

POPULATION DENSITY OF THE THREE DESTRUCTIVE INSECT PESTS INFESTING BROAD BEAN (*Vicia faba* L.) IN KAFR EL SHEIKH GOVERNORATE

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ABSTRACT

A field experiment was carried out at Kafr El Sheikh Governorate during two successive seasons (2008-2009) and (2009/2010) to detect the population density of three destructive insect pests (*Aphis craccivora*, *Empoasca decipience* and *Liriomyza trifolii*) infesting broad bean plants; *Vicia faba* and cause economic losses in the crop, recording the population of each pest at the three levels of the plant and during the three developmental plant stages. The obtained results showed that the number of pests, that *A. craccivora*, *E. decipiens* and *L. trifolii* are considered three destructive pests which invade broadbean plant causing serious damage throughout the planting stages of broadbean.

IPM program of these insect pests should be included in view of the fact that the end site of the tested insects infestation in the plants in this location.

A. craccivora was found with high density on upper level (recorded mean 26.66 individual/5 leaves in season 2008/2009 and 9.16 indiv./5 leaves in season 2009/2010) of *Vicia faba* through vegetative period of the plant ground season (gave 61.25 and 17.25 indiv./5 leaves) in 2008/2009 and 2009/2010 seasons, respectively.

E. decipience attacking broadbean on upper and middle level of the plant during the fruiting stage (recorded for middle level 5.55 indiv./5 leaves and 4.72 indiv./5 leaves) in season 2008/2009 and 2009/2010, respectively and recorded 13.28 indiv./5 leaves and 19.85 indiv/5 leaves for fruiting stage in 2008/2009 and 2009/2010 seasons, respectively.

L. trifolii caused highest damage in the plant leaves on basal level during the flowering and fruiting stages, (gave 62.83 indiv./5 leaves and 52.55 indiv./5 leaves in season 2008/2009 and 2009/2010, for lower level, flowering stage recorded 172.0 and 95.33 indiv/5 leaves in 2008/2009 and 2009/2010 seasons, respectively

This paper aims to guide in putting a correct and suitable IPM program, concerning the level of the plant on which each pest recorded its highest population beside the developmental stage found to receive the highest population and the timing of the infestation.

INTRODUCTION

Broad bean plant, *Vicia faba* L. is considered one of the most important legume vegetables in Egypt, consumed as a fresh vegetable in the local market or to be exported. The plant is attacked by many different insect pests during the planting season, Metwally, *et al.* 1997, studied in Egypt the susceptibility of some faba bean varieties and breeding lines to infestation with *Aphis craccivora* Koch and *Empoasca* spp under field conditions, stated that the mentioned pests caused severe injuring.

Devesthali and Saran, 1998 in India studied the reaction of twenty developed green gram cultivators and stated that six pests named thrips, blue beetles, bean aphid, green Jassid, green semi looper and mug bug appeared at the early stage of the plant growth. Being a vegetable crop, broad bean should receive no pesticide, besides giving as much as possible yield.

No one can carry out the best method for reducing the pest population at the correct plant part and plant stage at the proper time. El-Heneidy *et al.*, 1998 in Egypt studied the aphid population, in Sids Research station, Beni Seuif, and their associated natural enemies on faba bean. He stated that the population was relatively greater in early crops than in late planted ones. The present work is a trial to detect the population density of three destructive pests attack broad bean, besides the best favorite part of the plant for each pest, during the developmental plant stages. Ali *et al.* 2013, in Egypt studied the Aphid population density, *A. craccivora* and its associated predators on faba bean and cowpea fields at El-Khattara district, Sharkia governorate, who stated that *A. craccivora* had three peaks on faba bean for each season.

MATERIALS AND METHODS

A field experiment was carried out at Kafr El Sheikh in an area of about one feddan, was cultivated with broad bean cultivar Giza 2. From the 1st of November up till the last week of March during the two successive seasons 2008-2009 and 2009/2010.

Fifteen plants were taken weekly and randomly fifteen leaves from each level of the three levels of the plant, upper- middle- lower, each plant level was divided into three replicates in a complete randomized block design (five leaves were taken from each level for each replicate). The leaves were examined during the planting period to estimate the population density of three destructive insect pests attacking broad bean. The mean number of each pest on leaves were recorded. The number of insects were counted directly in the field.

Statistical analysis was made according to Duncan (1955) to show the significances of the level of the plant.

RESULTS AND DISCUSSION

The obtained results in Table (1) showed the population density of three insect pests (aphids- jassid and leafminer) mainly infesting broad bean in Kafr El Sheikh Governorate during the two successive seasons (2008/2009 and 2009/2010). Data revealed that aphid *Aphis craccivora* (Koch.) began to invade the plant on 2nd of December till the end of January and was the most abundant on the upper parts of the plant giving a number of 113 individuals/5 leaves, recording mean number 26.66 individuals/5 leaves, while on middle part three individuals/5 leaves were recorded. The peak of the pest took place on all leaves on the last week of December giving a number 117 individuals/5 leaves. On the other hand jassid, *Empoasca decipiens* began its appearance slightly on the first week of December to last week of March, recording the highest number 54 individuals/5 leaves on the beginning of February.

Regarding the three parts of the plant, the pest preferred to invade the middle parts of the plant. Rathore and Twari, 1998, in India stated that the growth stage didn't influence the distribution patron of *Empoasca* on mung bean,. Hashem and Abd El-Samed (2009), in Egypt, stated that *E. decipiens*

had one peak on broad bean at the 3rd week of February and 1st week of March during two seasons in Kafr El-Sheikh.

As for the leafminer, its highest number took place on the third week of February giving 332 individuals/5 leaves.

The results revealed that the pest greatly invade the middle and lower parts of the plant giving a mean number of 27.55 and 62.83 indiv./5 leaves, respectively. While the upper part of the plant was free of infestation.

Nath *et al.* 1998 in India indicated that jassid first appeared at seedling stage on crops and maintained their population up to pod formation, while aphid appeared at vegetative stage and continued until post reproductive stage.

Data in Table (2) showed that the fluctuation of the three pests infesting broad bean during the second season (2009/2010). The obtained data revealed that the results agree with the first season, as for *A.craccivora* population an upper level harboured most infestation and gave its highest number 56 individuals/5 leaves during the 4th week of December, preferring to invade the upper part of the plant giving a mean number 9.16 individuals/5 leaves which was considered slightly low than the first seasons. As for the middle and lower parts of the plant it occurred with mean of 0.55 and 0.44, respectively which is near the means of the first season.

Empoasca decipennis population was respectively moderate ranging from 1 to 15 individuals/5 leaves giving a mean number of 2.88 and 6.22 individuals/5 leaves for the upper and lower parts, respectively, proving that the lower part received the highest mean number of the pest.

The obtained data of leafminer *Liriomyza trifolii*, Burgess revealed that the lower part of the plant received the highest mean number of the pest 52.55 individuals/5 leaves, while the upper part of the plant had the lowest mean of the pest 1.83 individuals. The data proved that the peak of the pest 314 individuals/5 leaves took place during the last week of February then decreased till the last week of March.

Regarding the developmental plant stages, it is obvious from the forgoing obtained data Table (3) that the number of *A.craccivora* during the vegetative stage -beginning from planting date up to flowering stage- recorded 490 individuals/5 leaves with a mean number of 61.52 individuals, while during the flowering stage data proved that the pest recorded 14 individuals/5 leaves with an average of mean number of 4.66 individuals/5 leaves, while during the fruiting stage the pest gave zero because migrated the plants.

During the first season, statistical analysis revealed that *A.craccivora* population was the most abundant on the upper part of the plant while the middle and lower part received fewer number of aphids.

As for *E.decipiens* statistical analysis revealed that the three part of the plant received the same population while *L.trifolii* was most abundant at the lower part of the plants.

Nearly the same results were obtained during the second season for statistically *A.craccivora* was most abundant at the upper part of the plants and *L. trifolii* at the lower one while *E.decipiens* gave high individuals at the lower part and the upper part received less population.

Statistical analysis assured that significant differences between the three pests found infesting broad bean during three developmental plant

stages where *A.craccivora* and *L.trifolii* occurred to be the most abundant pest during the vegetative stage, while during the flowering and fruiting stages *L.trifolii* was the most pest found to invade the plant.

The obtained results during the second season recorded nearly the same averages for the three developmental stages of the plant giving an average of *A.craccivora* 17.25 individuals/5 leaves during the vegetative stage, while these averages were slightly low recording 0.3 and 6.28 individuals/5 leaves during the flowering and fruiting stages, respectively.

On the other hand, *E. decipiens* population Table (3) recorded an average numbers of 5.5, 30 and 13.28 individuals/5 leaves during vegetative, flowering and fruiting stages, respectively, proving that the mean pest numbers was high during the flowering stage,

Data for the second season proved the same results recorded a mean number of the pest 21.66 individuals/5 leaves during the flowering stage. The statistical analysis revealed that during the vegetative stage there were no significant differences between the three pests, the statistical analysis revealed that *L. trifolii* were the most abundant pest during the flowering and fruiting stages.

The data presented in, Table (4) showed that the leaf miner, *L. trifolii* population recorded considerable high means 95.33 and 150.00 individuals/5 leaves during the flowering and fruiting stages, respectively, which agree with the results obtained from the first season, proving that the pest mainly infest the plant with great number during the flowering and fruiting stages.

The statistical analysis revealed that during the vegetative stage there were no significant differences between the three pests statistical analysis revealed that *L. trifolii* were the most abundant pest during the flowering and fruiting stages .

Data in Table (3) revealed that the population density of the leafminer; *L. trifolii* during the first season, it is cleared that the pest population recorded high numbers during the three plant stages, vegetative, flowering and fruiting showed number of 446, 516 and 664 individuals/5 leaves , respectively. Considering the mean number of the pest during the three plant stages, it recorded 55.75, 172 and 94.85. thus it is clear that during the flowering and fruiting stages the pest greatly invade the plants.

Shahein and El- Maghraby (1993) in Egypt Found that there were little or no mines induced by the agromyzid on the upper parts of broad bean plants in the field. while the middle and lower parts were highly infested which lower part equal outer level and upper equal inter level . Patil et al. (1997) conducted that a study was to estimate the vegetative growth loss due to *L. trifoli infestation* on cotton and castor (*R. Communis*). plants exposed to leafminer 10 and 20 days after sowing recorded a significantly higher level of infestation and a greater number of larvae resulting in lower plant height and lower biomass compared to the uninfested plant .

Table (1) The average number of three insect pests (/5 leaves) infesting the three levels of broad bean plant during 2008-2009 season in Kafr El-sheikh governorate.

Insect species Sampling dates	<i>Aphis craccivora</i>				<i>Empoasca decipiens</i>				<i>Liriomyza trifolii</i>			
	Upper level	Middle level	Lower level	Total	Upper level	Middle level	Lower level	Total	Upper level	Middle level	Lower level	Total
2-12-2008	8	0	0	8	0	1	1	2	0	0	2	2
9/12	65	0	0	65	0	0	1	1	0	5	23	28
16/12	113	3	1	117	0	0	0	0	0	16	48	64
23/12	108	2	2	112	0	0	0	0	0	26	51	76
30/12	85	1	0	86	0	0	0	0	0	22	73	95
6/1/2009	89	1	0	90	3	5	6	14	0	8	46	54
13/1	12	0	0	12	4	3	2	9	0	29	60	89
20/1	0	0	0	0	10	6	2	18	0	16	22	38
27/1	0	2	12	14	7	11	1	19	0	55	50	105
3/2	0	0	0	0	19	28	7	54	0	41	111	152
10/2	0	0	0	0	9	4	4	17	0	73	186	259
17/2	0	0	0	0	3	3	2	8	0	99	233	332
24/2	0	0	0	0	5	4	4	13	0	70	130	200
2/3	0	0	0	0	4	7	5	16	0	25	80	105
9/3	0	0	0	0	4	8	2	14	0	6	10	16
16/3	0	0	0	0	2	8	3	13	0	1	3	4
23/3	0	0	0	0	1	3	4	8	0	2	3	5
30/3	0	0	0	0	5	10	7	22	0	2	0	2
Mean	26.66 a	0.50 b	0.83 b		4.22 a	5.55 a	2.83 a		0 c	27.55 b	62.83 a	

Mean followed by letters (a. b. c) illustrate the state of significance (Dancen 1955)

■ *Aphis craccivora* ▨ *Empoasca decipiens* □ *Liriomyza trifolii*

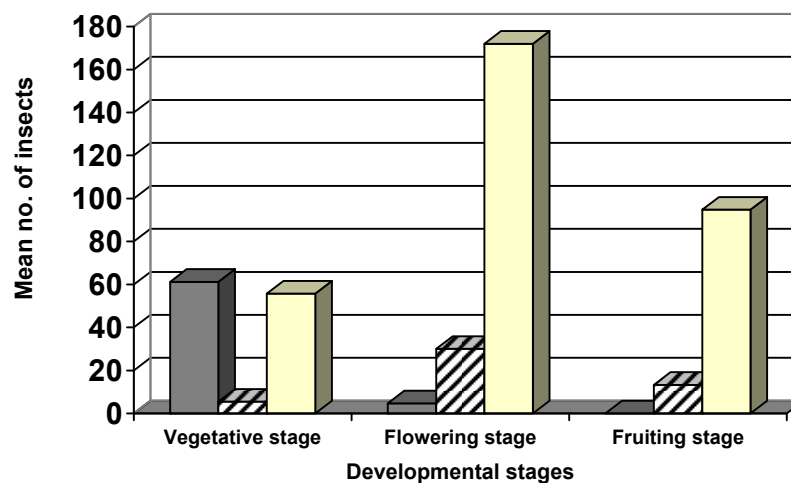


Fig (1): The average number of three insect pests infesting broad bean plants during three developmental stages (2008/2009 season) in Kafr El-Sheikh Governorate.

Table (2) The average number of three insect pests (/5 leaves) infesting the three levels of broad bean plants during 2009/2010 season in Kafr El-sheikh governorate.

Insect species Sampling dates	<i>Aphis craccivora</i>				<i>Empoasca decipiens</i>				<i>Liriomyza trifolii</i>			
	Upper level	Middle level	Lower level	Total	Upper level	Middle level	Lower level	Total	Upper level	Middle level	Lower level	Total
2-12-2009	3	3	1	7	0	0	0	0	0	0	0	0
9/12	8	2	0	10	0	0	0	0	0	0	0	0
16/12	38	4	3	45	0	1	1	2	0	0	0	0
23/12	54	0	2	56	0	2	2	4	0	0	5	5
30/12	12	0	2	14	1	3	1	5	0	2	7	9
6/1/2010	4	0	0	4	2	4	2	8	0	3	11	14
13/1	2	0	0	2	5	8	5	18	0	10	48	58
20/1	0	0	0	0	3	1	4	8	0	20	47	67
27/1	0	0	0	0	2	2	8	12	0	24	68	92
3/2	0	1	0	1	6	6	15	27	0	23	64	87
10/2	0	0	0	0	9	8	9	26	0	34	73	107
17/2	12	0	0	12	3	10	7	20	0	70	111	181
24/2	9	0	0	9	5	9	13	27	0	129	185	314
3/3	20	0	0	20	7	7	14	28	0	112	136	248
10/3	3	0	0	3	5	8	9	22	2	55	81	138
17/3	0	0	0	0	1	5	3	9	20	38	54	112
24/3	0	0	0	0	2	8	14	24	11	16	36	63
31/3	0	0	0	0	1	3	5	9	0	11	20	31
Mean	9.16 a	0.55 b	0.44 b		2.88 a	4.72 a	6.22 a		1.83 c	30.38 b	52.55a	

Mean followed by letters (a. b. c) illustrate the state of significance (Dancen 1955)

Table (3): The average number of three insect pests infesting broad bean plant during three developmental stages during 2008-2009 season in Kafr El-Sheikh Governorate.

Plant stages	<i>Aphis craccivora</i>		<i>Empoasca decipiens</i>		<i>Liriomyza trifolii</i>		F value
	Total	Mean	Total	Mean	Total	Mean	
Vegetative stage (8 inspections)	490	61.25 a	44	5.5 b	446	55.75 a	F= 6.7** LSD _{0.05} = 12.33 LSD _{0.01} = 16.75
Flowering stage (3 inspections)	14	4.66 b	90	30 b	516	172 a	F= 10.88* LSD _{0.05} = 54.61 LSD _{0.01} = 82.74
Fruiting stage (7 inspections)	0	0 c	93	13.28 b	664	94.85 a	F= 3.36** LSD _{0.05} = 31.43 LSD _{0.01} = 43.05

Table (4): The average number of three insect pests infesting broad bean plant during three developmental stages (2009/2010 season) in Kafr El-Sheikh Governorate.

Plant stages	<i>Aphis craccivora</i>		<i>Empoasca decipiens</i>		<i>Liriomyza trifolii</i>		F value
	Total	Mean	Total	Mean	Total	Mean	
Vegetative stage (8 inspections)	138	17.25	45	5.62	151	18.87	F=2.18 F _{0.05} =3.44 F _{0.01} = 5.72
Flowering stage (3 inspections)	1	0.3	65	21.66	286	95.33	F= 124.93* F _{0.05} =5.14 LSD = 73.67 F _{0.01} = 10.9 LSD = 21.36
Fruiting stage (7 inspections)	44	6.28	139	19.85	1050	150.0	F= 13.94** F _{0.05} =3.55 LSD = 47.99 F _{0.01} = 6.01 LSD = 35.02

■ *Aphis craccivora* ▨ *Empoasca decipiens* □ *Liriomyza trifolii*

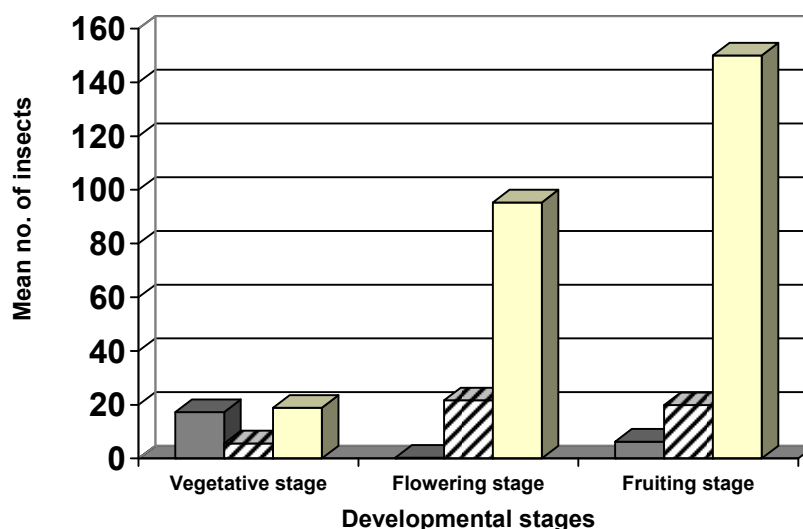


Fig (2): The average number of three insect pests infesting broad bean plant during three developmental stages (2009/2010 season) in Kafr El-Sheikh Governorate.

CONCLUSION

As a conclusion from the foregoing data it is obvious according to the number of the pests, that *A.craccivora*, *E. decipiens* and *L.trifolii* are considered three destructive pests which invade broad bean plant causing serious damage throughout the planting stages of broad bean.

It is of great importance for carrying out any lpm program to give a special care for the level of the plant in which the pest greatly invade besides the plant stage at which the pest may infest the plant.

It is clear, from the obtained data, that *A.craccivora* infest seriously broad bean at the upper part of the plant during the vegetative stage.

While *E.decipiens* greatly invade broad bean at the middle and upper part of the plant during the fruiting stage.

On the other hand, *L.trifolii*, greatly invade broad bean at the flowering stage at the lower part of the plant.

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الكثافة العددية لثلاثة آفات حشرية تصيب نبات الفول في محافظة كفر الشيخ

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أجريت التجارب الحقلية فى محافظة كفر الشيخ خلال موسمى ٢٠٠٨-٢٠٠٩ ، ٢٠٠٩/٢٠١٠ وذلك لتقدير تعداد ثلاث آفات حشرية تصيب نبات الفول على ثلاث مستويات للنبات وخلال مراحل نمو النبات المختلفة وذلك للمساهمة فى وضع خطة مناسبة متكاملة للمكافحة وان نضع فى الاعتبار تعدد الآفات المختلفة على مستويات النبات وكذلك مراحل نمو النبات.

حيث اوضحت النتائج ان *Aphis craccivora*, *Liriomyza trifolii*, *Empoasca decipiens* كانت من اشد و اخطر الآفات الحشرية التى تصيب نبات الفول و تسبب خسائر اقتصادية فادحة للمحصول.

ومن المهم عند وضع خطة متكاملة للمكافحة الاخذ فى الاعتبار ان المن يتواجد بأعداد كثيفة فى الجزء الاعلى من النبات حيث سجل متوسط تعداد ٢٦.٦٦ فرد/٥ أوراق فى موسم ٢٠٠٨/٢٠٠٩ وسجل ٩.١٦ فرد فى موسم ٢٠٠٩/٢٠١٠ وفى مرحلة النمو الخضرى سجل فى هذه المرحلة متوسط ٦١.٢٥ فرد/٥ أوراق فى موسم ٢٠٠٨/٢٠٠٩ وسجل ١٧.٢٥ فرد فى موسم ٢٠٠٩/٢٠١٠.

أما الجاسيد فقد تواجد على نبات الفول فى الجزء الاعلى و الاوسط من النبات وسجل متوسط تعداد ٥.٥٥ فرد/٥ أوراق فى موسم ٢٠٠٨/٢٠٠٩ ، متوسط ٤.٧٢ فرد للمستوى الوسط فى موسم ٢٠٠٩/٢٠١٠ وسجل فى مرحلة الإثمار تعداد عالى حيث أعطى ١٣.٢٨ فرد/٥ أوراق فى موسم ٢٠٠٨/٢٠٠٩ ، ١٩.٨٥ فرد/٥ أوراق فى موسم ٢٠٠٩/٢٠١٠.

بينما ناخرة الأوراق فقد تواجدت على نبات الفول على الجزء السفلى للأوراق بتعداد عالى وذلك خلال مرحلة التزهير والإثمار ، فقد سجلت على المستوى السفلى متوسط ٦٢.٨٣ فرد/٥ أوراق فى موسم ٢٠٠٨/٢٠٠٩ ، ٥٢.٥٥ فرد/٥ أوراق فى موسم ٢٠٠٩/٢٠١٠ ، وفى مرحلة التزهير سجلت متوسط تعداد ١٧٢ فرد/٥ أوراق فى موسم ٢٠٠٨/٢٠٠٩ ، ٩٥.٣٣ فرد/٥ أوراق وسجلت فى مرحلة الإثمار متوسط تعداد ٩٤.٨٥ فرد/٥ أوراق فى موسم ٢٠٠٨/٢٠٠٩ ، ١٥٠ فرد/٥ أوراق فى موسم ٢٠٠٩/٢٠١٠ .