



ESTIMATION THE POPULATION DENSITY OF LEAFMINER LIRIOMYZA TRIFOLII (BURGESS)(DIPTERA:AGROMYZIDAE) AND EFFECT THE INFESTATION AND SEVERITY OF INFESTATION ON SOME THE VARIETIES OF COWPEA

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Abstract

The study was conducted at the Agricultural Research Station of the Faculty of Agricultural Engineering Sciences / University of Baghdad for the period from 15/3 to 26/12/2018 to estimate the incidence of some varieties of cowpea (Bayader, Americana, Bonanza) with the insect larvae *Liriomyza trifolii* (Burgess) During the calculation of the population density of the insect on the varieties of cowpea and estimate the average of infected leaves and the severity of the infestation and the number of tunnels. The results of the statistical analysis showed a significant superiority of the Bayader variety on the Americana and Bonanza varieties. The population density of the leafminer *Liriomyza trifolii* (Burgess) began on 1st of August, 2018 at the lowest average of 0.5, 0.5, 0.2 Followed by a gradual increase in the population density until the highest average of 10.5, 6.7 and 5.9 leafminer / leave respectively was reached at 31/10, after which the average was reduced until in 19th December the lowest average was 1.7, 1, 0.6 leafminer / leave respectively. The average number of infected leaves / plant and the number of tunnel / leaf on the three varieties of cowpea started at the lowest average on 18th of July, 2018 with (5.73 leave / plant, 2.35 tunnel / leave), 3.25 leave / plant and 1.57 tunnel / leave and (1.46 leave / plant and 1.37 tunnel / leave), respectively and then the average of incidence of the rise gradually to reach at 31th of October the highest average (70.75 leave / plant and 22.36 tunnel / leave) and 45.64 leave / plant (15.84), (30.84 leave / plant and 9.73 tunnel / leave) respectively. The average was then reduced at the end of the harvest until it reached 19th of December at the lowest average (6.45 leave / plants and 2.63 tunnel / leave), (10.33 leave / plant, 3.26 tunnel / leave), (2.36 leave / plants, 1.23 tunnel / leave) respectively. The severity of the infestation on the three varieties of cowpea started as low as 18th of July, with 0.27, 0.19 and 0.13 tunnel / leave respectively. Then, the average severity of infestation gradually increased to reach the highest infestation level at 31th of October, reaching 2.35, 1.75 and 1.53 tunnel / leave respectively. After that, the average severity of infestation was reduced by the end of the crop until it reached, on 19th of December, the lowest intensity of 0.31, 0.28 and 0.11 tunnel / leave, respectively.

Key word: leafminer *Liriomyza trifolii*, population density, Cowpea varieties.

Introduction

Vigna sinensis L. is one of the most important legumes of the leguminaceae, a temperate zone plant that grows wild in central Africa and is believed to originate in Central Africa and spread to other parts of the world (Matlob *et al.*, 1989). The larvae are grown for their dry seeds and green seeds Which are used as cooked food for humans, Vegetative use is also used as a green feed or as a green fertilizer to improve the soil

properties and increase their fertility, as well as the importance of the crop in the agricultural cycle as it contributes to the addition of the soil nitrogen element (Kathrin *et al.*, 1994). The seeds are characterized by good content of some salts such as phosphorus, iron and calcium as well as some vitamins, the area planted with beans in Iraq 47750 acres in 2013 and the rate of production 74500 tons (Central Statistical Organization, 2013). In 2004, Prasad and Singh (2004) reported that

more than 300 species of insects and mites attack legumes in India, but a few are significant lesions. Amro (2004) recorded fifteen species of insects and non-insect pests. A kind of plant-eating insects with five species of insect predators as well as some spiders on the cultivation of cowpea in Egypt. *Vigna* spp. is one of the most important legume crops in Iraq and the world. Her food is used as a source of protein, carbohydrates and minerals and has attacked many cowpea pests including mite, legume, bean beetle and tunnel constructors. *Liriomyza trifolii* (Burgess) (Alayande *et al.*, 2012). The larvae attack many insects and non-insect pests and the leafminers *Liriomyza* sp. (Diptera: Agromyzidae) are serious lesions that attack a number of plants from 31 plant families (Spencer, 1990), including vegetable crops AL-Jorany *et al.*, (2016) confirmed the initial registration of the *Liriomyza trifolii* beans in Baghdad / Iraq. Abbas and AL-Jorany (2017) also studied the seasonal abundance, percentage of infestation and severity of the vegetables leafminer *Liriomyza sativa* B. (Diptera : Agromyzidae) in cucumber for autumn season in Baghdad. Species belonging to the sex *Liriomyza* sp. cause the leaf surface to be destroyed by feeding its larvae between the two leaves leading to damage to the middle tissues of the leaves reduce their ability to perform the process of photosynthesis because of the lack of chlorophyll content and then yellowing leaves and falling and small fruits and low productivity, as well as feeding holes and eggs laying holes made by adults in tissue leaves causing the death of tissues as adults transmit the diseases of the virus (Waterhouse and Norris, 1987, Mashhadani, 2000, Tran, 2000). Duddin (2007) reported that the main damage to the leafminer *L. trifolii* on vegetable crops comes from larvae feeding on the mesophilic middle layer of the leaf. The tunnel becomes visible after 3-4 days of laying eggs and becomes more significant with larvae in age. Chabi-Olaye *et al.*, (2008) found that tunnel manufacturers cause significant losses on vegetable crops ranging from 80-100% depending on the species of crop and the level of infection. Mahmalgi and Bashir (2011) noted that the larvae of *L. trifolii* larvae tunnel long and thin spaces between the two skins. The tunnel is wider at the end than the beginning and the infestation distorts the infected leaves and looks like the tunnels are white in color, as well as photosynthesis in the infected leaves, causing the leaves to wither. The insect may destroy infected seedlings and attack many vegetable crops such as okra, beans, onions, garlic, eggplant, peas, sugar beet, pepper, cotton, soybeans and peanuts. As for the importance of leafminers, on the other hand suggest this research to address the percentage infestation of leaves and severity of infestation, which is one of the important criteria to

know the economic importance of leafminers on the crop of cowpea.

Materials and Methods

Preparation of land and planting of seeds

Plantation of a field of 216 m² field of cereals in the field of agricultural experiments for the College of Agricultural Engineering Sciences in Jadiriya (Research Station) near the fuel station and the tillage and softening and settlement of the land was divided into 3 maroz fields and the length of the square each 27 m. Moreover, one left without planting to separate the rows to prevent the mixing of replicates and varieties and left one meter of the edges of the field as a walk and according to the design of the whole random sectors (RCBD) Randomized Complete Block Design. Agriculture was carried out on 15th of March, 2018. The seed was planted at three seeds / gourd on both sides of the plant. Agriculture was carried out on 15th of March, 2018. Seeds were sown at 3 seeds / gourd on both sides of the plant reduced to one plant after two weeks of germination and the distance between plant and another 50 cm. The crop service operations were done from the field tasmid and bush and according to the recommendations for growing the crop (Matlob *et al.*, 1989 and Al-Bayati *et al.*, 2016).

Calculation of the population density of *Laryomyza trofolii*

I took 30 vegetable leaves a week and placed them in 9 cm diameter Petri dishes after placing them on a slightly moisturizing filter to keep the leaves dry. Then put them in an incubator at 25 ± 2 ° C and 60% relative humidity. These dishes are monitored daily, entirely.

Estimation and severity of infestation

Six plants were examined weekly from each replicate for each variety of cowpea and calculated the number of total leaves and the number of infected leaves and the number of tunnels / leaves infected ... and included in the forms prepared for this purpose.

$\% \text{ of plants infected in the field} = \frac{\text{number of infected plants}}{\text{total number of plants}} \times 100$

$\% \text{ of leaves infected} = \frac{\text{number of infected leaves}}{\text{total number of leaves}} \times 100$

The severity of the infestation was calculated by using the Mc Kinnuy (1923) equation. The standard was given according to the number of tunnels per infected leaf. A standard for infestation level was determined based on the average number of tunnels / leaves during the planting season 2018.

The severity of infestation = (number of leaves of

$0 \times 0) + (\text{number of leaves of } 3 \times 3) / \text{Total number of leaves} \times \text{Highest degree} \times 100$

Calculation of feeding holes

I took ten leaves at random from each of the refined plants to calculate the number of feeding holes.

Results and Discussion

Population density of Leafminers *Liriomyza trifolii* to Cowpea *Vigna* spp. Plant For the season 2018 On the variety cowpea (Bayader)

The results of fig. 1, showed that *L. trifolii* was accompanied the crop cowpea on variety (Bayade) of the season 2018. The population density began on 18th of July with average of 1.5 leaf miner / leave, after which the population density gradually increased with average 5 leafminers / leave on the 29th of August and then decreased to reach the lowest average of 2.2 leafminer / leave on 19th of September. Moreover, then took the density of the population up to reach the highest average of 10.5 leafminer / leave increase the numbers of insect fit with temperatures and then decreased until it reached the lowest average of 2.3 leafminer / leave on the 19th of December to the end of the season. Kececi (2008). The decrease in leafminer numbers due to the environmental conditions of temperature and relative humidity and natural enemies that affect the insect and lead to a decrease in population density. The leafminer insect has three peaks and has surpassed the first peak on the second and third peaks and the highest number of insect densities average was 2.61 leafminer / leave and less than 0.2 leafminer /

leave on the Bayader varieties (Ghadban *et al.*, 2017). Shower *et al.* (2016) noted that the highest density of leafy leafmier *Liriomyza trifolii* (Burgess) was 43.66 leafminer by studying the effect of endurance and nitrogen fertilization on this insect on a soybean plant.

Population density of Leafminer *Liriomyza trifolii* to Cowpea *Vigna* spp Plant For the season 2018 On the cowpea variety(Americana)

The results of fig. 2, showed that the leafminer *L. trifolii* was present in the cowpea variety (Americana) of the season 2018 from the beginning of August to the end of the season. The population density of the leafminer *L. trifolii* began on the cowpea variety (Americana) with average of 0.5 leafminer / leave on 1st August and the population density was increased on 15th of August with average 2.8 leafminer / leave. The density was gradually reduced and increased on 31th of October until the highest average of 6.7 leafminer/ leave, followed by the population density of the decrease until the lowest average of 1.5 leafminer / leave on the 19th of December to the end of the season . This is consistent with the Reitz and Trumble (2000) study that the leafminer *Liriomyza* sp. cause severe damage to other vegetable crops as a result of feeding their larvae into the central mesophilic layer of the leaf, resulting in the release of the vegetable juice from the plant leaf and its drying. Some researchers have found that the leafminer density is 90% too high for some vegetable crops such as cowpea, potatoes and other crops (Lopez *et al.*, 2010, Facknath, 2005, Kang *et al.*, 2009).

Population density of Leafminers *Liriomyza trifolii* to Cowpea *Vigna* spp Plant For the season 2018 On the cowpea variety (Bonanza)

The results of fig. 3, showed that the population density of leafminer *L. trifolii* on the cowpea variety (Bonanza) for the 2018 season began on the 1st of August with average 0.2 leafminer / leave and increased by 2.3 leafminer / leave on 15th of August. After that, the population density decreased and gradually increased until it reached 5.1 leafminer / leave on the 19th of September, then decreased and increased until the highest average

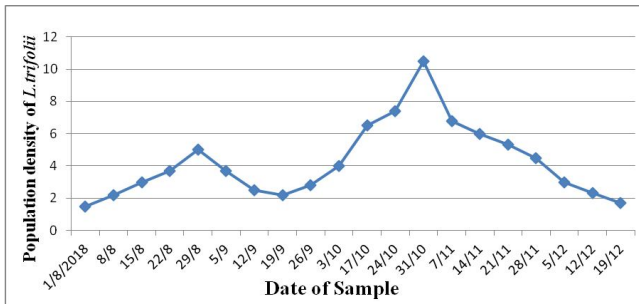


Fig. 1: The population density of cowpea leafminer *L. trifolii* on the cowpea variety (Bayader).

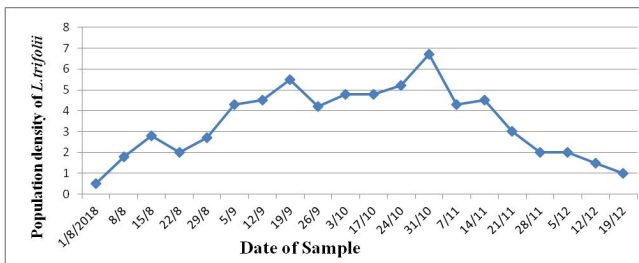


Fig. 2: The population density of cowpea leafminer *L. trifolii* on the cowpea variety (Americana).

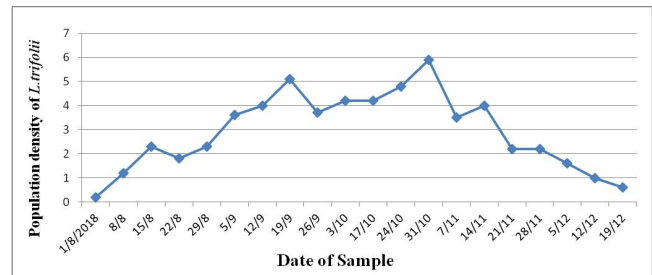


Fig. 3: The population density of cowpea leaf miner *L. trifolii* on the cowpea variety (Bonanza).

Table 1: Standard severity of infestation by the number of tunnels / leave.

Level of infestation	Number of tunnels/leave	Category
Sound	0	0
Light infestation	1 - 5	1
Moderate infestation	6 - 10	2
Severe infestation	or more 11	3

reached 5.9 leafminer / leave on the 31th of October, after which the density gradually decreased to that reached its lowest average 0.6 leafminer / leave on the 19th of December to the end of the season. Bassiony *et al.*, (2017) found that the population density of leafminer *L. trifolii* was average 50.7 leafminer by infecting the bean with the bean. Rauf *et al.*, (2000) reported that the average population density of *L. trifolii* was 10.4 leafminer on some vegetable crops, including cowpea and beans.

Infestation and severity of infestation to leaves of leafminer *L. trifolii* Of the cowpea varieties (Bayader

Table 2: An average number of total leaves and number of infected leaves and number of tunnels / leave for insect leafminer *L. trifolii* on the variety cowpea (Bayader) of the season 2018.

Data of sample	Average number of leaves / plant	Average number of leaves infected / plant	Average number of tunnels / leave
18/7/2018	175.52	5.73	2.35
25/7/2018	190.36	8.55	3.26
1/8/2018	204.48	11.26	3.48
8/8/2018	218.93	15.82	5.53
15/8/2018	233.14	18.45	5.72
22/8/2018	245.26	22.57	7.84
29/8/2018	260.35	27.32	8.95
5/9/2018	274.57	30.68	10.73
12/9/2018	287.38	35.73	13.65
19/9/2018	304.74	41.94	14.52
26/9/2018	315.62	46.26	16.64
3/10/2018	327.52	50.37	18.33
17/10/2018	342.75	56.54	19.72
24/10/2018	354.83	63.63	20.55
31/10/2018	365.47	70.75	22.36
7/11/2018	330.66	62.92	19.47
14/11/2018	280.84	50.46	17.52
21/11/2018	260.24	45.34	14.84
28/11/2018	230.96	37.25	11.36
5/12/2018	200.46	30.43	9.22
12/12/2018	167.33	23.62	8.45
19/12/2018	118.72	14.63	6.35
26/12/2018	65.22	6.45	2.63
2/1/2019	0	0	0
L.S.D. 05	8.53	5.64	1.33

'Americana' Bonanza) of the season 2018

1. The average of infestation and severity of infestation leafminer *L. trifolii* on the cowpea variety (Bayader) of the season 2018: The results of table 1, showed that the total number of leaves, leaves infected and tunnels of cowpea variety (Bayader) was affected by leafminer *L. trifolii* of the season 2018. The total number of leaves per plant began on 18th of July with average 175.52 leave / plant and The number of leaves infected with average 5.73 leave / plant and the number of tunnels was 2.35 tunnel /leave. The average was gradually increased until it reached the highest average of a total number of leaves per plant it reached 365.47 leave / plant and the number of infected leaves average was 70.75 leave / plant and the number of tunnels was with average 22.36 tunnel / leave on 31th of October. After that, the average was gradually reduced until it reached the lowest average of the total number of leaves per plant on 26th of December It reached 65.22 leave / plant and the number of infected leaves average was 6.33 leave / plant and the number of tunnels was 2.63 tunnel /leave. Table 2, showed that the severity of infestation was low at the beginning of infestation with the insect, as it average was 0.27 tunnel / leave. As the plant growth progressed, the number of

Table 3: The severity of infestation of leafminer *L. trifolii* on the variety cowpea (Bayader) of the season 2018.

Severity of infestation	Date of sample
0.27	18/7/2018
0.55	25/7
0.98	1/8
1.25	8/8
1.33	15/8
1.54	22/8
1.72	29/8
1.85	5/9
1.96	12/9
2	19/9
2.17	26/9
2.27	3/10
2.31	17/10
2.33	24/10
2.35	31/10
2.3	7/11
2	14/11
1.75	21/11
1.15	28/11
0.98	5/12
0.64	12/12
0.29	19/12
0.31	26/12
0	2/1/2019

Table 4: The average number of total leaves and number of infected leaves and number of tunnels / leave for insect leafminer *L. trifolii* on the variety cowpea (Americana) of the season 2018.

Data of sample	Average number of leaves / plant	Average number of leaves infected / plant	Average number of tunnels / leave
18/7/2018	130.34	3.25	1.57
25/7	142.62	5.36	1.28
1/8	153.53	7.47	2.36
8/8	165.74	10.53	4.44
15/8	178.25	13.62	4.50
22/8	194.53	15.94	5.83
29/8	207.85	18.27	6.20
5/9	220.96	21.83	7.76
12/9	235.22	24.16	8.12
19/9	246.35	27.24	9.21
26/9	259.68	32.55	11.47
3/10	277.45	35.33	11.28
17/10	298.28	39.17	12.15
24/10	308.53	42.42	14.36
31/10	320.77	45.64	15.58
7/11	217.94	41.83	13.75
14/11	205.56	36.45	12.36
21/11	193.47	32.34	10.24
28/11	180.73	27.62	10.77
5/12	165.25	23.20	7.16
12/12	152.67	19.55	5.43
19/12	136.52	15.47	4.35
26/12	85.46	10.33	3.26
2/1/2019	0	0	0
L.S.D.05	9.35	2.43	0.94

leaves increased and the number of the insect density increased, the severity of infestation increased on 31th of October it was 2.35 tunnel / leave. The severity of the decrease in the population density of the insect on 26th December and reached 0.31 tunnel / leaf at the end of season and dry plants. Some researchers found that leafminers prefer feeding on leaves with high nitrogen content (Helderman, 1990). Ganapathy *et al.*, (2010) reported that the damage of leafminer *L. trifolii* reached 26.2% in August by studying the insect's environment and life On the cowpea. Wi *et al.*, (2000) and Reji (2002) have explained that the female pea leafminer *L. huidobrensis* prefer to feed on leaves with high moisture content and do not prefer leaves whose walls are thick, low-moisture and age-old.

2. The average of infestation and severity of infestation of leafminer *L. trifolii* on the variety cowpea (Americana) of the season 2018: The results of table 3,

Table 5: The average severity of infestation of leafminer *L. trifolii* on the variety cowpea(Americana) of the season 2018.

Severity of infestation	Date of sample
0.19	18/7/2018
0.24	25/7
0.35	1/8
0.48	8/8
0.53	15/8
0.55	22/8
0.74	29/8
0.84	5/9
0.94	12/9
0.96	19/9
1	26/9
1.17	3/10
1.32	17/10
1.57	24/10
1.75	31/10
1.56	7/11
1.27	14/11
1.15	21/11
1	28/11
0.93	5/12
0.67	12/12
0.53	19/12
0.28	26/12
0	2/1/2019

showed that the total number of leaves, leaves infected and tunnels of the Americana varieties was affected by insect leafminer *L. trifolii* of the 2018 season. The total number of leaves per plant began on 18th of July with 130.34 leave / plant and The number of leaves infected with the average of 3.25 leave / plant and the number of tunnels was 1.57 tunnel /leave. The average was gradually increased until it reached the highest rate of a total number of leaves per plant it reached 320.77 leave / plant and the number of infected leaves was 45.64l leave/plant and the number of tunnels was 15.58 tunnel /leave on 31th of October. After that the average was gradually reduced until it reached the lowest average of the total number of leaves per plant on 26th of December. It reached 85.46l leave / plant and the number of infected leaves was 10.33 leave / plant and the number of tunnels average was 3.26 tunnel / leave. Table 4, showed that the severity of infestation was low at the beginning of infection with the insect, as it was 0.19 tunnel / leave, as the plant growth progressed, the number of leaves increased and the number of the insect density increased, the severity of infestation increased on 31th October it was 1.75 tunnel / leave. The severity of the decrease in the population

Table 6: The average number of total leaves and number of infected leaves and number of tunnels / leave for insect leafminer *L. trifolii* on the variety cowpea (Americana) of the season 2018.

Data of sample	Average number of leaves / plant	Average number of leaves infected / plant	Average number of tunnels / leave
18/7/2018	110.55	1.46	1.37
25/7	100.63	3.55	1.44
1/8	186.84	5.73	1.65
8/8	173.76	5.65	2.57
15/8	185.45	8.34	3.23
22/8	200.54	9.47	3.38
29/8	210.83	11.72	4.64
5/9	224.65	14.57	5.49
12/9	235.96	17.83	6.72
19/9	248.44	20.35	7.26
26/9	260.73	20.64	7.53
3/10	274.68	21.57	7.45
17/10	287.52	24.46	8.38
24/10	205.47	27.35	9.27
31/10	314.94	30.84	9.73
7/11	287.64	25.57	8.44
14/11	275.75	22.66	6.53
21/11	262.83	18.73	5.64
28/11	258.68	15.57	4.48
5/12	247.54	11.45	4.35
12/12	233.26	7.20	3.17
19/12	218.63	5.54	1.43
26/12	130.47	2.36	1.23
2/1/2019	0	0	0
L.S.D. 05	9.85	2.37	0.34

density of the insect on 26th of December and reached 0.35 tunnel / leaf at the end of season and dry plants. Some researchers have shown that the highest incidence of *L. trifolii* was in the autumn and winter months by the effect of environmental conditions on the insects life and its susceptibility to some vegetable crops (Chaudhuri and Senapati, 2004, Galande *et al.*, 2004, Liu *et al.*, 2009). Salman *et al.*, (2015) to infect the plant of beans and beans with a leafminer *L. trifolii* through their study on the rate of infection and the rate of damage to plants and leaves. Gathage (2018) reported that the infection rate was 80% by using some insect control methods on beans.

The average of infestation and severity of infestation of leafminer *L. trifolii* on the variety cowpea (Bonanza) of the season 2018: The results of table 5, showed that that the total number of leaves, leaves infected and tunnels of the Bonanza variety was affected by leafminer *L. trifolii* of the 2018 season the total

Table 7: The average severity of infestation of leafminer *L. trifolii* on the variety cowpea(Americana) of the season 2018.

Severity of infestation	Date of sample
0.13	18/7/2018
0.18	25/7
0.27	1/8
0.58	8/8
0.76	15/8
0.93	22/8
1.13	29/8
1.23	5/9
1.31	12/9
1.34	19/9
1.39	26/9
1.44	3/10
1.47	17/10
1.5	24/10
1.53	31/10
0.47	7/11
0.35	14/11
0.31	21/11
0.27	28/11
0.22	5/12
0.17	12/12
0.14	19/12
0.11	26/12
0	2/1/2019

number of leaves per plant began on 18th of July with 110.55 leave / plant and the number of leaves infected with the average of 1.46 leave / plant and the number of tunnels was 1.37 tunnel /leave. The average was gradually increased until it reached the highest average of a total number of leaves per plant it reached 314.94 leave / plant and the number of infected leaves average was 30.84 leave / plant and The number of tunnels average was 9.73 tunnel / leave in 31th of October. After that, the average was gradually reduced until it reached the lowest average of the total number of leaves per plant on 26th of December. It reached 130.47 leave / plant and the number of infected leaves average was 2.36 leave / plant and the number of tunnels average was 1.23 tunnel /leave. Table 6, showed that the average severity of the infestation was low at the beginning of infection with the insect, as it was 0.13 tunnel / leave. As the plant growth progressed, the number of leaves increased and the number of the insect density increased, the average severity of the infestation increased on 31th of October it was 1.53 tunnel / leave. The average severity of the decrease in the population density of the insect on 26th December and reached 0.11 tunnel / leaf at the end of season and dry

plants. Morgan *et al.*, (2000) noted that the leafminer *Liriomyza trifolii*, with its high population density, caused extensive damage to many plant crops, including beans, beans and other vegetable crops. Mujica and Kroschel (2011) reported that leafminers caused injury to vegetable crops, including lobsters, percent 88% by studying leafminers types that infect 27 types of vegetable crops. Ismaeel *et al.*, (2016) reported an infection rate of percent 52.08% by detecting this insect on vegetable crops.

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