

## **INFLUENCE OF SOME VARIETIES ON THE MAIN INSECT PESTS ATTACKING FABA BEAN PLANTS**

**Awadalla, S. S.\*; F. E. Abdallah\*\* and Nora R. El-Mashaly\*\***

**\* Economic Entomology Dept., Fac. of Agric., Mansoura Univ.**

**\*\* Field Crop Insect pest Dept., Sakha Agric. Res. Station, Plant Protection Res. Inst., Agric. Res. Center.**

### **ABSTRACT**

The present experiments were carried out at the experimental farm of Sakha Agricultural Research Station, Kafr El-Sheikh Governorate during two successive seasons; 2011/12 and 2012/13 to study the susceptibility of some varieties on the main insect pests attacking faba bean plants.

The highest average number of *Aphis craccivora* (Koch.) was recorded on Sakha 4 variety which had the highest of total Carbohydrate (51.58%) and the lowest of total Phenole (0.528%) with an average number of 287.14±80.53 and 171.56±35.63 indiv./20 plants followed by Sakha 2 variety (233.00±91.53 and 134.67±39.50 indiv./20 plants) during the two successive seasons, 2011/12 and 2012/13, respectively.

The highest average number of *Empoasca* spp. was recorded on Giza 3 variety which had high crude Protein (18.91%) with an average number of 70.00±8.71 and 116.92±18.73 indiv./ 100 leaflets followed by Sakha 4 in the first season (63.42±15.47 indiv./ 100 leaflets) and Giza 843 variety in the second one (110.92±15.78 indiv./ 100 leaflets).

The highest average number of *Nezara viridula* L. was recorded on Sakha4 in the first season (total Carbohydrate, 51.58%) and Giza 3 in the second one (crude Protein, 18.91%) with an average number of 4.57±1.44 and 7.00±0.47 indiv./20 plants during the two seasons, respectively. Statistical analysis revealed insignificant differences among faba bean varieties during the two seasons of study.

The highest average number of *Liriomyza trifolii* (Burgess) was recorded on Giza3 variety which had high C. protein (18.91%) and low Silica (1.54%) with average number of 157.6±3.4 and 201.5±64.65 larvae/ 100 leaflets followed by Sakha 3 and Sakha 1 variety (156.00±5.5 and 198.6±51.14 larvae/ 100 leaflets) during the successive seasons, respectively.

Statistical analysis revealed significant differences among faba bean varieties and the average number of *A. craccivora*, *Empoasca* spp. and *L. trifolii* during the two seasons of study.

The results showed insignificantly or significantly positive relationship among varieties contents from C. protein, T. lipids and T. phenole with *Empoasca* spp., *N. viridula* and *L. trifolii* while was negative relationship with T. carbohydrate and silica. In contrary, the results showed that significantly positive relationship among varieties contents from T. carbohydrate and silica with *A. craccivora* while was significantly negative relationship with C. protein, T. lipids and T. phenole.

### **INTRODUCTION**

Faba bean (*Vicia faba* L.) is considered one of the most important economic crops in Egypt. It ranks the first leguminous food and considered the main source of plant protein. However, production of this crop has been

constrained by the limitations imposed by insect pests and diseases (Metwally *et al.*, 1997).

Faba bean plants are attacked by several insect pests which cause a considerable damage, e.g. the serpentine American leaf miner, *Liriomyza trifolii* (Burgess) (Diptera : Agromizidae); cowpea aphid, *Aphis craccivora* (Koch.) (Homoptera:Aphididae); leafhopper, *Emposaca* spp. (Homoptera : Cicadellidae) and *Nezara viridula* L. (Hemiptera:Pentatomidae) that affect the quality and quantity of faba bean yield (Aly and Markadey, 1990; Abdallah, 2000 and Mohamed and Slman, 2001).

Because of genetic variation, faba bean varieties differ in the susceptibility to the aforementioned insect pest infestation thus, the resistant varieties could be used as an item in integrated pest management programs. The present work aimed to study the susceptibility of some varieties to the main insect pests attacking faba bean plants.

## **MATERIALS AND METHODS**

The present experiments were carried out at the experimental farm of Sakha Agricultural Research Station, Kafr El-Sheikh Governorate during two successive seasons, 2011/12 and 2012/13 to study the susceptibility of some varieties to the main insect pests attacking faba bean.

The experimental area was divided into plots, each of 1/100 feddan (42 m<sup>2</sup>). The tested varieties were Sakha 1, Sakha 2, Sakha 3, Sakha 4, Giza 3 improved, Giza 843 and Misr 1. The seeds of the tested entries were obtained from Food Legumes Research Section, Field Crops Research Institute, Agricultural Research Center. Seeds were sown on first of November in complete randomized blocks with four replicates for each entry. The normal agricultural practices were followed regularly without any insecticidal treatments throughout the growing season and the examination started 30 days after sowing until the end of the seasons.

To assess the population density of aphids and the green stink bug on the involved varieties, weekly samples of 20 plants (5 plants from each replicate) of each Variety were examined and numbers of insects were directly recorded in the field.

To assess the population density of leafhopper (nymphs and adults) and *L. trifolii* larvae on the involved varieties, weekly samples of 100 leaflets (25 leaflets from each replicate) of each variety were chosen at random and number of insects were counted and recorded.

### **Plant analysis**

Analysis of faba bean varieties were conducted at Agricultural Research Center. Total carbohydrates, crude protein, total lipids, silica and total phenoles were estimated using the method of Hedge and Hofreites (1962), Jones *et al.* (1991), A.O.A.C.(1984), APHA(1992) and Malick and Singh(1980), respectively.

### **Statistical analysis**

Statistical analysis using ANOVA and simple correlation of the collected data were subjected to Duncan's multiple range test (1955) at the

5% level and the mean values obtained were compared by the Least Significant Differences Test (LSD).

## RESULTS AND DISCUSSION

### A. Susceptibility faba bean varieties:

#### 1. *Aphis craccivora*

Data presented in Table (1) show the average numbers of *A. craccivora* on faba bean varieties during 2011/12 and 2012/13 seasons.

In the first season, the highest average number of *A. craccivora* was recorded on Sakha 4 variety with an average of  $287.14 \pm 80.53$  individuals / 20 plants, followed by Sakha 2 variety while, the lowest average number of aphid was recorded on Giza 3 variety with an average of  $182.57 \pm 46.53$  individuals / 20 plants.

Similar results were obtained in the second season, as the highest average number of *A. craccivora* was also recorded on Sakha 4 variety with an average of  $171.56 \pm 35.63$  individuals / 20 plants followed by Sakha 2 variety with an average of  $134.67 \pm 39.50$ . The lowest average number of aphid was recorded on Giza 3 variety with an average of  $70.89 \pm 25.63$  individuals / 20 plants.

As a conclusion, the highest average number of *A. craccivora* was recorded on Sakha 4 variety which had total Carbohydrate (51.58%) (Table 5) and total Phenoles (0.528%) with an average number of  $287.14 \pm 80.53$  and  $171.56 \pm 35.63$  indiv./20 plants followed by Sakha 2 variety ( $233.00 \pm 91.53$  and  $134.67 \pm 39.50$  indiv./20 plants) while, the lowest average number of aphid was recorded on Giza 3 variety that had total Carbohydrate (48.63%) and total Phenole (0.635%) with an average number of  $182.57 \pm 46.53$  and  $70.89 \pm 25.63$  indiv./20 plants during the two successive seasons, respectively. Statistical analysis revealed significant differences among faba bean varieties during the two seasons of study. The present results are in agreement with those obtained by Schulz (1993) who found that high contents of starch in faba bean leaf discs led to an increase of essential low molecular compounds and as a consequence an increase in the growth of *A. fabae*. Helal *et al.* (1997) who found that the highest infestation with aphid occurred on Giza3 while breeding line 716/1039 and Reina Blanca were the least infested. Metwally *et al.* (1997) indicated that, out of seven faba bean varieties and breeding lines, Giza3 proved to be the highest susceptible to aphid infestation while, Giza Blanca was the lowest infestation for aphid. Hegab (2008) showed a positive relationship between protein and carbohydrate with aphid infestation in the all faba bean varieties.

**Table (1): Influence of varieties on the average numbers of *A. craccivora* on faba bean plants during 2011/12 and 2012/13 seasons.**

Variety	2011/2012 season	2012/2013 Season	Average
Sakha1	200.57±80.70 c	109.56±14.76 d	155.07±45.96
Sakha2	233.00±91.53 d	134.67±39.50 f	183.84±49.66
Sakha3	183.00±77.83 a	81.33±28.18 b	132.17±51.35
Sakha4	287.14±80.53 e	171.56±35.63 g	229.35±58.38
Giza3	182.57±46.53 a	70.89±25.63 a	126.73±56.41
Giza843	196.86±98.75 b	115.00±12.2 e	155.93±41.35
Misr1	184.29±57.57 a	98.78±22.10 c	141.54±43.19
<b>LSD</b> at 5%	5.73	3.99	

In a column, means followed by the same letter are not significantly different at the 5% level

## 2. *Empoasca* spp.

Data presented in Table (2) show the average numbers of *Empoasca* spp. on faba bean plants on different varieties during 2011/12 and 2012/13 seasons.

In the first season, the highest average number of *Empoasca* pp. was recorded on Giza 3 variety with an average of 70.00±8.71 individuals / 100 leaflets followed by Sakha 4 variety while, the lowest average number of leafhopper was recorded on Sakha 2 variety with an average of 44.33±7.88 individuals / 100 leaflets.

In the second season, the highest average number of *Empoasca* spp. was recorded on Giza 3 variety with an average of 116.92±18.73 individuals / 100 leaflets followed by Giza 843 variety with an average of 110.92±15.78 while, the lowest average number of leafhopper was recorded on Sakha 2 variety with an average of 65.85±8.39 individuals / 100 leaflets.

As a conclusion, the highest average number of *Empoasca* spp. was recorded on Giza 3 variety which had crude Protein (18.91%) with an average numbers of 70.00±8.71 and 116.92±18.73 indiv./ 100 leaflets followed by Sakha 4 and Giza 843 variety (63.42±15.47 and 110.92±15.78 indiv./ 100 leaflets). The lowest average number of leafhopper was recorded on Sakha 2 variety which had crude protein (17.45%) with average numbers of 44.33±7.88 and 65.85±8.39 indiv./ 100 leaflets during the successive seasons, respectively. Statistical analysis revealed significant differences among faba bean varieties during the two seasons of study.

The present results are in agreement with those obtained by Metwally *et al.* (1997) indicated that Giza3 and Giza402 were the most infested varieties with *Empoasca* spp. Hegab (2008) showed a positive relationship between protein and carbohydrate with leafhoppers infestation in the all faba bean varieties.

**Table (2): Influence of varieties on the average numbers of *Empoasca* spp. on faba bean plants during 2011/12 and 2012/13 seasons.**

Variety	2011/2012 season	2012/2013 Season	Average
Sakha1	62.33±11.16 bc	107.38±14.88 e	84.86±22.75
Sakha2	44.33±7.88 a	65.85±8.39 a	55.09±10.87
Sakha3	61.92±11.79 bc	85.31±12.68 b	73.62±11.81
Sakha4	63.42±15.47 c	102.08±14.49 d	82.75±19.53
Giza3	70.00±8.71 d	116.92±18.73 g	93.46±23.69
Giza843	60.5±9.04 b	110.92±15.78 f	85.71±25.47
Misr1	60.08±11.01 b	89.46±12.42 c	74.77±14.84
<b>LSD</b> at 5%	2.72	3.86	

In a column, means followed by the same letter are not significantly different at the 5% level

### 3. *Nezara viridula*

Data presented in Table (3) showed the average numbers of *N. viridula* on faba bean plants according to different varieties during 2011/12 and 2012/13 seasons.

In the first season, the highest average number of *N. viridula* was recorded on Sakha 4 variety with an average of 4.57±1.44 individuals / 20 plants while, the lowest average number of stink bug was recorded on Misr 1 variety with an average of 3.00±0.77 individuals / 20 plants.

In the second season, the highest average number of *N. viridula* was recorded on Giza 3 variety with an average of 7.00±0.47 individuals / 20 plants while, the lowest average number of stink bug was recorded on Sakha 3 variety with an average of 5.3±0.88 individuals / 20 plants.

As a conclusion, the highest average number of *N. viridula* was recorded on Sakha 4 (total Carbohydrate, 51.58%) and Giza3 (crude Protein, 18.91%) variety with average numbers of 4.57±1.44 and 7.00±0.47 indiv./20 plants while the lowest average number of green stink bug was recorded on Misr 1 and Sakha 3 variety (3.00±0.77 and 5.3±0.88 indiv./20 plants) during the two seasons, respectively. Statistical analysis revealed insignificant differences among faba bean varieties during the two seasons of study.

**Table (3): Influence of varieties on the average numbers of *N. viridula* on faba bean plants during 2011/12 and 2012/13 seasons.**

Variety	2011/2012 season	2012/2013 Season	Average
Sakha1	3.86±1.28 a	5.8±0.89 a	4.83±0.98
Sakha2	3.57±1.06 a	5.7±0.99 a	4.64±1.08
Sakha3	4.43±0.99 a	5.3±0.88 a	4.87±0.44
Sakha4	4.57±1.44 a	6.5±1.00 a	5.54±0.97
Giza3	4.43±0.77 a	7.00±0.47 a	5.72±1.29
Giza843	4.29±1.08 a	6.2±1.06 a	5.25±0.96
Misr1	3.00±0.77 a	6.8±0.73 a	4.9±1.92
<b>LSD</b> at 5%	3.82	4.71	

#### 4. *Liriomyza trifolii*

Data presented in Table (4) showed the average numbers of *L. trifolii* on faba bean plants according to different varieties during 2011/12 and 2012/13 seasons.

In the first season, the highest average number of *L. trifolii* was recorded on Giza 3 variety with an average of 157.6±3.4 larvae / 100 leaflets followed by Sakha 3 variety while, the lowest average number of leaf miner was recorded on Sakha 2 variety with an average of 91.6±2.3 larvae / 100 leaflets.

In the second season, the highest average number of *L. trifolii* was recorded on Giza 3 variety with an average of 201.5±64.65 larvae / 100 leaflets followed by Sakha 1 variety with an average of 198.6±51.14 larvae / 100 leaflets while, the lowest average number of leaf miner was recorded on Sakha 2 variety with an average of 151.5±38.68 larvae / 100 leaflets.

As a conclusion, the highest average number of *L. trifolii* was recorded on Giza 3 variety which had 18.91% crude protein and 1.54% Silica with an average numbers of 157.6±3.4 and 201.5±64.65 larvae / 100 leaflets followed by Sakha 3 and Sakha 1 variety (156.00±5.5 and 198.6±51.14 larvae / 100 leaflets). The lowest average number of leaf miner was recorded on Sakha 2 variety which had 17.45% crude protein and 2.47% Silica with average numbers of 91.6±2.3 and 151.5±38.68 larvae / 100 leaflets during the successive seasons, respectively. Statistical analysis revealed significant differences among faba bean varieties during the two seasons of study.

The present results are in agreement with those obtained by Mesbah and Sherif (1994) who indicated that Giza461 and Giza3 proved to be the most susceptible varieties to infestation with *L. congesta* since number of mines ranged between 157.26 and 242.86 and number of larvae between 79.22 and 155.91 per 100 faba bean leaflets. El-Samahy (2008) indicated that the highest infestation happened in case of Sakha3 variety with a mean of 66.89 larvae/ 25 leaflets in the first season and Youssef El-Sediq in the second season with a mean of 58.72 larvae / 225 leaflets, while Giza 843 harbored the lowest number of larvae with a mean of 36.50 and 23.67 larvae / 25 leaflets during two seasons, respectively.

**Table (4): Influence of varieties on the average numbers of *L. trifolii* on faba bean plants during 2011/12 and 2012/13 seasons.**

Variety	2011/2012 season	2012/2013 Season	Average
Sakha1	138.2±2.4 b	198.6±51.14 e	168.4±30.51
Sakha2	91.6±2.3 a	151.5±38.68 a	121.55±30.26
Sakha3	156.0±5.5 e	197.8±51.57 e	176.9±21.11
Sakha4	145.6±3.6 c	157.7±50.42 b	151.65±6.11
Giza3	157.6±3.4 f	201.5±64.65 f	179.55±22.17
Giza843	148.8±4.4 d	184.7±61.17 d	166.75±18.14
Misr1	145.2±2.9 c	176.2±46.76 c	160.7±15.66
<b>LSD</b> at 5%	1.65	4.91	

In a column, means followed by the same letter are not significantly different at the 5% level

**B- The relationship between component of faba bean and insect pests**

Data in Table (5) present some chemical components of faba bean varieties. The highest percentage of total carbohydrates recorded on Sakha 4 variety (51.58%) and the lowest percentage was recorded on Giza 3 variety (48.63%). Concerning the percentage of crude protein and total lipids, the highest percentages of both were recorded on Giza 3 variety (18.91% and 2.22% respectively), while the lowest percentage was recorded on Sakha 4 variety (17.22% and 1.09%). Regarding to Silica, the highest percentage was recorded on Sakha 4 (2.65%) and the lowest percentage was recorded on Giza 3 (1.54%). The highest percentage of total Phenoles was recorded on Giza 3 (0.635%) while the lowest percentage was recorded on Sakha 4. Sakha 2, Sakha 3, Giza 843 and Misr 1 had moderate values of these components.

The data presented in Table (6) show the simple correlation coefficient among faba bean varieties and some components of plants of faba bean varieties. Population density of *A. craccivora* correlated with negative significant/ or highly significant with crude protein, total lipids and total phenols. By contrast, the aphid density correlated positively significant with total carbohydrate and silica.

*Empoasca* spp. correlated negatively with total carbohydrate and silica, but positively with crude protein, total lipids and total phenols.

*Nezara viridula* population density correlated negatively with total carbohydrate and silica, but positively with crude protein, total lipids and total phenols.

*Liriomyza trifolii* had positive correlation values with each of crude protein, total lipids and total phenols, but had negative correlation values with total carbohydrate and silica.

**Table (5): Chemical components of faba bean varieties**

Char. Varieties	Total carbohydrates %	Crude protein %	Total lipids %	Silica %	Total phenoles %
Sakha1	50.35 bc	18.01 d	1.54 cd	2.08 b	0.561 b
Sakha2	51.33 a	17.45 f	1.22 de	2.47 a	0.551 b
Sakha3	49.26 de	18.58 b	1.95 ab	1.64 d	0.624 a
Sakha4	51.58 a	17.22 g	1.09 e	2.65 a	0.528 a
Giza3	48.63 e	18.91 a	2.22 a	1.54 d	0.635 b
Giza843	50.90 ab	17.76 e	1.37 de	2.22 b	0.556 a
Misr1	49.86 cd	18.32 c	1.74 bc	1.85 c	0.609 b
<b>LSD at 5%</b>	<b>0.75</b>	<b>0.18</b>	<b>0.29</b>	<b>0.19</b>	<b>0.034</b>

In a column, means followed by the same letter are not significantly different at the 5% level

Table (6): Simple correlation coefficient among faba bean varieties and some components of plants of faba bean varieties.

Insect pests	Char. Total carbohydrates %	Crude protein %	Total lipids %	Silica %	Total phenole %
<i>A. craccivora</i>	0.872*	-0.911**	-0.877**	0.932**	-0.869*
<i>Empoasca</i> spp.	-0.399ns	0.387ns	0.389ns	-0.349ns	0.216ns
<i>N. viridula</i>	-0.205ns	0.160ns	0.212ns	-0.094ns	0.101ns
<i>L. trifolii</i>	-0.747*	0.746*	0.730*	-0.752*	0.626*

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### تأثير بعض الاصناف علي أهم الآفات الحشرية التي تهاجم نباتات الفول البلدي

سمير صالح عوض الله\* ، فهمي الدكتوروي عبدالله\*\* ، نورا رمضان المشالي\*\*

\* قسم الحشرات الاقتصادية – كلية الزراعة- جامعة المنصورة

\*\* قسم بحوث افات محاصيل الحقل- محطة بحوث سخا - معهد بحوث وقاية النباتات – مركز البحوث الزراعية

أجريت هذه الدراسة في المزرعة البحثية لمحطة بحوث سخا محافظة كفر الشيخ خلال موسم ١٢/٢٠١١ و ١٣/٢٠١٢ بهدف تقييم حساسية بعض أصناف الفول البلدي لأهم الآفات الحشرية. أوضحت النتائج أن أعلى متوسط لتعداد من البقوليات سجل علي صنف سخا٤ ذو المحتوى الأعلى من الكربوهيدرات (٥١.٥٨%) والمحتوي الأقل من الفينول (٥٢.٨%) بمتوسط  $287.14 \pm 80.53$  و  $171.06 \pm 35.63$  فرد / نبات يليه سخا ٢ بمتوسط  $233 \pm 91.03$  و  $134.67 \pm 39.50$  فرد / نبات خلال موسمي الدراسة علي التوالي. سجل أعلى متوسط لتعداد نطاطات الأوراق علي صنف جيزة٣ ذو المحتوى الأعلى من البروتين (١٨.٩١%) بمتوسط  $8.71 \pm 70$  و  $116.92 \pm 18.73$  فرد / وريقة يليه سخا ٤ في الموسم الأول بمتوسط  $63.42 \pm 15.47$  فرد / وريقة و جيزة ٨٤٣ بمتوسط  $110.92 \pm 15.78$  فرد / وريقة. بالنسبة للبقعة الخضراء سجل أعلى متوسط للتعداد علي صنف سخا٣ ذو المحتوى العالي من الكربوهيدرات (٥١.٥٨%) وجيزة٣ ذو المحتوى الأعلى من البروتين (١٨.٩١%) بمتوسط  $1.44 \pm 0.57$  و  $1.47 \pm 7$  فرد / نبات خلال موسمي الدراسة علي التوالي. أظهر التحليل الإحصائي وجود فروق غير معنوية في متوسط نسبة الإصابة بالبقعة الخضراء بين أصناف الفول البلدي خلال موسمي الدراسة. سجل أعلى متوسط لتعداد صناعة الأنفاق علي صنف جيزة٣ ذو المحتوى الأعلى من البروتين (١٨.٩١%) والمنخفض من السيلكا (١٠.٥٤%) بمتوسط  $107.6 \pm 3.4$  و  $201.5 \pm 64.65$  بريقة / وريقة يليه سخا٣ (موسم أول) و سخا١ (موسم ثاني) بمتوسط  $106 \pm 5.05$  و  $198.06 \pm 51.14$  بريقة / وريقة.

أظهر التحليل الإحصائي وجود فروق معنوية في متوسط نسبة الإصابة بكل من من البقوليات ونطاطات الأوراق وصناعة أنفاق أوراق الفول وأصناف الفول البلدي خلال موسمي الدراسة. أوضحت النتائج وجود علاقة غير معنوية أو معنوية موجبة بين محتوى أصناف الفول البلدي من البروتين والليبيدات والفينول مع حشرات نطاطات الأوراق والبقعة الخضراء وصناعة الأنفاق بينما كانت هذه العلاقة سالبة مع محتوى الكربوهيدرات والسيلكا. وعلي النقيض فقد أظهرت النتائج وجود علاقة معنوية موجبة بين محتوى الأصناف من الكربوهيدرات والسيلكا مع المن بينما كانت هذه العلاقة معنوية سالبة مع محتوى البروتين والليبيدات والفينول.

قام بتحكيم البحث

أ.د / حسن محمد فتحى  
أ.د / محمود رمزي شريف

أ.د / حسن محمد فتحى  
أ.د / محمود رمزي شريف