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# Agromyzid leafminers and its natural enemies on vegetables (squash and tomato) in green houses

**Soolaf A. Kathiar*[1], Nabaa A. Al Rada Mukuf[2], Saja H. AL. Abdulameer[1], Sawsan K. Flaih[3]**

[1]*Biology Department, College of Science for Women, University of Baghdad, Iraq*

[2]*Department of Higher Studies, University of Baghdad, Iraq*

[3]*Plant Protection Department, College of Agriculture, University of Baghdad, Iraq*

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**Key words:** Agromyzid leafminers, Liriomyza bryoniae, Phytomyza horticola.

**Abstract**

In Iraq, the leafminer, is one of the most destructive pests of vegetables. Vegetable crops, such as squash *Curcurbita pepo* L. and tomatoes *Solanum lycopersicum* L were surveyed to record abundance and diversity of agromyzid leafminers and their natural enemy species. Population density of these pests were studied for the period from April to June 2014 in the College of Agriculture, University of Baghdad- Abu Ghraib. Two leafminers were detected, including *Liriomyza bryoniae* (Kaltenbach) on squash crop and *Phytomyza horticola* Gaureue on tomato crop. The results revealed that infestation by Leafminer, *L. bryoniae* and *P. horticola* were initiated on leaves situated on the median level of squash and tomato plants, then on leaves of lower level. Because, adults don't tend to lay eggs on young leaves so that reflected on larval density on these leaves. The rate of larvae numbers of tested insect through the growth season showed that squash's and tomato's leaves of median level were more preferred for leafminer's larvae through the growth season. In addition, the results showed that significantly higher *L. bryoniae* on squash's leaves than *P.horticola* on tomato's leaves in all plant levels. Four hymenopteran parasites, including *Diglyphus isaea, D. crassinervis and Neochrysocharis Formosa* belong to the family Eulophidae were recorded on leafminers.

***Corresponding Author:** Soolaf A. Kathiar ✉ soolaf12345@gmail.com

## Introduction

Leafminers, *Liriomyza bryoniae* , and *Phytomyza horticola* are primary pest of many crops, ornamentals and vegetables in both greenhouses and fields. This agromized leafminer has a common name such as tomato leafminer (Wardlow, 1984). Most of such leafminers cause damage to hosts plant by larvae that mine the leaves and feed the mesophyll, between upper and lower leaf surfaces, and by the female when puncturing the leaf with its ovipositor and feeding on the exuding sap, so that contribute to reduction of the photosynthesis (Parrella *et al.,* 1985). As well, indirectly injury may happen by transmission of plant pathogens, when adult females insert their well-sclerotized ovipositors into leaf tissues for egg laying (Minkenberg. *et al*., 1990), (Boucher, 2008). Persistence of environmental conditions within the green houses permits leafminers adapted to the prevalent conditions to complete their life cycle. Similarly, natural enemies, such as parasitoids, can potentially be migrated from milder climates than those available outside the glasshouse (Kang. *et al.,* 2009). Though, this permits several pests to persist in locations at greater levels than field populations of the same species. Relatively small changes in temperature, within the scope of those that may be experienced in a glasshouse, can however impact important life history variables, such as developmental rate, longevity and fecundity (number of eggs laid); for both *L. bryoniae* and *Diglyphus isaea*, these variables have been previously studied (Minkenberg, 1989), (Minkenberg. *et al.,* 1990). Most of these parasitoids can naturally suppressed population of several species of leafminer. (Mekhlif. *et al.,* 2002) detected in Iraq 11 hymenopteran parasitized larvae and two parasitized pupae of the leafminer, *phytomyza horticola*. (Lasalle. *et al.,* 1991) reviewed 24 economically important species of *Liriomyza* in North America furthermore four species *Achrysocharella formosa, Derostenus variipes, A. variipes, D. fullawayi, Chrysontomyia formosoa* and *N. trifoli***.** In Ankara/ Turkey, many parasitoids species belonging to the Eulophidae (Chalcidoidea) were found, including *Diglyphus iseae* (Walker), *D. chabrias* (Walker), *Neochyrsocharis formosa* (Westwood), *N. arvensis* Graham, *Pediobius acantha* (Walker) (Gencer, 2004). The purpose of this study was to evaluate and detect Agromyzid leafminers and its natural enemies on vegetables (squash and tomato) in green house in Baghdad/ Iraq.

## Materials and methods

*Green House Supply*

The study was carried out at fields belong to Plant Protection Department, College of Agriculture, Abu-Ghraib, Baghdad, Iraq, in 2014. The dimensions of green house was 36m x 5m and supplied with drip irrigation system. Area of the green house was partitioned into four longitudinal lines for cultivation of vegetables so that the distance between two lines was 1m and between two plants was 40cm. Two cages (dimension of 1.5m high by 2m width by 2 length) covered with cloth net was prepared in the green house included 24 transplanted local squash cultivar (Mulla Ahmed), which distributed randomly. One of them for counting adult stings/ 20cm² of leaf area. Other one for estimating larval injury. Same design was applied with local tomato cultivar.

*Insect Sampling*

Three localities in the green house were defined for squash and tomato leafminer and its parasitoids sampling which where front (4m from green house entrance), median (17m from the entrance) and rear (31m from the entrance). It has been defined 5 plants/ locality. Sampling comprised three levels of plant height which are higher, median and lower height.

*Relationship between infection intensity of leafminer and percentage of parasitoids emergence*

Ten of each infected squash and tomato plants in green house were randomly defined. One infected leaf weekly was cut. One infected leaf of each plant was cut weekly from the beginning of the pest infestation in the green house until the end of crop cycle's growth**.** Picked out leaves were transit to laboratory, then each of them placed in plastic container of 4 litter size, its petiole was warped with a piece of dry cotton. Each container covered with piece of gauze cloth fitted with rubber band.

After 5 days we collected emerged adults of parasitoids and preserved in 70% of alcohol for detection and species counting.

*About counting leafminer stings*

*The rate of larval injury*

The rate of injury (Singh and Weigand, 1996)

a) Without mines = 0
b) Mines < 10% of total area = 1
c) Mines 10% - 20% of total area = 2
d) Mines 21-30% of total area =3
e) Mines 31-40% of total area = 4
f) And so on: mines 90-100% of total area = 10

*Insect Detection*

Samples of flies and parasitic wasps emerged from squash leaves were identified and classified by Dr. Mohammed S. Abdul-Rassuol in Iraq Natural History Museum, University of Baghdad.

**Results and discussion**

The results that presented in Fig. (1) shows that there were a significant differences of the number of leafminer among three different squash leaf levels (P = 0.0042). the results revealed that the first infestation by leafminer on squash was initiated on the median , and then on lower leaves, in other words the insect don't tend to lay their eggs on young leaves, which reflected on the density of larvae on that leaves. By observing the number's rates of studied insect larvae throughout the season we see that median leaves were more favorable to feed the larvae of leaf miner, where the mean number reached 76.07 larvae/ leaf with significant differences compared to the upper and lower leaves, in which number of larvae reached 2.101 and 61.73 respectively during the season. The peak population density number of *L. bryoniae* larvae on the median level was 88.45 larvae/ leaf on early June with significant preferences compared to the lower and upper leaves with no significance difference between them. Similarly, tomato's leafminer significantly (P <0.03) prefer the median leave levels compared to the upper and lower (Fig. 2). Several scientific studies revealed that some plant species characterized by increasing toxicity from the bottom to the top leaves of the plant.

The apical leave levels of cultivar of *Chrysanthemum morifolium* are significantly more toxic to leafminer *Liriomyza trifolii* than lower leave (Hawthorne, 1999). A higher number of tomato leafminers *Liriomyza spp.* mines/leaf was recorded in the lower than in the upper level of the tomato plants.

In addition, the number of mines/leaf concentrated more on the median and apical levels than on the basal (Leite. *et al.,* 2004).

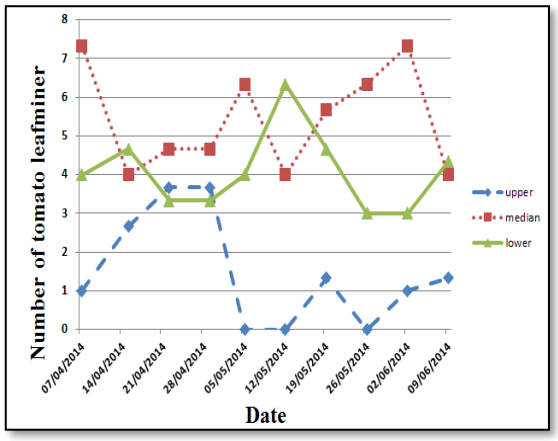


**Fig. 1.** The total number of squash leafminer (*L. bryoniae*). In 2014, the number of leafminers were counted on leaves of squash at different parts apical, median, basal. Different parts did significantly affect the number of leafminers (P = 0.0042).

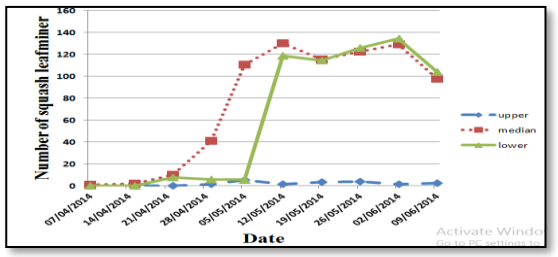


**Fig. 2.** The total number of tomato leafminer (*P. horticola*). In 2014, the number of leafminers were counted on leaves of squash at different parts apical, median, basal. Different parts did significantly affect the number of leafminers (P = 0.03).

In comparison between squash and tomato leafminer numbers on different plant levels, the results showed that there were no significant differences between squash and tomato leafminer numbers in the upper levels of these two plants (P= 0.06).

While there were a very significant differences (P <.0001, P <.0001) of these pests on both median and lower levels of squash and tomato crops respectively. Our results are similar to studies by (Devkota. *et al.,* 2016) found that squash produced significantly more mines than tomatoes.

**Table 1.** Natural enemies of squash and tomato leafminers.

| Crop | Family | Order | Parasite |
|---|---|---|---|
| Squash | Eulophidae | Hymenoptera | *Diglyphus isaea* (Walker) |
| Squash | Eulophidae | Hymenoptera | *Diglyphus crassinervis* Erdos |
| Tomato | Eulophidae | Hymenoptera | *Pediobius metallicus* (Nees) |
| Tomato | Eulophidae | Hymenoptera | *Neochrysocharis formosa* (Westwood) |

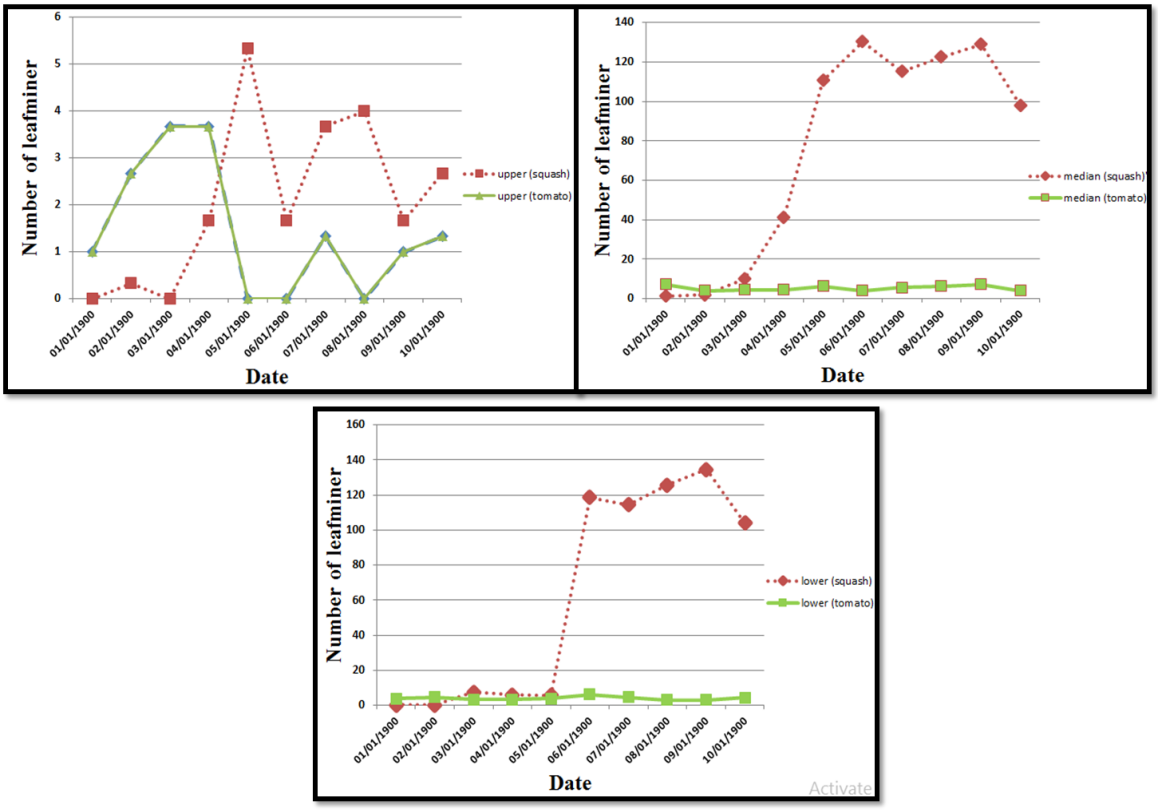


**Fig. 3.** Comparison between squash and tomato leafminers on different plant levels.

Four species of hymenopterous parasitoids were identified including, *Diglyphus isaaea*, *Diglyphus crassinervis*, *Pediobius metallicus* and *Neochrysocharis formosa*. Conceivably, they have a role in lowering *L. trifolii* population density as a part of natural balance (Al-Zubaidi, 1992), (Singh. *et al.,* 1996). In Antalya, The population density of cowpea leaf miner *L. trifolii* was investigated on cowpea and tomato grown in protected culture. The study indicated the occurrence of these natural enemies had a significant role in decreasing the leafminer infestation was below economic threshold. Three leafminer parasitoids (*Diglyphus isaea, D. crassinervis and Neochrysocharis formosa*) were detected on protected bean and tomato cultivation, these parasitoids were potentially decreased leafminer population during spring season (Kececi. *et al* 2008). In Central Vietnam, the number and diversity of parasitoid species indicates the potential for parasitoids to control leafminers (Tran, 2009).

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