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Bionomics and Eco – Friendly management of *Tuta absoluta* Meyrick (Gelechiidae: Lepidoptera) in Tomato crop

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Abstract

Tomato (*Solanum lycopersicum* Mill.), a prominent member of the Solanaceae family, is a leading global food crop among vegetables, with India ranking as the second-largest producer worldwide. The tomato production in India faces challenges, notably from the invasive South American tomato leaf miner, *Tuta absoluta* Meyrick, detected in 2014. This pest poses a significant threat due to its resistance to synthetic insecticides and secretive feeding habits. It's life cycle involves distinct stages: eggs, larvae, pupa, and adult. Eggs are laid singly or in clusters, progressing from leaves to stems and fruits, with an incubation period of 3 to 5 days. Larvae undergo four instars over 7 to 11 days, causing damage to foliage and fruits. Pupation occurs in soil or on leaves, lasting 7 to 10 days, leading to the emergence of mottled gray adults with differing lifespans between genders. Management strategies include the use of sex pheromone lures for early detection, application of entomopathogenic bacteria and fungi, release of egg parasitoids, and conservation of predators. Additionally, botanical extracts from Neem and Jatropha, along with foliar applications of Spinosad and Emamectin benzoate, offer effective control measures against *Tuta absoluta* infestations.

Key Words – Biology, Management, Tomato, *Tuta absoluta*

Introduction

Tomato (*Solanum lycopersicum* Mill.), a member of the nightshade family Solanaceae, stands as one of the preeminent food crops globally among vegetables. Its cultivation and consumption are widespread, contributing to an estimated global production of approximately 182 million tons across 4.76 million hectares. Notably, India ranks as the second-largest producer of tomatoes globally, trailing only behind China. Within India, tomato cultivation spans about 0.79 million hectares, yielding an annual production of 19.38 million tons at an impressive rate of

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24.65 tons per hectare. Andhra Pradesh emerges as a key player in tomato cultivation within the country, featuring extensive cultivation across all districts. The state boasts a substantial production of 2.74 million tons, covering an area of about 61,670 hectares. However, the flourishing tomato production faces multifaceted challenges, including a spectrum of biotic and abiotic stresses. Predominant among these are major pests and diseases that not only curtail yields but also compromise the quality of marketable fruits. Presently, a paramount obstacle to tomato production lies in the form of a novel invasive pest known as the South American tomato leaf miner, *Tuta absoluta* Meyrick—a nocturnal moth belonging to the Gelechiidae family within the order Lepidoptera. Originating primarily from South America, notably Peru, this pest made its debut in Indian tomato fields in 2014, initially reported in Maharashtra and subsequently identified in adjacent states. The intricacies of managing this insect have become formidable due to its pronounced aptitude for developing resistance to synthetic insecticides and its surreptitious feeding behavior.

Distribution

This pest was first detected outside South America in 2006 and it is now distributed in most tomato-growing areas in Europe, Africa and Asia. Currently, *Tuta absoluta* is reported in 41 of the 54 African countries.

Hosts – Alfalfa, Eggplant, Tobacco, Potato

Biology

Eggs - Females deposit ovoid to cylindrical eggs, characterized by a yellowish-white hue, primarily in a solitary fashion, although occasionally arranged in small clusters on nascent leaves, subsequently progressing to tender stems and green fruits. The incubation period for the eggs spans 3 to 5 days, with hatching predominantly occurring during the early morning hours.

Larvae - The neonatal larvae, exhibiting an initial hovering phase lasting approximately 5 to 23 minutes prior to initiating feeding, displayed a light yellowish-green coloration that progressively transitioned into a verdant hue, accentuated by a distinct pinkish-brown dorsal band. The larvae underwent four instars before reaching the pupal stage, with the larval phase spanning from 7 to 11 days. Notably, each instar featured a conspicuous prothoracic shield positioned just behind the head.

Pupa - The pupa, characterized by an obtect form and cylindrical shape, exhibits an initial light green hue that subsequently transforms into a brown coloration. Pupation predominantly occurs in soil, on leaves, or within larval galleries. The duration of the pupal stage is ranging from 7 to 10 days.

Adult - The mature individuals exhibit a mottled gray hue and are primarily active during the dawn, while throughout the rest of the day, they tend to conceal themselves in the shaded regions of the plant. Females display a longer lifespan of 15 to 16 days compared to males, who have a lifespan of 11 to 12 days.

Nature of damage

The larvae assail both the foliage and fruit throughout all stages of tomato growth. On leaves, the larvae exclusively consume the mesophyll, leaving the epidermis unharmed. Furthermore, they infiltrate tomato fruits, where they nourish themselves and undergo growth, creating mines and galleries in their wake (Braham and Hajji, 2012). The galleries crafted by *Tuta absoluta* are discernible on apical buds, stems, as well as on both green and ripe fruits (Moreno et al., 2017).

Management

- Sex pheromone lures can be used for early detection of *Tuta absoluta* in newly invaded areas.
- Foliar application entomophathogenic bacteria *Bacillus thuringiensis* var *Kurstaki* @ 2 ml/lit of water.
- Foliar application entomophathogenic fungi *Beauveria bassiana* @ 5 ml/lit of water and *Metarhizium anisopliae* @ 5 ml/lit of water.
- Release the Egg parasitoids *Trichogramma* spp
- Conserve the pradators *like Rhynocoris segmentarius* (Germar) (Hemiptera: Reduvidae) and *Hockeria* sp. (Hymenoptera: Chalcididae) play a role in combating the infestation.
- Botanical extract derived from Neem (*Azadirachta indica*) and Jatropha (*Jatropha curcus*) exhibit insecticidal effects against the eggs and larvae.
- Foliar application of Spinosad 45 SC @ 73g a.i./ha and Emamectin benzoate 5 SG 11g a.i./ha.

Fig 1.0 Larvae of Tuta *absoluta*

Fig 2.0 Damage Fruit

Fig 3.0 Adult

Source - Hogea, 2020

Conclusion

In the face of these challenges, a comprehensive and integrated pest management strategy is imperative to safeguard global tomato production, ensuring sustainability and resilience against the intricacies posed by *Tuta absoluta*. The collective efforts of researchers, farmers, and policymakers are crucial to overcoming this threat and maintaining the vitality of the tomato industry on a global scale.

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