



**Alexandria University**  
**Faculty of Agriculture. (Saba-Basha)**

**Management of *Tuta absoluta* on tomato and potato plants**

**BY**  
**HODA GABER ABDELSALAM IBRAHIM ATTIA**

**A thesis Submitted in partial fulfillment of the requirements Governing  
the Award for the Degree of**

**DOCTOR OF PHILOSOPHY IN AGRICULTURAL SCIENCES**

**(PESTICIDES)**

**Plant Protection Department**

**From**  
**Faculty of Agriculture (Saba-Basha)**  
**Alexandria University**

**2020**

# CONTENTS

	<u>Page No.</u>
CONTENTS .....	I
LIST OF TABLES .....	II
LIST OF FIGURES .....	III
LIST OF PHOTOS .....	VI
1. INTRODUCTION .....	1
2. REVIEW OF LITERATURE .....	2
1. Biology of <i>T. absoluta</i> .....	2
2. Effect of planting date on population density of <i>T. absoluta</i> .....	4
3. Population dynamic of <i>T. absoluta</i> .....	4
4. Capturing <i>T. absoluta</i> by sex pheromone traps.....	6
5. Chemical control of tomato Leafminer, <i>T. absoluta</i> .....	9
3. MATERIALS AND METHODS .....	14
1. Field trials .....	14
2. Insecticide used .....	15
3. Sampling technique and inspection of the <i>Tuta absoluta</i> .....	18
4. Data analysis .....	23
5. Statistical analysis .....	23
4. RESULTS AND DISCUSSION .....	24
1. Sex pheromone traps for capturing the tomato leafminer.....	24
2. Agrochemical performance of different adopted models tested chemical insecticides against the tomato leafminer, <i>Tuta absoluta</i> infesting tomato plants on 2017 season.....	36
3. Agrochemical performance for different adopted models against the tomato leafminer, <i>Tuta absoluta</i> infesting tomato plants on 2018 season.....	38
4. Generation number of the tomato leafminer, <i>Tuta absoluta</i> Meyrick on tomato and potato.....	40
5. The influence of planting date on the population density for <i>T.</i> <i>absoluta</i> on different tomato plant parts.....	42
5. SUMMARY AND CONCLUSION .....	50
6. REFERENCES .....	53
7. ARABIC SUMMARY .....	

## LIST OF TABLES

<u>Table No.</u>	<u>Title</u>	<u>Page No.</u>
1	Rates of the used insecticides during the two seasons of 2017 and 2018 .....	17
2	List of planting dates and inspected periods in tomato crop.....	19
3	Mean numbers of captured <i>Tuta absoluta</i> Meyrick males in pheromone traps, temperature and relative humidity on tomato for season 2017.....	25
4	Mean numbers of captured <i>Tuta absoluta</i> Meyrick males in pheromone traps, temperature and relative humidity on tomato for season 2018.....	27
5	Correlation and regression between climate change and <i>Tuta absoluta</i> infestation level through age on tomato.....	29
6	Mean numbers of captured <i>Tuta absoluta</i> Meyrick males in pheromone traps, temperature and relative humidity on potato season 2017 .....	30
7	Mean numbers of captured <i>Tuta absoluta</i> Meyrick males in pheromone traps, temperature and relative humidity on potato season 2018 .....	33
8	Correlation and regression between climate change and <i>Tuta absoluta</i> infestation level through age on potato .....	34
9	Agrochemicals performance means for the pesticides model on tomato leafminer, <i>Tuta absoluta</i> infesting tomato plants in 2017 season .....	37
10	Agrochemicals performance means for the pesticides models on tomato leafminer, <i>Tuta absoluta</i> infesting tomato plants in 2018 season .....	39
11	Generation number of <i>Tuta absoluta</i> Meyrick during 2017 season.....	40
12	Generation number of <i>Tuta absoluta</i> Meyrick during 2018 season.....	41
13	The effect of three planting dates on number of leaf miner, <i>T. absoluta</i> larvae/15 tomato plant during 2017 and 2018 seasons.....	45
14	Effect of weather conditions on the <i>T. absoluta</i> population density that infesting tomato plants during 2017 and 2018 seasons .....	48
15	Factorial analysis for the effect of the two year and different sowing dates.....	49

## LIST OF FIGURES

<u>Figure No.</u>	<u>Title</u>	<u>Page No.</u>
1	Relationship between the different weather factors (Temperature and Humidity) and number of males captures by pheromone traps through plant age on tomato traps during 2017 season .....	26
2	Relationship between the different weather factors (Temperature and Humidity) and number of males captures by pheromone traps through plant age on tomato traps during 2018 season .....	28
3	Relationship between the different weather factors (Temperature and Humidity) and number of males captures by pheromone traps though plant age on potato traps during 2017 season .....	31
4	Relationship between the different weather factors (Temperature and Humidity) and number of males captures by pheromone traps though plant age on potato traps during 2018 season .....	34
5	Correlation of infestation by Tuta absoluta for tomatoes and potatoes during the year 2017.....	35
6	The change in the population density of T. absoluta larvae infesting tomatoes plants during the first season of 2017.....	46
7	The change in the population density of T. absoluta larvae infesting tomatoes plants during the second season of 2018.....	47

## 5. SUMMARY and CONCLUSION

Field experiments were carried out during 2017 and 2018 seasons at El-Berka village, Abou Hommos city, Behaira province, Egypt to control *T. absoluta* on tomato variety namely; Malika F1 and potato variety namely spunta. **The aim of this study was:**

1. Study population fluctuations of *T. absoluta* on tomato and potato under open field conditions for two years (2017 and 2018) with sex pheromone to monitor and capture of *T. absoluta* males. Also, the climatic factors (temperature and relative humidity) on the population density and infestation percent of *T. absoluta* were studied.
2. Study the effect and efficiency of some chemical and bio pesticides to control *T. absoluta* by using four sequences as a model as follow:  
**Sequence (1):** Flubendiamide → Chlorfenapyr → Emamectin benzoate → Chlorantraniliprole  
**Sequence (2):** Chlorfenapyr → Flubendiamide → Chlorantraniliprole → Emamectin benzoate  
**Sequence (3):** Chlorantraniliprole → Emamectin benzoate → Chlorfenapyr → Flubendiamide  
**Sequence (4):** Emamectin benzoate → Chlorantraniliprole → Flubendiamide → Chlorfenapyr
3. Calculate the generation number of *T. absoluta* per year under normal conditions.
4. Study the effect of tomato planting date on infestation with *T. absoluta* and also study the infestation level on different plant parts (Leaves, flowers and fruits).

### **The obtained results can be summarized as follows:**

#### **Cultivation data for tomatoes 2017**

The average number of *T. absoluta* was 56.52 Male/3traps in the 1<sup>st</sup> week. thus the average number increased until reached the top number in the curve of the infestation by average of 103.44 Male/ 3 traps in 5<sup>th</sup> week while another increase was recorded on the week of 12<sup>th</sup> by an average of 155.38 Male/ 3 traps .

The statistical analysis of the obtained data revealed that positive correlation among climatic factors (max temperature and min ones)and the males trapped to the pheromone mean while the relative humidity gave negative and non-significant with the number of male of *Tuta absoluta* .

Furthermore there are highly significant between the plant age and the number of *Tuta absoluta* mele Ev% ( $R^2 \times 100$ ) = 86.87.

Also there are high significant difference between combined (the plant age and climatic factors) and the number of *Tuta absoluta* mele Ev% = 91.00.

### **Cultivation data for tomatoes 2018**

The average number of *T. absoluta* was 9.95 Male/ 3 traps in the 1<sup>st</sup> week, thus the average number increased until reached the top number in the curve of the infestation by average of 103.94 Male/ 3 traps in 10<sup>th</sup> week while another increase was recorded on the week of 17<sup>th</sup> by an average of 88.92 Male/ 3 traps .

The statistical analysis of the obtained data revealed that positive correlation among climatic factors (max temperature and min ones) and the males trapped to the pheromone mean while the relative humidity gave negative and non-significant with the number of male of *T. absoluta* .

Furthermore there are highly significant between the plant age and the number of *T. absoluta* male Ev% ( $R^2 \times 100$ ) = 70.03.

Also there are high significant difference between combined (the plant age and climatic factors) and the number of *T. absoluta* male Ev% = 72.72.

### **Cultivation data for potatoes 2017**

The average number of *T. absoluta* was 16.86 Male/ 3 traps in the 1<sup>st</sup> week, thus the average number increased until reached the top number in the curve of the infestation by average of 110.68 Male/ 3 traps in 9<sup>th</sup> week while another increase was recorded on the week of 14<sup>th</sup> by an average of 110.03 Male/ 3 traps .

The statistical analysis of the obtained data revealed that correlation among climatic factors ( max.; min. Temp and RH.) and the males of *T. absoluta* . trapped to the pheromone mean Ev% = 49.3.

Furthermore there are highly significant between the plant age and the number of *T. absoluta* male Ev% = 58.57.

Also there are high significant difference between combined (the plant age and climatic factors) and the number of *T. absoluta* male Ev% = 87.52 .

### **Cultivation data for potatoes 2018**

The average number of *T. absoluta* was 20.67 Male/ 3 traps in the 1<sup>st</sup> week, thus the average number increased until reached the top number in the curve of the infestation by average of 90.17 Male/ 3 traps in 10<sup>th</sup> week.

The statistical analysis of the obtained data revealed that correlation among climatic factors ( max.; min. Temp and RH.) and the males of *T. absoluta* trapped to the pheromone mean Ev% =39.33.

Furthermore there are highly significant between the plant age and the males of *T. absoluta* male Ev% = 84.21.

Also there are high significant difference between combined (the plant age and climatic factors) and the males of *T. absoluta* male Ev% = 88.83.

Taking in consideration the infestation with *Tuta absoluta* on tomato and potato we can conclude that the infestation on tomato was high rather than potato.

### **1. Agrochemical performance for different adopted models against the tomato leafminer, *T. absoluta* infesting tomato plants on 2017 and 2018 seasons**

Results indicated that the fourth model (Emamectin benzoate 5% SG, Chlorantraniliprole 20% SC, Flubendiamide5% SC and Chlorfenapyr 36% EC) give the highest percent reduction against *T. absoluta* in the first season of 2017. While, the third model ( Chlorantraniliprole 20% SC,Emamectin benzoate 5% SG, Chlorfenapyr 36% EC and Flubendiamide5% SC) and the fourth model gives the highest pest mean reduction for *T. absoluta* in the second season of 2018

### **2. Generation number of the tomato leafminer, *T. absoluta* on tomato and potato**

Ten of generations of *Tuta absoluta* were recorded per year. The longest generation period was on January while the shortest generation was on May.

### **3. The influence of planting date on the population density for *T. absoluta* on different tomato plant parts**

- The results showed that the first planting date (Apri, 20<sup>th</sup>) recorded the lowest infestation while the last planting dates (May, 20<sup>th</sup> and July, 20<sup>th</sup>) achieved the highest infestation.
- In general the infestation density was higher in 201 7tomato growing season than 201 8 season.
- The first planting date (Apri, 20<sup>th</sup>) was the best time for planting tomato to minimize the infestation by *T. absoluta* compared with the second planting date (May, 20<sup>th</sup>) and the third planting date (June, 20<sup>th</sup>).
- The results showed the highest infestation was on leaves then fruits and the least infestation was on flowers.