

(Article Review)

A LIFE STUDY OF THE LEAF MINER *Liriomyza sativae* (DIPTERA: AGROMYZIDAE)

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Received 23/ 10/ 2023, Accepted 13/ 5/ 2024, Published 31/ 12/ 2024

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ABSTRACT

The leaf miner *Liriomyza sativae* (Diptera: Agromyzidae) is a dangerous pest, causes damage to many plants in Iraq, and in results some economic losses. More than 370 species make up the genus *Liriomyza* is most common in all of the world's cucumber-cultivation areas. *L. sativae* is a very harmful pest that affects melons, tomatoes, cucumbers, beans, peas, and pumpkins. The majority of parasitoid insects that feed on leaves belong to the order Hymenoptera, which is comprised of species that fall under the taxonomic categories of the two families Ichneumonidae and Chalcidoidea.

Keywords: Leaf miner, *Liriomyza sativae*, Life cycle.

دراسة حياتية لصانعة أنفاق الأوراق (*Liriomyza sativae*) (Diptera : Agromyzidae)

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الخلاصة

تعد حشرة حفار الاوراق (*Liriomyza sativae* (Diptera: Agromyzidae) من الآفات الخطيرة التي تسبب اضرارا للعديد من النباتات في العراق، وتؤدي إلى خسائر اقتصادية. ويضم جنس *Liriomyza* أكثر من 370 نوعاً ينتشر على نطاق واسع في جميع مناطق زراعة الخيار في العالم. *L. sativae* هي آفة ضارة جداً تصيب البطيخ والطماطم والخيار والفاصوليا والبازلاء والقرع. يتطفل على حشرة حفار الاوراق *L. sativae* العديد من الحشرات الطفيلية التي تعود إلى رتبة غشائية الأجنحة وبالتحديد العوائل Ichneumonidae Chalcidoidea .

الكلمات المفتاحية: صانعة أنفاق الاوراق، *Liriomyza sativae*، دورة حياة.



## INTRODUCTION

According to Hering (1951), leaf miners are classified into four insect orders: Lepidoptera, Coleoptera, Hymenoptera, and Diptera. The majority of leaf miners are members of the Diptera order. According to Asadi *et al.*, (2006), the genus *Liriomyza* included about 370 species that grows widely over all of the world's cucumber-cultivation areas. Dursun *et al.*, (2010) indicated that agromyzidae is one of the largest families of the Diptera order. It included more than 3,000 species belonged to 30 genera, most of them are significant to economy. Mik's record *Liriomyza* genus in 1894. *Liriomyza trifolii* was discovered for the first time in Iraq, according to Al-Jurani *et al.*, (2016). The classification according to EPPO/CABI (2006) is the following:

Phylum: Arthropoda

Class: Insecta

Order: Diptera

Sub-order: Brachycera

Super-Family: Opomyzoidea

Family: Agromyzidae

Subfamily: Phytomyzinae

Genus: *Liriomyza*

Species: *sativae*, *citrigata*, *bryonia*

## SPREAD

*L. sativae* damaged leaf miners and quickly spread over western Japan. It is a major pest that reduces the productivity of vegetables, particularly tomatoes and cucumbers. It has been noticed by several researches in Vietnam and according to Anderson *et al.*, (2002) that the vegetable leaf miners *L. sativae* is a serious pest of melons, tomatoes, cucumbers, french beans, peas, and domestic beans. Rauf *et al.*, (2000) discovered that the tunnel builders of the genus *Liriomyza* originated on the continent of South America and spread around the world, effecting harming greenhouse and open-field vegetable crops alike. Several unique species, including in *Liriomyza* as *L. sativae*, *L. bryoniae*, and *L. trifolii* have developed a resistance to most common chemical pesticides (Pape, 2001). In Indonesia, losses in cucumber crop might exceed 60% due to the leaf miner *L. sativae*. Insects are a serious pest on ornamental plants and vegetable crops in Iran, according to a research by A. Parrella (1983) and Reitz and Trumble (2002). Tokumaru *et al.* (2005) discovered that, depending on the crop type and degree of infection, the infection rate on vegetable crops in Kenya varied from 80–100% with regard to vegetative mass damage (Olaye-Chabi *et al.*, 2008).

## PLANT HOST AND INFECTION RATE

According to Anderson *et al.* (2002), *L. sativae*, the leaf miner, is a highly harmful pest that affects cucumbers, beans, peas, tomatoes, pumpkins, and melons. Depending on the crop type and degree of infection, the pest can cause large losses to vegetable harvests of 80–100% (Olaye-Chabi *et al.*, 2008). According to Rauf *et al.*, (2000), more than 60% of the cucumber harvest was lost due to plant tunnel by *L. huidobrensis*. According to Chavez and Raman (1987), Rauf *et al.*, (2000), Milla and Reitz (2005), the plant tunnel in Peru lost up to 30% of the potato crop, 60–70% of the vegetables in Indonesia, and all of the vegetables in Western



Europe. While EPPO and CABI (2006) reported that both males and females are leaf miners (*L. sativae*). Shephard *et. al.*, (1998) stated that in some places of Indonesia, the leaf miner *L. huidobrensis* produced an infection rate of more than 70% on potatoes, beans, and tomatoes. During the egg-laying or feeding stages, it could be a carrier of viral infections.

## DAMAGE AND ECONOMIC IMPORTANCE

In addition to causing sun blight in the fruits and the mortality of recently grown seedlings, the cucumber leaf miner also reduces yield and distorts the morphology of the fruits, which results in subpar crop selling (**Complete & Room, 2011**). The larvae and adults of the leaf miner produce the harm, according to **W.A. (2003)** mentioning it, since they burrow into the mesophyll layer while residing inside the vegetative tissue mining for leaves. *Leafy sativae* this insect deposits its eggs beneath the plant's leaf's epidermis. When the eggs hatch, the first larval instar emerges and feeds on the tissue of the leaf's middle layer, which lies between the upper and lower surfaces of the leaf. This results in the formation of the characteristic winding tunnels on the leaf. The adult additionally feeds by using the ovipositor machine to scrape the leaf's tissue and then eating on the area it has made. The *L. sativae* infection was regarding the existence of other species, but **Al-Jassani et. al., (2016)** discussed the relative existence of the species, insects were present on 20% of the cucumber plants. The autumn 2016 season's *L. sativae* showed a 1.4% leaf infection percentage and a 16.0 infection severity. The proportion of infection grew steadily until it reached 3.93% in the first week of September 2016, the infection rate was 7.44% in leaves, and the infection severity was 45.2. Put differently, six to ten petioles are present on around 70% of leaf plants when prudence is used. In the second week of October 2016, the fruits weighed 505 g/10 plants; the next week, they weighed 180 g/10 plants. The number of shoots increased from 5.9 bunches/leaf to 6.11 tunnels/leaf (**Abbas and Al-Jourani, 2017**). According to **Abbas (2017)**, the pest infection rate for vegetable leaves (*Liriomyza sativae*) (Diptera:Agromyzidae) in cucumbers during the fall of 2016 was 20%, and for leaves in the first week of September, it was 4.1%, with a 0.16% severity level. The proportion and severity of infection grew steadily during the third week of October 2016, reaching 93.3% and 44.7% for the plants and leaves, respectively. The infestation severity was 2.45 during the same week. Hence, six to ten miners or leaves are present in 70% of the leaves.

## DESCRIPTION OF THE LIFE CYCLE

### The Egg

The image (1) illustrates the oval form and white hue of the *Liriomyza sativae* leaf miner egg. Maximum length of 0.2 mm. The egg size of the tunnel leaf *L. sativae* was discovered to be yellowish-white in color, with measurements ranging from 0.15 to 0.1 mm and 0.2 to 0.3 mm in width and length, respectively (**CABI, 2006**).

### The Larvae

The image (1) depicts the colorless first larval instar. (After hatching, the larva has two breathing apertures in a triangular cone that are useful for differentiating between the



three caterpillar instars). The subsequent instars are yellow-orange, (Petite, 1990) (used in the illustration).

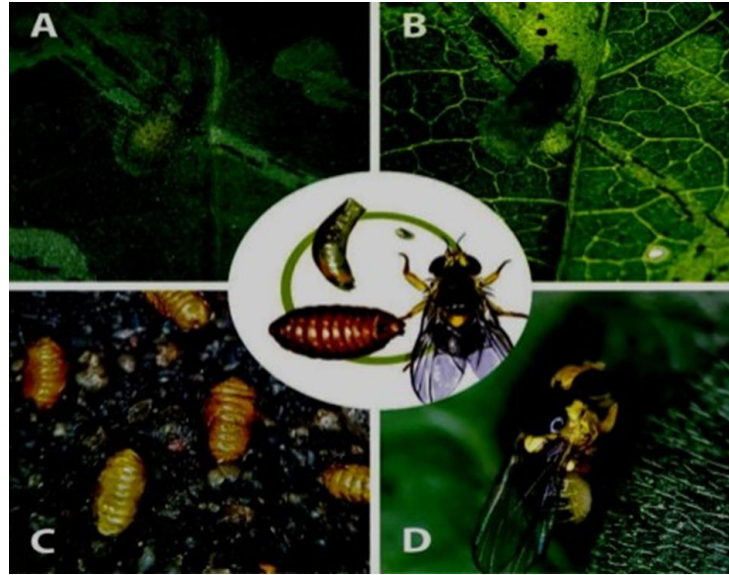
The oral hooks, which vary depending on the larva's stage, are used to distinguish between various instars. In the initial stage, the larva's length is roughly 0.57 mm, and the hook mouth's length is 95 microns; in the subsequent stage, the larva's length is roughly 1.55 mm, and the hook mouth's length is 188 microns; and in the final stage, the caterpillar's length is roughly 2.5 mm, and the mouth's length is 323 microns. According to (CABI, 2006), the older larvae have a white back and a yellowish-white back.

### The Pupa

Liriomyza coarctate pupae, which are young leaves of the leaf miner, according to (Tawfiq, 1993), it is golden yellow to black. (as seen in Image 1).

### The Adult

An adult turn into a leaf miner *Plantae L.* The area between the eyes is yellow, and the upper breast region is glossy black (Doudin, 2007), as shown in Image (1). When in an adult *L. trifolii*, it was discovered that the upper chest region and the area behind the black eyes are gray from coarse hair, while the area behind the eyes is primarily yellow. Brazil salad its look is very similar to that of *L. sativae*. According to (Spencer 1972; 1973), the male measures 1.5 mm in length, while the female is less than 2.3 mm. The male's wingspan falls between 1.75 to 2.10 mm, suggesting that the female is an adult (CABI, 2006). *Citrigata L.* somewhat comparable to grownups *L. andbryoniae* and *L. huidobrensis*. a mature miner extracts leaves. *Sativae L.*, the female lives longer than the male, ranging from 15 to 30 days (EPPO/OEPP, 1984). According to (Capinera2001), eggs are placed singly in the pores in the leaf's epidermis, with no preference for the top or bottom surfaces, in the adult leaf miner, *L. sativae* deposit. The recently deposited eggs are elongated elliptical in form and creamy white in hue. They hatch in two to four days. The female may produce between thirty and forty eggs a day, but as she matures, she stops laying as many eggs. The female may deposit 600–700 eggs in her lifetime, depending on her age.



**Image (1):** The stage of *L. sativae* where A: Egg, B: Larvae, C: Pupa, D: Adult.

### Natural Enemies

The majority of parasites that cause leafmining are found in the two families Chalcidoidea and Ichneumonoidea of the order Hymenoptera. Several of these parasitoids, according to (Al-Azawi, 1967) are members of the Agromyzidae family, including the genus *Liriomyza*. In the context of Iraq, citing O. Birio, *Opius Filicorne*, *D. Cassinervis*, and *Diglyphus isaea et. al.*, (2006) as examples of these parasitoids, it can be shown that the majority of Agromyzidae parasitoids are members of the Eucolidae, Eulophidae, and Braconidae families. Protozoan parasite *Diglyphus isaea* (Eulophidae: Hymenoptera) feeds on minnows. *Liriomyza* leaf miners are controlled using it (Sha *et. al.*, 2006). An experiment was carried out in Kenya to investigate the degree of *Phaedrotoma scabriventris* spam preference among three species of leaf miner producers on the parasite: *Linus huidobrensis*, *L. trifolii* and *L. sativae*. According to the findings, the preference was *L. huidobrensis* (95%), *L. sativae* (58%), and *L. trefoils* (20%). Over 140 known parasitoids have been reported to be utilized against *Liriomyza* leaf miners (Chabi-Olaye *et. al.*, 2009; Liu *et. al.*, 2009). Several of these parasitoids, such as *Dacnusa sibirica* and *Diglyphus isaea*, have been used in biological control. The principal parasites that prey on the genus *Liriomyza spp.* Are six female Agromyzidae parasites were found by (Fleih & Hamzaa, 2009) on leaf miners. According to (Rauf *et. al.*, 2000), these were *Hemiptarsenus varicornis*, *Asecodes*, *Cirrospilus vittatus*, and *Neochrysocharis formosa*. Surveillance research on eight distinct leaf-miner parasites whose presence fluctuated over a two-year period was conducted by (Falih, 2009). Study subjects in 2007 included *Cirrospilus vittatus*, *Diglyphus isaea*, *Diaeretiella rapae*, *Ratzeburgiola incomplete*, *Halticopter circle* *Neochrysocharis formosa*, *Opius sp.*, and *Pediobius acantha*. In six governorates (Baghdad, Karbala, Najaf, Diwaniyah, Salah al-Din, and Dohuk), several species of a metallic foot, *D. crassinervis*, *Diglyphus isaea* spammers, *Halticopter circle*, *Cirrospilus vittatus*, and *Neochrysocharis formosa* were found by (Abdulrassoul & Hanaa,





2014). During the survey and identification of Hymenoptera parasitoids on larvae and pupae of leaf miners belonging to the genus *Liriomyza* on various vegetable crops. Rozeburgiola not fully completed. Complete Ratzeburgiola, a member of the Pteromalidae and Hymenoptera families, was found on *Liriomyza sativae* in Baghdad (Faleh et. al., 2019).

## CONCLUSION

The *L. Sativae* (Agromyzidae: Diptera) is insect with a wide family range, and in an attempt to reduce or move away from traditional (chemical) control to natural control using parasites (natural enemies) is a serious and successful attempt that can keep pace with this trend of clean control. Therefore, it is necessary to continue this research to collect the largest possible amount of information in order to move to the stage of breeding and releasing these parasites within a long-term program.

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