TOMATO LEAF MINER (*TUTA ABSOLUTA* MEYRICK), THE MAIN PEST OF TOMATO CROP CULTIVATED IN PROTECTED AREAS

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Abstract

Tuta absoluta Meyrick is a microlepidopteran known in the scientific literature as the tomato leaf miner. It originates from South America, most likely from Peru, dating back to the 1960s, from where it spread to all continents: in Africa (Morocco and Algeria, 2008), from where it disseminated across the continent, causing catastrophic damage especially in Ethiopia, Kenya, Sudan, and Egypt, leading to the destruction of tomato crops; in Southeast Asia (2020); in China (2024); in India (2025), and so on. In Europe, the species was accidentally introduced in 2006, in the province of Castellón, Spain, from where it spread very rapidly across the Western Palearctic Region during 2008–2010, being registered as a quarantine pest. In 2009, new invasions of this pest were reported in Greece, Switzerland, Malta, Portugal, the United Kingdom, the Netherlands, Croatia, Albania, Bulgaria, France, and Italy, while in 2010 it was identified in Turkey and in Bosnia and Herzegovina. In Romania, the pest was reported for the first time in 2009, in the western part of the country, then in Satu Mare, and it quickly spread to several vegetable growing areas in the country, including Oltenia.

Key words**: **Tuta absoluta, distribution, description, mode of attack

INTRODUCTION

Tuta absoluta Meyrick is a microlepidopteran systematically classified in the Order *Lepidoptera*, Family *Gelechiidae*. In the specialized literature, it is known under several synonyms: *Scrobipalpuloides absoluta* (Povolny, 1987); *Scrobipalpula absoluta* (Povolny, 1964; Becker, 1984); *Gnorimoschema absoluta* (Clarke, 1962); *Phthorimaea absoluta* (Meyrick, 1917).It originates from South America, most likely from Peru, as early as the 1960s (Miniermotte, 2010), from where it spread to all continents: Morocco and Algeria (2008), Southeast Asia (2020), China (2024), and India (2025).According to data from the European and Mediterranean Plant Protection Organization (EPPO), the geographical distribution of *Tuta absoluta* was last updated on May 21, 2025.In Europe, the species was accidentally introduced in 2006 in the Castellon province of Spain (Urbaneja et al., 2007; Alfaro et al., 2009), from where it spread rapidly throughout the Western Palearctic Region between 2008 and 2010, being recorded as a quarantine pest.In 2009, new invasions of this pest were recorded in Greece, Switzerland, Malta, Portugal, the United Kingdom, the Netherlands, Croatia, Albania, Bulgaria, France, Italy, Lithuania, Libya, and other countries in the Gulf region such as Bahrain and Kuwait. In 2010, it was identified in Turkey and in Bosnia and Herzegovina. Currently, this pest is considered the most dangerous pest affecting tomato crops (Harizanova, 2009; Culjak et al., 2010; Miniermotte, 2010; Ostrauskas and Ivinskis, 2010; Marja et al., 2011; Tropea Garzia et al., 2012). In 2010, it was identified for the first time in Turkey (Erler et al., 2010; Balzan and Moonen, 2012), in Serbia (Đurić and Hrnčić, 2010), in Bosnia and Herzegovina, in Montenegro (Duric, 2014), and in Egypt

(Soliman et al., 2013). Guru-Pirasanna-Pandi et al. (2025) believe that climate change will alter the distribution of invasive pests, among which is the species *Tuta absoluta*. In Romania, the pest was first reported by Cean and Dobrin in 2009 in the western part of the country, then in Satu Mare, spreading rapidly throughout all vegetable-growing regions. In 2013, research conducted by Baeţan et al. reported the pest in tomato greenhouses in Arad County and later in Hunedoara County.

MATERIALS AND METHODS

The research was conducted in three localities in Dolj County, known as major producers of greenhouse-grown tomatoes: Apele Vii, Dăbuleni, and Perișor. In the Perișor site, studies were carried out in protected spaces both for seedling production and for tomato cultivation (Figures 1 and 2).In the protected space at Perișor, healthy seedlings (accompanied by a phytosanitary passport) were used. Before the establishment of the crop, prophylactic treatments were applied, the protected structure was sealed, and protective nets were installed.

Figure 1. Seedling cultivation in protected spaces – Perișor

All host plants in the immediate vicinity were eliminated. In previous years, monitoring of the moth population in Perișor was performed by phytosanitary inspectors, and infestations were observed only on a few plants.At Apele Vii and Dăbuleni, locally produced seedlings were used for planting, in traditional greenhouses covered with polyethylene film with an extended usage cycle.

Figure 2. Tomato crop in protected spaces – Apele Vii

The determination and monitoring of the average air and soil temperature were carried out using the triangulation method. The study on the dynamics of adult catches of the species *Tuta absoluta* Meyrick was conducted during the period May–September 2025.Studies on the morphology of the adult and larval stages were performed using specialized identification keys. The observations and measurements focused on the timing of adult emergence, the evolution of recorded captures, the identification of developmental stages, morphological studies of both adult and larval stages, and the monitoring of the damage caused by the pest. For the capture of *Tuta absoluta* males, ecological control methods were used, Delta adhesive traps with AtraTUT-s pheromone lures (Figures 3 and 4), supplied by the “Raluca Ripan” Institute of Chemistry in Cluj-Napoca — pheromone variant intended for protected cultivation systems. Two traps were used per 1,000 m² of protected space, inspected every 15 days and replaced every four weeks. One trap was installed near the entrance, and the second one in the center of the greenhouse. During the vegetation period, plant protection products (PPP) approved for use were applied, and their efficacy was monitored.

In the year 2025, in protected tomato-growing areas, a series of chemical treatments with approved products were carried out to reduce the population of *Tuta absoluta*, as follows:
At the PERIȘOR experimental station, a soil treatment with Dazomet 500 kg/ha (on February 27, 2025) and five foliar treatments were applied with: Abamectin 0.8 l/ha (on May 26, 2025 and June 26, 2025);
Bacillus thuringiensis 0.33 kg/ha (on June 10, 2025 and July 28, 2025); Chlorantraniliprole 175 ml/ha (on July 11, 2025).
At DĂBULENI, four foliar treatments were applied with: Chlorantraniliprole 0.8 l/ha (on May 8, 2025);
Metaflumizone 1.0 l/ha (on June 11, 2025 and August 5, 2025); Abamectin 1.0 l/ha (on July 3, 2025).
At APELE VII, four foliar treatments were applied with: Metaflumizone 1.0 l/ha (on May 19, 2025 and July 13, 2025); Chlorantraniliprole 0.8 l/ha (on June 3, 2025);
Abamectin 0.8 l/ha (on June 27, 2025).

Figure 3. Delta adhesive trap with AtraTUT-s pheromones in protected spaces – Apele Vii

Figure 4. Delta adhesive trap with AtraTUT-s pheromones in protected spaces – Apele Vii (capture detail)

RESULTS AND DISCUSSIONS

Starting from the fact that, prior to the 2025 study year, severe infestations had been reported in many protected cultivation systems in Dolj County — with numerous vegetable crops being compromised — tomato-growing facilities were monitored in three locations (*Dăbuleni*, *Apele Vii*, and *Perișor*), each situated at adequate isolation distances. In locations where a large number of phytosanitary treatments had been applied to ensure high-value commercial yields**,** *Tuta absoluta* developed resistance to certain approved plant protection products (PPP)**.** During the study period, it was observed that in the second decade period of May, *Tuta absoluta* adults began to emerge when the temperature inside the protected space exceeded 20°C, while the ten-day average temperature recorded at the meteorological station was 12.8°C (Table 1). The development of the pest can continue until the end of October or the beginning of November in unheated greenhouses, and even throughout the winter period in heated protected spaces**.**

Table 1. Average air and soil temperature in 2025 (Meteorological Station of SCDPN Dăbuleni)

Month/ decade		Average air temperature		Average soil tewmperature	
		Decadal	Monthly	Decadal	Monthly
April	1	9	12,5	11,3	15,1
	2	12,8		14,9	
	3	15,7		19,1	
May	1	16,8	16,5	21,2	19,1
	2	14,1		16,2	
	3	18,8		19,8	
June	1	23,8	24,3	23,8	24,4
	2	23,5		24,1	
	3	25,6		25,4	
July	1	25,7	26,5	26,5	25,8
	2	23,9		24,0	
	3	30,1		27,0	
August	1	25,6	24,7	25,6	23,5
	2	25,1		23,7	
	3	23,5		21,2	

The adults, commonly referred to as moths, measure 5–7 mm in length, with a wingspan of approximately 8–10 mm, and have a gray-brown coloration. The males are generally darker and smaller than the females, possessing filiform antennae**.** The forewings are grayish, with irregularly distributed markings, and the apical area bears fine hairs; in contrast, the hindwings have hairs both along the dorsal margin and the apical region, which are highly developed (Coelho, 1987; Souza, 1992; Tropea Garzia et al., 2012) (Fig. 5). The mouthparts of the adult insect, as in most Lepidoptera, are described as lapping and sucking. However, studies conducted by Băeţan (2015**)** in Italy, at the University of Bari, revealed that “the adult, when present on the tomato leaf, begins a rotational movement of the proboscis tip, consisting of very rapid motions, resulting in detachment of small fragments from the leaf surface, which appear as wounds.” Each wound measures approximately 0.5–3 mm in length and 0.4–2 mm in width. The wounds appear slightly concave, with a yellow-greenish margin. The lower surface of the wound exhibits an unusual characteristic.The larvae are cream-colored, with a black head capsule, and gradually acquire a pink or light green coloration as they develop, passing through four larval instars (Fig. 6). The larval instars are differentiated according to the width of the head capsule: Neonate larva – 0.15 mm; Second-instar larva – 0.29 mm; Third-instar larva – 0.39 mm; Fourth (final) instar larva – 0.75 mm (Erdogan, 2013).

Figure 5. *Tuta absoluta* adult in protected spaces during the plant dormancy period, before application of treatments with Dazomet 500 Kg/ha

Figure 6. *Tuta absoluta,* larva
https://seminte-ingrasaminte-turba.ro/tuta-absoluta/

In 2025, research was initiated in Dolj County to determine the flight dynamics of *Tuta absoluta* adults in protected cultivation systems where seedlings or tomato crops established from seedlings were grown, across three observation sites: Dăbuleni, Apele Vii, and Perișor, located at considerable distances from one another. Observations and measurements for monitoring the flight activity of adults were carried out during the April–September period. For the capture of adults, Delta adhesive traps equipped with locally produced AtraTUT-s pheromone lures were used. The graphical representation of the flight curve obtained for the three observation sites in protected spaces is shown in Figure 7.

From the analysis of the data obtained in protected spaces during 2025, it was observed that the numerical density of the population increased progressively during the capture period, with the highest number of specimens recorded at the end of August and the beginning of September. In tomato crops, adults are difficult to observe, as their flight activity is nocturnal; during the day, they hide among the tomato leaves without causing direct damage to the crop.

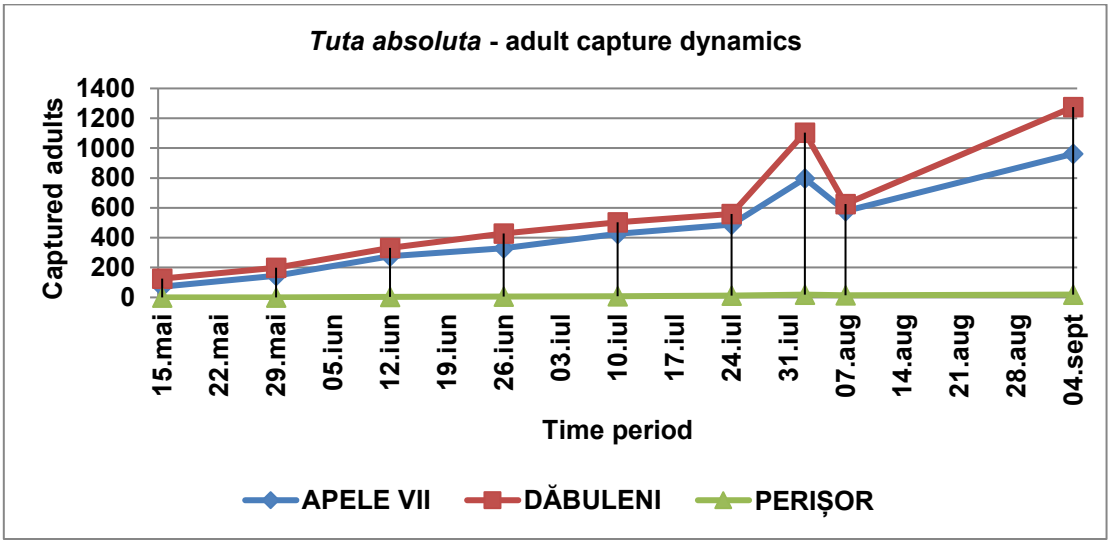

Fig.7. Adult *Tuta absoluta* capture dynamics in 2025

The first adults observed and captured in tomato crops under protected conditions were recorded in the Dăbuleni site during the first decade of May, on May 8. In Apele Vii, the first adults were captured in the second decade period of May, on May 12. In the Perișor site, the first captured adults were recorded relatively late, during the second decade period of June, which can be explained by the treatments applied in March using approved products. The capture dynamics by location show that the highest number of adults was recorded on September 4 in Dăbuleni (*1,275 specimens*), followed by Apele Vii (*962 specimens*), while the lowest number

(*19 specimens*) was recorded in Perișor. The low number of captures in the Perișor site can be attributed to the treatment applied in the greenhouse with the product Dazomet 500 kg/ha, which proved to have very high efficacy throughout the entire tomato growing season. Throughout the vegetation period of tomato plants cultivated in the protected spaces of the three study sites, it was observed that the population density of *Tuta absoluta* correlated directly with the level of damage caused by this pest, as it is well known that the larval stage is responsible for the destruction of the crop (Figs. 8, 9, and 10).

Figure 8. Infestaion on leaf – Apele Vii

The first signs of infestation were observed in the form of leaf mines, initially appearing on the growing tips, and later on the flowers and young fruits, with the presence of dark-colored larval excrement also being noted. As a result of leaf infestation, broad galleries are formed by the larvae, which then penetrate the stems, petioles, and fruits; under severe attack, this can lead to the complete destruction of the crop.

Figure 9. Infestation on leaves and fruits – Apele Vii

Figure 10. Uninfested crop – Perișor

When the infestation is concentrated on the growing tips of the plants, the infection pressure in the soil is already significantly higher than that observed on the plants themselves. Under such conditions, a considerable soil reservoir of adults**,** pupae**,** and eggs may be present — developmental stages in which the pest can successfully overwinter.

CONCLUSIONS

The monitoring of *Tuta absoluta* adult flight activity was carried out during the April–September period using Delta adhesive traps equipped with locally produced AtraTUT-s pheromone lures. The capture dynamics by location showed that the highest number of adults was recorded on September 4 at Dăbuleni (*1,275 specimens*), followed by Apele Vii (*962 specimens*), while the lowest number of captured specimens (*19*) was recorded at Perișor. The damage caused by *Tuta absoluta* extends throughout the entire production cycle, affecting all above-ground plant organs. The attack is caused by the larvae, which feed continuously, producing characteristic mines in the leaves, flowers, and young fruits, along with visible larval excrement. In plants where the growing tips are attacked, there is often a large soil reservoir of eggs, pupae, and adults, indicating a pyramidal infestation structure.The application of approved plant protection products (PPP) necessarily in combination with all preventive and protective measures — ensures a healthy tomato crop with high economic value.

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