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The Main Insect Pests Attacking Wheat Plants and their Associated Predators in Sakha District, Kafr Elsheikh Governorate

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ABSTRACT

During the two seasons of study, the most abundant order was Hemiptera, included cereal aphids. English grain aphid, *Sitobion avenae* Fab. was the common species followed by *Rhopalosiphum padi* (L.), *Schizaphis graminum* (Rond.), *Rhopalosiphium maidis* (Fitch) and *Diuraphis noxia* Mordvilko (Aphididae), *Empoasca* spp. (Cicadellidae), *Nilaparvata lugens* (Delphacidae), *Limothrips cerealium* Haliday, *Thrips tabaci* Lindeman (Thripidae), *Nezara viridula* (L.), *Eysarcoris inconspicuous* (West.) (Pentatomidae), leaf-miner, *Chromatomyia nigra* (Meigen) (Diptra: Agromyzidae) were recorded in Egypt which caused a harmful losses of a green area of leaves, executed yield loss. Followed by *Sphyrotheca* spp. (order: Collombolla) and Silver Y moth, *Phytometra gamma* (Lepidoptera). In addition, eleven spots ladybird, *Coccinella undecimpunctata* (L.), was the most associated aphid specific predator, followed by others predators, *Cydonia vicina isis* Cr., *Cydonia vicina nilotica* Mul., *Scymnus* sp. and *Rhyzobius litura* Fab. (Coccinellidae), *Paederus alfierii* (Staphylinidae), *Chrysoperla carnea* (Steph.) (Chrysopidae), *Metasyrphus corolla* (Fab.) (Syrphidae) *Orius sp.* (Hemiptera).

INTRODUCTION

Wheat, *Triticum aestivum* L. is ranked the first cereal crop for human nutrition in Egypt and all over the world. Their offal's and straw were uses for animal nutrition. Egypt imports about the half of its wheat requirements. Shortage of wheat production is caused by harvest and store miss, uses and pests. Insect pests caused a great yield loss of wheat production, where, cereal aphid only, caused yield reduction estimated by up to 23% (Tantawi, 1985). Thus, protection and expansion the productions of wheat, will be highly appreciated, the cooperation between plant breeders, plant growers and plant protection specialists is highly needed to reach this aim. There are a change of abiotic factors of agriculture ecosystem followed by changes of their insect fauna. So, the study of this change of wheat insect fauna is the aim of this paper.

MATERIALS AND METHODS

The present study was carried out to survey the main insect pests attacking wheat plants and their associated predators at wheat program of Sakha Experimental Farm, Sakha Agriculture Station, Kafr El-Sheik governorate, Egypt, during two successive seasons 2015/16 and 2016/17. Four replicates (plot dimensions: 3m× 3.5m log ═ $10.5m^2$) was sown by wheat variety Shandweel1 in optimum sowing date (Mid November), and visual count of all insects attacked ten tiller/ weekly beginning of second half of January to evaluate the main insect pests attacking wheat plants and their associated predators. Normal agriculture practices were carried out. No insecticides were used throughout the two studied seasons. All stages of main insect pests and associated predators were counted. The collected specimens were kept in vials containing 75% ethyl alcohol with some drops of glycerin to keep their tissues soft, and labeled for date. Identification according to key of Aphididae described by (Habib and El-Kady, 1961), (Helmi, 2011) and by Department of Classification in Plant Protection Research Institute, Agriculture Research Center, Cairo, Egypt.

RESULTS AND DISCUSSION

The injurious Insect pests

Mean numbers of insect pests/10 tiller were 364.64 ± 108.39 and 1270.5 ± 98.48 individuals in the first and the second seasons, respectively. These pests were classified to fourteen species belong to eight families and six orders, as follow:

Order: Hemiptera was the most abundant, with mean numbers 225.5 ± 24.74 and 580 ± 34.58 individuals, formed about 61.82% and 90.48% of mean counted insect pests in first and the second seasons, respectively. This order included seven species belong to three families. The numbers and ratio of these species were as follows:

- **Family Aphididae:**

Data presented in Table (1) recorded that aphids were the main insect pests on wheat plants. Aphids cause direct damage by feeding and indirect damage by transmission of viruses. On optimum conditions, aphid was a major squeeze of wheat production in Egypt. Wheat yield loss due to aphids' attacking was evaluated by up to 23 % in Upper Egypt (Tantawi, 1985). In addition, the data reported that *R. padi*, *R. maidis*, *S. graminum* and *S. avenae.* were recorded as main cereal aphid species on wheat plants in Egypt agree with obtained of those El-Hariry (1979), Ghanim and El-Adl, (1983), Tantawi *et al.* (1986), Samad (2004), Sobhy *et al.* (2004), Slman, (2006) and Adly *et al.*, (2006). Archer and Bynum (1993) and Attia and El-Kady (1988) were added the Russian wheat aphid, *D. noxia*. While, El-Heneidy (1994) found that *R. padi* was the most abundant aphid species in Egypt. El- Barro, (1992) recorded that *R. padi* was the most commonly trapped of cereal aphid species across South Australia, and *M. dirhodium* and *Sitobion fragariae* Walker were rarely trapped.

English grain aphid, *Sitobion avenae* Fabricius

The common species into the two seasons was *S. avenae* which attacked wheat plants beginning March to end-April causing of breakneck damage due to direct feeding on spikes. The mean number/10 tillers reached 158 ± 16.71 individuals, formed about 43.32% of mean insect pests in the first season, and 509 ± 34.64 individuals, formed about 79.4% in the second one.

Green cereal- bug aphid, *Schizaphis graminum* Rondani

Schizaphis graminum was appeared with a few numbers mixed with *S. avenea* beginning of March, feeding on high leaves and ears, causing of yield damage. Mean number/ 10 tillers was 32.5 ± 3.79 individuals, formed about 8.91% of mean insect pests in the first season and 11.5 ± 0.85 individuals, formed about 1.79% in the second one.

Bird cherry-oat aphid, *Rhopalosiphum padi* Linnaeus

This species was appeared in a few numbers beginning of the two seasons, but quickly increased by mid-April, where, attacked wheat plants during vegetable growth until yellow mature stage, causing harmful yield damage. Mean number/ 10 tillers was 4.75 ± 1.25 individuals, formed about 1.30% of mean insect pests in the first season, and 39.75 ± 4.03 individuals, formed about 6.20 % in the second one.

Corn leaf aphid, *Rhopalosiphum maidis* Fitch

A few numbers with slight damage were appeared during the studied seasons. Mean number/ 10 tillers was 9.25 ± 1.25 individuals, formed about 2.54% of mean insect pests in the first season and 4.75 ± 1.03 individuals, formed about 0.74% in the second one.

Russian wheat aphid, *Diuraphis noxia* Mordvilko

Russian wheat aphid, *D. noxia* was appeared in highly clad leaf of tillers, beginning of the season, during branching stage, synchronized with rain and low air temperature. Mean number/ 10 tillers was 9.25 ± 1.25 individuals, formed about 2.54% of mean insect pests in the first season and 8.75 ± 0.85 individuals, formed about 1.37% in the second one.

- **Family: Cicadellidae**

***Empoasca* spp.**

Empoasca spp. is a distributed insect pest to main crops all over much of the world. It was attacked wheat plants during all the season causing yield loss. Mean number/ 10 tillers in the first season was 4.75 ± 0.63 and 4.75 ± 0.85 individuals, formed 1.30 and .74% of mean insect pests in the first and second seasons, respectively. The results was agree with obtained of those Sosa *et al.* (1988) who surveyed the cicadellidae populations in wheat in Argentina, and reported the main species were *Syncharina punctatissima* Signoret, *Mendozellus dubius* (Linnavuori) (*Amplicephalus dubius*), *Atanus angatus*, *Empoasca* sp., *Tapajosa rubromarginata* (Signoret), *Agalliana ensigera* (Oman), *Exitianus obscurinervis* (Stal), *Amplicephalus obsoletus* Linnavuori, and *Stirellu picinus* Ber.

- **Family: Delphacidae**

***Nilaparvata lugens* (Stal)**

The appearance of plant hopper *N. lugens* in wheat field was not as much as leaf hopper species *Empoasca* spp. A mean number / 10 tillers in the first season was 7 ± 0.41 individuals, formed 1.92% of mean insect pests and 1.5 ± 0.65 individuals, and formed 0.23% in the second one.

- **Family: Thripidae**

Grain thrips, *Limothrips cerealium* Haliday

Grain thrips, *L. cerealium* was attacked wheat plants during April synchronized with yellow mature stage of wheat plants feeding directly on ears causing a harmful damage to wheat yield. A mean number/ 10 tillers reached 73 ± 0.41 individuals in first season, formed 20.22% of mean insect pests, and 29.5 ± 4.44 individuals in the second season, and formed 4.60% of mean insect pests. This results was agree with those of Ghanim and El- Adl (1983), and Gentile and Trematerra (2004).

Onion thrips, *Thrips tabaci* Linderman

This species was attacked wheat plants during the season and feeding on hidden parts of plants. Mean recorded number/ 10 tillers was 59 ± 12.49 individuals in the first season, formed 16.38% of mean insect pests, and 16.75 ± 3.77 individuals, and formed 2.61% in the second one. Similar results were obtained by Abdel-Aziz (2014)

- **Family: Pentatomidae**

Southern green stink bug, *Nezara viridula* Linnaeus

This species was found on wheat plants during two times, beginning the seasons and in the last third of the season, where, the air temperatures were optimum. This pest was a secondary pest on wheat plants, wherever, a few numbers were noted in both seasons/ 10 tillers was 1 ± 0.48 individuals in the first season, formed 0.27% of mean insect pests, and 2.5 ± .64 individuals, formed 0.39% in the second one.

Whites potted stink bug, *Eysarcoris inconspicuous* (Westwood)

This species was attacked wheat plants in the last of the season during earing stage on a few numbers with causing a slight damage. Mean bugs/ 10 tillers was 0.5 ± 0.29 individuals, formed 0.14% of mean insect pests in the first season, and 0.75 ± 0.48 individuals, formed 0.12% in the second one.

- **Order: Diptra (Agromyzidae)**

The leaf-miner, *Chromatomyia nigra* (Meigen, 1830)

The leaf-miner, *C. nigra* was infested wheat leaves in two times, the first in beginning of the season. The few hatched larvae fed on upper surface epidermis of wheat leaf in blotches miners, and development to pupa in the miners to begging of March. The second stage flies appear beginning March and laying eggs were hatched during a few times to the major stage larva, caused of a bag damage to a green leaves area. Accordingly, highly decline of the yield were done. Mean numbers of life larva and pupa in blotches were 3.75 ± 0.85 individuals/ 10 tillers in the first season, with percentage 1.03 % and 8.00 ± 2.08 individuals/ 10 tillers, percentage 1.25% in the second one.

- **Order: Collombolla**

Sphyrotheca spp. was attacked wheat plants beginning of February to end the season. Feed on strips upper the wheat leaves casing of dangerous harmful damage and yield loss. Their appearance was only during the second season. The mean number/10 tillers was 3.0 ± 1.47 individuals, with percentage 0.47%.

- **Order: Lepidoptera**

Silver Y moth, *Phytometra gamma* (Linnaeus, 1758)

The larva was feed on leaves and ears some time caused a slight damage. A few numbers were appeared during the two seasons 0.5 ± 0.29 individuals with percentage 0.17% in the first season, and 0.5± 0.29 individuals with percentage 0.08% in the second one.

Table 1. The main insect pest species infesting wheat plants and their percentages / 10 tillers, related to their orders in Kafr EL-Sheikh governorate during the two successive seasons 2015/16 and 2016/17.

Injurious insect species	2015/16		2016/17	
	Mean ± SE	%	Mean ± SE	%
Order: Homoptera	158 ± 16.71	43.32	509 ± 34.64	79.41
Sitobion avenea	32.5 ± 3.79	8.91	11.5 ± 0.85	1.79
Schizaphis graminum	4.75 ± 1.25	1.30	39.75 ± 4.03	6.20
Rhopalosiphum padi	9.25 ± 1.25	2.54	4.75 ± 1.03	0.74
Rhopalosiphum maidis	9.25 ± 1.11	2.54	8.75 ± 0.85	1.37
Diurahis noxia	4.75 ± 0.63	1.30	4.75 ± 0.85	0.74
Empoasca spp.	7 ± 0.41	1.92	1.5 ± 0.65	0.23
Nilaparvata lugens				
Total	225.5 ± 24.74	61.82	580 ± 34.58	90.48
Order: Thysanoptera	73.75 ± 15.69	20.22	29. 5 ± 4.44	4.60
Limothrips cerealium	59.75 ± 12.49	16.38	16.75 ± 3.77	2.61
Thrips tabaci				
Total	133 ± 28.19	36.60	46.25 ± 4.97	7.21
Order: Hemiptera	1 ± 0.48	0.27	2.5 ± 0.64	0.39
Nezara viridula	0.5 ± 0.29	0.14	0.75 ± 0.48	0.12
Eysarcoris inconspicuous				
Order: Diptra	3.75 ± 0.85	1.03	8.00 ± 2.08	1.25
Chromatomyia nigra				
Order: Collombolla	0.00	0.00	3.00 ± 1.47	0.47
Sphyrotheca sp.				
Order: Lepidoptera	0.5 ± 0.29	0.14	0.5 ± 0.29	0.08
Phytometra gamma				
General Total	724.25 ± 108.39	100	1270. 5 ± 98.48	100

2. The associated Predators.

- **Family: Coccinellidae**

Eleven spot Ladybird, *Coccinella undecim-punctata* Linnaeus

Eleven spot ladybird *C. undecimpunctata* was the most associated aphid specific predator. Mean individuals/ 10 tillers was 4.5 ± 0.65 individuals in the first season formed 26.09 % of mean predators, and 5 ± 0.41 individuals formed 22.47% in the second one. The obtained data agree with those of Ghanim and El-Adl (1983), El- Heneidy and Attia (1989), Salem (2002), Samad (2004), El- Heneidy and Rizk (2004), Slman and Ahmed (2005), Slman (2006) recorded that *C. undecimpunctata* was the most specific aphid predator.

Ladybirds, *Cydonia vicina isis* Mulsant

A few numbers were noticed during the two seasons 0.5 ± 0.29 individuals/ 10 tillers in the first season formed 2.9% of mean predators, and 0.25 ± 0.25 individuals/ 10 tillers in the second one with percentage 1.12% of mean predators.

Ladybirds, *Cydonia vicina nilotica* Mulsant

A few numbers were recorded during the two seasons, where, 0.25 ± 0.25 individuals/ 10 tillers in the first season formed 1.45% and 0.25 ± 0.29 individuals/ 10 tillers in the second one with percentage 1.12% of mean predators.

Ladybirds, *Scymnus sp.*

Scymnus sp. was one of coleopteran ladybirds associated aphids species on wheat plants. The noticed mean numbers in the first season were 1.75 ± 0.48 individuals with percentage 10.14% of mean predators in the first season, while, there were 2.5 ± 0.29 individuals with percentage 11.23% in the second one.

Ladybirds, *Rhyzobius litura* Fabricius

The recoded mean number in the first season was 2.5 ± 0.29 individuals, with percentage 14.49%, while, this mean was 3 ± 0.41 individuals with percentage 13.49% in the second one.

The rove beetle, *Paederus alfierii* Koch

A few numbers was associated with wheat insects during the two studied seasons, where, recorded 2 ± 0.41 individuals with percentage 11.59% in the first season, and 2.25 ± 0.63 individuals with percentage 10.12% in the second one.

- **Family: Chrysopidae**

The green lacewing, *Chrysoperla carnea* (Stephens)

The mean recorded numbers/ 10 tillers were 3.25 ± 0.48 individuals formed 18.84% in the first season of the mean recoded predators, and 3.25 ± 0.63 individuals formed 14.61 % in the second one. These data agree with those of Salem and Mogahed (1990), Salem (2002), Samad (2004), El- Heneidy and Rizk (2004) and Yigit *et al.* (2007) they found that *C. undecimpunctata* and *C. carnea* were the most predominant predators of cereal aphids in wheat fields.

- **Family: Syrphidae**

The hover-fly *Metasyrphus corollae* (Fab.)

The mean recoded numbers/ 10 tillers were 1.5 ± 0.50 individuals, formed 8.70% in the first season of the mean recoded predators, and 3 ± 0.41 individuals, formed13.48% in the second one. The obtained results agreed with Samad (2004), El- Heneidy and Rizk (2004) and Yigit *et al.* (2007) recorded *Syrphus spp.* in the third predator's position after *C. undecimpunctata* and *C. carnea.*

• **Family: Hemiptera**

Orius sp.

A few numbers of adults 1 ± 0.41 individuals/ 10 tillers was noticed, formed 5.80% of mean recoded predators in the first season, and 2.75 ± 0.48 individuals formed about 12.36% in the second one.

Data represented in Table (2) reported that *C. undecimpunctata*, *C. carnea*, and *M. corollae* were the most common specific aphid predators in wheat fields. These data agree with those obtained by Ghanim and El-Adl (1983), El-Heneidy and Attia (1989) and Salem and Mogahed (1990).

Table 2. The main insect predators and their percentages / 10 tillers associated wheat pests related to their orders in Kafr EL-Sheikh governorate during the two successive seasons 2015/16 and 2016/17.

Beneficial insect species	2015/16		2015/17	
	Mean ± SE	%	Mean ± SE	%
Order: Coleoptera				
Coccinella undecimpunctata	4.5 ± 0.65	26.09	5 ± 0.41	22.47
Cydiona vicina isis	0.5 ± 0.29	2.90	0.25 ± 0.25	1.12
Cydionia vicina noltica	0.25 ± 0.25	1.45	0.25 ± 0.29	1.12
Scymnus sp.	1.75 ± 0.48	10.14	2.5 ± 0.29	11.23
Rizobous litura	2.5 ± 0.29	14.49	3 ± 0.41	13.49
Paederus alfierii	2 ± 0.41	11.59	2.25 ± 0.63	10.12
Order: Neuroptera				
Chrysoperla carnea	3.25 ± 0.48	18.84	3.25 ± 0.63	14.61
Order: Diptera				
Metasyrphus corolla	1.5 ± 0.50	8.70	3 ± 0.41	13.48
Order: Hemiptera				
Orius sp.	1 ± 0.41	5.80	2.75 ± 0.48	12.36
Total	17.25 ± 1.79	100	22.25 ± 4.78	100

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حصر لأهم الأفات الحشريةٌ التى تصيب نباتات القمحٌ والمفترسات المصاحبة لها فى منطقة سخا- محافظة كفرالشيخ

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تم تسجيل أربعةٌ عشرةٌ نوعاً من الأفات الحشريه التى تصيب نباتات القمح، تتبع ثمان عائلات حشريه داخل ستةٌ رتب حشريه.وكانت رتبة متشابهة الأجنحه Hemiptera: تضم ثلاث عائلات حشريه بها أهم الأفات الحشريه التى تهاجم نباتات القمح وهى:عائلة Aphididae: تشمل أنوع من الحبوب cereal aphids مثل *Rhopalosiphium padi*، *Rhopalosiphium maidis* ، *Sitobion avenae* ، *Schizaphis graminum* و *Diuraphis noxia* وكانت نسبة تواجدها كالأتى: ١.٣٠ ، ٢.٥٤، ٤٣.٣٢، ٨.٩١ و ٢.٥٤ : ٦.٢٠ ، ٠.٧٤، ٧٩.٤١، ١.٧٩ و ١.٣٧ % فى الموسمين الأول و الثانى بالترتيب. العائله الثانيه Cicadellidae: التى تشتمل على نطاطات الأوراق *Empoasca* spp. بنسبة ١.٣٠ و ٠.٧٤ % فى الموسمين الأول والثانى بالترتيب. العائله الثالثه Delphacidae تحوى نطاطات النبات *Nilaparvata lugens* بنسبة ١.٩٢ و ٠.٢٣ % فى الموسمين الأول والثانى بالترتيب.الرتبه الثانيه Thysanoptera: تحوى نوعي التربس. تربس القمح *Limothrips cerealium* و تربس البصل والقطن *Thrips tabaci* بنسبة ٢٠.٢٢ و١٦.٣٨% فى الموسم الأول و٤.٦٠، ٢.٦١% فى الموسم الثانى. رتبة البق الحقيقى Pentatiomidae: تحوى نوعين هما البقه الخضراء *Nezara virdula* ؛وبقة الحبوب *Eysacoris inconspicuous* بنسبة ٠.٢٧ ، ٠.١٤ : ٠.٣٩ ، ٠.١٢ % فى الموسمين الأول والثانى على التوالى. صانعةٌ أنفاق أوراق القمح *Chromatomyia nigra* التابعة ل (Diptra: Agromyzidae) حيث وجدت يرقاتها متغذيةٌ داخل أنفاق مستعرضة تحت بشرة أوراق نباتات القمح العلوية غالباً، بنسبة ١.٠٣ و١.٢٥%،خلال موسمى الدراسه، بالترتيب. فراشةٌ نصف القياسيةٌ ذات الحرف Y التابعةٌ لرتبة (Lepidoptera) *Phytometra gamma* فوجدت متغذيةٌ على أوراق نباتات القمح وأحياناً على السنابل بنسبة بسيطة ٠.١٤ ، ٠.٠٨ % من إجمالى الأفات الحشريه خلال موسمى الدراسةٌ. النوع *Sphyrotheca* spp. (Collombolla): حيث شوهد متغذياً على أوراق نباتات القمح متسبباً فى خسائر كبيرة بها خلال الموسم الثانى للدراسة فقط بنسبة ٠.٤٧.% من إجمالى الأفات.حصر لأهم المفترسات المصاحبه لأفات القمح الحشريه فى منطقة سخا- محافظة كفرالشيخ. تم تسجيل خمسة أنواع من المفترسات الحشريه التى تصاحب الأفات الحشريه التى تصيب القمح ،منها خنفساء أبوالعيد ١١ نقطه، الأسود، السمنى ،الإسكمنس، خنفساء *Rhyzobius litura* ،خنفساء الرواغه، أسدالمن الأخضر ،ذبابة السرفيس و حشرة بق *Ourius* sp. بنسب ٢٦.٠٩ ، ٢.٩٠ ، ١.٤٥ ، ١٠.١٤، ١٤.٤٩ و١١.٥٩ % فى الموسم الأول. و ٢٢.٤٧ ، ١.١٢ ، ١.١٢ ،١١.٢٣ ، ١٣.٤٩و ١٠.١٢ % فى الموسم الثانى على التوالى ، من إجمالى المفترسات/١٠ تلر.