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Mini Review

The leaf miners *Liriomyza* sp (Diptera: Agromyzidae), nature, damage and economic importance - a review

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ABSTRACT:

The leaf miners are important pests that cause significant economic losses to most agricultural crops. Leaf miners belong to the order Diptera and the Agromyzidae family. The review focused on three main objectives related to the leaf miners, the first is to identify the species that cause damage in the field, the second is to show the economic importance in the field and the third is to clarify the leaf miners host range and their generation numbers.

Keywords:

Leaf miners, *Liriomyza* sp, Diptera: Agromyzidae.

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INTRODUCTION

The leaf miners are serious pests that attack a number of plants belonging to 31 families (Spencer, 1973), including economically important vegetable crops such as cucumbers, tomatoes, potatoes and eggplants, as well as attacking ornamental plants causing destruction of the leafy area by feeding the larvae between the two leaf surfaces, which leads to damage of the (leaves) tissues and reduce the ability to complete the photosynthesis process due to lack of chlorophyll content and thus yellowing and falling of leaves along with small fruits, low productivity, as well as formation of holes for feeding and laying of eggs made by adults in the leaf tissues causing tissue death and the adults transmit viral diseases (Waterhouse and Norris, 1987; AL-Mashhadani, 1998). The leaf miners belong to four insect orders such as Lepidoptera, Coleoptera, Diptera and Hymenoptera (Hering, 1951). Most of the leaf miners belongs to the Diptera order under the (Dursun *et al*., 2010; Shahreki *et al*., 2012). The Agromyzidae family which is one of the largest families of Diptera orders around the world and includes more than 3000 species and is widespread. It has about 30 genera and 1165 species which are small and some of them along the wings of hot and humid areas. *Liriomyza* was recorded by Mik in 1894.

Distribution

The leaf miner belonging to the genus *Liriomyza* originate from the South America, then spread to other world countries leading to injuries in most vegetable crops in open fields and greenhouses 'There are several species such as *L. sativae*, *L. bryoniae*, *L. trifolii* and *L. huidobrensis*. This pest has become resistant to most conventional chemical pesticides (Babi, 2001). Tokumaru *et al*. (2005) reported that the leaf miner *L. sativae* spread rapidly in western Japan and significantly damage in the vegetable crops, especially in cucumbers and tomatoes, causing great losses in their productivity.

In Vietnam, many researchers have pointed out that the leaf miner *L. sativae* is a very dangerous pest on local beans, French beans, peas, tomatoes, cucumbers, pumpkins and watermelons (Andersen *et al*., 2002). It is also spread in most European and Asian countries, especially near the Mediterranean Sea, including Syria. It is also recorded in most African countries and in Central, North and South America, as well as Australia and the former Soviet Union.

Economic importance

Spencer (1973) notes that *L. bryoniae* is a polyphagous pest that attacks most of the plants belonging to the eggplant, crusades, pumpkins, marshmallows, legumes, narcissus, tentacles, composites, and slices. It is also a major pest on greenhouse grown tomato plants in the United States and have several generations per year (Multivoltin) and reach its highest peak in April, whereas Abul-Nasr and Assem (1961) found that this insect is one of the main pests on the pumpkin, lettuce and tomato crops in Egypt under the greenhouses conditions in all stages of the gesture to adult plants, leading to vegetative and chlorophyll weakness and low productivity.

Spencer (1990) noted that the leaf miner *L. sitrigata* is a polyphagous insect recorded on 240 plant genus from more than 35 families worldwide, while the leaf miner *L. huidobrensis* has caused economic losses of up to 30% and 60-70 % on vegetables in Indonesia and 100 % in Western Europe (Chavez and Raman, 1987; Rauf *et al*., 2000; Milla and Reitz, 2005).

Infection and nature of damage

Razzaq and Deeb (2011) stated that the damage caused by the leaf miner *L. bryoniae* appears in leaf and plant tissue damage and poor photosynthetic activity as well as yellowing of the plant due to lack of food transfer between tissues followed by small fruit size in infected plants and subsequent plant death, and also reduction the marketing value of crops and foliage such as lettuce and spinach.

The adults of *L. sativae* implants eggs under the plant leaf epidermis. After hatching, first larval stage

appears, which feeds on the middle layer tissue of the leaf between the leaf top and bottom surface, leading to the emergence of zigzag tunnels which distinguishes this insect. Adult feeds very well by scratching the leaf tissue by female genitalia (ovipositor) and feeding on the scratched places (Jooda, 2014).

The damage arises from the larvae as a result of feeding them inside the foliage or the normal leaves leading to the plant weakening. The plant may die during the early infection. Abul-Nasr and Assem (1961) indicated that the infestation begins in the gourd family plants from the gesture stage to the lower leaves and then moves to infected apical leaves in case of persistence and intensification of infection, cotyledons may contain more than ten larvae and at this degree of infection the leaves become yellow and fall off, leading to their death. The fall of infected leaves affects the fruits size and maturity and may cause them to fall (Audemard and D'Aguilar, 1969), In addition to the larvae damage, there is another damage caused by the adult insect by feeding it on the cellular juice of the leaf tissue through the holes caused by the female insects in the epidermis leaf by female genitalia (ovipositor).

Several researchers (Parrella *et al*., 1985; Minkenberg and Van Lenteren, 1986) noted that adults and *L. bryoniae* larvae causes significant damage due to the holes resulted from the adult females depositing the eggs process, and the tunnels resulting from the larvae feeding between the top and bottom leaf layers. This damage leads to reduced photosynthetic process, high drought areas in the leaves and lesser growth of new leaves and indirectly causes the fungal and bacterial entry and plant viruses transformation in the tunnels caused by feeding and deposition of eggs.

Parrella (1987) reported that *L. bryoniae* female operates two types of holes in the plant leaf, the first is a propeller hole and is used for feeding only. The second is the tubular hole used for both feeding and egg laying. OEPP/EPPO (1992) indicated that *L. bryoniae* female perforates the young leaves of the host plant with female genitalia (Ovipositor) causing wounds that act as feeding or deposition eggs sites.

Tawfik (1993) showed that *L. huidobrensis* may cause limited damage in the plant leaves during its life cycle and thus its damage is minor and real damage occurs by increasing the larvae number dug in to the plant tissue resulting in tissues damage and irregular leachate and disruption of the plant materials supply, that it needs to keep growing and surviving. As the female genitalia (Ovipositor) pokes the plant tissues causing shredding and leading to dryness. Most of the damage occurs in the plant growth early stages as it severely affects some crops in case of severe infection and has indirect damage as other fungi and bacteria, also infect increasing the damage.

CABI/EPPO (2006) indicated that male and female *L. sativae* may be a vector of viral diseases during the deposition of eggs or feeding. Doudin (2007) explained that the main damage of *L. trifolii* on vegetable crops comes from larvae that feed on the leaf's mesophilic middle layer. The tunnel becomes visible 3-4 days after deposition of eggs and becomes larger in size as the larvae grow.

Host plant range

Several plant hosts were attacked by the leaf miner belonging to *Liriomyza* genus of *Agromyzidae* (Diptera), a polyphagus insect. *L. sativae* hosts on different plants, although they prefer to be nourished by the Cucurbitaceae and Solanaceae (Spencer, 1990). *L. bryoniae* was recorded on 16 plant families cultivated under greenhouse conditions, like Solanaceae such as tomato and leguminisae such as beans, and Cucurbitaceae such as pumpkin, watermelon, and cucumber and are considered a voracious feeding pest (Abul-Nasr and Assem, 1961; Lee *et al*., 1990). Al-Mahmalji and Bashir (2011) reported that *L. trifolii* a polyphagous insect, attack a large number of aromatic plants and also attack vegetable crops such as eggplant, okra, onions, garlic,

beans, watermelon, peas, pepper, sugar beet, cotton, soybeans, peanuts and spinach.

Generations numbers

The leaf miner *Liriomyza* has 5-10 generations per year (Tawfik, 1993), while Babi (2001) reported that *L. huidobrensis* has 12-15 generations per year, which is a multivoltine type. Their generations are intertwined, and generation duration varies depending on temperature reaching 40 days at 15°C, 26 days at 20°C and 17 days at 25°C (Babi, 2001).

CONCLUSION

From this review, it can be concluded that

1. The most important leaf miners are *L. sativae, L. bryoniae*, *L. trifolii* and *L. huidobrensis*.
2. These insects have great economic importance as it is polyphagous and attack most of the plants belonging to several families, including Solanaceae, Brassicaceae, Cucurbitaceae, Malvaceae, leguminisae, Convolvulaceae, Amaryllidaceae, Apiaceae, Asteraceae and Nepetoideae**.**
3. *L. sativae* was recorded on nine plant families and *L.bryoniae* was recorded on 16 host plant families cultivated under greenhouse conditions.
4. The leaf miners have several generations (multivoltine), which are intertwined and the generation duration varies depending on the temperature**.**

REFERENCES

Abdul Razzaq and Mahmoud Deeb. 2011. Diagnosis of vegetable diseases. Indicative bulletin. Human resources development department, Ministry of agriculture, Gaza. Palestine. 43 P.

Abul-Nasr S and Assem AH. 1961. A leaf miner, *Liriomyza bryoniae* (Kalt), attacking cucurbitaceous plants in Egypt. *Bulletin of the Entomological Society of Egypt*, 45: 401-403.

Andersen A, Nordhus E, Thang VT, An TTT, Quang HQ and Hofsvang T. 2002. Polyphagous *Liriomyza* species (Diptera: Agromyzidae) in vegetables in Vietnam. *Tropical Agriculture*, 79(4): 241–246.

Audemard H and D'Aguilar J. 1969. A dipterous pest of vegetable crops under glass: *Liriomyza bryoniae* Kalt. *Compt. Rend. Herb.* Des Seances de I'Acad. D'Agric. De France, 55: 896-901.

AL-Mahmalji and Bashir 2011. Field crop insects (theoretical part). Faculty of Agriculture. Damascus University Publications.

AL-Mashhadani and Wissam Ali Ahmed. 1998. Environmental and Biological Studies on tomato leaf digger *Liriomyza bryoniae* (Kaltenbach) (Diptera: Agromyzidae) and some means of control. Master Thesis. Faculty of Agriculture, Baghdad University.

Babi, Adnan 2001. Agricultural insect pests in greenhouses and their natural enemies and integrated management program. Regional training course in solar sterilization and integrated management of greenhouses. Muscat. Sultanate of Oman. 42 pages.

CABI/EPPO. 2006. *Liriomyza sativae*. Distribution maps of plant pests, No. 477. Wallingford, UK: CAB International, Entomology, 26: 515-516.

Chavez GL and Raman KV. 1987. Evaluation of trapping and trap types to reduce damage to potatoes by the leafminer, *Liriomyza huidobrensis* (Diptera : Agromyzidae). *International Journal of Tropical Insect Research*, 8(3): 369-372.

Doudin MMK. 2007. Biological and ecological studies on leafminer, *Liriomyza trifolii* (Diptera: Agromyzidae) in al-arroub agricultural experimental station, college of graduate studies, M.Sc program in plant protection. Hebron University, Palestine, 80 P.

Dursun O, Eskin A and Atahan T. 2010. Contribu-

tions to the Turkish (Diptera:Agromyzidae) fauna with ten new reords. *Turkiye Entomology Dergisi*, 34(3): 299 -306.

Hering EM. 1951. Biology of the leafminers. Graven age. Berlin. 420 P.

Jooda S. 2014. Extension program for greenhouse tomatoes in Palestine. Ministry of Agriculture, 63 P.

Lee HS, Wen HC and Lu, FM. 1990. The occurrence of *Liriomyza bryoniae* (Kaltenbach) (Diptera: Agromyzidae) in Taiwan. *Chinese Journal of Entomology,* 10: 133-142.

Minkenberg OPJM and Van Lenteren J. 1986. The leafminers *Liriomyza trifolii* and *L. bryoniae* (Diptera: Agromyzidae), their parasites and host plants: a review. Agricultural University of Wageningen Papers. 50 P.

Milla K and Reitz S. 2005. Spatial/temporal model for survivability of pea leafminer (*Liriomyza huidobrensis*) in warm climates: a case study in South Florida, U.S.A. *European Journal of Scientific Research*, 7: 65-73.

OEPP/EPPO. 1992. Quarantine procedures No. 42. Identification of *Liriomyza* spp. Bulletin OEPP/EPPO Bulletin 22: 235-238.

Parrella MP, Jones VP, Youngman RR and Lebeck LM. 1985. Effect of leaf mining and leaf stippling of *Liriomyza* spp. on photosynthetic rates of chrysanthemum. *Annals of the Entomological Society of America*, 78(1): 90-93.

Parrella MP. 1987. Biology of *Liriomyza*. *Annual Review of Entomology*, 32(1): 201–224.

Rauf A, Shepard MB and Johnson MW. 2000. Leafminers in vegetables, ornamental plants and weeds in Indonesia: surveys of host crops, species composition and parasitoids. *International Journal of Pest Management*, 46(4): 257-266.

Shahreki Z, Rakhshani E and Sasakawa M. 2012. A contribution to the agromyzid leaf miners (Diptera: Agromyzidae) of Iran. *Biologica Nyssana*, 3(1): 31-36.

Spencer KA. 1973. Agromyzidae (Diptera) of economic importance. Series Entomologica. Dr. W. Junk B. V, the Hague the Netherlands. 9: 418.

Spencer KA. 1990. Host specialization in the world Agromyzidae (Diptera). Kluwer Academic Publishers, London, UK.

Tawfik MF. 1993. Biological control of insect pests. Publications of the ministry of agriculture and land reclamation, Cairo, 722 P.

Tokumaru S, Kurita H, Fukui M and Abe Y. 2005. Insecticide susceptibility of *Liriomyza sativae, L. trifolii and L. bryoniae* (Diptera: Agromyzidae). *Japanese Journal of Applied Entomology and Zoology*, 49(1): 1-10.

Waterhouse DF and Norris KR. 1987. Biological control Pacific prospects. Australian center for International Agricultural Research, Inkata press, 454 P.