

SURVEY AND RELATIVE OCCURRENCE OF INSECTS AND ASSOCIATED NATURAL ENEMIES ON FENUGREEK PLANTS AND STUDY EFFECT OF PLANT LEVEL ON ABUNDANCE OF INSECTS

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(Manuscript received 12 April 2010)

Abstract

The present investigation was carried out at the Experimental Farm of Plant Protection Research Station at Qaha, Qalyubiya Governorate throughout two successive seasons (2006 / 2007 and 2007 / 2008). The obtained results clearly indicated the following points: (1)- Twenty three species of insects and associated natural enemies were surveyed on the fenugreek plant during two successive growing seasons. (2)- Thrips insect proved to be most abundant species during the two growing seasons showing the highest percent (50.27%) of grand total. (3)- It is worthy to mention that *A. pisum* among homopterous insects showed the highest relative occurrence comparing with the other homopterous insects (41.68 %). (4)- The investigated orders were descendingly arranged according to occurrence rates as Thysonoptera, Homoptera, Diptera, Coleoptera, Hemiptera, Lepidoptera, Mesostigmata and Neuroptera. (5) It is worthy to mention that the individuals of aphid species, berseem leaf weevil and cotton thrips were surveyed on terminal buds of fenugreek plant only and it is clear that lower leaves of plant were free from any individuals in both seasons. It mentioned that the lower leaves harboured the highest numbers of leafminer and whiteflies during two growing seasons.

INTRODUCTION

Fenugreek (*Trigonella foenum graecum* L.) is medicinal plant and an annual forage legume crop. The species name "foenum graecum" means "Greek hay" indicating its use as a forage crop in the past. Fenugreek is believed to be native to the Mediterranean region, but now is grown as a spice in most parts of the world and it is considered a medicinal plant in all world. It is reported as a cultivated crop in parts of Europe, northern Africa, west and south Asia, Argentina, Canada, United states of America (USA) and Australia (Basu, 2006). India is the leading fenugreek producing country in the world. In parts of Asia the young plants are used as "pot herbs" and the seed as a spice or herbal medicine. Nowadays, medical and aromatic plants are considered as important crops in our agricultural production for human health as well as for export purposes outside the country. These plants are used in medicinal industries and edibles for the human and animal. The value of fenugreek due to it contains 28 % mucilage occur in the endosperm, 22% protein, 16% fixed

oil , vitamins, saponin and two alkaloids, tregoniline and choline (Ahmed and Ali, 2002) . So, it is necessary to study insects attacking such important plants. However, many authors surveyed some insects on fenugreek plants (Hamid *et al.* , 1974 and Kalra *et al.*, 2002).

This study aimed to:

- 1- Survey fenugreek insects and associated natural enemies.
- 2- Determine relative occurrence of species.
- 3- Study the effect of plant level on insect population on fenugreek.

MATERIALS AND METHODS

Field experiments were carried out at Plant Protection Research Station at Qaha, Qalyubiya Governorate during two successive seasons 2006/2007 and 2007/2008 in order to study the surveying , relative abundance of insects in addition to their associated parasitoids and predators on fenugreek plants and study the effect of plant levels on mean numbers of insects .

An area of about 525 m² was divided into three replicates, each replicate was about 175 m². Fenugreek was sown on 15th and 10th of November in first and second seasons, respectively. The normal agricultural practices (irrigation and fertilization) were followed but no pesticidal treatments were applied. Weekly samples of terminal buds and leaves (20 of each replicate) were separately collected at random. Each sample was placed in polyethylene bags to examine in laboratory using stereomicroscope at the same day. Four aphid species [nymphs and adults of Leguminous aphid , *Aphis craccivora* Koch, pea aphid , *Acyrtosiphon pisum* (Harris), green peach aphid , *Myzus persicae* Sulz., cotton aphid , *Aphis gossypii* (Glover)], berseem leaf weevil (adults and larvae) , *Phytonomus brunneipennis* Boh , *Tychus* sp. (adults), cotton thrips, *Thrips tabaci* Lind. and *Haemogamasus pontiger* Berlese harboured terminal buds, but the leaf miner (larvae) , *Liriomyza* spp. , *Autographa gamma* L. (eggs) , white fly, *Bemisia tabaci* (Genn.) (eggs, larvae and nymphs) and aphid lion, *Chrysoperla carnea* (Steph.) (eggs) were occurred on leaves , the cotton seed bug , *Oxycarenus hylalinipennis* Costa , *Orius* spp. , *Coccinella* spp. and rove beetles , *Paederus alfieri* Koch were recorded as adults on stems and leaves of fenugreek (20 stems/ replicate) . Hover fly, *Sphaerophoria flavicauda*, honey bee, *Apis mellifera* Linnaeus, *Cosmlyce baeticus* L, *Pieries rapae* and *Vanessa cardui* L. were recorded as visitor adults for flowers by using sweeping net as a method of sampling technique. The net was made from a cone of muslin cloth (30 cm diameter and 60 cm deep) circular sold wire (30 cm diameter) and wooden rod (75 cm Length). Two rapid

strokes of opposite directions were performed over the fenugreek plant every two steps.

Leaves infested with larvae of *Liriomyza* spp. were put in glass jars till emergence of *Dacnusa sibirica* Kelenga and *Diglyphus isaea* (Walker) parasitoids for *liriomyza* spp.. "F" test and L.S.D. values were calculated by Fisher (1944) and Snedecor(1957).

RESULTS AND DISCUSSION

1: Survey studies.

Data in Table (1) revealed that twenty three species of insects and their associated parasitoids and predators were surveyed on fenugreek plants with their stages, site of occurrence, their status and periods of occurrence at Plant Protection Research Station, Qaha region during the two successive growing seasons 2006/2007 to 2007 /2008.

1. A: Survey of insect pests.

Data tabulated in Table (1) show that the recorded insect pests species belonging to seven families of six orders i.e. Coleoptera, Diptera, Hemiptera, Homoptera, Lepidoptera and Thysanoptera. Order Homoptera includes two families, Aleyrodidae and Aphididae, but the remaining orders contained only one family for each i.e., Curoulionidae (Or:Coleoptera),Agromyzidae (Or.:Diptera), Lygaeidae (Or.:Hemiptera), Noctuidae (Or.: Lepidoptera) and Thripidae (Or.: Thysonoptera). The surveyed insects differed in their frequency, stage and sites besides periods of occurrence, during 2006/2007 to 2007 /2008 growing seasons. Seven species are observed as terminal bud insects, *P. brunneipennis*, *Tychus* sp., *A. pisum*, *A.craccivora* , *A.gossypii* , *M.persicae* and *T. tabaci* , where the *B. tabaci*,*Liriomyza* spp. and *A. gamma* invading leaves of fenugreek plant but *O. hylalinipennis* found on leaves and stems .

The obtained data are in agreement with those obtained by Hammad (1978), Kaiser *et al.* (1988) and Kalra *et al.* (2004) .

Table 1. List of surveyed insects and associated natural enemies on fenugreek plants at Plant Protection Research Station at Qaha region Qalyubiya Governorate during two successive seasons 2006 / 2007 and 2007 / 2008.

Order Insects	Family	Species	Stage (s)	Status	Frequency	Period of occurrence
Coleoptera	Curculionidae	<i>Phytonomus brunneipennis</i>	Larvae+ adults	Phytophagous	Abundance	Dec. – Apr.
		<i>Tychnus</i> sp.	Adults	Phytophagous	Rare	Jan.
	Coccinellidae	<i>Coccinella</i> spp.	Adults	Predaceous	Abundance	Jan.-Apr.
	Staphylinidae	<i>Paederus affiera</i>	Adults	Predaceous	Rare	Feb.
Diptera	Agromyzidae	<i>Liriomyza</i> spp.	Larvae	Phytophagous	Abundance	Dec. – Apr.
	Syrphidae	<i>Sphaerophoria flavicauda</i>	Adults	Visitor	Rare	Feb.
Hemiptera	Lygaeidae	<i>Oxycarenus hyalinipennis</i> Costa	Adults	Phytophagous	Frequency	Feb.. – Mar..
		<i>Orius</i> spp.	Adults	Predaceous	Frequency	Feb.. – Mar..
Homoptera	Aleyrodidae	<i>Bemisia tabaci</i> (Genn.)	Immature stages	Phytophagous	Frequency	Dec. - Janu.
	Aphididae	<i>Acyrtosiphon pisum</i> (Harris)	Moving stages	Phytophagous	Abundance	Jan. – April.
		<i>Aphis craccivora</i> Koch	Moving stages	Phytophagous	Abundance	Jan. – Marc.
		<i>Aphis gossypii</i> (Glover)	Moving stages	Phytophagous	Rare	Marc.
		<i>Myzus persicae</i> Sulz	Moving stages	Phytophagous	Abundance	Jan. – Marc
Hymenoptera	Braconidae	<i>Dacnusa sibirica</i> Kelenga	Adults	Parasite	Abundance	Jan. – Marc
	Eulophidae	<i>Diglyphus isaea</i> (Walker)	Adults	Parasite	Abundance	Jan. – Marc
	Apidae	<i>Apis mellifera</i>	Adults	Visitor	Frequency	Feb.
Lepidoptera	Lcaenidae	<i>Cosmilyce baeticus</i> L.	Adults	Visitor	Rare	Feb.
	Pieridae	<i>Pieris rapae</i>	Adults	Visitor	Rare	Feb
	Nymphalidae	<i>Vanessa cardui</i> L.	Adults	Visitor	Frequency	Jan.
	Noctuidae	<i>Autographa gamma</i> L.	Eggs	Phytophagous	Rare	Jan.
Neuroptera	Chrysopidae	<i>Chrysoperla carnea</i> (Steph)	Eggs	Predaceous	Rare	Feb. Marc.
Thysanopta	Thripidae	<i>Thrips tabaci</i> Lind.	Moving stages	Phytophagous	Abundance	Jan. -Apr.
Mites						
Mesostigmata	Haemogamasidae	<i>Haemogamasus pontiger</i> Berlese	Adults	Predaceous	Rare	Jan.

It is worthy mention that , these insect pests can be divided into three groups for their appaearenc, first group consists of individuals that had high abundance (*P. brunneipennis*, *Liriomyza* spp.,*A.pisum*,*A.craccivora* and *M. persicae*),second group were frequently lower than the first (*B.tabaci*. *O. hylalinipennis* and *M. persicae*) and individuals of third group were rarely appeared (*Tychus* sp. , *A.gossypii* and *A.gamma*).These insects were differed in their occurrence periods as following , berseem leaf weevil and *Liriomyza* spp. were observed during December-April , *Tychus* sp. and *A.gamma* during January, cotton seed bug during February-March, the cotton thrips and pea aphid during January to April Leguminous aphid and green peach aphid during January and March , cotton aphid during March and cotton white fly during December-January.

Similar results were obtained by Hamid *et al.*(1974), Meena and Bhargava(2001), Kalra *et al.* (2002) and Sharma and Kalra (2002) .

1. B: Associated parasitoids and predators.

Seven species (six insect species and one mite species) belong to six families: Braconidae and Eulophidae, each contained one parasitoids species, *Dacnusa sibirica* kelenga and *Diglyphus isaea* (Walker) during the tested seasons , were emerged from incubated leaves infested with of *Liriomyza* spp. Fadel(2001)recorded that *Opius* sp. and *Diglyphus isaea* parasitizing larvae of *L. trifolii* Strobl and *Phytomyza atricornis* (Mg.). However, family Chrysopidae was presented by the predator, *Chrysoperla carnea* (Steph) in association with aphids on fenugreek terminal buds .Coccinellidae , was represented by adults of *Coccinellas* spp. with different insects on fenugreek plant . Staphylanidae family was represented with the adults of predator *Paederus alfieri* Kock. Lygaeidae family represented as adults of *Orius* spp. a predator for many insects. On the other hand, Haemogamasidae.

Family includes one species of mite, adults of *Haemogamasus pontiger* associated with terminal buds insects. Data show that , *Dacnus sibirica* , *Diglyphus isaea* and *Coccinella* spp. were abundant during January to March and January to April , respectively ,*Orius* spp. were frequently occurred at February to April , *Paederus alfieri* , *Chrysoperla cernea* and *Hoemogasmus pontige* their appearance were rare during February to March and January, respectively .

These results are in harmony with obtained by Brar and Kanwar (1996) and Meena and Bhargava(2001).

1. C- Survey of visitor insects:

The survey by using sweeping net revealed the presence of 5 species of 5 genera, belonging to 5 families of 3 insect orders were visitors for flowers of fenugreek plant i.e. Diptera, Hymenoptera and Lepidoptera. The first order and

second one had one species, *Sphaerophoria flavicauda* (syrphidae) and *Apis mellifera* (Apidae), respectively, Third order includes three families, Lcaenidae (had one species of *Cosmlyce baeticus* L.), Pieridae that had one species (*peries rapae*) and Nymphalidae presented by *Vanessa cardui* L. . It is obvious that these insects recorded as visitor adults for flowers. Data showed that *Vanessa cardui* and *Apis mellifera* were frequent appearance during January and February, respectively, but the other visitor insects were observed at February in both two seasons by rarity (Table,1).

2: Relative occurrence.

The results in Table (2) obviously demonstrate that the Thysanopteran insects represented by *T. tabaci* proved to be the most abundant species in each of growing seasons showing the highest mean numbers / sample of 1318.0 and 677.33 respectively, and it presented by 50.27 % from grand total. To the contrary, the lowest mean numbers of 0.33 and 0.0 individual / sample were obtained with Coleopterous *Tychus* sp. in both first and second seasons respectively. It is worthy to mention that among homopterous insects that showing high relative occurrence (comparing with the other homopterous insects) of 10.08, 41.68, 39.93, 0.27 and 8.05 % were *B. tabaci*, *A. pisum*, *A. craccivora*, *A. gosspii* and *M. persicae* respectively. Also, percentages of occurrence of Coleopterous individuals were 4.54, 0.01, 0.70 and 0.13 for *Phytonomus brunneipennis*, *Tychus* sp., *Coccinella* spp. and *Paederus alfieri*. But Hemipterous species were recorded at the same trend 33.8 % for *Oxycarenus hylalinipennis* and 66.13 % for *Orius* spp.. From the previously mentioned results, it is clear that *Autographa gamma* had the nearly level of *Haemogamasus pontiger* infestation with mean numbers of 3.67 and 3.33 at relative occurrence 0.11 and 0.10 % during the two studied seasons together, respectively. It is can descendently arranged orders according of occurrence rates of Thysonoptera, Homoptera, Diptera, Coleoptera, Hemiptera, Lepidoptera, Mesostogmeta and Neuroptera at 50.27, 18.89, 14.59, 5.39, 0.62, 0.11, 0.10 and 0.03% from grand total, respectively. These results are partial agreement with Afsah (2005).

Table 2. Relative occurrence of insect species and their natural enemies on fenugreek plant at Plant Protection Research Station at Qaha district, Qalyubiya Governorate during two successive seasons 2006 / 2007 and 2007 / 2008 .

Orders	Mean numbers		Total	%Occ.*	%Occ.**
	2006/2007	2007/2008			
Or.: Coleoptera					
<i>P. brunneipennis</i>	84.0	66.33	150.33	84.30	4.54
<i>Tychus</i> sp.	0.33	0.0	0.33	0.19	0.01
<i>Coccinella</i> spp.	11.0	12.33	23.33	13.08	0.70
<i>Paederus affera</i>	1.67	2.67	4.34	2.43	0.13
Total			178.33		
Occurrence%			5.39 %		
Order: Diptera					
<i>Liriomyza</i> spp.	351.0	132.0	483.0	100.0	14.59
Occurrence%			14.59		
Or.: Hemiptera					
<i>O. hyalinipennis</i>	3.0	4.0	7.0	33.87	0.21
<i>Orius</i> spp	6.67	7.0	13.67	66.13	0.41
Total			20.67		
Occurrence%			0.62 %		
Or.: Homoptera					
<i>B. tabaci</i>	32.0	31.0	63.0	10.08	1.91
<i>A. pisum</i>	147.33	113.33	250.66	41.68	7.87
<i>A. craccivora</i>	170.33	79.33	249.77	39.93	7.54
<i>A. gossypi</i>	0.33	1.33	1.66	0.27	0.05
<i>M. persicae</i>	29.33	21.00	50.33	8.05	1.52
Total			625.31		
Occurrence%			18.89 %		
Or.: Lepidoptera					
<i>A. gamma</i>	1.67	2.00	3.67	100.00	0.11
Occurrence%			0.11 %		
Or.: Neuroptera					
<i>C. carnea</i>	0.33	0.67	1.00	100.00	0.03
Occurrence%			0.03 %		
Or.: Thysanoptera					
<i>T. tabaci</i>	1318.00	677.33	1995.33	100.00	50.27
Occurrence%			50.27 %		
Or.: Mesostigmata					
<i>H. pontiger</i>	1.33	2.00	3.33	100.00	0.10
Occurrence%			0.10		
Grand total			3310.74		

* indicated that relative occurrence of the species from the total numbers of individuals in the same order.

** indicated that relative occurrence of the species from the grand total numbers of all individuals.

3: Effect of plant level on numbers of insects.

Data presented in table (3) show the differences between mean numbers of four aphid species, *A. pisum* (Harris), *Myzus persicae* Sulz., *A. craccivora* Koch and *Aphis gossypii* (Glover.), in addition to *Phytonomus bruneipennis*, *Thrips tabaci* Lind., *Liriomyza* spp., *Bemisia tabaci* (Genn.) at two levels of fenugreek plant. The obtained results evidently indicate that the mean numbers of leaf-miner (larvae /20 leaves) were higher at lower leaves than at upper ones, and the differences were statistically high significant and significant in the 1st and 2nd season, respectively. Also individuals of *Bemisia tabaci* harboured leaves of lower level with high average numbers of 2.28, 2.26 and 2.27 immature stages /20 leaves through first, second and in both seasons together, respectively showing significant differences between average numbers on lower and upper leaves during first and in both seasons together and insignificant in the second one.

Table 3. The mean numbers of insects at upper and lower levels of fenugreek Plants during two seasons of 2006 /2007 and 2007 / 2008.

Insects	Season	First season	Second season	Mean of two seasons
	Level			
<i>Liriomyza</i> spp.	Upper level	9.71 B	2.64 B	6.18 B
	Lower level	24.5 A	7.41 A	15.96 A
	F. test	**	*	**
<i>Bemisia tabaci</i>	Upper level	0.11 B	0.17	0.14 B
	Lower level	2.28 A	2.26	2.27 A
	F. test	*	N.S.	*
<i>Phytonomus bruneipennis</i>	Upper level	5.43 A	4.78 A	5.42 A
	Lower level	0.0 B	0.0 B	0.0 B
	F. test	**	**	**
<i>Thrips tabaci</i>	Upper level	94.17 A	48.41 A	71.29 A
	Lower level	0.0 B	0.0 B	0.0 B
	F. test	**	**	**
Aphid spp.	Upper level	24.87 A	15.36 A	20.1 A
	Lower level	0.0 B	0.0 B	0.0 B
	F. test	**	*	**

It is worthy to mention that the individuals of four aphid species together, berseem leaf weevil and cotton thrips were surveyed on terminal buds of fenugreek plant only and it is important to notice that the lower leaves of the plant were free

from any individuals of *Thrips tabaci*. The highest mean numbers of 94.17, 48.41 and 71.29 individuals / 20 terminal buds. The same observation was recorded for Aphid species, with average numbers of 24.87, 15.36 and 20.1 moving stages / 20 terminal buds, also the average numbers of berseem leaf weevil were 5.43 , 4.78 and 5.42 adults and larvae / 20 terminal buds throughout first season ,second one and in both seasons together, respectively . Statistical analysis of variance using F. test proved that differences between infestation degrees at the two tested levels were highly significant during two seasons, except in case of aphids that proved to be significant in the second season.

Results completely agreement with those of Kalra *et al.* (2003) and Kalra *et al.* (2004) who found that aphids and *Hypera postica* were significantly occurred with high population and severe damage in upper 10 cm of main shoot (terminal twig) of fenugreek . Also Soliman *et. al.* (2008) studied effect of upper and lower plant levels on mean numbers of eggs and larvae of tomato fruit borer, *Helicoverpa armigera* (Hubn.) they recorded significant differences between upper and lower plant levels for both eggs and larvae during the two tested successive summer seasons.

ACKNOWLEDGMENT

The writer wishes to express his deep thanks to Dr: Ahmed R. Hamed Prof. of Biological Control Department, Dr: Magdi M.H.Fawzy Prof. of Fruit Mites Department and Dr: Ahmed M. Z. Mosallam Associate Prof. of Horticultural Insects Department in Plant Protection Research Institute.

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حصر ونسبه تواجد الحشرات وأعدادها الحيويه المصاحبه لها على نباتات الحلبه ودراسه تأثير مستوى النبات على وفره تعداد الحشرات

عبد الجابر فتوح السيد عقصه ، أحمد رمضان إبراهيم حنفي

معهد بحوث وقايه النباتات - مركز البحوث الزراعيه - النقي - جيزه

- أجرى هذا البحث في المزرعه البحثيه بمحطه بحوث وقايه النباتات بقها محافظه القليوبيه خلال موسمين متتاليين ٢٠٠٦/٢٠٠٧ و ٢٠٠٧/٢٠٠٨ وأظهرت الدراسه النتائج الآتيه-
- ١- تم حصر ثلاثه وعشرون نوعا من الحشرات واعدتها الحيويه على نباتات الحلبه في موسمي الدراسه .
 - ٢- سجلت حشرة التريس أعلى نسبة تواجد (٢٧, ٥٠%) من العدد الكلي للأنواع الموجوده.
 - ٣- سجلت أعداد حشرة من البسله أكبر نسبة تواجد من بين الأنواع التابعه لرتبه نصفية الأجنحه المتجانسه حيث بلغت ٤١,٦٨% من أعداد الحشرات التابعه لنفس الرتبه .
 - ٤- ويمكن ترتيب الرتب الموجوده على النباتات تنازليا من حيث نسب التواجد كالاتي : رتبه هديبه الاجنحه ، رتبه نصفيه الاجنحه المتجانسه ، رتبه ثنائيه الاجنحه ، رتبه غمديه الاجنحه، رتبه نصفيه الاجنحه الغير متجانسه ، رتبه حرشفيه الاجنحه ، رتبه متوسطه الثغر و رتبه شبكية الاجنحه .
 - ٥- ظهر من الدراسه تواجد حشرات المن سوسة ورق البرسيم وتريس القطن في منطقة القمه الناميه وعدم تواجدها في المستوى السفلي للنباتات- بينما كانت صانعات الأنفاق والذباب الأبيض أكثر اعدادا في المستوى السفلي عن المستوى العلوي خلال موسمي الدراسه .