

Effect of Temperature, Relative Humidity and Natural Enemies on some Insect Pests Infesting Faba Bean Plants at El-Monofia Governorate

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ABSTRACT

Results were indicated that the population fluctuation of *Aphid craccivora* kock. and the *Thrips tabaci* were higher during (2012-2013 season) than the second season (2013-2014). The statistical analysis of simple correlation and partial regression showed that a positive significant relationship between the daily mean of temperature and relative humidity and aphid *A. craccivora* population in the two successive seasons (2012-2013 and 2013-2014). The relationship between the predators Green lacewing *Chrysoprla carnea* (Steph), Hover fly *Metasyrphus Corrollae* and the pest population were negative significant. The partial regression significant were negative significant relation between *C. carnea* and the pest population while the partial regression cleared that a positive significant relationship between *M. corollae* with *A. craccivora* in both seasons. The simples correlation indicated that a positive significant relationship between each of the daily mean temperature and the relative humidity and *Thrips tabaci* while the partial regression coefficient and the relationship were negative in the two successive seasons. The relationship between the Green lacewing *C. carnea* and hover fly *M. corrollae* and *Thrips tabaci* were negative significant. The partial regression values were insignificant in (2012-2013) but positive significant in (2013-2014) seasons for *C. carnea* but the partial regression values of *M. corrollae* were significant in the two successive seasons.

INTRODUCTION

The Faba bean (*Vicia faba* L.) is an important crop for the people in several regions of the world. It has gained a particular importance as available winter legume crop in Egypt. This is due to its high content of protein and it is considered one of the most public food in Egypt. Faba bean has been considered as a meat extender or substitute (Ebadah *et al.* 2006). Also, it contributes to feed and fodder supply for livestock and affect positively the soil productivity for the cereal crops grown in rotation (Zeghouane 1991).

Broad bean fields are subjected to severe infestation by sucking pests, especially aphids, jassids. Which cause serious damage, either directly by sucking plant juices or indirectly as vectors of virus diseases (Saleh, 1967, Saleh *et al.* 1972, Ali and Rizk, 1980, Salim *et al.* 1987, Abdel-Alim, 1994 and Hannou, 1995).

On the other hand, cowpea aphid also disturbs the photosynthesis process by the presence of fungus on the leaves that is supported by the aphids' honeydew secretion (Kingler *et al.* 2001, Smith and Boyko 2007). One of the most important pests of this crop is the black legume aphid, *Aphis craccivora* Koch, (Homoptera: Aphididea) (Safwat and Hany 2016).

Broad bean *Vicia fabae* is seriously damaged by another various pests. Thrips are among the most serious of these pests and are listed as a major insect pests in the Mediterranean region (Sexana, 1991). Thrips use their asymmetrical paired mouth parts to puncture cells on the leaf surface and then ingest or suck plant juices (Razi *et al.* 2013). Thus, the present study aimed to investigate the effect of biotic and abiotic factors on population of cowpea aphid, *A. craccivora* and *T. tabaci* on faba bean plants.

MATERIALS AND METHODS

Field studies were carried out in Samadon (El-Monofia Governorate) of five cultivars of faba bean *Vicia fabae* experiments were achieved throughout two successive winter seasons extending from 2012/2013 to 2013/2014.

Regular weekly visits were made, early in the morning at 8 a.m., to the experimental area for sampling purposes. Sampling began as soon as the plants appeared

above ground and continued until the crop mature stage, throughout the two successive seasons. The number of cowpea aphid, *A. craccivora*, *T. tabaci* and their associated predators were weekly recorded from 8 Nov. until the end of the season.

The faba bean (*V. fabae*) cultivars were provided from Agricultural Research Center (ARC).

In each season an area of about 840 m² was prepared and all regular cultural practices through the two growing seasons. No chemical application was used to evaluate the population without any disruption by insecticides. All broad bean seeds were sown on November on the two year respectively. Seeds were plant (2 seeds/hill) at distance of 15 cm between hills.

Sampling Methods:

Inspection was started on 8 November and continued at weekly intervals until 11 January. In which the total number of insects on the upper of five plants from each plot were randomly chosen and then examined weekly in the morning.

The numbers of insect pests and associated natural enemies were recorded.

The first data of the examination was performed after almost 14 days of plantation date.

Collected alive aphid were kept in specimen tubes containing ethyl alcohol 70% and carried to the laboratory of Piercing-Sucking Insects Research Department, Plant Protection Research Institute, Dokki, Cairo, Agricultural Research Center. The identification purposes as described by Habib and Alkady (1961).

The identification of the predator was confirmed at the Biological Control Department. Plant Protection Research A.R.C. Giza, Egypt.

To investigate the effects of some ecological factors (biotic and abiotic) on the population fluctuation of *A. craccivora* and *T. tabaci*, statistical analysis were carried out, simple correlation and regression was worked out between such factors and each of aphid, thrips populations.

Effect of weather factors:

Effects of temperature and relative humidity in addition to the numbers of predators (green lacewing and hover fly) on the population fluctuation of aphids and thrips and predators into consideration in the present study.

The recorded daily means of temperature and relative humidity obtained from (Agric. Res. Station) for the whole period of study, then fluctuations of insect pests and the main predator were calculated and expressed in terms of simple correlation coefficient (r) and partial regression (b).

Statistical Analysis:

Obtained data were statistically analyzed by ANOVA according to (SAS institute, 2002).

RESULTS AND DISCUSSION

Population density of insects:

a) Aphids;

During the study period which extended for two successive seasons from (2012-2013 and 2013-2014), it was found that faba bean plants were infested with aphid and thrips. Data of population density expressed in terms of weekly average number are summarized in Table (1) and Fig.(1). As shown in Table (1) and Fig.(1) the population density of *A. craccivora* in (2012-2013) season began at low level (6.7 individuals) in the 2nd week of Nov. then it tended to increase gradually until reaching its maximum (13.38 individuals) in the last week of Nov. after this peak, the number of aphids showed a gradual decrease by a sharp decline in January. The mean average was (7.99 individuals) in all season.

The population density of *A. craccivora* in (2013-2014) season began at low level (5.9 individuals) in the 2nd week of November the population were more disturbed in all season.

It reached its maximum by the last week of December (7.4 individuals). The mean average of population were (3.6 individuals), indicating that the insect population was higher during the 1st season than the 2nd season.

In general, agreement with the precious results, Saleh (1967) and Saleh *et al.* (1972) mentioned that aphids on faba bean reached its 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.

Meanwhile, Rizk *et al.* (1981) showed that the same species of aphid reached its maximum by the end of February and disappeared from the field of broad bean by the end of March, which was somewhat different from the present results.

Table 1. Weekly mean numbers of the cowpea aphid, *Aphis craccivora* Koch, on Faba bean plants during (2012-2013) and (2013-2014) seasons.

Date	2012-2013	2013-2014
Nov. (8,9) 2012-2013	0.00	0.00
Nov. (15, 16) 2012-2013	6.704	5.986
Nov. (22, 23) 2012-2013	12.688	5.194
Nov. (29, 30) 2012-2013	13.38	4.272
Dec. (6, 7) 2012-2013	11.198	0.192
Dec. (13, 14) 2012-2013	10.482	0.00
Dec. (20, 21) 2012-2013	9.844	5.934
Dec. (27, 28) 2012-2013	8.434	7.424
Jan. (3, 4) 2013-2014	7.188	7.13
Jan. (10, 11) 2013-2014	0.00	0.00
Mean	7.9918	3.6132

b) Thrips:

Data in Table (2) and Fig. (2) cleared that the activity period and the population of *T. tabaci* during (2012-2013) was higher than during the second season (2013-2014), the average number was (6.46 individuals) in the first season while it was (2.94 individuals) in the 2nd season.

Table 2. Weekly mean numbers of the *Thrips tabaci* on Faba bean plants during (2012-2013) and (2013-2014) seasons.

Date	2012-2013	2013-2014
Nov. (8,9) 2012-2013	0.00	0.00
Nov. (15, 16) 2012-2013	6.302	2.298
Nov. (22, 23) 2012-2013	5.586	2.826
Nov. (29, 30) 2012-2013	9.63	3.7
Dec. (6, 7) 2012-2013	7.348	4.446
Dec. (13, 14) 2012-2013	8.736	4.704
Dec. (20, 21) 2012-2013	8.392	4.368
Dec. (27, 28) 2012-2013	9.354	3.816
Jan. (3, 4) 2013-2014	9.25	3.196
Jan. (10, 11) 2013-2014	0.00	0.00
Mean	6.4598	2.9354

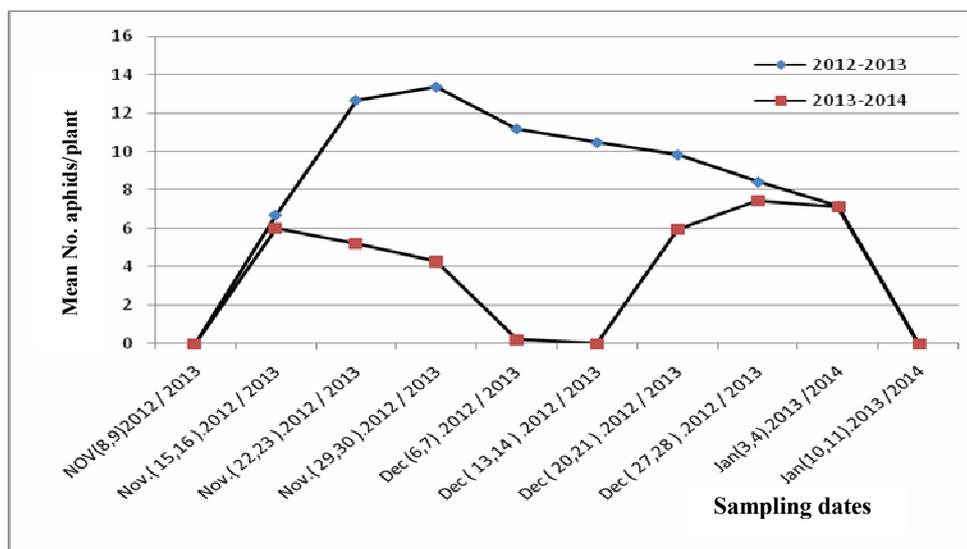


Fig. 1. Weekly mean numbers of the cowpea aphid, *Aphis craccivora* Koch, on faba bean plants during (2012-2013) and (2013-2014) seasons.

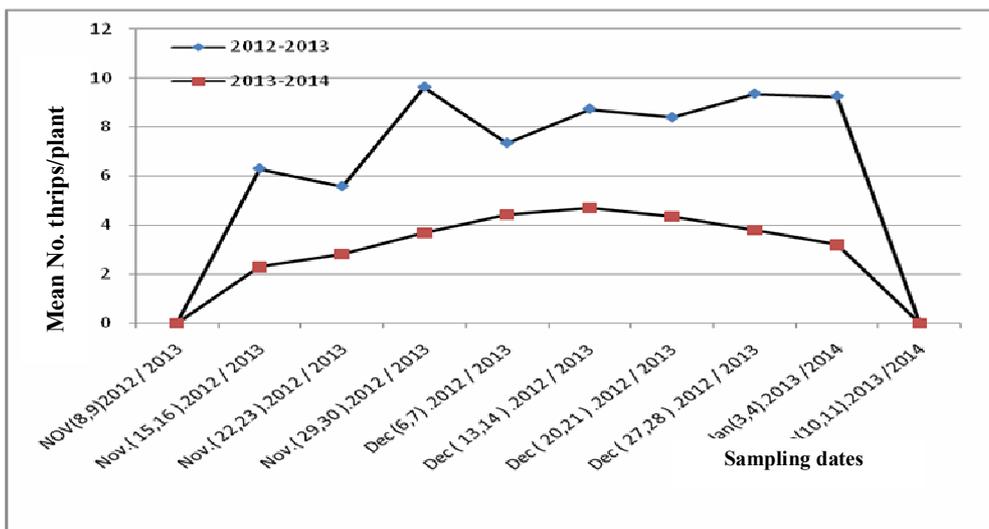


Fig. 2. Weekly mean numbers of the *Thrips tabaci* on faba bean plants during (2012-2013) and (2013-2014) seasons irrespective to plant cultivars.

Effect of biotic and abiotic factors on cowpea aphid *Aphis craccivora* on faba bean plants during (2012-2013) and (2013-2014) growing seasons:

Effect of daily mean temperature:

The statistical analysis of simple correlation showed a positive significant relation between the daily mean of temperature and *A. craccivora* population fluctuation during both seasons (2012-2013 and 2013-2014), the correlation coefficient values (r) were 0.250 and 0.246 in the two successive seasons respectively. The partial regression coefficient values give the exact relationship between the climatic factor and the *A. craccivora*. These values showed the same relationships as shown by the simple correlation values (Table 3).

Results on partial regression analysis of data revealed that an increase or decrease by one unit of the tested factor in the daily mean of temperature would change the mean number of *A. craccivora* by 0.381 and 0.164 in the both seasons respectively. From these results it can be concluded that the weekly mean numbers of *A. craccivora* on faba bean plants markedly varied according to temperature factor. Computed data of the two annual seasons gave a positive significant relationship between the daily mean of temperature and insect population.

Effect of relative humidity:

The simple correlation analysis showed that a positive significant relationship between the daily mean of relative humidity and aphids population in both seasons respectively. (r) Values were 0.151 and 0.144 respectively. The partial regression values insure that there was a positive significant relationship in 2012-2013 season, while it was negative significant in 2013-2014 season. The increase or decrease in this factor would change the mean number of aphids by 0.062 and -0.048 in the two successive seasons respectively. These results are in agreement with that obtained in Egypt by El-Mezaien (1996); El-Khouly *et al.* (1998) and Salem (1998). They concluded that relative humidity was positively affected *A. craccivora* population on faba bean plants.

Effect of the Green lacewing *C. carnea* on *A. craccivora*:

The results cleared that the relationship between the predator (*C. carnea*) and the pest population were negative significant, the (r) values were -0.297 and -0.222 in 1st and 2nd seasons respectively. The partial regression values (b) were -0.354 and -0.677 with negative significant relation between the predator and the pest population.

Table 3. Simple correlation and regression coefficient values between main weather factors and predators on the population density of cowpea aphid *Aphis craccivora* on faba bean plants during (2012-2013) and (2013-2014) growing seasons.

Years	Tested factor	Simple correlation		Partial regression		F	
		r	p	b	p	f	p
2012-2013	Temp.	0.250**	0.0029	0.381**	0.0029	9.21**	0.0029
	R.H.	0.151*	0.053	0.062*	0.0539	3.24*	0.0539
	Green Lacewing	-0.297***	0.0001	-0.354***	0.0004	13.36***	0.0004
	Hover fly	-0.546***	0.0001	1.378***	0.0001	58.71***	0.0001
2013-2014	Temp.	0.246***	0.001	0.164***	0.0012	10.87***	0.0012
	R.H.	0.144*	0.059	-0.048*	0.0596	3.60*	0.0596
	Green Lacewing	-0.222**	0.003	-0.677**	0.0036	8.72**	0.0036
	Hover fly	-0.212**	0.005	1.497*	0.0055	7.91**	0.0055

Effect of Hover fly *M. corollae* on the pest population:

The relation between the predator *M. corollae* and *A. craccivora* was negative significant, the (r) values were -0.456 and -0.212 in 1st and 2nd season, respectively. While the partial regression showed a positive significant relationship; the (b) values were 1.378 and 1.497 insects in the both seasons. These results were disagreement with the results reported by Ali (1996 b) and Kareim (1998).

May be due to a week population of predator. This means that whenever increases the number of aphidophagous predators within faba bean fields parallel decrease in the abundance of corresponding aphids that noticed. Abdel-Wahab and Morsy (1983) stated that the natural enemies had a great role on decreasing aphid population infesting faba bean plants. El-Mezaien (1996) reported that *A. craccivora* on faba bean was found aphidophagous predators. Salem (1998) stated that the natural enemies had a great role on decreasing aphid population El-Defrawi et al. (2000a) found that the activity of *C. carnea*, had a great role in suppressing *A. craccivora* population on faba bean fields.

Effect of biotic and abiotic factors on *Thrips tabaci* on faba bean during (2012-2013 and 2013-2014) growing seasons:

Effect of daily mean temperature:

Data in Table (4) cleared that the simple correlation analysis showed a positive insignificant relationship between the daily mean of temperature and *Thrips tabaci* population fluctuation in the (2012-2013) season while the relationship was positive significant in (2013-2014) season; the (r) values were 0.012 and 0.453

respectively. The partial regression coefficient values (b) were -0.015 and -0.0162 and the relationship were negative insignificant in 1st season, while it was negative significant in the 2nd season.

Effect of relative humidity on *Thrips tabaci* :

The statistical analysis of simple correlation showed that a positive insignificant relation between the daily mean of the relative humidity and the pest population in 2012-2013 season, while the relation was positive significant in 2013-2014 season and the (r) values were 0.078 and 0.163 respectively. The partial regression values were 0.024 and 0.633 in 2012-2013 and 2013-2014 respectively with insignificant relationship in the first season and significant in the second season respectively.

Effect of the Green lacewing *C. carnea* on *Thrips tabaci* insect:

The results revealed that the relationship were negative insignificant in the first season while it was negative significant in the second season with (r) values -0.112 and -0.672 respectively. The data showed the partial regression values were insignificant, with (b) values was 0.104 in 2012-2013 season and positive significant in 2013-2014 season (b= 1.103).

Effect of Hover fly *M. corolla* on the pest population:

The relationship between the predator *M. corolla* and the insect pest population were negative significant in the both seasons and the simple correlation (r) values were -0.491 and -0.488, the partial regression values were 0.958 and 1.853 with significant relationship in the two successive seasons.

Table 4. Simple correlation and regression coefficient values between main weather factors and predators on the population density of *Thrips tabaci* on faba bean plants during (2012-2013) and (2013-2014) growing seasons.

Years	Tested factor	Simple correlation		Partial regression		F	
		R	p	b	p	F	p
2012-2013	Temp.	0.012 NS	0.882	-0.015NS	0.8821	0.02 NS	0.8821
	R.H.	0.078 NS	0.359	0.024 NS	0.3596	0.85 NS	0.3596
	Green lacewing	-0.112NS	0.185	0.104 NS	0.1859	1.77 NS	0.1859
	Hover fly	-0.491***	0.0001	0.958***	0.0001	43.95***	0.0001
2013-2014	Temp.	0.453***	0.0001	-0.162***	0.0001	43.56***	0.0001
	R.H.	0.163**	0.016	0.633**	0.0166	5.86**	0.0166
	Green lacewing	-0.672***	0.0001	1.103***	0.0001	138.53***	0.0001
	Hover fly	-0.488***	0.0001	1.853***	0.0001	52.52***	0.0001

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تأثير درجة الحرارة والرطوبة النسبية والأعداء الحيوية على بعض الآفات الحشرية التي تصيب زراعات الفول البلدي في محافظة المنوفية

محمد عبدالغفار محمود ، خالد أحمد الخواص ، سعيد عبدالعليم حماد و محمد إبراهيم على
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أوضحت النتائج أن تعداد حشرة من اللوبيا والتربس وذلك خلال الموسمين الزراعيين المتتاليين (2012-2013 و 2013-2014) أن التعداد في الموسم الزراعي الأول كان أعلى بدرجة معنوية عن الموسم الزراعي الثاني. أوضحت نتائج التحليل الأحصائي عند دراسة تأثير العوامل الجوية (درجة الحرارة – الرطوبة النسبية) على الكثافة العددية لحشرة من اللوبيا أن هناك تأثيراً معنوياً لهذين العاملين على تعداد الآفة ويتضح ذلك من قيم الارتباط البسيط والانحدار الجزئي وذلك خلال الموسمين الزراعيين المتتاليين. وقد لوحظ أن الارتباط بين أسد المن وكذلك ذبابة السيرفيس من ناحية وبين تعداد الآفة من ناحية أخرى علاقة عديمة المعنوية بينما أظهرت نتائج التحليل الأحصائي معنوية عالية بين ذبابة السيرفيس ومن اللوبيا في كلا الموسمين. وقد بينت النتائج أن تأثير متوسط درجة الحرارة والرطوبة النسبية على حشرة التربس كان معنوياً وذلك من قيم الارتباط البسيط أما قيم الانحدار الجزئي فقد أظهرت علاقة عديمة المعنوية خلال الموسمين الزراعيين المتتاليين. كما بينت النتائج العلاقة بين أسد المن وذبابة السيرفيس من ناحية وكثافة تعداد حشرة التربس عديمة المعنوية وقد أظهرت قيم الانحدار الجزئي في موسم الزراعة الأول (2012-2013) علاقة غير معنوية ولكنها كانت ذات معنوية في موسم الزراعة الثاني (2013-2014) وذلك عند دراسة العلاقة بين العدو الحيوي أسد المن وحشرة التربس بينما أظهرت قيم الانحدار البسيط لذبابة السيرفيس معنوية عالية في كلا الموسمين الزراعيين المتتاليين.