

RELATIVE SUSCEPTIBILITY OF CERTAIN FABA BEAN BREEDING LINES TO INFESTATION BY THE SERPENTINE LEAF MINER, *Liriomyza trifolii* (BURGESS) UNDER FIELD CONDITIONS IN NORTH DELTA

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ABSTRACT

Seasonal fluctuations and the relative susceptibility of eleven breeding lines of faba bean in addition to the local variety Sakha 3 to the infestation by the serpentine leaf miner, *Liriomyza trifolii* (Burgess) were investigated at Farm of Sakha Agricultural Research Station during two successive growing seasons; 2005/06 and 2006/07.

Data collected weekly using binocular microscope and by visual counts indicated that the population of the leaf miner, *L. trifolii* was higher in the second season than in the first one and the highest number of the live larvae was recorded during the second half of February on all tested breeding lines and variety Sakha 3 . The mean number of *L. trifolii* larvae indicated that the highest number was recorded on the line 1566/574 in the first season, while in the second season the highest number was observed on line 461.Sakha1. On the hand, the breeding line 1618/837 recorded the lowest number of larvae during the two study seasons.

Regarding to the susceptibility degree to this insect, line 461.Sakha1 appeared as highly susceptible, while the lines 1566/574; 1571/638; 81/38; 96/67 and variety Sakha 3 appeared as susceptible. The other lines showed some sort of resistance, where 1561/492; 1610/705; 1618/ 846 and 92/59 appeared as low resistant lines, but 1618/837 appeared as moderately resistant one . Thus, from the gained results, entomologists and the plant breeders could develop a management strategy for the control of the leaf miners on faba bean in north Delta through selecting lines that have a desirable resistance levels.

INTRODUCTION

In Egypt, the serpentine leaf miner , *Liriomyza trifolii* (Burgess) is one of the serious insect pests of faba bean , *Vicia faba* L. , causing considerable loss in yield (Awadalla, 1998 ; Salem *et al.*,1998; Abou-Elhagag & Salman,2001 and Abdel-Galil *et al.*, 2002). Nowadays, the control strategies must be developed to control the pests of faba bean without using insecticides which cause environmental pollution, destruction of beneficial insects and insect resistance to many insecticides. Therefore, there is an urgent need to determine the sources of resistance existing within faba bean breeding lines and cultivars, as the resistant plants are much better than use of chemicals for pest control. From the point of view of the farmer, entomologists and others, the use of resistant cultivars to insect species represents one of the simplest and most convenient method in insect pest control (Dent, 1991), since they spread rapidly without much extension effort (Dyck,1974). Also, the resistant cultivars represent the inherent ability of crop plants to restrict, retard or overcome pest infestation and thereby to

improve the yield and / or quality of the harvestable crop product (Kumar, 1984).

So, the present work was undertaken to evaluate the relative susceptibility of eleven new breeding lines of faba bean in addition to the variety Sakha 3 to the serpentine leaf miner infestation under field conditions in north Delta.

MATERIALS AND METHODS

The experiment was carried out at the Farm of Sakha Agric. Res. Station to evaluate the relative susceptibility of eleven breeding lines of faba bean in addition to variety Sakha 3 to the serpentine leaf miner, *Liriomyza trifolii* (Burgess) infestation during the two successive faba bean growing seasons, 2005/06 and 2006/07. The tested breeding lines and variety Sakha 3 were obtained from Food Legumes Research Section, Sakha Agric. Res. Station. For each season, the experimental area was divided into 36 plots each of 1/100 feddan. The breeding lines were sown in nearly mid-November in a complete randomized block design with three replicates for each breeding line. Normal agricultural practices were followed without any pesticidal treatments throughout the growing season.

To determine the population density of leaf miner *L. trifolii*, weekly sample of 10 leaflets was picked up at random from each plot representing upper, middle and lower levels of the plant. The chosen leaflets were placed in polyethylene bags and transferred to the laboratory. Only the numbers of live larvae per leaflet were counted and recorded using binocular microscope.

The classification of the susceptibility degree of each faba bean breeding line was determined according to the mean number (X) of the leaf miner larvae and the standard deviation (SD) as reported by Chiang and Talekar (1980). The lines that had mean number of the insect, more than $X + 2SD$, was considered highly susceptible (HS); between X and $X + 2SD$, susceptible (S); between X and $X + 1SD$, low resistant (LR); between $X - 1SD$ and $X - 2SD$, moderately resistant (MR) and less than $X - 2SD$, were considered highly resistant (HR).

Data obtained were statistically analyzed using F- test. The means were compared according to Duncan's multiple test (Duncan, 1955).

RESULTS AND DISCUSSION

1- Seasonal fluctuation of *Liriomyza trifolii* (Burgess) on certain faba bean breeding lines:

The mean numbers of live larvae of the leaf miner, *L. trifolii* were determined on the tested faba bean breeding lines and variety Sakha 3 during two successive growing seasons; 2005/06 and 2006/07. During the first season, results in Table (1) revealed that the larval population started to appear in low numbers on all the tested lines almost at the same time after one month of sowing. The population increased gradually reaching its maximum levels during the second half of February. Then, the population

decreased gradually till the end of the season. Based on the mean number of larvae throughout the whole season, statistical analysis indicated that the highest number was recorded on the line 1566/574 (20.29 ± 1.37 larvae/ 10 leaflets) followed closely by lines 461.Sakha 1 and 96/67 (19.58 ± 1.29 and 17.86 ± 0.71 larvae/ 10 leaflets, respectively), while the line 1618/837 harbored the lowest number by 14.07 ± 1.10 larvae/10 leaflets. The other breeding lines varied in their infestation by this insect.

Table (1): Population density of *Liriomyza trifolii* larvae on different faba bean breeding lines during season of 2005/06 at Kafr El-Sheikh region.

Sampling date	Mean number of live larvae / 10 leaflets of different breeding lines											
	1561/482	1566/574	1571/638	1610/705	1618/837	1618/846	73/27	81/38	92/59	96/67	461.Sakha1	Sakha3
20/12/2005	3.3	5.3	3.7	2.3	5.7	7.0	4.7	7.3	8.3	4.3	9.0	4.0
27/12	8.7	7.7	5.7	1.0	12.7	7.3	14.3	3.3	12.7	4.0	17.7	9.7
3/1/2006	4.3	5.7	2.3	3.3	2.0	11.7	1.7	2.3	7.3	7.7	8.3	2.0
11/1	1.7	1.7	2.3	0.0	0.0	0.7	2.0	1.3	3.7	15.7	7.0	2.0
18/1	0.0	2.7	0.0	3.3	3.3	1.0	0.0	6.3	5.7	5.0	3.0	0.3
25/1	4.0	7.7	1.7	6.0	2.3	2.0	2.3	5.3	3.0	4.7	2.0	1.0
2/2	14.7	29.7	19.7	11.7	18.0	7.7	17.7	11.3	17.7	18.3	22.7	12.3
9/2	17.0	26.3	36.7	16.7	20.3	16.7	19.3	23.7	19.7	24.0	16.7	28.7
16/2	40.3	54.3	44.3	45.3	23.0	47.7	26.3	27.7	39.3	41.7	41.7	56.7
23/2	38.7	45.0	26.7	31.3	34.7	33.0	34.0	24.7	35.7	30.7	55.7	30.3
2/3	20.0	33.3	19.7	25.0	20.3	27.0	15.7	25.7	20.0	20.3	22.7	27.3
9/3	24.7	21.7	17.7	21.7	19.7	20.3	17.3	20.7	19.7	19.7	25.3	22.3
16/3	29.3	28.7	28.7	26.7	21.7	21.3	24.7	35.3	22.7	34.3	26.7	18.7
24/3	19.7	14.3	18.7	17.7	13.3	21.7	23.3	14.7	12.7	19.7	15.7	16.7
Total	226.4	284.1	227.8	212.0	197.0	225.1	203.3	209.6	228.2	250.0	274.1	232.0
Mean± SE*	16.17 +1.01	20.29 +1.37	16.27 +1.13	15.14 +1.10	14.07 +1.10	16.08 +1.11	14.52 +0.77	14.97 +0.60	16.30 +1.25	17.86 +1.70	19.58 +1.29	16.57 +1.40

SE* Standard error

Regarding to season of 2006/07, the results in Table (2) indicated that the insect larvae started to appear in higher numbers than those recorded in the first season 2005/06 on all tested breeding lines. Then, the population fluctuated recording maximum level during the second half of February and the first week of March with variable levels of its numbers. According to the seasonal mean of larvae, it was clear that the line 461.Sakha1 harbored the highest number of larvae (34.10 ± 0.86 larvae / 10 leaflets), while the line 1618/837 recorded the lowest number with a mean of 26.59 ± 0.86 larvae / 10 leaflets.

Table (2): Population density of *Liriomyza trifolii* larvae on different faba bean breeding lines during season of 2006/07 at Kafr El-Sheikh region.

Sampling date	Mean number of live larvae / 10 leaflets of different breeding lines											
	1561/492	1566/574	1571/638	1610/705	1618/837	1618/846	73/27	81/38	92/59	96/67	461.Sakha1	Sakha3
18/12/2006	27.7	22.3	24.3	21.3	35.7	27.3	26.7	27.7	26.7	19.7	33.0	21.3
25/12	19/7	36.0	43.7	36.7	36.3	35.7	41.7	32.07	31.3	22.7	49.0	37.0
1/1/2007	17.0	8.0	20.0	26.7	19.7	25.0	34.0	24.7	17.0	13.3	30.7	22.7
8/1	8.0	13.0	13.0	8.0	7.3	6.0	6.3	13.7	9.7	13.0	15.0	18.3
15/1	8.0	5.0	17.7	11.0	9.3	11.7	18.0	16.3	14.0	11.3	12.0	9.7
22/1	9.7	14.3	10.7	10.3	13.3	10.3	13.7	9.7	10.3	10.3	25.7	15.0
29/1	11.3	10.0	12.7	21.0	9.0	15.3	16.3	24.3	12.7	21.3	23.3	22.3
5/2	24.7	28.3	29.0	21.3	26.3	21.3	20.7	20.0	27.7	30.0	20.7	17.3
12/2	28.0	24.3	41.7	28.3	30.0	21.0	35.0	35.7	26.7	35.0	25.0	35.0
19/2	58.7	38.0	66.0	68.3	53.3	67.7	56.7	88.7	74.0	68.7	50.7	68.7
26/2	67.0	78.7	63.3	73.3	39.3	76.7	43.7	51.7	60.7	57.0	79.7	87.7
5/3	45.3	54.3	43.3	39.0	44.0	45.3	54.0	35.7	35.0	39.7	59.7	36.7
12/3	26.7	36.0	21.7	28.0	22.7	28.3	16.7	27.3	24.0	24.7	28.0	27.0
19/3	32.7	31.3	33.0	29.7	32.7	23.0	32.3	38.0	23.7	38.3	33.7	27.3
26/3	21.7	19.7	21.3	21.3	20.0	25.0	35.0	22.3	16.0	22.7	25.3	19.3
Total	406.2	419.3	461.4	444.2	398.9	439.5	450.8	468.5	427.5	427.5	511.2	465.0
Mean± SE*	27.08 +0.86	27.95 +1.29	30.76 +0.58	29.61 +0.39	26.59 +0.86	29.30 +0.50	30.05 +0.83	31.23 +0.95	28.50 +1.27	28.50 +0.58	34.10 +0.86	31.0 +0.40

SE* Standard error

2- Relative susceptibility of the tested faba bean breeding lines to *Liriomyza trifolii* (Burgess) infestation :

The results in Table (3) clear the mean number and the susceptibility degree of the tested faba bean breeding lines to the leaf miner, *L. trifolii* during the two studied seasons. It was apparent that the number of larvae was higher in the second season than in the first one . This may be attributed to the differences in the environmental conditions or to other factors as mentioned by Kumar, 1984, who revealed that certain environmental conditions influence fundamental physiological processes of the plant as well as the pest. Thus, a variety that exhibits resistance in one locality or environment may be susceptible in another. Also, Metcalf and William (1975) reported that certain environmental conditions may alter the physiology of the plant to the extent that it becomes unsuitable as a host for a certain pest .

Based on the mean number of the two study seasons, the results revealed that the line 461.Sakha1 harbored significantly the highest number of *L. trifolii* (26.84 larvae/ 10 leaflets), while line 1618/837 received the least numbers (20.29 larvae/ 10 leaflets). The rest lines showed variable levels of infestation.

In respect to the susceptibility degree, the line 461.Sakha1 appeared as highly susceptible (HS), whereas it exhibited the highest number of this insect. The lines 1566/574; 1571/638; 81/35; 96/67 and the variety Sakha3 appeared as susceptible (S), as they harbored relatively high number of larvae. The other lines which harbored quietly low numbers showed some

sort of resistance, where lines 1561/492; 1610/705; 1618/ 846 and 92/59 appeared as low resistant (LR) lines, while 1618/837 appeared as moderately resistant (MR)one . However, it is an important to point out herein that the insect mean numbers must be refer to and/ or agree with the resistance degree of each line.

However, many authors reported differences in susceptibility of faba bean varieties and breeding lines to the leaf miners irfestation under Egyptian conditions (Abdallah *et al.*, 2000; Mohamed & Siman, 2001; Ebadah, 2006; Abdel-Samed & Ahmed, 2007 and El-Samahy, 2008). The latter author showed that the differences may be due to the differences in contents of faba bean varieties (i.e., Si, N, P, K, Zn, Cu, Fe, Mn and chlorophyll contents), while Mustafa and Samara (1999) reported that the differences to leaf miners infestation may be due to the differences in nitrogen and protein content in plant leaves and stems.

Table (3): Seasonal mean numbers of larvae and susceptibility degree (SD) of faba bean breeding lines and variety Sakha 3 to *Liriomyza trifolii* infestation during two successive seasons; 2005/06 and 2006/07 .

Breeding line	20005/06		2006/07		General mean of the two seasons	
	Seasonal mean	SD	Seasonal mean	SD	mean	SD
1561/492	16.17 bcd	LR	27.08 de	MR	21.63 cd	LR
1566/574	20.29 a	S	27.95 cde	LR	24.12 b	S
1571/638	16.27 bcd	LR	30.76 bc	S	23.52 bc	S
1610/705	15.14 cd	LR	29.61 bcd	S	22.38 bcd	LR
1618/837	14.07 d	MR	26.50 e	MR	20.29 d	MR
1618/846	16.08 cd	LR	29.30 bcd	LR	22.69 bc	LR
73/27	14.52 cd	MR	30.05 bc	S	22.29 bcd	LR
81/35	14.97 cd	LR	31.23 b	S	23.10 bc	S
92/59	16.30 bcd	LR	28.50 bcde	LR	22.40 bcd	LR
96/67	17.86 abc	S	28.50 bcde	LR	23.18 bc	S
461.Sakha1	19.58 ab	S	34.10 a	HS	26.84 a	HS
Sakha3	16.57 bcd	S	31.00 b	S	23.79 bc	S
Mean± Sd*	16.49 ± 1.91		29.55 ± 3.48		23.02 ± 1.58	
F-value	3.302**		5.450***		5.405***	

HS = highly susceptible, S = susceptible, LR = low resistant, MR = moderately resistant .

Sd*= standard deviation

In general, plant resistance to insects derives from certain biochemical and/or morphological characteristics of plants, which affect the behavior and / or metabolism of insects and influence the relative degree of damage caused by these insects (Metcalf & William, 1975). Also, Kumar (1984) reported that environmental conditions are known to affect the ability of plants to resist pest attack in addition to these factors influence fundamental physiological processes of the plant as well as the pest and these may interact to make plant resistant or non- resistant temporarily.

From the foregoing results, it could be concluded that the moderately resistant breeding line 1618/837 and the low resistant lines; 1561/492; 1610/705 ; 1618/846; 73/27 and 92/59 can be recommended to cultivate under the conditions of north Delta as they harbored the least larval numbers of leaf miner. However, this work needs more efforts to indicate the real reasons responsible for resistance in faba bean breeding lines. Consequently, collaboration between the breeders and entomologists is highly emphasized and should be continuous as a major part of breeding program aiming at releasing high-yielding cultivars carrying characteristics that enable them to withstand insect and disease attacks.

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حساسية بعض السلالات المبشرة للبقول البلدي للإصابة بصناعة أنفاق الفول تحت الظروف الحقلية في منطقة شمال الدلتا
محمد عبد الحافظ خطاب ، السيد محمد السيد خلف الله و على ممدوح ناصف
معهد بحوث وقاية النباتات - مركز البحوث الزراعية - الجيزة مصر

تم تقييم التذبذبات الموسمية والحساسية النسبية لإحدى عشرة سلالة مبشرة من الفول البلدي وكذا الصنف سخا ٣ للإصابة بصناعة أنفاق الفول تحت الظروف الحقلية في مزرعة محطة البحوث الزراعية بسخا خلال موسمي الزراعة ٢٠٠٥/٢٠٠٦، ٢٠٠٦/٢٠٠٧ م .
أوضحت نتائج الفحص الأسبوعي أن التعداد كان أعلى في الموسم الثاني عنه في الموسم الأول، وأن أعلى تعداد لليرقات الحية لصناعة الأنفاق سجل خلال النصف الثاني من شهر فبراير. وقد أظهرت السلالة ١٥٦٦/٥٧٤ أعلى تعداد لليرقات الحية في الموسم الأول بينما سجلت السلالة ١٤٦١. سخا أعلى تعداد في الموسم الثاني. على الجانب الآخر كانت السلالة ١٦١٨/٨٣٧ أقل تعداد خلال موسمي الدر اسه .
بالنسبة لدرجات الحساسية للإصابة بصناعة الأنفاق أظهرت السلالة ٤٦١. سخا أعلى حساسية يليها السلالات ١٥٦٦/٥٧٤، ١٥١٧/٦٣٨، ٨١/٣٨، ٩٦/٦٧ والصنف سخا ٣. أما السلالات ١٥٦١/٤٩٢، ١٦١٠.٧٠٥، ١٦١٨/٨٤٦، ٩٢/٩٥ أوضحت مقاومة منخفضة، في حين كانت السلالة ١٦١٨/٨٣٧ ذات مقاومة متوسطة.
وبناءً على النتائج المتحصل عليها يمكن لباحثي الحشرات ومربي النباتات تطوير استراتيجيه مكافحة صناعات الأنفاق على الفول البلدي في شمال الدلتا باختيار السلالات المقاومة لهذه الحشرة والتوصية بزراعتها.