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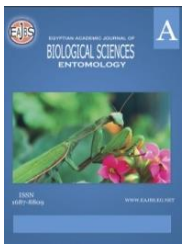

Population Fluctuations of Two Aphids and Their Main Predators in Broad Bean plants in Qalyubiya Governorate

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ABSTRACT

Field experiments were carried out at Qaha, Qalyubiya Governorate, throughout 2017-2018 and 2018-2019 seasons to study population fluctuations of *Aphis craccivora* (Koch) and *Aphis fabae* Scopoli infesting broad bean plantations, and two associated predators addition, effects of certain weather factors (daily mean temperatures and daily mean R.H.). *A. craccivora* had two peaks both seasons (1st week of December and 3rd week of January) and (1st week of December and 1st week of January) in the 1st and 2nd seasons respectively. *A. faba* showed three peaks in 1st season (2nd week of December, last week of December and 1st week of March). while 2 peaks in the second season (1st week of December. and end of December.)

Population fluctuations of *A. craccivora* and *A. faba* and associated predators were higher in the 1st season than the second season and *C. undcimpunctata* was dominant than *C. carneaea*.

A simple correlation between *A. craccivora and C. undcimpunctata* showed a significant positive correlation in both seasons while with *C. carneaea* was insignificant negative in the 1st season and positive in the 2nd season, and the relationship between *A. fabae* was negative in both seasons with the two predators. The relationship between A. *craccivora* and daily mean temperature show negative insignificant relation during the 1st season while was significant in the 2nd season. Also, the simple correlation with *A. fabe* was insignificant negative in both seasons .as well as A. *craccivora* and *A. fabe* showed the insignificant positive value in both seasons with relative humidity.

INTRODUCTION

The Faba bean (*Vicia faba* L.) is an important crop for people in several regions of the world. It has gained particular importance as an available winter legume crop in Egypt. This is due to its high content of protein and it is considered one of the most public foods in Egypt. Faba
bean has been considered as a meat extender or substitute (Ebadah *et al*., 2006).

Bean crops are subjected to attack by sucking pests, especially aphids. Which causes serious damage, either directly by sucking plant juices or indirectly as vectors of virus diseases (Abdel-Alim, 1994; Mahmoud *et al*., 2017; El- Sarand *et al*., 2019 and

Khodeir *et al*., 2020). The natural enemies and climatic conditions are the most important factors affecting the population dynamics of insect pests (Nuessly *et al*., 2004 and Abdelhalim 2020).

Most farmers in Egypt have become familiar with a range of insecticides that they can use to increase their yields and profits. Hazard uses of insecticides could kill beneficial insects such as natural enemies and bees which pollinate many of our crops (El-Heneidy *et al.,* 1991). Three sprays at 15-20-day intervals are recommended for the control of *Aphis craccivora* in the different regions of Egypt. (El-Defrawi and El-Harty, 2009).

Either ecological information about this insect or its mainly associated predators in the field is essential for developing an integrated pest management program. Therefore, the present work was conducted to clarify the incidence and population fluctuation of two species of aphids cowpea aphid *Aphis craccivora* Koch., and black bean aphid *Aphis fabae* Scopli, in addition, predators associated. The lady beetle *Coccinella undcimpunctata* and Aphid lion *Chyrsoperla carneaea* moreover whether factors in Qaha, Qalyubiya Governorate were delt during 2017- 2018 and 2018-2019 seasons.

MATERIALS AND METHODS

This study was conducted at Qaha, city, throughout two seasons, 2017-2018 and 2018-2019 aimed to follow up the population dynamics of Aphis *craccivora* and *A. fabae* on winter faba bean (*Vicia faba* L.) crop. An experimental area equal to about 750 m^2 was divided into three plots each seeded with Sakha 3 variety on the 3rd of October in both seasons. The normal agricultural practices were followed regularly without any chemical control. A random sample of fifteen plants (5 from each plot) was chosen from the 3rd week of November until the 1st week of April for each plot to count by Lens all aphids (nymphs and adults). At the same time, different developmental stages of *Coccinella undcimpunctata* and *Chyrsoperla carneaea* were also taken.

Effects of temperature and relative humidity on the population fluctuation of aphids were taken in the present study, the recorded daily means were obtained from (Agric. Res. Station) for the whole period of study, then fluctuations of the insects were calculated and expressed in terms of simple correlation coefficient (r).

The statistical analysis using Simple correlation to correlate between the average weekly number of insects and weather factors, natural predators, according to. (SAS Institute, 2003).

RESULTS AND DISCUSSION

The results tables of this study were found in tables (1&2) and illustrated in Figures (1&2).

A-Fluctuation of aphids

The results showed that, *Aphis craccivora* infested (111 individual /15 plants) in the first week of December. The insect number higher to 442ind.after one week represented the first peak. The infestation still fluctuates between this number and 921 ind. represented a second peak, till the third week of January. The infestation decreased until the end of the season, ranged 25-120 ind. the results, in general, showed two peaks for *A. craccivora*on broad bean plants, in the first season, 442 and 921 ind. at the beginning of Dec. and January, respectively.

As for the second aphid sp. *A. fabae* the results pointed to the appearance of this

insect as 85 ind. was recorded at the first of Dec. it gradually increased to reach the first peak (298 ind.) through the beginning of Dec. the number relatively decreased but increased again to 245 ind. Represented a second peak for this insect.

The infestation gradually decreased to reach the lowest value 0.0 ind. At the first of Feb. the insect number increased again to make its third weak peak as 115 ind. at the first of March. The numbers gradually go down to the last infestation level as 22.0 ind. at the first of April.

It is cleared from the results that, *A. fabe* infested fabe bean plants in lower number when compared with the other species. While its numbers ranged 22-298 ind. that of *A. craccivora* was 25-921 ind. with a grand mean of 94 and 287 ind., respectively in the season.

The results of insect infestation in the second season, pointed that it was gradually lower than in the first season, ranged 15-915 with a mean 179 ind. in the case of *A. craccivora* and 15-210 with a mean of 66 ind. for *A. fabe*. Infestation with the first species started (15 ind.) one week earlier than the second *sp.*45ind.

Table 1: Weekly mean numbers of Aphid species and their predators /5 plants during 2017-2018 seasons.

Sampling date	Aphids		Predators		Temp. (C°)	RH (%)
	A. craccivora	*A. fabae*	*C. undcimpunctata*	*C.carnea*		
17/11/2017	0	0	0	0	20.4	60.45
24/11/	0	0	0	0	18.47	70.22
01/12/	111	85	0	0	16.77	68.21
08/12/	442	298	11	0	17.54	68.21
15/12/	360	210	10	0	16.25	69.25
22/12/	897	187	55	0	18.6	71.7
29/12/	752	245	75	0	16.3	68.5
5/1/2018	921	103	174	11	14.5	61.2
12/01/	498	89	114	14	15.4	67.2
19/01/	687	22	74	19	15.1	63.3
26/01/	67	0	72	22	14.8	58.5
02/02/	120	0	131	28	13.5	71.1
09/02/	57	18	45	44	17.8	61.6
16/02/	89	42	58	77	17.8	67.3
23/02/	77	57	55	48	16.9	58.6
02/03/	45	115	28	32	18.6	54.9
09/03/	88	66	22	12	22.7	46.8
16/03/	57	112	10	11	19.45	58.1
23/03/	89	75	22	25	22.22	42.1
30/03/	77	42	0	22	21.4	46.4
06/04/	25	22	0	0	19.94	56.9
total	5459	1788	956	365		
Grand mean	287	94	60	28		

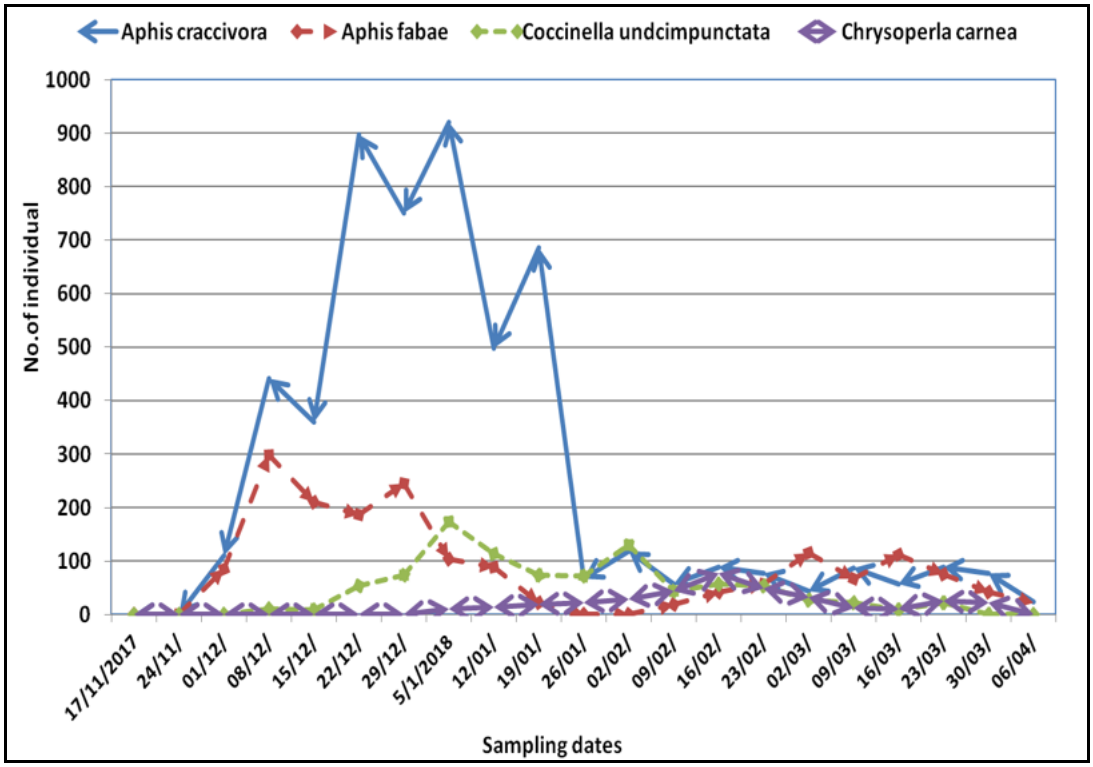

Fig.1: mean numbers of Aphid and their predators during 2017-2018 seasons.

With regard to *A. fabe*. Infestation, the results, in the same season, showed in lower numbers, 66 ind. as a grand means the infestation started with 45 ind. and jumped to 210 ind. through a week a peak (8/12/18). Decreased gradually to 111ind. (22/12/18) then increased sharply to 162 ind. (a peak) at end of Dec. number go down till the end of the season. these findings showed that *A. fabe* had relatively two wear peaks, 210 and 162 ind. through Dec. The previous results are in agreement with those of Mousa and Metwally (2014), *A. craccivora* is considered a destructive pest that invades broad bean plant causing serious damage throughout the different stages. Also, *A. craccivora* infest seriously broad bean at the upper part of the plant during the vegetative stage. Li *et al.* (1994) Helal *et al.* (1996) and Shalby *et al*. (2012) found that the population of the same insect was obviously higher on young plants than on older ones.

In general, in agreement with the previous results, Saleh *et al*. (1972) mentioned that aphids on faba bean reached their maximum during March. In addition, Ali and Rizk (1980) revealed that *A. craccivora* was found during the whole season, and reached its maximum numbers during the pod development stage. On the other side, Rizk *et al*. (1981) showed that the same species reached its maximum by the end of February and disappeared from broad bean field by the end of March, which was somewhat different from the present results.

B. Fluctuation of predators:

Populations of the two survived predators, in the first season are shown in table (1) and drawn in figure (1)

The results revealed that, *C. undcimpunctata* appeared two months earlier than *C.carneaea*.in the same time, the former predator showed the highest increased, 10-174 ind. with a mean of 60 ind. the other predator ranged 11-77 ind. with a mean of 28 ind. only .number of *C. undcimpunctata* increased from 10 ind. to reach 174 ind. represented the at the first Jun. they decreased gradually to 72 ind. but increased again to 131 ind. recorded another peak at the first of Feb. the predator number decreased gradually and

finely disappeared by the end of March. The same trend was noticed with *C.carnea* individuals they began low (11 ind.) at the first of Jan. and increased gradually to record 77 ind. represented a peak at half of Feb. The individuals decreased, from the next week (48 ind.) until reached its lowest incidence (0.0) in April.

Table 2: Weekly mean numbers of Aphid species and their predators /5 plants during 2017-2018 seasons.

Sampling date	Aphids		Predators		Temp. (C°)	RH (%)
	A. craccivora	*A. fabae*	*C. undcimpunctata*	*C.carnea*		
17/11/2018	0	0	0	0	18	65
24/11/	15	0	0	0	16	62.5
01/12/	24	45	24	0	16.4	46.5
08/12/	312	210	38	0	15.74	65
15/12/	189	118	40	0	16.74	59.68
22/12/	40	111	77	0	15.8	65.2
29/12/	348	162	114	0	14.7	67.1
5/1/2019	915	96	210	10	13.3	53.0
12/01/	741	25	99	18	12.4	57.4
19/01/	444	55	75	22	13.0	60.2
26/01/	110	41	88	28	14.2	51.3
02/02/	78	22	112	37	14.8	50.7
09/02/	41	22	72	45	14.7	62.6
16/02/	12	39	60	87	13.9	57.8
23/02/	45	28	51	34	15.8	57.2
02/03/	73	68	22	10	15.6	52.1
09/03/	65	44	10	10	16.4	67.7
16/03/	66	34	12	0	17.5	54.4
23/03/	45	15	0	0	18.9	58.1
30/03/	23	0	0	0	18.08	50.4
06/04/	12	0	0	0	20.67	51.7
total	3598	1135	1104	301		
mean	179	66	69	30		

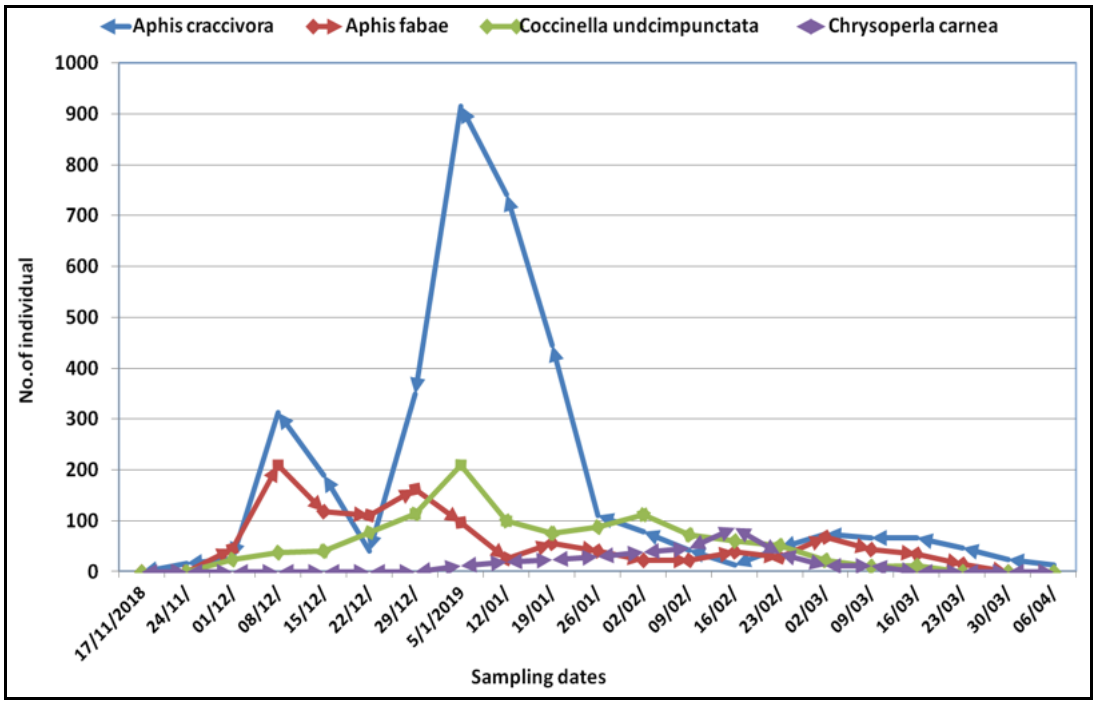

Fig.2: mean numbers of Aphied and their predators during 2018-2019 seasons.

The previous results pointed to that, *C. undcimpunctata* was more increase than *C.carnea* and at the same time had two peaks instead of one only for the other predator. In the second season the obtained results showed that, *C. undcimpunctata* had, as in the first season, a higher number when compared with *C.carnea* . while the first insect ranged 12-210 ind. with mean 69 ind. the later ranged 10-87 ind with mean of 30 ind. only. At the same time, *C. undcimpunctata* started about one month earlier than the second predator with 24 ind. and increased to record a peak (210 ind.) at the first week of Jan. number of individuals decreased also gradually to 88 ind. at the four the week of Jan. the individuals increased again in the next week to record 112 ind. as a second peak.

C. carnea ind. appeared later than *Coccinella* spp. as in the first season. it appeared as 10 ind. at the first of Jun. and increased gradually to record its peak as 87 ind. at 16 of Feb. the individuals decreased gradually and disappeared finally at half of March. The results of the second season pointed to that, *C. undcimpunctata* had, as in the first season, two peaks while the second predator had only one peak. This result agrees with that of Srikanth and Lakkundi, (1990) they found the activity of predatory coccinellids started 1 to 3 weeks after the appearance of aphids. Abdel Khlek *et al*. (2018) showed that *C. undecimpunctata* was the most dominant predator in faba bean fields.

C- Statistical Analysis:

Simple correlation values were calculated between aphids, predators, and climatic factors. The values are found in table (3) they revealed that the relationship between *A.craccivora* and *C. undcimpunctata* recorded a significant positive correlation in both seasons, while with *C.carnea* was insignificant negative in 1st season but was positive in the 2nd season. Also, the relationship between *A. fabae* and the two predators was insignificant negative in both seasons. The current results are similar to those shown by Abdelhalim (2020), the relationship between the two ladybirds population and the aphids populations was a positive correlation during two seasons. Also, the relationship between *C. carnea* population and the aphids population was a positive correlation during two seasons.

Table 3: simple correlation of population for *A. craccivora , A. fabae* and its predators as well as climatic factors

Predators, C° &R.H% / Pest	*C. undcimpunctata*		*C. carnea*		Temp.(C°)		R.H. (%)	
	2017-2018	2018-2019	2017-2018	2018-2019	2017-2018	2018-2019	2017-2018	2018-2019
Aphis craccivora	0.5736	0.7487	-0.3177	0.3631	-0.4395	-0.6185	0.4045	0.0207
Aphis fabae	-0.2969	-0.0682	-0.3778	-0.2116	-0.0662	-0.2812	0.2885	0.3890

As for the effect of daily temperature relative humidity, data in the same table revealed that, the relation between temperature and both pests was significantly negative. This relation with relative humidity was significantly positive in both seasons. These results are similar to that El-Mezaien (1996); El-Khouly et al. (1998) and Mahmoud et al. (2017) humidity positively affected *A. craccivora* population on faba bean plants.

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ARABIC SUMMARY

تذبذب التعداد لنوعين من المن والمفترسات الرئيسية في نباتات الفول في محافظة القليوبية

حسام احمد صالح وعلاء محمد خورشيد ومنى ابراهيم عمار
معهد بحوث وقاية النباتات- مركز البحوث الزراعية –الدقى-جيزة

أجريت التجارب الحقلية في قها بمحافظة القليوبية على مدار موسمي 2017- 2018 و 2018-2019 لدراسة التذبذب العددى لكل من مَنّ البقوليات و مَنّ الفاصوليا على نباتات الفول البلدى كذلك المفترسات المصاحبة لها بالإضافة إلى دراسة تأثير بعض العوامل الجوية (المتوسط اليومي لدرجات الحرارة والرطوبة النسبية)

سجل مَنّ الفول قمتين خلال الموسمين(الاسبوع الاول من شهر ديسمبر والاسبوع الثالث من يناير) ،(الاسبوع الاول من شهر ديسمبر والاسبوع الاول من شهر يناير) خلال الموسمين الاول والثانى على التوالى.

كما أظهرت النتائج ان لمَنّ الفاصوليا ثلاث قمم في الموسم الاول (الأسبوع الثاني من ديسمبر والأسبوع الاخير من ديسمبر والأسبوع الأول من مارس) بينما ظهر قمتين فقط فى الموسم الثانى (الاسبوع الاول من شهر ديسمبر والاسبوع الاخير من شهر ديسمبر) وكان اعداد مَنّ البقوليات و مَنّ الفاصوليا وكذلك المفترسات المصاحبة لها أعلى في الموسم الأول عن الموسم الثاني وكانت حشرة ابو العيد الاكثر شيوعا عن اسد المَنّ.

أظهرت التحليلات الاحصائية للعلاقة بين مَنّ البقوليات وابوالعيد ارتباطًا إيجابيًا معنويًا في كلا الموسمين بينما كان الارتباط مع اسد المَنّ سالبًا وغير معنوي في الموسم الأول وإيجابي في الموسم الثاني وكانت العلاقة بين مَنّ الفاصوليا سلبية وغير معنوية في كلا الموسمين مع كلا المفترسين.

كذلك ظهرت العلاقة بين مَنّ الفول والمتوسط اليومي لدرجة الحرارة غير معنوية وسالبة خلال الموسم الأول بينما كانت معنوية في الموسم الثاني كذلك كان الارتباط مع مَنّ الفاصوليا سلبيًا غير معنوى في كلا الموسمين ، كما أظهرت العلاقة غير معنوية موجبة مع الرطوبة النسبية فى كلا الموسمين .