S. ocellatella* larvae (21 indiv ., with 29.57%), *Spodoptera* spp. larvae (12 indiv., with 16.90%%), *C. vittata* larvae (8 indiv., with 11.26) and aphids nymph + adult (7 indiv., with 9.85 %) out of total. In the Second cultivation, the total number of insect prey to *H. fulgens* was 66 individuals, divided into 26 indiv. with 39.39% to *P. mixta* larvae Also, 16 indiv., with 24.24% to *S. Ocellatella* larvae, 13 indiv. with 19.69% to *C. vittata* larvae, 7 Indiv. with 10.60% to *Spodoptera* spp, 4 indiv. with 6.06 % to aphid species. While, the total prey to *N. cerussata* was 65 individuals. The majority prey were *P. mixta* larvae (18 indiv with 27.69%), *S. ocellatella* larvae (19 indiv. with 29.23%), *C. vittata* larvae (17 indiv. with 26.15 %), *Spodoptera* spp. larvae (8 indiv with 12.30%) and aphid species (3 indiv. with 4.61%). Concerning the third cultivation, the total prey to *H. fulgens* was 82 individuals.The dominant prey were *P. mixta* larvae (20 indiv. with 24.39%), *S. ocellatella* (25 indiv. with 30.48%), *C. vittata* (30 indiv. with 36.58%), *Spodoptera* spp. larvae

(2 indiv. with 2.43%) and aphid species (5 indiv. with 6.09%). As the total prey to *N. cerussata* was 85 Individuals . The prey classified to *P. mixta* larvae (20 indiv. with 23.52%), *S. ocellatella* larvae (28 indiv. with 32.94%), *C. vittata* larvae (32 indiv. with 37.64%), *Spodoptera* spp. (3 indiv. with 3.52 %) and aphids species (2 indiv. with 2.35%) The total prey to salticid species was higher in third cultivation than first and second one.

Table 8. various prey species of the two salticid species, 2021/2022 seasons.

Prey Taxa	First cultivation				Second cultivation				Third cultivation			
	H. fulgens		N. cerussata		H. fulgens		N. cerussata		H. fulgens		N. cerussata	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
P. mixta (larvae)	19	28.35	23	32.39	26	39.39	18	27.69	20	24.39	20	23.52
S. ocellatella (larvae)	20	29.85	21	29.57	16	24.24	19	29.23	25	30.48	28	32.94
C. vittata (larvae)	9	13.43	8	11.26	13	19.69	17	26.15	30	36.58	32	37.64
Spodoptera spp. (larvae)	13	19.40	12	16.90	7	10.60	8	12.30	2	2.43	3	3.52
Aphids (Nymph + Adult)	6	8.95	7	9.85	4	6.06	3	4.61	5	6.09	2	2.35
Total	67	--	71	--	66	--	65	--	82	--	85	--

In 2022/2023, (Table 9) the total number of insect prey to *H. fulgens* was 51 individuals, The majority of collected insects were *P. mixta* larvae (14 indiv., with 27.45), *S. ocellatella* larvae (18 indiv ., with 35.29%), *Spodoptera* spp. larvae (14 indiv., with 27.45%), *C. vittata* larvae (3 indiv., with 5.88) and aphids nymph + adult (2 indiv., with 3.92 %) out of total. While, the total prey to *N. cerussata* was 54 individuals. The majority prey were *P. mixta* larvae (15 indiv with 27.77%), *S. ocellatella* larvae (18 indiv. with 33.33%), *C. vittata* larvae (5 indiv. with 9.52%), *Spodoptera* spp. larvae (13 indiv with 24.07%) and aphid species (3 indiv. with 5.55%) in the first cultivaion. In the Second cultivation, the total number of insect prey to *H. fulgens* was 61 individuals, divided into 22 indiv. with 36.06% to *P. mixta* larvae Also, 19 indiv., with 31.14% to *S. ocellatella* larvae, 10 indiv. with 16.39% to *C. vittata* larvae, 6 indiv. with 9.83% to *Spodoptera* spp, 4 indiv. with 6.55 % to aphid species. While, the total prey to *N. cerussata* was 62 individuals. The majority prey were *P. mixta* larvae (20 indiv with 32.25%), *S. ocellatella* larvae (20 indiv. with 32.25%), *C. vittata* larvae (9 indiv. with 14.51%), *Spodoptera* spp. larvae (7 indiv with 11.29%) and aphid species (6 indiv. with 9.67%) Concerning the third cultivation, the total prey to *H. fulgens* was 92 individuals. The dominant prey were *P. mixta* larvae (31 indiv. with 33.69%), *S. ocellatella* (27 indiv. with 29.34%), *C. vittata* (26 indiv. with 28.26%), *Spodoptera* spp. larvae (zero indiv) and aphid species (8 indiv. with 8.69%). As the total prey to *N. cerussata* was 88 individuals . The prey classified to *P. mixta* larvae (33 indiv. with 37.5%), *S. ocellatella* larvae (23 indiv. with 26.13%), *C. vittata* larvae (22 indiv. with 25.0%), *Spodoptera* spp. (1 indiv. with 1.13 %) and aphids species (9indiv. with 10.22%) The total prey to salticid species was higher in third cultivation than first and second one during the two seasons.

Table 9. various prey species of the two salticid species, 2022/2023 season.

Prey Taxa	First cultivation				Second cultivation				Third cultivation			
	H. fulgens		N. cerussata		H. fulgens		N. cerussata		H. fulgens		N. cerussata	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
P. mixta (larvae)	14	27.45	15	27.77	22	36.06	20	32.25	31	33.69	33	37.5
S. ocellatella (larvae)	18	35.29	18	33.33	19	31.14	20	32.25	27	29.34	23	26.13
C. vittata (larvae)	3	5.88	5	9.25	10	16.39	9	14.51	26	28.26	22	25.00
Spodoptera spp. (larvae)	14	27.45	13	24.07	6	9.83	7	11.29	0	0.00	1	1.13
Aphids (Nymph + Adult)	2	3.92	3	5.55	4	6.55	6	9.67	8	8.69	9	10.22
Total	51	--	54	--	61	--	62	--	92	--	88	--

Sunderland (1999) reported that Spiders are excellent biocontrol for the following reasons: 1) they catch more insects than they actually consume. 2) a diverse assemblage of spiders may have the greatest potential for keeping the pest densities at low levels. 3) the spider populations In agroecosystems are stable and can be maintained at low levels when insects are absent. Also, Greenstone (1999) indicated that numerous researchers have stressed that an assemblage of spider species is more effective at reducing prey densities than a single species of spiders. Different spiders feed on different insects at different times of the day is in the advantage of pest control, for better pest control, spider assemblage is important for the following reasons : 1) different spiders feed on different insects at different times of a day. 2) variation in body size of both predator and prey species also contributes to prey reduction; with large spiders attacking larger prey and smaller spiders attacking Smaller prey (Nyffeler *etal*. 1994). Over the last two decades there has been a rapid increase in the number of studies of spider predatory behavior(Nelson and Jackson, 2022). The majority of studies have focused on salticid spiders with exceptionally good eyesight (Land and Nilsson, 2002). Moreover, Guseinov (2003) clarified that the jumping spiders are characterized by a unique and highly developed visual system, which governs their peculiar and complex predatory behaviour. The Salticid slowly creeps up to its prey untill close enough for an attack, Pauses, and then finally leaps at the prey (Richman and Jackson, 1992). Many authors noted that hunting spiders e.g. Salticidae. Frequently capture Orthoptera, Homoptera, Hemiptera, Lepidoptera, Thysanoptera, Diptera, Coleoptera, and Hymenoptera (Guseinov, 2003; Batros and Szczepko, 2022 and Huseynov, 2005). According to these previous results, the two salticid species can significantly reduce certain suger beet insects.

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المكافحة الحيوية لبعض حشرات بنجر السكر باستخدام نوعين من عائلة العناكب القافزة Salticidae في حقول بنجر السكر المصرية

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الملخص

تركز الدراسات الحديثة في العلوم الزراعية إلى تقليل استخدام المبيدات الحشرية خاصة وأن الاستدامة البيئية تجبرنا على زيادة الاهتمام بالعناكب الحقيقية كأداة فعالة في المكافحة الحيوية. أثبتت معظم الأبحاث دور هذه العناكب في تقليل كثافة وتعداد الحشرات. تعتبر عائلة Salticidae من أكبر عائلات العناكب حيث تحتوي على 5000 نوعاً. لذلك، أجريت الدراسة الحالية في المزرعة البحثية لمحطة البحوث الزراعية بسخا – محافظة كفرالشيخ خلال موسمي 2022/2021م، و2023/2022م. لحصر أهم أنواع هذه العائلة ومراقبة تعدادها في الثلاث عروات وكذلك معرفة دورها في افتراس حشرات بنجر السكر كأحد العناصر الهامة في المكافحة الحيوية بعيداً عن استخدام المبيدات الضارة نجحت هذه الدراسة في تعريف وتسجيل نوعين من هذه العناكب القافزة وهما: *Heliophanillus fulgens* (O.P. Cambridge) and *Neaetha cerussata* (Simon, 1868). كذلك، أثبتت النتائج أن أهم الفرائس التي يتغذى عليها نوعي العناكب وهي يرقات العمر الأول لذبابة البنجر (قبل دخولها للنفق Blotch)، يرقات أعمار مختلفة لكل من فراشة وخنفساء البنجر وكذلك ديدان ورق القطن ثم أنواع المن (حوريات + حشرات كاملة). في ضوء هذه النتائج، أثبتت الدراسة الحالية أن هذه العناكب القافزة أداة فعالة في مكافحة وتقليل تعداد حشرات بنجر السكر دون اللجوء للمبيدات الحشرية. لذلك، لابد من وضع العناكب الحقيقية في برامج المكافحة المتكاملة للحشرات كأداة هامة جداً من أدوات المكافحة الحيوية.