

ASPECTS CONCERNING THE MONITORING OF THE PEST *TUTA ABSOLUTA* (MEYRICK) (LEPIDOPTERA: GELECHIIDAE) WITH PHEROMONE TRAPS ON TOMATO CROP UNDER HIGH PLASTIC TUNNELS

ASPECTE PRIVIND MONITORIZAREA DĂUNĂTORULUI *TUTA ABSOLUTA* (MEYRICK) (LEPIDOPTERA: GELECHIIDAE) CU CAPCANE FEROMONALE LA CULTURA DE TOMATE DIN SOLARII

HOGEA Simona Ștefania^{1*}

*Corresponding author e-mail:hogea.simona@yahoo.com

Abstract. *Tuta absoluta* (tomato leafminer) is a pest that causes significant damage on tomato protected crops. The larvae attack both foliage and fruit during all tomato growth stages. The experience done at the R.I.V.F.G Vidra, in 2020, had as purpose the monitoring of this pest on tomato crop under high plastic tunnels using Delta trap with pheromones. Two traps were placed in 2 high plastic tunnels, one of which with insect proof net. The number of adults caught in the Delta traps was recorded weekly in the period May - August and varied between 14 and 583 (in the high plastic tunnel with insect-proof net) and between 9 and 708 (in the high plastic tunnel without net), respectively. The evolution of the pest attack on 3 different tomato hybrids was studied: Prekos F1, Beldine F1 and Siriana F1.

Key words: pest, tomato, tomato leafminer

Rezumat. *Tuta absoluta* (molia minieră a tomatelor) este un dăunător care produce pagube importante culturilor de tomate din spații protejate. Larvele atacă atât foliajul, cât și fructele, în toate stadiile de vegetație ale plantelor. Experiența realizată la I.C.D.L.F Vidra, în anul 2020, a avut ca scop monitorizarea dăunătorului la cultura de tomate din solarii, cu ajutorul capcanelor Delta cu feromoni. S-au amplasat două capcane în 2 solarii, dintre care unul cu plasă insect-proof. Numărul adulților capturați în capcanele Delta a fost înregistrat săptămânal în perioada mai - august și a variat între 14 și 583 (în solarul cu plasă „insect-proof”) și respectiv între 9 și 708 (în solarul fără plasă de protecție). S-a studiat evoluția atacului dăunătorului pe 3 hibrizi de tomate diferiți: Prekos F1, Beldine F1 și Siriana F1.

Cuvinte cheie: dăunător, tomate, molia minieră a tomatelor

INTRODUCTION

Tuta absoluta (tomato leafminer) is a major pest of tomato crops (Braham and Hajji, 2012), which can reduce yield by more than 90% (Batalla-Carrera et al., 2010).

¹Research and Development Institute for Vegetable and Flower Growing Vidra, Ilfov, Romania

It can also attack crops such as: potato, eggplant, pepper, tobacco and European black nightshade (Abbes *et al.*, 2016; Desneux *et al.*, 2010; Biondi *et al.*, 2016; Mohamadi *et al.*, 2017).

The optimal temperature for development is 30°C, and the life cycle varies between 26 and 75 days, depending on the temperature (Biondi *et al.*, 2016) and includes four stages of development: egg, larva, pupa and adult (Desneux *et al.*, 2010).

Females lay eggs on leaves, petioles of leaves and stems. Larvae of all ages feed and grow in the mines inside the leaf, between the upper and lower epidermis, but can also be found in fruits and stems. The pupae are usually found in the soil, but can also be seen on tomato plants. The damage caused by this pest is represented by the larval galleries made on the leaves, terminal buds, flowers and green and ripe fruits (Cubertson *et al.*, 2013).

The Food and Agriculture Organization (FAO) encouraged the use of a *T. absoluta* pest control program in the Mediterranean basin, including in North African countries, to reduce the use of chemical-based pesticides and the use of natural enemies (predators) and pheromone traps (Cabezas, 2019). Thus, a complementary method of this pest control is based on the use of pheromones for the annihilation of males or the interruption of mating (Cocco *et al.*, 2012).

Females of *T. absoluta* emit a specific pheromone that attracts males of this pest. During 1995, the main pheromone component was identified (3E, 8Z, 11Z)-3,8,11-tetradecatrienyl acetate, which was subsequently confirmed by comparison with a synthetic sample (Cabezas, 2019).

MATERIAL AND METHOD

The experiment was done in 2020, at RDIVFG-Vidra. Two traps were placed in 2 high plastic tunnels and 3 different tomato hybrids were used: Prekos F1, Beldine F1 and Siriana F1. No pest control treatments have been carried out in any high plastic tunnels. In the 1P high plastic tunnel, an "insect-proof" protection net was placed on the sides.

Prekos F1 is a very early hybrid, with semi-determined growth. The fruits weigh 160 - 200 g, are smooth, firm, with a sweet taste (www.marcoser.ro).

The Beldine F1 hybrid has undetermined growth, being recommended for all crop cycles. The fruits are uniform, with a very good taste and an intense red color (www.syngenta.ro).

Siriana F1 is a Romanian hybrid of tomatoes, with undetermined growth. The fruits are sweet, weigh 120-180g, are spherical, slightly flattened and large (www.marcoser.ro).

A type of pheromone trap, commonly used, is the Delta trap (fig. 1). It consists of a triangular body (made of paper or plastic) open at the ends, a removable sticky plate (placed inside the triangular body) and a pheromone bait placed in the middle of the sticky plate (Caparros Megido *et al.*, 2013). The pheromone bait has as active substance (3E, 8Z, 11Z)-3,8,11-Tetradecatrienyl acetate and its duration of action is usually 4-6 weeks.

The sticky plate from the Delta trap was changed weekly when its surface was full of captured adults. The surface of the plate has the size of 397.75 cm² (21.5 x 18.5 cm).



Fig. 1 Delta trap with adults caught in tomato crop



Fig. 2 *Tuta absoluta* adults caught on the sticky plate

The number of adults caught on the sticky plate of the Delta trap was recorded weekly (fig. 2), between May and August, 2020 (fig. 3, fig. 4).



Fig. 3 Adults caught on the sticky plate (23th June)

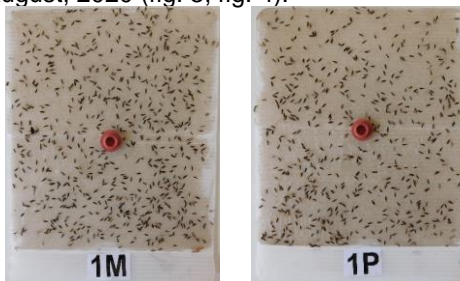


Fig. 4 Adults caught on the sticky plate (21st August)

The degree of attack was calculated according to the S.O.P./March standard 2010. The damage assessment was done on 10 plants from each variant and 5 leaves from each plant were chosen (50 leaves/variant).

RESULTS AND DISCUSSIONS

Following the observations, it was found that the Beldine F1 hybrid is less sensitive to pest attack (GA% = 1.46% and 2.34%, respectively; tab. 1).

Table 1

The degree of attack for each hybrid depending on the type of protection

	Variant	Degree of attack (%)	Difference from control (%)	Signification of the difference (%)
1.	Proof-insect net + Prekos F1	2.73	-0.32	-
2.	Proof-insect net + Beldine F1	1.46	-1.59	**
3.	Proof-insect net + Siriana F1	2.75	-0.30	-
4.	No Proof-insect net + Prekos F1	2.94	-0.11	-
5.	No Proof-insect net + Beldine F1	2.34	-0.71	-
6.	No Proof-insect net + Siriana F1 (control)	3.05	-	-

LSD 5% = 0.94; LSD 1% = 1.27; LSD 0.1% = 1.75

Regardless of the hybrid used, the insect-proof net has an insignificant influence on the attack of the pest *T. absoluta* (tab. 2).

Table 2

The influence of the net on the *Tuta absoluta* attack

Type of protection	Degree of attack (%)	Difference from control (%)	Signification of the difference
With insect-proof net	2.31	-0.46	-
No insect-proof net (control)	2.77	-	-

LSD 5% = 0.94; LSD 1% = 1.27; LSD 0.1% = 1.75

Regardless of the type of protection, the Beldine F1 hybrid has a significant negative degree of attack compared to the Syrian F1 hybrid considered as a control (tab. 3).

Table 3

The influence of the hybrid on the *Tuta absoluta* attack

Hybrid	Degree of attack (%)	Difference from control	Signification of the difference
Prekos F1	2.84	-0.06	-
Beldine F1	1.90	-1.0	*
Siriana F1 (control)	2.90	-	-

LSD 5% = 0.94; LSD 1% = 1.27; LSD 0.1% = 1.75

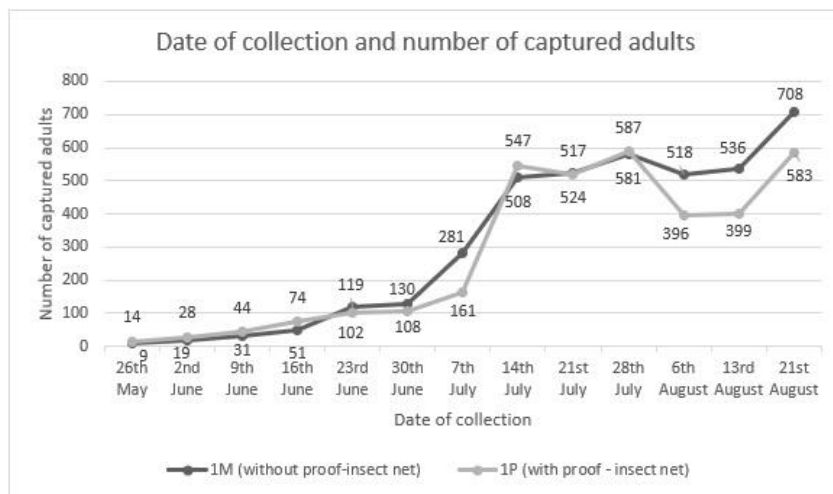


Fig. 5 The date of collection on pheromone plates and the number of adults caught between May and August

The number of adults captured from the two high plastic tunnels, in May-July, is similar, but starting with August, a higher number of adults was registered in the high plastic tunnel without insect – proof net (fig. 5). Consequently, the

plants are more affected (fig. 6) in this high plastic tunnel, while in the protected high plastic tunnel with insect – proof net, the plants are less attacked by the pest (fig. 7).



Fig. 6 Tomato crop in the high plastic tunnel without insect proof net



Fig. 7 Tomato crop in the high plastic tunnel with insect proof net

CONCLUSIONS

1. Delta traps with pheromones facilitate the monitoring of the number of adults present in tomato crops and at the same time, contribute to its numerical decrease.
2. Insect-proof nets prevent entering the pests from the outside, thus contributing to its numerical reduction compared to unprotected high plastic tunnels.
3. Among the experimented hybrids, Beldine F1 is less sensitive to the attack of the pest *T. absoluta*.

Acknowledgments: Work carried out within the Sectorial Plan for Rural Research-Development ADER 2020, financed by MADR, Project 7.3.15. "Establishing measures and means for integrated pest prevention and control *Tuta absoluta*, the tomato leafminer in greenhouse tomato crops" (contract nr. 7.3.15/16.09.2019).

REFERENCES

1. Abbes K., Harbi A., Elimem M., Hafsi A., Chermiti B., 2016 - Bioassay of three solanaceous weeds as alternative hosts for the invasive tomato leafminer *Tuta absoluta* (Lepidoptera:Gelechiidae) and insights on their carry over potential. Afr. Entomol. 24:334–42.
2. Batalla - Carrera L., Morton A., Garcia – del - Pino F., 2010 - Efficacy of entomopathogenic nematodes against the tomato leafminer *Tuta absoluta* in laboratory and greenhouse condition. BioControl 55:523-530, DOI 10.1007/s10526-010-9284-z.

3. **Biondi A., Guedes R.N.C., Wan F.-H., Desneux N., 2016** - *Ecology, Worldwide Spread and Management of the Invasive South American Tomato Pinworm, Tuta absoluta: Past, Present and Future*. Annual Review of Entomology, 63:239–58.
4. **Braham M., Hajji L., 2012** - *Management of Tuta absoluta (Lepidoptera, Gelechiidae) with Insecticides on Tomatoes*. Insecticides - Pest Engineering Dr. Farzana Perveen (Ed.), ISBN: 978-953-307895-3, InTech, Available from: <http://www.intechopen.com/books/insecticides-pest-engineering/managementof-tuta-absoluta-lepidoptera-gelechiidae-with-insecticides-on-tomatoes>
5. **Cabezas J.A., 2019** - *A new and efficient synthesis of (3E,8Z,11Z)-tetradeca-3,8,11-trienyl acetate, the major sex pheromone component of the tomato leafminer Tuta absoluta*. Tetrahedron Letters 60, 407–410.
6. **Caparros Megido R., Haubruge E., Jean Vereggen F., 2013** - *Pheromone-based management strategies to control the tomato leafminer, Tuta absoluta (Lepidoptera: Gelechiidae)*. A review. Biotechnol. Agron. Soc. Environ. 17(3), 475-482.
7. **Cocco A., Deliperi S., Delrio. G., 2012** - *Control of Tuta absoluta (Meyrick) (Lepidoptera: Gelechiidae) in greenhouse tomato crops using the mating disruption technique*. J. Appl. Entomol., doi: 10.1111/j.1439-0418.2012.01735.x.
8. **Cuthbertson A.G.S., Mathers J.J., Blackburn L.F., Korycinska A., Luo W., Jacobson R.J., Northing P., 2013** - *Population Development of Tuta absoluta (Meyrick) (Lepidoptera: Gelechiidae) under Simulated UK Glasshouse Conditions*. Insects, 4, 185-197; doi:10.3390/insects4020185-.
9. **Desneux N., Wajnberg E., Wyckhuys K.A.G., Burgio G., Arpaia S., Narvaez-Vasquez C.A., Gonzalez-Cabrera J., Ruescas D.C., Tabone E., Frandon J., Pizzol J., Poncet C., Cabello T., Urbaneja A., 2010** - *Biological invasions of European tomato crops by Tuta absoluta: ecology, geographic expansion and prospects for biological control*. J. Pest. Sci. 83:197-215.
10. **Mohamadi P., Razmjou J., Hassanpour M., 2017** - *Population Growth Parameters of Tuta absoluta (Lepidoptera: Gelechiidae) on Tomato Plant Using Organic Substrate and Biofertilizers*. Journal of Insect Science, 17(2):36; 1-7, doi: 10.1093/jisesa/lex011.
11. ****, www.marcoser.ro
12. ***, www.syngenta.ro