Population fluctuations of aphid pests and their insect predators on four different crops at Ismailia Government

El-Basha, N. A., A. A. Sarhan*, N. S. Mandour* and D. S. Abd El-Motaal****
* Department of Plant Protection, Faculty of Agriculture, Suez Canal University 41522, Ismailia, Egypt.
**Department of Biological Control, Plant Protection Research Institute, Agricultural Research Center, Egypt.

Received: *11/11/2013*

Abstract: This study aimed to investigate the population fluctuations of aphids and their associated insect predators in alfalfa, faba bean, cantaloupe fields as well as apricot orchards at Ismailia Governorate for two successive seasons. Data indicated that four aphid species were surveyed including *Aphis craccivora* Koch, *Acyrthosiphon pisum* (Harr.) on alfalfa plants, *A. craccivora* on faba bean stands, *Aphis gossypii* Glov. on cantaloupe plants and *Hyalopterus pruni* (Geof.) on apricot trees. The recorded aphidophagous predators were *Hippodamia variegata* (Goeze), *Coccinella undecimpunctata* Linn., *Coccinella septempunctata* Linn. (Coleoptera: Coccinellidae), *Chrysoperla carnea* (Steph.) (Neuroptera: Chrysopidae), *Syrphus corollae* Fabr. (Diptera: Syrphidae) and *Orius albidipennis* (Reut.) (Hemiptera: Anthocoridae). Obviously, coccinellid predators were the dominant predators associated with aphid infestations on all studied crops and *H. variegata* was the most abundant predator in all surveyed plants. Data showed complete synchronization between aphids populations and their associated predators during the course of this study.

Keywords: Ladybird beetles, *Acyrthosiphon pisum, Aphis craccivora*, *Hyalopterus pruni, Aphis gossypii*.

INTRODUCTION

Aphids (Homoptera: Aphididae) are among the most noxious pests worldwide. They are cosmopolitan pests in tropical growing areas as well as in commercial and hobby greenhouses in temperate regions (Rabasse and Wyatt 1985). Most damage of aphids has greatly increased in the recent years due to the extensive cultivation of crops and to extended use of pesticides that has led to environmental pollution as well as disruption of the natural balance between pests and their natural enemies (Amer and Marei, 2001). Therefore, biological control agents that attack these pests should be encouraged and managed in integrated programs.

The predatory ladybirds (Coccinellidae: Coleoptera) are widely recognized as important and successful biological control agents for many insect and mite pests such as aphids, mealy bugs, scale insects, whiteflies and several species of mites (Obrycki and Kring, 1998). They are commercially available in Europe and other countries to control scores of insect pests worldwide (Obrycki and Kring, 1998). Other non-coccinellid predators such as *Chrysoperla carnea*, *Orius* spp., syrphids, mirids etc. are also known to play crucial role in biological suppression of aphid populations on diverse range of crops in Egypt (El-Maghraby *et al.* 1989; Ali, 2008)

In this study, the population fluctuations of aphids and their associated aphidophagous predators were studied on alfalfa, faba bean, and cantaloupe fields as well as in apricot orchards at Ismailia Government during two successive seasons.

MATERIALS AND METHODS

The relationship between aphid species and their associated predators was studied in alfalfa, faba bean, and cantaloupe fields as well as in an apricot orchard during two successive seasons of 2009 and 2010 for all crops, except for faba bean that was surveyed during 2010 and 2011 seasons. Irrespective of number of samples per month, data are presented here as summation of collected insects per month.

On alfalfa plants:

The population fluctuations of aphids and their associated predators were carried out during the two seasons of 2009 and 2010 at Ismailia Agricultural Research Station. Bimonthly random samples were collected using sweep net method. Thirty double net strokes were practiced. Collected insects (aphids and predators) were placed in paper bags and transferred to the laboratory to establish their taxonomic affiliations and their populations.

On faba bean plants:

In this experiment, weekly count of aphid and their predators were performed using 20 random sample plants. These plants were examined directly. Numbers of aphids or insect predators were counted during the two successive seasons of 2010 and 2011.

On cantaloupe plants:

This survey was conducted during the periods from December to March in the two successive seasons of 2009 and 2010 at the Experimental Farm, Faculty of Agriculture, Suez Canal University. Here, 20 cantaloupe plants were chosen randomly to check the populations of aphids and their associated predators. Specimens of each predator were collected and placed in paper bags for further identifications.

On apricot trees:

This experiment was also conducted at the same Experimental Farm during the periods from March to June in the two successive seasons of 2009 and 2010. Weekly random samples were collected from three different tree levels (low, medium and upper level). Twelve apricot branches (10-15 cm in length) were taken from each of the three assigned levels of the selected trees from three apricot trees, and examined

carefully to record numbers of either aphids or their associated predators.

Data calculation:

Due to difficulties in identifying immature stages of coccinellids, they were recorded and presented as immature stages of coccinellids. Immature stages of non-coccinellid predators were easily identified; therefore they were included within the population of each non-coccinellid predator. The summation of the percentage of all components of the two predatory groups (coccinellids and non-coccinellids) equals 100%. The representative percentage of each predatory group or a given predator from the total collected predators was calculated as follow:

$$\text{Population \%} = \frac{\text{number of each predator or predatory group}}{\text{total number of collected predators}} \times 100$$

RESULTS

On alfalfa plants:

Aphids:

In this study, two aphid species *viz.*, *Acyrthosiphon pisum* (Harr.) and *Aphis craccivora* Koch. were recorded on alfalfa plants. The population of *A. pisum* appeared in the period from October to June of the following season, while that of *A. craccivora* covered the period from October to March of the following season. *A. pisum* showed two peaks in either of 2009 or 2010 season. In 2009 season, the first peak was observed at 1117 individuals in February, whereas the second peak appeared at 394 individuals in December. In 2010 season, the first peak was observed in March at 1112 individuals, while the second peak was observed at 180 individuals in December (Tables 1&2). However, *A. craccivora* had only one peak appeared in January 2009 season (88 individuals) and in February, 2010 season (97 individuals).

Predators:

Data in Tables 1 and 2 showed that the highest number of collected predators was 86 individuals in March, 2009 season and 107 individuals in April, 2010 season.

Three coccinellid predators were associated with aphid infestations on alfalfa plants. They were *Hippodamia variegata* (Goeze), *Coccinella undecimpunctata* Linn. and *Coccinella septempunctata* Linn. Data further indicated that the highest total number of coccinellid predators (69 individuals) was observed in March, 2009 constituting 80.2 % of total number of predators, and 87 individuals constituting 81.3 % of total collected predators in April, 2010 season (Tables 1&2). The highest number of collected immature coccinellids (28 individuals) was observed in March, 2009 season constituting 32.6% of total collected predators, whereas the highest number in 2010 season (25 individuals) was collected in April constituting 23.4% of total collected predators. The representative rate of *H. variegata* was highest in April, 2009 season constituting 64.3 % of the total number of recorded predators, whereas it peaked in the second season in September accounting for 100 % of the total number of recorded predators. As for *C. undecimpunctata,* it peaked in December 2009 and in November 2010 at 21.6 and 23.1% of the total collected predators, respectively. In case of *C. septempunctata,* its rate was highest at 5.4 % in May 2009 season and 14.3 % of total collected predators in December, 2010 season (Tables 1&2).

The non-coccinellid predators associated with aphid infestations on alfalfa were *Chrysoperla carnea* (Steph.), *Syrphus corollae* Fabr. and *Orius albidipennis* (Reut.). The highest number of non-coccinellid predators in 2009 was 25 individuals in June and 29 individuals in May, 2010 season, constituting 58.1 and 35.4%, respectively. Obviously, *C. carnea* was the dominant non-coccinellid predator in this study with 100 % of the total predators in January 2009 and 2010 seasons. Regarding *S. corollae*, its existing rate was highest at 12.8 % from total collected predators in March, 2009 season and 57.1 % in July, 2010 season. As for *O. albidipennis,* it was represented in 2009 season by the respective ratios of 8.9, 55.8 and 65 % of the total number of predators in May, June and July, while the corresponding percents in 2010 season were 15, 28 and 24.1 % in April, May and June (Tables 1&2).

On faba bean stands:

Aphids:

A. craccivora was the only aphid species that was recorded in faba bean fields. It showed only one peak (3869 individuals) in December 2010; however two peaks were observed in 2011 season; the first peak (2757 individuals) was in December, whereas the second one (184 individuals) appeared in March (Table 3).

Predators:

The highest numbers of the total collected predators were 493 individuals in December, 2010 season and 456 individuals in March, 2011 season. The coccinellid predators that were associated with aphid infestations on faba bean were *H. variegata*, *C. undecimpunctata* and *C. septempunctata*. Results showed that the highest number of coccinellid predators (410 individuals) was surveyed in December 2010 season, accounting 83.2% of the total number of predators. In 2011 season, the corresponding number and percent were 366 individuals and 94.6% in January. The highest numbers of collected coccinellid immature stages were 312 individuals in December, 2010 season and 283 individuals in January, 2011 season constituting 63.3 and 73.1% of total collected predators, respectively. The existence rate of *H. variegata* was highest in January 2010 and in December 2011at 40.7 and 21.1 % of the total number of collected predators, respectively. As for *C. undecimpunctata*, its highest rates were observed in November 2010 and 2011 at 30 % and 100 % of total collected predators, respectively. Moreover, *C. septempunctata* was the least abundant coccinellid predator at the rates of 5 % of total predators in November, 2010 season and 2 % in November, 2011 season (Table 3).

As for the non-coccinellid predators, the largest numbers of this predatory group were 141 and 133 individuals in March constituting 34.6 and 29.2% of the total collected predators in 2010 and 2011 seasons, respectively. *C. carnea* was represented by 65 and 16.8 % of total number of collected predators in November, December 2010 season and 12.3 and 5.4 % in December and January, 2011. Moreover, the representative rates of *S. corollae* were 54.9 and 34.6% of the total collected number of predators in February and March, 2010 opposed to 36.6 and 29.2 % in February and March, 2011 season (Table 3).

On cantaloupe plants:

Aphids:

Aphis gossypii was the only surveyed aphid species from cantaloupe plants at Ismailia Governorate. There was only one peak for *A. gossypii* in March, 2009 season (4326 individuals) and in March, 2010 season (4144 individuals), respectively (Table 4).

Predators:

As shown in Table 4, the numbers of total collected predators were highest at 531 and 576 individuals in March of 2009 and 2010 seasons, respectivly. The coccinellid predators that were associated with aphid infestations on cantaloupe plants were *H. variegata*, *C. undecimpunctata* and *C. septempunctata*. Results showed that the highest numbers of coccinellid predators were surveyed in March 2009 (522 individuals) and in March, 2010 seasons (537 individuals) constituting 98.3 and 93.2% of the total number of collected predators, respectively. As for total immature stages of coccinellid predators, they peaked in March, 2009 of the respective seasons at 389 individuals and 339 individuals, constituting 73.3 and 58.9%. The representative rates of *H. variegata* were highest in April 2009 and 2010, being 27.5 and 40.7 % of the total number of collected predators, respectively. Regarding *C. undecimpunctata,* its rates were highest at 5.6 % of the total number of collected predators in January, 2009 season and 4.5% in February, 2010 season. On other hand, the highest rates of existing *C. septempunctata* appeared in January, 2009 season and February, 2010 season; being in respective 16.7 % and 3.7% of the total number of predators (Table 4).

Pertaining to the non-coccinellid predators, the population of this predatory group peaked (30 individuals) in April 2009 and in March 2010 season (39 individuals) forming 9.8% and 6.8% of the total number of collected predators, respectively. *C. carnea* formed 50 and 6.8 % of total non-coccinellid predators in January and February, 2009, respectively; opposed to the respective rates of 9 and 4.7 % in February and March, 2010. *S. corollae* population was observed only in March and April; constituting 1.7 and 9.8 % of the total number of collected predators in 2009 season and 2.1 and 3.1 % in 2010 season, respectively.

On apricot trees:

Aphids:

Hyalopterus pruni was the only aphid species that was observed infesting apricot trees during the course of this study. It showed only one peak in April of the two seasons; being represented by 4608 and 3003 individuals in 2009 and 2010 seasons, respectively (Table 5).

Predators:

The total number of predators was the highest in April in 2009 and 2010 season at 460 and 412 individuals, respectively. Number of coccinellid predators was highest in April, 2009 at 377 individuals representing 82% of the total number of collected predators and 312 individuals in April 2010 season representing 75.7%. As for total immature stages of coccinellid predators, they peaked in April, 2009 of the respective seasons at 317 and 251 individuals, constituting 68.9 and 60.9%. *H. variegata* was highest in June, 2009 with 100 % of the total number of collected predators and 43.8 % in May 2010. As for *C. undecimpunctata,* its population in 2009 season was greatest (2.8 %) in April, 2009 and 7.8 % of the total number of collected predators in March, 2010 (Table 5).

The non-coccinellid predators that were associated with aphid infestations on apricot trees were *C. carnea* and *S. corollae*. The total populations of this predatory group were highest (83 individuals) in April, 2009 and 100 individuals in April, 2010 constituting 18 and 24.3% of total collected predators, respectively. As for *C. carnea*, its existence rate was greatest at 17.1 and 17.6 % of total number of collected predators in March, 2009 and 2010 seasons, respectively. Regarding *S. corollae*, its highest existing rates on apricot trees were recorded in May in 2009 and 2010 seasons at 26.2 and 27% respectively (Table 5).

Synchronization between populations of aphids and their predators:

One of the most important factors affecting the efficacy of any predator is the existence in large numbers when its prey outbreaks, which is known as prey-predator synchronization. This synchronization should lead to the reduction in prey population. Indeed, this was the case in the relationships between aphids and their insect predators during the course of this study. In this study, *A. pisum* showed two peaks, whereas *A. craccivora* showed one peak on alfalfa plants synchronized with two peaks of its insect predators. Pertaining to *A. craccivora* in faba bean fields, *A. craccivora* showed only one peak at 3869 individuals that was accompanied by a peak of its predators (493 individuals) in December 2010 coincided with weather factors of 15.4 ºC and 56.5% R.H. in 2010 season. The same trend of synchronization between *A. craccivora* and its predators on faba bean stands was also observed in 2011 season. Also, *A. gossypii* and its associated predators peaked at the same time in March in both studied seasons coincided with weather conditions on average of 18.2 ºC and 55.6% R.H in the first season and 18 ºC and 55% R.H. in the second one. Similarly, *H. pruni* and its insect predators showed concrete synchronization and peaked in April in both studied seasons coincided with weather factors of 22.7 ºC and 54.1% R.H. in 2009 season and 21.9 ºC and 50.9% R.H. in 2010 season.

Table (1): Total monthly populations of *A. pisum* and *A. craccivora* and their associated insect predators in alfalfa fields at Ismailia Governorate during 2009 season.

Inspection time	2009														
	A. pisum	***A. craccivora***	**Total predators**	**Total coccinellid predators**		**Total coccinellid immature stages**		***H. variegata***	***C. undecimpunctata***	***C. septempunctata***	**Total non-coccinellid predators**		***C. carnea***	***S. corollae***	***O. albidipennis***
	No.	No.	No.	No.	%	No.	%	%	%	%	No.	%	%	%	%
January	812	88	7	0	0	0	0	0	0	0	7	100	100	0	0
February	1117	79	29	21	72.4	8	27.6	34.5	10.3	0	8	27.6	27.6	0	0
March	744	25	86	69	80.2	28	32.6	46.5	1.2	0	17	19.8	7	12.8	0
April	193	0	42	38	90.5	11	26.2	64.3	0	0	4	9.5	0	9.5	0
May	55	0	56	44	78.6	7	12.5	60.7	0	5.4	12	21.4	0	12.5	8.9
June	0	0	43	18	41.9	0	0	41.9	0	0	25	58.1	0	2.3	55.8
July	0	0	20	7	35	1	5.0	30	0	0	13	65	0	0	65.0
August	0	0	2	2	100	1	50.0	50	0	0	0	0	0	0	0
September	0	0	4	4	100	1	25.0	75	0	0	0	0	0	0	0
October	37	26	4	4	100	1	25.0	75	0	0	0	0	0	0	0
November	193	49	18	18	100	11	61.1	27.8	11.1	0	0	0	0	0	0
December	394	66	74	67	90.5	40	54.1	10.8	21.6	4.1	7	9.5	9.5	0	0

Table (2): Total monthly populations of *A. pisum* and *A. craccivora* and their associated insect predators in alfalfa fields at Ismailia Governorate during 2010 season.

Inspection time	2010														
	A. pisum	*A. craccivora*	Total predators	Total coccinellid predators		Total coccinellid immature stages		*H. variegata*	*C. undecimpunctata*	*C. septempunctata*	Total non-coccinellid predators		*C. carnea*	*S. corollae*	*O. albidipennis*
	No.	No.	No.	No.	%	No.	%	%	%	%	No.	%	%	%	%
January	527	77	10	0	0	0	0	0	0	0	10	100	100	0	0
February	950	97	13	2	15.4	0	0	15.4	0	0	11	84.6	84.6	0	0
March	1112	47	94	78	83.0	24	25.5	54.3	3.2	0	16	17.0	9.6	7.4	0
April	312	3	107	87	81.3	25	23.4	53.3	1.9	2.8	20	18.7	0	3.7	15.0
May	124	0	82	53	64.6	11	13.4	47.6	0	3.7	29	35.4	0	7.3	28.0
June	22	0	29	14	48.3	0	0	48.3	0	0	15	51.7	0	27.6	24.1
July	0	0	7	3	42.9	0	0	42.9	0	0	4	57.1	0	57.1	0
August	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
September	0	0	1	1	100	0	0	100	0	0	0	0	0	0	0
October	0	13	5	5	100	0	0	80.0	20.0	0	0	0	0	0	0
November	35	34	13	13	100	2	15.4	53.8	23.1	7.7	0	0	0	0	0
December	180	48	14	11	78.6	3	21.4	21.4	21.4	14.3	3	21.4	21.4	0	0

Table (3): Total monthly populations of *A. craccivora* and its associated insect predators in faba bean fields at Ismailia Governorate in 2010 and 2011 seasons.

Inspection time	*A. craccivora*	Total predators	Total coccinellid predators		Total coccinellid immature stages		*H. variegata*	*C. undecimpunctata*	*C. septempunctata*	Total non-coccinellid predators		*C. carnea*	*S. corollae*
2010													
	No.	No.	No.	%	No.	%	%	%	%	No.	%	%	%
November	921	20	7	35.0	0	0	0	30.0	5.0	13	65.0	65.0	0
December	3869	493	410	83.2	312	63.3	19.1	0	0.8	83	16.8	16.8	0
January	61	135	135	100	77	57.0	40.7	0.7	1.5	0	0	0	0
February	75	133	60	45.1	36	27.1	15.8	2.3	0	73	54.9	0	54.9
March	128	408	267	65.4	189	46.3	19.1	0	0	141	34.6	0	34.6
2011													
	No.	No.	No.	%	No.	%	%	%	%	No.	%	%	%
November	107	2	2	100	0	0	0	100	0	0	0	0	0
December	2757	284	249	87.7	186	65.5	21.1	1.1	0	35	12.3	12.3	0
January	1035	387	366	94.6	283	73.1	20.4	0	1.0	21	5.4	5.4	0
February	0	202	128	63.4	92	45.5	12.9	3.0	2.0	74	36.6	0	36.6
March	184	456	323	70.8	228	50.0	20.8	0	0	133	29.2	0	29.2

Table (4): Total monthly populations of *A. gossypii* and its associated insect predators on cantaloupe plants at Ismailia Governorate in 2009 and 2010 seasons.

Inspection time	2009												
	A. gossypii	Total predators	Total coccinellid predators		Total coccinellid immature stages		*H. variegata*	*C. undecimpunctata*	*C. septempunctata*	Total non-coccinellid predators		*C. carnea*	*S. corollae*
	No.	No.	No.	%	No.	%	%	%	%	No.	%	%	%
January	0	18	9	50.0	5	27.8	0	5.6	16.7	9	50.0	50.0	0
February	1774	281	262	93.2	219	77.9	11.4	2.1	1.8	19	6.8	6.8	0
March	4326	531	522	98.3	389	73.3	25.0	0	0	9	1.7	0	1.7
April	1065	305	275	90.2	191	62.6	27.5	0	0	30	9.8	0	9.8
Inspection time	2010												
	A. gossypii	Total predators	Total coccinellid predators		Total coccinellid immature stages		*H. variegata*	*C. undecimpunctata*	*C. septempunctata*	Total non-coccinellid predators		*C. carnea*	*S. corollae*
	No.	No.	No.	%	No.	%	%	%	%	No.	%	%	%
January	0	0	0	0	0	0	0	0	0	0	0	0	0
February	357	134	122	91.0	68	50.7	32.1	4.5	3.7	12	9.0	9.0	0
March	4144	576	537	93.2	339	58.9	34.2	0.2	0	39	6.8	4.7	2.1
April	516	162	157	96.9	91	56.2	40.7	0	0	5	3.1	0	3.1

Table (5): Total monthly populations of *H. pruni* and its associated coccinellid and non-coccinellid predators in apricot orchards at Ismailia Governorate in 2009 and 2010 seasons.

Inspection time	2009											
	H. pruni	Total predators	Total coccinellid predators		Total coccinellid immature stages		*H. variegata*	*C. undecimpunctata*	Total non-coccinellid predators		*C. carnea*	*S. corollae*
	No.	No.	No.	%	No.	%	%	%	No.	%	%	%
March	1428	105	84	80.0	72	68.6	10.5	1.0	21	20.0	17.1	2.9
April	4608	460	377	82.0	317	68.9	10.2	2.8	83	18.0	0	18.0
May	963	267	197	73.8	164	61.4	11.6	0.7	70	26.2	0	26.2
June	0	2	2	100	0	0	100	0	0	0	0	0
Inspection time	**2010**											
	H. pruni	Total predators	Total coccinellid predators		Total coccinellid immature stages		*H. variegata*	*C. undecimpunctata*	Total non-coccinellid predators		*C. carnea*	*S. corollae*
	No.	No.	No.	%	No.	%	%	%	No.	%	%	%
March	2850	102	79	77.5	47	46.1	23.5	7.8	23	22.5	17.6	4.9
April	3003	412	312	75.7	251	60.9	13.8	1.0	100	24.3	1.0	23.3
May	281	89	65	73.0	26	29.2	43.8	0	24	27.0	0	27.0
June	0	0	0	0	0	0	0	0	0	0	0	0

DISCUSSION

In this study, two aphid species were recorded from alfalfa plants. These species were *A. pisum* and *A. craccivora.* These findings are in agreement with those reported earlier from alfalfa fields (Schotzko and Keeffe, 1989; Mendes *et al.,* 2000). *H. pruni* is the only aphid species that was recorded from apricot trees during this study and its appearance was observed during the period from January to June. The same finding was reported in Egypt (Ali, 2008) and abroad (Blackman and Eastop, 1984; Atilhan *et al.,* 1999; Ozturk *et al*., 2004). In this study, *H. pruni* showed only one peak on apricot trees in both studied seasons; however, Ali (2008) found that *H. pruni* infested peach trees at Sharqia Governorate with 3, 4 and 2 peaks in 2001, 2002 and 2003 seasons, respectively. The differences might be attributed mainly to the differences in the host plant (Ali, 2008), the study area in addition to the weather conditions.

Moreover, *A. gossypii* was recorded from cantaloupe plants. These findings are in harmony with those reported earlier by in several studies (*e.g.* El-Maghraby *et al.* 1989; Metwally, 1998; Kinawy *et al*., 2008) in which *A. gossypii* was considered as the main insect pest infesting cantaloupe crop in Egypt. On the other hand, faba bean crop is attacked by many insect pests in Egypt, especially *A. craccivora* and *A. fabae* (Metwally, 1998; El-Defrawi *et al.,* 2000; Abou-El-Hagag and Salman, 2001). Moreover, *A. craccivora* was the only aphid species recovered from faba bean plants. *A. fabae* is not recorded during the course of this study at Ismailia Governorate. This might be due to the smaller experimental plots used for this survey.

In this study, the ladybird beetles that were collected were *H. variegata*, *C. undecimpunctata* and *C. septempunctata*. These findings are in agreement with those reported by Ali (2008) who recorded several predators associated with *H. pruni* infestation on peach trees including *Cydonia vicina* var. *nilotica*, *C. undecimpunctata*, *C. septempunctata*, *C. carnea*, *S. corollae*, and *A. aphidimyza.* Other native coccinellids such as *Scymnus interuptus*, *S. syriacus*, *Rodalia cardinalis*, *Hippodamia tredecimpunctata*, *Cydonia vicina* var. *nilotica* and *Cydonia vicina* var. *isis* were not observed during the course of this study. The last two ladybird beetles were very common on broad bean stands during 2005-2006 (Mandour *et al*., 2006). The reason for the disappearance of these ladybird beetles is uncertain; however, it may be due to the small size of experimental plots (approximately10000 m^2 for each studied crop), and the poor vegetative cover in the surrounding area. The disappeared beetles were observed in Egypt on other crops, such as cotton, corn and on other ornamental plants such as ficus (Metwally, 1998; Mandour *et al.*, 2006).

As for the recorded predators on cantaloupe plants, these results are in harmony with those reported by El-Maghraby *et al.* (1989) who recorded several insect predators feeding on *A. gossypii* on cantaloupe and cucumber plants at El-Khattara district, Sharqia Governorate including *C. undecimpunctata, C. septempunctata, C. carnea, S. corollae* and *O. albidipennis*.

To summarize, predatory coccinellids are the most important and abundant predators associated with aphid pests in the four studied crops. Concrete synchronization was observed between aphid populations and their associated predators during the two studied seasons and on the four selected crops that indicate the crucial role of these predators in the biological regulation of aphid populations in the Egyptian agro ecosystem. Although *H. variegata* is newly recorded in Egypt (Mandour *et al.*, 2011; Mandour, 2013), this species has become the most abundant coccinellid predators in Qalyobia and Sharkia (Bahy-Eldin, 2006) and Ismailia and Sinai Peninsula (Abdel-Motaal, 2011). This is mainly due to the high predation and reproductive capacities of *H. variegata* as well as its wide host range (Sarhan *et al*., 2011; Mandour *et al.*, 2011; Mandour, 2013).

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