

Population Density of *Empoasca* Spp.; *Liriomyza trifolii* (Burgess) and the Common Natural Enemies on Faba Bean Plants in Relation to Sowing Dates in Kafr El-Sheik Governorate

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ABSTRACT

Leafhoppers, *Empoasca* spp. (Homoptera: Cicadellidae) and The serpentine leafminer, *Liriomyza trifolii* (Burgess) (Diptera: Agromyzidae) are important harmful insect pests of faba bean, *Vicia faba* L. (Sakha 1 variety), which causes considerable loss in yield. So, population density of these insects and the common natural enemies in relation to sowing dates were studied on faba bean during two successive growing seasons, 2016/17 and 2017/18 at Kafr EL-Sheikh Governorate. The obtained results revealed that population densities of *Empoasca* spp. were higher in mid- October plantation than mid- November plantation in first and second season, respectively with two peaks during both growing season. Population densities of *L. trifolii* larval recorded two peaks of abundance for the first and second sowing date during the two study seasons. The rate of emerging (*Opius* sp.) parasitoids synchronized with high parasitism. Statistical analysis cleared that the positive higher relation between rate of parasitism and population of leafminers larvae in second plantation in first season also, between rate of parasitism and emerged parasitism in second season. The population of *L. trifolii* in (first season) mid- November was significant than first one. The rate of parasitism as well as the emerging parasitoids was significantly higher in mid –November than mid- October (second season) Statistical analysis cleared that the population of leafhoppers; rate of parasitism and associated predators were insignificant differ during the two planting dates, while leafminers were significant in first seasons on contrast in the second one. On the other hand, the common predatory were significantly higher on mid-October than mid-November in the second one synchronized with the highest levels of leafhoppers and leafminers. These results could be useful in developing programs of integrated insect management in faba bean fields to reduce insecticide.

Keywords: population density, parasitism; parasitoid, *Opius* sp.; Leafhoppers, *Empoasca* spp.; Cicadellidae; serpentine leafminer, *Liriomyza trifolii*; integrated and management

INTRODUCTION

In Egypt, faba bean, *Vicia faba* L. is a main nutritive source for human beings and their domestic animals, as its seeds contain 22% protein, 58% carbohydrates and 2% fat (Nopke and Nemeck, 2010) in addition to many vitamins and other nutrients (Mohamed *et al.*, 1996). Also, it has the ancillary benefits of a nitrogen fixation and thus a reasonably low fertility requirement (Al-Antary *et al.*, 2007). Faba bean is subjected to infestation by several insect pests. Among of which are Leafhoppers, *Empoasca* spp and leafminers, *Liriomyza trifolii* (Burgess) which cause considerable damage either in quality and quantity of faba bean yield (Abdallah, 2000 and Mohamed & Silman, 2001). Both adults and nymphs of leafhoppers inject a toxin into the foliage during feeding causing down-curling of leaf edges, which turn yellow at first, then become brown and began to die (Nielson, 1995 and El-Gindy, 2002). This symptom is known as hopper burn. The leafhoppers also transmit pathogenic organisms: viruses, mycoplasma, spiroplasma and bacteria.

The serpentine leaf miner, *Liriomyza trifolii* (Burgess) causes considerable loss in yield as females puncture the upper surfaces of faba bean leaves to oviposit and the hatching larvae live in mines between the two surfaces of blades, consuming the palisade tissue, consequently reduces photosynthesis and the leaflets become yellow and dry (Schuster and Everett, 1983). Therefore, leafminers are often difficult to control solely by chemical insecticides (Parrella *et al.*, 1984), consequently integrated pest management with bio control measure can be a promising measure to manage these insects (Salvo & Valladares, 2007 and Liu *et al.*, 2009). Many species of parasitoids have been reported to attack leafminers, *Liriomyza* spp. and such natural enemies are often the most

reliable agents of mortality of these insects (Liu *et al.*, 2009).

Therefore, it is an important to determine parasitoid species that are effective in the region and/or season concerned (Tran *et al.*, 2007; Mujica & Kroschel, 2011 and Ueno & Tran, 2015). Amer and Hegazi, 2014) in Egypt, reported that *Diglyphus isaea* was the most predominant species and positively correlated with the leafminer population.

Nowadays, rice crop is harvested earlier than normal because of release of early maturing varieties; consequently the land after rice can receive winter crops by the beginning of October. Thus, faba bean can be cultivated early in October, although the recommended sowing date is the first half of November (Amer, *et al.*, 1992).

So, the present work was conducted to study the effect of early sowing date of faba bean on the population density of leafhoppers, *Empoasca* spp. ; leafminer, *Liriomyza trifolii* (Burgess) and the common natural enemies with compared to the recommended sowing date during two successive growing seasons; 2016/17 and 2017/18 at Kafr EL-Sheikh Governorate.

MATERIALS AND METHODS

A field experiment was conducted at Sakha Agricultural Research Station Farm to evaluate the population density of leafhoppers; *Empoasca* spp. ; leaf miner; *Liriomyza trifolii* (Burgess) and the common natural enemies on faba bean plants at two sowing dates; mid-October (early date) and mid-November (recommended date) during 2016/17 and 2017/18 growing seasons. In each season, an area of 600 m² for every sowing date was divided into three plots (replicates). Sakha 1 variety was provided from National Legumes Research Program at Sakha Agric. Res. Station. This variety was cultivated in ; mid-October (early date) and mid-November (recommended

date) in every season. The normal agricultural practices were followed regularly without any pesticidal treatments throughout the growing season.

To determine the leafhoppers population (nymphs and adults), weekly sample of 25 leaflets was chosen at random from each plot representing the three levels of the plant and the numbers of insects were directly counted early in the morning in the field. With respect to leafminers, the previous same leaflets were picked up and placed in the paper bags, then were transferred to the laboratory for inspection of leafminer larvae using a binuclear microscope.

Regarding the predators, sample of 10 branches was randomly chosen from each plot and the number of the common predators was directly counted in the field using a suitable lens. The common predators were *Crysoperla carnea* (Steph.); (larvae and adults); *Scymnus interruptus* (Goeze), (nymphs and adults); *Paederus Alfieri* (Koch.) (adults) and *Coccinella undecimpunctata* (L.) (larvae and adults).

To determine the parasitism rate, infested leaflets with leafminer were weekly collected and put on papers under laboratory conditions, then checked every day till the emergence of pupae and the emerged pupae were carefully separated from the leaflets. One hundred pupae were divided in to four groups, 25 pupae each and transferred to petri-dish (10cm diam.) till the emergence of adults of *L. trifolii* and of parasitoids. The number of parasitized pupae and emerged parasitoids were counted and recorded. The emerged parasitoids were identified at systematic laboratory, Plant Protection Research Institute, Agricultural Research Center, Egypt. Sampling was performed after

nearly one month of sowing and continued at weekly intervals till the harvest time. Statistical analyses of the obtained data were performed by using SPSS and "t"test.

RESULTS AND DISCUSSION

1-Population fluctuations of leafhoppers, *Empoasca* spp. And leaf miners, *liriomyza trifolii* (Burgess) faba bean plants at two sowing dates:-

At present time, because of release of early maturing rice varieties, the land after rice can be cultivated with winter crops by the beginning of October. Thus, the farmers cultivate faba bean early in October, although the recommended sowing date is the first half of November (Amer, et al., 1992). Therefore, the effect of early date of faba bean (mid-October) on the population density of leafhoppers, *Empoasca* spp. , leaf miners, *liriomyza trifolii* (Burgess) and the common predators was evaluated with compared to the recommended date (mid-November) during 2016/17 and 2017/18 growing seasons.

1-Season of 2016/17:

Data presented in Table (1) indicated that the plants of early date (mid-October) received higher number of leafhoppers (seasonal mean of 35.3 insects/25 leaflets) than plants of recommended date (mid-November) (seasonal mean of 28.01 insects/25 leaflets) without significant difference. On the other hand, mid-November plantation (recommended date) recorded significantly higher numbers of leaf miners (seasonal mean of 51.32 insects/25 leaflets) than mid-October plantation (seasonal mean of 32.52 insects/25 leaflets).

Table 1. Mean numbers of leafhoppers, *Empoasca* spp. and *Liriomyza trifolii* (Burgess) larvae /25 leaflets in faba bean fields at two sowing dates during 2016/17 season at Kafr EL-Sheikh Governorate

Inspection dates	Sowing of mid- October		Inspection dates	Sowing of mid- November	
	Mean No. of <i>Empoasca</i> spp.	Mean No. of <i>L.trifolii</i> larvae		Mean No. of <i>Empoasca</i> spp.	Mean No of <i>L.trifolii</i> larvae
Nov.,13	5.00	5.67	Nov.,25	0.00	0.00
Dec.,16	8.33	8.67	Dec.,16	0.00	12.00
19	14.00	17.67	19	6.00	20.00
23	19.67	38.33	23	10.00	30.00
30	26.67	45.67	30	15.00	40.00
Jun.,8	27.00	41.33	Jun.,8	20.00	45.00
15	30.00	40.33	15	25.00	56.0
19	35.67	38.67	19	35.00	70.00
24	37.00	35.67	24	40.00	71.00
30	36.00	40.33	30	38.00	68.00
Fab.,2 9	35.67	47.00	Fab.,2	36.00	56.67
16	40.33	61.33	9	41.00	57.00
26	45.33	65.67	16	42.00	60.00
	50.67	59.33	26	46.00	78.00
Mar.,4	61.33	43.67	Mar.,4	20.00	80.00
12	67.00	35.33	12	25.00	79.07
21	59.33	15.33	21	28.00	68.00
28	37.67	13.33	28	33.00	60.67
Apr.,1	36.33	9.67	Apr.,1	45.00	40.00
6	33.00	7.33	6	55.00	35.00
General	35.30±	32.52±	General	28.01±	51.32±
mean± SE*	3.68	4.21	mean± SE*	0.54	5.14

SE* = Standard error; T-tabulated=2.09 at5;2.88 at 1%

T-calculated for leafhoppers=1.42ns T-calculated for leafminers=2.68*

In general, the infestation by the two insect species started to appear in few numbers after one month after sowing. After that, the population increased gradually and fluctuated throughout the growing season. Leafhoppers population reached its maximum by January 24th with means of 37.00 and 40.00 insect/25 leaflets on the plants of early and recommended date, respectively. After that, the population fluctuated and again recorded high number (67.00 insect/25 leaflets) by March 12th on plants of early date, while the plants of recommended date received again high number (46.00 insect/25 leaflets) by February 26th. After that, the insect population decreased gradually till the end of the season.

As for leaf miners, the population recorded maximum numbers by December 30th (45.67 insect/25 leaflets) and February 16th (65.67 insect/25 leaflets) on early sown plants, while the high population occurred by January 24th (71 insect/25 leaflets) and March 4th (80.00 insect/25 leaflets) on the plants of the recommended date.

2-Season of 2017/18:

The results shown in Table (2) revealed that the plants of early date significantly harbored higher population of leafhoppers (seasonal mean of 30.03 insects/ 25 leaflets) than the plants of recommended date (seasonal mean of 21.09 insects/ 25 leaflets). Meanwhile, the population of leaf miners did not significantly differ on the plants of the two sowing dates as the seasonal mean was 26.00 and 29.38 insects/ 25 leaflets). However, the leafhoppers population began to appear in few numbers with means of 10.00 and 2.067 insects/ 25 leaflets by Nov.20th and Dec.10th on plants of early and recommended date, respectively.

Then, the population gradually increased reaching its maximum of 70.33 and 40.00 insects by Feb.26th and Feb.9th on plants of early and recommended date, respectively. Thereafter, gradual decrease of population took place till the end of the season. With respect to leaf miners, the first appearance occurred by Nov.20th on the early sown plants (3.67 insect) and by Dec.10 on plants of the recommended date (26.00 insects). The population, then gradually increased recording its maximum on plants of early date with means of 38.67 and 47.67 insects by Jan.18th and Feb.16th, respectively. While, the plants of the recommended date exhibited maximum population by Dec. 31th and Feb.16th with means of 40.00 and 41.00 insects, that respectively. After, the population gradually decreased till the end of the season

These results disagree with El-sarand (2013) who found that mid-October plantation, population density of leafhoppers were highly significant in the second season than that of the first one but he agreement with these results of mid-October which it's were higher than mid-November in both season .

In the other hand, the highest numbers of larvae of *L. trifolii* occurred during January and February during the two study seasons. These results agree with the findings of Abou Elhagag and Salman (2001) who found that the population of *L. trifolii* recorded three peaks of abundance on faba bean during Jan. February and March . Also, Kotb (2001) reported that the larval population of *L. trifolii* recorded two and three peaks of abundance on faba bean plants. El-Dash and Abo-Shaeshae (2001) detected four peaks of *L. trifolii* larvae on broad bean and the highest numbers of larvae occurred during Jan. and Feb. at Shebin El kom region.

Table 2. Mean numbers of leafhoppers, *Empoasca spp.* and *Liriomyza trifolii* (Burgess) larvae /25 leaflets in faba bean fields at two sowing dates during 2017/18 season at Kafr EL-Sheikh Governorate

Inspection dates	Sowing of mid- October		Inspection dates	Sowing of mid- November	
	Mean No. of <i>Empoasca spp.</i>	Mean No. of <i>L.trifolii</i> larvae		Mean No. of <i>Empoasca spp.</i>	Mean No. of <i>L.trifolii</i> larvae
Nov.,20	10.00	3.67	Nov.,20	0.00	0.00
Dec., 10	11.67	9.67	Dec., 10	2.67	26.00
18	13.33	10.67	18	6.00	30.00
25	15.00	16.33	25	8.00	39.00
31	16.00	20.33	31	15.00	40.00
Jan.,5	17.67	21.33	Jan.,5	16.00	35.00
11	18.33	28.33	11	20.00	32.00
18	20.67	38.67	18	17.00	30.00
23	25.67	32.67	23	16.00	28.00
29	35.33	35.33	29	28.00	32.00
Feb.,2	37.00	40.00	Feb.,2	35.00	34.00
9	45.33	45.33	9	40.00	38.00
16	67.67	47.67	16	34.00	41.00
26	70.33	43.33	26	30.00	40.00
Mar.,4	68.67	42.67	Mar.,4	25.00	35.00
11	61.33	35.33	11	27.00	31.00
18	55.33	20.33	18	23.00	28.00
27	40.33	18.33	27	23.33	23.00
Apr., 4	40.67	17.67	Apr., 4	24.00	20.00
11	35.33	10.33	11	25.00	18.00
18	30.00	8.00	18	28.00	17.00
General mean±SE*	30.03±4.37	26.00±3.04	General mean±SE*	21.09±2.32	29.38±2.18

SE= standard error SE; T-tabulated=2.09 at 5; 2.88 at 1%

T-calculated for leafhoppers=2.81* T-calculated for leafminers=0.91ns

In the other hand, the highest numbers of larvae of *L. trifolii* occurred during January and February during the two study seasons. These results agree with the findings of Abou Elhagag and Salman (2001) who found that the population of *L. trifolii* recorded three peaks of abundance on faba bean during Jan. February and March. Also, Kotb (2001) reported that the larval population of *L. trifolii* recorded two and three peaks of abundance on faba bean plants. El-Dash and Abo-Shaehae (2001) detected four peaks of *L. trifolii* larvae on broad bean and the highest numbers of larvae occurred during Jan. and Feb. at Shebin El kom region. Nassef *et al.* (2008) recorded 2-3 peaks of *L. trifolii* larvae during growing season.

2- Population fluctuations of the common natural enemies in faba bean fields at two sowing dates:-

1-The common predators:-

In this study, the common predators in faba bean fields were *Chrysoperla carnea* (Steph.); *Scymnus interruptus* (Goeze); *Paederus alfieri* (Koch.) and *cocenlla undecempunctata* (L.) at the two sowing dates. Also, the first predator was the most abundant. Because of very low number of every species, the total of predators was taken into consideration and presented in Table (3 and 4).

In the first season (2016/17), results in Table (3) indicated that the numbers of predators firstly appeared in few numbers coinciding with the first appearance of the considered insect pests. Then, the population increased gradually and fluctuated during the growing season recording the highest numbers during February and March on the plants sown in the two dates. Also, the same trend of results was observed in the second season (Table 4). In general, the total of the predators did not significantly differ on plants sown at two date during the first season. Meanwhile, in the second season, the total of the predators was.

These results agree with those obtained by Khattab (2003) who found *P. alfieri* and *Ch. carnea* in faba bean fields during two successive seasons;1999/2000 and 2000/01. Also, El -Sarand (2005) found *P. alfieri* and *Ch. carnea* in faba bean fields during;1999/2000 and 2000/01 seasons. Nassef *et al.* (2008) recorded four species of predators; *Ch. carnea*, *p. alfieri*, *Sc. interruptus* and the true spiders in faba bean fields during 2005/06 and 2006/07seasonsand Kattab *et al.*(2013) found that four species of associated predators; *Ch. carnea* ;*P. alfieri*; *Scymnus interruptus* (Goeze) and true spiders were found in faba bean fields

Table 3. Mean numbers of predators/ 10 branches; percentage of parasitism and emerged parasitoids on pupal *L.trifolii* in faba bean fields at two sowing dates during 2016/17 season at Kafr EL-Sheikh Governorate

Sowing of mid-October				Sowing of mid-November			
Inspection dates	Mean No. of Predators	% Parasitism	% emerged parasitoid	Inspection dates	Mean No. of Predators	% Parasitism	% emerged parasitoids
Nov.,25	2.33	15.00	5.00	Nov.,25	0.00	0.00	0.00
Dec.,11	4.00	24.00	17.34	Dec. 11	1.67	28.00	18.60
19	4.67	27.28	18.57	19	2.00	30.00	20.00
23	5.33	35.00	25.04	23	3.00	38.00	23.00
30	7.00	40.00	28.60	30	4.67	43.00	30.00
Jan.,8	7.67	50.00	30.00	Jan. ,8	5.00	52.00	35.00
15	8.00	80.43	34.00	15	6.00	60.00	40.00
19	8.67	70.00	30.37	19	8.00	65.00	44.00
24	7.33	52.00	12.50	24	7.00	62.00	39.00
30	6.00	57.01	11.20	30	6.00	61.00	38.00
Feb.,2	8.00	42.86	34.29	Feb.,2	7.67	59.00	35.00
9	8.33	50.06	37.00	9	8.00	51.00	32.00
16	9.00	58.00	38.00	16	7.00	49.00	30.00
26	9.67	66.19	23.00	26	6.00	60.00	35.00
Mar.,4	9.00	46.07	22.12	Mar.,4	4.00	67.00	41.00
12	6.00	35.14	21.74	12	7.00	70.00	46.00
21	8.00	52.09	13.95	21	7.33	60.00	45.00
28	7.00	54.55	27.23	28	8.00	50.00	42.00
Apr.,1	6.00	61.54	23.08	Apr.,1	6.00	40.00	47.00
6	5.00	77.75	11.11	6	7.00	35.00	39.00
General mean±SE*	6.85±0.42	49.75±3.86	23.21±2.10	General mean±SE*	5.57±0.52	50.28±4.10	34.34±2.33

SE= standard error;T-tabulated=2.09at5% ; =2.88 at1%

T-calculated for predators=1.91ns ;T-calculated for emerged parasitoids%=3.55**

T-calculated for parasitism%=0.36 ns

Significantly higher on plants of early date than the plants of the recommended date.

2-population density of parasitized pupae, *Opius* sp. on *Liriomyza trifolii* (Burgess):

The emerging parasitoid was identified as the braconid, *Opius basalis*(Fischer) results of the first season Table (3) revealed that the *Opius* sp. started in few rate on November 25th by mean of 15% for the first sowing date

and on December 11th with a mean of 28% for the second one. Then, the parasitoid increased gradually recording the highest rate of parasitism on January15th (80.43%) and Apr. 6th (77.75%) for the first sowing date. While the second sowing date recorded the highest rate of parasitism on January 19th (65.00%) and March 12th (70.00%).

With regard to the second season (2016/17), the results in Table(4) revealed that the *Opius* sp. started in few rate on November 20th with a mean of 2% for the first sowing date and on December 10th with a mean of 2.30% for the second one. Then, the parasitoid recorded the highest rate of parasitism in January 29th (45.433%) and February 9th.(57.14%)for the first sowing date .While, the second sowing date recorded the highest rate of parasitism on January23rd (98.00%) and February12th (96.00%). In

general, the rate of emerging parasitoids synchronized with high parasitism. Also, the rate of parasitism and emerging parasitoids were lower during the first sowing date than during the second one in both growing season. The emerging parasitoids were significantly higher in mid – November than mid- October in two season. Also, rate of parasitism in the second season were significantly higher in mid –November than mid- October.

Table 4. Mean numbers of Predators/10 branches ; percentage of parasitism and emerged parasitoids on pupal *L.trifolii* in faba bean fields at two sowing dates during 2017/18 season at Kafr EL-Sheikh Governorate

Sowing of mid-October				Sowing of mid-November			
Inspection dates	Mean No. of predators	% Parasitism	% emerged parasitoid	Inspection dates	Mean No. of Predators	% Parasitism	% emerged parasitoids
Nov.,20	1.67	2.00	1.00	Nov.,20	0.00	0.00	0.00
Dec.,10	2.33	29.60	16.13	Dec.,10	1.33	2.30	7.00
18	3.00	32.60	21.74	18	1.67	40.00	16.00
25	4.00	31.71	17.07	25	2.67	45.00	21.00
31	6.00	37.27	15.05	31	3.00	50.00	30.00
Jan.,5	4.30	25.00	12.50	Jan.,5	3.33	66.00	32.00
11	5.00	33.33	12.60	11	3.00	78.00	35.00
18	5.67	20.66	10.66	18	2.67	90.00	36.00
23	6.00	12.00	7.33	23	3.00	98.00	45.00
29	7.00	45.43	27.27	29	3.67	92.00	62.00
29				29			
Feb.,2	8.00	27.28	18.18	Feb.,2	4.00	87.00	58.00
9	8.67	57.14	45.71	9	5.33	72.00	53.00
16	9.00	21.62	10.81	16	4.00	65.00	50.00
26	9.67	32.86	17.02	26	3.67	80.00	60.00
Mar.,4	8.00	35.29	17.65	Mar.,4	3.00	83.00	62.00
11	10.00	19.05	14.29	11	5.00	96.00	65.00
18	8.33	38.89	22.22	18	6.00	80.00	61.00
27	6.00	12.50	6.25	27	6.67	76.00	60.00
Apr.,4	5.00	16.04	8.06	Apr.,4	7.00	72.00	56.00
11	3.67	18.65	9.00	11	9.00	66.00	54.00
18	3.00	20.00	10.00	18	3.00	60.00	50.00
General	6.27±	27.09±	15.26±	General	4.05±	66.59±	43.48 ±
mean±SE*	0.54	2.73	2.02	mean±SE*	0.45	5.87	4.25

*SE= standard ; T-tabulated=2.09at5% ; =2.88 at1%

T-calculated for predators=2.92** ;T-calculated for emerged parasitoids%=5.99**

T-calculated for parasitism%=6.11**

These results are in partially agreed with those of Awadalla (1998) and El-Samahy (2008) who reported that *Diglyphs* sp. and *Opius* sp. were dominant and highly effective parasitoid against *L. trifolii*. Also, Aamer and Hegazi (2014) and Bassiony *et al.* (2017) in Egypt found that two parasitoid wasps *Opius dissitus* and *Diglyphs isaea* were commonly on faba bean fields. These parasitoids were detected throughout the growing season of bean plants. Therefore, this parasitoid can be the most promising bio control agent in Egypt.

1-Relationship between numbers of larvae of *L.trifollii* and rate of parasitism in two sowing dates during two growing season

Statistical analysis in table (5) show that, there was highly significant positive relationship between the number of larvae of *L. trifollii* and rate of parasitism during second sowing date of first season ,while there was insignificant and positive relation in second season and mid-October in first season these results are in agreement with those of Awadall (1998)who found that *opius* sp. occurred the highest rates of parasitism in two season .

Table 5. Relationship between numbers of larvae of *Liriomyza trifolii* (Burgess) and rate of parasitism in two sowing dates during two growing seasons; 2016/2017 and 2017/2018 at Kafr EL-Sheikh Governorate

Season	Sowing of mid-October		Sowing of mid-November	
	R	B	R	b
2016/2017	0.248	0.270	0.948**	1.286**
2017/2018	0.393	0.437	0.418	0.175

r =simple correlation b=simple regression -r tabulated= 0.444 at 5% and 0.5614 at 1% in first season

r tabulated =0.433 at 5% and 0.548 at 1% in second season) :

2-Relationship between rate of pupal parasitoids of *Liriomyza trifolii* (Burgess) and emerged parasitoids in two sowing dates during two growing seasons

Data presented in table (6) indicate that relation between rate of parasitism of *L.trifollii* and emerged parasitoids was positive and higher significantly in two seasons except mid-October in first season was insignificant and positive .These results were agreement with Kattab *et al.*(2013) who reported that the rate of

emerging parasitoids (successful parasitism) synchronized with high parasitism

Table 6. Relationship between rate of pupal parasitoids of *Liriomyza trifolii* (Burgess) and emerged parasitoids in two sowing dates during two growing seasons: 2016/2017 and 2017/2018 at Kafr EL-Sheikh Governorate

Season	Sowing of mid-October		Sowing of mid-November	
	R	B	R	B
2016/2017	0.294	0.160	0.835**	0.565**
2017/2018	0.917	0.677**	0.845**	0.612**

r =simple correlation b=simple regression r tabulated= 0.444 at 5% and 0.5614 at 1% in first season

r tabulated =0.433 at 5% and 0.548 at 1% in second season

Thus, the results will be useful in developing integrated insect management programs in faba bean fields. The growers could be advised to minimize use of insecticides to conserve natural

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الكثافة العددية لنشاطات الأوراق (*Empoasca* spp.) وذبابة صانعات الأنفاق (*Liriomyza trifolii* (Burgess)) والأعداء الحيوية على نباتات الفول البلدي وعلاقتها بمواعيد الزراعة في محافظة كفر الشيخ السيد أحمد الصرند ، السيد عبد الحميد رفاعي ومديحة الصباحي حامد الديوي معهد بحوث وقاية النباتات - مركز البحوث الزراعية - جيزة - مصر

تعتبر نشاطات الأوراق (*Empoasca* spp (Homoptera: Cicadellidae) و صانعات الأنفاق *Liriomyza trifolii* (Burgess) (Diptera: Agromyzida) من أهم الحشرات التي تصيب الفول البلدي (صنف سخا 1) والتي قد تسبب فقد كبير كمي ونوعى في المحصول الناتج ولذا تم اجراء تجارب لدراسة الوفرة الموسمية لهذة الحشرات والأعداء الحيوية المتواجدة وعلاقتها بمواعيد الزراعة في منتصف كلا من شهر أكتوبر (مبكر) و شهر نوفمبر (الموصى به) في حقول الفول البلدي خلال موسمين (17/2016 و 18/2017) في محافظة كفر الشيخ. وأوضحت النتائج المتحصل عليها أن تعداد نشاطات الأوراق كان أعلى في منتصف أكتوبر عن نوفمبر في الموسمين مكونا ذروتين في كل موسم وكذلك صانعات الأنفاق سجلت ذروتين للتعداد في مواعيد الزراعة لكل موسم ولكن الميعاد الموصى به كان أكثر إصابة وأظهرت أعلى تعداد في يناير وفبراير وتزامن معها على نباتات الفول عديد من المفترسات أهمها أسد المن الأسكمنس والرواعة وابو العيد ذو الأهدا عشر نقطة بينما كان لطيفيل *Opius* sp دور كبير في تقليل أعداد ذبابة صانعات الأنفاق الخارجة من العنراء وذلك بزيادة أعداد الطفيل الناجحة في الخروج من العنراء وخاصة في الميعاد الموصى به. ووجدت علاقة طردية بين معدل خروج الطفيل ومعدل التطفل وكذلك أعداد يرقات ذبابة صانعات الأنفاق أظهر التحليل الحصائي للنتائج وجود علاقة طردية موجبة عالية المعنوية بين معدل التطفل وتعداد يرقات صانعات الأنفاق في الميعاد الثاني في الموسم الأول كذلك بين معدل التطفل والطفليات الخارجة في الموسم الثاني. وأوضحت النتائج أن تعداد نشاطات الأوراق كان أكثر تعداد في الميعاد الأول عن الثاني مكونا ذروتين في كلا الموسمين وبينت النتائج أيضا ان تعداد يرقات صانعات الأنفاق *L. trifolii* بدأ بأعداد قليلة ثم كون ذروتين في كلا الميعادين خلال الموسمين في شهر يناير وفبراير. وأظهر التحليل الاحصائي للنتائج وجود فروق بدرجة معنوية بين تعداد اليرقات في الميعاد الثاني عن الأول في الموسم الأول وللزراعة وكان معدل التطفل ونسبة الطفليات الخارجة من العنارة أعلى بدرجة عالية المعنوية في الميعاد الثاني عن الأول للزراعة في الموسم الثاني بينما كانت نسبة الطفليات في الموسم الأول أكثر بدرجة معنوية في منتصف نوفمبر عن منتصف أكتوبر ولم توجد فروق معنوية في أعداد نشاطات الأوراق في الميعادين في الموسم الأول بينما كانت عالية المعنوية في الموسم الثاني. ووجدت فروق عالية المعنوية للمفترسات بين الميعاد الأول والثاني في الموسم الثاني. تعتبر هذه النتائج لها أهمية كبيرة في وضع برامج إدارة الآفات الحشرية التي تصيب حقول الفول البلدي لتقليل استخدام المبيدات.