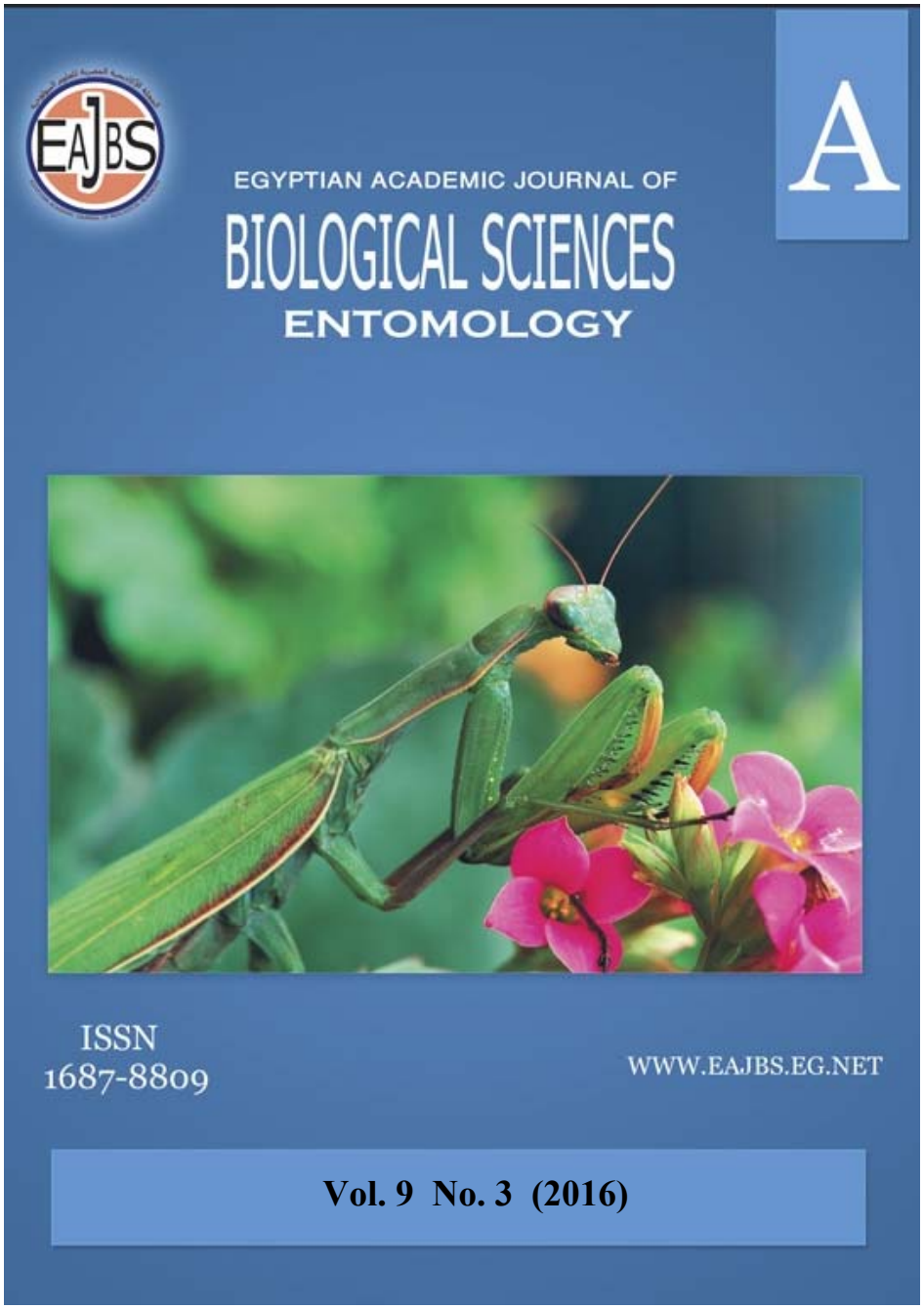


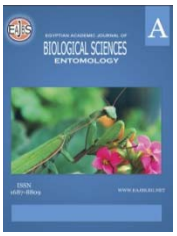
Egyptian Academic Journal of Biological Sciences is the official English language journal of the Egyptian Society for Biological Sciences, Department of Entomology, Faculty of Sciences Ain Shams University.
Entomology Journal publishes original research papers and reviews from any entomological discipline or from directly allied fields in ecology, behavioral biology, physiology, biochemistry, development, genetics, systematics, morphology, evolution, control of insects, arachnids, and general entomology.
www.eajbs.eg.net

Citation: *Egypt. Acad. J. Biolog. Sci. (A. Entomology) Vol.9 (3)pp. 21- 30(2016)*

Egypt. Acad. J. Biolog. Sci., 9(3): 21–30 (2016)

Egyptian Academic Journal of Biological Sciences
A. Entomology

ISSN 1687- 8809
www.eajbs.eg.net



Effect of Planting Space, Some Weather Factors and Plant Age on the Population Density of *Liriomyza trifolii* (Burgess) Infesting Pea Plants.

Shaalan, H. S. and Maha, S. El-Ghanam
Plant Protection Research Institute, (A.R.C.), Dokki, Giza, Egypt.

ARTICLE INFO
Article History
Received:15/6/2016
Accepted:20/7/2016

Keywords:
populationdensity . Leaf miner, *Liriomyza trifolii* (Burgess)

ABSTRACT

An experiment was carried out to study the effect of planting space, some weather factors and plant age on the population density of Leaf miner, *Liriomyza trifolii* (Burgess) infesting pea plants in Plant Protection Research Station in Kaha region during two successive seasons 2013 and 2014.

The obtained results revealed that the population density of *L. trifolii* larvae on pea plants differed significantly according to the planting spaces (10cm, 20cm and 30cm) during the two studied seasons. Planting of pea seeds in the planting space (10cm) lead to plants suffered from the highest infestation by *L. trifolii*. Larvae (30.7 and 34.1 larvae/ 15 leaves during the two seasons, respectively. On the contrary, sowing the pea plants at the second and third spaces (20 & 30cm) can be reduced the infestation rate of this insect pest (4.97 & 3.2 larvae/ 15 leaves) and (5.16 & 2.6 larvae/ 15 leaves) during the two seasons, respectively.

The population density of leaf miner, *L. trifolii* increased by increasing the plant age until middle of the flowering stage. The lightest population was recorded during the fruiting stage. While, the pea plants infested by the heaviest population during vegetative and flowering and stages.

Statistical analysis of correlation coefficient and partial regression values showed that the effect of weather factors and plant age on the population density of *L. trifolii* was differed to positive or negative correlation according to planting spaces and plant stages (vegetative, flowering and fruiting stages) during two studied seasons.

The weather factors were more effective on leaf miner population when comparing with plant age, the explained variance (E.V. %) were 74.4, 66.4 and 72.3% for the three planting spaces in the first season and 18.5, 29.3 and 40.4% in the second season, respectively. While the combined effect of the plant stages (vegetative, flowering and fruiting stages) together on *L. trifolii* population in the tested planting spaces on pea plants were 38.5, 21.1 and 15.7 at the three planting spaces during 2013 season and 27, 10.2 and 6.3 % during 2014 season, respectively.

INTRODUCTION

Green pea plants are liable to infestation by vegetable leaf miner *Liriomyza trifolii* (Burgess) (Diptera: Agromyzidae) ,is a polyphagous species spread around the world, becoming vegetable crop pests. It is generally recognized in all the countries bordering the Mediterranean (Chaney, 1995) . The damage is punctures caused by females during the feeding and oviposition processes can result in a stippled appearance on foliage, especially at the leaf tip and along the leaf margins (Chaney, 1995) and (Wilkerson, *et al.* , 2005). However, the major form of damage is the mining of leaves by larvae, which results in destruction of leaf miner.

The mine becomes noticeable about three to four days after oviposition and becomes larger in size as the larva matures (Capinera, 2001) and (Bueno, *et al* 2007). The pattern of mining is irregular. Both leaf mining and stippling can greatly depress the level of photosynthesis in the plant. Extensive mining also causes premature leaf drop, which can result in lack of shading and sun scalding of fruit (Bueno, *et al* 2007). Wounding of the foliage also allows entry of bacterial and fungal diseases (Abou-fakhr-Hammad and Nemer. 2000). Pea *Pisum sativum*, Citrine (Leguminaceae) is one of the most important economic vegetables (Onwueme and Sinha, 1991 and FAO, 1993) its cultivated area was increased during the last years especially in new reclaimed land for local consumption. It is thus sufficient need of nitrogen and leaves after harvest 100-120 kg nitrogen per hectare, equivalent to 20-25 tons of organic fertilizer which workers enough for the growth of another crop. The total cultivated area of green peas in the world about 2.8 million acres and Egypt take third place for the Arab States and of the cultivated area in Egypt 64037 acres in 2008 and average production 4.45 tons / acres, according to statistics from the Central Administration of Agricultural Economics - Ministry of Agriculture.

Many researchers on the role of planting spaces, weather factors and plant age on the infestation of certain insects infesting leguminous plants has been done previously, Meena and Bhargava (2001); Mishra *et al*. (2001); Wale (2002); Abd-Elmalak and Salem (2002); Shalaby (2004); Mittal and Ujagir (2005); Arif *et al*. (2006); Hanafy A.R.I (2007); Hanafy *et al*. (2008); Afsah (2009); Hussein *et al*., (2010); Abdel Hamed *et al*. (2011) and Omaprakash and Raju (2014).

The aim of the present study to determine the suitable planting date of fenugreek seeds to escape from the infestation of leaf miner, *L. trifolii* which causes a serious damage of leaves and study the effect of some weather factors and plant age in three tested planting spaces.

MATERIALS AND METHODS

Field experiments were carried out to study the effect of planting space, some weather factors and plant age on the population density of Leaf miner, *Liriomyza trifolii* (Burgess) infesting pea plants *(Pisum sativum*). The pea seeds (cultivar Master B) were obtained from Department of Vegetable plants, Horticulture Research Institute (A.R.C.). An area of about 900 m2 was cultivated in three planting space , 10cm, 20cm and 30cm in Plant Protection Research Station in Kaha region, Qalubia Governorate throughout two successive seasons, 2013 and 2014. In both seasons, the experimental area was divided into 9 plots, each replicate was 100 m^2. Each planting space was represented by three replicates. All replicates were arranged in Randomized Complete Block Design. All agricultural practices were done and no pesticide treatments were applied. Weekly randomized samples of pea leaves (15 of each replicate) were taken after foliage appearance and continue for 11 weeks. Each sample from each replicate were kept in tightly closed paper bags and transferred to the laboratory where all samples were thoroughly examined by the aid of stereomicroscope to count the number of leaf miner, *L. trifolii* larvae. Weather factors for both studied seasons were obtained from the Central Laboratory for Agriculture Climate and recorded as the daily maximum & minimum temperature; and mean relative humidity. Three periods of plant age (first, vegetative stage from planting till 37 days later; the second, flowering stage from 38 to 65 days and the third one, fruiting stage (pods formation) from 66 to the end of the growing season) were also recorded for each planting space to determine the relationship between these factors

and infestation of *L. trifolii* larvae on pea plants. The mean numbers of leaf miner, *L. trifolii* larvae between the three tested planting spaces were compared statistically. The simple correlation and partial regression were adopted to show the average rate of changes in population due to changes in the two mentioned factors. Data were analyzed according to SAS program (SAS Institute, 2003) and mean separation was conducted by using Duncan's multiple range test in this program.

RESULTS AND DISCUSION

Effect of planting spaces on the population density of *Liriomyza trifolii* infesting pea plants.

Results in Table (1&2) revealed that the population density of *L. trifolii*. larvae on pea plants was significantly differed according to the planting spaces during the two studied seasons 2013and 2014.In the first season, data in Table (1) showed that the population density of *L. trifolii*. larvae increased by the first planting space. The pea plants were sown in the planting space (10 cm) infested by the significantly highest numbers of *L. trifolii*. larvae (30.7 larvae/ 15 leaves) followed by pea plants sowing at the planting space (20cm) which infested by 4.97 larvae/ 15 leaves. While, pea plants of the planting space (30 cm) harboured the seasonal mean numbers of *L. trifolii* larvae (3.2 larvae/ 15 leaves).

Table 1: Effect of three planting spaces on infestation level of *Liriomyza trifolii* larvae on pea plants during season 2013.

Inspection Date	Plant age (days)	Mean number of *L. trifolii* larvae /15 leaves			Weather factors		
		Space 10 cm	Space 20 cm	Space 30 cm	Min. Temp.	Max. Temp.	R.H.%
October, 1st, 2013	**16**	23.3	1.7	0	**19.6**	**28.9**	**55.7**
7th	**23**	35	3.3	1	**18.6**	**27.7**	**49.3**
15th	**30**	45	10	7.3	**18.6**	**29.1**	**59.9**
22nd	**37**	60	21.7	13	**17**	**27.7**	**52.6**
29th	**44**	71.7	10	9	**16**	**25.9**	**62.9**
November, 5th	**51**	45	5	4.3	**18.3**	**25.6**	**73.7**
12th	**58**	25	2.3	0.7	**17.6**	**26**	**65.7**
19th	**65**	16.7	0.7	0.7	**16.1**	**24.1**	**65.4**
26th	**72**	10.7	0	0	**17.1**	**26.6**	**41**
December, 3rd	**79**	3.3	0	0	**17.3**	**25.9**	**52.3**
10th	**86**	1.7	0	0	**13.7**	**20.1**	**54**
Mean	**---**	30.7a	4.97b	3.2b	17.3	26.1	57.5
F value		13.2					
L.S.D.		12.3					

The data illustrated in(Table, 1) showed that infestation of *L. trifolii* were stated at 16 days after sowing on 1th October (23.3, 1.7 and 0.0 larvae/ 15 leaves) between space 10 cm, 20 cm and 30 cm, respectively, then it was increased sharply to reach its maximum (71.7 larvae / 15 leaves) at 44 days after sowing on 29th October at space 10 cm, but it was increased sharply to reach its maximum (21.7 and 13 larvae/15 leaves) at 37 days after sowing on 22th October at the distance between the hills was about 20 cm and 30 cm, respectively. After that the insect population fluctuated then decreased gradually to reach a lower level (1.7 larvae / 15 leaves) on 10th December after at 86 days from sowing at space 10 cm but it was decreased

sharply to reach a lower level (0.7 and 0.7 larvae / 15 leaves) at 65 days after sowing on 19th November at the space 20 cm and space 30 cm, respectively. Meanwhile, data indicated also that larvae population of *L. trifolii* was obviously higher on young plants (4-7 weeks) than the older plants. This result indicated that young fresh plants showed higher biological activities with turgid fully nourished cells than older pea plants and was more suitable for the reproduction of the insect pest. Also, indicated that larvae population of *L. trifolii* was obviously higher on space 10 cm than the distance between the hills was about 20 cm at the least space 30 cm.

In the second season 2012, statistical analysis of the obtained data in Table (2) indicated that there was significant differences between the mean number of *L. trifolii* on planted at the shortest space (10 cm) and other distances (20 & 30 cm), as the calculated LSD value was 11.9 and the results took the same trend obtained in the first season. The highest mean numbers of *L. trifolii* (34.1 larvae/ 15 leaves) was recorded on pea plants sowing at shortest space, 10 cm between hills. On the other extreme, the lowest level of infestation with *L. trifolii* larvae on pea plants occurred on the plants sown at the largest space (30 cm), recording 2.6 larvae/ 15 leaves. For the planting space 20 cm between plants, an infestation was recorded 5.16 larvae/ 15 leaves.

Table 2: Effect of three planting spaces on infestation level of *Liriomyza trifolii* larvae on pea plants during season 2014.

Inspection Date	Plant age (days)	Mean number of *L. trifolii* larvae /15 Leaf			Weather factors		
		Space 10 cm	Space 20 cm	Space 30 cm	Min. Temp.	Max. Temp.	R.H. %
October, 3rd t 2014	16	18	1	0	21.6	30.3	48.9
10th	23	33.3	3.7	1.3	20.1	31	57.7
17th	30	50	5.7	2	19.7	28.3	55.1
24th	37	63.3	11.7	7	19.3	28.3	49
31st	44	70	25	16.3	19	28.1	51.4
November, 7th	51	45	5	1.7	16.6	25.9	51
14th	58	41.6	3	0	15.6	26.6	56.9
21st	65	29	1.7	0	15.1	24.1	63.4
28th	72	14.3	0	0	13.7	20.9	61.9
December, 5th	79	6	0	0	14.6	25.1	58.6
12th	86	4	0	0	13.3	22.6	52.7
Mean		34.1[a]	5.16[b]	2.6[b]	17.1	26.5	55.1
F value		17.5					
L.S.D.		11.9					

Obtained results are in agreement with those recorded by Abd-Elmalak and Salem (2002) on sweet potato in Egypt, who stated that the some pests, were abundant in the narrow spacing (20cm) than 25 and 30 cm. Emam *et. al*. (2006) on sweet pea plants in Egypt recorded that the largest sowing space 40 cm harbored significantly the lowest seasonal mean number of insects. Hanafy *et. al*. (2008) on cucumber in Egypt indicated that the highest mean numbers of insects were recorded on planted at the shortest space in the two seasons.

Effect of weather factors on the *Liriomyza trifolii*. infestation rate on pea plants.

With regard to the effect of some weather factors on the population density of leaf miner, *L. trifolii* infesting pea plants in three planting spaces during 2013 and 2014 seasons at Qalubia Governorate, each of the simple correlation and the partial regression values were calculated and tabulated in Tables 3 and 4.

Data arranged in Table (3) showed that, in the simple correlation coefficient “r”

indicated insignificantly positive correlations between leaf miner population and each of the maximum (r= 0.31, 0.46 and 0.30) and minimum temperature (r= 0.12, 0.15 and 0.15 for 10cm, 20cm and 30cm planting spaces, respectively) while, RH% had a significant positive effect in the first and second planting spaces and a insignificantly positive in the third space (r= 0.51, 0.55 and 0.09, respectively). During the first season. For the partial regression analysis, significant positive effect was recorded between the above mentioned pests population and both of maximum temperature and relative humidity in the three planting spaces thorough 2013 season. While, minimum temperature had significant negative effect during three planting spaces.

Concerning the all over correlation and the partial regression values for the three tested planting spaces, statistical analysis of the obtained data in the first, second and third planting spaces gave the same results of relationship, except for relative humidity in the third planting space.

The average rate of changes in the pest activity due to the changes in the combined effect of the tested three weather factors were 74.4, 66.4 and 72.3%, during the 10cm , 20cm and 30cm planting spaces, respectively. (Table 3).

Table 3: Effect of weather factors on the population density of *Liriomyza trifolii* (Burgess) infesting pea plants in three planting spaces during 2013 season.

Planting space 2013	Mean Count / 15 leaves	Factors	Simple correlation		Partial regression				
			R	P	B	P	F value	P	EV%
10cm	10cm	Max. Temp.	0.315	0.345	44.41	0.008	6.78	0.01	74.4
		Min. Temp.	0.127	0.710	-57.2	0.020			
		RH%	0.514	0.105	0.130	0.006			
20cm	20cm	Max. Temp.	0.465	0.149	14.8	0.020	4.61	0.04	66.4
		Min. Temp.	0.155	0.648	-18.7	0.118			
		RH%	0.092	0.786	0.933	0.120			
30cm	30cm	Max. Temp.	0.308	0.357	38.4	0.015	6.10	0.02	72.3
		Min. Temp.	0.154	0.649	-48.1	0.036			
		RH%	0.558	0.074	5.90	0.006			

In the subsequent season, 2014, data arranged in Table (4) indicated that in the maximum temperature had insignificantly positive effect on the occurrence of the studied pest (r= 0.32, 0.42 and 0.47) while, minimum temperature had insignificantly positive effect in the first and second planting spaces and had a significantly positive effect in the third date (r= 0.34, 0.47 and 0.57, respectively). But, RH% had insignificant negative effect in the three planting spaces (r= -0.40, -0.47 and -0.50, respectively). During the second season. Also, the partial regression analysis, insignificant positive effect was recorded between the above mentioned insect population and minimum temperature in the three planting spaces, but this relation was insignificant negative between the insect population and both of maximum temperature and relative humidity in the three planting spaces except for maximum temperature in the first planting space (10cm).

The amount of variability that could be attributed to the combined effect of the tested weather factors on the population of leaf miner was 18.5, 29.3 and 40.4% uring the 10cm , 20cm and 30cm planting spaces, respectively, (Table, 4).

Table 4: Effect of weather factors on the population density of *Liriomyza trifolii* (Burgess) infesting pea plants in three planting spaces during 2014 season.

Planting space 2014	Mean Count / 15 leaves	Factor	Simple correlation		Partial regression				
			R	P	B	P	F value	P	E.V.%
10cm	10cm	Max. Temp.	0.325	0.333	0.556	0.979	0.53	0.67	18.5
		Min. Temp.	0.346	0.296	3.573	0.885			
		RH%	-0.405	0.215	-4.26	0.477			
20cm	20cm	Max. Temp.	0.423	0.194	-0.934	0.881	0.97	0.45	29.3
		Min. Temp.	0.476	0.138	3.201	0.653			
		RH%	-0.475	0.139	-1.276	0.457			
30cm	30cm	Max. Temp.	0.473	0.141	-1.915	0.591	1.59	0.27	40.4
		Min. Temp.	0.572	0.055	3.864	0.348			
		RH%	-0.505	0.112	-0.672	0.485			

In a similar work of the studied the effect of climatic factors and plant age on the population density of different insect pests infesting many crops had been done in different countries. Meena and Bhargava (2001) in India on fenugreek plants stated that the population density of aphid, *Acyrthosiphon pisum* correlated significantly negative correlation with temperature and had a positive correlation with relative humidity. Shalaby (2004) in Egypt on common bean found a significant correlation between minimum temperature and numbers of *L. trifolii*, while, an insignificant correlation was found between relative humidity and the population of *L. trifolii*. Arif *et al.* (2006) found that rainfall and temperature were significantly positive relationship with the population density of *T. tabaci,* Jassid and whitefly infesting cotton plants, while the relative humidity showed non- significant effect. Hanafy (2007) in Egypt on sweet pea plants stated that the population density of *T. tabaci* was affected by climatic factors and plant age in three planting dates. Afsah (2009) in Egypt on fenugreek plants stated that the population density of *Liriomyza* spp. was positively correlated with temperature and wind velocity, while it was negatively correlated with relative humidity. Hussein *et al*.(2010) in Egypt on garlic plants recorded that there are a Positive relationships between the population density of *T. tabaci* and the developmental stages of plant, and negatively correlated with maximum and minimum temperatures, while, the mean of R.H was affected positively on the population this pest. Abdel Hamed *et al.* (2011) in Egypt on okra plants found that **t**he weather factors (maximum, minimum, mean temperature) and plant age had significantly positive effect on population of *B. tabaci*, *T. tabaci*, *L. trifolii* and *T. urtica,*while the relative humidity had significantly negative effect. Omaprakash and Raju (2014) in India on brinjal plants, *Sollanum melongena* L. stated that *B.tabaci* population was significant and negative correlation with temperature and insignificantly negative with humidity.

Effect of plant age on the *Liriomyza trifolii*. infestation rate on pea plants.

With regard to the effect of plant age on the population density of leaf miner, *L. trifolii* infesting pea plants in the three planting spaces during 2013 and 2014 seasons at Qalubia Governorate, each of the simple correlation and the partial regression values were calculated and tabulated in Tables 5 and 6.

Data arranged in Tables (5&6) showed that, in the simple correlation coefficient "r" indicated high significant positive correlations between leaf miner population and the plant age (vegetative stage) (r= 0.99, 0.94 and 0.96 during 2013 season) and (r= 0.99, 0.96 and 0.91 during 2014 season) for the three planting spaces

10cm, 20cm and 30cm respectively. While, the plant stage of flowering stage had a significant negative effect (r= -0.97, -0.95 and -0.95 in the three planting spaces respectively) and (r= -0.95, -0.84 and -0.82 in the three planting spaces respectively) during 2013 & 2014 respectively. Also, the relationship between leaf miner population and the plant age (fruiting stage) of the first planting space indicated significant negative effect (r= -0.93 and -0.94) during two seasons respectively.

Table 5: Effect of plant age on the population density of *Liriomyza trifolii* (Burgess) infesting pea plants in three planting spaces during 2013 season.

Planting spaces	Planting stages	Mean count/15 leaves	Simple correlation		Partial regression				
			r	P	B	P	F value	P	E.V.%
10cm	Vegetative	40.8	0.996	0.003	0.578	0.003	5.6	0.04	38.47
	Flowering	39.6	-0.975	0.024	-0.360	0.02			
	Fruiting	5.6	-0.937	0.226	-1.366	0.226			
	All stages	30.7	-0.620	0.041	-0.628	0.041			
20cm	Vegetative	9.2	0.947	0.052	0.941	0.052	2.4	0.155	21.1
	Flowering	4.5	-0.959	0.030	-2.151	0.030			
	Fruiting	0.0	_	_	_	_			
	All stages	4.97	-0.459	0.155	-1.600	0.155			
30cm	Vegetative	5.3	0.966	0.033	1.44	0.033	1.67	0.227	15.7
	Flowering	3.7	-0.958	0.041	-2.100	0.041			
	Fruiting	0.0	_	_	_	_			
	All stages	3.2	-0.396	0.227	-2.006	0.227			

Table 6: Effect of plant age on the population density of *Liriomyza trifolii* (Burgess) infesting pea plants in three planting spaces during 2014 season.

Planting spaces	Planting stages	Mean count/15 leaves	Simple correlation		Partial regression				
			r	P	b	P	F value	P	E.V.%
10cm	Vegetative	41.1	0.999	0.001	0.457	0.001	3.3	0.10	27
	Flowering	46.4	-0.950	0.049	-0.500	0.049			
	Fruiting	8.1	-0.942	0.216	-1.208	0.216			
	All stages	32.1	-0519	0.101	-0.542	0.101			
20cm	Vegetative	5.5	0.968	0.031	1.926	0.031	1.03	0.33	10.2
	Flowering	8.7	-0.846	0.153	-0.697	0.153			
	Fruiting	0.0	_	_	_	_			
	All stages	5.16	-0.320	0.337	-0.999	0.337			
30cm	Vegetative	2.6	0.914	0.08	2.696	0.085	0.60	0.45	6.3
	Flowering	4.5	-0.826	0.173	-0.944	0.173			
	Fruiting	0.0	_	_	_	_			
	All stages	2.6	-0.250	0.458	-1.159	0.458			

Concerning the all plant stages correlation coefficient values for the three studied stages together (vegetative, flowering and fruiting) in the three tested planting spaces, statistical analysis of the obtained data in the second and third planting spaces gave the same results of relationship, as the relationship were insignificant negative with on population of *L. trifolii* (r = -0.45 and -0.39 in the 2nd & 3rd planting spaces respectively) and (r = -0.32 and -0.25 in the 2nd & 3rd planting spaces respectively) during 2013 and 2014 seasons, respectively. On the other hand, these relations were significant negative between the all plant stages and the population of insect, as r values were -0.62 and -0.52 during two seasons, respectively.

The partial regression analysis, significant positive effect was recorded between the above mentioned insect population and plant age(vegetative stage) in the three planting spaces and during two seasons. but this relation was significant negative between the insect population and flowering stages in the three planting spaces during two seasons, also, this relation was insignificant negative with fruiting stages in the first space during two seasons.

The amount of variability that could be attributed to the combined effect of the plant stage factors (vegetative, flowering and fruiting stages) on the population of *L. trifolii* was 38.47, 21.1 and 15.7% for the 10cm, 20cm and 30cm planting spaces, respectively, during 2013 season. While, the explained variance (E.V. %) was 27, 10.2 and 6.3 for the three planting spaces, respectively, during 2014 season.

Generally, it could be concluded that the population density of leaf miner, *L. trifolii*. increases by increasing the plant age until middle of the flowering stage. The lightest population was recorded during the fruiting stage. While, the pea plants infested by the heaviest population during vegetative and flowering stages. Also The climatic factors were more effective on *L. trifolii* population when comparing with plant age.

In a similar work of the studied the effect of plant age on the population density of different insect pests infesting many crops had been done in different countries. Hanafy (2007) in Egypt on sweet pea plants stated that the population density of *T. tabaci* was affected by climatic factors and plant age in three planting dates. Hussein *et al*. (2010) in Egypt on garlic plants recorded that there are a Positive relationships between the population density of *T. tabaci* and the developmental stages of plant. Abdel Hamed *et al.* (2011) in Egypt on okra plants found that the weather factors (maximum, minimum, mean temperature) and plant age had significantly positive effect on population of *B. tabaci*, *T. tabaci*, *L. trifolii* and *T. urtica*. Afsah *et. al* (2014) in Egypt on fenugreek plants stated that the effect of planting stages on population density of *Liriomyza* spp. The population density of leaf miner, *Liriomyza* spp increases by increasing the plant age. The lightest population was recorded during the vegetative stage. While the heaviest population during flowering and fruiting stages.

REFERENCES

Abdel Hamed, N. A.; H.S. Shaalan; S. A. Yasin and A.M.M. Abou-Zaid (2011): Effect of some abiotic factors on the population fluctuation of some pests infesting okra plants, with the using of some compounds in their controlling. J. Plant Protect. and Pathol., Mansoura Univ., 2(4):407-420.

Abd-Elmalak, V. S. G. and A.A. Salem (2002): Influence of planting spaces and hybrids on the population of six arthropods attacking sweet potato plant. Annals of Agric. Sci. Moshtohor, 40(3): 1797-1806.

Abou-fakhr-Hammad, E. M., and Nemer,N. M. (2000): Population densities, spatial pattern and development of the pea leaf miner (Diptera: Agromyzidae) on cucumber, swisschard and bean. J. Agric. Sci. 134: 61-68.

Afsah,A. F. E.(2009): Seasonal abundance of some insect pests and associated natural enemies on fenugreek plants. Egypt. J. Agric. Res., 87(5):1335-1350.

Afsah, A. F. E.; Hanafy, A.R.I. and Hussein, S.H.A.(2104): Effect of certain climatic factors and plant age on the population density of leaf miner , *Liriomyza spp*. infesting Fenugreek plants, *Trigonella foenumgraecum L*. in different planting dates. Acad. J. Biolog. Sci., 7(2) 77 – 87.

Arif, M.G.; M.D. Gogi; M. Mirza; K. Zia and F. Hafeez (2006): Impact of plant spacing and abiotic factors on population dynamics of sucking insect pests of cotton. Pakistan J. Biol. Sci., 9(7):1364-1369.

Bueno, A. F., Zechmann, B., Hoback, W. W., Bueno, R. C. O. F. and Fernandes, O. A. (2007): Serpentine leaf miner *(Liriomyza trifolii*) on potato (*Solanum tuberosum*): Field observations and plant photosynthetic responses to injury. Ciencia Rural 37(6):1510-1517.

Capinera, J. L. (2001): American Serpentine Leafminer, *Liriomyza trifolii* (Burgess) (Insecta: Diptera: Agromyzidae). Entomology and Nematology Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida.

Chaney, W.E. (1995): The pea leaf miner as a pest of vegetable,crops. Crop, 4 pp Notes, P.4. Monterey Co.Extension Office.

Emam, A. Z., M. F. A. H. Hegab and M. A. M. Tantawy (2006): Effect of planting space and date on the population densities of certain insect pests infesting sweet pea plants at Qalyoubia Governorate. Annl. Agric. Sci. Moshtohor, 44 (1): 299-308.

FAO, 1993. Plant production and protection paper 56. Pesticide Residues in food. Rep. Joint meeting on pesticide residues held in Geneva, December 5 – 14, Rome 4(4): 12-20

Hanafy, A.R.I. (2007): effect of certain climatic factors and plant age on the level of infestation with cotton and onion thrips , *thrips tabaci* Lind. on sweetpea plants in different planting dates. Egypt. J. Agric. Res., 85(6): 2051-2063.

Hanafy,A. R. I. ., Maha, A. M. Tantawy and Gehad, M. M. (2008): Combined effects of planting date, space and releasing of *Chrysoperla carnea*(Stephens) on the population density of whitefly, *Bemisia tabaci* (Genn) infesting cucumber plants and yield. E. J. Agric. Res. 86 (2): 455-470.

Hussein, S.H.A.; A.R.I. Hanafy and Maha A.M. Tantawy (2010): Effect of cultivars, some climatic factors and plant developmental stages on the population density of onion thrips, *Thrips tabaci* Lind. on garlic plants in Egypt. Fayoum J. Agric. Res. & Dev., 24(1):30-36.

Meena, B.L.M. and C.B. hargava (2001): Relationship between aphid and predator populations with meteorological factors in different fenugreek varieties. Insect Environment, 7(3):108-109.

Meena, B.L.M. and C.B. hargava (2001): Relationship between aphid and predator populations with meteorological factors in different fenugreek varieties. Insect Environment, 7(3):108-109.

Miltal, V. and R. Ujagir (2005): Effect of various treatments against major insect pests of field pea, (*Pisum sativum* L.). Ann. Plant Protection Sci, 13(1): 111-118.

Mishra, S. K.; P. M.Kanwat and Sharma (2001): Effect of dates of sowing and intercropping on the seed yield and incidence of mustard aphid, *Lipaphis erysimi* (Kalt.). Ann. Agric. Res., 22(3):445-446.

Omaprakash, S.O and S. V. S. Raju (2014): A brief review on abundance and management of major insect pests of brinjal (*Solanum Melongena L.*). Int. J. Appl. Biol. and Pharmaceutical Technol., 5(1):228-234.

Onwueme, C.J. and O.T. Sinha, 1991. Field crop C.T.A publication, pp: 259.

SAS Institute (2003). SAS version 9.1. SAS Institute Inc, Cary, NC, USA.

Shalaby, S.H. (2004): Studies on the efficiency of some new pest control measures against certain pests of common bean. Ph.D. Thesis, Fac. Agric. Moshtohor, Zagazig Univ.: 265pp.

Wale, M. (2002): Population dynamics of the pea aphid, *Acrythosiphon pisum* (Harris) (Homoptera: Aphididae) on field pea (*Pisum sativum* L.) in Northwestern Ethiopia. Insect Science and its Application, 22(2): 131-137.

Wilkerson JL, Webb SE, Capinera JL. (2005): Vegetable Pests I: Coleoptera - Diptera - Hymenoptera. UF/IFAS CD-ROM. SW 180.

ARABIC SUMMERY

تأثير مسافات الزراعة وبعض العوامل المناخية وعمر النبات على الكثافة العددية لصانعات أنفاق أوراق الفول والتى تصيب نباتات البسلة

هشام صالح شعلان ومها صبرى الغنام

معهد بحوث وقاية النباتات - مركز البحوث الزراعية – الجيزة – مصر

تم اجراء التجربة الحقلية فى محطة بحوث وقاية النباتات فى منطقة قها – بمحافظة القليوبية خلال موسمين شتاء متتاليين ٢٠١٣ و ٢٠١٤ وذلك لدراسة تأثير ثلاثة مسافات للزراعة (١٠ و ٢٠ و ٣٠ سم) وبعض العوامل المناخية وعمر النبات على الكثافة العددية لصانعات أنفاق أوراق الفول *Liriomyza trifolii* (Burgess) والتى تصيب نباتات البسلة.

وقد أظهرت الدراسة ان مسافات الزراعة لها تاثير على معدلات الاصابة بهذه الافة حيث تبين ان نباتات البسلة المزروعة على مسافة ١٠ سم قد تعرضت لأعلى معدل اصابة بصانعات انفاق اوراق الفول (٣٠.٧ و٣٤.١ يرقة/ ١٥ ورقة وذلك خلال موسمى الدراسة على التوالى) وعلى العكس من ذلك وجد ان الزراعة على مسافات ٢٠ و ٣٠ سم قد قلل من الاصابة بهذه الافة وقد اظهرت نتائج التحليل الاحصائى انه لا يوجد اختلافات معنوية فى الاصابة عند الزراعة على مسافة ٢٠سم و٣٠ سم.

كما بينت النتائج ان الكثافة العددية لصانعات انفاق اوراق الفول تزيد بزيادة عمر النبات حتى عمر ٤٥ يوم (خلال مرحلة الازهار) حيث سجلت اعلى تعداد لها خلال مرحلتى النمو الخضرى و الازهار فى حين ان النباتات فى طور الاثمار قد اصيبت بأقل عدد من هذه الحشرة وذلك عند الزراعة على مسافة ١٠سم ، فى حين ان المسافات الاخرى قد سجلت تعداد صفر خلال طور الاثمار. و اظهرت نتائج التحليل الاحصائى ان التعداد للافة محل الدراسة قد ارتبطت ارتباطا موجبا او سالبا مع بعض عوامل المناخ و عمر النبات بحسب مسافات الزراعة ومراحل نمو النبات المختلفة خلال موسمى الدراسة.

كما بينت نتائج الدراسة ان عوامل المناخ (درجات الحرارة العظمى و الصغرى و متوسط الرطوبة النسبية) قد اثرت تاثيرا عاليا على الكثافة العددية لصانعات الانفاق بالمقارنة بتاثير عمر النبات وكان التاثير المشترك للعوامل المناخية هو ٧٤.٤ ، ٦٦.٣ و ٧٢.٣% لمواعيد الزراعة الثلاثة خلال الموسم الاول و ١٨.٥ ، ٢٩.٣ و ٤٠.٤% خلال الموسم الثانى لمواعيد الزراعة الثلاث على التوالى. وكما اوضحت النتائج ان تاثير مراحل عمر النبات مجتمعة (خضرى ، زهرى وثمرى) على الكثافة العددية لصانعات الانفاق خلال مواعيد الزراعة المختبرة لنباتات البسلة هو ٣٨.٥ ، ٢١.١ و ١٥.٧% خلال الموسم الاول و ٢٧ ، ١٠.٢ و٦.٣% خلال الموسم الثانى للثلاث مواعيد الزراعة المختبرة على التوالى.