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ROLE OF ORB-WEB WEAVER SPIDERS IN CONTROLLING THE PESTS OF THE EARLY SUGAR BEET PLANTATION IN KAFR EL-SHEIKH REGION

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ABSTRACT

The current investigation was carried out during 2012/13 and 2013/14 sugar beet seasons at the Experimental Farm of Sakha Agricultural Research Station and laboratory of Plant Protection Department, Faculty of Agriculture, Tanta University for identifying the arthropods (insect pests and acari) trapped in spider webs. Most of trapped arthropods pests were collembolan (48.08%), followed by aphids (*Aphis gossypii* (Glover) and others) (25.64%). Moderate number of cicadellids (12.82%), *Thrips tabaci* Lind. (4.81%), *Spodoptera littoralis* (Boisd.) larvae (3.21%), *Spodoptera exigua* (Hubn.) larvae (2.88%) and *Tetranychus sp.* (2.56%). Also, eight spider species, belonging to five families were surveyed. The highest family was Araneidae which contained three species, *Araneus sp., Argiope trifasciata* Forscall and *Singa sp.* followed by Linyphiidae was represented by two species (*Bathyphantes sp.* and *Erigone sp.*). Each of Amaurobiidae (*Amaurobius sp.*), Dictynidae (*Dictyna sp.*) and Theridiidae (*Theridion sp.*) had one species only.

Finally, these results show the importance of spider webs in capturing sugar beet pests, consequently, play a major role in controlling pests without use of any pesticides.

INTRODUCTION

Sugar beet is the second main source of sugar production, after sugarcane, in Egypt and allover the world.

Sugar beet plants are subjected to attack of several insect pests which reduce the crop quality and quantity (Abo-Saied Ahmed, 1987; Bazazo, 2010; Shalaby, 2012 and Fayed *et al*., 2014).

Fortunately, the sugar beet ecosystem has several natural enemies, especially spiders (Order Araneae) that should be conserved to keep the natural balance in the fields (Talha, 2001; Hendawy, 2009; Bazazo, 2010; Shalaby, 2012 and Bazazo *et al*., 2015). Bazazo (2010) reported that out of surveyed arthropod predators, 77-78% were spiders, while 16-22% were insect predators. These spiders were reported as highly significant predators in sugar beet fields (Thornhill, 1983; Harwood and Obrycki, 2007 and Bazazo, 2010).

Kajak *et al*. (1968) showed that the high populations of spiders greatly reduce the insect populations in sugar beet fields. Accordingly, the losses in sugar beet yield are lower in the presence of spiders as compared with the absence of spiders. Bazazo (2010), in Egypt, found that the most dominant family of spiders in sugar beet fields was Linyphiidae as represented by 83.39% of the total surveyed spider families. Also, several authors

emphasized that the dominant web-building spider family in sugar beet fields was Linyphiidae (Thornhill, 1983; Brooks *et al*., 2003; Haughton *et al*., 2003 and Roy *et al*., 2003).

Harwood and Obrycki (2007), in USA, reported that spiders build their webs at the ground level and above leaves, harbouring mainly aphids, cicadellids, dipterous and collembolan insects.

In China, particulary at Hubei province the use of chemical insecticides was reduced by 70-90% because of existing spiders in the fields (Rajeswaran *et al*., 2005).

The current study was carried out to investigate the following items in early sugar beet plantation:

1. Identify orb-web weaver spider species associated with sugar beet insect pests.
2. Identify arthropod (insect pests and Acari) trapped in spider webs and its population fluctuation.

MATERIALS AND METHODS

The current investigation was carried out at the Experimental Farm of Sakha Agricultural Research Station and Laboratory of Plant Protection Department, Faculty of Agriculture, Tanta University, during 2012/13 and 2013/14 seasons. The experimental sugar beet field (about ½ feddan) was sown with "Husam" cultivar on mid-August in two successive seasons of study and received all recommended cultural practices, but without use of any pesticides. The design of the experiment was randomized complete block design.

Identify spider species and arthropods (insect pests and Acari) trapped in spider webs:

Spiders spin their webs to capture arthropods to feed upon, as the webs are constructed on the soil surface, soil cracks and onto the sugar beet plants. In each sample, the webs with its content were carefully picked up using a brush and introduced into glass vials containing 70% ethyl alcohol for preservation till examination.

Ten samples (30 webs/sample) were collected monthly, beginning from September 15th, up to February 15th, during 2012/13 and 2013/14 in the first and second sugar beat seasons, respectively. Samples were transferred to the laboratory for counting and identifying the insect pests and Acari in the webs by using a stereoscope (4.8-56.0 x magnification).

RESULTS AND DISCUSSION

1. Survey of spider species:

The spider species inhabiting sugar beet fields are listed in Table (1) and Fig. (1). Eight spider genus and species were surveyed using a fine brush method.

The surveyed spiders belong to five families. Family Araneidae was represented by three genera and species followed by Linyphiidae was

represented by two genera and species. Amaurobiidae, Dictynidae and Theridiidae were each represented by only one genus. These results are in agreement with those obtained by Rahil *et al*. (2005), Hendawy (2009), Bazazo (2010) and Bazazo and Salem (2013) in the Egyptian sugar beet fields, and Janssens *et al*. (1986); Epperlein and Schmidt (2001) and Haughton *et al*. (2003) in the European sugar beet fields. Fig. (2) illustrates some spider species in Egyptian sugar beet fields and their webs.

Table (1): Survey of spiders associated with sugar beet arthropod pests at the Experimental Farm of Sakha Agricultural Research Station, during 2012/13 and 2013/14 seasons.

Family	Common name	Genus/species	No. of genus
Araneidae	Typical orb weaver	- *Araneus sp.*, - *Argiope trifasciata* Forscal - *Singa sp.*	3
Linyphiidae	Sheet-web spider	- *Bathyphantes sp.*, - *Erigone sp.*	2
Amaurobiidae	Hackled-mesh weavers	-*Amaurobius sp.*	1
Dictynidae	Mesh-Web weaver	- *Dictyna sp.*	1
Theridiidae	Comb-footed	- *Theridion sp.*	1
Total	-	-	8

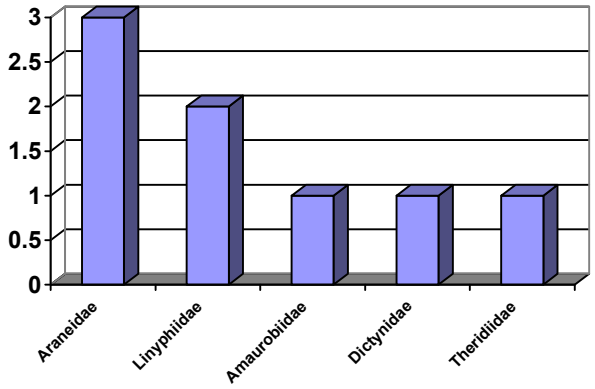

Fig. (1): Spider families and their species, in two seasons.

Fig. (2): Spider species and their webs

2. Identify arthropods trapped in spider webs:

Data presented in Table (2) show that the total number of arthropods collected in 300 webs of spiders were 312 individuals. Most of trapped arthropod pests were collembolan (48.08%), followed by aphids (25.64%), moderate numbers of cicadellids (12.82%), and few numbers of *Thrips tabaci* (4.81%), *Spodoptera littoralis* (larvae) (3.12%), *Spodoptera exigua* (larvae) (2.88%) and *Tetranychus sp.* (2.56%).

The web-building spiders were reported by authors to reduce the populations of insect pests in sugar beet fields. *Myzus persicae* (Sulzer) populations were reduced, as the aphid was regularly obtained in webs of the spider, *Theridion ipressum* L. (Schroder *et al*., 1999 and Rajeswaran *et al*., 2005). Most of prey items captured in the webs of *Argiope sp.* were insect pests, belonging to Heteroptera, Homoptera and Coleoptera (Szymkowiak *et al*., 2005). The webs of Lynyphiid spiders, built at the ground level in sugar beet fields, were found capturing aphid, cicadellid and dipterous insects (Thornhill, 1983 and Harwood and Obrycki, 2007).

Table (2): Arthropods trapped in webs of spiders, during 2013/14 season.

Taxa	Stage	No.*	%
Collembola	Adult	150	48.08
Aphids	Adult + nymph	80	25.64
Cicadellidae	Adult + nymph	40	12.82
Thrips tabaci (Lind.)	Adult + nymph	15	4.81
Spodoptera littoralis (Boisd.)	1^{st}, 2^{nd} instar larvae	10	3.21
Spodoptera exigua (Hubn.)	1^{st}, 2^{nd} instar larvae	9	2.88
Tetranychus sp.	Adult	8	2.56
Total		312	

* **Number of arthropods collected in 300 webs (10 samples x 30 webs) in both seasons.**

Nyffeler and Benz (1988) considerd all arthropods founding webs of spiders as prey, regardless if the spiders were observed feeding on these prey or not.

The aforementioned results showed that the key role of spiders as biocontrol agents in sugar beet fields, particularly the spiders are considered generalist predators. The insect pest populations in sugar beet fields were greatly reduced by the high population of spiders, which reflected less losses in the crop yield (Kajak *et al*., 1968). Orb-weaver spiders practice two tricks to enhance the population of trapped insects in their webs:

1) Choose web sites where prey are abundant, such as some nocturnal spiders that build their webs near artificial lights to catch flying insects.
2) Adjust their web structure to allow more captured insects (Heiling, 1999).

This indicates that spiders actively work to capture more insect pests which maximizes their role.

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دور العناكب الناسجة فى مكافحة آفات العروة المبكرة لبنجر السكر فى منطقة كفرالشيخ

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أجريت الدراسة الحالية فى كل من المزرعة البحثية لمحطة البحوث الزراعية بسخا ومعمل قسم وقاية النبات بكلية الزراعة ـ جامعة طنطا ، خلال موسمين لزراعة بنجر السكر ١٣/٢٠١٢ ، ١٤/٢٠١٣م

تم فحص شباك العناكب واتضح أن مكوناتها كانت تحتوى على ٤٨.٠٨% كولمبولا ، من القطن وأنواع أخرى ٢٥.٦٤%، ١٢.٨٢% نطاطات الأوراق ، ٤.٨١% تربس القطن ، ٣.٢١% يرقات (العمر الأول والثانى) لدودة ورق القطن الكبرى ، ٢.٨٨% يرقات (العمر الأول والثانى) لدودة ورق القطن الصغرى ، ٢.٥٦% أكاروسات.

تم أيضا تعريف أنواع العناكب التى تنسج الشباك حيث تم تسجيل ثمانية أنواع تنتمى إلى خمس عائلات كانت أكثر العائلات هى Araneidae (٣ أنواع) ، عائلة Linyphiidae (٢ نوع) ، أما عائلة Dictynidae وAmaurobiidae, Theridid (نوع واحد فقط).

أخيرا ، توضح هذه النتائج أهمية العناكب الناسجة للشباك فى اصطياد الآفات الحشرية والأكاروسات مما يجعلها عنصر أساسى فى المكافحة المتكاملة للآفات فى حقول بنجر السكر وبالتالى ترشيد لإستخدام المبيدات فى مكافحة آفات بنجر السكر فى الحقل.