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The Distribution and Ecology of Liriomyza Sativae (Blanchard 1938) in the Entomofauna of Artsakh Republic

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ABSTRACT

In 2018, for the first time in Artsakh, we've conducted research studies on leaf miners in the village Ivanyan at Askeran region. The objective of the work is to study the composition of leaf miner species, their distribution and eco-biological features. The results of the study have revealed the polyphagous species Liriomyza sativae. In this work we introduce the external structure of the species, its development peculiarities, as well as the length and location of miners (larvae feeding results) on the leaves of different vegetable crops.

Introduction

The distribution of entomofauna at the Artsakh Republic, which is promoted by the moderate climate conditions and geographical location of the Republic is rich and varied. However in our country we need serious entomological investigation. Agromyzidae is a large family of dipterans including more than 3.000 species belonging to 30 genera, widely distributed throughout the world (Spencer, 1989). Leaf miner flies are important agricultural pests worldwide, and cause both direct and indirect damage to plants. Nowadays, we don't have information about the leaf miner flies (Diptera: Agromyzidae), and especially about the ecology, biology, distribution, reproduction, growth and development of the species L. sativae, which belongs to the genus Liriomyza. So, in the current article, we have made attempts to introduce some results of observation related to L. sativae.

Artsakh Republic is an agricultural country where vegetable growing is the leading branch. The reason of various studies of this species is urgent and actual, because it's considered one of the most important pests in agriculture.

Materials and methods

The collected data and implemented observations have served as a material for our study launched from 2018 up to 2019. As the study area we've chosen the Ivanyan village which is located in the Askeran region of the Artsakh Republic. Leave samples infested with leaf miners were collected in spring, summer and autumn of the experimental years. Investigations of the given species have been carried out on various cultivated crops. For the sample collection and their future study we have used classical zoological methods (Martin Hering, E. 1951, Spencer, et al., 1986). To determine the presence of larvae under leaf epidermis, as well as for the study of formed mines on the leaves we used magnifying

glass. And we used digital microscopes of XSZ-0800 and ADSM302 types to study the external structure of the flies.

To find out the distribution of the L. sativae, we conducted ecological observations in the chosen areas in different seasons and months of the year. To identify the species we used different identification guidelines (Bey-Bienko, G. 1970, Spencer, et al., 1986).

Results and discussions

The fauna of invertebrate animals in Artsakh has not been studied at all. In this work, for the first time we introduce our own observations on L.sativae-one of the species of the Agromyzidae family. Today the cultivation of vegetable crops in Artsakh is growing rapidly, which naturally creates favorable conditions for the widespread distribution of discussed species in almost all zones of the republic. However, the observations were made in the Ivanyan village, which is located at an altitude of 580-600 m above the sea level (Figure 1).

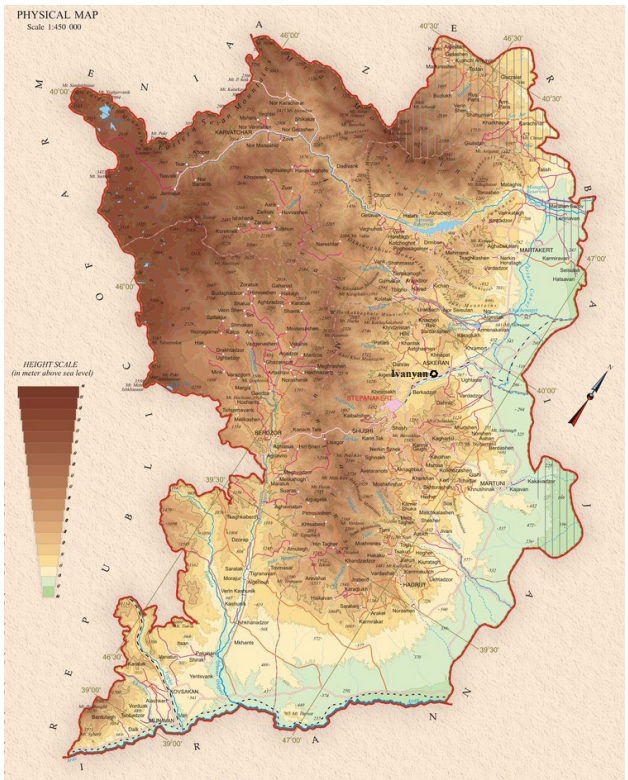

Figure 1. Ivanyan village on the map of the Artsakh Republic

The selected area has moderate climatic conditions, and we chose different vegetable crops as a target study object. Thus, L. sativae has different length of mines and larval development stages at the different plant species, and depending on particular plant the mines (the result of larvae feeding) are developed either on the front or the back side of the leaf blade. For example, the mines' length on the pepper (Capsicum L, 1753) leaves varies between 6.4 cm-10.5cm, the pupa develops within 9-10 days, and the mines are frequently formed on the back side (dorsal) of the leaves. The mines' length on the cucumber (Cucumis sativus L., 1753) leaves is 6.8 cm -12.8 cm, pupa development lasts 8-11 days, and mines are only formed on the front side (ventral) of the leaves. The mines' length on the tomato (Solanum lycopersicum L., 1753) leaves is 8.2 cm-10 cm, pupa develops in 8-10 days; mines appear only on the front side of the leaves. The length of the mines on the bean (Phaseolus vulgaris L., 1753) leaves varies from 6 cm-9.5 cm, pupal stage lasts 8-11 days, mines are found only on the front side of the leaves. On the pumpkin (Cucurbita L., 1753) leaves the length of the mine is 9.3 cm-10 cm, pupa development lasts 9-10 days, and mines are only formed on the front side of the leaves. The larvae-bearing leaves of the discussed crops were kept in separate jars each, under constant environmental conditions with 23˚C -24˚C temperature and 79 ± 2 % relative humidity. On the leaves of all plants the larval stage lasts 4-5 days, they form irregular serpentine mines and frass in threads on the right or left side of the mine.

The pupa development observations show that there are no significant differences in its development stages among the above mentioned plant species. In our opinion, it is conditioned by the necessary air temperature (26 ˚C -27˚C) and relative air humidity (70 %-75 %) (Table).

Larvae are often easily visible within the mine where they remove the mesophyll between upper surfaces of leaf. Larva is a colorless and headless maggot up to 2 mm in length when fully grown. Black mouthparts are apparent in all instars. The irregular mine increases in width from about 0.25 mm to about 1.5 mm as the larva matures (Figure 2).

Figure 2. Mines of L. sativae on the cucumber (Cucumis sativus L.) leaf

Table. Summary of the development features of L. Sativae and mine characteristics*

Scientific names of plants	Larval stage, days 23 ˚C -24˚C 79 ± 2% RH	Pupal stage, days 26 ˚C -27˚C 70%-75% RH	Type of mine	Mine length, cm	Mines' location on the leaves	Type of frass
Capsicum L., 1753	4-5	9-10	irregular serpentine	6.4-10.5	ventral side and dorsal side	threadlike
Cucumis sativus L., 1753	4-5	8-11	irregular serpentine	6.8-12.8	only ventral side	threadlike
Solanum lycopersicum L., 1753	4-5	8-10	irregular serpentine	8.2-10	only ventral side	threadlike
Phaseolus vulgaris L., 1753	4-5	8-11	irregular serpentine	6-9.5	only ventral side	threadlike
Cucurbita L., 1753	4-5	9-10	irregular serpentine	9.3-10	only ventral side	threadlike

* *Composed by the author.*

The mature larva cuts a semicircular slit (in the upper surface of the leaf) in the mined leaf just before formation of the pupa. The larva usually emerges from the mine, drops from the leaf, and burrows into the soil to a depth of only a few centimeters to form a puparium (Capinera, 2001).

The pupa is oval with variable colors, pale yellow-orange often darkening to golden brown. Pupation takes place externally. The adult emerges from the puparium, mainly in the early morning hours. The most favorable temperature for rearing adults is the 26˚C-27˚C, which is proven through our results obtained in laboratory conditions. Thus, the pupal stage lasts 8-11 days.

In the natural environment the favourable temperature conditions for the imago species development range between 25˚C-30°C. Therefore, under appropriate temperature conditions, mature individuals can give several generations per year. Adults are very small (1.3–2.2 mm in body length), females are slightly larger than males (Figure 3).

Mesonotum is black to the edge of a bright-yellow scutellum (Walker, K. 2005). The sides of scutellum are also black. Head is with broad, yellow frons and red eyes; palps are yellow; the hind margin of eye is mostly black, third antennal segment round and yellow. Wing costa extending to apex of vein M1+2; vein M1+2 nearest wing tip; outer vertical bristle (vte) on black ground and inner vertical bristle (vti) on yellow. Second (outer) cross vein (dm-cu) well developed; last section of CuA1 2.5-3 times length of penultimate section, wing length 1.3-1.7 mm; discal cell (1-M2) small (Figure 4).

Mesopleuron yellow, with black patches along front and lower margins; halteres yellow. Abdominal tergites black, sternites yellow; ovipositor is black. Legs with femora bright yellow, tibiae and tarsi brownish (Spencer, 1989).

Figure 3. The overall appearance of L. sativae.

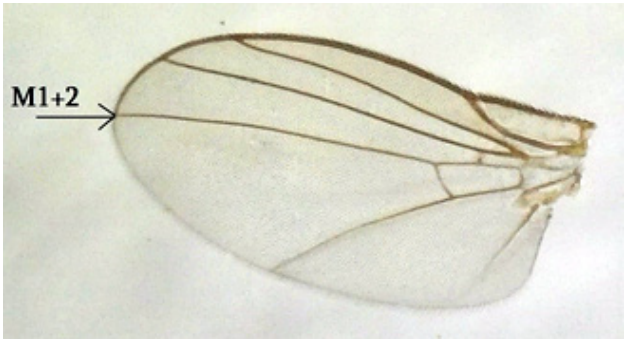

Figure 4. The wing of L. sativae.

Conclusion

So, Liriomyza sativae is extremely polyphagous and has been considered as a serious pest of several cultivated plants. The species has many host plants in the families: Cucurbitaceae, Leguminosae, Solanaceae (Spencer, 1990). The primary damage is the mines caused by the feeding of larvae. Immature leaf fall can be caused by extensive mining which leads to lack of shading and sun scalding of fruit. Studies have shown that the optimum temperature for pupa development is 26˚C -27˚C.

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