STUDIES ON THE LEAF MINER, *LIRIOMYZA TRIFOLII* (Burgess) AND ITS PARASITOID *Diglyphus isaea* (Walker) ON COMMON BEAN PLANTS

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Abstract

This study was conducted during 2009 and 2010 seasons in Giza governorate in order to estimate the population abundance of major pest *Liriomyza trifolii* of the common bean plants (*Phaseolus vulgaris* L.), (Burgess). The percentage of parasitism by *Diglyphus isaea* (Walker) was also investigated. The population of pest larvae differed during the period of investigation and reached its maximum level on November 28th (62.5 Larvae/20 leaves) and on November 20th (24.8 larvae/20 leaves), during 2009 and 2010 seasons respectively. The percentage of parasitism by *Diglyphus isaea* (Walker). reached its maximum on November 21st (21.8%) and on November 13th (21.6%) during 2009 and 2010 seasons, respectively.

Concerning the overall mean of parasitism by *D. isaea* on *L. trifolii* values were 9.1 and 11.8%, during 2009 and 2010 seasons, respectively. It can be stated that, this parasitoid plays a natural role for controlling this insect pest.

Introduction

The common bean (*Phaseolus vulgaris* L.) is considered one of the most important leguminous vegetable crops in Egypt. It is cultivated in many Governorates either for export or for local consumption.

It is the second in the export among the legume crops. Common bean is cultivated either for green pods (contains 1.7% protein), dry seeds (contains 24.9% protein) or consumed as canned. It can be cultivated under both warm and cool conditions.

Common bean as other edible crops is infested with different insect pests in the field and in store causing severe damage. The most important of the field pests is the leaf miner, *L. trifolii* (Burgess) according to **Spencer (1973). (Doss *et al.*,1992)** and **Abdel-gawad 2008).**

Materials And Methods

Experiments were carried out at the experimental station (Giza Governorate) during the two successive plant seasons of 2009 and 2010.

An area of 1\4 feddan was planted with common bean seeds (*Phaseolus vulgaris* L.) variety 'Bronco 'on August 25th 2009 and August 24th 2010 plantation. Seeds were sown in rows at the rate of 12 rows/2 poles; the distance between the hills was 20 cm^2 apart on one side of the ridge.

1-Population estimation of the pest:

This experiment was conducted in an area of about 240 m^2, divided into four plots. The plants of this experiment received all normal recommended agricultural practices of common bean with no insecticidal application. The population study of the insect pest started after about four weeks from sowing and extended to the harvesting time.

Weekly direct counts of the leaf miner, was carried out. Sample of leaves (20 larva each) were picked at different levels of plant, put in paper bags and transferred to the Laboratory; then examined on the same day with the aid of a stereomicroscope for counting the leaf miner, *L. trifolii* "mines and larvae"

2-**Percentage of parasitism of the ecto- larval parasitoid**, ***Diglyphus isaea* (Walker):**

This study was conducted during fall season of 2009 and 2010. Random samples of 20 leaves / replicate of the common bean were picked one month after sowing; and continued weekly until the end of season (Four replicates were inspected). The leaves were picked, put in paper bags and transferred for examining in the laboratory under a stereomicroscope to determine all a live instars of the leaf miner and the parasitoid. The average percentage of parasitism was calculated regarding the following formula (according to **Woets** and **Van Der Linden, 1985):**

$$\frac{\text{Parasitized larvae}}{\text{No. of } \textit{Liriomyza} \text{ larvae}} \times 100$$

Statistical analysis:

The Data were subjected to analysis of variance (ANOVA) and T test. Means were compared by L.S.D. test at 0.05 level, using SAS program.

Results And Discussion

The weekly average numbers of *Liriomyza trifolii* larvae and the number of mines/20 leaves on different plant levels of the common bean (i.e., upper, middle and lower parts) during 2009 season were presented in **Table** (1) .The first count began on September 26th (after one month from planting). The data indicated that, the population of *L. trifolii* larvae varied from one plant level to another. Larval infestation on the upper leaves of the plant appeared only at the beginning of the season then disappeared again all over the season, except for November 21st (17.4 $\pm$ 1.6 larvae/20 leaves).

Statistical analysis of the data revealed that the population of *L. trifolii* larvae on upper, middle and lower plant levels during 2009 season varied significantly at the different levels. Thus, it could be arranged in a descending order as follows; lower, middle and upper plant level, indicating that the lower leaves received the highest infestation followed by middle level and then upper leaves that were infested.

In respect to the total *L. trifolii* larvae population estimated for the different plant levels (upper, middle and lower), data revealed that the total mean population began high at the inspection and amounted 35.1 larvae/20 leaves on September 26th, after that the total mean population of larvae differed weekly by the time lapses and reached its maximum level on November 28th (62.5 Larvae/20 leaves), then the total mean population of larvae slowly decreased by the end of the season to reach 37.1 larvae/20 leaves on December 5th.

Concerning the number of mines/20 leaves in 2009 season, results in **Table** (1) showed almost the same trend as indicated with the larval population. Whereas, the total average numbers of mines throughout the whole season of 2009 were 3.9 ± 0.7, 50.1 ± 4.3 and 88.9 ± 6.4 mines/20 leaves for upper, middle and lower level of common bean plants, respectively. Statistical analysis of data revealed significant differences between the three plant levels in the number of mines during 2009 season.

Accordingly, the three plant parts could be arranged in descending order regarding their total average numbers of mines as follows; lower, middle and upper part. Meanwhile, the total mean number of mines found on the different plant levels had the same trend as achieved with the total mean of larval population during 2009 season, where it recorded 31.8 mines/20 leaves at the first inspection and differed from one inspection to another by the time lapses to reach its maximum values on November 14th (72.0 mines/20 leaves) and on November 28th (71.1 mines/20 leaves); the total mean number of mines decreased at the end of the season to record 50.9 mines/20 leaves on December 5th.

Data in **Table** (2) indicated that, the population of *L. trifolii* larvae and number of mines for upper, middle and lower plant level during 2010 season was obviously lower than those of 2009 season. This might be attributed to the effect of some abiotic and biotic factors during the two seasons.

Generally, data revealed the same trend as achieved during 2009 season for larvae and mines on the three levels of the plant, the total average numbers were 2.9 ± 0.4, 16.4 ± 1.7 and 33.8 ± 2.2 larvae/20 leaves and 2.9 ± 0.3, 17.2 ± 1.7 and 36.9 ± 2.7 mines/20 leaves.

Statistically, during 2010 season, there was also a significant difference between the population of *Liriomyza* larvae and number of mines on the three common bean plant levels. Generally, the three levels could be arranged in descending order regarding the population of larvae and number of mines as follows: lower, middle and upper part, indicating that lower part of common bean plants had the highest rate of infestation followed by the middle than the upper part that was the lowest in infestation.

Regarding the total mean of larva population found on the different plant levels (upper, middle and lower) during 2010 season, results showed that the total mean had the same trend as achieved with 2009 season, where it recorded 6.8 larvae/20 leaves at the first inspection and differed weekly by time lapses to reach its maximum on November 20th (24.8 larvae/20 leaves) then, decreased by the end of the season to record 14.3 larvae/20 leaves on December 4th .

Also, the total mean number of mines found on the different plant levels had the same line and trend as achieved with the total mean of larval population during 2010 season; where, it recorded 8.6 mines/20 leaves at the first inspection and increased sharply to reach its maximum on October 9th (25.1 mines/20 leaves) then, decreased again at the end of the season and recorded 18.1 mines/20 leaves on December 4th.

These results are almost similar to the data obtained by **Shahein and El-Maghraby (1993) and Shahein and El-Magharaby (1998).**

Population fluctuation of the parasitoid*, Diglyphus isaea* (Walker):

In **Table** (3) the mean number of parasitized *L. trifolii* larvae started during 2009 season by the second inspection on October 3rd (1.5 ± 0.5 larvae/20 leaves) with percentage of parasitism 3.0%. The parasitized larvae and the percent parasitism increased gradually with the time lapses to reach its maximum on November 21st (32.0 ± 5.9 larvae/20 leaves with the highest % parasitism of 21.8%) then decreased gradually by end of the season amounting10.0 ± 2.8 larvae/20 leaves on December 5th with parasitism of 10.3 %.

In **Table** (4), the mean number of parasitized larvae 20/leaves during 2010 season that was lower than those of 2009 season, this was due to that the total host larvae of *L. trifolii* was lower in 2010 season than those of 2009 season. On the other hand, the percent parasitism during 2010 season was higher than in 2009 season.

The parasitized larvae started also by the second inspection on October 2nd (1.5 ± 0.9 larvae/20 leaves and 7.5% parasitism) then increased slightly until November 13th to reach its maximum (8.0 ± 1.4 larvae/20 leaves with the highest % parasitism

of 21.6%). After that, the parasitized larvae and percent parasitism decreased gradually and by the end of the season on December 4th reached 4.0 ± 2.2 larvae/20 leaves and 15.4%, respectively. Regarding the seasonal parasitism by *D. isaea*, the previous results revealed that percent parasitism all over 2009 and 2010 season varied (9.1 and 11.8 %, respectively), this could be due to the abundance of the host insect or the neighboring plantations of the host plant, also the dominant climatic factors could affect the parasitoid efficiency.

The obtained results are in coincidence with **Hannou (1992), Sharaf El-Din *et al.*,(1997) and Trefas and Bujaki (1997).**

Table (1): Population of *Liriomyza trifolii* (Burg.) on common bean plants during 2009 season at Giza Governorate.

Date of inspection	*Mean number of larvae and mines per 20 leaves at different plant levels*							
	Upper part		Middle part		Lower part		*Mean*	
	Larvae	Mines	Larvae	Mines	Larvae	Mines	Larvae	Mines
26/9	21.0 ± 2.4	24.0± 3.8	33.4± 0.6	34.0± 4.0	51.4±1.0	37.4±2.2	35.1	31.8
3/10	12.4 ± 2.4	5.0 ± 1.2	63.4±9.6	58.4± 3.4	56.0±6.6	65.0±3.4	43.9	42.8
10/10	0.0 ± 0.0	0.0± 0.0	29.4± 3.2	23.0± 3.4	60.4±6.4	63.0±5.2	29.9	28.7
17/10	0.0 ± 0.0	0.0± 0.0	53.0±3.4	50.4± 1.4	56.0±2.8	68.0±5.0	36.3	39.5
24/10	0.0 ± 0.0	0.0± 0.0	29.0± 1.4	29.0±1.2	52.4±2.4	68.4±4.0	27.1	31.5
31/10	0.0 ± 0.0	0.0±0.0	30.0± 3.6	26.4±1.2	78.4±13.6	88.4±7.4	36.1	38.3
7/11	0.0 ± 0.0	0.0± 0.0	19.0±3.6	16.4±3.2	74.0±5.0	128.4±13.2	31.0	48.3
14/11	0.0 ± 0.0	0.0± 0.0	47.0±12.4	74.0±6.8	97.4±10.2	142.0± 11.8	48.1	72.0
21/11	17.4 ± 1.6	14.4± 2.6	55.0±4.2	73.4±8.0	75.0±4.2	117.0±5.8	49.1	68.3
28/11	0.0 ± 0.0	0.0± 0.0	72.0± 9.2	79.0±11.8	115.4±9.0	134.4±7.6	62.5	71.1
5/12	0.0 ± 0.0	0.0± 0.0	67.0± 4.8	87.4±3.4	44.4±3.2	65.4±5.0	37.1	50.9
Total	51.8 ± 6.4	43.4± 7.6	498.2 ± 56.0	551.4± 47.8	760.8 ± 64.4	977.4± 70.6	436.2	524.1
Average	4.6± 0.6a	3.9± 0.7*	45.3 ± 5.1a	50.1± 4.3*	69.2± 5.9a	88.9± 6.4*	39.6	47.6
L.S.D.	7.0	4.8						

a, *= Significant at 5% level.
± = SE.

Table (2): Population of *Liriomyza trifolii* (Burg.) on common bean plants during 2010 season at Giza Governorate.

Date of inspection	Mean number of larvae and mines per 20 leaves at different plant levels							
	Upper part		Middle part		Lower part		*Mean*	
	Larvae	Mines	Larvae	Mines	Larvae	Mines	Larvae	Mines
25/9	0.0± 0.0	0.0± 0.0	11.4± 1.6	13.4± 1.2	9.0± 1.8	12.4± 0.4	6.8	8.6
2/10	4.4± 1.2	4.0± 1.4	14.4± 0.8	19.4± 1.6	31.0± 1.6	27.4± 1.2	16.6	16.9
9/10	17.0 ±1.8	18.4± 0.8	22.0± 2.2	23.0± 2.2	34.0± 2.8	34.0± 2.0	24.3	25.1
16/10	0.0± 0.0	0.0± 0.0	19.4± 1.6	24.4± 2.6	40.0± 3.0	50.4± 3.4	19.8	24.9
23/10	0.0± 0.0	0.0± 0.0	12.0± 1.6	11.0± 3.0	29.4± 1.6	32.0± 2.0	13.8	14.3
30/10	0.0± 0.0	0.0± 0.0	12.0± 1.6	13.0± 1.6	29.0± 3.0	33.4± 2.2	13.7	15.5
6/11	0.0± 0.0	0.0± 0.0	0.0± 0.0	0.0± 0.0	63.0± 3.6	65.4± 7.4	21.2	21.8
13/11	0.0± 0.0	0.0± 0.0	17.4± 1.8	13.4± 1.2	31.4± 1.0	34.4± 1.6	16.3	15.9
20/11	4.0± 1.4	3.4± 1.4	27.4± 3.4	27.4± 2.2	43.0± 1.4	43.0± 3.0	24.8	24.6
27/11	6.0± 0.4	6.0± 0.0	24.4± 1.4	25.0± 1.2	38.4± 2.2	38.4± 2.0	22.9	23.1
4/12	0.0± 0.0	0.0 ± 0.0	19.4± 3.0	19.0± 1.6	23.4± 1.8	35.4± 4.0	14.3	18.1
Total	31.4± 4.8	31.8± 3.6	180.4± 19.0	189.0± 18.4	372.0± 23.8	406.2± 29.2	194.6	209.0
Average	2.9±0.4a	2.9± 0.3*	16.4± 1.7a	17.2± 1.7*	33.8± 2.2a	36.9± 2.7*	17.7	19.0
L.S.D.	2.0	2.0						

a, *= Significant at 5% level.
± = SE.

Table (3): Percentage of parasitism by the ecto-larval parasitoid, *Diglyphus isaea* (Walker) on *Liriomyza trifolii* during 2009 season at Giza Governorate.

Date of inspection	Mean No. of host larvae	Parasitized larvae/20 leaves	
		Number	*Parasitism %*
9 /26	±1.9 31.0	± 0.0 0.0	0.0
3/10	± 4.9 50.0	± 0.5 1.5	3.0
10/10	± 5.3 46.0	± 0.8 2.0	4.3

17/10	± 5.0 84.5	± 0.8 4.0	8.2
24/10	± 11.8 66.0	± 2.2 6.0	9.1
31/10	± 5.2 91.0	± 1.2 6.5	7.1
7/11	± 15.5 122.5	± 0.8 8.0	6.5
14/11	± 10.4 132.0	± 1.3 21.0	15.9
21/11	± 20.3 146.5	± 5.9 32.0	21.8
28/11	± 11.4 148.0	± 0.5 20.5	13.9
5/12	± 17.3 97.0	± 2.8 10.0	10.3
Total	± 108.9 898.5	± 16.8 111.5	100.2
Mean	± 9.9 81.7	± 1.5 10.1	9.1

Table (4): Percentage of parasitism by the ecto-larval parasitoid, *Diglyphus isaea* (Walker) on *Liriomyza trifolii* during 2010 season at Giza Governorate.

Date of inspection	Mean No. of host larvae	Parasitized larvae/ 20 leaves	
		Number	*Parasitism %*
25/9	± 1.3 11.0	± 0.0 0.0	0.0
2/10	± 2.9 20.0	±0.9 1.5	7.5
9/10	± 3.3 32.0	± 0.9 1.5	4.7
16/10	± 8.5 34.5	± 1.3 3.0	8.7
23/10	± 2.7 26.5	± 1.3 3.0	11.3
30/10	± 3.4 23.0	± 1.6 4.0	17.4
6/11	± 1.6 32.0	± 0.6 3.0	9.4
13/11	± 4.3 37.0	± 1.4 8.0	21.6
20/11	± 2.4 34.0	± 4.5 7.0	20.6
27/11	± 1.3 39.0	± 0.9 4.5	11.5
4/12	± 2.9 26.0	± 2.2 4.4	15.4
Total	± 34.9 311.0	± 15.6 39.5	129.9
Mean	± 3.2 28.3	± 1.4 3.6	11.8

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الملخص العربى

دراسات على صانعة الأنفاق ***Liriomyza trifolii*, (Burgess)** والمتطفل ***Diglyphus isaea* (Walker).** على نباتات الفاصوليا

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أجريت الدراسات الحقلية في محافظة الجيزة للموسمين 2009 و 2010م . فقد تم دراسة تقدير غزارة تعداد أهم الآفات التي تصيب الفاصوليا في الحقل **وهى صانعة أنفاق الأوراق** *Liriomyza trifolii* وكذلك نسبة الطفيل الحشري *Diglyphus isaea* الذي يتطفل عليها.

في العام 2009 سجل التعداد الكلى ليرقات **صانعة الأنفاق** *Liriomyza trifolii* أعلى معدل لها (62.5 يرقة/20 ورقة) في 28/11 أما في العام 2010 فقد سجل التعداد الكلى لليرقات أعلى معدل له في 20/11 (24.8 يرقة/20 ورقة).

وقد لوحظ أن نسبة التطفل **لطفيل صانعة أنفاق الأوراق** *Diglyphus isaea* قد سجل قمة واحدة 21.8٪ في 21/11 للموسم 2009 و 21.6٪ في 13/11 للموسم 2010 أما نسبة التطفل الموسمية علي حشرة صانعة أنفاق أوراق الفاصوليا خلال الموسمين 2009، 2010 فقد سجلت 9.1، 11.8٪ علي الترتيب. وهذا يشير الى أن هذا الطفيل يلعب دوراً مهما فى المكافحة البيولوجية لهذه الآفة.