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ECOLOGICAL STUDIES ON CERTAIN HOMOPTEROUS INSECTS INFESTING BROCCOLI PLANTS AND THEIR ASSOCIATED PREDATORS INSECTS AT SHARKIA GOVERNORATE.

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ABSTRACT

Field studies had been carried out in broccoli plants at Minia El – Kamh, district, Sharkia Governorate. Survey and seasonal abundance of certain Homopterous insects (aphids, Leafhoppers and whitefly) and their associated predatory insects during the two successive years 2006 / 2007 and 2007/2008. In addition, we evaluated the effect of temperature and relative humidity on the population densities of these insects under field conditions. Obtained results revealed that aphid species were *Brevicoryne brassicae* (Linnaeus), *Myzus persicae* (Sulz), leafhopper species were *Empoasca decipiens* (Poali) , *Empoasca decedens* (Poali) , and *Balclutha hortensis* (Linds.), the white fly was *Bemisia tabaci* (Genn.), also six predators were associated with these insects. These predators were *Coccinella undecimpunctata , Cydonia vicina isis , Paederus alferii, Scymnus syriacus, Chrysoperla carnea* and *Metasyrphus corollae.* The population density of immature stages of *B.tabaci* (Genn.) occurred with two peaks in end January and February in 2006/2007 season and mid January and February in 2007/2008 season. In the same time, there was one peak of adult stage in mid of February in 2006/2007 season while two peaks in end of January and February in second season. Two peaks for *B.brassicae*(L.) and *M. persicae* (Sulz.) in end December and February in 2006/2007 season also two peaks in mid of December and February in second season. Two peaks for *E.decipiens* (Paoli) were found in end November and February in 2006/2007 and 2007/2008 seasons, also two peaks for *E.decedens* (Paoli) were recorded during mid of December and February in both seasons. The occurrence of *B.hortensis* (Linds) occurred with only one peak in end November in first and second season. One peak for predator insects was found in the mid March in the 2006/2007 season, also one peak in the second season at end of February. The statistical analysis showed that temperature and relative humidity had significant with some insects and insignificant with the other.

Keywords: *Myzus persicae, Brevicoryne brassicae, Empoasca.decipiens* , *Empoasca decedens , Bemisia.tabaci,* Predators.

INTRODUCTION

Broccoli (*Brassicae olerace* var . italica) is a popular vegetable crop in the United State and Europe. It is fairly high in vitamin (A) and vitamin (C) and contains appreciable quantities of thiamin (B_1), riboflavin (B_2), niacin (B_7), calcium and iron. Broccoli is also high in protein. Although, broccoli is of high nutritional value, and it's production and consumption has increased, (Abo El-Kheir, 2004) during the recent years, the cultivated area of broccoli plants had noticeably increased to cover with the needs of people and the requirement of arabious and foreign markets for export purpose to increase the national income. Unfortunately, these plants are subjected to be attacked by a great number variety of insects which affect seriously on the yield. Among these pests, the Aphids, leafhoppers and whitefly which undoubtedly play an important role in yield decrease and also known to transmit virus

diseases to the plant (Harris and Maramorosch, 1980; Hegab, 1988 and El-Gindy, 1997).An ecological studies on these pests on some cruciferous plants were carried out by many workers such as (El-Dafrawy, 1979; Hegab *et al*., 1989 a,b ; Soliman, 1993 and El-Dash, 2001). But according to happen change in climatic factors and pollution, some a new pest appeared and some virus disease. Among the predators, several investigators have been stated the important role of coccinellid ones in controlling different insect pests of the world (Comis and Heppner 1986, Turnock *et al*., 1990, Schmid , 1992, Rao et al. 2003 and saleh 2004). Therefore, the scope of the present study was conducted to contribute towards a better knowledge of the following aspects. a)Survey and seasonal abundance of aphids, leafhoppers and white fly (adult and immature stages) infesting broccoli plants and their associated predatory insects. b) the effects of some climatic factors on their population density of these insects and their predators.

MATERIAL AND METHODS

Survey and seasonal abundance of certain homopterous insects (whitefly, aphids and leafhoppers) infesting Broccoli plants were carried out at Minia El-Kamh, District, Sharkia Governorate, during two successive seasons winter plantation 2006/2007 and 2007/2008. The normal agricultural practices were followed in due time and no chemical control. Sampling started when the age of broccoli plants reached 21 days and samples were taken weekly and calculated biweekly during the period from the first November until end March of the next year. It was necessary to use different sampling methods for each group of insect pests.

Plant samples:

(a)Aphids: Randomly seven infesting broccoli leaves, (twenty inch^2) from each infested broccoli leaf were taken weekly and calculated biweekly. The sampling were placed in paper bags and then transferred to the laboratory in the same day. Count for aphids individuals were made in the laboratory by using a hand lens and small brush. The number of nymphs and adults (alata and apterous) was separately recorded.

(**b) Whitefly:** Twenty five leaves were taken from broccoli plant randomly. These leaves were examined in the laboratory by using a binocular microscope. The number of immature stages (larvae and pupae) of *Bemisia tabaci* was recorded per (50 inch^2) for each leaf. The total number of adult stage was also counted on the plant samples.

Sweeping net: Each sample consisted of 100 strokes, was taken randomly from both diagonals of the field. The samples were taken weekly to survey leafhoppers and their associated predators and calculated biweekly. Daily records of temperature and relative humidity during the period of investigation were obtained from the Metrological station, at Sharkia Governorate. The effect of temperature and relative humidity on the relative a abundance of *B. tabaci*, two aphid and three leafhoppers and their associated predators found in broccoli plant have been studied. Costat Software program (1990) was used to these insects.

RESULTS AND DISCUSSION

The results in Table (1) indicated that six injurious pests have been recorded attacking broccoli plants, these species are belonging to order**:** Homoptera namely, *B.brassicae, M.persicae, B.tabaci, E.decipiens, E.decedens* and *B.hortensis,* the mean numbers and ratio of these species were *B.brassicae* (6092 individuals = 62.89% and 7142 individuals = 57.96 %), *M.persicae* (706 individuals = 7.29% and 841 individuals = 6.83 %), *B.tabaci* (2451individuals = 25.31% and 3755 = 30.47 %) , *E.decipiens* (171 individuals = 1.77 % and 237 individuals = 1.92 %), *E.decedens* (98 individuals = 1.01 % and 103 individuals = 0.84 %) and *B.hortensis* (168 individuals = 1.73 % and 244 individuals = 1.98 %) in the two seasons respectively. the total number of individuals from these species were 1614.33 and 2053.67 in the two seasons 2006/2007 and 2007/2008 respectively (Table 1).

Table (1): Total number of injurious insect species and their percentages to the total catch on broccoli crop during 2006/2007 and 2007/2008 seasons at Sharkia Governorate.

Species / Year	2006/2007		2007/2008	
	Total number of insect species (Mean ± S.E)	% of total number	Total number of insect species (Mean ± S.E)	% of total number
B.brassicae	6092	62.89	7142	57.96
M.persicae	706	7.29	841	6.83
E.decipiens	171	1.77	237	1.92
E.decedens	98	1.01	103	0.84
B.hortensis	168	1.73	244	1.98
B.tabaci	2451	25.31	3755	30.47
Total	9686	100	12322	100
Mean ± S.E	1614.33		2053.67	

Table 2 shows predator species found on broccoli plants 2006/2007 and 2007/2008 seasons. six beneficial insects , these species are belonging order : Coleoptera, Neuroptera and Diptera. The mean numbers and ratio of these species were *C.undecimpunctata* (8.6 individuals = 27.56% and 9.0 individuals=25.5 %), *C.vicina isis* (7.40 individuals = 23.72% and 6.8 individuals=19.26 %), *P.alferii* (4.1 individuals = 13.14% and 6.5 individuals = 18.41 %), *S.syriacus* (3.5 individuals=11.22% and 4.2 individuals=11.89 %), Order Neuroptera was represented by one species *Ch.carnea* (4.6 individuals = 14.74% and 5.3 individuals = 15.02 %) and *M.corollae* (order **:** Diptera) (3.0 individuals = 9.62% and 3.5 individuals = 9.92 %) in the two seasons, respectively (Table 2)**.**

Table (2): Mean number of predators species and their percentages to the total catch on broccoli crop during2006/2007 and 2007/2008 seasons at Sharkia governorate.

Species / Year		2006/2007		2007/2008	
		Number of predators species (Mean ± S.E)	% of total number	Number of predators species (Mean ± S.E)	% of total number
Coleoptera	*C.undecimpunctata*	8.6 ± 1.82	27.56	9.0 ± 1.2	25.50
	Cydonia vicina isis	7.4 ± 1.14	23.72	6.8 ± 1.09	19.26
	Paederus alferii	4.1 ± 8.76	13.14	6.5 ± 0.96	18.41
	Scymnus syriacus	3.5 ± 0.56	11.22	4.2 ± 0.63	11.89
Neuroptera	*Ch.carnea*	4.6 ± 0.78	14.74	5.3 ± 0.58	15.02
Diptera	*Metasyrphus corollae*	3.0 ± 0.52	9.62	3.5 ± 0.45	9.92
Total		31.2	100	35.3	100
Mean ± S.E		5.20		5.88	

Seasonal abundance of the dominant homopterous insect species:

1-(*Bemisia tabaci*):

a) Immature stages. The total number of *B. tabaci* immature stages collected from broccoli plants during the two seasons are illustrated graphically in Figs (1 and 2). Results obtained revealed that two peaks of *B.tabaci* immature stages population during the two seasons. The first one occurred in end and mid of January with a total number of immature stages (343 and 428)/ sample for the two seasons respectively. The second peak recorded in end and mid of February , while the total number of immature stages on broccoli was (250 and 497) / 50 In^2 for two seasons respectively. Similar results were obtained by Hegab and Helaly 1989) Soliman (1993), El-Gindy (1997) and Hashem (2005)**.** These results **(**disagree with the findings of El-Dash (2001) who mentioned that the highest peak of *B.tabaci* immature activity on different hosts (potato, tomato, cabbage, bean and pea) occurred during November and December only. This difference may be due to the variations of the experimental sites and the environmental sites and the environmental conditions prevailing during execution of these experiments and host.

(b) Adult stage: Numbers of *B.tabaci* adults from broccoli plants during two seasons are illustrated graphically in Figs (1 and 2). According to the abundance of adults Population, one peak in the first season and two peaks were recorded in the second season. During 2006/2007 season one peak in mid of February with a total number of 215 adults/sample while two peak at the fourth week of January and February with a total number of 317 and 373 in the second season. Similar results agreement with El-Gindy (1997) who mentioned that *B.tabaci* adult population has one peak in winter plantation on cabbage and cauliflower at Dakahlia Governorate.

2- *Brevicoryne brassicae:* The biweekly numbers of *B.brassicae* collected from broccoli plants are illustrated graphically in Figs. (3 and 4) show two peaks representing high population densities of *B.brassicae* during 2006/2007 and 2007/2008 seasons . the first one occurred in end and mid December with a total number of 863 and 917 aphid/sample, respectively. the second peak took place at end and mid of February with a total number of

967 and 1109 aphid/sample for the two seasons respectively , these results agree with the findings of Hegab *et al*., (1989 a) , Soliman (1993) , El-Gindy (1997) and El-Sharkawy (2002).

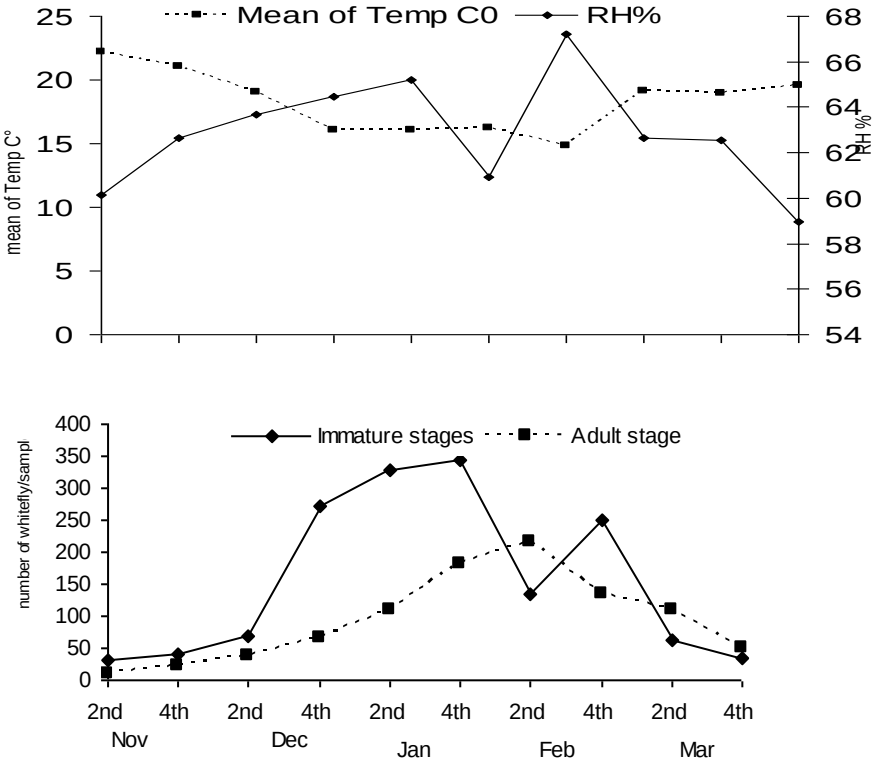

Fig.(1) : Seasonal abundance of Whitefly *B.tabci* (Genn.) (Immature stages and adult stage) infesting broccoli plant at Sharkia Governorate during 2006/2007 seasons.

3- *Myzus persicae* :As shown in Figs (3 and 4) two peaks of abundance on broccoli plants were recorded in both seasons . The first one was recorded in fourth and second week of December with a total number of 103 and 99 aphid /sample for the two seasons respectively. The second peak took place at end and mid of February with a total number of 99 and 223 / aphid / sample during the two seasons 2006/2007 and 2007/2008.

4- *Empoasca decipiens*: Two peaks for this species were recorded on broccoli plants in both seasons as shown in Figs (5 and 6). The first one occurred on end November with a total number of 47 and 69 adults / 100 strokes for the two seasons respectively. The second peak was observed in end February with a total number of 20 and 26 adults / 100 strokes for the two seasons, respectively. These results agree finding of El-Gindy (1997) who mentioned that two peaks of *E.decipiens* were obtained on cabbage and cauliflower.

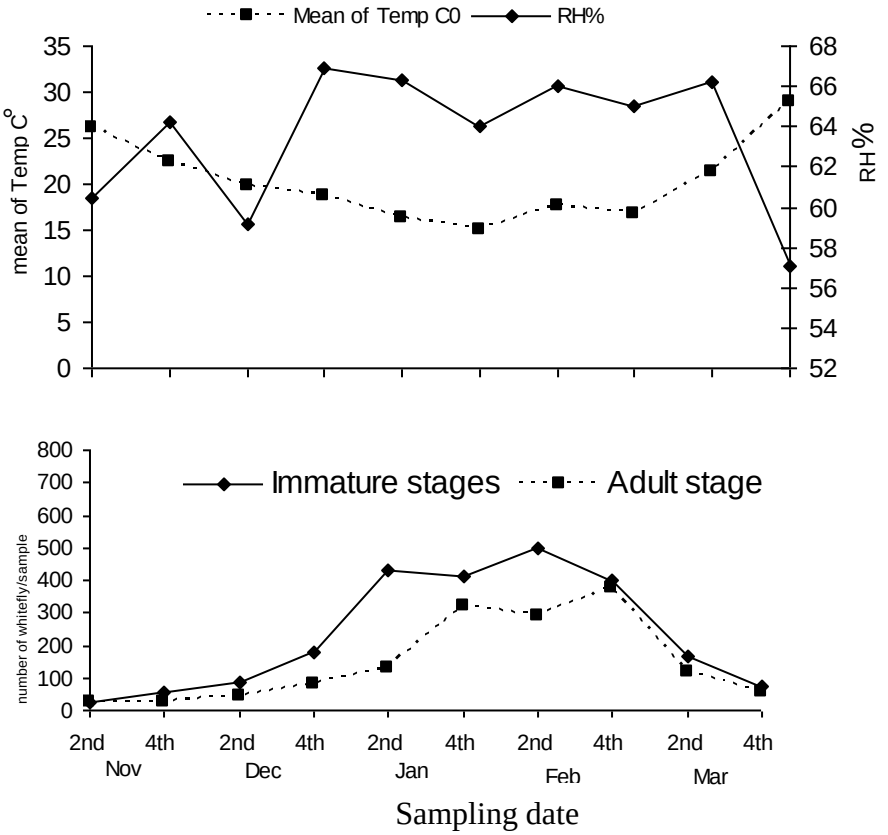

Fig.(2) : Seasonal abundance of Whitefly *B.tabaci* (Genn.) (Immature stages and adult stage) infesting broccoli plant at Sharkia Governorate during 2007/2008 seasons.

5- *Empoasca decedens*: The population density of *E.decedens* showed two peaks on broccoli plants in both seasons as shown in Figs. (5 and 6) the first one was recorded on mid December with a total number of 26 and 29 adults / 100 strokes for the two seasons respectively. The second peak occurred on mid February with a total number of 8 and 7 adults/100 strokes for the two seasons respectively. These results agree with findings of El-Gindy (1997) and El Sharkawy (2002) who mentioned that *E. decedens* has two generations on cabbage and cauliflower. These results agree with findings of Hegab *et al*., (1989 b), Soliman (1993), El-Gindy (1997) and El Sharkawy (2002) who mentioned that *E.decedens* has two generations on cabbage and cauliflower and disagree with Habib *et al.* (1997), who recorded nine species of leafwoppers on cabbage and one species on cauliflower were being *E.decedens*, the dominant one on both hosts together with *Asymmetrasca decedens* on cabbage.

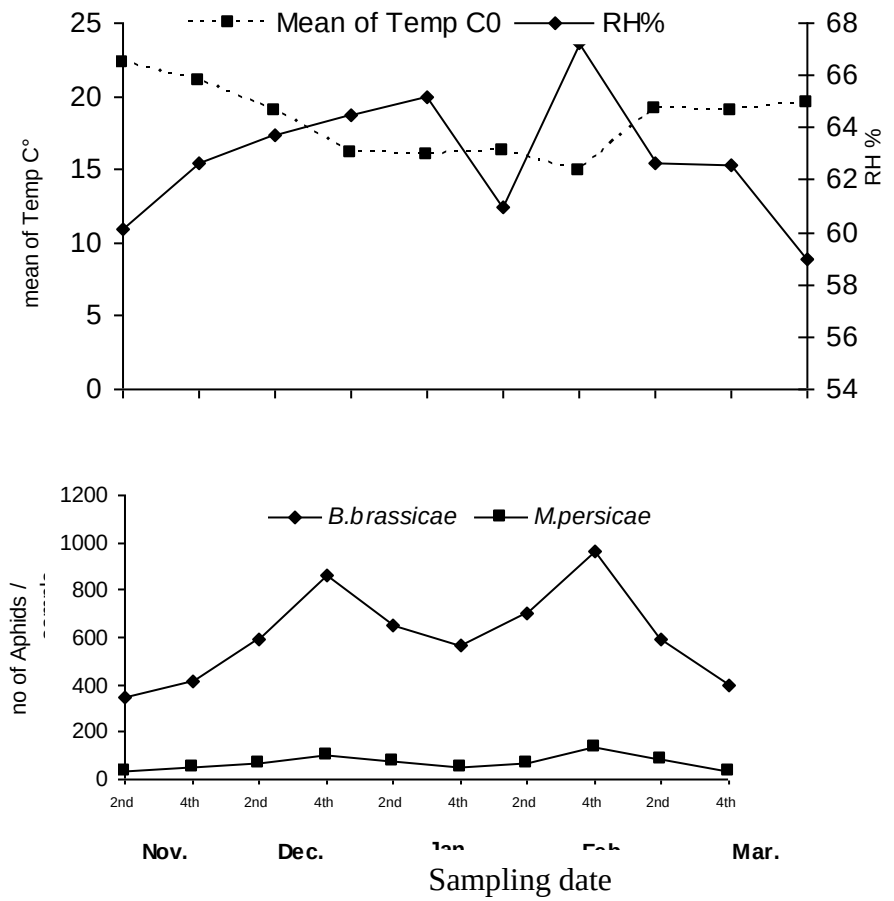

Fig.(3) : Seasonal abundance of Aphids *B.brassicae* and *M.persicae* on broccoli plants collected by plant samples at Sharkia Governorate during 2006/2007 seasons.

6) *Balclutha hortensis*:

According to the population fluctuations of *B.hortensis* on broccoli plants one peak was obtained on end November in both seasons with a total number of 57 and 73 adults / 100 strokes for the two seasons respectively Figs. (5 and 6) .

These results agree with findings of Hegab *et al*., (1989 b) , Soliman (1993) , El-Gindy (1997) and El-Sharkawy (2002) and disagree with Habib *et al* (1997) who recorded nine species of leafhoppers on cabbage and one species on cauliflower were being *E.decipiens* (Paoli) the dominant one on both hosts together with *Asymmetrasca decedens* (Paoli) on cabbage .

Figure (7, 8) show the total number of biweekly pests and their beneficial insects in the broccoli field during 2006/2007 and 2007/2008 seasons . It can be noted from this Figure (7) that two peaks of injurious

insects was (1357 and 1520) individuals in end of December and February, the lowest number was 474 individuals in the mid of November. Meanwhile the highest number of predators was 50 individuals in the mid week of March, but the lowest number was 3.0 individuals in the mid of November. In 2006/2007 season .Figure (8) shows two beaks of injurious insects was (1230 and 2154) individuals in mid of December and February, the lowest number was 596 individuals in mid of November. Meanwhile the highest number of beneficial insects was 51 individuals in end of February, but the lowest number was 8.0 individuals in mid of November in 2007-2008 seasons. These finding are in agreement with those of Comis and Heppner 1986; Lui and Qin 1987, Musa 1992, Mohammed (1996) and Saleh 2004.

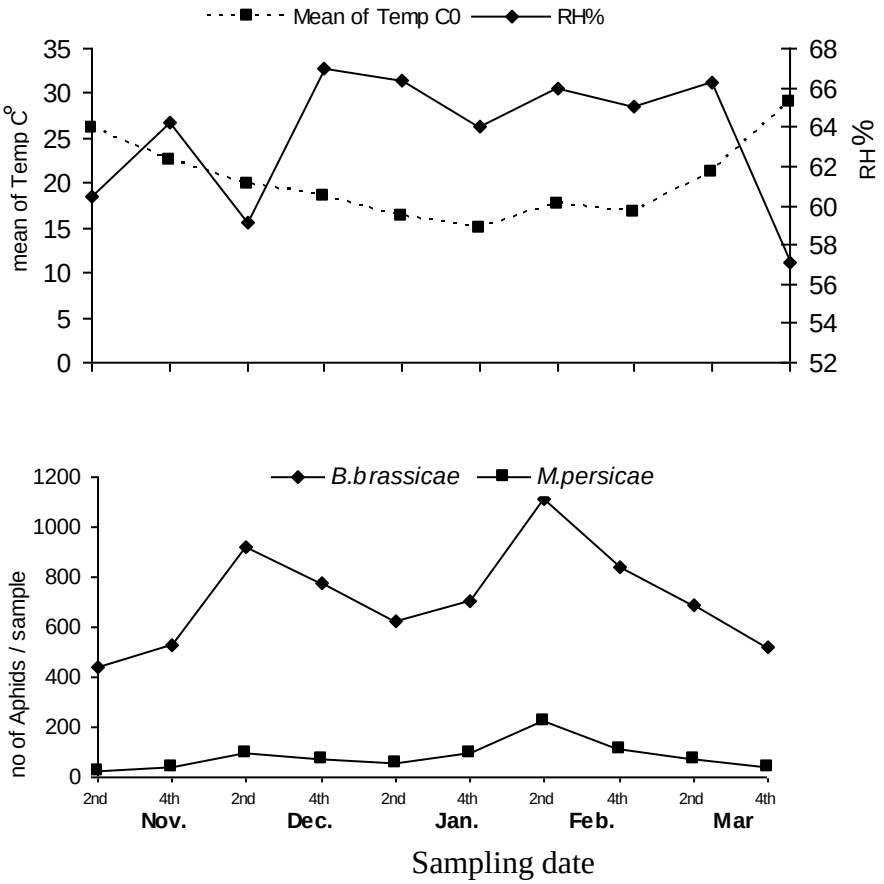

Fig.(4): Seasonal abundance of Aphids *B.brassicae* and *M.persicae* on broccoli plants collected by plant samples at Sharkia Governorate during 2007/2008 seasons.

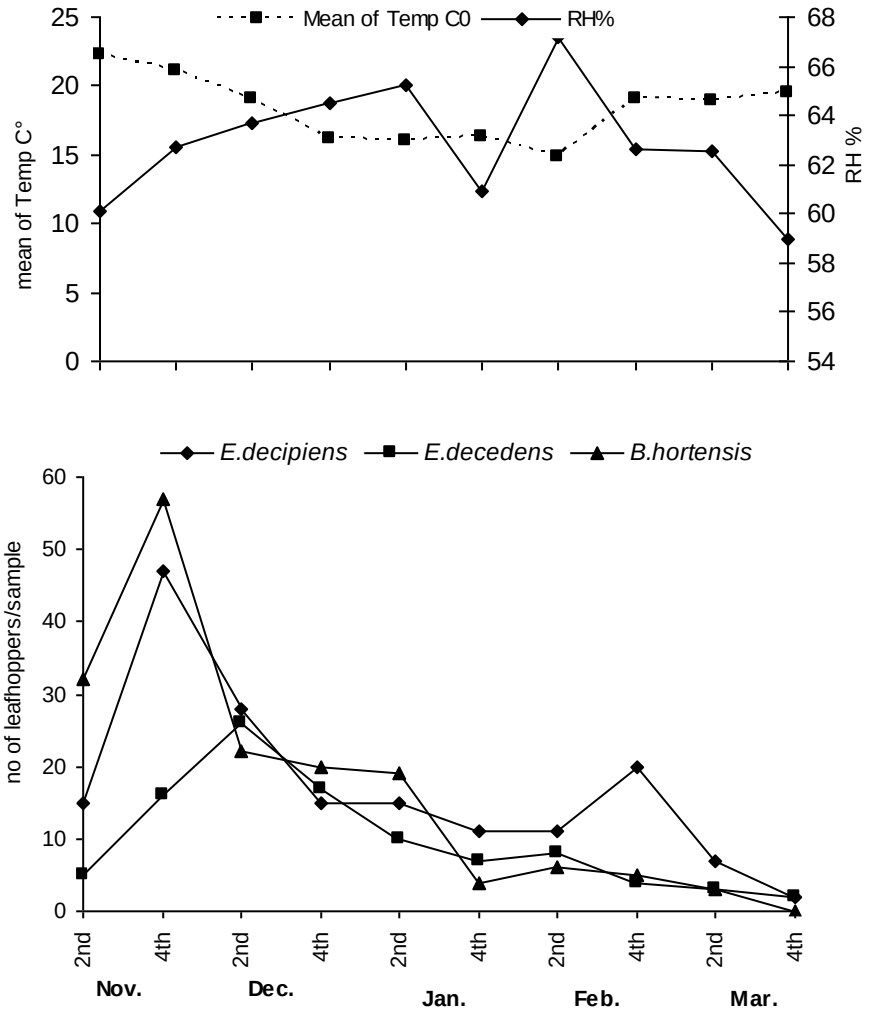

Fig.(5) : Seasonal abundance of leafhoppers *E.decipiens, E,decedens* and *B.hortensis* on broccoli plants collected by sweeping net at Sharkia Governorate during 2006/2007 seasons.

4- Effect of temperature and relative humidity on the population density of certain homopterous insects and their associated predators.

Table (3) showed that correlation coefficient between the adult of *B.tabaci* and maximum temperature was positive and significant (0.636*) in 2006/2007 season, and 2007/2008 seasons (0.626*) similar trend was also recorded between the adult of whitefly and minimum temperature was positive and significant (0.749*) and (0.676*) in 2006/2007 and 2007/2008 seasons. Also correlation coefficient between the number of aphid and

maximum temperature was positive and significant (0.553*) and (0.524*) in 2006/2007 and 2007/2008 seasons, there was positive and significant correlation coefficient between minimum temperature and *B.brassicae* (0.518*) and insignificant 2007/2008 seasons.

Also correlation coefficient between activity of *M.persicae* insects with maximum temperature was positive and significant in 2006/2007 season (0.504*) but, 2007/2008 season was positive and insignificant (0.410), minimum temperature was positive and insignificant (0.431) and (0.346) in two seasons. Correlation coefficient between *E.decipiens,* minimum temperature was positive and significant in first season (0.511*) and insignificant (0.380) in 2007/2008 season.

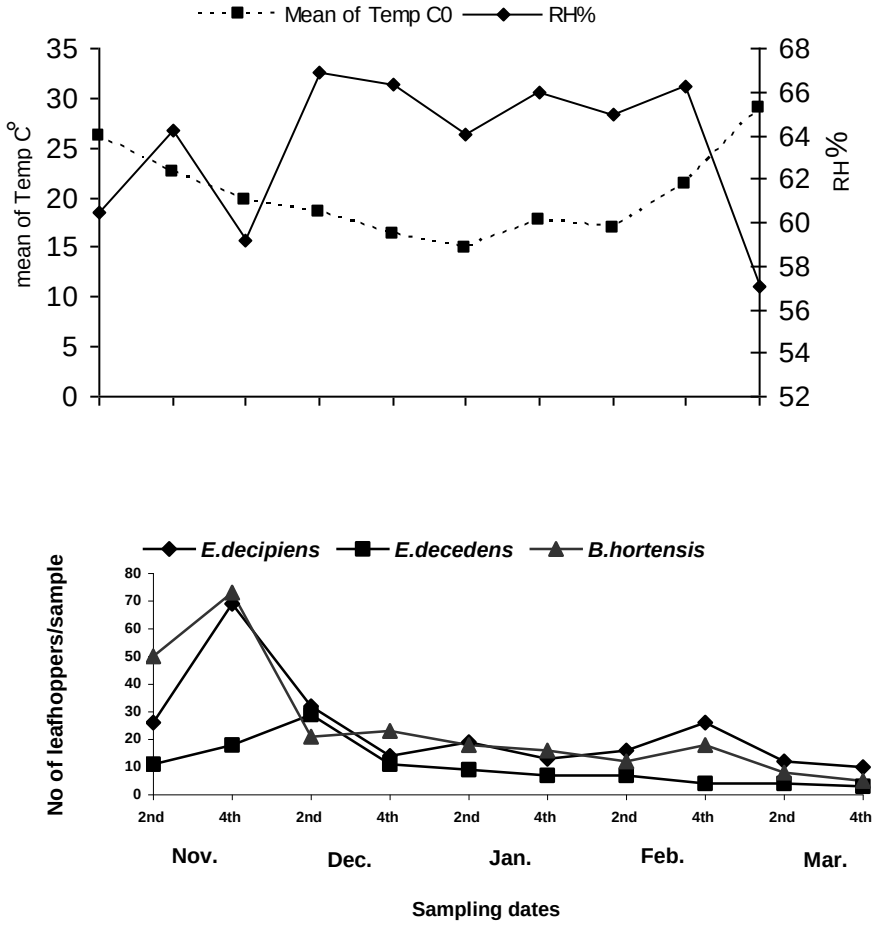

Fig.(6): Seasonal abundance of leafhoppers *E.decipiens, E,decedens* and *B.hortensis* on broccoli plants collected by sweeping net at Sharkia Governorate during 2007/2008 seasons.

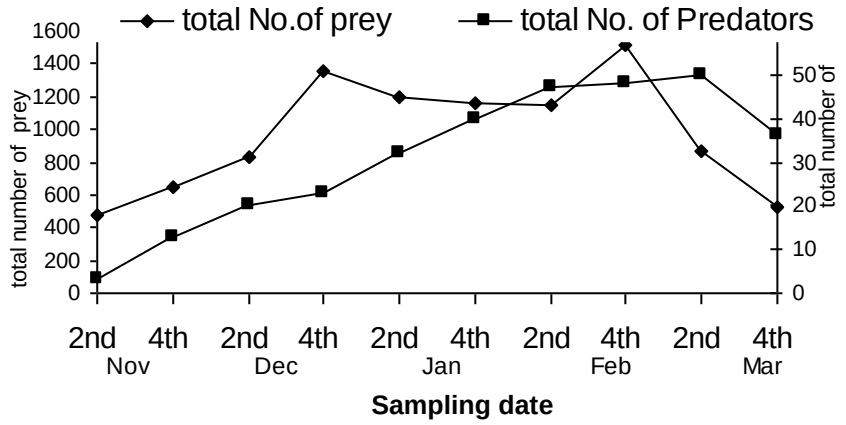

Fig.(7): Total number of prey and predators collected from broccoli plants 2006/2007 season plant at Sharkia Governorate.

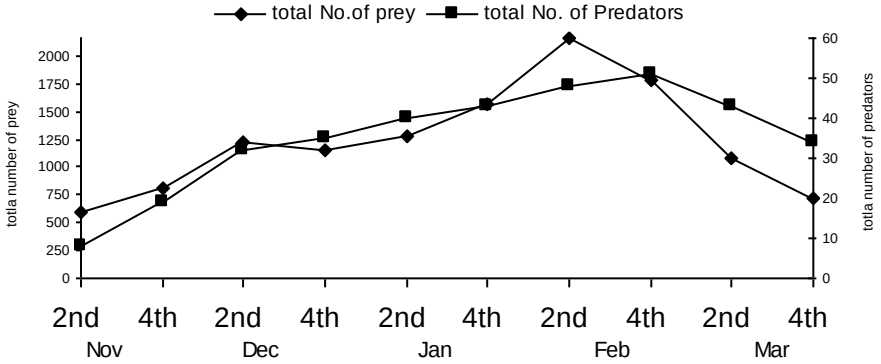

Fig.(8) : Total number of prey ... llected from broccoli plants 2007/2008 season plant at Sharkia Governorate.

Table (3): Correlation coefficient and the effect maximum, minimum temperature and relative humidity and total number of certain homopterous insects infesting broccoli plants during 2006/2007 and 2007/2008 seasons.

Insects	Simple correlation					
	2006/2007			2007/2008		
	Max. Temp.	Mini. Temp.	Mean R. H.	Max. temp.	Mini. Temp.	Mean R. H.
B.tabaci adult	0.636*	0.749*	-0.383	0.626*	0.676*	-0.287
B.brassicae	0.553*	0.518*	-0.267	0.524*	0.373	-0.220
M.Persicae	0.504*	0.431	-0.392	0.410	0.346	0.016
E.decipiens	0.200	0.511*	0.181	0.140	0.380	-0.084
E.decedens	-0.216	0.027	0.440	-0.027	0.276	-0.332
B.hortensis	0.292	0.627	0.042	0.302	0.515	-0.033

On predators: Results in Table (4) showed the values of simple correlation coefficient among temperature, relative humidity and the population density of predators in the two seasons of study. During the first season 2006/2007, temperature showed insignificant, while mean relative humidity cleared a significant negative with population density of *C. undecimpunctata*. On the other hand temperature and mean relative humidity showed insignificant correlation with the population density of *P.alferii* and *M.corollae*. Maximum temperature indicated a significant negative correlation while the mean relative humidity showed a significant positive correlation with the population density of *S. syriacus* and *C.vicina isis* . The temperature and mean relative humidity showed insignificant with the population density of *Ch. carnea*. In the second season.2007/2008 , the maximum and minimum temperature cleared highly significant negative correlation with the population density of *C. undecimpunctata* and *Scymnus syriacus ,*also showed a significant negative correlation with the population density of *Ch..carnea* meanwhile minimum temperature induced a significant negative correlation, but the maximum temperature showed insignificant negative with the population density of *P.alferii* and *C.vicinai isis* .On the other hand mean relative humidity showed a significant positive correlation with the population number of *P. alferii,* while insignificant correlation with the population density of *C. undecimpunctata, S. syriacus ,M. corollae, Ch. carnea* and *C.vicinia isis.* Data in Table (5) showed numerical relation between temperature, relative humidity and the total number of predators during the two seasons of study. In the first season, 2006/2007 the minimum temperature showed highly significant effect on the population density *C.vicina isis,* also the maximum temperature inducted a significant positive effect on the population density of *M.corollae* and *C.vicina isis .* The mean relative humidity showed a significant positive effect on the population density of *C.undecimpunctata*. Also multiple regression analysis indicated a highly significant positive effect on the population density of *C.vicina isis* , while showed a significant positive effect on the population density of *C.undecimpunctata* and *M.corollaee*. During the second season 2007/2008 , the minimum temperature showed a highly significant positive effect on the population density of *C. undecimpunctata* and *S. syriacus*, while cleared a significant positive effect on the population density of *P.alferii , Ch. carnea* and *C.vicina isis*. Also the maximum temperature showed a significant positive effect on the population density of *C.undecimpunctata* , *S. syriacus* and *Ch. carnea*, on the other hand, mean relative cleared insignificant effect on the population density of all predators. The multiple regression analysis showed a highly significant positive effect on the population density of *C. undecimpunctata* , *P. alferii* and *S. syriacus.* Table (6 and 7) Show the simple correlation coefficient value among *B.tabaci, B.brassicae, M. persicae, E. decipiens, E.decedens* and *B.hortensis* and its associated predators. *C. undecimpunctata* showed highly significant negative effect on the population density of *B.tabaci* in the second season and a significant negative correlation on the number of *E.decedens and B.hortensis* in both seasons. On the other hand, *C.vicina isis* indicated highly significant negative correlation on the population density of *B.hortensis* and *B.tabaci* in the first season, while in the second season showed significant negative correlation on the number of *B.tabaci, E.de*cipiens and *B.hortensis.*

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Also *S. syriacus* cleared a significant negative correlation on the number of *B. tabaci* and *B. horetensis* in the second season. Meanwhile, *Ch. carnea* showed a significant positive correlation on the population density of *B.tabaci* in the second season and a significant negative correlation on the number of *E.decipiens* and *E.decedens* in the first season, and *B.hortensis* in both seasons. On the other hand *P.alferii* showed highly significant negative correlation on the population density of *B.hortensis,* and a significant negative correlation on the number of *B.tabaci* in the first season , also showed a significant negative correlation on the population density of *B.tabaci, E.dece*dens and *B.hortensis* in the second season. Meanwhile, *M.corollae* indicated a significant negative correlation on the number of *B.hortensis* in both seasons. While in the first season showed highly significant negative on the population density of *B .tabaci* and a significant negative correlation in the second season, also showed a significant positive correlation on the population density of *B. brassicae* and *M. persicae.*. In the first season 2006/2007, data in Table (8) shows that the proportional effect of *Ch. carnea, M.corollae* was a significant positive effect on the population density of *M.persicae* while *C.vicinia isis* was highly significant positive ($R^2 = 0.776$) , also *P.alferii* and *M.corollae* showed a significant positive effect (R^2 value was 0.499 and 0.512),on the population density of *B.tabaci* simple regression suggested that *C.undecimpunctata* was a significant positive effect (R^2 =0.661) on the number of *E.decipiens*. Meanwhile simple regression cleared that *Ch. carnea* was highly significant positive effect on the population density of *B. hortensis,* while *C.vicina isis* showed a significant positive effect on the population density of *B.hortensis,* Multiple regression analysis indicated that the presence a significant positive relationship between predators and *B.tabaci* and *B.hortensis* populations (R^2=0.4459 and 0.5573) respectively. In the second season 2007-2008, *B.tabaci* population and the following predators, *C.undecimpunctata* ,*C.vicina isis* , *S.syriacus* , *C.carnea* and *P.alferii* showed a significant positive effect. Also simple regression cleared that *P.alferii* was a significant positive effect (R^2 =0.469) on the population density of *E.decedens,* simple regression showed that predators, *C.undecimpunctata, C.vicina isis* and *M.corollaee* cleared that a significant positive relationship on the population density of *B.hortensis*R^2 (0.521,0.529 and 0.640, respectively). Multiple regression analysis indicated that the presence a significant positive relationship between predators and *B.tabaci* population (R^2 = 0.465) (Table 8) .

Generally, from the previous results, the following conclusion could be discussed as follows: the temperature had positive effects with all insects, because the temperature effect on developmental rate, activity, dispersal and immigration, also the temperature effect on size and length of the plant (Ewin and Heins 1995), so if the area leaf (food of insects) decrease the total number of insects will be decrease as a results. One the other hand mean relative humidity has little effects.

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دراسات ايكولوجية لبعض حشرات متشابهة الأجنحة التي تصيب نبات البر وكلي ومفترساتها الحشرية في منطقه منيا القمح محافظه الشرقية

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أجريت تلك الدراسة في موسمي ٢٠٠٦ / ٢٠٠٧ و ٢٠٠٧ / ٢٠٠٨ بهدف حصر ودراسة الوفرة الموسمية لبعض حشرات متشابهة الأجنحة (الذبابة البيضاء – المن – نطاطات الأوراق) والحشرات المفترسة المرتبطة بها بمنطقة منيا القمح شرقية وكذلك تأثير بعض العوامل الجوية (الحرارة العظمي , الصغرى و الرطوبة النسبية) علي الوفرة الموسمية لأنواع الحشرات السائدة والحشرات المفترسة المرتبطة بها . وقد خلصت الدراسة إلي النقاط التالية:

أنواع المن التي تم حصرها *Brevicoryne brassicae* (Linnaeus) , *Myzus Persicae* (Sulz) . بينما أنواع نطاطات الأوراق *Empoasca decipiens* (Poali) , *Empoasca decedens* (Poali) , and *Balclutha hortensis* (Linds.) . بينما الذبابة البيضاء فقط *Bemisia tabaci* (Genn.) . وأوضحت الدراسة ستة مفترسات حشرية تم حصرها *Coccinella undecimpunctata, Cydonia vicina isis , Paedrus alferii, Scymnus syriacus, Chrysoperla carnea* and *Metasyrphus corollaee*

وسجلت نتائج الوفرة الموسمية للأنواع السائدة ما يلي :

أنواع المن : وجد للنوعين *Myzus Persicae* , *Brevicoryne brassica* ذروتين علي نبات البروكلي في (نهاية ديسمبر وفبراير) في موسم الدراسة الأول ٢٠٠٦/٢٠٠٧ ومنتصف ديسمبر وفبراير في موسم الدراسة الثاني ٢٠٠٧/ ٢٠٠٨ .وكانت لانواع نطاطات الأوراق *Empoasca decipiens* ذروتين في (نهاية نوفمبر – نهاية فبراير) وأيضا ذروتين للنوع *Empoasca decedens* في (منتصف ديسمبر – منتصف فبراير) . وسجل ذروه واحده للنوع *Balclutha hortensis* في (نهاية نوفمبر) فى كلا موسمى الدراسة. وسجلت تعداد الأطوار غير الكاملة للذبابة البيضاء ذروتين في نهاية (يناير وفبراير) في الموسم الأول بينما في الثاني في منتصف (يناير وفبراير)، بينما سجل الطور الكامل ذروه واحده في (منتصف فبراير) في الموسم الأول ، بينما في الموسم الثاني ذروتين في نهاية (يناير وفبراير).

كما أوضحت النتائج أن لاجمالي تعداد الحشرات الكلية ذروتين في نهاية (ديسمبر وفبراير) في موسم الدراسة الأول وسجلت ذروتين أيضا في الموسم الثاني في منتصف (ديسمبر وفبراير) بينما أجمالي تعداد المفترسات المرتبطة بتلك الحشرات سجل ذروه واحد في منتصف (مارس) في الموسم الأول بينما في نهاية (فبراير) في الموسم الثاني .

وأوضحت نتائج تأثير العوامل الجوية (الحرارة العظمي والصغرى والرطوبة النسبية) علي الكثافة العددية للحشرات السائدة والحشرات المفترسة المرتبطة بها أنها توجد علاقة معنوية بين درجات الحرارة والرطوبة النسبية وبين تعداد الحشرات وبعض الحالات الأخرى توجد علاقة غير معنوية وذلك عند دراسة معامل الارتباط البسيط.

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Table (4): Simple correlation coefficient between maximum, minimum temperature and relative humidity and the total numbers of predators during 2006/2007 and 2007/2008 seasons.

Predators / Weather factors	*C.undecimpunctata*		*P. alferii*		*S. syriacus*		*M. corolla*		*Ch.carnea*		*C. vicina isi*	
	r ± S.E	Slope (b) ± S.E	r ± S.E	Slope (b) ± S.E	r ± S.E	Slope (b) ± S.E	r ± S.E	Slope (b) ± S.E	r ± S.E	Slope (b) ± S.E	r ± S.E	Slope (b) ± S.E
2006 / 2007												
Max.Temp	0.268 ± 0.340 Ns	2.521 ± 3.202	-0.282 ± 0.339 Ns	-0.291 ± 0.349	-0.520 ± 0.301*	-0.345 ± 0.199	-0.296 ± 0.337 Ns	-0.180 ± 0.205	-0.259 ± 0.341 Ns	-0.237 ± 0.312	-0.705 ± 0.250*	-0.944 ± 0.335
Mini.Temp	-0.063 ± 0.352 Ns	-0.754 ± 4.201	-0.435 ± 0.318 Ns	-0.568 ± 0.415	-0.432 ± 0.318 Ns	-0.363 ± 0.267	-0.532 ± 0.299 Ns	-0.410 ± 0.230	-0.489 ± 0.308 Ns	-0.568 ± 0.357	-0.833 ± 0.195**	-1.414 ± 0.331
Mean R.H. %	-0.580* ± 0.287*	-5.761 ± 2.858	0.193 ± 0.346 Ns	0.210 ± 0.377	0.516 ± 0.302*	0.361 ± 0.211	0.219 ± 0.344 Ns	0.140 ± 0.221	0.109 ± 0.351 Ns	0.106 ± 0.339	0.498 ± 0.306*	0.704 ± 0.433
2007 / 2008												
Max.Temp	-0.757 ± 0.230**	-0.697 ± 0.212	-0.0587 ± 0.286 Ns	-0.415 ± 0.202	-0.781 ± 0.220**	-0.362 ± 0.102	-0.192 ± 0.349 Ns	-0.064 ± 0.116	-0.682 ± 0.258*	-0.291 ± 0.110	-0.362 ± 0.329 Ns	0.293 ± 0.265
Mini.Temp	-0.869 ± 0.174**	-1.107 ± 0.222	-0.746 ± 0.235**	-0.729 ± 0.229	-0.897 ± 0.156**	-0.576 ± 0.100	-0.187 ± 0.347 Ns	-0.086 ± 0.160	-0.632 ± 0.273*	-0.373 ± 0.161	-0.546 ± 0.296*	-0.610 ± 0.330
Mean R.H. %	0.385 ± 0.326 Ns	0.459 ± 0.389	0.506 ± 0.304*	0.464 ± 0.279	0.373 ± 0.327 Ns	0.224 ± 0.197	0.146 ± 0.349 Ns	0.063 ± 0.151	0.446 ± 0.316 Ns	0.246 ± 0.175	0.253 ± 0.342 Ns	0.264 ± 0.357

Table (5): Numerical relation among weather factors between maximum, minimum temperature and relative humidity and the total numbers of predators during 2006/2007 and 2007/2008 seasons.

Predators / Weather factors	*C. undecimpunctata*		*P. alferii*		*S. syriacus*		*M. corollae*		*Ch. carnea*		*C. vicina isi*	
	R^2	P	R^2	P	R^2	P	R^2	P	R^2	P	R^2	P
2006 / 2007												
Max.Temp	0.0741	Ns	0.3146	Ns	0.4156	Ns	0.6475	*	0.2527	Ns	0.6057	*
Mini.Temp	0.1866	Ns	0.3818	Ns	0.3134	Ns	0.3671	Ns	0.2977	Ns	0.7212	**
Mean R.H. %	0.6585	*	0.0649	Ns	0.2749	Ns	0.0542	Ns	0.0540	Ns	0.3161	Ns
Multiple regression	0.5424	*	0.2910	Ns	0.3010	Ns	0.5937	*	0.4165	Ns	0.7382	**
2007 / 2008												
Max.Temp	0.5765	*	0.3492	Ns	0.6263	*	0.1898	Ns	0.4982	*	0.1887	Ns
Mini.Temp	0.8521	**	0.5688	*	0.8055	**	0.3919	Ns	0.5764	*	0.6111	*
Mean R.H. %	0.2181	Ns	0.2633	Ns	0.1401	Ns	0.1901	Ns	0.2921	Ns	0.4265	Ns
Multiple regression	0.7736	**	0.7057	*	0.8253	**	0.0397	Ns	0.4696	Ns	0.4580	Ns

P= Probability

Table (6): Correlation coefficient between , *B.brassicae, M. persicae* and *B. tabaci* and its predators on broccoli plants during two seasons 2006- 2007 and 2007-2008.

Insect species / Predator Species	*B.brassicae*		*M.Persicae*			*B.tabaci*
	r ± S.E	Slope (b) ± S.E	r ± S.E	Slope (b)± S.E	r ± S.E	Slope (b)± S.E
2006 / 2007						
C.undecimpunctata	0.116± 0.351 Ns	0.024± 0.724	0.410± 0.322 Ns	0.233± 0.183	-0.330± 0.333 Ns	-0.051± 0.052
C. vicina isi	-0.216± 0.345 Ns	-0.006± 0.010	-0.181± 0.347 Ns	-0.014± 0.028	-0.811± 0.206**	-0.018± 0.004
S. syriacus	-0.085± 0.352 Ns	-0.001± 0.005	-0.219± 0.344 Ns	-0.008± 0.013	-0.608± 0.280 Ns	-0.006± 0.003
Ch.carnea	0.329± 0.333 Ns	0.006± 0.006	0.460± 0.313 Ns	0.025± 0.017	-0.629± 0.274 Ns	-0.009± 0.004
P. alferii	0.132± 0.350 Ns	0.002± 0.007	0.067± 0.352 Ns	0.004± 0.021	-0.667± 0.263*	-0.011± 0.004
M. corollae	0.250± 0.342 Ns	0.003± 0.004	0.159± 0.349 Ns	0.005± 0.012	-0.714 ± 0.247**	-0.007± 0.002
2007 / 2008						
C.undecimpunctata	0.041 ± 0.353 Ns	0.601 ± 0.005	-0.037 ± 0.353 Ns	-0.002 ± 0.205	-0.835 ± 0.194**	-0.015 ± 0.003
C. vicina isi	0.226 ± 0.344 Ns	0.002 ± 0.004	0.051 ± 0.353 Ns	0.002 ± 0.018	-0.725 ± 0.243*	-0.011 ± 0.004
S. syriacus	0.220 ± 0.353 Ns	0.161 ± 0.002	-0.031 ± 0.353 Ns	-0.926 ± 0.0103	-0.682 ± 0.258*	-0.006 ± 0.002
Ch.carnea	0.017 ± 0.352 Ns	0.481 ± 0.002	0.154 ± 0.349 Ns	0.004 ± 0.009	0.703 ± 0.251*	0.006 ± 0.002
P. alferii	0.162 ± 0.348 Ns	0.001 ± 0.003	0.083± 0.353	0.523± 0.013	-0.652 ± 0.267*	-0.009 ± 0.003
M. corollae	0.586 ± 0.286*	0.003 ± 0.001	0.590 ± 0.285*	0.012 ± 0.008	-0.637 ± 0.272*	-0.004 ± 0.001

Table (7): Correlation coefficient between, *E.decipiens, E.decedens* and *B. hortensis* and its predators on broccoli plants during seasons 2006- 2007 and 2007-2008.

Insect species / PredatorSpecies	*E.decipiens*		*E.decedens*		*B.hortensis*	
	r ± S.E	Slope (b) ± S.E	r ± S.E	Slope (b)± S.E	r ± S.E	Slope (b)± S.E
2006 / 2007						
C.undecimpunctata	-0.524± 0.301*	-0.104± 0.601	-0.472± 0.311*	-0.155± 0.102	-0.496± 0.306*	-0.713± 0.440
C. vicina isi	-0.487± 0.308*	-0.138± 0.087	-0.315± 0.335 Ns	-0.148± 0.157	-0.745± 0.235**	-0.152± 0.048
S. syriacus	-0.125± 0.350 Ns	-0.017± 0.049	0.179± 0.347 Ns	-0.041± 0.080	-0.468± 0.312 Ns	-0.047± 0.031
Ch.carnea	-0.541± 0.297*	-0.105± 0.057	-0.577± 0.288*	-0.185± 0.092	-0.698± 0.252*	-0.097± 0.035
P. alferii	-0.403± 0.323 Ns	-0.088± 0.070	-0.376± 0.327 Ns	-0.136± 0.118	-0.746± 0.235**	-0.117± 0.037
M. corollae	-0.252± 0.340 Ns	-0.032± 0.044	-0.097± 0.351 Ns	-0.020± 0.075	-0.584± 0.286*	-0.054± 0.026
2007 / 2008						
C.undecimpunctata	-0.498± 0.306*	-0.112± 0.069	-0.330± 0.333 Ns	-0.164± 0.165	-0.720± 0.245*	-0.135± 0.045
C. vicina isi	-0.529± 0.300*	-0.104± 0.059	-0.427± 0.319	-0.186± 0.139	-0.727± 0.242*	-0.119± 0.039
S. syriacus	-0.394± 0.324 Ns	-0.044± 0.036	-0.356± 0.330 Ns	-0.089± 0.082	-0.618± 0.277*	-0.058± 0.026
Ch.carnea	-0.292± 0.338 Ns	-0.030± 0.035	-0.083± 0.352 Ns	-0.019± 0.081	-0.558± 0.293*	-0.048± 0.025
P. alferii	-0.429± 0.319 Ns	-0.074± 0.055	-0.650± 0.268*	-0.248± 0.102	-0.593± 0.284*	-0.085± 0.040
M. corollae	-0.246± 0.342 Ns	-0.020± 0.028	-0.171± 0..348 Ns	-0.030± 0.062	-0.558± 0.293*	-0.048± 0.025

Table (8): Simple, multiple regression and explained variance between *B.brassicae, M. persicae* and *B.tabaci, E.decipiens, E.decedens, B.hortensis* and its predators on broccoli plants during two seasons 2006-2007 and 2007-2008.

Insect species / Predators species	*B.brassicae*		*M.Persicae*		*B.tabaci*		*E.decipiens*		*E.decedens*		*B.hortensis*	
	R^2	P	R^2	P	R^2	P	R^2	P	R^2	P	R^2	P
1-Simple regression	**2006 / 2007**											
C.undecimpunctata	0.042	Ns	0.238	Ns	0.175	Ns	0.661	*	0.401	Ns	0.439	Ns
C. vicina isi	0.327	Ns	0.423	Ns	0.776	**	0.249	Ns	0.117	Ns	0.578	*
S. syriacus	0.070	Ns	0.201	Ns	0.400	Ns	0.190	Ns	0.037	Ns	0.200	Ns
Ch.carnea	0.436	Ns	0.572	*	0.432	Ns	0.446	Ns	0.340	Ns	0.772	**
P. alferii	0.043	Ns	0.134	Ns	0.499	*	0.168	Ns	0.197	Ns	0.439	Ns
M. corollae	0.250	Ns	0.463	*	0.512	*	0.074	Ns	0.101	Ns	0.453	Ns
2-Multiple regression	0.017	Ns	0.004	Ns	0.445	*	0.162	Ns	0.141	Ns	0.557	*
1-Simple regression	**2007 / 2008**											
C.undecimpunctata	0.002	Ns	0.166	Ns	0.767	*	0.248	Ns	0.286	Ns	0.521	*
C. vicina isi	0.119	Ns	0.002	Ns	0.626	*	0.280	Ns	0.390	Ns	0.529	*
S. syriacus	0.205	Ns	0.264	Ns	0.544	*	0.163	Ns	0.290	Ns	0.383	Ns
Ch.carnea	0.147	Ns	0.293	Ns	0.509	*	0.086	Ns	0.089	Ns	0.329	Ns
P. alferii	0.033	Ns	0.158	Ns	0.560	*	0.223	Ns	0.469	*	0.404	Ns
M. corollae	0.383	Ns	0.410	Ns	0.406	Ns	0.139	Ns	0.332	Ns	0.640	*
2-Multiple regression	0.00004	Ns	0.00009	Ns	0.465	*	0.015	Ns	0.127	Ns	0.392	Ns

P= Probability