

## THE DYNAMICS OF TOMATO LEAFMINER *TUTA ABSOLUTA* (MEYRICH, 1917) (LEPIDOPTERA: GELECHIIDAE) IN PROTECTED TOMATO CROPS FROM MUNTENIA REGION (ROMANIA)

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**Abstract:** The South American native species *Tuta absoluta* is recognized as a tomato pest with fulminant dispersal ability in the new invaded areas. *T. absoluta* monitoring in all tomato-producing regions of the country is a vital step in early detection and integrated management decision-making. The aim of the study was to elucidate the interval of occurrence and population dynamics of *T. absoluta* in Muntenia region, respectively the vegetable basin that supply Bucharest northern markets. The paper presents the results of pest monitoring carried out in 2016, 2017, 2018 and 2019, by using pheromone-baited traps and also by visual inspection of tomato crops in various greenhouses in four localities from Bucharest surrounding area. The study provides first systematic monitored data about *T. absoluta* dynamics in protected tomato crops from southern Romania. Depending on year weather conditions, in the greenhouses tomato crops from the investigated area, the tomato leaf miner completed maximum 3 to 4 generations from spring to autumn and the degree of attack on tomatoes reached its maximum at the end of the second vegetation cycle. There was also noted a steady annual increase in the number of adult catches and degree of attack on tomatoes in the protected crop from analysed area.

**Key words:** *Tuta absoluta*, tomato leaf miner, pheromone traps, AtraTut-S

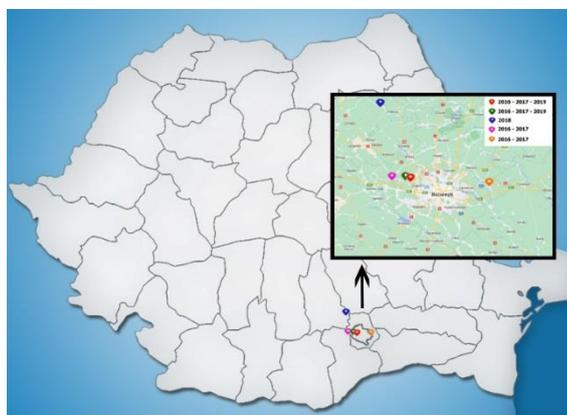
### INTRODUCTION

*Tuta absoluta* (Meyrich 1917) (Lepidoptera: Gelechiidae), known as the tomato leaf miner or South American tomato moth, is an invasive species, that have proven its extraordinary dispersal ability since, after entering in Europe, and pest first mention in 2006 in the province of Castellon (Spain), has rapidly spread in the first 10 year after invading in Mediterranean Basin and most of Europe, Africa and Asia countries (Mansour et al., 2018). In Romania, the occurrence of *T. absoluta* was reported for the first time in 2009 in north and western part of the country and the very next year in southern Romania on tomato plants grown in some greenhouses near Bucharest, in Ilfov County (Leaota, 2009; Cean & Dobrin, 2010). According to a recent review, by 2017 *T. absoluta* spread in all the major vegetable producing areas of Romania (Husariu et al. 2017). Due to this, *T. absoluta* monitoring in all tomato-producing regions of the country is a vital step in early detection and integrated management decision-making. On the other hand, no data were available regarding the situation of pest in southern Romania. Sex pheromones are species specific and widely used as a method for pest population detection and monitoring (Svatos et al., 1996, Witzgal et al., 2010).

The aim of this study was to elucidate the interval of occurrence and *T. absoluta* population dynamics in the area surrounding northern Bucharest, by using pheromone-baited traps and also by visual inspection of tomato infested plants.

## MATERIAL AND METHODS

The study was performed in four successive years, from 2016 to 2019, in five greenhouses located in four localities from the vegetable growing areas in Giurgiu, Dambovita and Ilfov Counties in the northern Bucharest proximity (Figure 1).



**Figure 1.** Selected greenhouse locations in Bucharest area, on Romanian map

Every year, from April to October, at least one out of five tomato greenhouses, cultivated with “Prekos” variety of tomato, which were managed with conventional or biological means (Table 1), have been used for the survey. Except Pasarea greenhouse, where two vegetation cycles were set up, the rest of tomato crop were under prolonged cropping systems, in all years and locations. At the start of the collaboration, all the farmers mentioned that they had heard about *T. absoluta* but the pest did not create any problems in their own greenhouses.

At the beginning of every tomato vegetation cycle 100 tomato plants, randomly selected and marked, were used to determine the level of *T. absoluta* larvae attack. The evaluation consisted of weekly observation using 10x magnification hand lens and counting the number of larval mines on leaves. At harvest, 100 tomato fruits were analysed and all galleries generated by *T. absoluta* larvae were accounted.

To monitor the adult’s activity, sex pheromones lures AtraTut-S coupled with white Delta traps from Raluca Ripan Institute for Research in Chemistry, Cluj-Napoca, were used. All traps were installed in greenhouses early April, regardless when the tomatoes were transplanted. The number of *T. absoluta* adult caughts on sticky insertion inside Delta traps were recorded weekly. The sex pheromones lures were replaced every 4 weeks. Weather data were taken from the nearest official weather station (Bucharest Baneasa) and precipitations from local measurement, performed by collaborating farmers at Dragomiresti Vale (in 2016, 2017 and 2019) and Bilciuresti (2019).

**Table 1.** Details about the study greenhouses

Greenhouse ID code	Locality	Year(s) of study	Type of pest management
Jo	Joita (Giurgiu County)	2016, 2017	Biological
DV-1	Dragomiresti Vale ( Ilfov County)	2016, 2017, 2019	IPM
DV-2	Dragomiresti Vale ( Ilfov County)	2016, 2017, 2019	IPM
Pa	Pasarea (Ilfov County)	2016, 2017	Biological
Bi	Bilciuresti (Dambovita County)	2018	IPM

## RESULTS AND DISCUSSIONS

Regarding the flight activity of *T. absoluta*, the 2016 survey revealed the first male catches on pheromones traps at the beginning of July. This situation can be explained by weather condition during the beginning of vegetation cycle in the area, characterised by a constant rainy and relatively cold spring. Afterwards, a very low number of *T. absoluta* was observed during summer to fall 2016, no catches in Jo greenhouses and a maximum of 14 adults per week at DV-1 greenhouse in September (Figure 2). According to literature data *T. absoluta* is a multivoltine species with as many as 12 generation per year, depending on environmental conditions (EPPO, 2005). Our preliminary results from 2016 were in contrast with the findings of Baetan et al. in 2013 in a study conducted into greenhouses from west of Romania. This mentions an earlier occurrence of the pest at the end of March and a frequency of attack of approximately 8% in the last week of May. The situation has changed in 2017 in monitored greenhouses from southern Romania, weekly data for adults captured shows the first catches from the late-May to early-June, and a low population during June, trend probably influenced by rain (figure 3). Three flight peaks were noted, first in late July with maximum 9 adults per trap per week, second from late-August to mid-September, when counts reached an average of 26 to 105 adults per trap per week, and a third increasing of catches throughout October (figure 3). Weather conditions in 2018 influenced again the flight pattern of *T. absoluta* adults (figure 4), first male being trapped earlier, during the third week of May, and the flight activity had 3 - 4 peaks: in mid-June (19 adults/trap/week), beginning of August (81 adults/trap/week) and beginning of September (79 adults/trap/week) (figure 4). In 2019, the number of flight peaks increased to four: one in mid-June, second mid-July, 3<sup>rd</sup> late-August to early September and the 4<sup>th</sup> in mid-October (figure 5).

*T. absoluta* larval damage on tomato leaves was extremely low throughout all studied greenhouses in 2016, from no attack at Jo to 0.05 galleries per leaf at DV-1. The sporadically attack on tomato fruit at harvest was observed in only one greenhouse at Dragomiresti Vale (DV- 1) (Table 2).

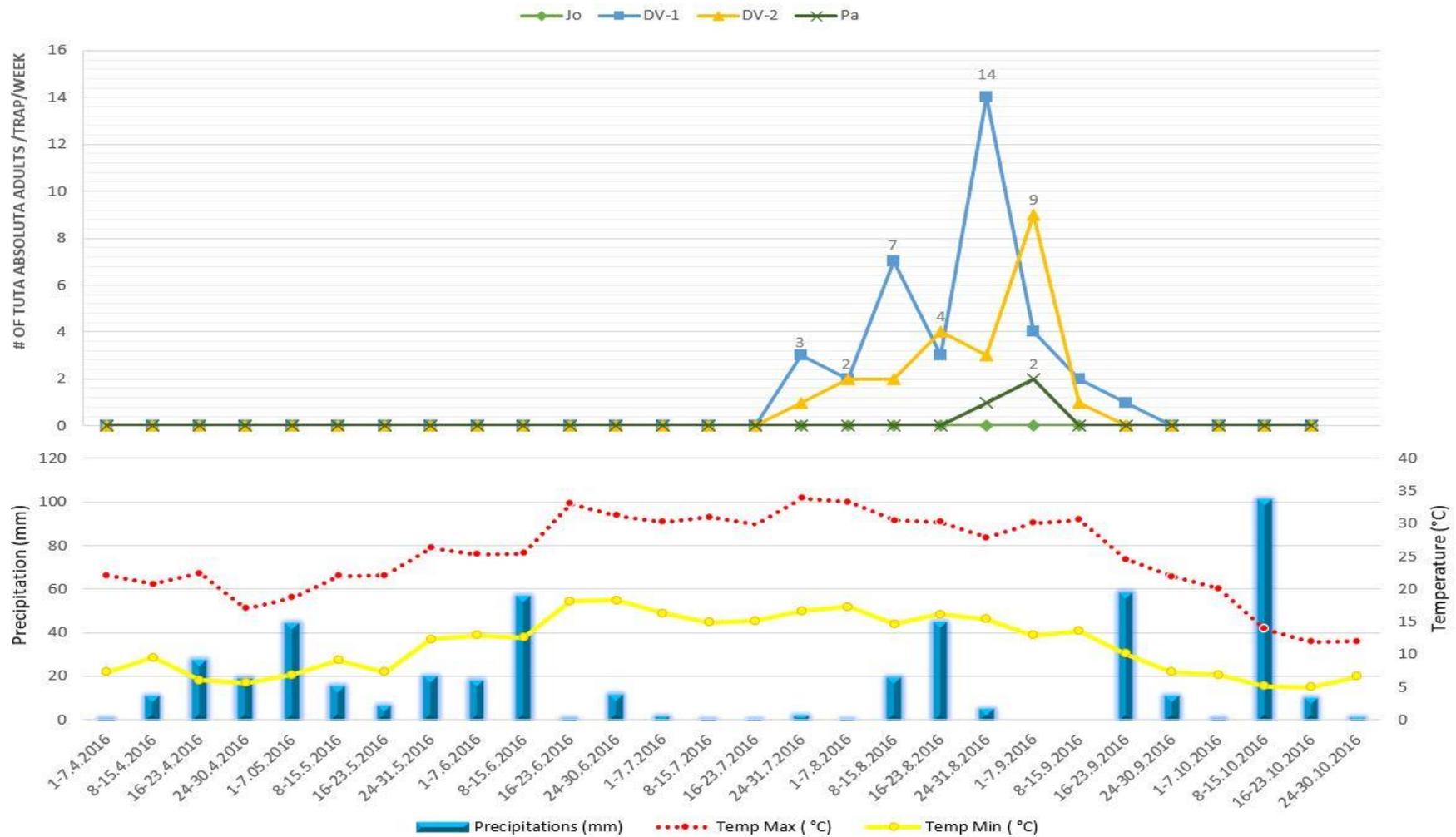
**Table 2.** *Tuta absoluta* larval damages evolution on tomato leaves and fruits in Southern Romania

Greenhouse ID code	Average number of mines per tomato plant parts/Year of study							
	2016		2017		2018		2019	
	Leaf	Fruit	Leaf	Fruit	Leaf	Fruit	Leaf	Fruit
Jo	0.00	0.00	0.21	0.09	-	-	-	-
DV-1	0.05	0.01	0.17	0.06	-	-	0.39	0.22
DV-2	0.03	0.00	0.14	0.05	-	-	0.27	0.14
Pa	0.01	0.00	0.37	0.16	-	-	-	-
Bi	-	-	-	-	0.31	0.19	-	-

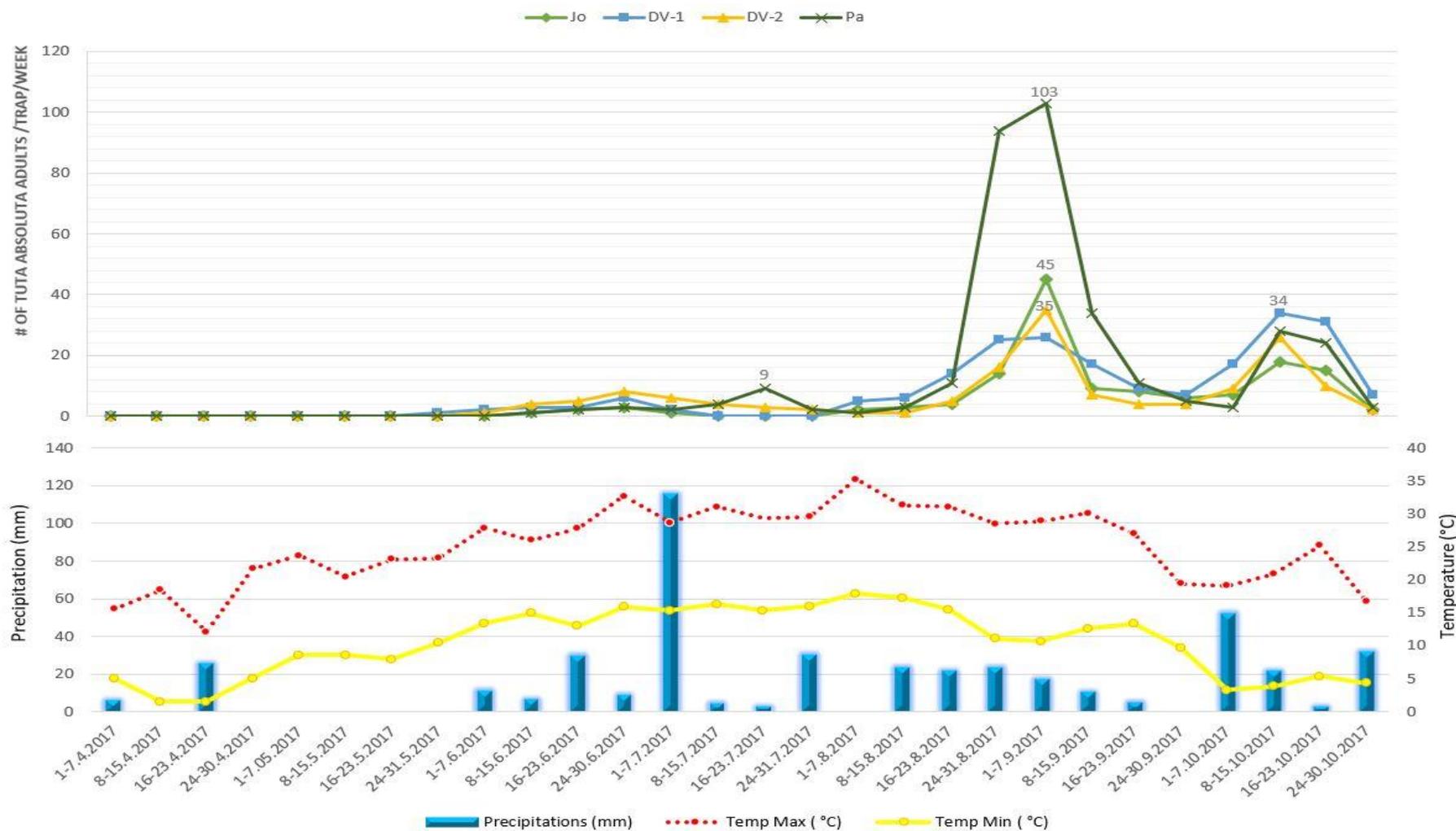
Results from 2017 indicate that the mean number of mines per leaf was, in average, from 0.04 at DV-2 greenhouse to 0.34 at Pa greenhouse. While leaves attack constantly increased in summer to fall, fruit damage was low, throughout all study greenhouses.

In 2018 *Tuta absoluta* larval damage in Bilciuresti greenhouse was rather low throughout the whole growing season, with an average of 0.19 galleries per leaf and 0.05 galleries per fruit.

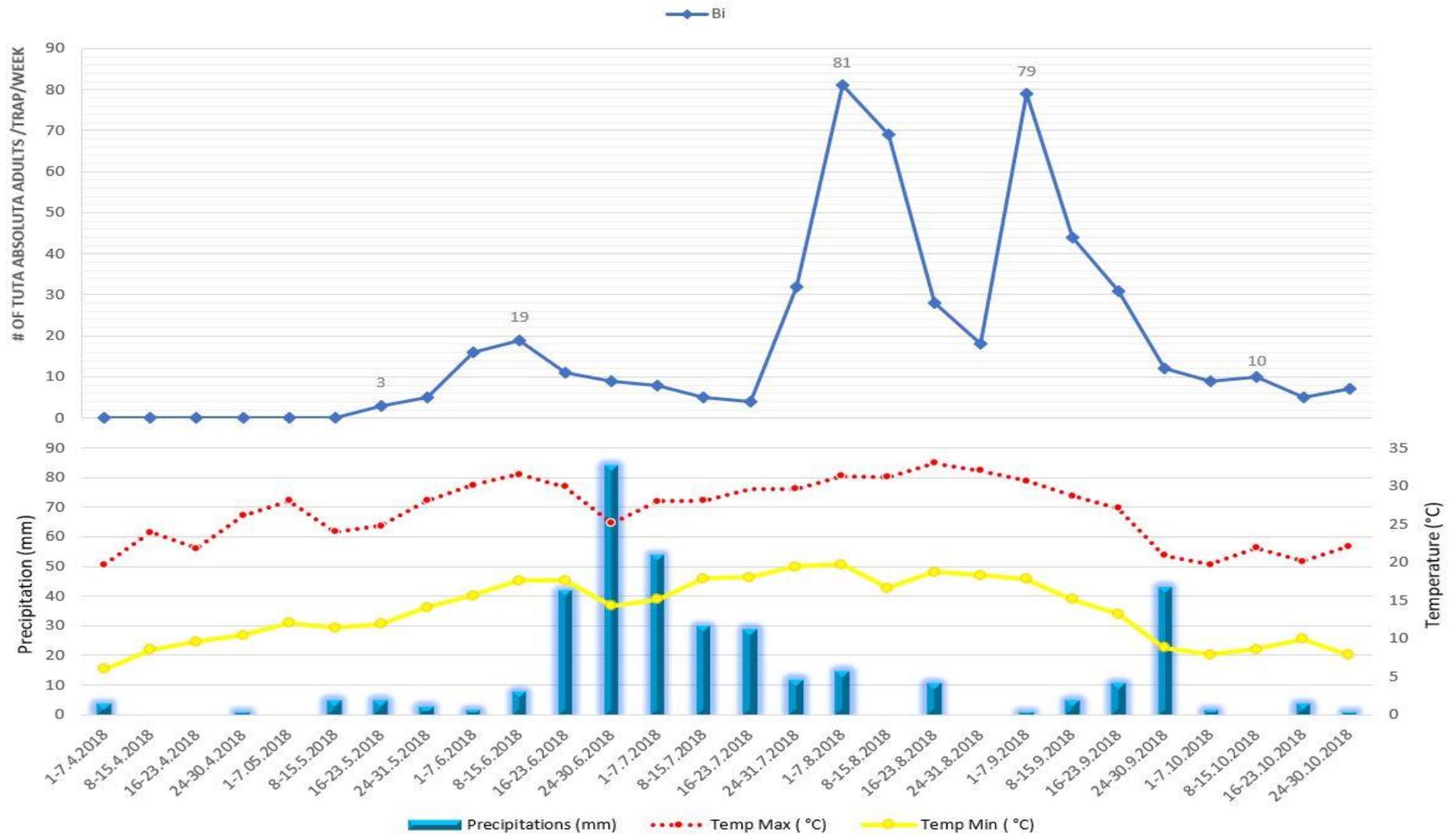
Under 2019 conditions, at both greenhouses from Dragomiresti Vale, the larval damages on tomato obviously increased compared to previously years, attending 0.27 to 0.39 mines per leaf and 0.14 to 0.22 galleries on tomato fruits (table 2).



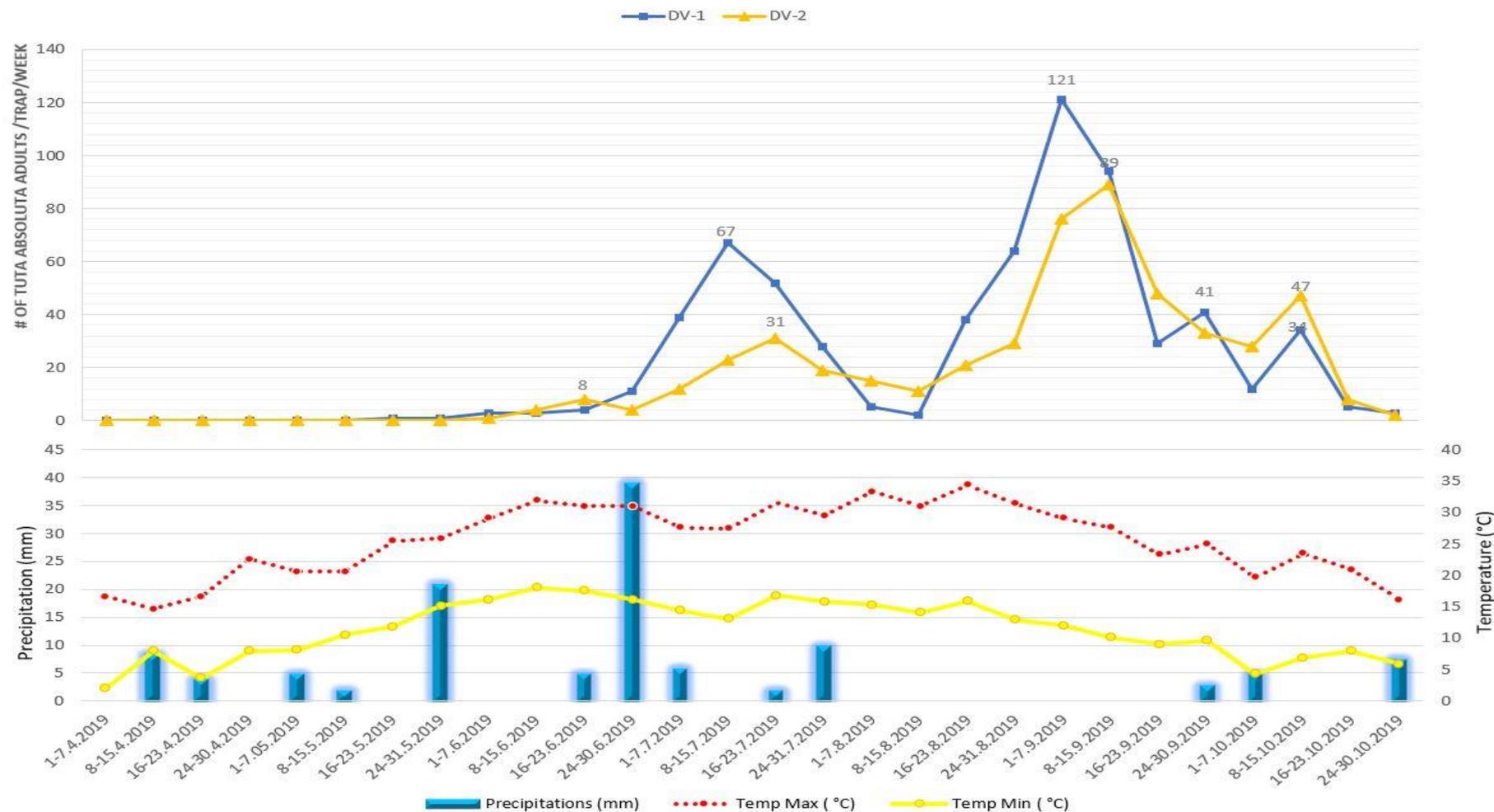
**Figure 2.** The dynamic of *Tuta absoluta* adults weekly catches on pheromone traps and the variation of weather main parameters during tomato vegetation period in 2016 at Jo: Joita; DV-1: Dragomiresti Vale-1; DV-2: Dragomiresti Vale-2; Pa: Pasarea- greenhouses



**Figure 3.** The dynamic of *Tuta absoluta* adults weekly catches on pheromone traps and the variation of weather main parameters during tomato vegetation period in 2017 at Jo: Joita; DV-1: Dragomiresti Vale-1; DV-2: Dragomiresti Vale-2; Pa: Pasarea- greenhouses.



**Figure 4.** The dynamic of *Tuta absoluta* adults weekly catches on pheromone traps and the variation of weather main parameters during tomato vegetation period in 2018 at Bi: Bilciuresti- greenhouse.



**Figure 5.** The dynamic of *Tuta absoluta* adults weekly catches on pheromone traps and the variation of weather main parameters during tomato vegetation period in 2019 at DV-1: Dragomiresti Vale-1; DV-2: Dragomiresti Vale-2 greenhouses.

## CONCLUSIONS

During this study, the occurrence and establishment of tomato leaf miner populations was confirmed for the vegetable producing area surrounding Bucharest.

The study provides first systematic monitored data about *T. absoluta* dynamics in protected tomato crops from southern Romania.

Depending on year weather conditions, in the greenhouses tomato crops from the investigated area, the tomato leaf miner completed maximum 3 to 4 generations from spring to autumn and the degree of attack on tomatoes reached its maximum at the end of the second vegetation cycle, in late-August to mid-September.

There was also noted a steady annual increase in the number of adult catches and degree of attack on tomatoes in the protected crop from analysed area.

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