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COEXISTENCE OF CERATIN SUCKING INSECT PESTS AND THEIR ASSOCIATED PREDATORS ON THREE VEGETABLE CROPS IN MINIA REGION

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ABSTRACT

Faunistic composition of insects on three vegetable crops snap beans, cucumber and tomato; revealed the presence of 26 insect species belonging to 17 families and 8 orders on all crops. The serious insect species was represented by 13 species on the three crops associated with 6 predaceous species. The most abundant sucking insect pests were thrips, *Thrips tabaci* on snap-beans followed by whitefly, *Bemisia tabaci*, then jassid, *Empoasca* spp. during the two successive seasons of 2005 and 2006.

In general, the overall population of the thrips in both seasons was represented by 76 and 48.2% of the total mean numbers of sucking insects on cucumber and snap-beans, respectively. However, the whitefly was represented by 47.5% on tomato plants.

Significant positive correlation between the population density of predators and their preys (sucking insects) were recorded on all crops during both seasons of 2005 and 2006.

Simple correlation coefficient values between the population density of sucking insects and weekly means of maximum and minimum temperatures were positive and significant for cucumber during 2005-2006 seasons, while it was positive and significant for only snap beans during 2006 season. However, temperature showed in significant negative correlations on tomato. Relative humidity showed significant negative correlation on cucumber during 2005 season only.

Explained variance (E.V. %) for the combined effect of the three weather factors on the total population of sucking insects infesting snap-beans and tomato during 2006 season were highly significant (E.V. % = 96.31 and 88.77%, respectively). Also, these factors significantly affected the sucking insects infesting snap beans and cucumber during 2005 season (E.V.% =70.36 and 85.52%, respectively).

INTRODUCTION

Vegetable fields are subjected to severe infestation by several pests especially, thrips, whiteflies, leafhoppers and aphids, which cause serious damage, either directly by sucking plant juice or indirectly as vectors of virus diseases (Jenser *et al.*, 2003; Atakan and Uygur, 2005 and Powell *et al.*, 2006). However, several reports revealed that climatic factors, agricultural practices and natural enemies proved to be effective in regulating the populations of such pests and reduce their damage to vegetable and field crops (Aly, 1990; Hassanein, 1994 and Zamani *et al.*, 2006).

In Egypt, vegetable growers used to apply extensive insecticidal treatments during the whole growing season against vegetable pests, which in return pollute the environment and indirectly affect the human health. Nevertheless, in Minia region the infestation of vegetable crops by sucking insect pests received comparatively little attention (Aly and Gharib, 1989; Hamouda, 1993 and Abd El-Alim, 2005).

Therefore, the present work aimed to investigate the insects associated with three different vegetable crops i.e.; snap-beans (Leguminosae), cucumber (Cucurbitaceae) and tomato (Solanaceae). The densities and coexistence of the dominant sucking insect pests and their relation with the associated predators and the weather factors were studied.

MATERIALS and METHODS

Three vegetable crops belonging to three different families were chosen for the present study. They are presented in Table 1.

Table 1: Vegetable crops cultivated in Minia region during 2005 and 2006 growing seasons

Common name	Scientific name	Family name	Cultivars
Snap-beans	*Phaseolus vulgaris* L.	Leguminosae	Pollesta, Giza 6, Giza 3
Cucumber	*Cucumis sativus* L.	Cucurbitaceae	Madena, El-Zaem, El-Nemis, Amira II, Beit-alpha
Tomato	*Lycopersicon esculentum* L.	Solanaceae	Super-strain B

All experiments were situated in the Farm of the Faculty of Agriculture, Minia University during 2005 and 2006 growing seasons as follows:

For survey and assessment of the population density and fluctuation of the common insects and the associated natural enemies on the three vegetable crops, an area averaged 800m² was selected for each crop. Each area was divided into 4 plots (each 200m²) as four replicates. Cucumber (cv. Madena), snap-beans (cv. Pollesta) and tomato (cv. Super-strain B) were planted on 6th, 12th and 22nd of March for the season of 2005, and on 15th, 15th and 27th of March, respectively for the season of 2006.

Sampling took place as soon as the newly growth appeared till harvest. Ten random plants/replicate/week/crop were directly examined in site and the observed insects were counted. Specimens of unknown insect species were kept in glass vials containing 70% ethyl alcohol and transferred to the laboratory for inspection and identification by aid of a stereoscopic microscope. In order to study the population densities and fluctuations of common sucking insects and their predators on the tested plants samples were taken every 3-4 days (Twice weekly). Sampling started from the 4th week of March for snap-beans and cucumber and from the 2nd week of April 2005 for tomato and started one week later for all crops during 2006 season, and continued until harvest. Direct count technique was used

according to Southwood, (1978); Robert *et al.*, (1988); and Gusmao *et al.*, (2006). Forty leaflets every 3-4 days for each of snap-beans and tomato or 40 leaves for cucumber (10 leaflets or leaves per each replicate) were randomly chosen and examined in site early in the morning before sun rise and the numbers of nymphs and adults of leafhoppers, aphids, the whitefly and thrips adults were counted. The same examined leaflets or leaves were collected and kept in paper bags, then transferred for laboratory inspection by aid of a stereoscopic microscope for detecting the immature stages of whitefly and thrips.

Natural enemies (predators) were also counted visually on 10 plants selected randomly per replicate/week/crop during both seasons. All existed developmental stages of any predator were counted and recorded. The average numbers of each sucking insect/10 leaflets or leaves/week and average number of each predator/10 plants per week were calculated and tabulated.

The recorded daily means of maximum and minimum temperatures and relative humidity percentage (R.H. %) were obtained from Mallawy Agric. Res. Station. The weekly means of these weather factors were calculated parallel with the sampling dates on the investigated crops. Simple correlation and partial regression tests were used according to Fisher (1950). The relationship between sucking insects density and their predators or weather factors or crop yields were tested by using tests of simple regression and correlation, t, F and qui-square according to Gomez and Gomez (1984).

RESULTS and DISCUSSION

In the general survey, 26 insect species belonging to 17 families and 8 orders were recorded on the investigated vegetable crops, snap-beans, cucumber and tomato (Table 2).

The serious insect species represented half of the recorded species (13 species on all investigated crops belonging to 11 families). Meanwhile, insect predators on these crops were represented by 6 species belonging 4 families. Only one species represented the pollinators on all crops (*Apis mellifera* L.).

Sucking insect pests on vegetable

The results showed that infestation by onion thrips, *Thrips tabaci,* whitefly, *Bemisia tabaci*, leafhopper, *Empoasca* spp. and leafminer, *Liriomyza congesta* could be detected on the three tested crops during both seasons of 2005 and 2006. Meanwhile, cowpea aphid, *Aphis craccivora* on snap beans, green peach aphid, *Myzus persicae* on tomato and melon aphid, *A. gossypii* on snap-beans and cucumber were observed during the whole study periods. This was naturally accompanied by the early activity of natural enemies such as *Coccinella undecimpunctata*; *Orius* spp.: *Chrysoperla carnea* and *Metasyrphus corollae*. However, individual numbers of certain insect pests namely; *Nezara viridula*, *Agrotis ipsilon*, *Spodoptera littoralis*, *Spodoptera exigua* and *Oxycarenus hyalinipennis* and the predators; *Cydonia vicina* var. *isis* and *Scymnus interruptus* were observed on the three tested crops.

Moreover, *Dacus ciliatus* and *Epilachna chrysomelina* were detected on cucumber only, while, *Lygus* spp. and *Heliothis armigera* existed on tomato only, and *Cosmylce baeticus* encountered on snap-beans during the experimental periods.

Several authors came to the same findings i.e. El-Saadany and Abd El-Fattah, (1980); Hamouda, (1993) and Mariy *et al.*, (1999) on tomato plants; Aly and Gharib, 1989; and Zhang *et al.* (2005) on cucumber. In addition, El-Khawas and Shoeb (2004) surveyed the major sap-sucking insects on potato (*M. persicae, B. tabaci, T. tabaci* and *E. decipiens).*

Table 2: Taxonomic list of observed insects on certain vegetable crops by using visual direct count method in Minia region during 2005 and 2006 growing seasons

Order	Family	Scientific name	Vegetable crops (1)			2
			SnSnap-beans	Cucumber	Tomato	Note
Hemiptera	Anthocoridae	***Orius* spp.**	+	+	+	N
	Lygaeidae	***Oxycarenus hyalinipennis*** (Costa)	+	+	+	P
	Miridae	***Lygus* spp.**	-	-	+	P
	Pentatomidae	***Nezara viridula*** L.	+	+	+	P
Homoptera	Alyerodidae	***Bemisia tabaci*** (Genn.)	+	+	+	P
	Aphididae	***Aphis craccivora*** Koch.	+	-	-	P
		Aphis gossypii Glov.	+	+	-	P
		Myzus persicae Sulz.	-	-	+	P
	Cicadellidae	***Empoasca decipiens*** Paoli	+	+	+	P
		Empoasca fabae Harris	+	+	+	P
Thysanoptera	Thripidae	***Thrips tabaci*** Lin.	+	+	+	P
Neuroptera	Chrysopidae	***Chrysoperla carnea*** Steph.	+	+	+	N
Lepidoptera	Lycaenidae	***Cosmolyce baeticus*** L.	+	-	-	P
	Noctuidae	***Agrotis ipsilon*** Hb.	+	+	+	P
		Hellothis armigera Hb.	-	-	+	P
		Spodoptera exigua Hb.	+	+	+	P
		Spodoptera littoralis (Boisd.)	+	+	+	P
Hymenoptera	Apidae	***Apis mellifera*** L..	+	+	+	C
	Braconidae	Non-identified	-	+	+	N
Coleoptera	Coccinellidae	***Cydonia vicina*** var. ***isis***	+	+	+	N
		Coccinella undecimpunctata L.	+	+	+	N
		Epilachna chrysomelina F.	-	+	-	P
		Scymnus interruptus Goeze	+	+	+	N
Diptera	Agromyzidae	***Liriomyza congesta*** (Beck.)	+	+	+	P
	Syrphidae	***Metasyrphus corollae*** (F.)	+	+	+	N
	Trypetidae	***Dacus ciliatus*** Leow	-	+	-	P

These results based on two weekly samples detected by direct count method on plants during both seasons

(1) (+) Existed (-) Non existed

(2) P: Insect pest N: Natural enemies C: Pollinator

Sucking insect pests on vegetable

Results in Table 3 summarized the coexistence of four sucking insects infesting the vegetable crops of snap beans, cucumber and tomato during 2005 and 2006 seasons. These pests occurred and survived in the same habitat and ecosystem of each crop. However, they showed variable population densities and coexistence percentages with unvital competition. It is clearly obvious that the most common and dominant sucking insect pests on snap-beans and cucumber was *T. tabaci*, which was represented by 48.2 and 76.0%, respectively, followed by the whitefly, which was represented by 24.9 and 14.3%, respectively, of the total sucking insects population. Meanwhile, the most abundant sucking pest on tomato was *B. tabaci* which coexisted by 47.5%, followed by thrips (24.0%) of the total population of sucking insects.

Table 3 : Coexistence of certain sucking insect pests on snap-beans, cucumber and tomato plants cultivated in Minia region during l 2005 and 2006 growing seasons.

Parameter	Sucking insects				
	Leafhopper	Aphid	Whitefly	Thrips	Total
Snap-beans					
Avg. No./week/10 leaflets	14.0	7.9	20.3	39.3	81.5
% Coexistence	17.2	9.7	24.9	48.2	100.0
Cucumber					
Avg. No./week/10 leaves	14.4	5.3	29.0	153.5	202.2
% Coexistence	7.1	2.6	14.3	76.0	100.0
Tomato					
Avg. No./week/10 leaflets	10.6	5.9	27.4	13.8	57.5
% Coexistence	18.3	10.2	47.5	24	100

Average number and % coexistence were calculated overall both summer seasons of 2005 and 2006.

In this respect, the whitefly and the melon aphid were dominant pests on summer plantations of cucumber, sweet-melon and squash (Aly, 1990). Hamouda (1993) recorded high infestation of aphids (*M. persicae* and *A. gossypii*) on tomato plantations, while *A. craccivora* occurred 9 weeks on late cultivations of cowpea. Also, Abdel-Alim (1994) mentioned that *Empoasca* spp. and *A. craccivora* gave maximum numbers on cowpea aged 56-98 days. Moreover, Atakan and Uygur (2005) reported that *T. tabaci* was the most abundant pest on weeds between May and June.

Data presented in Table 4 demonstrate the relationship between population density of sucking insect pests and their associated predators on snap-beans, cucumber and tomato plants during 2005 and 2006 seasons. Statistical analysis showed positive significant correlation (ranged 0.561-0.886) for the relationship between sucking pest density and their associated predators. The highest density of predators was recorded earlier or later than the peaks of their preys. This may be due to the differences in the developmental life cycle of the predators and their preys. It is known that the population of the predators always lagging behind the preys and thus having only a limited chance in suppressing its activity.

In previous studies, El-Heneidy *et al.* (1979) found that *C. undecimpunctata, Orius* spp. and *Chrysopa vulgaris* were peaked during April-May. The *Orius* spp. predator constituted more than 50% of the inspected predator species in untreated cotton plants (El-Maghraby *et al.*, 1993). Meanwhile, Hamouda (1993) stated that coccinellid predator species represented 78.5-90.1% and the chrysopid predator represented 5.5-10.2% of the total predator species in vegetable fields. Also, significant positive correlations between sucking insects density and their predators were reported by Aly and Gharib (1989), Salem (1998) and Hamouda *et al.* (2001).

Weekly means of maximum, minimum temperatures and relative humidity (R.H. %) were calculated according to the daily data obtained from the Mallawy Agricultural Research Station. The relationships between these weather factors and population density of sucking insects for the growing seasons of 2005 and 2006 are illustrated in Table 5.

Table 4 : Relationship between sucking pests and their associated predators on three vegetable crops in Minia region during 2005 and 2006 growing seasons

Inspection date		2005 season						2006 season					
		Snap-beans		Cucumber		Tomato		Snap-beans		Cucumber		Tomato	
Month	Week	P	N	P	N	P	N	P	N	P	N	P	N
March	4th	48.0	2.0	80.0	1.2	-	-	-	-	-	-	-	-
April	1st	52.9	5.0	118.2	1.9	-	-	7.2	0.2	30.0	0.5	-	-
	2nd	52.2	2.0	363.8	2.1	39.0	0.5	23.8	1.0	166.3	1.4	-	-
	3rd	63.4	1.0	360.1	3.5	65.2	1.0	39.0	4.2	587.3	1.0	19.6	1.0
	4th	169.7	4.5	488.9	9.7	147.0	6.5	67.7	1.8	604.5	4.0	34.2	0.5
May	1st	166.2	4.5	595.0	10.1	98.0	5.0	113.4	5.2	437.4	6.0	57.8	1.4
	2nd	108.1	11.8	565.8	9.2	80.0	3.4	134.1	5.2	572.5	8.1	90.7	4.2
	3rd	144.9	7.1	607.9	5.4	91.0	5.9	129.3	8.6	747.1	5.7	96.8	4.2
	4th	163.2	10.2	868.3	5.0	76.0	5.6	123.4	6.9	683.3	9.5	80.6	6.6
June	1st	145.9	3.2	293.8	1.8	72.7	8.7	58.5	3.7	235.6	3.4	51.1	6.4
	2nd	76.9	4.0	-	-	87.5	8.2	54.1	2.1	195.1	3.3	51.1	3.2
	3rd	76.8	1.8	-	-	74.3	7.1	27.6	0.8	114.0	1.0	36.7	2.6
	4th	22.5	1.0	-	-	38.3	5.3	13.5	0.2	-	-	36.6	2.9
July	1st	-	-	-	-	34.0	2.8	-	-	-	-	9.9	2.4
	2nd	-	-	-	-	7.0	1.3	-	-	-	-	7.8	1.2
	3rd	-	-	-	-	-	-	-	-	-	-	5.7	0.6
"r"		0.561*		0.630*		0.589*		0.886**		0.701*		0.635*	

P= Sucking pests N= Natural enemies (predators)

* Significant at 0.05 probability level

** Significant at 0.01 probability level

Table 5 : Simple correlation (r) and partial regression (b) values of the population density of sucking insects (infesting three vegetable crops) on three main weather factors during the 2005 and 2006 growing seasons in Minia region

Crop	Season	Weather factors	Simple correlation (r)	Partial regression (b)	Explained variance E.V.%	F. value
Snap-beans	2005	Max. temp.	0.492	-7.14		
		Min. temp.	0.655	11.36	70.36	7.15*
		Daily mean R.H%	-0.419	-2.96		
	2006	Max. temp.	0.666*	6.99		
		Min. temp.	0.748*	0.21	96.31	65.29**
		Daily mean R.H%	0.925**	-4.53		
Cucumber	2005	Max. temp.	0.715*	-21.28		
		Min. temp.	0.876**	71.65	85.52	12.72**
		Daily mean R.H%	0.759*	-7.61		
	2006	Max. temp.	0.709*	36.81		
		Min. temp.	0.745*	22.45	64.02	4.45
		Daily mean R.H%	-0.566	-9.38		
Tomato	2005	Max. temp.	-0.515	-7.29		
		Min. temp.	-0.422	-5.00	56.41	5.17
		Daily mean R.H%	0.533	-1.60		
	2006	Max. temp.	-0.480	11.00		
		Min. temp.	-0.742	-19.19	88.77	27.67**
		Daily mean R.H%	0.125	-0.23		

* Significant at 0.05 P.L ** Significant at 0.01 P.L.

Chosen periods for analysis were 4th of March till 4th week of May 2005 and during April and May 2006 for snap-beans and cucumber and from 4th week of April till 2nd week of June 2005 and from 2nd week of May till 3rd week of June 2006 for tomato.

Sucking insect pests on vegetable

Simple correlation coefficient values showed significant positive correlations between population density of sucking insects and mean weekly maximum or minimum temperatures on cucumber during 2005 and 2006 seasons ("r" ranged between 0.709-0.876) and only significant positive on snap-beans during 2006 ("r" ranged between 0.666-0.748), while, it was insignificant positive during 2005 season. However, temperatures showed insignificant negative correlations with sucking insects population that infesting tomato plants for both seasons. On the other hand, R.H% showed only significant negative correlation on sucking pests abundance on cucumber during 2005 ("r" = -0.759), and on snap-beans it was also significantly negative (-0.925) during 2005 season. In contrast, R.H. % was insignificantly correlated with sucking insects abundance on tomato during both seasons (Table 5).

The partial regression analysis was done for estimating the combined effect of the three weather factors (weekly means of maximum, minimum temperatures and R.H.%) on the population activity of sucking insects infesting the three tested crops. Explained variance values showed highly significant effect of weather factors on sucking insects abundance infesting snap-beans and tomato during 2006 season (E.V. 96.31% and 88.77%, respectively), while it was only significant on snap-beans and cucumber during 2005 season (E.V. 70.36% and 85.52%, respectively). However, weather factors insignificantly affected the population density of sucking insects infesting tomato during 2005 season and cucumber during 2006 season (E.V.= 54.61 %, 64.02 %, respectively).

In previous studies, Ammar *et al.* (1986) recorded significant positive correlation between the number of jassid and weather factors (temperatures and R.H.%). Also, Hassanein *et al.* (1995) reported that, on cotton, the weather factors showed insignificant positive effect on sucking pests. Salem (1998) stated that the maximum, minimum temperatures and R.H.% significantly affected the jassid and aphid densities on broad bean plants and the explained variance (E.V.%) of the three weather factors was significant.

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Sucking insect pests on vegetable

التواجد المشترك للآفات الحشرية الثاقبة الماصة و المفترسات المصاحبة لها على ثلاثة محاصيل خضر فى منطقة المنيا

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قسم وقاية النبات-كلية الزراعة-جامعة المنيا

سجلت دراسات الحصر للأنواع الحشرية المتواجدة على ثلاثة من محاصيل الخضر هى: الفاصوليا، الخيار و الطماطم ٢٦ نوعاً حشرياً تابعة لـ ١٧ عائلة تنتمى إلى ٨ رتب حشرية. و قد تم تسجيل ١٣ نوعاً حشرياً ضاراً على الثلاثة محاصيل تحت الدراسة مصاحباً لها ٦ أنواع من المفترسات.

كان تربس البصل والذبابة البيضاء و جاسيد الأوراق هى الآفات الثاقبة الماصة الأكثر شيوعاً و انتشارا و ذلك خلال موسمى الدراسة ٢٠٠٥ ، ٢٠٠٦م.

وبصفة عامة كمتوسط عام لموسمى الدراسة فإن التربس قد تواجد بنسبة ٧٦%، ٤٨,٢% من إجمالى متوسطات أعداد الحشرات الثاقبة الماصة على كل من الخيار و الفاصوليا على الترتيب، بينما سجلت الذبابة البيضاء نسبة ٤٧,٥% من مجموع الحشرات الثاقبة الماصة المسجلة على الطماطم.

أوضح التحليل الإحصائي وجود ارتباط موجب و مؤكد بين الكثافة العددية للمفترسات و فرائسها (الحشرات الثاقبة الماصة) على الثلاثة محاصيل المختبرة خلال موسمى الدراسة.

اتضح من قيم معامل الارتباط البسيط بين الكثافة العددية للحشرات الثاقبة الماصة و المتوسط الأسبوعى للحرارة العظمى و الحرارة الصغرى وجود ارتباط موجب و مؤكد بالنسبة لمحصول الخيار خلال موسمى ٢٠٠٥و ٢٠٠٦م. بينما كان الارتباط موجب و مؤكد بالنسبة لمحصول الفاصوليا خلال موسم ٢٠٠٦ فقط. فى حين أظهرت الحرارة

ارتباط موجب غير معنوى على الطماطم. أما الرطوبة النسبية فقد سجلت وجود ارتباط سالب و مؤكد بالنسبة للخيار خلال موسم ٢٠٠٥ فقط.

سجلت قيم معامل الارتداد الجزئى للتأثير المشترك للعوامل الجوية الثلاثة على مجموع الحشرات الثاقبة الماصة التى تصيب الفاصوليا و الطماطم خلال موسم ٢٠٠٦ تأثير عالى المعنوية حيث كان معامل الارتداد الجزئى ٣١,٩٦، ٧٧,٨٨% على الترتيب. أيضا كانت العوامل الجوية الثلاثة ذات تأثير معنوى على الحشرات الثاقبة الماصة التى أصابت الفاصوليا و الخيار خلال موسم ٢٠٠٥ (معامل الارتداد الجزئى كان ٣٦,٧٠، ٥٢,٨٥% على الترتيب).