

Integrated Pest Management of Serpentine Leaf Miner in Tomato

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Abstract

The serpentine leaf miner, *Liriomyza trifolii*, is a pest that affects tomato plants, causing damage to the leaves and reducing crop yield. This article discusses the importance of integrative pest management strategies for the serpentine leaf miner in tomato plants. The most important aspect of leafminer management is conserving their natural enemies, which are often killed by broad-spectrum insecticides applied for other tomato pests. An integrated approach combining cultural, biological, and physical methods should be implemented to keep the serpentine leaf miner under control in tomato plants.

Keywords: - SLM, Tomato, IPM, Serpentine leaf miner, ETL

Introduction

Tomato (*Solanum lycopersicum* L. M.; family: Solanaceae) is the most important warm-season vegetable crop that is widely cultivated for its edible fruits and is commonly cultivated both for market and processing. It is indigenous to tropical America. It is a significant crop cultivated in both tropical and subtropical climatic conditions. After potatoes and onion, tomato is the third most important crop in India and India is the second-largest producer of tomatoes in the world after China. Andhra Pradesh, Telangana, Karnataka, Madhya Pradesh, Gujarat, Chhattisgarh, and Maharashtra, are the major tomato-producing states in India. Uttar Pradesh produced 902 thousand tonnes with an area of 23 thousand ha. in 2021-22.

Tomato yield in India is affected by various abiotic and biotic factors. The production quality of tomato fruits is significantly affected by an array of insect pests infesting at different stages of crop growth i.e., from the time of planting until the fruit is harvested. Different parts of the tomato plant offer food, shelter and reproduction sites for different insects. There are many insect pests attacking tomatoes have been reported which create havoc by causing both quantitative and qualitative loss to the crop.

Among the insect pests, leaf miners are one of the most important pests of tomato which cause serious production and economic losses. The leaf-mining by *Liriomyza* spp. may result in plant desiccation, defoliation and susceptibility to plant pathogens. Fruit size and sun-scalding of fruit may occur when defoliation is severe. Serpentine leaf miner (*L. trifolii*) gradually attained the major pest status in different regions of the country and was reported to cause 35% losses in tomato crops. The estimated losses due to infestation of *L. trifolii* were 46-70 % to tomato seedlings, 90 % loss to tomato foliage and 70% loss to tomato yield.

Alternate Host Plant and Distribution

Earlier *Liriomyza trifolii* was known as the pest of chrysanthemums and celery, but later it was known that it has a wide host range. It is a polyphagous pest that attacks over 55 hosts, including potato, tomato, brinjal, bean, beet, carrot, celery, cucumber, lettuce, melon, onion, pea, pepper, squash, and. Flower crops that are infested by this pest include chrysanthemum, gerbera, marigold and gypsophila. It is widely distributed in Africa, Asia, Europe, North America and the Pacific.

Morphological identification

The eggs are small and orange-yellow in colour. They hatch within four days. The Apodous larvae of the serpentine leaf miner are white or pale green, with black and dried brown areas. When fully grown, the larva measures 3mm in length. Pupation occurs in the soil or on the leaves and takes place inside a thin, loose mesh of silken cocoon. The serpentine leaf miner is a small fly, with a body length of approximately 1.5 to 2.5 mm, with a slightly flattened oval body. The adult fly is typically greyish-brown in colour. The wings of the adult fly are transparent with a slight yellow tint. They are internal feeders causing mines in the surface of the leaf tissue. The mines created by the larvae are typically long, linear, and narrow, often serpentine or irregular in shape, and increase in size as the larvae mature.



Fig. Larval and adult stage of serpentine leaf miner

Nature of damage and damaging symptoms

The serpentine leaf miner, *Liriomyza trifolii*, causes damage to plants both directly and indirectly. The most direct damage is caused by the larvae mining the leaf tissue, leading to desiccation, loss of healthy leaf tissue, and affecting the plant's ability to photosynthesize. The damage caused by the mining activity can lead to diseases caused by fungi and bacteria, which can further weaken the plant. In severe infestations, leaves can wilt and die, causing defoliation. The damage caused by the serpentine leaf miner can result in reduced crop yield and marketability, leading to economic losses for growers, particularly for leafy vegetables. Host plants of any age and stage of growth can be infested, but young plants are most susceptible. The most obvious evidence of leafminer damage is the twisting trails (or mines) the larvae leave as they tunnel through the leaf tissue. These mines are typically white or pale green, with black and dried brown areas, and are usually serpentine or irregular in shape. As the larvae mature, the mines increase in size and can lead to premature leaf drop, poor growth, and reduced crop yields.



Fig.2 Damage symptoms of serpentine leaf miner on tomato leaf

Biological life cycle

The life cycle of the serpentine leaf miner, *Liriomyza trifolii*, is relatively short, with the time required for a complete life cycle in warm environments, often being 21 to 28 days. This short life cycle allows for numerous generations to occur annually in warm climates. The female flies pierce the leaf surface to lay eggs inside, and these eggs hatch in 2 to 5 days, depending on the temperature. After that the larvae mine the leaf tissue, primarily feeding on the leaf in which the eggs are laid. After the mining phase, the larvae leave the plant to pupate. Most damaging stage is larva of serpentine leaf miner. The adult flies emerge after pupation,

and the entire life cycle repeats, contributing to the potential for multiple generations in a year. This damage can result in reduced crop yield and marketability, particularly for leafy vegetables, leading to economic losses for growers. The serpentine leaf miner affects a wide range of common horticultural crops and ornamental plant species.



Fig. 3 Life cycle of serpentine leafminer (*Liriomyza trifolii*).

Integrative management strategies for serpentine leaf miner in tomato

- Infestation of serpentine leaf miner should be monitored regularly on tomato plants.
- Infested plants should be collected and destroyed. Further spread should be controlled by uprooting plant debris and they should be burnt or buried.
- Tomato varieties having curled leaves are slightly less susceptible to leafminer damage and can provide a suitable alternative where leafminer damage is expected. Growing resistant varieties such as Patherkuchi and MT-2
- Crop rotation should be followed after uprooting the plant by crops other than solanaceous crops, Asteraceae, Cucurbitaceae, and Fabaceae families.
- Use of sticky traps to detect leaf miner activity early and timely intervention
- Appropriate use of fertilizers, using reflective mulch and avoiding water stress conditions in the field as they can weaken the plants
- Spraying neem oil or neem seed kernel extract 5% solution on the leaf surface.
- Parasitic wasps, *Chrysocharis parksi* and *Diglyphus begini* can be used.
- By planting flowers like dill, coriander or fennel near your tomato plants, you can create a habitat for these beneficial insects.

- Predatory insects such as *Trichogramma pretiosum*, *Nesidiocoris tenuis* and *Macrolophus pygmaeus* are found helpful.
- Fungal agents such as *Metarhizium anisopliae* and *Beauveria bassiana* attack the eggs, larvae, and adults of the pest.
- Companion planting such as planting herbs like basil, marigold or chrysanthemum around the affected plants can deter leaf miners and other pests.
- Following insecticides should be applied or sprayed are Cyantranilprole 10.26% OD 1.7-2.0 ml/lit, Quinalphos 25 % EC 2 ml/lit, Imidacloprid 17.8% SL 0.75 to 1 ml/lit, Acetamiprid 20% SP 0.5 gm/lit, Fipronil 40% + Imidacloprid 40% WG 0.2 – 0.6 gm/lit in 500 litres of water or spray solution. To reduce the resistance, it is recommended to rotate multiple insecticides, such as indoxacarb, abamectin, azadiractin and fenoxycarbe + lufenuron.

Conclusion

Serpentine leaf miner is a severe problem for vegetable growers, particularly tomato growers. Leaf miner can reduce plant growth, reduce yield and premature leaf drop which can affect the overall productivity of the crop. Integrated management of leaf miners in crops involves a combination of preventive and management measures that can effectively control leaf miner infestations and minimize crop damage. This will help reduce the economic impact of this pest and ensure a healthy and sustained crop yield. Preventive and biological control measures can be used to detect and control infestations at an early stage. In severe cases, chemical control is necessary, but it should only be used as a last option and with caution to prevent harm to beneficial insects and pollinators.

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