

Integrated Approach for Management of Tomato Leaf Miner (*Tuta Absoluta* Meyrick)

Pramod Kumar Mishra^{1*}, Arun Kumar², Pawan Kumar³, Ashutosh Singh Aman⁴ and Pankaj Kumar Rajpoot⁵

^{1*,2,4} Department of Entomology, Chandra Shekhar Azad University of Agriculture & Technology, Kanpur (U.P)-208002

³ Department of Entomology, Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut (U.P)-250110

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Summary:

Tomato leaf miner is currently is in threat in India since it has recently invaded in farmers fields there, where it has established itself as a severe pest of tomato crop. The majority of tomato-producing nations in India, Europe and Africa etc. were infested by the tomato leaf miner due to its high reproductive potential, ability to disperse, and tolerance of climatic conditions. It damages to stems resulting in necrosis, which inhibits the growth and development of tomato plants. Fruit with bore holes has low quality and a lower market value. *T. absoluta* (Meyrick) leaf-mining activities and, to a lesser extent, tunneling in the fruits are what seriously harm to tomatoes. If no effort is taken to prevent the moth, the damage on the tomato could reach 100 per cent.

Introduction:

Vegetables are important components of daily diets in India and important sources of income, especially in rural and urban areas. Globally, India is the second largest producer of vegetables with 199.88 million tonnes production during 2021-22 after China with production around 700 million tonnes during 2016-20 and contributes 16.7% total area and 15.4% total production of vegetables to the world's. The area under tomato cultivation in India is 0.84 Million hectare with estimated annual production of 21.1 million tones. Vegetables provide a cheap source of proteins, fats, vitamins, carbohydrates, minerals and different other crucial elements for human health and wellbeing. Insect-pests are the major biotic constrains in tomato production in India. Tomato crop is suffering from various insect-pests. Among these tomato leaf miner considered as oligophagous pest damaging tomato crop from seedling to fruiting stage. Tomato leaf miner, *Tuta absoluta* (Meyrick) belongs to family Gelechiidae

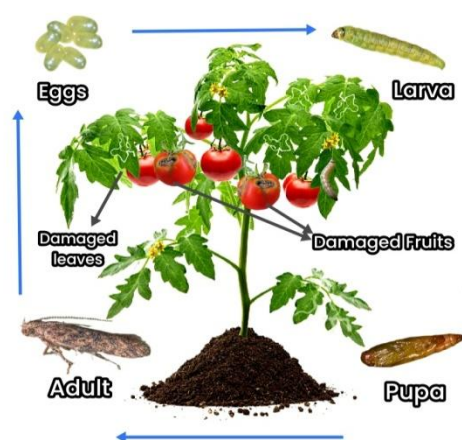
originating from South America and was first introduced in Spain in 2006 and from where it spread in the different countries of the world. It is also known as South American tomato pinworm. It is a serious aggressive insect pest of tomato crop (*Solanum lycopersicum* L.) globally. Its harmful population can cause 100 per cent loss in tomato crop in both protected and open field condition. Tomato is a primary host plant but leaf miner can also attacks other vegetables family including solanaceae and Amaranthaceae.

Tomato leaf miner:

(i) **Scientific name** – *Tuta absoluta* (Meyrick)

(ii) **Taxonomic position:**

- ❖ **Kingdom:** Animalia
- ❖ **Phylum:** Arthropoda
- ❖ **Class:** Insecta
- ❖ **Order:** Lepidoptera
- ❖ **Family:** Gelechidae
- ❖ **Genus:** *Tuta*
- ❖ **Species:** *absoluta*



(iii) **Host plants:** Primarily it is feed on many related species of the family Solanaceae including tomato (*Solanum lycopersicum* L.), chilli (*Capsicum annuum* L.), potato (*Solanum tuberosum* L.), brinjal (*Solanum melongena* L.), tobacco (*Nicotiana tabacum* L.), sweet pepino (*Solanum muricatum* L.), datura weed (*Datura stramonium* L.) and some Amaranthaceae species are *Chenopodium album* L. and *Beta vulgaris* L. etc.

(iv) **Distribution:** It is distributed throughout Asia, Africa, South, Central America and Europe etc. In Indian nation it is occurred in all states, where tomato or other solanaceae vegetable crops are cultivated.

(v) **Marks of identification:**

The egg of Tomato Leaf miner, *T. absoluta* (Meyrick) is small, elliptical shape and creamy white to bright yellow color. The diameter of eggs about approximately 0.36 mm long and 0.22 mm wide. Its Larva is whitish during first instar about 0.9 mm long and becomes greenish or lightish pink in the 2nd and 4th in star with 7-8 mm diameter, while pupa is obtect type with greenish coloration at first than turning to chestnut brown and dark brown near adult emergence. The adult moth of leaf miner is mall with body length of 5–7 mm and

wingspan of 10–15 mm. Its fully matured adult moth has silvery-gray scales and black spots on the forewings, while the antennae are long, filiform type with black and brown scales. The male and female genitalia as well as the pupal genital aperture as useful distinguishing character for coupling of the moth.

(vi) Nature of damage:

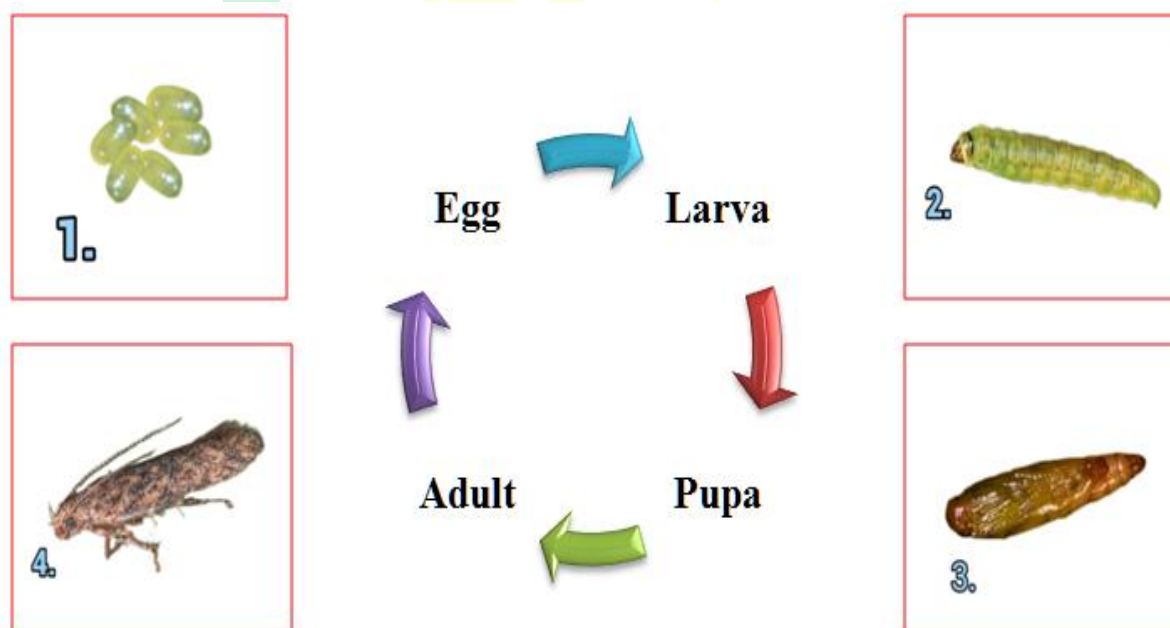
Tomato leaf miner, *T. absoluta* (Meyrick) usually attacks on the apical buds, flowers, and new fruits of tomato. Its Larvae make conspicuous mines and galleries on leaves and stems. The larvae feed on the mesophyll tissue and leaving the epidermis intact, thus making irregular mines and galleries on the leaves. The galleries and mines may become necrotic with time. This mining activities lead to reduction of the photosynthetic potential of infested leaves. Its incidence can occur at any stage of tomato growth from seedlings to fruiting stage.



Damaged tomato with *T. absoluta* show burnt up-like appearance. When tomato at high density, its larvae can penetrate the axillary buds of young stems. Thus, it leads to plant withering and check of vegetative growth and after some time complete plant may die. After fruit setting, the larvae excavate tunnels in the fruits, which may facilitate invasion by pathogenic agents, resulting in fruit rot. The major difference between the damaging symptoms of both *T. absoluta* (Meyrick) and *Liriomyza trifolii*, the galleries made by the larvae are wider than that caused by the dipteran leaf miner *L. trifolii*.

(vii) Life cycle (Bionomics):

Tomato leaf miner, *T. absoluta* (Meyrick) is an invasive pest of tomato causing up to 100 per cent damage to crop. Its life cycle completed in four stages viz. egg, larva, pupa and adult. Its life cycle completed in four stages viz. egg, larva, pupa and adult. Its eggs are small, cylindrical, creamy white to yellow in colour and laid singly or in group up to 260 eggs on leaves, tender shoots, flowers and developing fruits. Its larvae are cream-colored with dark head. Its Larvae make irregular mines and galleries on different vegetative parts (leaves, stems and fruits etc.) of the host plant. Its egg incubation, larval and pupal period completed in 4-6, 8-12 and 10-11 days, respectively with 4 larval instars. Its pupa is obdect with greenish coloration at earlier stage than turning to light brown and dark brown. Pupation may take place in the soil, on the leaf surface or within mines. The adults are small moths with 5-7 mm body length. They can be easily identified by their thread-like antennae and forewings with grey scales and black spots. It is complete their entire life cycle within 30-35 days with 10-12 generations per year.

**Integrated Pest Management:**

1. Collect and destroy by hand picking the egg clusters, larvae, pupae, damaged leaves, fallen fruits and fruits with pin holes to prevent population buildup.
2. Destruction of debris, crop residues, weeds and other alternate host plants such as *Solanum*, *Datura*, and *Nicotiana*

3. Deep summer ploughing is effective to exposing the different stages of insect's viz., egg, larvae and pupae to sunlight greatly reduce the pest occurrence and prevent the pest population buildup.
4. Judicious and proper application of manures and fertilizers at proper time can directly manage the insect pests because the excessive use of nitrogenous fertilizer attracts the different pests.
5. Avoid continuous mono cropping of Tomato.
6. Timely sowing and harvesting of crop is the effective method to avoid the pests.
7. Adopt the proper crop rotation and avoid the solanaceae crops in sequence.
8. Use pest free planting material to prevent the pest's distribution.
9. Manipulate the soil characteristics and apply biofertilizers to enhance tomato plant resistance through bottom up effects.
10. Weeding and earthing up in rows should be done at proper time.
11. Use the moth-proof sealing in greenhouses or protected cultivation.
12. Visit the field timely for pests monitoring and take the action timely.
13. Use Pheromone baited sticky traps; it can be used to monitor the male population of the tomato leaf miner
14. Use Light traps @ 12/ha and water traps (carosented) can also be used to capture the both sexes.
15. Field should be kept free from harmful weeds or other unusual plants.
16. In case for of heavy infestations in plants may be uprooted and burning considered as effective.
17. Male annihilation by mass trapping of adults, install the delta pheromone traps, for mass trapping @ 20–40 traps/hectare are effective. Replace the lures with fresh lures after every 15-20 day interval.
18. Install bird perches @ 10/ acre should be erected for facilitating field visits of predatory birds.
19. Grow resistance cultivars, because they work as non-preference to pests.
20. Avoid using insecticides at the time of fruit maturation and harvest because the synthetic pyrethroids cause resurgence in insects.

21. Release the Eulophidae Hymenopteran parasitoids wasp *Necremnus tutae* and *N. cosmopterix* are effective bio-control agents against Tomato leaf miner.
22. Conserve the existing bio-control agents like Hemipteran predators such as anthocorids, geocorids, mirids (*Nesidiocoris tenuis*), nabids, and pentatomids have been identified to be biological agents against *Tuta absoluta* and other tomato pests including the whiteflies, thrips and aphids.
23. The *Macrolophus basicornis* (Stal) and *M. pygmaeus* are potential biocontrol agents of miridae family used against tomato leaf miner. Its nymphal stage can consume approx. 330 eggs per day, while the adult can feed up to 100 eggs per day.
24. Augment the bio-control agents like egg parasitoids, *Trichogramma achaeae*, *T. pretiosum*, *T. evanescens* and *T. brassicae* is a potential agent for biological control of *T. absoluta*.
25. For microbial control use biocontrol agents such as entomopathogenic nematode, *Steinernema* and *Heterohabditis* have potential to kill larvae of Tomato Leaf miner
26. In case of severe incidence, spray any one of the insecticide starting from one month after planting at 15 days interval, Neem oil 1500 ppm @ 1-1.5 ml/lit. or NSKE 5% 50 gm./lit. or *Beauveria bassiana*, *Metarhizium anisopliae* @ 5-10 ml/lit or *Bacillus thuringiensis* Var. *Kurstaki* @ 3-5 ml/lit. of water.
27. If the borer incidence crosses economic threshold level, spray Lambda cyhalothrin @ 2 ml/lit. or *Emamectin benzoate* 5% SG @ 1 gm./lit. or *Spinosad* 45% SC @ 0.20-0.30 ml/lit. Water.

Conclusions:

The larvae of the tomato leaf miner, *Tuta absoluta* (Meyrick), live in underground tunnels or mines in tomato leaves and fruit, respectively and feed there. They are endophagous. Farmers risk damaging their entire crop if they do not act quickly. Pesticide resistance management approaches are required to maintain tomato crop production in order to deal with the problems of insecticide resistance and other negative consequences on the tomato ecosystem caused by the overuse of insecticides. These tactics include implementing alternate control methods such cultural control, manipulation based on semiochemicals, biological control, and host plant resistance. The use of insecticides would be reduced by all of these alternative techniques and approaches.

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