



## Contribution to the study of some biological aspects of *Tuta absoluta* in the region of Mascara (Algeria)

M. Elouissi<sup>1,2\*</sup> and A. Berkani<sup>2</sup>

<sup>1</sup>Laboratory for Research on Biological systems and Geomatics, Faculty of Nature and Life Sciences, University of Mascara, Algeria

<sup>2</sup>Faculty of Nature and Life Sciences, University of Mostaganem, Algeria

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### ABSTRACT

*Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae), is a serious pest species that recently became a major threat to tomato production in the Mediterranean Basin. In Algeria, it was observed for the first time in 2008. The present study followed some biological aspects of this devastating agent in tomato greenhouses installed in the experimental station of the University of Mascara. Our results showed that sex pheromone traps were effective as *T. absoluta* males were trapped and their number increased during the season (from December, 2013 to July, 2014). Furthermore, dynamics of the populations seem to be closely linked to weather conditions. Captures are maximal when the temperatures vary from 20 to 25 °C and when the hygrometry is situated between 50 and 70 %. On the other hand, we demonstrated that attacks on the first floor are significantly higher than those of the intermediate and superior floors.

**Key words:** *Tuta absoluta*; tomato; Mascara; Greenhouse; Algeria.

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### INTRODUCTION

The tomato (*Lycopersicon esculentum*, Mill) is a member of the Solanaceae family and originated Tropical America, probably in Mexico or in Peru [1]. Tomatoes and tomato products are the most consumed nonstarchy vegetable and are the most significant source of dietary lycopene; a powerful antioxidant that has greater bioavailability after cooking and processing [2]. In 2012, tomato area in the world amounted to 4.8 million hectares, denoting, during the last ten years (2012–2003), an increase of 17.3%. This increase was due essentially to the African (+34.9%) and Asian (+30.8%) continents, which in 2012, represented, respectively, 21.0% and 58.8% of world tomato areas [3].

The tomato borer, *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae), is a serious pest species native to South America that recently became a major threat to tomato production in the Mediterranean Basin [4]. Larvae feed on the mesophyll of all aerial parts of the plants, as well as on the fruit, resulting in significant yield loss and cosmetic damage to fresh market tomato [5]. The potential impact of *T. absoluta* can be very high, in case of introduction of the pest in greenhouses. Both yield and fruit quality can be significantly reduced and crop losses up to 100% have been reported. Without any control measure the potential damage may be 100% [6]. *Tuta absoluta* Meyrick became the most important pest of tomato crops in Algeria since 2008. It causes extensive damage on tomato in the north western of Algeria [7].

The present study followed some biological aspects of this devastating agent in tomato greenhouses installed in the experimental station of the University of Mascara.

## EXPERIMENTAL SECTION

### 2.1. Experimental site

The present study was carried out in plastic greenhouses at the experimental station of the University of Mascara. Mascara province (5941 km<sup>2</sup>) is located in the north west of Algeria, (at 360 km of Algiers) with mediterranean climate and mean annual precipitations of about 450 mm [8,9,10].

### 2.2. Climatic data

Climatic data provided by the laboratory's meteorological station installed in the experimental station.

### 2.3. Trapping of *T. absoluta*

For the capture of adults *T. absoluta*, traps of type *Delta* (INRA) were used. The trap is constituted by a cardboard tent with a mobile stuck cardboard at the bottom and provided with a capsule in charge of pheromone (Fig. 01). Males are mainly attracted.



Figure 01: Trap Delta with pheromone (A) for the capture of adults *Tuta absoluta* (B)

To estimate the population of *Tuta absoluta*, two (02) traps are placed. These traps are positioned at the bottom of the foliage (approximately 1m of the ground) to avoid that they are covered by the vegetation.

To be able to follow the evolution of *Tuta absoluta* populations, observation of the traps was realized every week and the trapped adults were counted and removed to avoid being counted again in the next statement. Pheromone dispensers were replaced every 4 weeks. Patches stuck the traps were regularly changed to avoid their saturation.

### 2.4. Statistical analysis

Mean data values are presented, with their standard deviations (mean  $\pm$  SD). All statistical comparisons were made by Student's *t* test, and statistical significance was defined as  $p < 0.05$ .

## RESULTS AND DISCUSSION

In the Mediterranean Basin and Europe, the tomato crop has recently been affected by the new exotic pest *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae) [11]. Recently, non-insecticide control strategies of *T. absoluta* have been developed, including biological control mating disruption and mass trapping using light and pheromone water traps [12]. The present study aimed to follow the dynamics of *T. absoluta* at greenhouses installed in the experimental station of the University of Mascara.

### 3.1. Spatiotemporal dynamics of the population of *Tuta absoluta*

We made a follow-up of the number of *T. absoluta* trapped in the traps Delta. The dynamics of *Tuta absoluta* followed during the period from December, 2013 till July, 2014 by captures in the traps with pheromone were established (Fig.02).

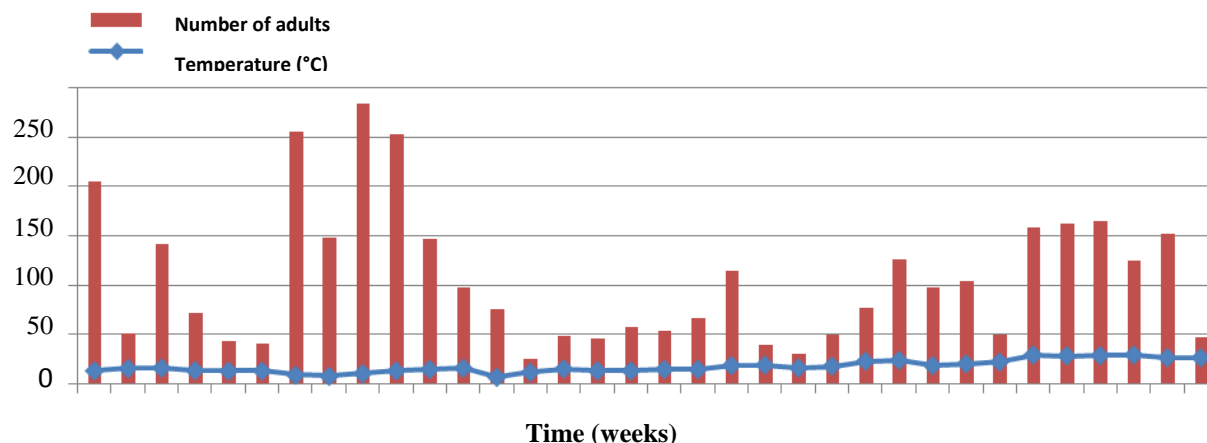


Figure 02: Populations of *Tuta absoluta* trapped according to temperature

As shown in our results (figure 02), *T. absoluta* adults are present in every statement and their number increased during the season. *T. absoluta* adults trapped increases from 26 on 16/03/2014 to 294 on 17/02/2014 which corresponds to the observed peak.

The first adults were captured on 15/12/2013, just after installation of the capsule with pheromone. Our results demonstrate a good effectiveness of the trapping system used in the present study. Numbers of *T. absoluta* adults trapped are higher than those reported in similar studies in Maghreb region. Abbas and Chermiti (2012) [13] reported lower numbers of *T. absoluta* adults trapped with sex pheromone water traps in greenhouses in Tunisia. Similar findings have been also reported in Iraq [14].

The dynamics of the populations seems closely linked to weather conditions. If we juxtapose the statements of temperatures and hygrometry, we notice that captures are low when temperatures are extreme (10 °C) with too low hygrometry or too high. Captures are maximal when the temperatures vary from 20 to 25 °C and when the hygrometry is situated between 50 and 70 % with the exception of dates 10/02 and 17/02/2014. Our findings are in consistence with those previously reported [15]. On the other hand, influence of winds in general, and sirocco particularly, on the captures of *T. absoluta* adults was verified. Captures were clearly reduced when the sirocco occurred. This seems to be due to the high temperatures superior to 40 °C and hygrometry lower than 40 %.

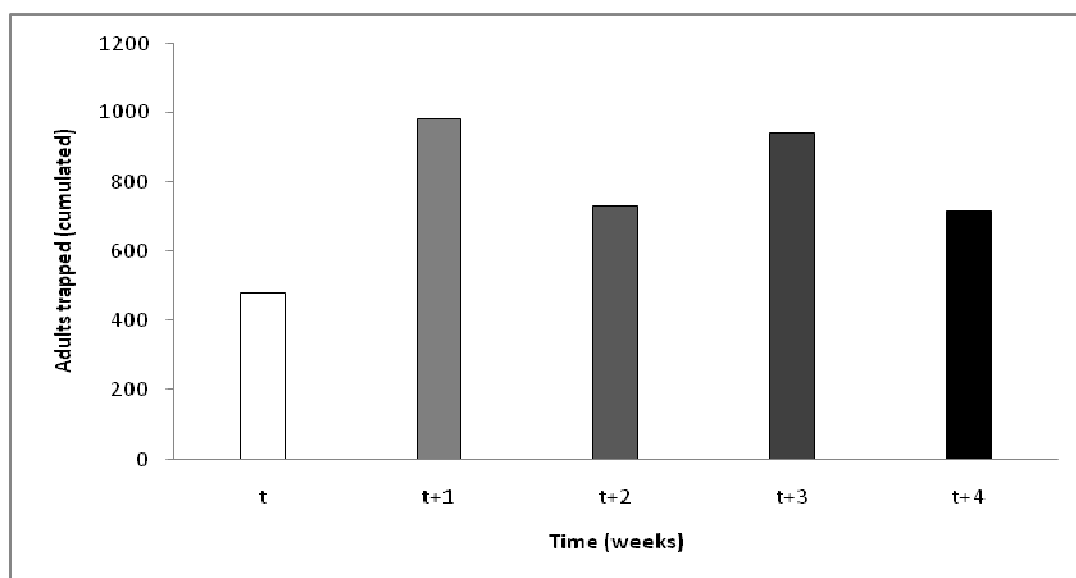


Figure 03: Impact of pheromone's capsules change on *T absoluta* trapping

### 3.2. Significant impact of replacement of pheromone's capsules

According to our results (Fig.03), we noticed that after every replacement of pheromone's capsule, a significant increase of *T. absoluta* adults trapped is observed in the week which follows, and that the trapping is similar other weeks.

This effect may be explained by the attractive activity of sex pheromones on males *T. absoluta*. In fact, the sex pheromone for *T. absoluta* has been found to be highly attractive to male moths. Pheromone lures are used extensively throughout Europe, South America, North Africa and the Middle East for the monitoring and mass-trapping of *T. absoluta* [16].

### 3.3. Distribution of the insect in the greenhouse

Our results demonstrated that the first damages were all observed at the walls of greenhouses. Indeed, hundred percent of the first damages is situated in the North of the greenhouse and, more exactly, 92 % on the northwest wall of shelters. The number of stings and larvae increases according to the culture's evolution and temperature's rise (Fig.04). From the week of 20/06/2010, the daily average temperatures exceeded 22°C; we noted a strong intensity of damages as well as the appearance of the first damages against walls in the North and on the West shelters.

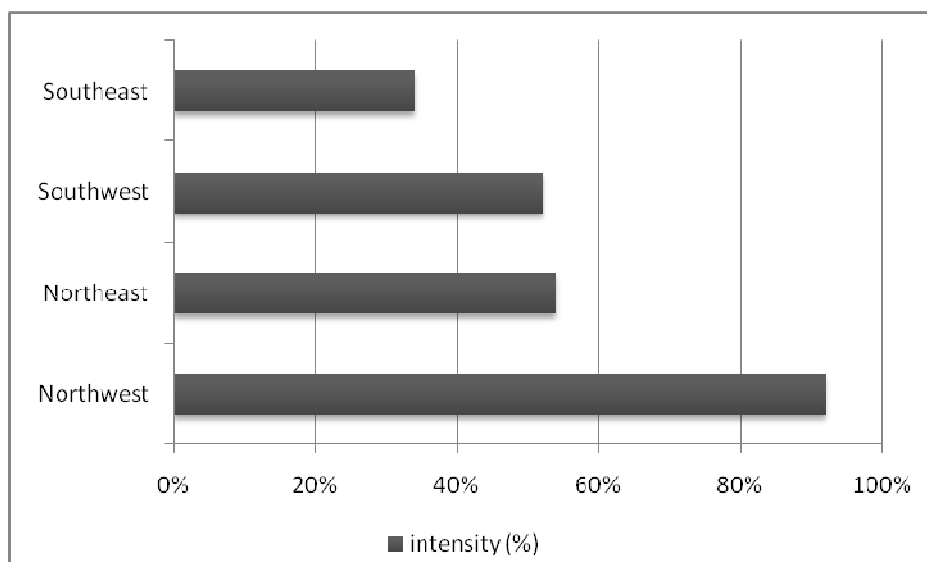


Figure 04: Intensity of the damages according to the cardinal orientation

### 3.4. Distribution of the damages by foliar floor of plants

In order to determine the damage levels, we have taken (at random) in consideration 25 plants affected. Distribution of the damages by foliar floor according to the level of affection of the plant is given in Fig.05.

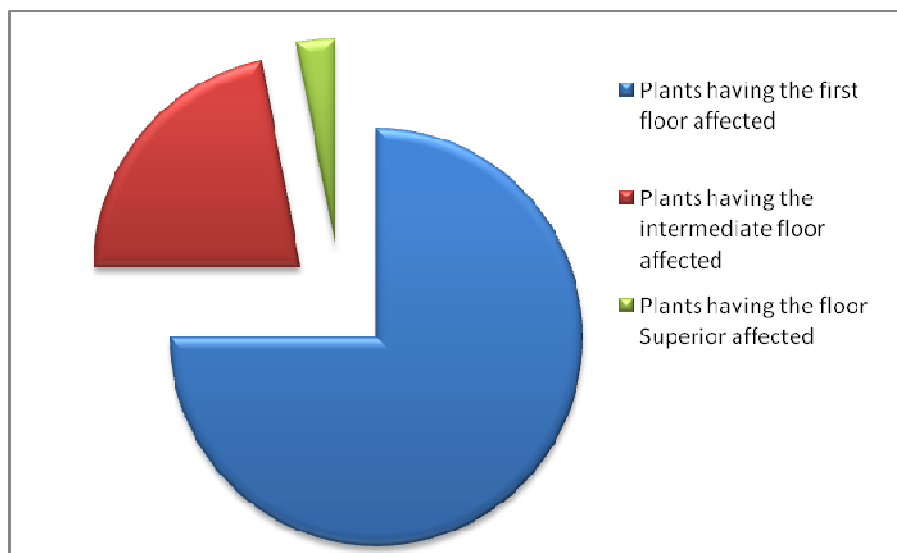


Figure 05: Distribution of the damages by foliar floor of plants according to the level of affection of the culture  
As shown, attacks on the first floor are significantly higher than those of the intermediate floor. The latter is also higher than those of the upper floor. These results corroborate the findings reported by Cely *et al.* (2010) [17]. Furthermore, a relation between the frequency of attack of the culture and the localization of the damages on the plant can be revealed.

## CONCLUSION

The present study showed the effectiveness of sex pheromone trap for the capture of *Tuta absoluta* adults males in greenhouses. Furthermore, our results suggest a strong relationship between Adults capture and weather conditions. Also, we give evidence that attacks on the first floor are significantly higher than those of the intermediate and superior floors. Further studies may be useful to more understand population's dynamics of *Tuta absoluta* in greenhouses in Algeria.

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