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INTERACTION AMONG VEGETABLE CROPS, PIERCING SUCKING INSECT PESTS AND ASSOCIATED PREDATORS.

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ABSTRACT

The coccinelid predators (*Coccinella undecimpunctata* and *Coccinella sptempunctata*) were more abundant species on the tested host plants than *Chrysoperla carnea* and *Eupeodes corolla* (F) .The coccinelid predators greatly preferred white bean over cowpea and squash. However, the chrysopid predator, *Chry. carnea* greatly preferred white bean over squash and cowpea plants. *E. corolla* (F) showed more preferability to cowpea than white bean or squash plants.

In respect to the preference of predators for their prey, *Chrysoperla Carnea* and *E. corolla* (F) greatly preferred aphids and whitefly over leafhopper. On contrary, coccinelid predators showed highest degrees of preference to leafhoppers and aphids than whitefly.

INTRODUCTION

Legume vegetables are widely cultivated crops in many countries of the world and in Egypt because they contain high protein (about 20%) that is characterized as a complete protein compared with those of other vegetables (Nosser, 1996). The cowpea, *Vigna unguiculata* (L.) is one of the most important vegetable leguminous crops in many parts of the world and in Egypt as a protein rich food. In Egypt, in 2009 (Anony mous.,2010). *Phaseolus Vulgaris b.*, are grown in every continent except Antarctica.. Worldwide, 23 million tones of dry *Phaseolus Vulgaris L.* and 17.1 million tones of green beans were produced in 2010 (USDA, 1986)., In Egypt, *Cucurbita pepo L.* is one of the most popular garden vegetables planted today.

Unfortunately, these crops are attacked by several insect pests throughout their different grouth stages. Piercing-sucking insect pests are very injurious and cause serious damage to the yield in both quantity and quality (Jackai, 1995; Ward et al., 2002 and Hassan 2013). Their damage occur either directly by sucking plant juice or indirectly as vectors of virus diseases.

Chemical control of pests result an environmental pollution, serious side effects to human, domestic animals and natural enemies (Schmutterer, 1990).. So, the biological control remains a very essential component in insect pest management. This is especially recommended in vegetable plantations, because vegetable crops are most likely used as fresh foods . In the last few years, the Ministry of Agriculture aims to minimize the use of insecticides in integrated pest management programs. To maintain the natural balance, it is imported to conserve the natural enemies.

The aphidophagous predators (Helal et al., ,1996 ; Abdel-Kareim et al.,2011; Salman et al., 2014; Khuhro et al., 2012 and Al-Deghair et al.,

2014) proved to be the main mortality factor of piercing-sucking insect pests (i.e. aphids, white fly and leafhopper).

The host plant had an effective role on the piercing-sucking pest populations and their predators, the natural enemies showed differences of their searching characteristics in response to host plant species (Abd El-Kareim ,2002) . So the host plant it must be considered in the IPM programs (Marouf, 2007 and Abdel-kareim et al.,2011).

Therefore, the present investigation aimed to study the following topics:

1.Studying the seasonal abundance of the main predaceous insect species and their prey (aphids, leafhoppers and the whitefly) in cowpea, white bean and squash fields.

2- Evaluating the interaction among host plants, prey and seasonal activity of associated predators.

MATERIALS AND METHODS

Field experiments:

The field experiments were carried out at the Experimental Farm of the Faculty of Agriculture, Mansoura University to determine the relation between insect natural enemies (i.e. predators) and sucking insect pests (aphids, leafhoppers and whitefly) on different vegetable crops (squash, *Cucurbita pepo* L white bean, *Phaseolus vulgaris L.* and cowpea (*Vigna unguiculata* (L.).

To estimate the seasonal abundance of the main sucking insect pests and predaceous insects associated with cowpea, white bean and squash plants, an area of about 630 m2 was prepared, as recommented, and divided into nine plots (each of 70 m2) This means three treatments (crops) and three replicated.

All vegetable crops were sown on 20th February (during 2013) and on 6th February (during 2014).All regular agricultural practices were normally conducted except the use of insecticides.

Sampling techniques:

Plant samples were collected weekly at random from each replicate starting one month after sowing date and continued till harvest. Each sample consisted of 15 leaves /replicate. Leaves were introducted into polyethylene bags in the field and then picked up and transferred to the laboratory for examination.

In the laboratory, the collected samples were inspected using a binocular microscope as follows: three inches were determined for every squash leaf (2 lateral and 1 terminal).Individuals of both aphid and whitefly were counted on every square inch. It means that 135 sq. in. (45 leaves x 3 Sq. In.) as well as 45 leaves of both cowpea and white bean were inspected weekly. In case of leafhopper the individuals were counted directly in the field on the leaves.

The numbers of each insect species (tomato whitefly, aphids and leafhoppers) were counted and recorded. The presence of predators on the collected samples was also recorded. The insect predators which observed on each sample were collected using an aspirator and counted.

Statistical analyses:

correlation and regression analysis were done between prey densities (i.e., the weekly average of each prey density) and the seasonal abundance of insect predators.

RESULTS

1. The relation between predaceous insects and the tested host plants:

1.1 Total number and relative abundance of predaceous insects:

As shown in Table (1), the coccinelid predators (*C. undecimpunctata* and *C. stemptpunctata*) were more occurring on the tested host plants than were *Chy. carnea* and *E. corolla*. However, the coccinelid predators represented by 40.1, 36.5 and 35.3% (in the first season) and 41.8, 61.8 and 41.6% (in the second season) of the total number of predaceous insects in white bean, cowpea and squash fields, respectively.

The coccinelid predators preferred white bean (40.1&41.8) and cowpea (36.5 &61.8) over squash (35.3 &41.6) in the first and second seasons, respectively (Table,1). On the other hand, the chrysopid predator, *Chy. carnea* greatly preferred white bean and squash to cowpea plants. The occurrence percentages of *Chy. Carnea* population on white bean, squash and cowpea plants were 31.2, 34.6 and 23.3 in the first and 23.6, 17.7 and 14.3% in the second season , respectively. *E. corollae* showed more preferability to cowpea (36.5 and 43.8) to white bean (25.7 and 31.5)or squash plants (26.3 and 37.2%) in the first and second seasons, respectively.

1.2. Seasonal abundance of predaceous insects:

1.2.1. The coccinelid predators :

As shown in Figure (1), the coccinelid predators started to visit white bean and cowpea plants early on 13th of March (in the first season) and exhibited a distinct peak on white bean (13 individual) and cowpea (19 individuals/sample), recorded on the 1st of May and 24th of April, respectively. While on squash plants, it appears later on the 3rd of April with one peak of abundance on 22th of May represented by 14 individuals. In the second year (2014), coccinellid populations exhibited approximately similar trend of changes on all host plants. It started to visit all host plants at the first week of March and showed one peak of abundance; recorded on the 29th of April. So, it could be concluded that coccinellid predators preferred cowpea over squash and white bean.

1.2.2. The chrysopid, *Chry. carnea* :

Chy. carnea population started to appear on white bean and cowpea fields on the 4th of March and showed the highest occurrence on the 15th of May 2013, represented by 14 and 9 individuals/sample. While, *Chy. carnea* population started to visit squash plants at the last week of March and exhibited the highest peak on the 17th April (9 individuals/sample). In the second season, it exhibited similar trend of changes on white bean, cowpea and squash plants. However, it showed one peak of abundance on the 6th of May, represented by 12, 6 and 6 individuals/sample, respectively.

So, it could be concluded that *Chry. carnea* preferred white bean plants in comparsion with cowpea or squash.

1.2.3. The hoverfly, *E. corollae*:

Data illustrated in Fig.(1) indicated that *E. corollae* showed more preferability to cowpea than to white bean or squash plants. In the first year, it exhibited the highest abundance on 15th May, 15th May and 27th May on cowpea, white bean and squash, represented by 16, 13 and 8 individuals /45 leaves, respectively. In the second year, *E. corollae* showed no preferrability to all host plants. However, it starts to appear on all host plants on 25th of March 2014 and showed no preference among host plants.

2. The relation between predaceous insects and their prey.

2.1. Seasonal abundance of predators in response to prey density:

The changes of each predator's population in response to their prey densities on each host plant were iluustrated in Fig (2, 3 and 4).

2.2. The interaction among host plants, preys and seasonal activity of associated predators.

To evaluate the interaction among the different prey densities and seasonal activities of associated predators on tested host plants, multi-regression analysis was done. The calculated values of multi-regressions representing the common effect of mean preys densities (i.e. aphids, leafhoppers and whitefly) on the population of each predator in white bean, cowpea and squash fields, are shown in Tables (2, 3 and 4) which indicated to the following :

In whitebean field:

With respect to coccinelid predators: Multi-regression analysis revealed that the common effect of the prey population size (aphids, whitefly, *B..tabaci* and leafhopper) exhibited strong effect on the coccinelid populations (Table,2). However, 85.0 and 95.6% of the total population changes were due to the compound effect of the tested prey in 2013 and 2014. In 2013, the highest effective prey was that of the mean aphid densities followed by means of whitefly and leafhopper densities, where the determination coefficient values (R^2) were 67.1, 59.6 and 40.9%, respectively. In 2014 season, the highest effective prey was that of mean whitefly followed by leafhopper and aphid densities , where R^2 were 84.8, 82.2 and 69.5%, respectively.

Malti-regration analysis illustratrd that the relation between number of coccinelids (N_{co}) and all of mean aphids (A) , whitefly (W) and leafhopper (L) **could be represented by the following sub models:**

$$N_{co} = - 0.97 +0.31\ A -0.25\ W+ 0.36\ L \text{ (in 2013)}$$

$$N_{co} = - 1.90 +0.09\ A +0.22W + 0.27\ L \text{ (in 2014)}$$

As shown in Table (2), *Chry. carnea* population exhibited insignificant correlation with leafhopper population in 2013 and 2014 seasons. The highest effective prey density was that of aphid followed by mean whitefly and leafhopper densities, where the (R^2) were (76.5, 60.4 and 23.4%) and (39.8, 72.2 and 22.8%, respectively) in the first and secondseasons.

The relation between number of *Chy. carnea* population (N_{ch}) and all of mean aphids (A) , whitefly (W) and leafhopper (L) could be represented by the following sub models:

$$N_{ch} = - 1.07 +0.30 A -0.14 W + 0.18 L \text{ (in 2013)}$$

$$N_{ch} = 1.08 -0.01 A + 0.61 W - 0.22 L \text{ (in 2014)}$$

E. corolla population showed variable responses to the changes of leafhopper population, it exhibited an insignificant and significant response in the first and second seasons (Table,2).On the other hand, the highest effective prey density in 2013 season was that of aphid followed by whitefly and leafhopper, where (R^2) were 92.9, 76.5 and 24.0% . In 2014 season, the highest effective prey density was that of whitefly followed by leafhopper and aphids.(R^2 values were 72.3,60.0 and 50.5%, respectively).All prey population contributed 93.0 and 75.0% of the total population changes of *E. corolla*. The relation between numbers of *E. corolla*. population (N_s) and all of mean aphids (A) , whitefly (W) and leafhopper (L) could be represented by the following sub models:

$$N_s = - 1.16 + 0.21 A + 0.03 W- 0.01 L \text{ (in 2013)}$$

$$N_s = 0.91 + 0.02 A + 0.23 W + 0.09 L \text{ (in 2014)}$$

In cowpea field:

Statistical analysis indicated that the common effect of the prey population size (aphids, whitefly, *B..tabaci* and leafhopper) exhibited strong effect on the coccinelid populations, especially in 2014 season (Table,3). However, 72.5 and 90.5% of the total population changes were due to the compound effect of the tested prey in 2013 and 2014. In 2013, the highest effective prey was that of the mean leafhoppers followed by whitefly and aphid densities, where R^2 values were 49.5, 44.5 and 35.2%, respectively. While, in 2014 season, the highest effective prey was that of mean whitefly followed by aphids and leafhopper,R^2 were 84.4, 79.8 and 43.9%, respectively. The relation between number of coccinelids (N_{co}) and all of mean aphids (A) , whitefly (W) and leafhopper (L) could be represented by the following sub models:

$$Nco = - 1.43 +0.16 A -0.30 W +0.89 L \text{ (in 2013)}$$

$$Nco = - 2.40 +0.22 A +0.29 W + 0.10 L \text{ (in 2014)}$$

Chy. carnea population exhibited no response to the changes of leafhopper population on cowpea plants in both seasons (Table,3), however, there was insignificant correlation between *Chy. carnea* population and leafhopper density. While, aphids and whitefly approved to be the key preys, its contributed 73.2 &78.6% (in 2013) and 78.8 & 72.6% (in 2014) of the total population changes of *Chy. carnea* population. On the contrary, leafhopper contributed only 35.1 and 29.5% in 2013 and 2014. The compound effect of all preys in 2013 and 2014 , represented by 92.5 and 82.4% of the total population changes of *Chy. carnea*. The relation between number of *Chy. carnea* population (N_{ch}) and all prey densities could be represented by the following sub models:

$$N_{ch} = - 0.89 +0.06 A+ 0.23 W -0.10 L \text{ (in 2013)}$$

$$N_{ch} = - 1.39 +0.12 A + 0.08 W + 0.01 L \text{ (in 2014)}$$

Correlation and regression analysis showed that *S. corolla* population was significantly affected by their prey (aphids and whitefly population) and insignificantly affected by leafhoppers, where the (R^2) was 85.0, 55.2 and 20.9% in 2013season. While, in 2014 the R^2 was 88.5, 86.6 and 42.6%. So, it could be noticed that *E. corolla* population showed different response to the changes of leafhopper population, it exhibited an insignificant and significant response in the first and second seasons(Table,2) .The relation between numbers of *E. corolla*. population (N_s) and its preys represented by the following sub models:

$$N_s = 2.78 + 0.21\ A + 0.21\ W - 0.02\ L \text{ (in 2013)}$$
$$N_s = -2.40 + 0.23\ A + 0.19\ W + 0.07\ L \text{ (in 2014)}.$$

In squash field:

As shown in Table (4) coccinelid populations were significantly affected by all preys on squash plants during 2013 and 2014 season, the common effect of the preys populations represented by 93.5 and 80.0% of the total population changes in 2013 and 2014. In 2013, the highest effective prey was leafhoppers density followed by whitefly and aphids, where the R^2 values were 93.3, 80.8 and 47.5%, respectively. While, in 2014 season, the highest effective prey was whitefly followed by aphids and leafhopper, R2 was 64.1, 42.5 and 38.6%, respectively.

The relation between number of coccinelids (N_{co}) and their preys represented by the following sub models:

$$Nco = - 1.43 + 0.03\ A - 0.12\ W + 0.49\ L \text{ (in 2013)}$$
$$Nco = = -2.95 - 0.87\ A + 0.96\ W + 0.65\ L \text{ (in 2014)}$$

Values of the compound effect of all preys on *C. carnea* population was lower in 2013 than those in 2014, represented by 58.7 and 98.3% in 2013 and 2014 seasons. *C. carnea* population exhibited a seight response in the first season to the changes of leafhopper population on squash plants. However, aphids , whitefly and leafhopper population contributed 52.9, 45.5 and 29.9% (in 2013) and 94.6, 89.6 and 40.6% (in 2014) of the total population changes of *C. carnea* populationThe relation between number of *C. carnea* population (N_{ch}) and all prey densities could be represented by the following sub models:

$$N_{ch} = - 0.42 + 0.16\ A + 0.28\ W - 0.18\ L \text{ (in 2013)}$$
$$N_{ch} = - 0.53 + 0.21\ A + 0.07\ W - 0.05\ L \text{ (in 2014)}$$

Correlation and regression analysis showed that the highest effective prey on *E. corolla* population in 2013 season was that of the mean leafhopper, followed by whitefly and aphid, where the values of (R^2) were 78.9, 68.9 and 53.1%, respectively. While, in 2014 season, the highest effective prey was that of mean aphids followed by whitefly and leafhopper, where R^2 valuse were 93.1, 78.9 and 37.3%, respectively (Table,4).The relation between numbers of *E. corolla*. population (N_s) and its preys represented by the following sub models:

$$N_s = 0.29 + 0.05\ A + 0.18\ W + 0.01\ L \text{ (in 2013)}$$
$$N_s = - 0.39 + 0.59\ A + -0.003\ W - 0.17\ L \text{ (in 2014)}$$

DISCUSSION

4.1 Attractiveness of tested host plants to insect predators

Surveying the insect predators associated with summer plantations of white bean, cowpea and squash assured that the most dominant predators were the coccinellid *C. undecimpunctata* and *C. septempunctata*), *E. corolla* and *C. Carnea*. As mentioned by other authors, these predators were recorded as important natural enemies associated with white bean, cowpea and squash plants in Egypt (Abdel-Gawaad *et al.*,(1990) ; Amro (2004); Ali *et al.*, (2013) and Gameel (2013)

The present investigation indicated that seasonal abundance of predaceous insects showed differences in their response to host plant species. However, the collected predators , coccinelids and *C. carnea* greatly preferred white bean over cowpea and squash. On the contrary, *E. corollae* greatly preferred cowpea over white bean and squash.. Also, the predators of *Rodolia cardinalis*, *Chilocorus bipustulatus* and *C. motrouzari* exhibited different response to different host plants Cardosa, 1990; Heidari et al., 1999 and Abdel-Mageed, (2005). Plant volatiles are derived from a complex of biochemical processes and some of these compounds appear to be common in different plant species (Arab and Bento, 2006).

According to El-Baradey (2012), differences in predators response to different host plant species may be attributed to chemical stimulants (kairomone) produced by the plant species and may explain variation of predator abundance on different host plants. Similar conclusion was obtained by Abd El-Kareim (2002) ; Abdel-Kareim et.al, (2011) and Marouf (2011) that emission of auditory stimuli from the host plant is the main factor in insect attraction. Luna and Jepson (2001) indicated that differences of predators (hoverflies and coccinellid beetles) in response to the tested host plants may be attributed to physical or chemical stimulants For some predatory species, a blend of compounds, including volatiles from the plants in the habitat as well as prey volatiles are involved (Hagen, 1986).

4.2 Interaction among host plants, preys and predators activity.

Predator-prey interactions play a substantial role in shaping spatial distributions of organisms in biological communities (Williams and Flaxman, 2012). Jalali (2012) demonstrated that significant host plant-prey interactions were evident for every component of development (juvenile survival, developmental time, adult mass at emergence) and reproduction of associated predators .

In the present study, tested predators (coccinelids, *C.carnea and E. corolla*) showed variable responses to prey population on the tested host plants, especially with leafhopper populations. *C. undecimpunctata* exhibited higher searching rates when fed on *A. gossypii* than when fed on *Aphis punicae* (Shinji) (Al-Deghair *et al.*, 2014). Also, the total developmental time from egg hatching to adult eclosion of chrysopid, *Chrysoperla carnea* differed significantly when reared on the four aphid species (*Aphis gossypii*, *Sitobion avenae(F)*, *Rhopalosiphum maidis* (Fitch), and *Aphis nerii*) (El-Serafi *et al.*, 2000). According to Giles *et al.* (2002), *Aphis pisum* reared on *Medicago* *sativa* L was suitable prey for *C. septempunctata* survival, development, and adult size than *A. pisum* reared on *Vicia faba* L. A significant faster rate of development when the predator *C. septempunctata* was reared on *Acyrthosiphon pisum* Harris than observed on *R. maidis* (Obrycki and Orr ,1990)

Table (1): Total number and relative abundance of predaceous insect species (*Chrysoperla. carnea, Eupeodes corolla* (F.). and the coccinelids, *Coccinella. undecimpunctata, Coccinella. stemptpunctata*) in white bean, cowpea and squash summer plantations colectad throught 2013 and 2014 seasons.

Predator	2013 season						2014 season					
	Phaseolus vulgaris L.		*Vigna unguiculata*		*Cucuerbita pepo L.*		*Phaseolus vulgaris L.*		*Vigna unguiculata*		*Cucuerbita pepo L.*	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Chrysoperla carnea Steph.	63	31.2	44	23.3	54	34.6	39	23.6	16	14.3	20	17.7
Eupeodes corolla Fabr	52	25.7	69	36.5	41	26.3	52	31.5	41	43.8	42	37.2
Coccinelid: *C.undecimpunctata* & *C. semptpunctata*	81 (54) (27)	40.1	69 (41) (28)	36.5	55 (31) (24)	35.3	69 (75) (48)	41.8	49 (70) (48)	61.8	47 (57) (34)	41.6
Other: *Peaderes alferii, Orius sp.*	6	3.0	7	3.7	6	3.8	5	3.0	6	5.4	4	3.5
Total	202	100	189	100	156	100	165	100	112	100	113	100

Table (2): The correlation and regression coefficient between the mean number of collected predators and each of aphids , whitefly and leafhoppers population densities in white bean field during 2013 and 2014 seasons.

Preadators	Prey	Season	Simple Correlations and regression				Malti regression			
			r	b	p	R^2 %	b	P	E.V.% 2013	E.V.% 2014
Coccinellds	Aphids	2013	0.82	0.50	0.002	67.1	0.31	0.011	85.0	95.6
		2014	0.83	0.24	0.001	69.5	0.09	0.041		
	White fly	2013	0.77	0.13	0.005	59.7	-0.25	0.066		
		2014	0.92	0.66	0..000	84.8	0.22	0.114		
	Leaf hopers	2013	0.64	0.23	0.034	40.9	0.36	0.026		
		2014	0.91	0.53	0.000	82.2	0.27	0.012		
Chrysoperla carania	Aphids	2013	0.88	0.21	0.000	76.5	0.30	0.063	78.9	87.6
		2014	0.63	0.11	0.037	39.8	-0.01	0.795		
	White fly	2013	0.78	0.17	0.005	60.4	-0.14	0.451		
		2014	0.85	0.36	0.001	72.2	0.61	0.001		
	Leaf hopers	2013	0.48	0.23	0.131	23.4	0.18	0.401		
		2014	0.47	0.16	0.140	22.6	-0.24	0.022		
Eupeodes coralla	Aphids	2013	0.96	0.23	0.000	92.9	0.21	0.034	93.0	75.0
		2014	0.71	0.19	0.014	50.5	0.02	0.653		
	White fly	2013	0.87	0.19	0.000	76.5	0.23	0.803		
		2014	0.85	0.36	0.001	72.3	0.23	0.218		
	Leaf hopers	2013	0.49	0.23	0.126	24.0	-0.01	0.803		
		2014	0.78	0.27	0.005	60.4	0.08	0.479		

Table (3): The correlation and regression coefficient between the mean number of collected predators and each of aphids, whitefly and leafhoppers population densities in cowpea field during 2013 and 2014 seasons.

Preadators	Prey	Season	Simple Correlations and regression				Multi regression			
			r	b	p	R^2 %	b	P	E.V.% 2013	E.V.% 2014
Coccinellds	Aphids	2013	0.59	0.15	0.050	35.2	0.16	0.050	72.5	90.5
		2014	0.89	0.46	0.000	79.8	0.22	0.091		
	White fly	2013	0.67	0.35	0.024	44.9	-0.30	0.304		
		2014	0.91	0.58	0..000	84.4	0.29	0.108		
	Leaf hopers	2013	0.70	0.61	0.016	49.5	0.89	0.050		
		2014	0.66	0.42	0.026	43.9	0.09	0.346		
Chrysoperla carania	Aphids	2013	0.86	0.12	0.001	73.2	0.06	0.001	97.5	82.4
		2014	0.89	0.81	0.000	78.8	0.12	0.089		
	White fly	2013	0.88	0.25	0.000	78.6	0.23	0.001		
		2014	0.85	0.21	0.001	72.6	0.08	0.363		
	Leaf hopers	2013	0.59	0.28	0.055	35.1	-0.98	0.162		
		2014	0.54	0.13	0.084	29.5	0.009	0.868		
Eupeodes coralla	Aphids	2013	0.92	0.26	0.000	85.0	0.21	0.002	91.8	95.9
		2014	0.94	0.39	0.000	88.5	0.23	0.006		
	White fly	2013	0.74	0.44	0.009	55.2	0.21	0.263		
		2014	0.93	0.48	0.000	86.6	0.19	0.057		
	Leaf hopers	2013	0.45	0.46	0.158	20.9	-0.02	0.92		
		2014	0.65	0.33	0.029	42.6	0.06	0.225		

Table (4): The correlation and regression coefficient between the mean number of collected predators and each of aphids, whitefly and leafhoppers population densities in squash field during 2013 and 2014 seasons.

Preadators	Prey	Season	Squash Correlations and simple regression				Malti regression			
			r	b	p	R^2 %	b	P	E.V.% 2013	E.V.% 2014
Coccinellds	Aphids	2013	0.69	0.49	0.019	47.5	0.03	0.847	93.5	80.0
		2014	0.65	0.56	0.030	42.5	-0.89	0.077		
	White fly	2013	0.89	0.39	0.000	80.8	-0.12	0.542		
		2014	0.80	0.55	0.003	64.1	0.95	0.011		
	Leaf hopers	2013	0.97	0.40	0.000	93.1	0.49	0.010		
		2014	0.62	0.69	0.041	38.6	0.65	0.066		
Chrysoperla carania	Aphids	2013	0.73	0.31	0.011	52.9	0.16	0.466	58.7	98.3
		2014	0.97	0.26	0.000	94.6	0.21	0.001		
	White fly	2013	0.67	0.18	0.023	45.5	0.28	0.355		
		2014	0.95	0.20	0.000	89.6	0.06	0.035		
	Leaf hopers	2013	0.55	0.13	0.082	29.9	-0.18	0.411		
		2014	0.64	0.22	0.035	40.6	-0.05	0.100		
Eupeodes corolla	Aphids	2013	0.73	0.31	0.011	53.1	0.05	0.792	69.2	96.1
		2014	0.96	0.49	0.000	93.1	0.59	0.001		
	White fly	2013	0.83	0.22	0.002	68.9	0.18	0.490		
		2014	0.89	0.36	0.000	78.9	-0.003	0.972		
	Leaf hopers	2013	0.79	0.19	0.004	62.0	0.012	0.951		
		2014	0.61	0.40	0.046	37.3	-0.17	0.063		

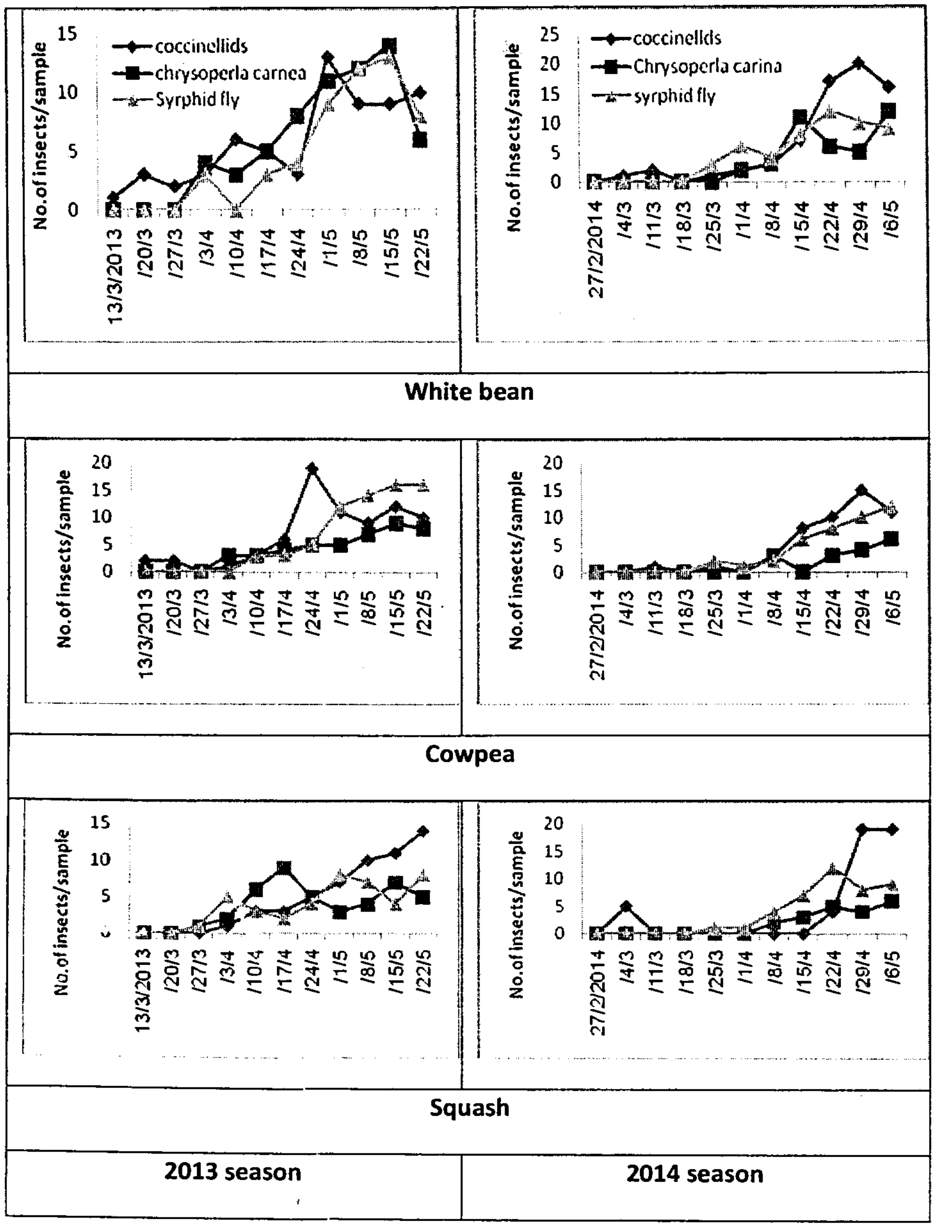

Figure (1): Seasonal abundance of Coccinelid predators (Coccinella undecimpunctata and Coccinella septempunctata) ; the chrysopid, C. carnea and the hoverfly, Eupeodes corolla in response to host plant sprcies (white bean, cowpea and squash) at Mansoura district during 2013 and 2014.

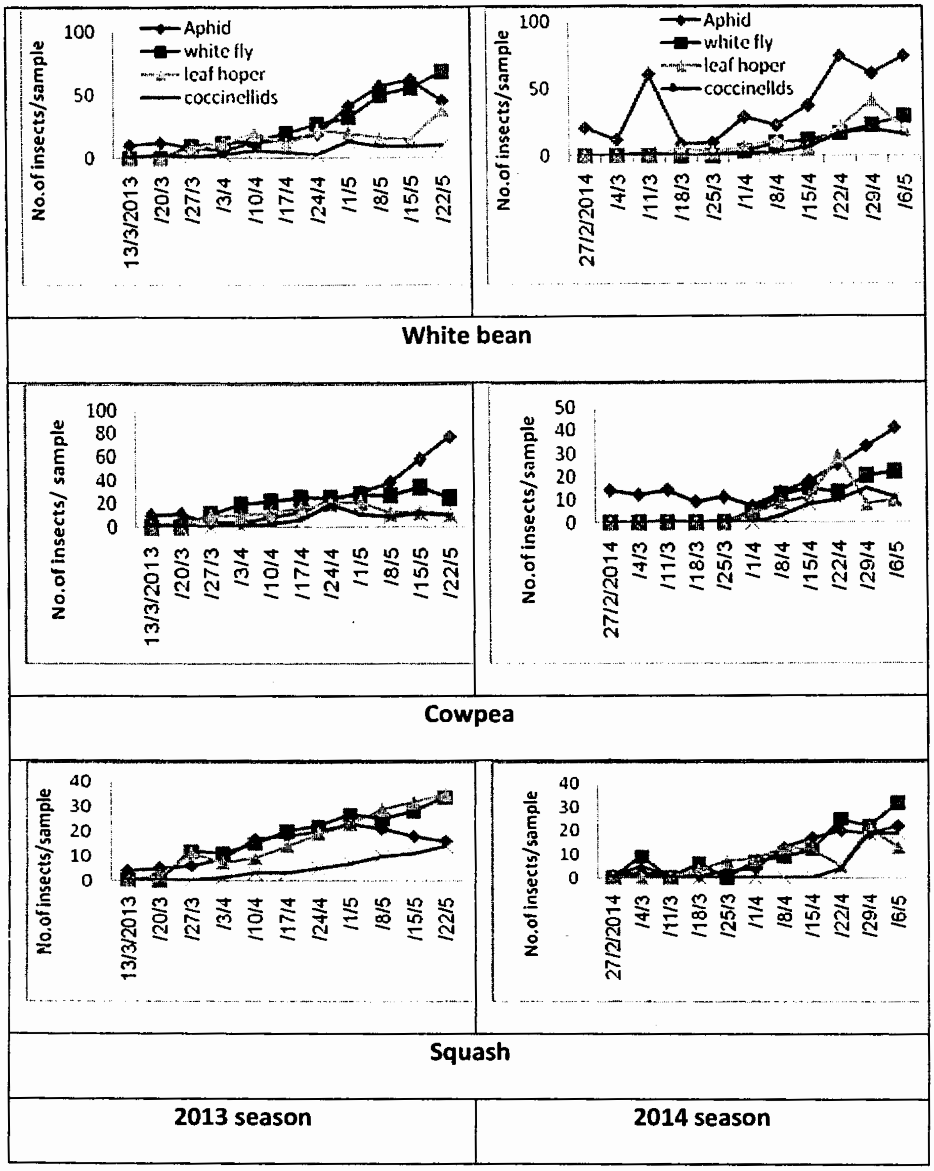

Fig.2: Seasonal abundance of the coccinellid predators (Coccinella *undecimpunctata and Coccinella septempunctata*) in respose to prey densities (aphids, whitefly and leafhoppers) on white bean, cowpea and squash plants during 2013 and 2014 seasons.

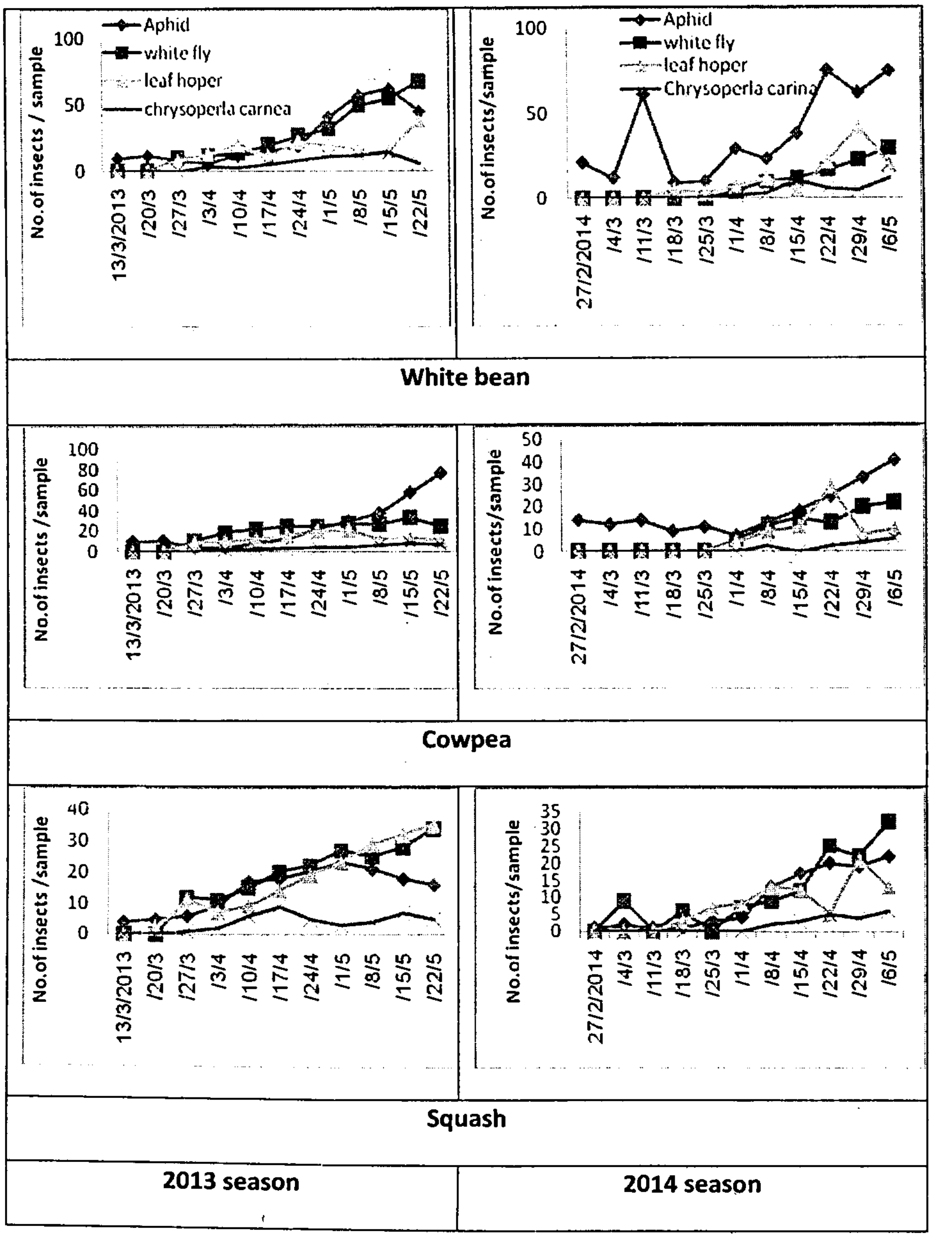

Fig.3: Seasonal abundance of the chrysopid predator *(Chrysoperla carnea)* in respose to prey densities (aphids, whitefly and leafhoppers) on white bean, cowpea and squash plants during 2013 and 2014 seasons.

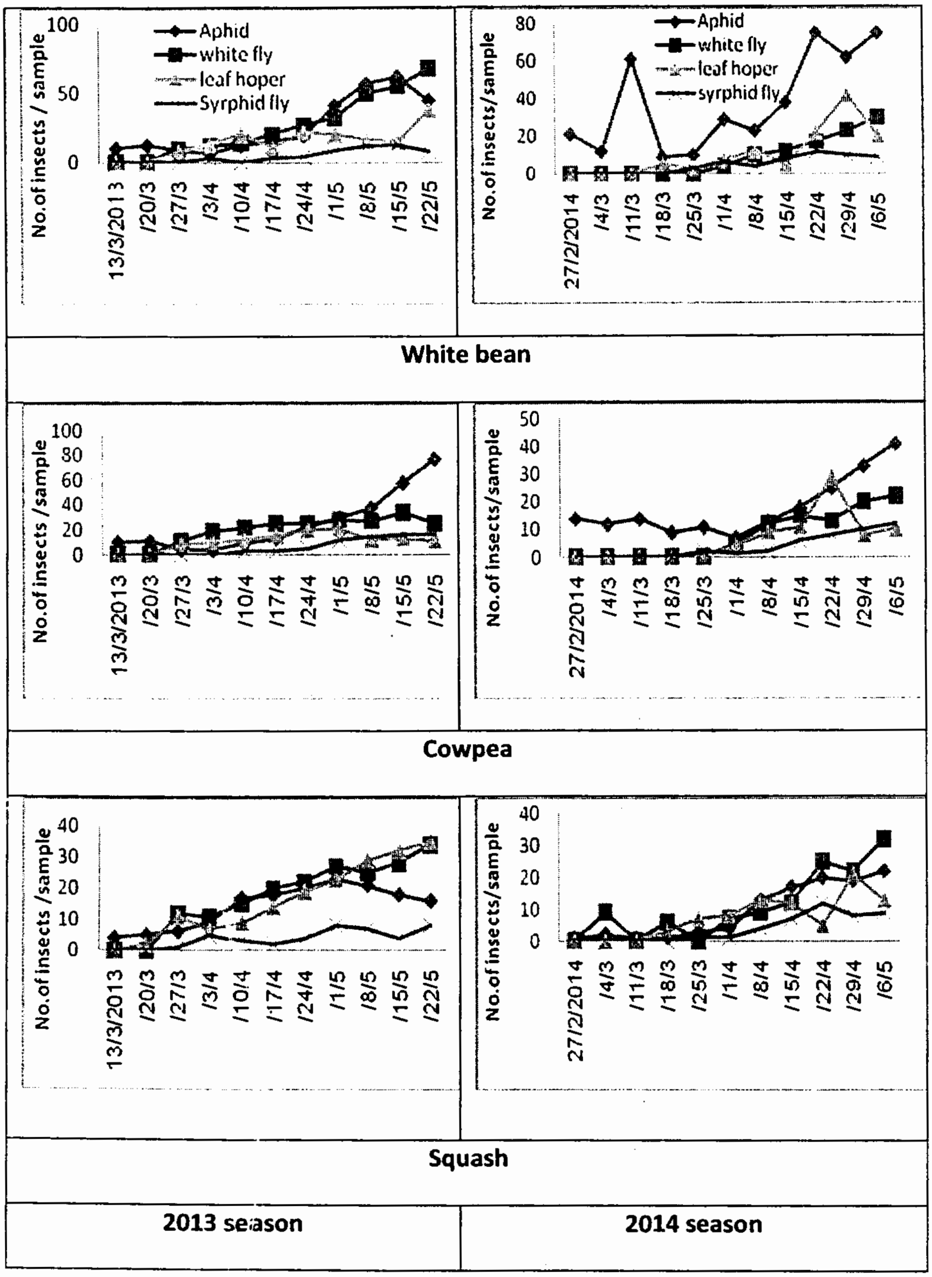

Fig.4: Seasonal abundance of the syrphid predator (*Eupeodes corollae*) in respose to prey densities (aphids, whitefly and leafhoppers) on white bean, cowpea and squash plants during 2013 and 2014 seasons.

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التفاعل بين كلا من محاصيل الخضر والحشرات الماصة والمفترسات المرتبطة بها.

عبد الستارأبراهيم عبد الكريم[١] ، لبيب محمود شنب[١] ، ليلى عبدالستار البطران[١] و محمد جمال علي[٢]
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أثبتت الدراسة الحالية أن كلاً من مفترسات أبو العيد (أحدعشرة نقطة وأبو العيد سبع نقط) كانت أكثر الأنواع تواجداً على النباتات تحت الدراسة مقارنة بأسد المن الأخضر وذبابة السيرفس. وقد وجد أن مفترسات أبو العيد كانت تفضل الفاصوليا أكثر من اللوبيا والكوسة بينما فضل مفترس أسد المن الفاصوليا عن كل من نباتات الكوسة واللوبيا . أما ذبابة السيرفس فقد أبدت أعلى تفضيل لها لنباتات اللوبيا مقارنة بكل من الفاصوليا والكوسة.

بالنسبة لتفضيل المفترسات لفرائسها فقد أوضحت النتائج أن كلا من أسد المن وذبابة السيرفس تفضل حشرات المن والذبابة البيضاء على نطاطات الأوراق بينما أبدت مفترسات أبو العيد تفضيلاً لكل من نطاطات الأوراق والمن عن الذبابة البيضاء .