Estimating the population density of Vegetable leaf miner *Liriomyza sativae* Blanchard (Diptera:Agromyzidae) on Tomato and Cucumber crops in the Greenhouses

Ahmed Abdulsahib Mezher Shukur¹, Hanaa H. Al- Saffar² and Feryal Bahjat Hermize³

 ^{1,3}College of Agricultural Engineering Science, University of Baghdad, Baghdad, Iraq.
 ²Iraq Natural History Research Center and Museum, University of Baghdad, Baghdad, Iraq. Corresponding author Email:ahmed.abdulsahib1204a@coagri.uobaghdad.edu.iq

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Abstract

Greenhouse experiments were conducted to estimate the larva densities of *Liriomyza sativae* on tomato and cucumber crops in the greenhouses of the Plant Protection Department at the Faculty of Agricultural Engineering Sciences / University of Baghdad / Al-Jadriya for the season 2021-2022. The average larva densities on tomato and cucumber crops were 4.67 and 9.67 larva / 15 leaves, respectively whereas, the average a number of tunnels was 12.33 and 25.33 tunnels / 15 leaves , respectively. The percentage of leaf infection was 28.88% and 33.33% for cucumber and tomato respectively in the first week of December 2021 and increased larva densities to 23.00 and 41.33 larva / 15 leaves, the average of number of tunnels was 61.00 and 87.33 larvae / 15 tunnels and the percentage of leaf infection was 93.33and 97.77% for cucumber and tomato respectively in the third week of April 2022. These results suggest that the variation in the densities of larvae, number of tunnels and the percentage of infection is related to variations in temperature and humidity during the planting season.

Keywords: Cucumis sativus, greenhouses, Liriomyza sativae, Solanum lycopersicum



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Introduction

Cucumbers Cucumis sativus L. (Cucurbitaceae), native to Asia and widely cultivated all over the world, It is also a rich source of valuable nutrients and biologically active compounds not only used as food but also in cosmetology and medicine, rich therapeutic also in cucurbitacins and polyphenolics which are known to have multiple biological activities such as anti-hyaluronidase, anticarcinogenic, antioxidant, anti-elastase, anti-hyperglycemic, antimicrobial, diuretic and analgesic effects (12).

Tomato, Solanum lycopersicum L. (Solanaceae) is the most consumed vegetable worldwide as well as an important source of many antioxidants such as lycopene, which is responsible for the red color and helps prevent cell Tomatoes also prevent damage. the of harmful effects lead in blood components. Tomato fruits contain 94% water, malic acid, citric acid, soluble sugars, vitamin A, vitamin B1, B2 and many mineral salts (8) (10).

Tomato and cucumber crops are attacked by many insect pests, including the vegetable leaf miner *Liriomyza sativae*, which belongs to the family (Agromyzidae: Diptera) this family attacks a wide range of plants up to 31 plant families (11). (9) Showed that one of the species belonging to the Agromyzidae family infested 34 plant species belonging to 11 plant families of dicotyledons and two types of monocots. (5) Showed in a study of the seasonal abundance of vegetable leaf miners on the okra plant that the percentage of infection reached 100% in April. (3) Indicated in a study that *L. sativae* caused losses of 300-400 gm per 1000 cm2. There are includes nearly 3200 species of the family Agromyzidae distributed all over the world (13).

Materials and Methods

The conducted the study in was of the Plant Protection greenhouses Department at the Faculty of Agricultural Engineering Sciences / University of Baghdad / Al-Jadriya for the season 2021-2022. The area of the greenhouses is 237.5 m^2 with a dimension (length 25m, width 9.5m, height 3.5m), after carrying out all the necessary agricultural operations and according to the approved recommendations. The experiment was designed according to the randomized complete block design. The greenhouses were divided into three sectors (replicates); each sector contains 5 ridges between one and another 75 cm, planted on 15/11/2021



with a Newton variety for tomato and an Almudhish variety for cucumber, and on two lines for ridge and the distance between the two lines was 30 cm and between one plant and another was 25 cm, Leave a distance of 1 m for the end edges. The population density of the larval stage was studied by sampling weekly from 7/12/2021 to 3/5/2022 selecting 5 plants randomly from each replicate and picking 3 leaves from 3 levels for each plant, the upper, middle and lower levels, so the specimen size is 15 leaves / replicate. The leaves were placed separately in Petri dishes, each according to the appropriate size of the leaf; after putting in each plate, a filter paper was slightly moistened with water to keep the leaf from drying out, and it was monitored daily until the adults appeared and leave drought. Also the percentage of infection was calculated as follows:

Percentage of infection = (number of infested leaves) / (Total number of leaves) ×100

Statistical Analysis

The data were analyzed statistically according to a completely randomized block design using the GenStat 12 program, and the significant differences between the means were compared by the Least Significant Difference (L.S.D.) test with a significance level of 0.05.

Results and Discussion

The results of Table (1) estimate the population density of *L. sativae* larvae in greenhouses showed the significant differences in the population density rate, it accompanied the tomato and as cucumber crops from the beginning of the emergence of seedlings until the end of the growth stage. As the number of larvae was 4.67 and 9.67 larva / 15 leaves respectively on 7/12/2021, when the temperature was 21.3 °C and relative humidity 50.2% Figure (1) at the beginning of the study, then it gradually decreased to reach the lowest rate of 2.33 and 4.67 larva / 15 leaves respectively when the temperature was 19.05, and the relative humidity was 66% on 4/1/2022. Then the number rates increased weekly to reach the highest rate of larvae 23.00 and 41.33 larva / 15 leaves respectively on 19/4/2022 when the temperature was 34.73 °C and the relative humidity was 20.24%, after which the rates began to decrease, it was on 3/5/2022 8.33 and 27.00 larva / 15 leaves respectively at a temperature of 41.27°C and a relative humidity 36.04%, conclude from this study that the population density increased in the first week of November, then decreased in the fourth week of December and the first



and second weeks of January, then began to increase gradually to reach its highest density in the third week of April, then began to decrease. Thus, the insect's infection of the crop accompanied it in all stages of its growth, which clearly affected the plant, and this is (1) found in the study of the seasonal presence, incidence and severity of infection.

The results of Table (2) also showed that the average number of tunnels of vegetable leaf miner L. sativae on the tomato and the greenhouses cucumber crops in indicated that there were significant differences in their rates, as they were 12.33 and 25.33 tunnels / 15 leaves respectively on 7/12/2021, It gradually decreased to reach its lowest rates of 6.33, 12.00 tunnels / 15 leaves respectively on 4/1/2022. After that, their rates began to increase reaching 61.00 and 87.33 tunnels / 15 leaves respectively on 19/4/2022; then their rates began to decrease as they were 40.00 and 70.00 tunnels / 15 leaves respectively on 5/3/2022. The findings of this study revealed that leaf miners exhibited a widespread distribution and caused significant damage during the spring season, particularly in March and April. This was attributed to the availability of tender leaves on infested plants and the presence of favorable

environmental conditions, especially optimal temperatures and humidity levels. Furthermore, (2) indicated that April is the most suitable month for the proliferation of leaf miners.

The results of Table (3) also showed the percentage of infection with the vegetable leaf miner on the tomato and cucumber crops in the greenhouses indicating that there were significant differences in the percentage rate of infection as their rates were 28.88% and 33.33% for the leaves respectively at the beginning of the study on 7/12/2021, Then, the percentage was 84.44% and 86.66% respectively on 29/3/2022. After that it started to increase until it reached its highest rates reaching 93.33% and 97.77% for leaves respectively on 19/4/2022, after that, their rates began to decline, reaching 48.88% and 77.77% for leaves respectively on 3/5/2022. the percentage of infection with leaf miners was higher on the cucumber crop compared to the tomato crop, which is attributed to variation in the content of secondary compounds of leaves and this is what (7) found in a study conducted, it was found that there is a difference in the leaves content of eggplant and squash of secondary compounds (flavonoids, phenols alkaloids) and their variation and concentrations when infected with the

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insect. Trichomes, whose density and distribution contrast in different plants, are also important factors in selecting plant

hosts for species belonging to the genus Liriomyza (4) (6).

Table 1. The average number of larvae of the vegetable leaf miner *L. sativae* on the leaves of tomato and cucumber crops in the greenhouses

		Average n	umber of larva	ae / 15 leaves
INO.	Sampling date	Cucumber	Tomato	Average
1	07/12/2021	9.67	4.67	7.17
2	14/12/2021	9.00	3.00	4.00
3	21/12/2021	7.67	3.00	5.33
4	28/12/2021	4.67	2.67	3.67
5	04/01/2022	4.67	2.33	3.50
6	11/01/2022	5.67	3.33	4.50
7	18/01/2022	10.00	3.67	6.83
8	25/01/2022	13.00	4.67	8.83
9	01/02/2022	16.00	5.33	10.66
10	08/02/2022	18.67	6.00	12.33
11	15/02/2022	22.33	8.33	15.33
12	22/02/2022	21.00	8.67	14.83
13	01/03/2022	25.33	9.67	17.50
14	08/03/2022	28.00	11.00	12.00
15	15/03/2022	28.67	12.67	20.67
16	22/03/2022	31.67	16.67	24.17
17	29/03/2022	32.67	17.67	25.17
18	05/04/2022	33.67	18.33	26.00
19	12/04/2022	37.33	21.33	29.33
20	19/04/2022	41.33	23.00	32.16
21	26/04/2022	33.67	12.33	23.00
22	03/05/2022	27.00	8.33	17.66



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General Average	20.98	9.39	14.73	
Values L.S.D. 0.05 Plant	:2.50 Time:	3.63	Interaction:6.41	

Table 2. The average number of tunnels of vegetable leaf miner *L. sativae* on the leaves of tomato and cucumber crops in the greenhouses

Na	Compline data	Average nu	umber of tunne	ls / 15 leaves
INO.	Sampling date	Cucumber	Tomato	Average
1	07/12/2021	25.33	12.33	18.83
2	14/12/2021	23.67	10.66	17.16
3	21/12/2021	20.00	8.33	14.16
4	28/12/2021	12.33	7.00	9.66
5	04/01/2022	12.00	6.33	9.16
6	11/01/2022	15.33	9.00	12.16
7	18/01/2022	26.33	9.67	17.99
8	25/01/2022	35.00	12.33	24.16
9	01/02/2022	43.00	14.00	28.50
10	08/02/2022	49.33	16.00	32.66
11	15/02/2022	59.33	22.00	40.66
12	22/02/2022	62.00	24.00	43.00
13	01/03/2022	66.33	27.33	46.83
14	08/03/2022	70.33	30.33	50.33
15	15/03/2022	74.00	36.00	55.00
16	22/03/2022	76.00	40.00	58.00
17	29/03/2022	78.00	44.00	61.00
18	05/04/2022	80.33	47.00	63.66
19	12/04/2022	82.00	54.33	68.16
20	19/04/2022	87.33	61.00	74.16
21	26/04/2022	80.67	58.00	69.33
22	03/05/2022	70.00	40.00	55.00

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General Average	52.21	26.80	35.27
Values L.S.D. 0.05	Plant:2.23	Time:3.20	Interaction:5.41

Table 3. Percentage of infection with vegetable leaf miner *L. sativae* on the leaves of the tomato and cucumber crop in the greenhouses

		Average percer	ntage of larval	infestation /
No.	Sampling date		15 leaves	
		Cucumber	Tomato	Average
1	07/12/2021	33.33	28.88	31.10
2	14/12/2021	31.11	22.22	26.66
3	21/12/2021	28.88	20.00	24.44
4	28/12/2021	24.44	17.77	21.10
5	04/01/2022	26.66	13.33	19.99
6	11/01/2022	31.11	22.22	26.66
7	18/01/2022	37.77	24.44	31.10
8	25/01/2022	42.22	31.11	36.66
9	01/02/2022	46.66	26.66	36.66
10	08/02/2022	60.00	33.33	46.66
11	15/02/2022	66.66	44.44	55.55
12	22/02/2022	66.66	46.66	56.66
13	01/03/2022	73.33	51.11	62.22
14	08/03/2022	75.55	57.77	66.66
15	15/03/2022	80.00	68.88	74.44
16	22/03/2022	84.44	82.22	83.33
17	29/03/2022	84.44	86.66	85.55
18	05/04/2022	86.66	84.44	85.55
19	12/04/2022	88.88	88.88	88.88
20	19/04/2022	97.77	93.33	95.55
21	26/04/2022	82.22	68.88	75.55
22	03/05/2022	77.77	48.88	63.32

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General Average	60.02	48.2	7 54.28
Values L.S.D. 0.05	Plant:1.60	Time:3.31	Interaction:5.42



Figure 1. Average temperatures and relative humidity in the greenhous

Conclusion

The leaf miner *Liriomyza sativae* was present continuously from the beginning to the end of the growing season. Cucumber plants exhibited higher susceptibility to infestation compared to tomato plants, as indicated by increased infestation rates, larval counts, and the number of feeding tunnels. The infestation peaked during March and April, highlighting these months as critical periods for the implementation of effective pest management strategies.

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Conflict of interest

The authors declare no conflict of interest.

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