TRENDS IN AGRICULTURE SCIENCE
Popular Article
Vol.3 Issue 06 June 2024, Page: 2023-2026

An Invasive Pest *Tuta Absoluta* (Meyrick) (Lepidoptera: Gelechiidae): A Threat to World Tomato

Deepika Shandil[1], Ekta kaushik[2], Sonali Sharma[3] and Amisha Chauhan[1]
[1]Dr Yashwant Singh Parmar University of Horticulture and Forestry, Nauni. Solan India.173230
[2]Plant Quarantine Division, Directorate of Plant Protection, Quarantine and Storage, Faridabad
[3] Department of Agriculture, Maharishi Markandeshwar University Mullana-Ambala, Haryana, India.133207
DOI:10.5281/Trendsinagri.13144143

Invasive pests or invasive alien species are non-native species of plants, animals, insects or diseases that are nonnative to the areas which they damage, invade and establish populations, leading to an unchecked increase in the population. These pests generally lack natural enemies and can grow exponentially to cause heavy crop losses and may disrupt the existing management programs resulting in an increased reliance on the chemical control. *Tuta absoluta* (Meyrick) (Gelechiidae: Lepidoptera), commonly known as tomato leafminer or South American tomato pin worm is native to Peru and is one of the most devastating oligophagous invasive pest capable of causing up to 100% damage in tomato. Until 2006, this pest was confined to its native home i.e. South America from where it invaded Spain followed by the Asian subcontinent. Following this invasion, its pest status changed altogether from a pest restricted to South America to a devastating threat to tomato all around the world. Currently this pest is reported to invade 79 countries. It was reported for the first time in India in 2014 at Pune, Maharashtra from where it has been spread to many parts of the countries. The pest is more serious under greenhouse conditions and multiplies continuously throughout the growing season

Economic Importance

This invasive pest *Tuta absoluta* attacks all types of tomatoes, whether grown outdoor, indoor, for fresh consumption or for processing at all growth stages from seedling to final harvest. Under favourable conditions and in the absence of appropriate control measures, the pest is capable of causing 100 per cent crop damage in tomato (Ballal et al. 2016)

Host Range

Although tomato is the most preferred host for *T. absoluta*, its damage has also been reported on egg plant (*Solanum melongena* L.), pepper (*Capsicum annuum* L.), potato (*S. tuberosum),* tobacco (*Nicotiana tabacum* L.), solanaceous weeds, garden bean (*Phaseolus*

Published: 28 July 2024
ISSN: 2583-7850

vulgaris L.), cape gooseberry (*Physalis peruviana* L.), *Lycium* sp. and *Malva* sp. (Negi et al. 2018)

Bioecology

Tuta absoluta adults start mating within a day or two after emergence and a single female can mate many times in its life time with each mating lasting for few minutes to few hours

Each female can lay upto 250 yellow-coloured eggs, 0.35 mm in batches of 2 to 3 during its life time on all the aerial parts of tomato and prefers underside of the leaves, buds, stems and calyx of unripe fruits. Incubation period lasts for 7 days

The neonate larvae are 0.5 mm, pale yellow to green that change to 9 mm long dark green larva in later stages. The larvae have a thin black line posterior to the brown head capsule. The larvae mines in the leaf epidermis and also bore into fruits, flower buds, apical shoots and stems. There are four larval instars in 8 to 15 days

Pupae are 6 mm, light brown. Pupation takes place inside loose silken cocoons in soil or in folded leaves. Pupal duration is around 7 to 10 days

Adults are 6–7 mm long with silvery-brown speckled wings, which are folded along their back at rest. Antennae and legs are relatively long with black and brown bands. Adults live for 10-15 days

Total life cycle from egg to adult is completed in 24-38 days and10-12 generations are recorded in a year.

Dam age symptoms

L arvae create conspicuous blister type mines and galleries on leaves and feed on the mesophyll tissue leaving only epidermal layer on both sides of the leaves. Characteristic identical necrotic blotches are seen on both sides of the leaves

Infested leaves dry up leading to early defoliation and ultimately drastic reduction in yield. Plants remain stunted and gives a burnt apperance

Larvae also bore into the fruits causing characteristic pin holes. The fruit damage attracts secondary pathogen leading to fruit rot

Management

Pre-planting stage

- Deep ploughing after harvest to expose the pupa to sunlight and predation
- Crop rotation with non - solanaceous crops such as bhindi, beans, leafy vegetables etc.

Published: 28 July 2024
ISSN: 2583-7850

- Removal of alternative host plants inside/around the greenhouses
- Physical barriers such as exclusion by fine mesh and double doors of greenhouses reduce infestation risk

Nursery stage

- Raise the tomato seedlings under 200 mesh size nylon net
- Proper nursery management and use of pest free seedling materials
- Root dip treatment of seedling in imidacloprid 17.8 sl @ 0.3 ml/l at the time of transplanting

Transplanting to harvest stage

- Install pheromone trap Tuta lure @ 4-5 traps /ha for monitoring and @ 40 traps/ha fixed at 2 feet height from the ground at the time of transplanting for mass trapping
- Mechanical collection and destruction of infested leaves and fruits during early crop stage
- Conserve native predators such as mirid bug (Nesidiocoris tenuis) and anthocorid bugs (Orius sp.).
- Inundative releases of egg parasitoids viz., Trichogramma pretiosum, Trichogramma acheae @ 45000/ ha at weekly intervals.
- Spray chemical insecticides such as Profenophos 50 EC @ 2ml/l, Chlorantraniliprole 18.5 SC @ 0.15 ml/l and Lambda cyhalothrin 5 EC @ 0.6 ml/l . Do not repeat same insecticide so as to prevent development of resistance

Abbes (2011) reported that sex pheromone water traps at the rate of 32 traps/ha were efficient in reducing the pest population. The effective package for the control of *Tuta* under polyhouse conditions as per ICAR-IIHR includes consists of use of incandescent bulb @ one bulb/150 m^2 + 1 pheromone trap/300 m^2 + need based spray of spinosad 0.25 ml/l/flubendiamide @ 0.20 ml/l in rotation at 3 weeks interval. Ndor (2018) reported 8-9.47% low incidence of *T. absoluta* in Garkawa, Nigeria by following crop rotation practice with non-solanaceous crops along with clean cultivation through destruction of post-harvest plant debris and infested plants along with the application of neem oil

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ISSN: 2583-7850