Dynamical Seasonal Fluctuations of the Prevailing Insect-Pests on Faba Bean and Garden Pea Plantations at Alexandria Governorate, Egypt

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ABSTRACT

A survey of insect- pests and beneficial –insects of faba bean and garden pea plants was conducted during the consequent growing seasons of 2014-2015 and 2015-2016 at Abis, Alex. Egypt.

The identified insect- pests of faba beans foliage implied 4 species: *Liriomyza trifolii* (Burgess), *Aphis craccivora* (Koch.), *Bemisia tabaci* (Gennadius)and *Emposca lybica*(De Berg.). The highest recorded number of inspected insects was aphid, versus the lowest recorded one of *E. lybica*, throughout both the consequent seasons of (2014-2015) and (2015-2016).

The two inspected and identified insect species on garden peas foliage were *Liriomyza trifolii* and *Bemisia tabaci*. Leafminer was recorded at highest numbers throughout both the growing seasons.

Additionally both the detected lepidopteran insects; the blue butterfly, *Cosmolyce baeticus* Polyommatus and bean pod borer,*Etiella zinckenella* Treitschke injuriously infested faba beans and garden peas pods. Where as, *C.baeticus* has been registered at high numbers on faba bean pods during both the growing seasons ,versus *E.zinckenella*, which was relatively high of garden peas pods.

The three inspected and identified beneficial insect species on faba beans plants were *Diglyphus isaea (*Walker) (Or.Hymenoptera) *Chrysoperla carne* (Stephens) (Or. Neuroptera) & *Coccinella undecimpunctate* (Linnaeus) (Or.Coleoptera). The calculated numbers of parasitoids and predators on faba bean plants increased as the number of their hosts increased. The calculated number of *(Diglyphus isaea*) was relatively high followed by *Chrysoperla carnea* and *Coccinella undecimpunctate* in both the growing seasons.

Two species of natural enemies were also inspected and identified on garden peas plants, ie. *D. isaea* and C. *undecimpunctate*. *D. isaea* was recorded as the highest number of the natural enemies, and *C. undecimpunctata as* the lowest number of inspected predators.

Key words: faba bean, garden peas, survey and fluctuation

INTRODUCTION

Faba bean (*Vicia faba* L.) is the most important annual pulse crop grown worldwide. It is one of the promising pulse crops,which can play an important role in increasing legume production in Egypt.Seeds are used for human nutrition as seeds have 28% protein, 58% carbohydrate and 2%fat (Köpke and Nemecek 2010).The cultivated area of faba bean has been decreased in the last three years in Egypt from 34871 to 26700 ha (FAO,2014).Besides it contributes as fodder to feed livestock and also affect positively the soil productivity for the cereal crops grown in rotation (Zeghouane, 1991).

Garden peas (*Pisum sativum* L.) is among the most popular vegetable crops in Egypt.It has a great nutritional value because of its higher components of protein(7.0g),calcium(25mg),phosphorous (124mg), thiamin, riboflavin,niacin and ascorbic acid (0.38, 0.14, 2.3 and 26 mg/100g seed, respectively) (Pellet and Shadarevian, 1970). In Egypt, the cultivated area with garden peas comprises 53874 acres and the annual production is about 38.843 thousands tons dry seeds (A.O.A.D.Satis. year book, 2012). United States, India ,Russia, England and France are among the first great producers of peas.

Unfortunately, faba beans and garden peas crops are subjected to the attack by several insect pests, right from the early stage of plant growth throughout its late development stage up to post-harvest and grains storage. Many insects belonging to the orders Lepidoptera, Diptera, Hemiptera,Thysanoptera and Coleoptera are known to attack faba bean. But, the major pests are the legume leaf miners(*Liriomyza trifolii*), aphids (*Aphis craccivora*), whitefly (*Bemisia tabaci*) and leafhopper (*Emposca lybica*) on the foliage of faba bean plants.Additionally the blue butterfly (*Cosmolyce baeticus*) and bean pod borer (*Etiella zinckenella*) infesting pods (Lanzoni *et al.* 2003).

Therefore, the present study was conducted to

1- survey and identification of the found insect-pests and natural enemies species on faba bean and garden pea plants,

2- study the seasonal fluctuations of these insects during the growing seasons of (2014-2015) and (2015-2016), and

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Received November 9, 2016, Accepted December 12, 2016

3- Determe the relationship between the inspected insect-pests and prevailing temperature and relative humidity in the field.

MATERIALS AND METHODS

Experimental site and design:

Field experiments were carried out during the successive growing seasons of (2014-2015) and (2015-2016) at the Experimental Farm of the Agricultural Research Station, Faculty of Agriculture, Alexandria University at Abis,Alex.,Egypt.

One variety of faba bean (Giza planka) and one variety of garden pea (master B) were used in the initiated experimental study.The experimental area of each of faba beans and garden peas was 390m^2 (6×65m), nearly 2 kirats. The seeds were sown in hills at distance of 20-25cm apart, and in rows of 70cm width. The normal agricultural practices were followed as recommended by the Egyptian Ministry of Agriculture and recommendation guidance. The sowing date of run cultivations was fixed and occurred on the 2nd half of November in both growing seasons of (2014-2015) and (2015-2016).

Survay of pests attacking faba bean and garden pea plants:

the survey of the main insect pests attacking the different stages of growing plant was performed throughout the elapsed period from 21 December (Winter) till 7 April (Spring) under field condition,for studying the seasonal numerical variations of detected insects along the interval of perforemed inspection dates.Samples of plant leaves and /or pods were collected weekly. Infestations by the main of insect-pests faba bean and garden pea plants were observed and recorded .

Sampling techniques were differed according to the detected pests and their stage. For the purpose of detecting the incidence of the leafminer (larvae) ,whitefly (immature), aphids and leaf hoppers (immature,aduts) regarding to natural enemies the parasite *Diglyphus isaea* was counted as larvae, while the predators *Chrysoperla*, *Coccinella undecimpunctate* were counted as adults. Samples of 15 plants of faba bean and garden pea were randomly collected, put in polyethylene bags and transferred immediately to the laboratory. The three parts of plant canopy (lower-medium-upper) were carefully examined using a stereoscopic binocular microscope for counting the numbers of leafminer larvae inside their mines; they made between the upper and lower leaf surface, as to the immature stages of whitefly, aphids and leaf hoppers counted / 45 leaves (15 plants).

Natural enemies have been inspected and counted on 15 randomly plants from each plot in the field.

Inspection of blue butterfly and the bean pod borer larvae on the sampled premature and full mature pods,was performed.The pods were weekly taken at random from the 15 plants at a rate of three pods/ plant.They were examined in the laboratory to record the number of larvae .

Data were subjected to the analysis of variance test (ANOVA) as randomized complete block design. The least significant differences (LSD) at the 5% level were determined using a computer program (Costat) and Duncan's Multiple Range testes modified by Steel and Torrie (1981) and LSD values were used to compare the mean numbers of inspected pest infestation.

RESULTS AND DISCUSSION

A-Survey of the prevailing insect- pests and their natural enemies on faba bean and garden pea plants:

The inspected insect pests of faba bean and garden pea foliage were identified and classified;they included 4 species infesting faba beans,i.e,(*Liriomyza trifolii*), (*Aphis craccivora*), (*Bemisia tabaci*) and(*Emposca lybica*) . While the main pests of garden pea were *L. trifolii* and *Bemisia tabaci* .

The pods of faba bean and garden pea were attacked by the lepidopterous butter flies(*Cosmolyce baeticus*) and (*Etiella zinckenella*).

Concerning numbers of natural enemies, three inspected and identified natural enemies in the present investigation on faba bean *D. isaea, C. undecimpunctate* and *C. carnea*, and two identified natural enemies presented on garden pea plants *D. isaea* and *C. undecimpunctate*.

B- Population fluctuation of insect pests and their natural enemies on faba bean plants during the two growing seasons (2014-2015) and (2015-2016):

As shown in table (1), during the growing season of (2014-2015) etc. The mean numbers of leafminers was (1± 0.58) and a range of (0-2)insects/45 leaves by the end of December 2014 under the prevailing higrothermic conditions of 14^{o}C and 60% R.H%.While that number of inspected leafminers did not excecd (64± 0.88) with a range of (60-69) individuals /45 leaves in the beginning of April 2015 corresponding to19^{o}C and R.H%. of 73%.

Statistical analysis showed that there were highly significant differences between the inspection periods and, the rates of detected leafminers insects.

Table 1. Mean numbers of the prevailing insect-pests and natural enemies on faba bean plants; during the growing season of (2014-2015)

Inspection Date	Mean ±SD (range)									Weather conditions	
	Mean No. of insects/leaf				Mean No. of insects/pod		Mean No. os Natural enemies/ plant				
	L. trifolii	A.craccivora	B.tabaci	E.lybica	C.boeticus	E.zinckenella	D.isaea	C.undecimpunctata	C.carnea	Temp.	R.H%
21/12/2014	2.33^{i} ± 0.33 (2-3)	-	-	-	-	-	-	-	-	16	76
28/12/2014	^{1i}±0.58 (0-2)	-	-	-	-	-	-	-	-	14	60
5/1/2015	2^{i}±1.16 (0-4)	-	-	-	-	-	-	-	-	13	60
13/1/2015	2.67^{i}±0.33 (2-3)	-	-	-	-	-	2.33^{gh}=0.33 (2-3)	-	-	13	72
20/1/2015	3^{i}±0.57 (2-4)	-	-	-	-	-	3.33^{g}±0.33 (3-4)	-	-	13	82
27/1/2015	6.67^{h}=1.16 (5-7)	-	-	-	-	-	4^{g}±0.58 (3-5)	-	-	16	74
3/2/2015	10^{h}±1.56 (9-11)	-	3^{efg}±0.58 (2-4)	3.33^{de}±0.88 (2-5)	-	-	7^{f}±0.58 (6-8)	-	-	16	75
10/2/2015	14^{g}±1 (12-15)	-	1.67^{fg}±0.33 (1-2)	2.67^{e}±0.33 (2-3)	4^{ef}±4.00 (0-12)	1.33^{bc} ± 0.33 (1-2)	9^{ef} ± 0	-	-	11	47
17/2/2015	14.67^{g}±0.88 (13-16)	12^{f}±0.58 (11-13)	3^{efg}±1.16 (1-5)	3.67^{de}±0.88 (2-5)	7.33^{de}±3.67 (0-11)	1.67^{bc}±0.67 (1-3)	11^{de}±0.58 (10-12)	-	-	12	79
24/2/2015	22^{f}±1.53 (20-25)	11.67^{f}±0.33 (11-12)	3^{efg}±1.00 (1-4)	3.67^{de}±0.67 (3-5)	8.67^{de}±4.33 (0-13)	2.33^{abc}=0.88 (1-4)	11^{de}±1.16 (9-13)	-	-	14	79
3/3/2015	21.67^{f}±0.88 (20-23)	16^{f}±0.58 (15-17)	5^{def}±2.08 (2-9)	5^{d}±1.53 (2-7)	13^{bcd}±0.58 (12-14)	2.33^{abc}=1.33 (1-5)	13.67^{bc}=0.88 (12-15)	-	-	14	72
10/3/2015	32.67^{e}=1.77 (30-36)	23^{e}=1.53 (20-25)	6.33^{de}±1.86 (4-10)	9^{bc}±0.58 (8-10)	12.67^{cd}±1.20 (11-15)	5^{a} ± 0	14.67^{ab}=0.88 (13-16)	-	-	17	73
17/3/2015	40.33^{d}±0.33 (40-41)	45.33^{d}±2.91 (40-50)	8^{cd}=1.53 (7-11)	8^{c}=0.58 (7 - 8)	18.67^{ab}±0.88 (17-20)	3^{ab}±0.58 (2-4)	13.33^{bcd}±0.88 (12-15)	1.33^{a} ± 0.33 (1-2)	-	15	71
24/3/2015	52.33^{c}=1.45 (50-55)	76.33^{c}±2.33 (72-80)	10.33^{bc}±0.88 (9-12)	7.33^{c}±0.8 (6 -9)	18.33^{abc}±2.03 (15-22)	1.67^{bc}±1.20 (0-4)	12^{cd}±1.16 (10-14)	0.33^{cd} = 0.33 (0-1)	1^{a}±0	18	73
31/3/2015	59^{b}±2.04 (55-62)	90^{b}±2.89 (85-95)	12.33^{ab}±0.88 (11-14)	10.33^{b}±0.33 (10-11)	22.67^{a}±0.33 (22-23)	3^{ab}±1.53 (1-6)	14.33^{abc}±0.67 (13-15)	0.67^{bc} = 0.33 (0-1)	0.67^{ab}±0.33 (0-1)	17	67
7/4/2015	64^{a} 0.88 (60-69)	106.67^{a} ± 2.91 (102-112)	14.33^{a} 2.85 (11-20)	12.67^{a} ± 0.67 (12-14)	22.33^{ab} ± 1.45 (20-25)	3.33^{ab} ± 2.03 (0-7)	16.67^{ab} ± 1.77 (14-20)	1^{ab} ± 0	0.33^{bc} ± 0.33 (0-1)	19	73
r(with Temp.)	0.61	0.57	0.64	0.65	0.59	0.58	0.54	0.29	0.41		
r(with R.H.)	0.06	0.07	0.08	0.08	0.07	0.07	0.14	0.01	0.01		
$L.S.D_{0.05}$	3.6	4.19	3.42	1.83	5.44	2.42	2.25	0.42	0.34		

#Mean followed by the same letter(s) are not significantly different at 5% level.

In addition, *A craccivora* started to appear in the 2nd half of Februry, whereas,the measured number of the aphids started to grow up as temperature increased. The highest calculated mean number of (106.67 ± 2.91) with a range of (102-112 insects/ 45 leaves) individuals in the first week of April at the prevailing temperature of 19 ^{o}C and 73% R.H.

The numbers of both of whitfly and leafhoppers increased as the temperature increased table(1). Their recorded mean numbers equaled 3±0.58 and 3.33± 0.88 with ranges (2-4) and (2-5) insects/45leaves, in respect at 16^{0}C and relative humidity 75 % in the first week of February, then gradually increased till reaching their Maximum numbers during the first week of April their means numbers amountedto 14.33± 2.85 and 12.67± 0.67 and ranges of (11-20) and (12-14) insects/45leaves.

Because, the population increase of both insect-pests need a suitable condition of high temperature above 19 ^{0}C.This thermic conditions were not available during the period of winter season plantation(December-february) and led to the reduced detected numbers of them.These results are in agreement with those of Schuster and patel (1985).

Moreover,the performed correlation between the prevailed temperature and the mean number of the leafminers showed a strong positive relationship(r value of 0.61), aphid, also showed a positive strong relationship with temperature r=0.57 during the same period of inspection.On the contrary, the number of whitefly and leafhopper increased as the temperature increased giving a positive strong relationship (r= 0.64 and 0.65, successively).

Statistical analysis showed that there was a positive weak relationship between the prevailing relative humidity(R.H.%) throughout the season. The population of each of leafminer, aphid, whitfly and leaf hopper (r=0.06,0.07,0.08 and 0.08, in respect)(table,1).

With regad to the other detected insect-pests, lately infesting pods of both faba bean at the end of the growing season, two species were inspected *Cosmolyce baeticus* and *Etiella zinckenella* recorded a low mean number of (4± 4.00 and 1.33±0.33) with ranges of (0-12 &1-2) individuals, insects/ 45pods in mid February at 11^{0}C and 47% of R.H%. The highest (22.67± 0.33) mean number of *C. baeticus* was found in the last day of March, while in *E. zinckenella* the highest (5±0) individuals mean number was observed in mid March. (Table,1), at 17 ^{0}C and 73 of % R.H.

The prevailing conditions of temperature and relative humidity were suitable for both insects as the number of both insects started to be increased when the temperature increased.

Statistical analysis signified a positive relationship between the incidence of *C. baeticus* and *E. zinckenella* with the prevailing temperature (r=0.59 and 0.58 ,subsequently).The correlation coefficient was positively weak with the relative humidity(R.H.%)(r=0.07 and 0.07,in respect) during that season.Table (1).

The prevalent beneficial insect- species on faba bean plants,these surveyed insects were also classified as defined below:

- *D. isaea* which was collected in relatively highest mean numbers of (16.67± 1.77), by 7 th April, respectively table(1).
- *C. undecimpunctate* which was collected in a comparatively lower estimated mean number representing (0.33± 0.33) insects/ plant 24 th of March .
- *C. carnea* which was also found in a relatively comperatively low mean number of (0.33± 0.33) insects / plant on 7th of April, respectively.

The relationship between the *D. isaea* individuals were positive with either temperature or the relative humidity (r = 0.54 and 0.14, respectively).

Statistical analysis referred to a positive relationship between the prevailing temperature and the number of *C. undecimpunctate* individuals (r = 0.29), the correlation coefficient (r = 0.01) was positively weak with the relative humidity R.H.(Table, 1).

From the above cited results it could be concluded that, *D. isaea* was abundant when the calculated number of leaf miner was very hight. In other words the population reflected the number of that ecto-parasitoid (*D.isaea*) with the increase in temperature.The natural ememies prove a positive relationship with temperature and R.H%.

These results are in agreement with those of Doss *et al*. (1992) who founded that leaf miner infestation began with low numbers on December, then increased gradually till March and declined by the end of April (that was the period of inspection in the present study).

Statistical analysis showed that there were highly significant differences between the inspection periods and, the rates of detected aphids,whitfly, leafhoppers,pod borer insects and natural enemies.

Table (2) presented the population densities of the injurious insect-pests infesting faba bean plants during the growing season of (2015-2016). It was noticed that the aphidsand whitefly started its population from the last week of January (2016) with the mean number of (2 ± 0.58 and 6.33 ± 1.86) and a range of (1-2)& (4-10)insects/45 leaves, individuals, respectively, at the temperature of 10 ^{0}c and 81% R.H. %,

Table 2. Mean number of the prevailing insect-pests and natural enemies on faba bean plants; during the growing season of (2015-2016)

Inspection Date	Mean ±SD (range)									Weather conditions	
	Mean No. of insects/leaf				Mean No. of insects/pod		Mean No. os Natural enemies/ plant				
	L. trifolii	A.craccivora	B.tabaci	E.lybica	C.boeticus	E.zinckenella	D.isaea	C.undecimpunctata	C.carnea	Temp.	R.H%
21/12/2015	3.67±0.88 (2-5)	-	-	-	-	-	-	-	-	16	85
28/12/2015	2^{f}±0.58 (1-3)	-	-	-	-	-	-	-	-	17	73
5/1/2016	3^{f}±0.58 (2-4)	-	-	-	-	-	5.67^{d}±0.33 (5-6)	-	-	14	53
13/1/2016	2.67^{f}±1.20 (1-5)	-	-	2^{ef}±0.58 (1-3)	-	-	3^{e}±0.58 (2-4)	-	-	13	82
20/1/2016	4^{f}±0.58 (3-5)	-	-	1^{ef} ± 0	-	-	6.33^{cd}±0.33 (6-7)	-	-	13	71
27/1/2016	5.33^{ef}=0.67 (4-6)	2^{gh}±0.58 (1-2)	6.33^{e}=1.86 (4-10)	0.33^{f}±0.33 (0-1)	-	-	13.33^{c}±0.67 (12-14)	1^{bc}± 0	-	10	81
3/2/2016	7.67^{ef}±0.88 (6-9)	12^{g}±1.53 (10-15)	13.67^{d}±1.45 (11-16)	1.67^{ef}=0.33 (1-2)	-	1^{de}± 0	14.67^{c}±1.45 (12-17)	-	-	14	82
10/2/2016	7.67^{ef}±0.57 (10-12)	27.33^{f}±1.45 (25-30)	12^{d}±1.16 (10-14)	1.33^{ef}=1.33 (0-4)	9.67^{ef}±4.85 (0-15)	0.33^{e}±0.33 (0-1)	18.67^{b}±0.88 (17-20)	1^{bc} ± 0	-	13	69
17/2/2016	11^{de}±0.88 (14-17)	35.67^{f}±2.34 (32- 40)	18^{bc}±1.56 (16-20)	3.67^{de}±1.56 (0-6)	$4f^{g}$±4.00 (0-12)	1^{de}± 0	16^{c}±0.58 (15-17)	0.33^{c} ± 0 33 (0-1)	1^{bc} ± 0	19	79
24/2/2016	21.33^{e}±0.58 (20-23)	49.67^{e}±2.73 (46-55)	17^{c}±1.73 (16-18)	6.33^{d}±0.33 (6:7)	14.33^{de}±0.33 (14-15)	1^{de}±0.58 (0-2)	14.67^{c}±1.77 (12-18)	1.33^{abc}= 0.33 (1-2)	0.67^{bc}±0.33 (0-1)	17	72
3/3/2016	24.33^{c}±1.20 (22-26)	65.67^{cd}±3.18 (60-71)	16.67^{c}±0.88 (15-18)	10.67^{c}±0.67 (10-14)	16.33^{cd}±1.20 (14-18)	2.67^{cd}±1.45 (0-5)	15^{c}±1.53 (13-18)	1.67^{ab}± 0 67 (1-3)	1^{bc} ± 0	14	71
10/3/2016	31.67^{b} ± 0.88 (30-33)	83^{c} ± 4.05 (78-91)	20.33^{ab} ± 0.88 (19-22)	13^{abc} 1.53 (10-15)	22.33^{c} ± 1.45 (20-25)	4^{c} ± 1.16 (2-6)	19.33^{ab} 0.33 (19-20)	-	1.33^{ab} ± 0.33 (1-2)	16	75
17/3/2016	32^{b} =1.16 (30-34)	87^{c}±6.03 (80-99)	20.33ab±0.33 (20-21)	11.33^{bc}±0.67 (10-12)	23c ±3.52 (19-30)	7^{de}±0.58 (6-8)	20.33^{ab}=0.33 (20-21)	1.33^{abc} ± 0.33 (1-2)	2^{fg}±0.58 (1-3)	14	71
24/3/2016	34^{b} =2.52 (101-120)	112^{b}±5.69 (20-22)	21^{a}±0.58 (10-16)	13.67^{ab}±1.86 (22-32)	28.33^{bc}±3.18 (5-6)	5.67^{b}±0.33 (18-20)	19^{ab} ±0.57 (0-1)	0.67^{bc} ± 0.33 (0-3)	1.33^{ab}±0.88	21	40
31/3/2016	40.33^{b} ± 0.33 (40-41)	121.67^{b} ± 9.29 (110-140)	20.33^{ab} ± 0.88 (19-22)	14.33^{a} ± 1.20 (12-16)	33.33^{ab} ± 0.88 (32-35)	7.76^{a} ± 0.67 (7-9)	21.67^{a} ± 0.88 (20-23)	2.33^{a} ± 1.20 (0-4)	-	17	73
7/4/2016	62.33^{a}±1.45 (60-65)	215^{a}±2.89 (210-220)	19.67^{ab}±0.88 (18-21)	15.33^{a}±0.88 (14-17)	36.67^{a} ±0.67 (36-38)	8^{a}± 0	21.33^{aff}±1.45 (19-24)	1.33^{abc} ± 0.33 (1-2)	0.67^{bc}±0.33 (0-1)	22	76
r (with Temp.)	0.65	0.69	0.49	0.58	0.72	0.56	0.31	0.14	O.37		
r (with R.H.)	-0.19	-0.21	-0.18	-0.28	-0.18	-0.24	-0.19	-0.07	-0.29		
$L.S.D_{0.05}$	5.96	10.37	2.51	2.77	5.89	1.57	2.61	1.13	0.87		

#Mean followed by the same letter (s) are not significantly different at 5 % level.

till the end of inspection period (first week of April 2016) their populations increased gradually with the mean numbers of 215± 2.89 and 19.67± 0.88 insects /leaf, respectively, at the prevailing temperature of 22 ^{0}C and 76% R.H.

Statistical analysis showed a positive strong relationship between the incidence of the whitefly& aphids and the temperature (r = 0.69 and 0.49) in respect. This relationship was a negative the prevailing R.H. % (r = - 0.21 and -0.18, respectively) (Table ,2).

On the contrary, the counted number of leafminer started to increase by the end of December 2015, with the mean number of (3.67± 88)and a range of (2-5 insects/45leaves), individuals at the temperature 16^{0}C and 85% R.H.%, table(2). The highest level of this insect was recorded in the first week of April (62.33± 1.45) with a range of (60-65)/45leaves.

Statical analysis showed a positive relationship between the prevailing temperature and the number of the insect individuals (r =0.65), while the correlation coefficient was negative with the relative humidity R.H. % r = - 0.19 (Table,2).

The jassid started to appeared in the 2nd week of January 2016 (2± 0.58) with temperature of 13^{0}C and 82% R.H.% the highest level (15.33± 0.88) was witnessed in the first week of April. The relationship between jassid population and the temperature was positive (r = 0.58),while it was negative with R.H.% (r =- 0.28%) R.H. Table (2).

Regarding the pod borers, *C. baeticus* was considered to be a severely injurious economic insect-pest on faba bean pods. Since it has been registered at ratherly high numbers and then increased to shows the highest mean numbers of (36.67± 0.67) during the first week of April as the temperature increased to 22 ^{O}C (table, 2).

E. zinckenella was found in low levels from the first week of February to the first week of March then increased to record the highest level during the first week of April (8±0)insect/pod.

The relationship between the temperature and mean number of either *C. baeticus* or *E. zinckenella* showed that there was a positively high relationship (r =0.72 and 0.56, in respect) and negatively with R.H.% (r = - 0.18% and -0.24%, successively) (Table,2).

The mean number of the natural enemies *D.isaea*, *C. undecimpunctata* and *C. carnea* were prevalented along the growing season (2015-2016) giving the highest calculated number of individuals (21.33± 1.45, 1.33±0.33 and 0.67±0.33), in respect, during the first week of April at the prevailing temperature of 22 ^{0}C and 76% R.H.(Table, 2).

There was a negative correlation (r = - 0.29) between the prevailing relative humidity (R.H.%)and the number of individuals of *E. zinckenella* meanwhile, there was a lower positive relationship between R.H. and *C. baeticus* (r = 0.12) (Table, 2).

There was a positive correlation between temperature and the population of D. isaea ,C. undecimpunctata and C. carnea (r = 0.31, 0.14 and 0.37),respectively. While there was a negative relationship r = (- 0.19, – 0.07 and -0.29) between the prevailing relative humidity R.H.%. (table,2).

C- Population fluctuation of insect pests and their natural enemies on garden pea plants during two growing seasons (2014-2015) and (2015-2016):

Table,3 showed the detect insects during the growing season of (2014-2015), the mean number of leafminer was very low (1.67± 1.15) and a range (1-3) individuals / 45 leaves by the end of December 2014. The highest mean number was found during the first week of April (72.33 ± 2.52) with a range of (70-75)individuals /45 leaves in highly temperature 19 ^{0}C and 73% of R.H%.

On the contrary, the mean number of whitfly individuals was low (1.33± 0.58) by the mid of January and this number increased and reached (53±2.65) insects/ leaf by the first week of April.

Statistical analysis showed that there were highly significant differences between the inspections date of the leafminers and whitefly. The relationship between the leafminer individuals were positive with either the temperature or the relative humidity (r =0.57and 0.09), respectively.

A same trend was found with the whitfly individuals, the relationship was positively strong (r =0.68 and 0.09, respectively) between this insect and either the temperature or the R.H.% (Table,3).

Results in Table (3) demonetrated the highly occurring individuals mean number of *C.baeticus* and *E. zinckenella* on garden pea pods along with all the periods of performed inspections in season (2014-2015). Whereas, the estimated population densities of insect- pods were more or less high in most of the periodic intervals of the conducted inspections. According to the prevailing conditions in this locality, these calculated densities were relatively the highest mean numbers of (2±1) and (55±5) insect/ pod throughout 7 th of April 2015.

Statistical analysis indicated positive relationship between the prevailing temperature and the mean number of pod borers *C.baeticus* and *E. zinckenella* (r = 0.32 and 0.73 respectively),

Table 3. Mean number the prevailing insect-pests and natural enemies on garden pea plants; during the growing season of (2014-2015)

Inspection dates	Mean ± S.D (range)						Weather conditions	
	Mean No. of insects/ leaf		Mean No. of insects / pod		Mean No. of Natural enemies/ plant			
	L. trifolii	*C. undecimpunctata*	*D. isaea*	*E.zinckenella*	*C.baeticus*	*B.tabaci*	Temp.	R.H%
21/12/2014	0	0	0	0	0	0	16	76
28/12/2014	1.67^{k}±1.15 (1-3)	0	0	0	0	0	14	60
05/01/2015	1.67^{k}±0.58 (1-2)	0	0	0	0	2.67^{hi}±1.53 (1-4)	13	60
13/01/2015	7^{l} ± 2 (5-9)	0	0	0	0	1.33^{hi}±0.58 (1-2)	13	72
20/01/2015	13.67^{l}±1.53 (12-15)	0	0	0	0	1.67^{hi}±1.15 (1-3)	13	82
27/01/2015	20.33^{h}±1.3 (19-22)	0	0	0	0	1.67^{hi}±0.58 (1-2)	16	74
03/02/2015	25^{g} ± 2 (23-27)	0	0	2.33^{fg}±1.53 (1-4)	1.33^{abc}±0.8 (1-2)	2.67^{hi}±1.53 (1-4)	16	75
10/02/2015	29^{f} ± 1 (28-30)	2.67^{b} ±2.08 (1-5)	0	3.33^{fg}±1.53 (2-5)	1.67^{abc}±1.15 (1-3)	4.33^{h}±1.15 (3-5)	11	47
17/02/2015	30.33^{f}±1.3 (29-32)	0.33^{de} ±0.58 (0-1)	0	4.67^{f}±2.08 (3-7)	0.33^{bc}±0.58 (0-1)	10.67^{g}±0.8 (10-11)	12	79
24/02/2015	32^{f} ± 2 (30-34)	1.67^{bcd} ±1.53 (0-3)	5.33^{d}±1.3 (4-7)	5.33^{f}±3.51 (5-9)	0.3^{bc}±0.58 (0-1)	13^{g} ± 1 (12-14)	14	79
03/03/2015	43^{e}±2.65 (40-45)	1^{cde} ±0	6.67^{d}±3.1 (3-9)	12^{e}±2.65 (10-15)	0.67^{bc}±0.58 (0-1)	18^{f}±2.65 (15-20)	14	72
10/03/2015	42.33^{e}±2.1 (41-45)	2^{bc} ±0	12^{c} ±2 (10-14)	20.67^{d}±0.58 (20-21)	0.33bc±0.8 (0-1)	22.67^{e}±2.12 (20-25)	17	73
17/03/2015	46^{d} ±1 (45-47)	1^{cde} ±0	15^{c} ±3 (12-18)	22.33^{d}±2.52 (20-25)	1^{abc} ± 1 (1-2)	32.33^{d}±2.1 (31-35)	15	71
24/03/2015	52^{c}±2.64 (50-55)	2^{bc} ±1 (1-3)	18.33^{a}±15 (17-20)	32^{c}±2.65 (30-35)	1.33^{abc}±1.53 (0-3)	35^{c} ± 1 (34-36)	18	73
31/03/2015	66.33^{b}±0.8 (66-67)	4^{a} ± 1 (3-5)	12^{c} ±2 (10-14)	41^{b} ±1 (40-42)	0.33^{bc}±0.58 (0-1)	41.67^{b}±2.8 (40-44)	17	67
07/04/2015	72.33^{b}±2.2 (70-75)	1.33^{bcde} ± 0.58 (1-2)	17^{ab}±1 (16-18)	55^{a} ± 5 (50-60)	2^{a} ±1 (1-3)	53^{a}±2.65 (50-55)	19	73
r (with temperature)	0.57	0.27	0.71	0.73	0.32	0.68		
r (with R. H)	0.09	-0.31	0.12	0.05	-0.24	0.09		
L.S.D. $_{0.05}$	2.99	1.27	2.39	3.43	1.15	2.64		

#Mean followed by the same letter (s) are not significantly different at 5 % level.

Table 4. Mean number of the prevailing insect-pests and natural enemies on garden pea plants; during the growing season of (2015-2016)

Inspection dates	Mean ± S.D (range)						Weather conditions	
	Mean No. of insects/ leaf		Mean No. of insects / pod		Mean No. of Natural enemies/ plant			
	L. trifolii	*C. undecimpunctata*	*D. isaea*	*E.zinckenella*	*C.baeticus*	*B.tabaci*	Temp.	R.H%
21/12/2015	0	0	0	0	0	0	16	85
28/12/2015	0	0	0	0	0	0	17	73
05/01/2016	0	0	0	0	0	0	14	53
13/01/2016	0	0	0	0	0	1.67^{k}±0.58 (1-2)	13	82
20/01/2016	0	0	0	0.67^{bc}±0.58 (0-1)	3^{ij}±1 (2-4)	1.67^{k}±1.15 (1-3)	13	71
27/01/2016	0	0	3^{g}±1 (2-4)	1.5^{abc}±1 (0-2)	3.33^{ij}±2.08 (1-5)	11^{j}±1 (10-12)	10	81
03/02/2016	0	0	1^{g}	0	6.33^{i}±0.58 (6-7)	18^{i}±2.65 (15-20)	14	82
10/02/2016	0	0	3.33^{g}±1.53 (2-5)	0	2.67^{j}±1.15 (2-4)	21^{h}±1 (20-22)	13	69
17/02/2016	5^{b}±1 (4-6)	11^{e}±1 (10-12)	11^{f}±1 (10-12)	1^{abc}	10^{h}±1 (9-11)	30.33^{g}±0.58 (30-31)	19	79
24/02/2016	4.67^{b}±2.08 (3-7)	13.67^{d}±1.53 (12-15)	16.33^{e}±2.52 (14-19)	1.33^{ab}±0.58 (1-2)	14.33^{g}±2.52 (12-17)	32.33^{g}±5.52 (30-32)	17	72
03/03/2016	7.67^{a}±0.58 (7-8)	17^{c}±1 (16-18)	25.67^{d}±4.04 (22-30)	1.33^{ab}±1.53 (0-3)	20^{f}±3 (19-21)	40.67^{f}±1.15 (40-42)	14	71
10/03/2016	8^{a}±1 (7-9)	12.33^{de}±2.52 (10-15)	34^{e}±3 (31-37)	0	27^{e}±4.36 (22-30)	43.67^{f}±2.08 (42-46)	16	75
17/03/2016	9^{a}±1 (8-10)	10.33^{e}±3.21 (8-14)	40.33^{b}±0.58 (40-41)	1.67^{a}±0.58 (1-2)	32.33d±2.52 (30-32)	51.33^{d}±3.21 (49-55)	14	71
24/03/2016	7.67^{a}±0.58 (7-8)	17.67^{bc}±1.53 (16-19)	42^{b}±2.65 (40-45)	0	39.33^{c}±2.08 (37-41)	62.67^{c}±3.06 (60-66)	21	40
31/03/2016	7.67^{a}±1.15 (7-9)	19.33^{ab}±0.58 (19-20)	42^{b}±1 (41-43)	1^{abc}	52^{b}±1.73 (50-53)	71.67^{b}±0.58 (71-72)	17	73
07/04/2016	9^{a}±1 (8-10)	20.67^{a}±0.58 (20-21)	51.67^{a}±2.89 (50-55)	0	62.33^{a}±3.21 (60-66)	80^{a}±1 (79-81)	22	76
r (with temp.)	0.58	0.68	0.61	0.87	0.65	0.63		
r (with R. H)	-0.24	-0.27	-0.29	0.12	-0.23	-0.25		
$L.S.D._{0.05}$	1.34	2.04	3.02	0.87	3.18	2.76		

#Mean followed by the same letter (s) are not significantly different at 5 % level.

while the correlation coefficient was negative with the relative humidity r = - 0.24 with *C. baeticus* insect and positive with *E. zinckenella* r = 0.05, respectively.

From the listed results in Table(3), it could be easily noticed that the prevalent beneficial insect-species on garden pea plants *D. isaea* was along the growing season givin the highest calculated mean number (18.33± 1.5) individuals on 24 th of March at the prevailing temperature of 18^0C and 73% R.H%. (table,3).

While, the highest mean number of *C. undecimpunctata* was in the last day of March (4±1) with a rang of (3-5insects /15 plants) at 17^0C and 67% R.H%.

The relationship between the *D. isaea* individuals were positive with either temperature or the relative humidity (r = 0.71 and 0.12, respectively).

Statistical analysis referred to thes a positive relationship between the prevailing temperature and the number of *C. undecimpunctate* individuals (r = 0.27), while the correlation coefficient (r = -0.31) was negative with the relative humidity R.H.%(Table, 3).

It have been mentioned before that the level of the leafminer and whitefly were very low by the 3 rd week of January in the season of (2015-2016), it would be necessary to detect its level with the other insects attacking and related to the garden peas as a host. The population densities of those insects were inspected during the growing season, which started by the end of December 2015, till the first week of April 2016 (Table,4). The highest levels of leafminer and whitefly were recorded in the first week of April (80± 1) and (62.33±3.21) with a range of (79-81)&(60-66) individuals / 45 leaves at 22^0 C and 76% R.H% (table, 4).

Statistical analysis showed a strong positive relationship (r = 0.63 & 0.65) between the prevailing temperature and number of leafminers and whitefly individuals,while the correlation coefficient was negative (r = - 0.25 &- 0.23) with the relative humidity (R.H.%).

C. baeticus began to appear on 20 th of January and then the population dropped to zero in th 2nd week of February and then began to appear for the last time in the middle of march, recording the highest levels of (1.67± 0.58) with a range of (1-2 insects/45pods) at the prevailing temperature of 14 ^{0}C and 71 % R.H.% (table,4).

Conversely, the mean number of *E. zinckenella* individuals was high and started to increase by the end of January (3±1) at the prevailing temperature of 10^0C and 81% R.H%,the relationship between the mean number of this insects and the prevailing temperature was highly positive (r= 0.87 & 0.61) (Table,4).

There was a negative correlation (r= - 0.29) between the prevailing relative humidity(R.H.%)and the number of individuals of *E. zinckenella* meanwhile, there was a lower positive relationship between R.H. and *C. baeticus* (r= 0.12) (Table,4).

Regarding the other insects (natural enemies) on garden peas, it could be stated that the number of *D. isaea* started to grow up as the temperature and relative humidity increase.The highest mean number (20.67± 0.58)/ 15 plants was found during the first week of April at the privialing temperature of 22 ^{0}C and 76% R.H%.

On the other hand, *C. undecimpunctata* increased as the temperature increased reaching the highest mean number of (9±1 insect/ plant) at the temperature of 22 and 76% R.H. (table,4).

The number of *D. isaea* and *C. undecimpunctata* increased as the temperature increased giving a positive correlation of (r =0.68 and 0.58) individuals.There was a negative relationship r = (- 0.27 and -0.24) between the prevailing relative humidity R.H. (Tabl,4).

CONCLUSION

From the above demonstrated results it could be mentioned that the highest recorded number of inspected insect-pests on faba bean plants foliage was leaf miners, vs. the lowest recorded of *E. lybica* throughout season (2014-2015).

It is worth mentioning that this study must be a preliminary step in initialins the so-called(surveillance system) (Zaghloul, 1982)for insect –pests on the country level of Egypt.

It is of importance to conclude that the aforementioned objectives are needed for the determination of economic injury level (EIL) and the economic threshold (ET)]in future studies. Such economic thresholds are considered as salient factors in initialing an integrated pest control (IPM) program.

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الملخص العربي

التغيرات العددية الموسمية للأفات الحشرية المتواجده في زراعات نباتات الفول والبسلة بمحافظة الأسكندرية، مصر

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في هذه الدراسة أجري حصر لأهم الأفات الحشرية والأعداء الطبيعية الموجودة علي نباتات الفول والبسلة أثناء موسمي الزراعة(٢٠١٤-٢٠١٥)و(٢٠١٥-٢٠١٦) بمنطقة أبيس بمحافظة الأسكندرية- مصر وأمكن التعرف علي أربعة أنواع من الحشرات تصيب المجموع الخضري لنبات الفول وهي صانعات أنفاق الأوراق *Liriomyza trifolii*، من البقوليات الاسود *Aphis craccivora*، الذبابة البيضاء *Bemisia tabaci* والجاسيد *Emposca lybica* .

كما تم تصنيف والتعرف علي نوعين من الحشرات التي تصيب المجموع الخضري لنباتات البسلة وهي: صانعات أنفاق الاوراق *Liriomyza trifolii* والذبابة البيضاء *Bemisia tabaci* بالأضافة إلي ذلك تم التعرف علي نوعين من حشرات رتبة حرشفية الأجنحة (دودة قرون اللوبيا *Etiella zinckenella* وأبو دقيق البقوليات *Cosmolyce baeticus*) التي تصيب قرون نباتات الفول والبسلة.

كذلك أمكن التعرف علي ٣ أنواع من الأعداء الطبيعية الشائعة والتي تنتمي إلي كل من الرتب التاية: غشائية الأجنحة Hymenoptera، شبكية الأجنحة Neuropteraوغمدية الاجنحة Coleoptera .

وقد وجد أن تعداد أفراد المن كان الأعلي خلال موسمي الزراعة بعكس أفراد الجاسيد التي كانت الاقل تواجدا خلال موسمي الزراعة لنبات الفول. أما بالنسبة لنبات البسله كان تعداد صانعات الانفاق الأعلي أثناء موسمي الزراعة. وفي هذا الصدد كانت أعلي معدلات الإصابة في قرون نبات الفول راجعة إلي حشرة أبو دقيق البقوليات. وعلي العكس بالنسبة لحشرة دودة قرون اللوبيا التي تسبب أعلي معدلات الأصابة في قرون البسلة.

حيث تم ملاحظة زيادة أعداد كلا من الطفيليات والمفترسات بزيادة تعداد عوائلها الحشرية وكان طفيل *Diglyphus isaea* الاعلي في معدل الإنتشار والتواجد العددى متبوعا بالتواجد العددي الاقل لكلا من حشرة أسد المن *Chrysoperla carnea* وحشرة أبو العيد *Coccinella undecimpunctate* علي التوالي خلال موسمي الزراعة.