

ASPECTS REGARDING THE APPEARANCE AND EVOLUTION OF THE PEST *TUTA ABSOLUTA* (LEPIDOPTERA: GELECHIIDAE) IN TOMATO CROPS IN GREENHOUSES

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Abstract

The most important vegetable crop in the world in greenhouses is tomato (*Solanum lycopersicum* L.) with an yield of 182 MT per year. *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae) commonly known as "tomato leafminer" or "South American tomato moth" is the main pest in tomato crops in greenhouses, that can cause economic losses of up to 80-100%, if appropriate control measures are not taken. The experience was carried out during 2 years (2020-2021), between July and September, in greenhouse conditions (second cycle) in Vărăști village (Giurgiu county). The pest population was dynamically monitored by placing pheromone traps in the tomato crops in the high plastic tunnels, the average of the captured adults being 3367.5. In both years, the climatic conditions were favorable for the appearance and evolution of the pest attack. To prevent the spread of the attack, chemical treatments were applied at intervals of 7-10 days. In 2021, the yield obtained was with 4.76% higher than in 2020.

Keywords: crop, pest, tomato, trap

1. INTRODUCTION

The most important vegetable crop in the world in greenhouses is tomato (*Solanum lycopersicum* L.) with an yield of 182 MT per year (Mzibra et al., 2021). Numerous pests are present in tomato crops, like *Helicoverpa armigera*, *Macrosiphum euphorbiae*, *Trialeurodes vaporariorum*, *Tetranychus urticae* and *Thrips tabaci*, but the most dangerous is *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae) commonly known as "tomato leafminer" or "South American tomato moth". It has invaded more than 90 countries outside of South America, being a major threat to global tomato production (Desneux et al., 2021) and can cause economic losses of up to 80-100%, if appropriate control measures are not taken (Poudel and Kafle, 2021). Like other invasive species, *T. absoluta* spread rapidly through the importation of tomato fruits and infected packaging materials (Kumari et al., 2021).

The pest attack is easily to recognize. The larvae attacks apical buds, stems, foliage and green or ripe fruits (Moreno et al., 2017; Hoge, 2020). In the second cycle of crop, it strongly affects the growth peak of the plant.

T. absoluta is a poikilothermous insect and temperature is an important factor, because it affecting their biology and ecology (Mohamed et al., 2022).

The experience was at a farmer from Vărăști village (Giurgiu County) and has as purpose the monitoring of *T. absoluta* pest, in the second crop cycle in 2020 and 2021.

2. MATERIALS AND METHODS

The experience was carried out during 2 years (2020-2021), between July and September (cycle II of crop), in greenhouse conditions in Vărăști village (Giurgiu County). In both years, the biological material was Zadurella F1 hybrid, resistant to *Fusarium oxysporum* f.sp. *lycopersici*, *Fusarium oxysporum* f.sp. *radicis-lycopersici*, *Verticillium dahliae* and *Tobacco mosaic virus* pathogens.

Pest population was dynamically monitored by placing Delta pheromone traps in tomato crops. On the sticky plate of Delta trap is a bait with the active substance (3E, 8Z, 11Z)-3,8,11-Tetradecantrienil acetat, placed in a rubber stopper. Every 7 days, the number of adults caught on the sticky plates of the Delta trap was recorded. The surface of the plate is 397.75 cm² (21.5 x 18.5 cm).

To prevent the spread of the attack, chemical treatments were applied at intervals of 7-10 days with products based on different active ingredients, like chlorantraniliprole, metaflumizone, emamectin benzoate, cyantraniliprol and spinosad. The products were applied alternatively to prevent the occurrence of pest resistance. Before harvesting, the waiting period for each product was respected. During the 2 years, the occurrence and evolution of the pest attack were noted every 10 days and the degree of attack and the frequency of the attacked fruits were calculated. The yield obtained was also recorded.

3. RESULTS AND DISCUSSIONS

In both years, the climatic conditions were favorable for the appearance and evolution of the pest attack (the mean of the average temperature was 28.1°C in 2020 and 26.6°C in 2021 and average of relative air humidity was 55.1% in 2020 and 55.3% in 2021; table 1 and 2). In 2020, the average of adults captured on sticky places, between July and September, was 3616 adults and in 2021, in the same period, number was 3119 adults captured (fig. 1).

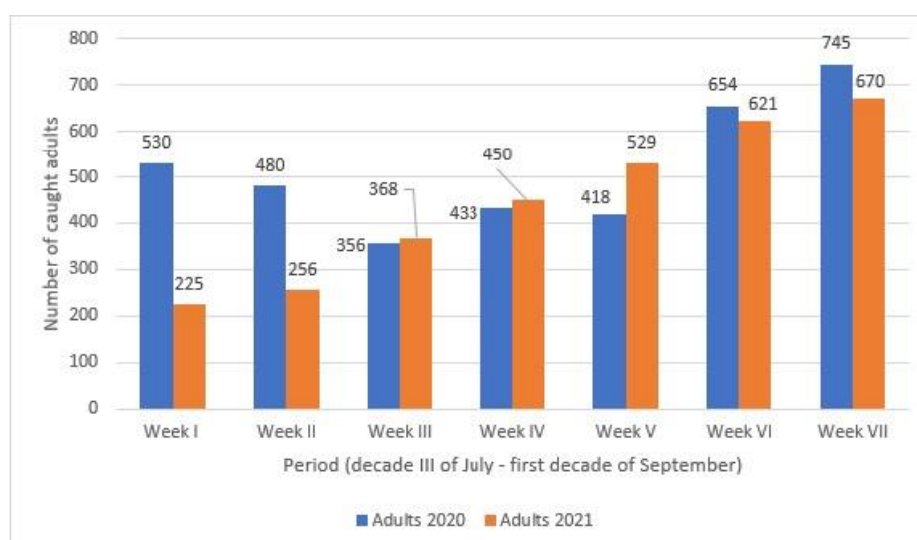


Figure 1. Dynamics of captured adults between July and September (2020 and 2021)

In 2020, the attack occurred on 23.07, and 6 days later in 2021 (29.07; tables 1 and 2).

In the first year, nine treatments were applied at intervals of 7 - 10 days, with Alverde (metaflumizone 240 g/l) 0.1%, Affirm (emamectin benzoate 0.95%) 0.15%, Benevia

(cyantraniliprole 100 g/l) 0.0125%, Laser 240 SC (spinosad 240 g/l) 0.05%, Coragen 0.0175% (clorantraniliprole 200 g/l), Affirm 0.15%, Alverde 0.1%, Laser 240 SC 0.05% and Coragen 0.0175%, in succession. In 2021, were applied seven treatments with the same products (Alverde 0.1%, Affirm 0.15%, Laser 240 SC 0.05%, Coragen 0.0175%, Laser 240 SC 0.05%, Benevia 0.0125%, Coragen 0.0175%). After each treatment, the waiting period until harvesting specific to each product was respected (Alverde, Affirm and Laser 240 SC – 3 days, Benevia – 7 days, Coragen – 1 day).

Table 1. The appearance and evolution of the *T. absoluta* attack on the tomato leaves and fruits between July and September 2020

Climatic factors / Pest	The date of the attack appearance		Degree of attack (%) and the frequency of the attacked fruits (%)					Average
			July	August			September	
			III	I	II	III	I	
<i>Tuta absoluta</i>	23.07	DA treated (%)	0.5	1.7	4.0	7.8	8.9	-
		DA untreated (%)	3.6	12.3	15.5	18.4	36.4	-
		FA treated (%)	0	0	0.1	1.3	2.0	-
		FA untreated (%)	0	0.9	2.9	4.1	5.6	-
Minimum T. (°C)	-	-	18.1	17.6	16.7	16.7	15.9	17.0
Average T. (°C)	-	-	29.6	29.9	26.9	28.7	25.4	28.1
Maximum T. (°C)	-	-	43.0	42.2	40.5	43.4	37.4	41.3
Minimum R.H. (%)	-	-	24.6	18.6	24.5	17.5	32.9	23.6
Average R.H. (%)	-	-	58.7	44.4	57.6	52.7	62.0	55.1
Maximum R.H. (%)	-	-	91.9	77.9	87.5	89.4	79.8	85.3

In 2020, the degree of attack on foliage reached its maximum value in the first decade of September (8.9%) and the frequency of attacked fruits was 2.0%, in the treated variant. In the untreated control variant, the degree of attack on the foliage, in the same period, was 36.4% and the frequency of attacked fruits 5.6% (table 1).

Aspects of tomato crops and sticky plates of traps from the second decade of August are shown in figures 2 and 3.



Figure 2. Aspect from crop and sticky plate with captured adults (2020)



Figure 3. Aspect from crop and sticky plate with captured adults (2021)

In 2021, for the treated variant, in the first decade of September, the maximum value of the degree of attack on the foliage was recorded (8.2%) and the frequency of attacked fruits was 1.7%. The degree of attack on foliage (fig. 4) in the untreated control variant was 33.2% and the frequency of attacked fruits was 4.7% (table 2).

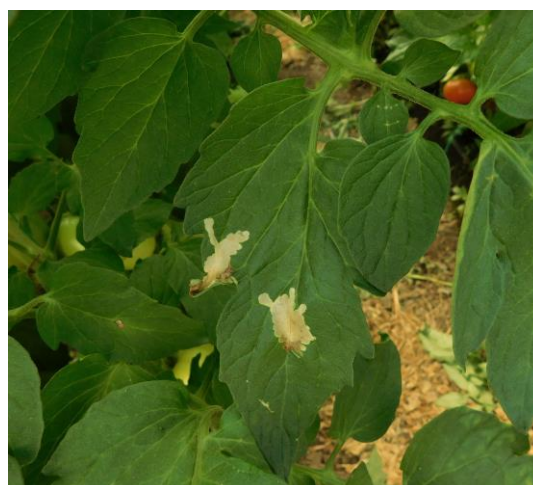


Figure 4. T. absoluta attack on tomato leaves

Table 2. The appearance and evolution of the *T. absoluta* attack on the tomato leaves and fruits between July and September 2021

Climatic factors / Pest	The date of the attack appearance	DA treated (%)	Degree of attack (%) and the frequency of the attacked fruits (%)					Average
			July	August			September	
			III	I	II	III	I	
<i>Tuta absoluta</i>	29.07	DA treated (%)	0.3	1.5	3.5	7.1	8.2	-
		DA untreated (%)	3.3	11.9	14.2	16.2	33.2	-
		FA treated (%)	0	0	0	1.1	1.7	-
		FA untreated (%)	0	0.7	2.3	3.8	4.7	-
Minimum T. (°C)	-	-	18.8	16.8	18.0	15.7	10.6	16.0
Average T. (°C)	-	-	25.7	30.1	29.2	25.9	22.1	26.6
Maximum T. (°C)	-	-	32.8	45.6	42.7	39.4	37.2	39.5
Minimum R.H. (%)	-	-	13.2	19.4	21.9	26.5	20.6	20.3
Average R.H. (%)	-	-	57.8	53.6	52.0	59.4	53.8	55.3
Maximum R.H. (%)	-	-	85.8	89.6	82.1	88.8	85.7	86.4

The yield obtained at treated variant was higher with 4.76% in 2021 than in 2020. In 2020 the yield was 6.880 kg/m² and the difference compared to untreated control variant was +0.890 kg/m² (table 3). In 2021 the total yield was 7.208 kg/m² with a yield difference of +0.94 kg/m² compared to untreated control.

Table 3. The yield obtained in 2020 and 2021

Variant	Yield					
	kg/m ²		Difference from untreated control (kg/m ²)		% to the untreated control	
	2020	2021	2020	2021	2020	2021
V1. Treated ^{*)}	6.880	7.208	+0.890	+0.780	114.8	112.2
V2. Untreated control	5.990	6.425	-	-	100.0	100.0

^{*)} succession of treatments

4. CONCLUSIONS

- The climatic factors recorded (average temperature and average relative humidity) in the greenhouse, during the 2 experimental years, were favorable to the appearance and evolution of the attack of the pest *T. absoluta* (tomato leafminer).
- The succession of treatments ensured a good protection of the crop against the pest *T. absoluta*.
- The number of adults captured in 2020 was 3616 and in 2021, 3119 (15.93% more).

- In 2021, degree of attack on leaves, at the end of the experience was 33.2%, at untreated control, compared with 36.4% in 2020 and the frequency of the attacked fruits was also higher in 2020 (5.6%) brought into comparison to 2021 (4.7%).
- Compared to the untreated control variant, the yield obtained was 14.8% higher in 2020 and 12.2% in 2021.

5. ACKNOWLEDGEMENTS

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