

STUDY ON MONITORING AND COMBATING THE ATTACK OF TUTA ABSOLUTA ON TOMATOES CULTIVATED IN PROTECTED SPACES IN SOUTH ROMANIA

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ABSTRACT

Lately, for tomatoes grown in protected spaces there is another limiting factor, an extremely dangerous pest (*Tuta absoluta*). *Tuta absoluta* is an extremely dangerous polyphagous insect. It belongs to the Gelechiidae family, Lepidoptera order. The pest is a small butterfly (moth), 5-7 mm long, brown with shades of dark gray. The larva is white-green, with a black head and a brown pupa. It has 12 generations per year. An adult female can have up to 250 eggs during her lifetime. The life cycle is completed in 30-40 days, but largely dependent on environmental conditions. It has 4 larval stages, wintering as an egg, pupa or adult. Moths are more active during the night, during the day being hidden among the leaves. Starting with 2020, in some protected spaces from well-known vegetable basins for growing tomatoes in South Romania, a study was initiated on monitoring the attack of *Tuta absoluta*. Preliminary results show that the pest is extremely harmful (sometimes the damage to tomato crops can be very high, even compromising the crop), and that chemical control measures, in the absence of agrophytotechnical measures, do not ensure good effectiveness.

INTRODUCTION

The origin of tomatoes is in Central and South America, Peru and Ecuador (Costel Vânătoru et al., 2019). Today, tomatoes are quite widespread in the world, being the crop with the highest share. Through the several thousand varieties / hybrids, tomatoes are grown on about 4.8 million hectares, in multiple technological variants and for many directions of food use. Lately, tomatoes grown in protected areas have a limiting factor, an extremely dangerous

pest. *Tuta absoluta* was first found in Romania in 2009. According to the National Phytosanitary Authority, *Tuta absoluta* was reported first in Botoșani County and then in Maramureș County (Elena Leaotă, 2009), while Băețan et al (2013) reported its first appearance in June 2009 on tomatoes imported from Spain. *Tuta absoluta* is an extremely dangerous polyphagous insect. It belongs to the family Gelechiidae, order Lepidoptera. The pest is a small butterfly (moth), 5-7 mm long, brown with shades of dark gray. The larva is white-green, with a black head and a brown stern (Figures 1, 2). It has 12 generations per year. An adult female can have up to 250 eggs during her lifetime. The life cycle is completed in 30-40 days, but largely dependent on environmental conditions. It has 4 larval stages, wintering as an egg, pupa or adult. Moths are more active during the night, the day being hidden among the leaves (Syngenta - Catalog of plant protection products, 2021).



Figure 1. *Tuta absoluta* adult



Figure 2. *Tuta absoluta* larva

In Romania, there are not many scientific publications on this topic. We mention articles published by Cean and Dobrin (2009) and Cean (2011), about the identification and spread of this pest. *Tuta absoluta* was indicated as a new pest for the Oltenia Region, on the sandy soils between Olt and Jiu de Mitrea I., 2013, and Boiu-Sicuia et al. 2017 found the pest in the Muntenia regions, Giurgiu and Ilfov counties. Băețan (2015) dedicated a special chapter to this pest in his doctoral thesis and also published four articles on the behavior of feeding and spreading the pest in western Romania (Băețan et al., 2015). In 2019, the *Tuta absoluta* pest was also reported in the area of sandy soils from Dăbuleni. Protected tomato growers in this area have suffered heavy losses due to this pest.

MATERIAL AND METHOD

In 2020 and 2021, in several localities from well-known vegetable basins (Dăbuleni -Dolj, Grădinari - Olt), tomato growers were selected, in whose solariums were installed, immediately after planting, Delta baits with specific pheromones.

The height at which the traps were placed was adapted to the phenophase of plant growth. The traps were checked every 15 days, and after 4-6 weeks, both the adhesive plate and the bait were replaced. 2 traps / 1000 m² were used, placed near the entrance as well as in the central positions of the solar. During the vegetation period, the evolution of soil and air temperatures was followed, in order to see its influence on the duration of the pest's life cycle, on the number of adults / solar. The effectiveness of *Tuta absoluta* pest control chemicals was also monitored. The *Tuta absoluta* pest causes damage in all phases of vegetation, in all above-ground organs of plants. Among the host plants can be listed: tomatoes, eggplants, potatoes, peppers, as well as weeds of the *Solanaceae* family (*Solanum nigrum*, *Datura stramonium*). Adults are more difficult to observe, given their night flight. They hide during the day among the leaves of the plants, not directly harming the culture. Lately, however, in some solariums in the Dăbuleni area, adults have been able to be observed during the day. The larvae are the ones that cause damage in crops, knowing that after hatching during the 4 larval stages, they feed continuously for 12-15 days. They produce galleries in the attacked organs. The first attacks can be observed in the form of galleries formed in the leaves (or on the growth tip), in flowers and young fruits, and the presence of black excrement of the larvae is a sign of the existence of the pest in the culture. When an attack is found on the top of the plants, the infection pressure in the soil is much higher than on the plant (at the ground level the insect has a considerable reserve of adults, pupae and eggs). In this case we can talk about a pyramidal infection, the base being the most affected.

RESULTS AND DISCUSSIONS

It is known from the literature that the biological cycle of the *Tuta absoluta* insect is temperature dependent and lasts 25-38 days. Studies on this pest have shown that, at temperatures of 14 °C, development lasts about 76 days, while at 27 °C, the biological cycle is complete in 24 days. From practice, it has been found that, at temperatures of 34 - 40 °C, *Tuta absoluta* ends its biological cycle in

10 - 15 days. Following the data presented in Tables 1 and 2, it can be seen that the first adults of *Tuta absoluta* were observed starting with the second decade of May, once the solar temperature exceeded 20 °C.

Table 1

Evolution of air and soil temperature (Dăbuleni, 2020)

Time interval	Air temperature (°C)		Soil temperature (°C)	
	Average / decade	Monthly average	Average / decade	Monthly average
April 11-20	18.3	20.4	25.1	24.8
April 21-30	22.6		24.5	
May 01-10	24.6	24.5	23.5	22.5
May 11-20	27.0		23.8	
May 21-31	21.9		20.3	
June 01-10	25.9	27.3	21.9	23.4
June 11-20	26.0		23.7	
June 21-30	30.0		24.8	
July 01-10	31.3	28.9	25.5	25.2
July 11-20	26.2		24.8	
July 21-31	29.3		25.4	
August 01-10	30.2	28.1	25.9	24.6
August 11-20	26.9		24.8	
August 21-31	27.4		23.7	
September 01-10	26.1	23.8	21.6	21.0
September 11-20	24.6		21.7	
September 21-30	20.8		19.9	
October 01-10	19.5	17.2	20.2	18.7
October 11-20	16.3		18.4	
October 21-31	15.8		17.5	

Specifically, the observations from May 24 show that in the version treated with *Voliam Targo* one of the plants shows a leaf with traces of attack, while in the untreated version on four of the plants 7 leaves show traces of *Tuta absoluta*. The other variants do not show plants with traces of attack. As the temperature shows an increasing evolution inside the protected spaces, the number of identified adults is higher, which is also visible in the tomato crop, where the number of affected plants and leaves is increasing. On June 11, 2020, in all studied variants were identified plants affected by the *Tuta absoluta* attack: 8 plants in the control variant, 2 plants in the version treated with *Coragen* and one plant in all other variants.

Table 2

Number of affected plants and leaves, depending on the applied treatment

Date / plants, leaves affected	24.05.2020		11.06.2020		24.06.2020		07.07.2020		18.07.2020	
	Affected plants	Affected leaves	Affected plants	Affected leaves	Affected plants	Affected leaves	Affected plants	Affected leaves	Affected plants	Affected leaves
Control variant (untreated)	4	7	8	15	8	49	10	100%	10	100%
Voliam Targo (0,8 l/ha)	1	1	1	2	3	3	7	14	10	100%
Coragen (175 ml/ha)	0	0	2	2	8	20	8	53	10	100%
Tutafort+Defort (25 ml / 10 l water + 35 ml / 10 l water)	0	0	1	1	7	15	7	28	10	100%
Affirm (1,5 kg/ha)	0	0	1	1	4	6	6	13	10	100%

Starting with June 24, the number of affected plants and leaves increased significantly in all the studied variants, so that after July 18 the attack will be complete, all the plants studied being affected (Table 2). It can be seen that, regardless of the product used for treatments, the intensity of the attack increases with increasing temperature and that, in the absence of other agro-phyto-technical (cultural) measures, rational crop rotation, biological control, etc., the damage caused by the attack of *Tuta absoluta* can be very large, reaching the point of completely compromising the culture (Figure 3).



Figure 3. Tomato crop totally affected by the *Tuta absoluta* attack

In 2021, we continued to monitor the *Tuta absoluta* attack in the protected spaces grown with tomatoes from Dăbuleni and Grădinari. Following the data presented in Table 3 and Figures 4 and 5, it is found that, as the temperature inside the protected space increases,

the number of adults of *Tuta absoluta* is increasing. Following the data in Figure 4, we find that, if at the beginning of July 98 adults of *Tuta absoluta* were registered on an adhesive board, their number increased as time progressed, reaching 416 adults on the same board in only 50 days. After this date, the presence of the pest begins to decrease, so that on October 4, on an adhesive board are registered about 157 adults. The number of adults registered daily follows the same course, starting from 1.2 adults / day at the beginning of July, reaching a maximum of 41.6 adults / day at the end of August, after which it decreases until the beginning of October.

Table 3

Evolution of air and soil temperature (Dăbuleni, 2021)

Time interval	Air temperature (°C)		Soil temperature (°C)	
	Average / decade	Monthly average	Average / decade	Average / decade
April 11-20	16.5	18.7	13.4	14.5
April 21-30	20.9		15.7	
May 01-10	26.4	25.4	18.9	20.9
May 11-20	27.0		23.8	
May 21-31	22.7		20.2	
June 01-10	24.3	26.6	18.6	20.5
June 11-20	24.6		20.0	
June 21-30	30.9		23.0	
July 01-10	28.5	29.2	22.2	22.5
July 11-20	29.7		23.0	
July 21-31	29.3		22.2	
August 01-10	29.6	27.6	21.4	21.0
August 11-20	28.0		21.8	
August 21-31	25.3		19.7	
September 01-10	22.4	22.6	17.2	18.0
September 11-20	24.1		18.4	
September 21-30	21.2		18.4	

Monitoring the presence of the pest *Tuta absoluta* in the Grădinari basin, Olt was carried out between May and September, 2021. The data presented in figure 5 show that the presence of the pest *Tuta absoluta* is reported since May 13, when 141 adults were registered on a adhesive board. Every day, as the temperature inside the protected area increases, we register more and more individuals, so that at the beginning of September the number of individuals on

an adhesive board was 461. The number of individuals registered per day increased from 3.8 individuals / day on May 13 to 35.4 individuals / day registered on September 2, although there were periods within the time interval in which the number of individuals also registered slight decreases.

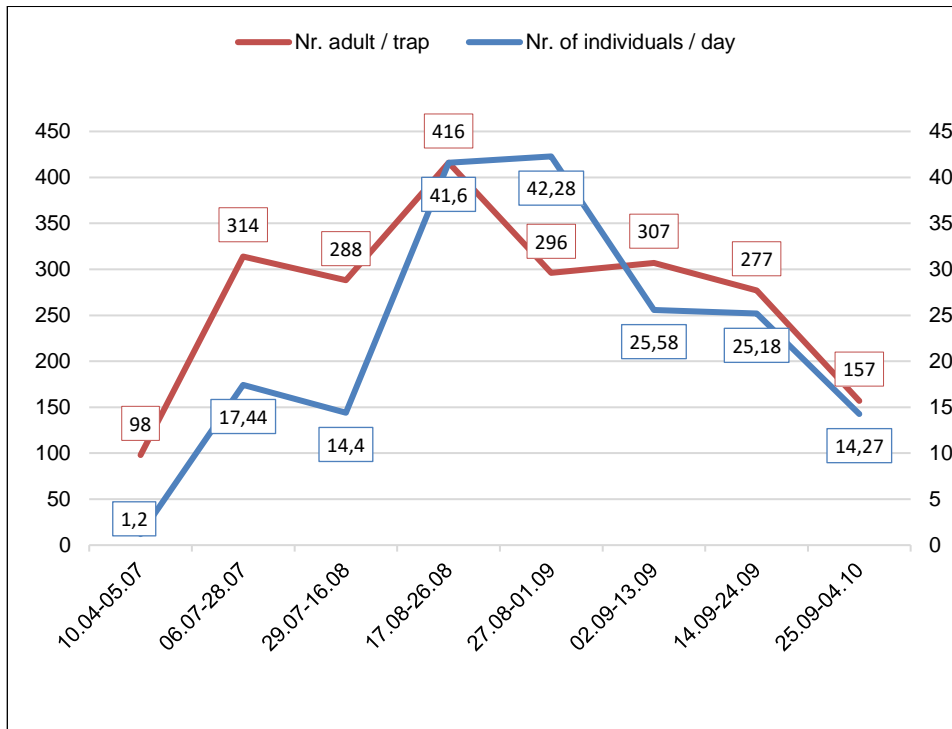


Figure 4. Monitoring *Tuta absoluta* individuals, collected in Delta traps, Dăbuleni 2021

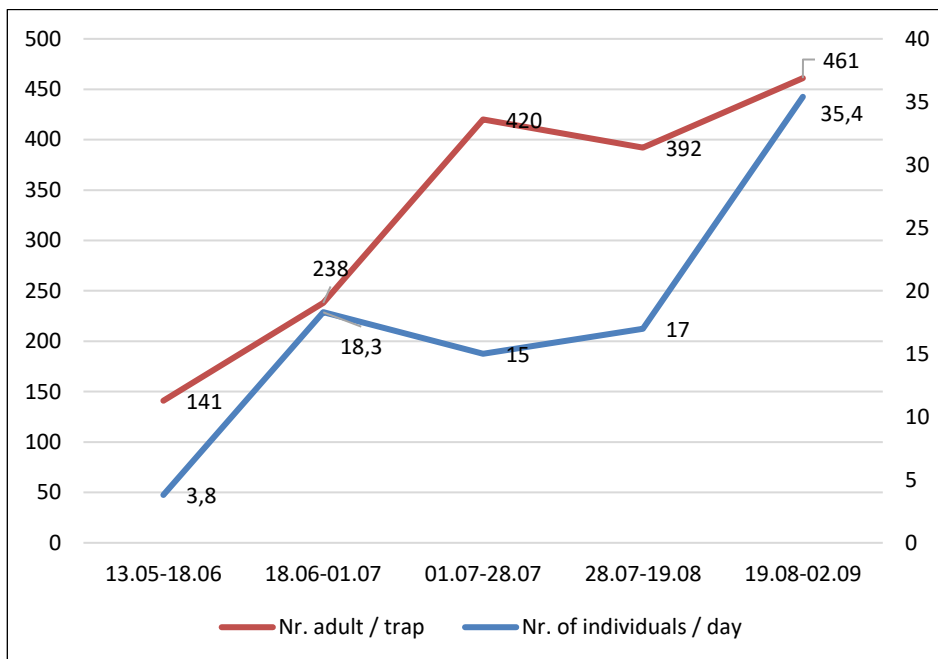


Figure 5. Monitoring *Tuta absoluta* individuals, collected in Delta traps, Grădinari 2021

CONCLUSIONS

The pest *Tuta absoluta* causes damage in all phases of vegetation, in all the above-ground organs of tomato plants, producing galleries in the attacked organs (leaves, fruits, shoots).

The intensity of the attack increases with the temperature in the culture spaces.

Without taking other agro-phytotechnical measures, rational crop rotations, biological control, etc., phytosanitary treatments fail to stop the *Tuta absoluta* attack.

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