

**SEASONAL ABUNDANCE OF *LIRIOMYZA* SPP. AND
EMPOASCA SPP. ON FABA BEAN IN RELATION TO
THE ASSOCIATED PREDATORS AND PREVAILING
WEATHER FACTORS IN NORTH DELTA**

By

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ABSTRACT

The leaf miners, *Liriomyza* spp. and leafhoppers, *Empoasca* spp. are of the important insects attacking faba bean plants causing serious damage. So, the seasonal abundance of the two groups of insects and its relation to the associated predators and the prevailing weather factors were studied on faba bean plants during two successive seasons; 2005/2006 and 2006/2007 at Sakha Agric. Res. Station Farm, Egypt

The obtained results revealed that the larval population of leaf miner was significantly more abundant in the second season than in the first one, but the reverse was found for the associated predators, while the leafhoppers did not differ during the two seasons of study. The leaf miner larvae started in low numbers; then recorded two peaks in the first season (in the second week of Dec. and the first week of March) and three peaks in the second season (the first week of Jan., the first and last week of Feb.). The leafhoppers also, appeared with low number at early season; then fluctuated recording three and four peaks for first and second season, respectively. In the first season, the insect peaked in the second week of Dec.; the last week of Jan. and the first week of March, while in the second season, the peaks were detected in the last week of Nov.; the first & fourth week of Jan. and the third week of Feb. Four species of predators; *Chrysoperla carnea* (Steph.), *Paderus alfieri* (Koch.); *Scymnus interruptus* (Goeze) and true spiders were found in faba bean field. Based on the predatory complex, the population started to appear in low numbers at the beginning of the

season and recorded its maximum numbers during Nov. and Jan. for the first season and during Nov. and Dec. for the second season.

The effect of the three weather factors (temperature, relative humidity and wind speed) and the associated predators on both the leaf miners and leafhoppers was insignificant during the two study seasons except the effect of relative humidity on the leafhoppers in the first season, as it was significant. Also, the combined effect of the considered weather factors and the predators was only more pronounced on the leafhoppers in the first season.

INTRODUCTION

In Egypt, faba bean, *Vicia faba* L. is attacked by a large number of insect pests causing serious damage, among of which are the leaf miners, *Liriomyza* spp. and the leafhoppers, *Empoasca* spp. The leafhoppers (nymphs and adults) inject a toxin into the foliage while feeding causing down-curling of leaf edges, which turn yellow at first, then become brown and began to die; this symptom are known as hopperburn. The leafhoppers also, transmit pathogenic organisms (viruses, mycoplasmas, spiroplasmas and bacteria) (Weeb,1987; Chandler&Thomas,1991 and Malaschi,1995). The leaf miners females puncture the upper surfaces of 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. Thus, the larvae are protected from contact insecticides (Schuster and Everett, 1983) .

However, the study of the population densities of the predators is believed to be of the most importance in enlightening integrated control of insect pests.

The role of predacious insects in suppressing the population of the insects on faba bean has been reported by several authors (El-Heneidy *et al.*,1998; Abou-Elhagag and Salman, 2001 ; Salem,2002 and El-Samahy,2008) . The interaction between the insects and their natural enemies is an essential ecological processes that contribute to the regulation of insect populations. Also, environmental conditions at any location influence the seasonal phenology of insect numbers, the number of generations and the level of insect abundance (Dent,1991)

in addition to the geographic range and abundance of various groups of predators (Kogan and Herzog,1980). So, in the present study, the seasonal abundance of the leaf miners and leafhoppers and its relation to associated predators and the prevailing weather factors were studied in faba bean fields during two successive seasons.

MATERIALS AND METHODS

A field experiment was carried out at the Farm of Sakha Agric. Station, Kafr El-Sheikh during two successive seasons ; 2005/2006 and 2006/2007. The experimental area was divided into four plots of 100 m² each. Local variety Sakha 3 was sown in the first week of October for each season. All normal agricultural practices were followed and no pesticidal treatments were applied throughout the growing season.

To determine the population density of the leaf miners and the leafhoppers, sample of 30 leaflets was chosen at random from each plot representing the three levels of the plant and the number of leafhoppers (nymphs and adults) was directly counted early in the morning in the field. The same leaflets were picked up and transferred in paper bags to the laboratory for inspection of the leaf miners. The number of larvae per leaflet was counted and recorded using a binuclear.

Regarding the associated predators, sample of 10 branches was chosen at random from each plot and the number of the common predators was directly counted in the field under a suitable lens. Sampling started one month after sowing until the end of the season.

The daily records of temperature , relative humidity and wind speed during the inspection period throughout the two study seasons, were obtained from the Meteorological Station at Sakha Res. Station. Weekly means of the three considered weather factors and the associated predatory complex were calculated. The relationships between these factors and the insect population were estimated (Fisher,1950).

RESULTS AND DISCUSSION

1- Seasonal abundance of leaf miners *Liriomyza* spp on faba bean:-

Data presented in Table (1) show the leaf miners larvae, *Liriomyza* spp on faba bean plants during two successive seasons; 2005/2006 and 2006/2007. The larval population firstly appeared on faba bean plants in low numbers with a mean of 1.5 larvae / 30 leaflets in the first and sixth of Nov. for the first and second season, respectively. Thereafter, the population of insect larvae fluctuated showing two and three peaks of abundance for the first and second season, respectively. In the first season, it peaked on Dec.13th and March 7th with means of 15 and 176 larvae/ 30leaflets, respectively. During the second season, the three peaks occurred on Jan.1st, Feb. 5th and Feb. 26th recording mean numbers of 34.0; 99.5 and 214.0 larvae, respectively.

However, the differences in the population density of leaf miners infesting faba bean plants in different locations were due to the differences in the environmental conditions or/ and the natural enemies. El-Khouly *et al.*(1997),at Sakha Agric. Res. Station showed three peaks of *Liriomyza* sp. larvae on faba bean plants during two successive seasons; 1991/92 and 1992/93 and the highest peak occurred during March. Also, Salem *et al.*(1998) , at Sakha Agric. Station , Egypt showed three peaks of larval population of leaf miners on faba bean plants during season of 1996/97 and two peaks during 1997/98. Abou-Elhagag and Salman (2001) found that the population of *Liriomyza trifolii* recorded three peaks of abundance on faba bean during Jan. ,Feb. and March. Kotb (2001) at El-Sabbahia Agric. Res. Station, Alexandria reported that the larval population of *L. trifolii* recorded two and three peaks of abundance on faba bean plants during two successive seasons. El-Dash and Abo Shaeshae (2001) showed that the population of *L. trifolii* larvae had four peaks on broad bean at Shebin El-Kom region during two successive seasons; 1991/2000 and 2000 /2001 and the highest average numbers of larvae occurred during Jan. and Feb.

Table (1): Mean numbers of *Liriomyza* spp. (larvae) and *Empoasca* spp (nymphs and adults)/ 30 leaflets and predatory complex /10 branches of faba bean during two successive seasons; 2005/2006 and 2006/2007 .

Season of 2005/2006				Season of 2006/2007			
Inspection date	<i>Liriomyza</i> spp.	<i>Empoasca</i> spp.	Predatory complex	Inspection date	<i>Liriomyza</i> spp.	<i>Empoasca</i> spp.	Predatory complex
1/11/2005	1.5	6.5	1.0	6/11/2006	1.5	20.5	1.75
8/11	1.5	26.0	4.75	13/11	3.0	54.0	5.5
15/11	3.0	37.5	6.5	20/11	4.5	56.5	6.3
29/11	5.0	78.0	9.5	27/11	6.0	72.5	2.75
6/12	5.5	95.5	6.75	4/12	9.0	52.5	2.5
13/12	15.0	111.5	6.5	18/12	12.5	45.5	0.5
20/12	9.5	90.0	4.3	25/12	22.0	57.5	1.0
27/12	5.0	75.5	2.75	1/1/2007	34.0	75.0	2.5
3/1/2006	1.0	57.0	1.5	8/1	22.5	43.0	0.75
16/1	6.0	45.0	3.75	15/1	26.0	54.5	1.5
23/1	13.5	62.5	2.0	22/1	49.0	55.5	1.0
30/1	38.0	64.0	4.5	29/1	80.5	51.0	0.75
7/2	78.5	54.5	2.5	5/2	99.5	66.0	1.75
14/2	85.0	52.5	3.5	12/2	78.0	73.0	1.3
28/2	141.5	52.0	3.0	19/2	176.0	75.0	1.0
7/3	176.0	54.0	1.3	26/2	214	66.5	1.3
14/3	107.0	42.5	0.75	12/3	90.0	48.5	0.5
General mean	40.74	59.09	3.81	General mean	54.59	56.88	1.92

2- Seasonal abundance of the leafhoppers, *Empoasca* spp.:-

The results in Table (1) indicated that the population appeared firstly in low numbers by 6.5 and 20.5 insects/ 30 leaflets on the 1st and 6th of Nov. for the first and second season, respectively. The population, after that fluctuated forming three peaks for each season. In the first season, the three peaks were attained on Dec.13th; Jan.30th and March7th with means of 111.5; 64 and 54 insects/ 30 leaflets, respectively. The population in the second season peaked on Nov.27th; Jan,1st & 22nd and Feb.19th by means of 72.8 ; 75.0; 55.5 and 75.0 insects, respectively.

These results agreed with those of El-Srand (2005) who found three peaks of leafhoppers on faba bean plants at Kafr El-Sheikh governorate during Jan., Feb. and March. On the other hand, Helal *et al.*(1997) reported two peaks of *Empoasca* spp. on faba bean plants; the first occurred in the 2nd week of Jan. and the second was on March 16th. Also, El-Gindy (2002) showed that *Empoasca* spp. recorded two peaks of abundance on faba bean during the second week of Dec. and the third week of Feb.

3- Seasonal abundance of the predators :-

In this study, the total count of the predators was taken into consideration because they occurred in low numbers. *Scymnus interruptus* (Goeze) ;*Crysoperla carnea* (Steph.);*Paderus alfieri* (Koch) and true spiders were found in the faba bean field and the first predator was the least abundant. The predatory complex appeared by mean of 1 and 1.75 individuals /10 branches in the first and sixth of Nov. for the first and second season, respectively. Then, the population fluctuated recording maximum number of 9.5 and 4.5 predators on Nov.29th and Jan.30th for the first season, while in the second season, the maximum number (6.3 and 2.5 predators) occurred on Nov. 20th and the first of January.

These results agreed with those obtained by Salem,Fathia (2002) who reported that *Ch. carnea*; *P. alfieri*; *C. undecimpunctata* and *Sc. interruptus* were the dominant predator in faba bean fields. Also, Khattab (2003) found *P. alfieri* ; *Ch. carnea* and true spiders in faba bean fields during two successive seasons; 1999/2000 and 2000/2001. El-Srand (2005) showed *P. alfieri* and *Ch. carnea* in faba bean fields during 1999/2000 and 2000/2001.

The results in Table (2) revealed that the leaf miner population was significantly less abundant in the first season than in the second one, as the general mean number of the insects was 40.74 and 54.59 insects, respectively, but the reverse was found for the predatory complex that averaged 3.81 and 1.92 individuals. On the other hand, the leafhopper population did not significantly differ in the two seasons, where the general mean was 59.09 and 56.88 insects, respectively.

Table (2) : Seasonal mean of leaf miners , leaf hoppers and the predatory complex on faba bean plants during the two successive seasons; 2005/2006 and 2006/2007.

Season	Leaf miners	Leaf hoppers	Predatory complex
2005/2006	40.74	59.09	3.81
2006/2007	54.59	56.88	1.92
LSD (5%)	10.141	9.393	0.391

LSD = Least significant difference

4- Effect of some weather factors and the predatory complex on the leaf miners and leafhoppers on faba bean plants:

4.1- on the leaf miners :-

The results in Table (3) indicated that the three weather factors (temperature, relative humidity and wind speed) were around the optimum range for the leaf miners activity in the two seasons, as their effect was insignificant. Also, the predators had negative and insignificant effect.

These results agreed with those of El-Samahy (2008) who reported that temperature, relative humidity and wind speed had insignificant effect on leaf miners on faba bean plants.

The combined effect (expressed as percentage of explained variance) of the predatory complex and the three weather factors on the leaf miners was 24.9 and 35.0% for the first and second season, respectively. This means that there are many unconsidered factors affecting the population.

4.2-on the leafhoppers :-

The three considered weather factors and the predatory complex had insignificant effect in the two seasons except the relative humidity in the first season, as the effect was significant (Table 3).

These results were in agreement with those of El-Gindy (2002) and El-Srand (2005) who found that temperature, relative humidity and wind speed induced insignificant effect on *Empoasca* spp. on faba bean plants.

The combined effect of the predatory complex and the three weather factors was more pronounced in the first season, where it was 63.4 and 19.8% in the first and second season, respectively.

Table (3): Simple correlation (r) , regression coefficient (b) and explained variance (EV%) between population density of leaf miners and leafhoppers on faba bean plants and three weather factors and associated predatory complex during two successive seasons; 2005/2006 and 2006/2007 .

Season	Factor	Leaf miners			Leafhoppers		
		r	b	EV %	r	b	EV %
2005/2006	Temp.(°c)	-0.178	- 1.184	24.9	-0.133	-0.787	63.4
	RH%	0.046	2.506		0.693	2.725*	
	WS (Km/h)	0.204	8.143		-0.460	0.202	
	Predators	-0.432	- 9.001		0.495	4.598	
2006/2007	Temp.(°c)	-0.137	3.874	35.0	-0.242	-1.577	19.8
	RH%	0.436	.787		0.267	0.330	
	WS(Km/h)	0.051	1.623		-0.361	-7.148	
	Predators	-0.390	- 3.443		0.091	1.873	

* = Significant at 5%

Finally, it could be concluded that the population of the leaf miners was more abundant in the second season than in the first one in contrast of the associated predators, while the leafhoppers did not differ during the two study seasons. Also, the three considered weather factors and associated predators induced insignificant effect on the population of the leaf miners and the leafhoppers ,except the effect of the relative humidity on the leafhoppers in the first season that it was significant.

REFERENCES

- Abou-Elhagag, G.H. and A.M.A. Salman (2001).** Seasonal abundance of certain faba bean pests and their associated predators in southern Egypt. *Assiut J. Agric. Sci.*, 32(4): 50-63
- Chandler, L.D.; C.E. Thomas (1991).** Effect of leaf miner feeding activity on the incidence of *Alternaria* leaf blight lesions on muskmelon leaves. *Plant Disease*, 75 (9): 930-940
- Dent, D.(1991).** Insect pest management. C.A.B. International, Wallingford ,UK, pp.604
- El-Dash, A.A. and A.A. Abo Shaeshae (2001).** Abundance and dynamic of larval population of the serpentine leaf miner, *Liriomyza trifolii* (Burgess) (Diptera : Agromyzidae) on some leguminous plants. *J. Adv. Agric. Res.*, 6(4): 1007-1019
- El-Gindy, M.A.A.(2002).** Studies on certain homopterous insect vectors of plant pathogenic diseases. Ph.D. Thesis, Plant Protection Dept., Fac. of Agric., Zagazig Univ.,pp.263
- El-Heneidy, A.H.; G. Resk ; A.M. Hekal and S. Abdel Samad (1998).** Impact of planting date on aphid populations and associated natural enemies on faba bean plants in Egypt. *Arab J. Plant Prot.*, 16(2): 55-59
- El-Khouly, A.S.; E.M.E. Khalafalla; M.M. Metwally; H.A. Helal and A.B.El-Mezaien. (1997).** Larval population of *Liriomyza congesta* (Beck.) (Diptera: Agromyzidae) on faba bean and its relation to certain weather factors at Kafr el-Skeish Governorate, Egypt. *Egypt J. Agric. Res.*, 75(4): 961-967
- El-Samahy, M.F.M.(2008)** .Studies on faba bean aphid, *Aphis craccivora* and faba bean leaf miner, *Liriomyza trifolii* and their natural enemies at Kafr El-Sheikh Governorate . Ph.D. thesis, Fac. Agric.Tanta Univ.,pp.167
- El-Srand, E.A.(2005).** Ecological and biological studies on some leafhoppers (Homoptera : Cicadellidae). M. Sci Thesis, Fac. Agric.Tanta Univ.,pp.93
- Fisher, R. A.(1950).** Statistical methods for research workers. II. Rev. Ed. Oliver and Boyd. London.

- Helal, H.A.; A.S. El-Khouly; E.M.E. Khalafalla; M.M. Metwally and A.B. El-Mezaien (1997).** Preliminary studies on the population of legume aphid, *Aphis craccivora* (Koch.) and jassids *Empoasca* spp. on different faba bean varieties and breeding lines under the field condition of Kafr El-Sheikh Governorate . Egypt. J. Agric. Res., 75(4): 951-959.
- Khattab, M,A.A.(2003).** Ecological and biological studies on the green bug, *Nezara viridula* L. (Pentatomidae : Hemiptera). Ph.D. Thesis, Fac. Agric. Tanta Univ.,pp.147
- Kogan , K. and D. C. Herzog (1980) .** Sampling methods in soybean Entomology, Springer-Verlag New York ,pp.507
- Kotb, F.K.(2001).** Field evaluation of certain insecticides on faba bean leaf miner *Liriomyza trifolii* (Diptera: Agromyzidae) and its ectoparasite *Diglyphus isaea* (Hymenoptera : Eulophidae). Adv. Agric. Res. ,5(2): 1359-1370.
- Malaschi, D.(1995).** Leafhoppers in winter wheat crops of the Hall/Sall district of Germany in 1992 and 1993. Probleme de Pratictia Plantelov., 23:1145-1150
- Salem, Fathia, A.(2002).** Studies on some natural enemies of some aphid species at Kafr El-Sheikh region. M.Sc. Thesis,Fac.Agric. Kafr El-Sheikh, Tanta Univ., Egypt. , pp.130
- Salem, R.M.; Samia A. Mahmoud ;E.M.E. Khalafalla and M.M. Radi (1998).** Identification of leaf miners attacking faba bean, *Vicia faba* (L.) and yield losses caused by their infestation in north delta. Alex. Sci. Exch., 19(2):269-275
- Schuster, D.J. and P.H. Everett (1983).** Response of *Liriomyza trifolii* (Diptera: Agromyzidae) to insecticides on tomato. J. Econ. Entomol., 76(5):1170-1174
- Weeb, M.D.(1987).** Species recognition in cicadulina leafhoppers (Hemiptera : Cicadellidae) , Vectors of Pathogens of Graminae. Bull. Ent. Res., 77:683-712

الملخص العربي

الوفرة الموسمية لصانعات الأنفاق ونطاطات الأوراق على الفول البلدي وعلاقتها بالمفترسات المصاحبة والعوامل الجوية السائدة في شمال الدلتا

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تعد صانعات الأنفاق ونطاطات الأوراق من أهم الحشرات التي تهاجم نباتات الفول البلدي مسببة ضرراً شديداً - لذا تم دراسة الوفرة الموسمية للحشريتين وعلاقتها بالمفترسات المصاحبة والظروف الجوية السائدة على نباتات الفول البلدي في مزرعة محطة البحوث الزراعية بسخا خلال موسمين متتاليين ٢٠٠٦/٢٠٠٥ م. ٢٠٠٧/٢٠٠٦ م.

أوضحت النتائج المتحصل عليها أن تعداد يرقات صانعات الأنفاق كان أكثر وفرة بدرجة معنوية في الموسم الثاني عن الموسم الأول عكس المفترسات المصاحبة ، ولكن تعداد نطاطات الأوراق لم يختلف خلال الموسمين. وبدأ ظهور يرقات صانعات الأنفاق بتعداد قليل ثم تذبذبت مسجلة ذروتين في الموسم الأول (الأسبوع الثاني من ديسمبر والأسبوع الأول من مارس) وثلاث ذروات في الموسم الثاني (الأسبوع الأول من يناير والأسبوع الأول والأخير من فبراير) .

أيضاً بدأ ظهور نطاطات الأوراق بتعداد قليل في بداية الموسم ثم تذبذبت مسجلة ثلاث ذروات لكل موسم، ففي الموسم الأول كانت الذروات في الأسبوع الثاني من ديسمبر والأسبوع الأخير من يناير والأسبوع الأول من مارس ، بينما في الموسم الثاني كانت الذروات في الأسبوع الأخير من نوفمبر والأسبوع الأول والرابع من يناير والأسبوع الثالث من فبراير.

سجلت النتائج أيضاً وجود أربعة أنواع من المفترسات في حقول الفول البلدي هي أسد المن والحشرة الرواغة والأسكمنس والعناكب الحقيقية ، على أساس المجموع الكلي للمفترسات فقد بدأت في الظهور بأعداد قليلة في أول الموسم وسجلت أعلى تعداد خلال نوفمبر ويناير في الموسم الأول وخلال نوفمبر وديسمبر في الموسم الثاني.

كان تأثير العوامل الجوية الثلاثة (الحرارة والرطوبة الجوية وسرعة الرياح) والمفترسات المصاحبة غير معنوي على كل من صانعات الأنفاق ونطاطات الأوراق خلال موسمي الدراسة ماعدا تأثير الرطوبة الجوية على نطاطات الأوراق في الموسم الأول حيث كان التأثير معنوياً. كان أيضاً التأثير المشترك للعوامل الجوية الثلاثة والمفترسات أكثر وضوحاً على نطاطات الأوراق في الموسم الأول فقط.