Egypt. Acad. J. biolog. Sci., 4 (1): 131- 144 (2011) A. Entomology
Email: egyptianacademic@yahoo.com ISSN: 1687– 8809
Received: 11/5/2011 www.eajbs.eg.net

The relationship between some insect predators and aphid insects in Qena Governorate

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ABSTRACT

The sweep net was used for studying the relationship between predators (*Hippodamia convergens* Guer. and *Chrysopa carnea* Stephens) and preys (*Aphis faba* Scopoli, *Aphis gossypii* Glover and *Myzus persicae* Sulzer). Regular samples were collected weekly from Alfalfa at the two stations (A & B) in the two trapping years (March 2007-February 2009).

The seasonal distributions showed that *Hippodamia convergens* Guer. ,*Chrysopa carnea* Steph., *Aphis faba* Scopoli, *Aphis gossypii* Glover and *Myzus persicae* Sulzer had three generations per year. The relationship between the activity of predators (*H. convergens*, *C. carnea*) and preys *(A. faba, A. gossypii, M. persicae*) explained that the more increasing in the predators the more decreasing in the population of the preys.

Keywords: predation, aphids, insect predators

INTRODUCTION

Predation is a kind of intimacy where attacking one a predator to prey for food, and eliminate the predator with the prey a period of time and may exercise the predatory habits in the larval or nymph stages or in the adult insect, but some insects are predators in the adult insect or incomplete phase, such as (Family: Coccinellidae) or predators in the developed larvae only, such as some types of Aphid lion (Family: Chrysopidae).

Few attempts have been made to study the relationship between catches of family Coccinellidae and aphid by Foott (1973), Mack and Smilowitz (1982), Hemptinne and Dixon (1997), Solomon *et al*.,(2000), Papachristos and Milonas (2008) and Piñol *et al*., (2009). Moreover, Alrouedchi (1980), Aly (1991), Hodek and Honek (1996), Kabissa *et al*., (1996) and Hagen *et al*., (1999) made studies on the relationship between catches of family Chrysopidae and aphid. Therefore, it was useful to helpful in the biological control of aphids.

The aim of the present work initiates to throw abeam light on the seasonal distribution of some species of Coleoptera, Hemiptera and Neuroptera.. Moreover, this work is aimed to clarify the association between the predatory behaviors of Coccinellidae, Chrysopidae and aphid species.

MATERIAL AND METHODS

The sweep net was used for studying the relationship between catches of predators (*Hippodamia convergens* Guer. and *Chrysopa carnea* Stephens) and preys (*Aphis faba* Scopoli, *Aphis gossypii* Glover and *Myzus persicae* Sulzer) at the two stations (A& B) in the two trapping years (March 2007- February 2009).

The catches of predators (*Hippodamia convergens* Guer. and *Chrysopa carnea* Steph.) and preys (*Aphis faba* Scopoli, *Aphis gossypii* Clover and *Myzus persicae* Sulzer) in each station were counted to study the seasonal distribution and the relationship between catches of predators and

preys. One was added to avoid the zero catches, and then the daily numbers were transformed into logarithms (Williams, 1935&1937). The five running mean was calculated in order to smooth the curve. The smoothed curve was superimposed on the histogram to have an idea about the number of generations.

RESULTS AND DISCUSSION

The seasonal distribution of *Hippodamia convergens* Guer.:

An examination of Table (1), suggests that the largest numbers of *H. convergens* were collected in autumn 2007, while in spring 2009 at the two stations (A&B). The number of *H. convergens* captured in two years was 6459 individuals. This result indicated that *H. convergens* was abundant in the 1st year than the 2nd year. On the other hand, the least numbers were trapped in winter of both years.

Table 1: Catches of *Hippodamia convergens* Guer at two different areas in Qena over a period of two years (2007-2009).

Months	2007-2008		2008-2009		Two years (2007-2009)		Total
	A	B	A	B	A	B	
March	170	87	106	136	276	223	499
April	249	217	204	233	453	450	903
May	98	174	224	254	322	428	750
June	46	55	72	81	118	16	254
July	81	197	122	126	203	323	526
August	135	285	136	128	271	413	684
September	213	139	130	114	343	253	596
October	440	455	239	232	679	687	1366
November	159	122	125	119	284	241	525
December	75	70	34	48	109	118	227
January	60	14	5	22	65	36	101
February	9	9	1	9	10	18	28
Total	1735	1824	1398	1502	3133	3326	6459

Figure (1) shows that *H. convergens* had three generations per year. The first generation was captured from early March till late June. The second generation appeared from late June till mid September. The third generation appeared from mid September till early January.

The seasonal distribution of *Aphis faba* Scopoli:

Table (2) shows that the total catch of *Aphis faba* collected in the two years by sweep net was 4836 individuals. Moreover, in the 2nd year the catches were higher than that in the 1st year. In addition to that, the largest numbers were collected in winter at the two stations in the two trapping years. In contrast, the lowest population was recorded in spring.

Table 2: Catches of ***Aphis faba*** Scopoli at two different areas in Qena over a period of two years (2007-2009).

Months	2007-2008		2008-2009		Two years (2007-2009)		Total
	A	B	A	B	A	B	
March	8	8	48	50	56	58	114
April	11	10	15	6	26	16	42
May	1	0	0	0	1	0	1
June	0	0	0	0	0	0	0
July	0	0	0	0	0	0	0
August	0	0	0	0	0	0	0
September	10	10	13	18	23	28	51
October	11	13	16	31	27	44	71
November	25	77	105	9	130	86	216
December	85	296	267	491	352	787	1139
January	532	449	594	382	1126	831	1957
February	266	223	383	373	649	596	1245
Total	949	1086	1441	1360	2390	2446	4836

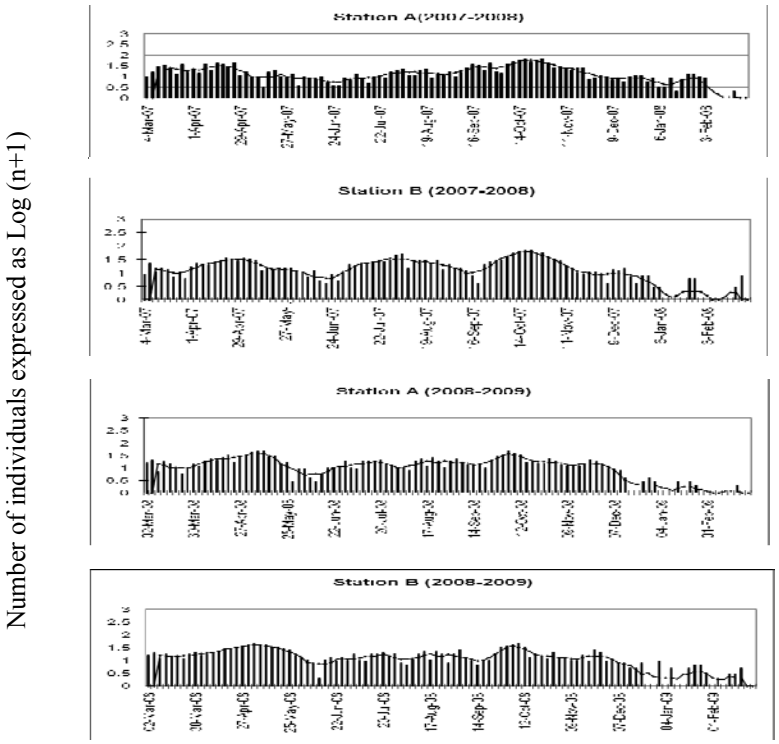

Fig 1: The daily fluctuations of *Hippodamia convergens* (superimposed curve on histogram represents the smoothed 5-days running mean).

Figure (2), shows that *A. faba* Scopoli had three generations per year. The individuals of the first generation were collected from early March till late April at the two stations in the two trapping years.

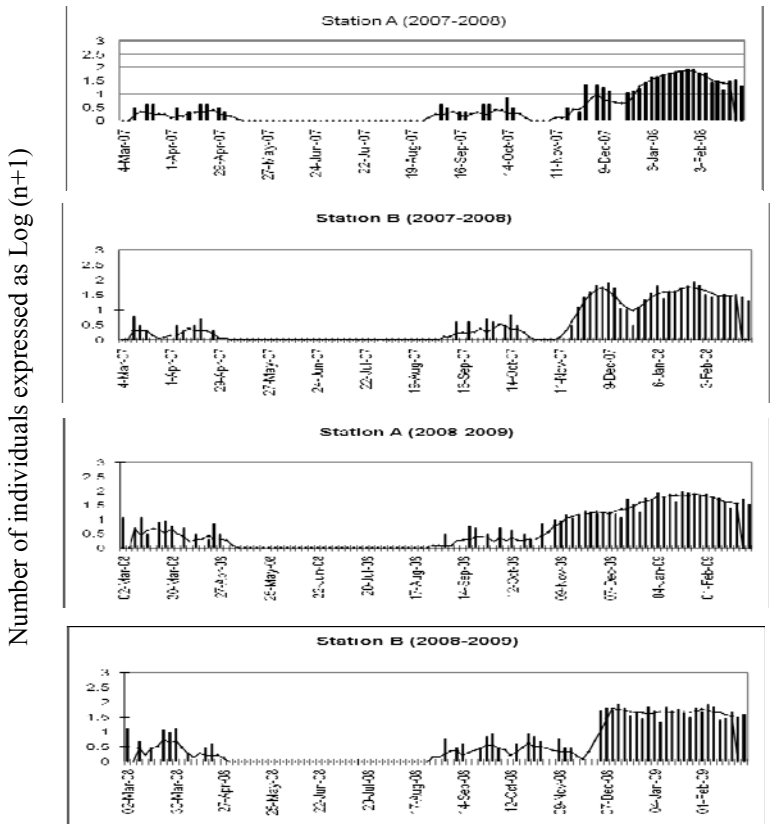

Fig 2: The daily fluctuations of *Aphis faba* (superimposed curve on histogram represents the smoothed 5-days running mean).

The second generation was captured from mid August till late October but at station (B) of the 2nd year this period started from mid August till early November.

The third generation appeared from early November to late February. The obtained results disagree with that obtained by Aly (1991), found that *Aphis sp.* had two generations per year. Disagreement perhaps result from the difference in the methods of the study, where the mentioned author, used the light trap nocturnally, while the present catches were collected diurnally by the sweep net.

The relationship between populations of *Hippodamia convergens* G. and *Aphis faba* Scopoli:

An examination of Figure (3) explained that, there is a relationship between the activity of *H. convergens* Guer. and *A. faba* Scopoli. This relation explains that the more increasing in the predator (*H. convergens* Guer.) reverse the more decreasing in the population of the preys (*A. faba* Scopoli) especially during summer and autumn. In contrast, the more decreasing in the population of predators (*H. convergens* Guer.) the more increasing in populations of preys (*A. faba* Scopoli) during winter.

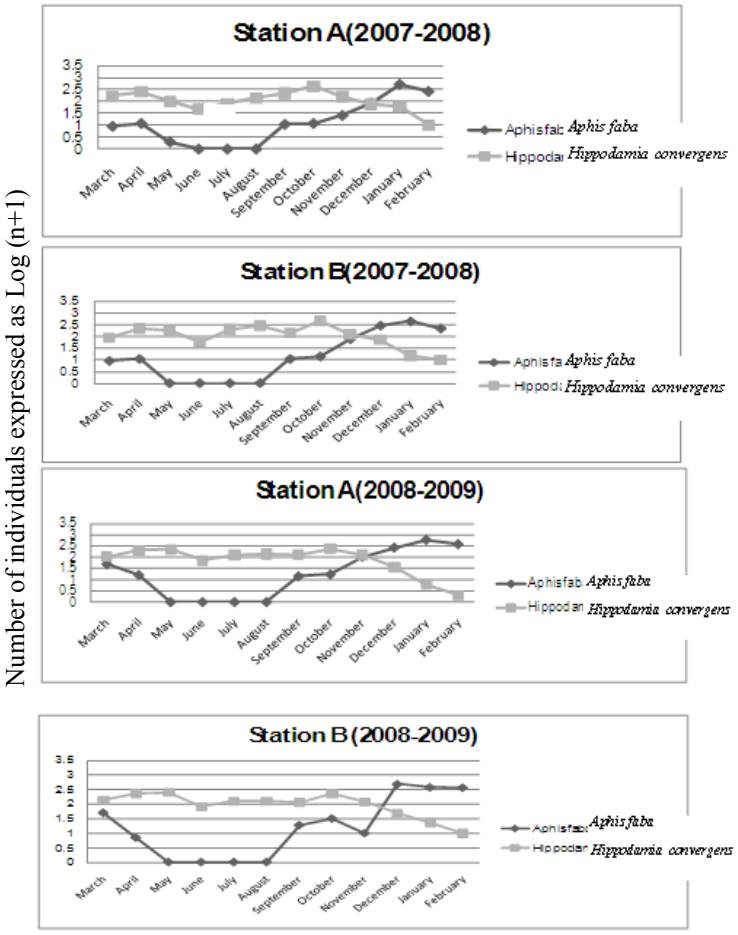

Fig 3: The relationship between the catches of *Hippodamia convergens* and *Aphis faba* over a period of two years (March 2007- February 2009)

Thus, it might be *H. convergens* populations had a high quality predation on *A. faba*. Results obtained by Dixon (1998) and Solomon *et al.*, (2000) were in agreement with those results. They pointed out that most of predatory species especially Coccinellidae become abundant when the aphid density was already high. Some of present result was studied by Papachristos and Milonas (2008) and confirmed it when they worked on lady bird bettle as a predator and *Vicia faba* as a prey. Moreover the present result was agreed with those of Pinol *et al.*, (2009). The last authors proved high quality of the coccinellids a predator on aphids.

The seasonal distribution of *Aphis gossyipi* Clover:

Table (3) shows that the total catch of *Aphis gossypii* Glover collected in the two years by sweep net was 24960 individuals. However, in the 1st year the catches were higher than that in the 2nd year. In addition to that, The highest population of *Aphis gossypii* was recorded in winter at stations (A) of the 1st year and (B) of the 2nd year and in autumn at stations (B) of the 1st year and (A) of the 2nd year. Inversely, the lowest populations were collected during spring at the two stations in both years.

Table 3: Catches of *Aphis gossypii* Glover at two different areas in Qena over a period of two years (2007-2009).

Months	2007-2008		2008-2009		Two years (2007-2009)		Total
	A	B	A	B	A	B	
March	207	128	213	215	420	343	763
April	270	227	289	424	559	651	1210
May	232	467	214	225	446	692	1138
June	342	244	247	220	589	464	1053
July	496	289	312	397	808	686	1494
August	201	605	721	602	922	1207	2129
September	708	1863	820	777	1528	2640	4168
October	799	1210	725	392	1524	1602	3126
November	204	497	496	412	700	909	1609
December	337	749	628	412	965	1161	2126
January	536	748	611	588	1147	1336	2443
February	1110	969	716	866	1826	1835	3661
Total	5442	7996	5992	5530	11434	13526	24960

Fig. (4), shows that, *A. gossypii* Glover had three generations per year. The first generation started from early March till mid August, the second generation was collected from mid August till early December and the third generation was captured from early December till late February.

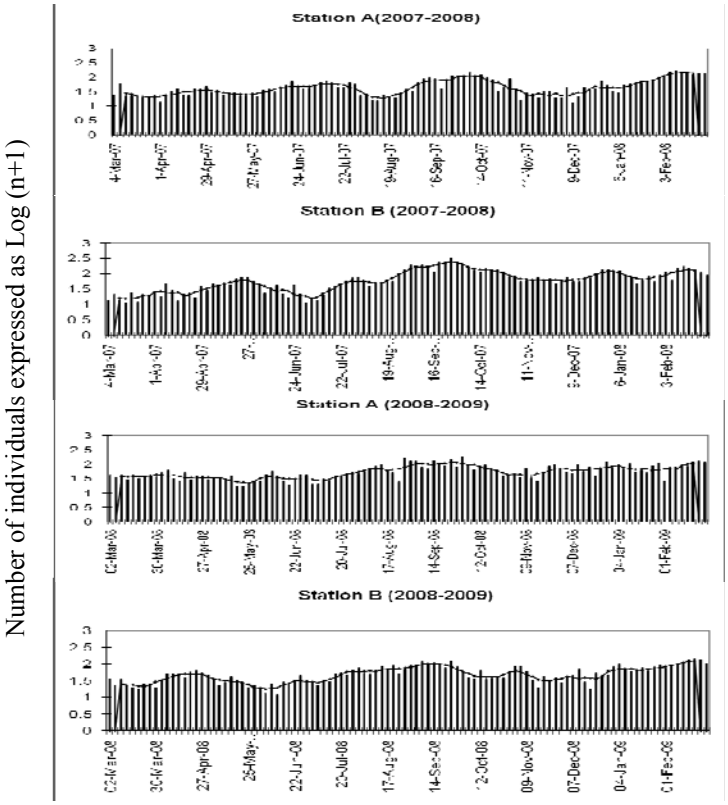

Fig. 4: The daily fluctuations of *Aphis gossypii* (superimposed curve on histogram represents the smoothed 5-days running mean).

As shown in (Fig. 4-B of the 1st year and (A&B) of the 2nd year) The first generation occurred from early March till late July, the second generation started from late July till early November and the third generation was captured from early November till late February. The second and the third annual periods were extended to be overlapped.

The relationship between catches of *Hippodamia convergens* Guer. and *Aphis gossypii* Glover:

An examination of Fig. (5), explains that, there is a relationship between the activity of *H. convergens* and *A. gossypii*. This relation explains that, the more decreasing in the predator (*H. convergens*) the more increasing in the population of the preys (*A. gossypii*) especially during summer and winter. Therefore, it could be a balanced relationship between the two mentioned predators and preys populations during spring. In contrast, disagreement was obtained by Conway *et al*., (2006), where they reported that the Coccinellids are generally most abundant and is most synchronized with cotton aphid density. Simelane *et al.,* (2008) found that both *N. fresenii* and coccinellids (including *Coccinella septempunctata*) simultaneously contribute to declines of *A. gossypii* Glover densities in cotton fields. This disagreement may be due to the difference in species of the family.

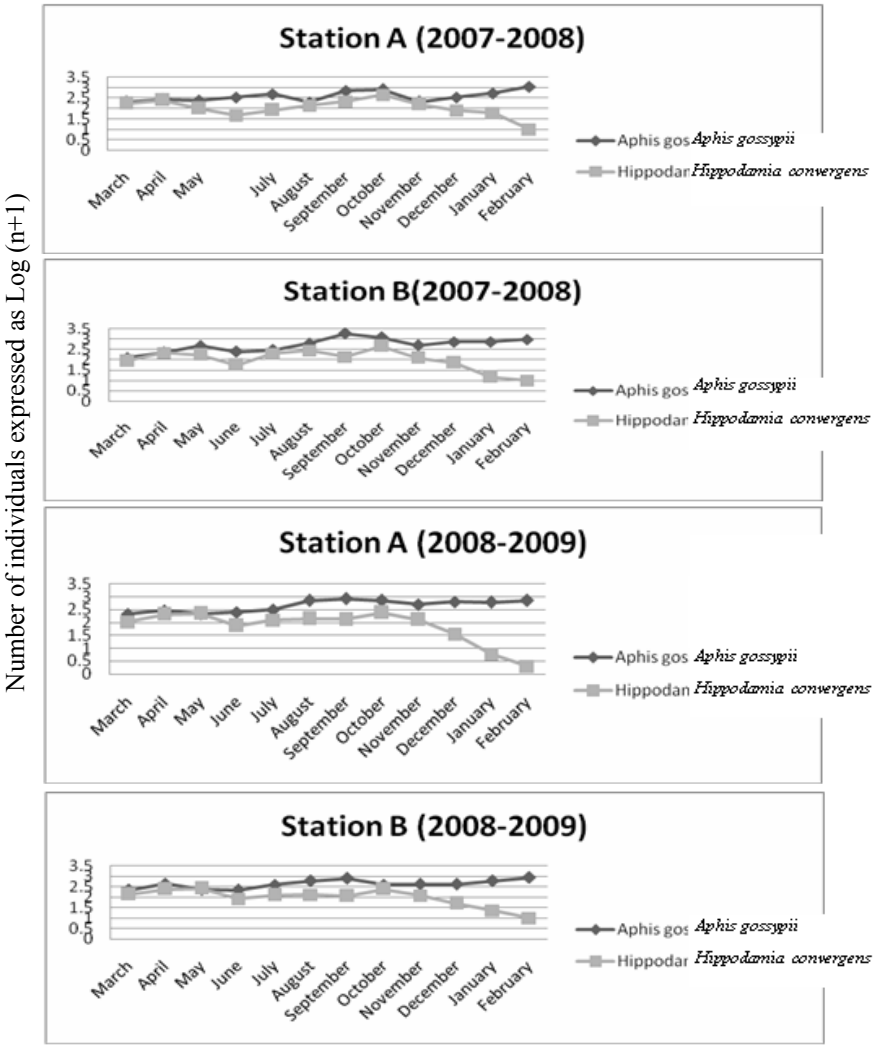

Fig. 5: The relationship between the catches of *Hippodamia convergens* and *Aphis gossypii* over a period of two years (March 2007- February 2009).

The seasonal distribution of *Myzus persicae* Sulzer:

Table (4) shows that the total catch of *Myzus persicae* collected in the two years were 2240 individuals. Moreover, in the 2nd year the catches were higher than that in the 1st year. Regarding to the 1st year, the seasonal distribution of *M. persicae* was recorded in winter at the two stations (A & B). However, the highest populations were recorded in spring at the two stations (A & B) during the 2nd year. Inversely, the lowest population collected during autumn at station (A) of the 1st year and in summer at stations (B of the 1st year and A&B of the 2nd year).

Table 4: Catches of *Myzus Persicae* Sulzer at two different areas in Qena over a period of two years (2007-2009)

Months	2007-2008		2008-2009		Two years (2007-2009)		Total
	A	B	A	B	A	B	
March	45	40	188	141	233	181	414
April	72	52	130	50	202	102	304
May	53	49	40	44	93	93	186
June	39	31	32	30	71	61	132
July	37	11	19	2	56	13	69
August	4	0	0	0	4	0	4
September	9	2	6	16	15	18	33
October	36	29	39	32	75	61	136
November	1	29	20	4	21	33	54
December	0	1	1	12	1	13	14
January	117	175	56	35	173	210	383
February	127	152	193	39	320	191	511
Total	540	571	724	405	1264	976	2240

Figure (6), shows that, *M. persicae* Sulzer had three generations per year. At station (A) of the 1st year, the first generation started from early March till late July, the second generation was captured from late July till early December and the third generation beginning on late December till late February as shown in (Fig. 6-A). At station (B) of the 1st year, *M. persicae* Sulzer had three generations.

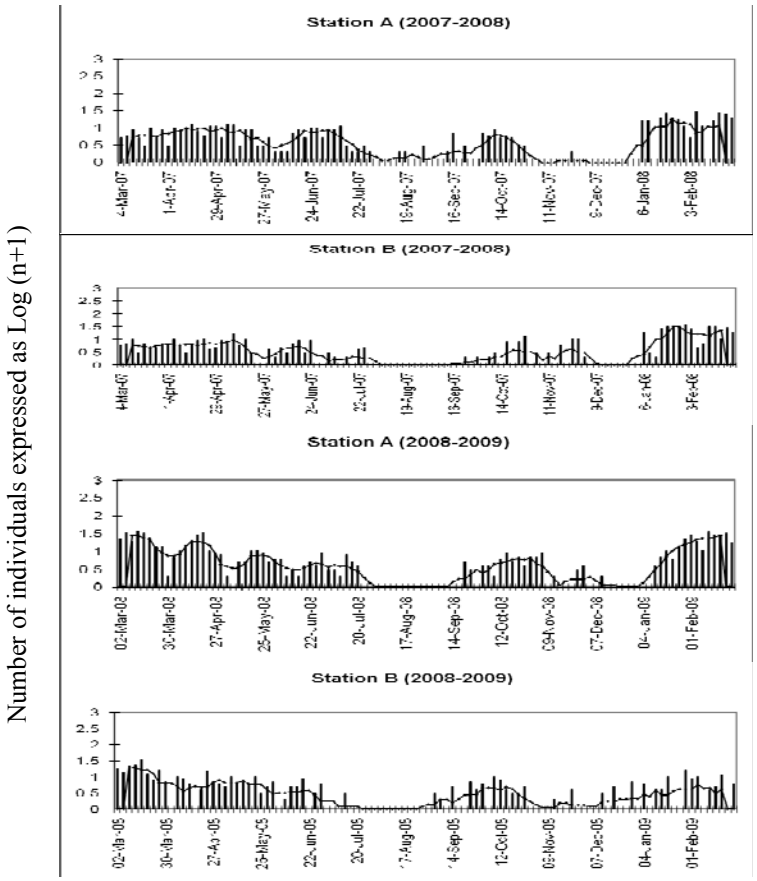

Fig. 6: The daily fluctuations of *Myzus persicae* (superimposed curve on histogram represents the smoothed 5-days running mean).

The first generation started from early March till late July, the second generation occurred from mid September till early December and the third generation started from early December till late February as shown in (Fig. 6-B). Concerning the2nd year at stations (A& B) three generations were detected. The 1st generation was captured from early March till late July, the second generation beginning on mid September till early December and the third generation was collected from early December till late February.

The relationship between populations of *Hippodamia convergens* Guer. and *Myzus persicae* Sulzer:

An examination of Fig. (7), explains that, a relationship between *H. convergens* and *M. persicae* where, the more increasing in the predator (*H. convergens*) the more decreasing in the population of the prey (*M. persicae*) especially during autumn. Inversely, the more decreasing in the population of the predator (*H. convergens)* the more increasing in the population of the prey during winter. In addition, the predator may be able to consume most of preys during late summer and autumn.

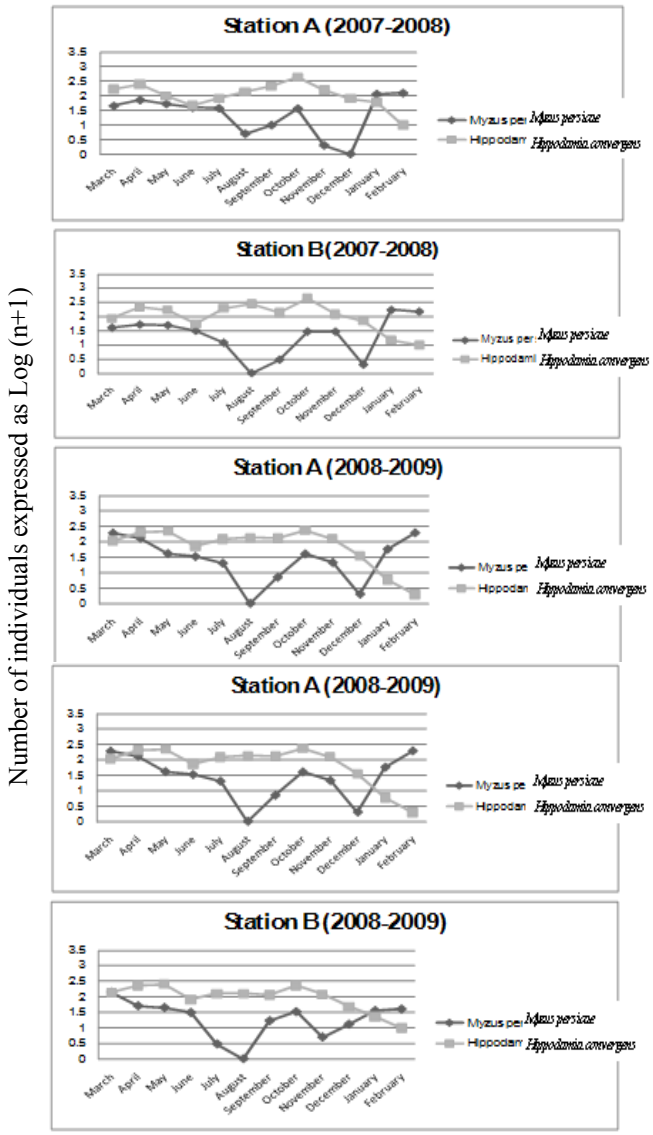

Fig 7: The relationship between the catches of *Hippodamia convergens* and *Myzus persicae* over a period of two years (March 2007_ February 2009).

However, they can be consuming less during spring. These results agree with those obtained by Obrycki *et al.,* (1998), who found that *Coccinella septempunctat.* (Coleoptera: Coccinellidae reduced peak densities of *M. persicae* Sulzer **(**Hemiptera: Aphididae) (green peach aphid) on potatoes. Results obtained by Mack and Smilowitz (1982) are in agreement with results, where they showed that the interactions between coccinellids and aphids pests predict reductions of aphid densities based on predation rates and numbers of Coccinellidae, and these predictions are supported by empirical field studies.

The seasonal distribution of *Chrysopa carnea* Steph.:

Table (5) shows that the total catch of *Chrysopa carnea* collected in the two years were 885 individuals. However, in the 2nd year the catches were higher than that in the 1st year. In addition to that, the highest population of *C. carnea* was recorded in spring at stations (A) of the 1st year and (A&B) of the 2nd year and in autumn at station (B) of the 1st year. Inversely, the lowest populations were recorded during summer at stations (A&B) of the 1st year and (A) of the 2nd year and in winter at station (B) of the 2nd year.

Table 5: Catches of *Chrysopa carnea* Steph. at two different areas in Qena over a period of two years (2007-2009).

Months	2007-2008		2008-2009		Two years (2007-2009)		Total
	A	B	A	B	A	B	
March	22	8	41	3	63	11	74
April	48	20	64	15	112	35	147
May	68	0	71	6	139	6	145
June	0	0	7	2	7	2	9
July	3	5	0	1	3	6	9
August	19	17	0	0	19	17	36
September	31	17	15	2	46	19	65
October	72	37	66	22	138	59	197
November	15	13	70	0	85	13	98
December	26	39	11	1	37	40	77
January	0	0	0	1	0	1	1
February	0	0	0	0	0	0	0
Total	304	165	345	53	649	209	885

Fig. (8), shows that, *C. carnea* had three generations during the 1st year and two generations during the 2nd year. The first generation started from early March till late May. The 2nd generation was captured from early July till early November and the third generation occurred from early November till early January. Concerning the 2nd year at station (A) two generations were detected. The 1st one started from early March till early June. The 2nd generation occurred from late August till late November. At station (B) *C. carnea* had two generations too, the 1st generation started from early March till late May and the 2nd period started from late August till early November.

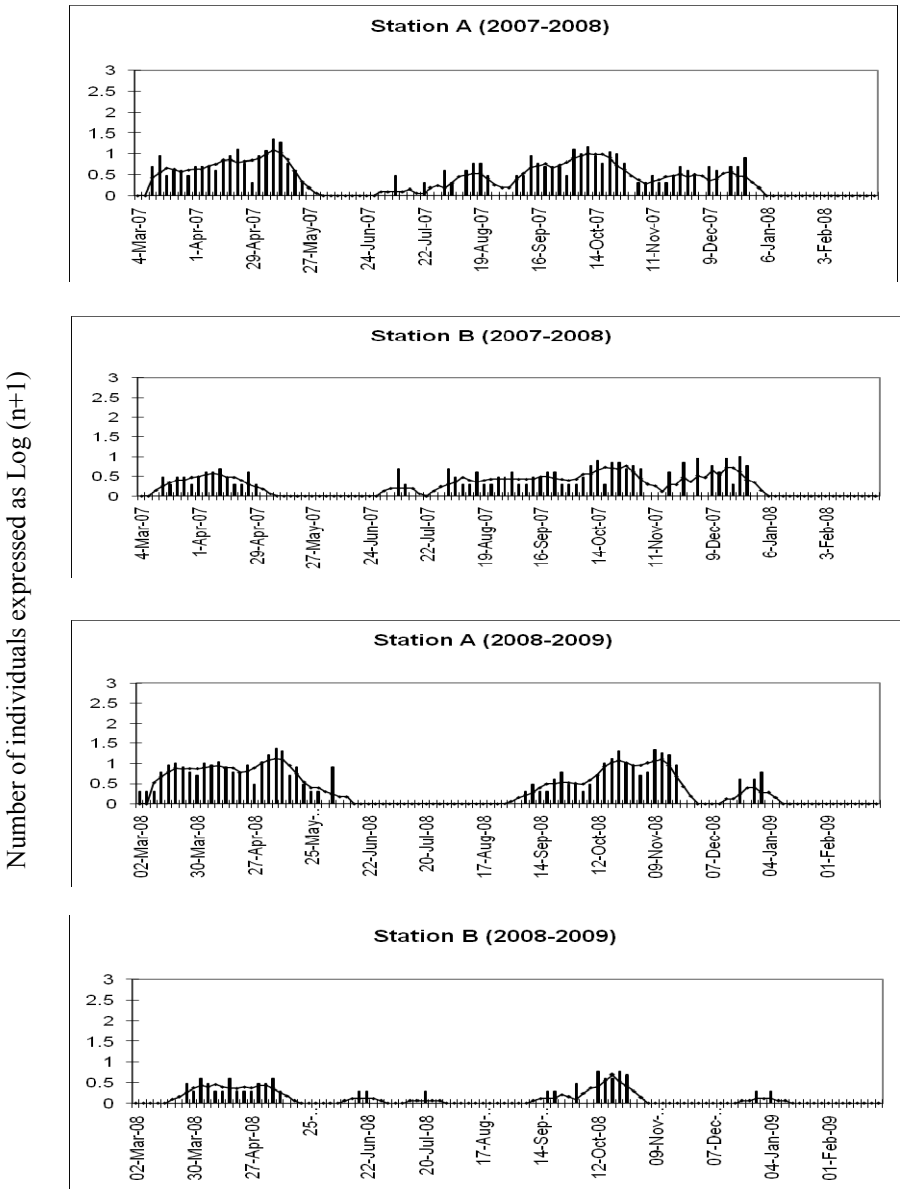

Fig. 8: The daily fluctuations of *Chrysopa carnea* (superimposed curve on histogram represents the smoothed 5-days running mean).

The relationship between population of *Chrysopa carnea* Stephens and *Aphis faba* Scopoli:

An examination of Figure (9), explains that, there is a relationship between *C. carnea* and *A. faba* the more increasing in the predator (*Chrysopa carnea*) the more decreasing in the populations of the preys (*Aphis faba*) Spring, Summer .So, there is a relationship between the two mentioned predators and preys populations where *C. carnea* population has a high quality predation on *A. faba* especially during summer, autumn. In contrast, the more decreasing in the population of predators (*C. carnea)* the more increasing in populations of preys (*A. faba)* during winter. The above results agree with Honek and Kraus (1981), Aly (1991), where found that the size of the catch of *C. carnea* increase, with the density of aphid populations.

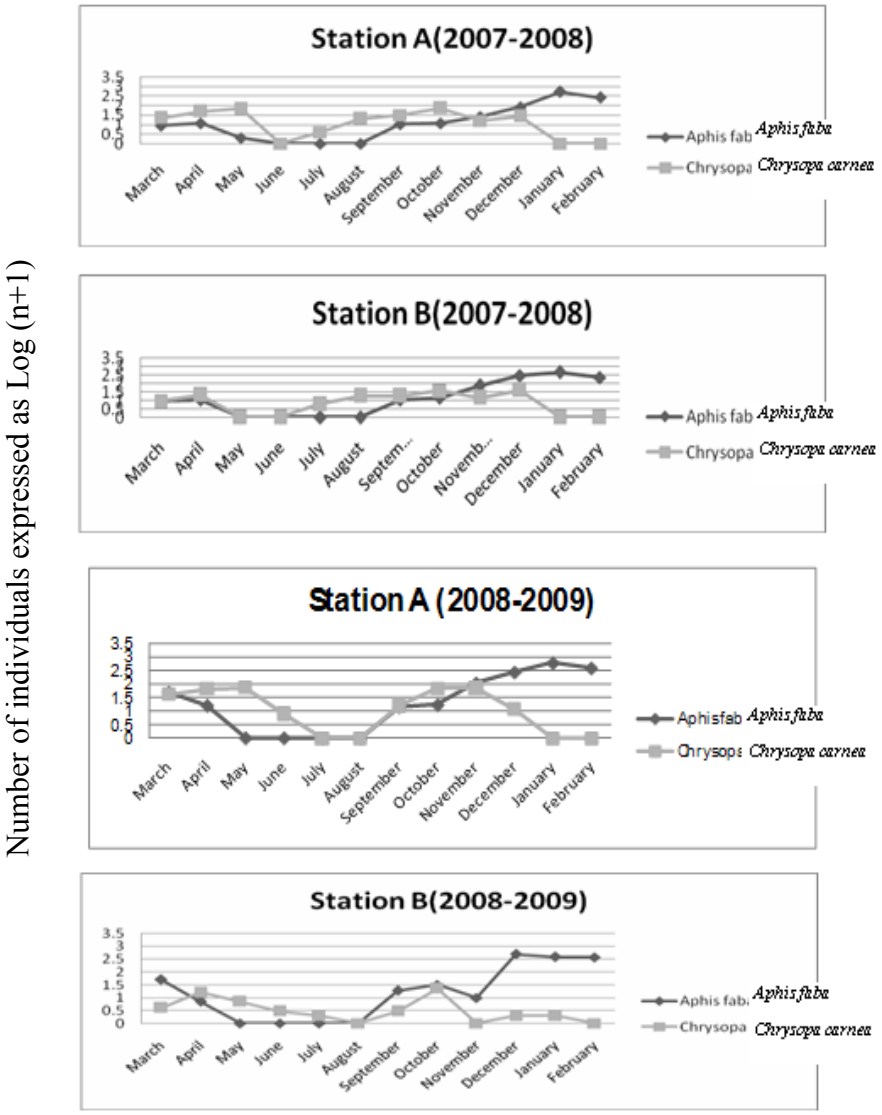

Fig. 9: The relationship between the catches of *Chrysopa carnea* and *Aphis faba* over a period of two years (March 2007- February 2009).

The relationship between catches of *Chrysopa carnea* Stephens and *Aphis gossypii* Glover:

An examination of Figure (10), explains that, a relationship between *C. carnea* Steph. and *A. gossypii* Glover where, the more decreasing in the predator (*C. carnea*) the more increasing in the populations of the preys (*A. gossypii*). So, there is a parallel relationship between the two mentioned predators and preys populations. This result disagree with Kabissa *et al.*, (1996) claims that *Chrysoperla* sp. occurred on cotton when both *H. armigera* and *A. gossypii* were present. This dissimilarity may be due to the difference in the methods of the study or the weather factors.

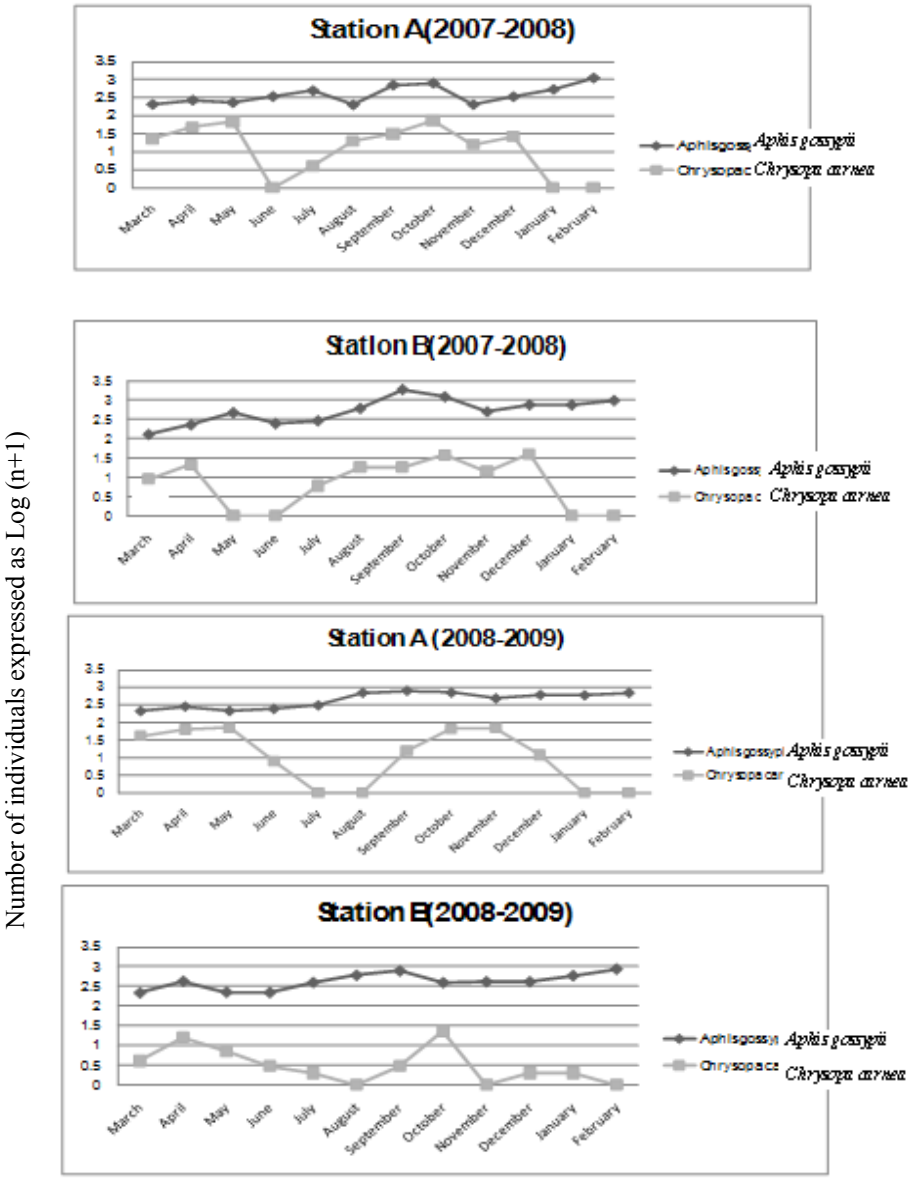

Fig. 10: The relationship between the catches of *Chrysopa carnea* and *Aphis gossypii* over a period of two years (March 2007_ February 2009).

The relationship between population of *Chrysopa carnea* Stephens and *Myzus persicae* Sulzer:

An examination of Fig. (11), indicated that, a relationship between *C. carnea* Steph. and *M. persicae* Sulzer where, the more increasing in the predator (*C. carnea* Steph.) the more decreasing in the population of the preys (*M. persicae* Sulzer) especially during autumn. In contrast, the more decreasing in the population of predators (*C. carnea* Steph) the more increasing in populations of preys (*M. persicae* Sulzer) during winter. In addition, the predator may be able to consume most of preys during autumn. However, they can be consuming less during spring.

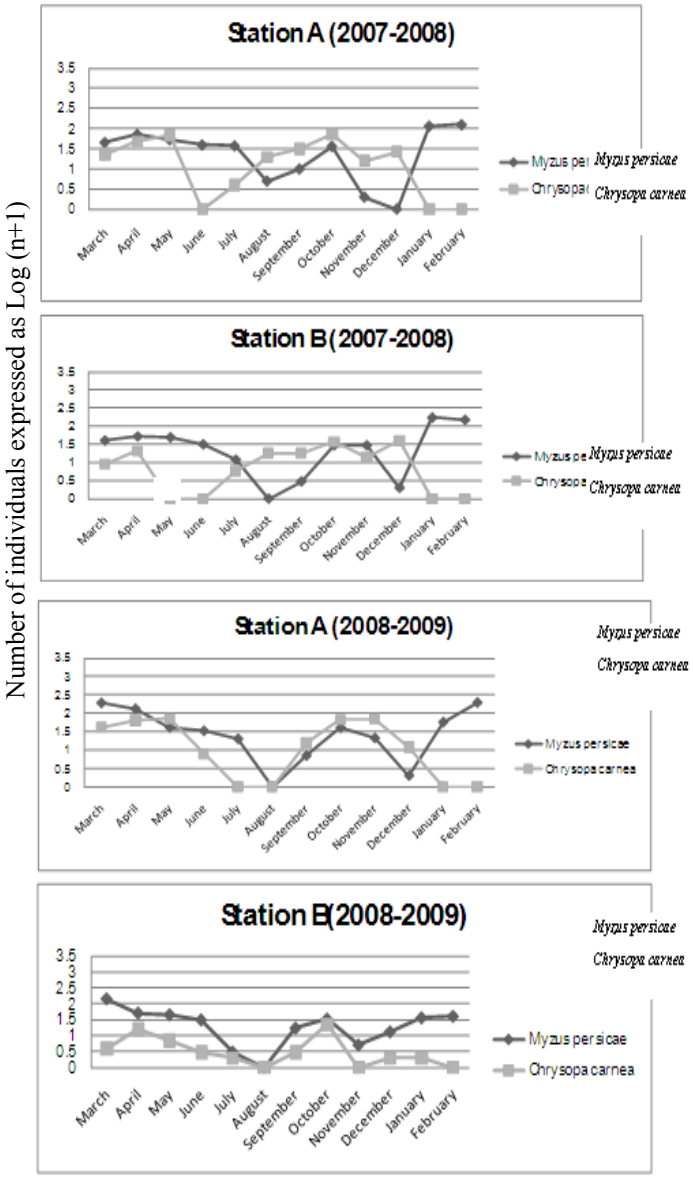

Fig. 11: The relationship between the catches of *Chrysopa carnea* and *Myzus persicae* over a period of two years (March 2007 February 2009).

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ARABIC SUMMARY

العلاقة بين بعض الحشرات المفترسة وحشرات المن فى محافظة

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تم أستخدام شبكة صيد الحشرات لمدة سنتين من مارس ٢٠٠٧ الى فبراير ٢٠٠٩ و ذلك لدراسة العلاقة بين المفترسات (هيبوداميا كونفيرجنس و كريزوبا كارنيا) و الفرائس (أفيس فابا، أفيس جوسيبى، ميزس بيرسيكا) فى مكانين مختلفين (أ ، ب) بمحافظة قنا.

وقد أظهر التوزيع الموسمى للمفترسات و الفرائس أن لهذه الحشرات ثلاث أجيال فى السنه. وقد درست العلاقه بين نشاط المفترسات (هيبوداميا كونفيرجنس و كريزوبا كارنيا) و الفرائس (أفيس فابا، أفيس جوسيبى ، ميزس بيرسيكا). و أوضحت النتائج أن هناك علاقة بين نشاط المفترسات و الفرائس حيث أن كلما أزداد عدد المفترسات قل عدد الفرائس لاغتذاء الأولى على الثانيه بالافتراس والعكس صحيح.