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## Population Fluctuation of Tomato Leaf Miner, *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae) During Winter and Summer Plantations in Egypt.

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### ABSTRACT

The Solanaceous plants especially tomatoes have great economic impacts in Egypt. Tomato leaf miner *Tuta absoluta* (Meyrick) is present throughout the crop duration; larvae can infest leaves, flowers, stems and fruits, causing severe losses in tomatoes. So, this research focused on studying the population fluctuation of this pest in both winter and summer plantations. The results indicated that, in winter plantations, *T. absoluta* population started to appear in the 2<sup>nd</sup> week of Jan., and increased gradually forward till reached its maximum activity in the 3<sup>rd</sup> week of Feb., the 3<sup>rd</sup> week of March and the 1<sup>st</sup> week of April then decreased and approximately declined in the 4<sup>th</sup> week of April. *T. absoluta* had four peaks during winter season; the first peak occurred in the 4<sup>th</sup> week of Jan., the second peak occurred in the 3<sup>rd</sup> week of February, the third was in 3<sup>rd</sup> week of March while the fourth peak occurred in the 1<sup>st</sup> week of April. In summer plantations, the population of *T. absoluta* started very weak, in the 4<sup>th</sup> week of June. An approximately outbreak occurred in the 1<sup>st</sup> week of Sept. and the population then decline in the 2<sup>nd</sup> week of Oct. Also, four peaks of *T. absoluta* were recorded in summer plantation, the first peak was in 2<sup>nd</sup> week of July, the second was in 1<sup>st</sup> week of August, the third and fourth were in the 1<sup>st</sup> and the 4<sup>th</sup> week of Sept., respectively.

**Keywords:** Summer plantation, winter plantation, Adult catches, *Tuta absoluta*.

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## INTRODUCTION

Tomato crop is considered one of the most important horticultural crops in the world. About 130 million tons of tomatoes were produced in the world in 2008. China is the largest producer (34 million tons) while Egypt comes in the fifth order by about 10 million tons [1]. In Egypt, about 70% of the production destination is for consumption and the rest is industrialized. Tomato is produced under green houses as well as in outdoor areas for consumption brings the highest gross financial return to the farmers in Egypt.

The tomato leaf miner, *Tuta absoluta* (Meyrick), is a neotropical oligophagous insect, which attacks solanaceous crops. Since the 1960s it has become one of the key pests of tomato crop in many South American countries [2-4] and recorded in Egypt in the middle of 2009 [5]. Larvae can damage tomato plants during all growth stages, producing large galleries in their leaves, burrowing stalks, apical buds, green and ripe fruits [4,6,7]. It can cause important yield losses in different production regions and under diverse production systems [6, 8].

Since its appearance in Egypt, chemical control has been the main method of control used against *T. absoluta* in all infested regions. Farmers tried to decrease its injury by applying insecticides two times till several times a week especially in highly infested areas. Effective chemical control was difficult to achieve good results because of the mine-feeding behavior of larvae, lack of threshold action, and deficient spraying technology [5].

Unfortunately, there are no records on the population fluctuation of this pest in Egypt. So, the objective of this study is to record the population fluctuation of *T. absoluta* during winter and summer plantations to make accurate information about this pest for facilitating its control.

## MATERIALS AND METHODS

The present investigation was carried out in new land region of Berneshit, Giza governorate from the second week of January to the fourth week of April (winter plantations) and from the fourth week of June to the second week of October (summer plantation). Nursery-plants of tomato GS variety at the same age (30 days old) were planted in an area of about two feddans (feddan= 4200 m<sup>2</sup>) in the fourth week of December (winter plantation) and at the second week of June (Summer plantation). The tomato plants were grown in rows 50 cm wide and nursery-plants were sown in hills, 30cm apart. One nursery-plant was planted in each hill. To study the population fluctuation of *Tuta absoluta*, white pheromone traps baited with pheromone lure type TUA-500 were well positioned and instilled 50m apart and 30cm above the ground [5]. The number of captured adults was counted each week during the whole period.

### Statistical analysis

*T. absoluta* catches during winter and summer plantations were analysed using Statistix 9 (Statistix analysis Software) [9]. The relationship between temperature and relative humidity percentages during both winter and summer plantations was correlated with *Tuta absoluta* catches using the same program.

## RESULTS AND DISCUSSION

Till now, there are no studies on the population fluctuation of *Tuta absoluta* around the year on tomato crop in Egypt. The fluctuation in *T. absoluta* population on tomato foliage during winter and summer plantations, at Giza Governorate, Egypt is showed in Tables (1 and 2). The obtained data show that, in winter plantation, *T. absoluta* population started to appear in the 2<sup>nd</sup> week of Jan., where the number of adults caught was 1425.5 adults/trap, and increased gradually forward till reach its maximum activity in the 3<sup>rd</sup> week of Feb. (8794.5 adults/trap), the 3<sup>rd</sup> week of March (9672.4 adults/ trap) and the 1<sup>st</sup> week of Feb. (8321.8 adults/ trap) then decreased and approximately declined in the 4<sup>th</sup> week of April (2018.4 adults/ trap) ( Table 1).

In summer plantation, the population of *T. absoluta* started very weak, in the 4<sup>th</sup> week of June (478.3 adults/trap/ week). An approximately outbreak occurred in the 1<sup>st</sup> week of Sept. (8136.3 adults/ trap week) and the population then decline in the 2<sup>nd</sup> week of Oct. (1366.3 adults\ trap\ week) (Table 2).

**Table 1: Mean catches of tomato leaf miner *Tuta absoluta* adults at Giza Governorate during winter plantation of tomato plants**

Month	Mean Number of <i>Tuta absoluta</i> /trap/week±SE	
January	2 <sup>nd</sup> week	1425.5±44.3
	3 <sup>rd</sup> week	2733.2±279.4
	4 <sup>th</sup> week	5674.5±659.3
February	1 <sup>st</sup> week	3491.2±720.0
	2 <sup>nd</sup> week	6367.4±323.5
	3 <sup>rd</sup> week	8794.5±295.9
	4 <sup>th</sup> week	4364.1±494.5
March	1 <sup>st</sup> week	3292.6±451.8
	2 <sup>nd</sup> week	6487.3±531.9
	3 <sup>rd</sup> week	9672.4±226.1
	4 <sup>th</sup> week	5436.5±344.4
April	1 <sup>st</sup> week	8321.8±419.4
	2 <sup>nd</sup> week	5642.2±406.7
	3 <sup>rd</sup> week	4263.5±586.4
	4 <sup>th</sup> week	2018.4±364.3

**Table 2: Mean catches of tomato leaf miner *Tuta absoluta* adults at Giza Governorate during summer plantation of tomato plants**

Month	Mean Number of <i>Tuta absoluta</i> /trap/week±SE	
June	4 <sup>th</sup>	478.3±118.6
July	1 <sup>st</sup> week	519±98.5
	2 <sup>nd</sup> week	3247.3±260.8
	3 <sup>rd</sup> week	2337.3±295.5
	4 <sup>th</sup> week	3103.3±702.9
August	1 <sup>st</sup> week	5863.8±548.1
	2 <sup>nd</sup> week	3737.1±690.9
	3 <sup>rd</sup> week	5058.8±490.3
	4 <sup>th</sup> week	7440.8±539.6
September	1 <sup>st</sup> week	8136.3±437.8
	2 <sup>nd</sup> week	3760.2±260.3
	3 <sup>rd</sup> week	4388.5±650.3
	4 <sup>th</sup> week	6090.2±396.1
October	1 <sup>st</sup> week	2091.3±205.8
	2 <sup>nd</sup> week	1366.3±187.4

Generally, in both winter and summer plantation the population of *Tuta absoluta* started to appear with the first day of tomato plantation and increased gradually with increasing the development of tomato plant till flowering stage at which the peak of population was noticed.

It is noticed that, *T. absoluta* has four peaks in winter plantations, the first peak occurred in the fourth week of Jan., the second in the 3<sup>rd</sup> week of FEBRUARY, the third in 3<sup>rd</sup> week of March while the fourth peak occurred in the 1<sup>st</sup> week of April (Figure 1). Also, four peaks of *T. absoluta* were recorded in summer plantation. The first peak was in the 2<sup>nd</sup> week of July, the second was in the 1<sup>st</sup> week of August, the third was in the 1<sup>st</sup> week of Sept. and the fourth peak was in the 4<sup>th</sup> week of Sept (Figure 2). From the data in Tables (1 and 2) it is observed that the general mean number of captured adults of *T. absoluta* was higher (5199.007 adults) in winter plantation than in summer plantation (3841.233 adults).

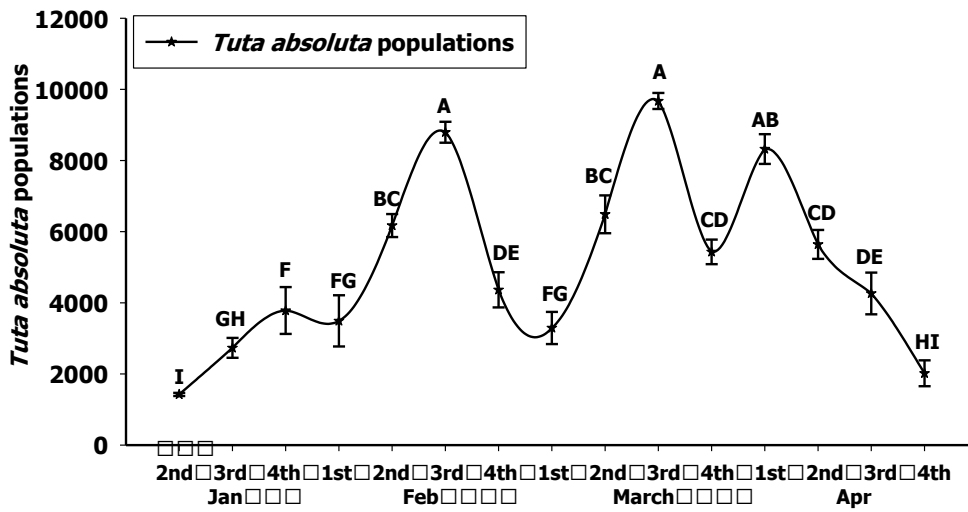


Figure 1: Variances between mean catches of *T. absoluta* during 15 weeks of estimation in winter plantations.

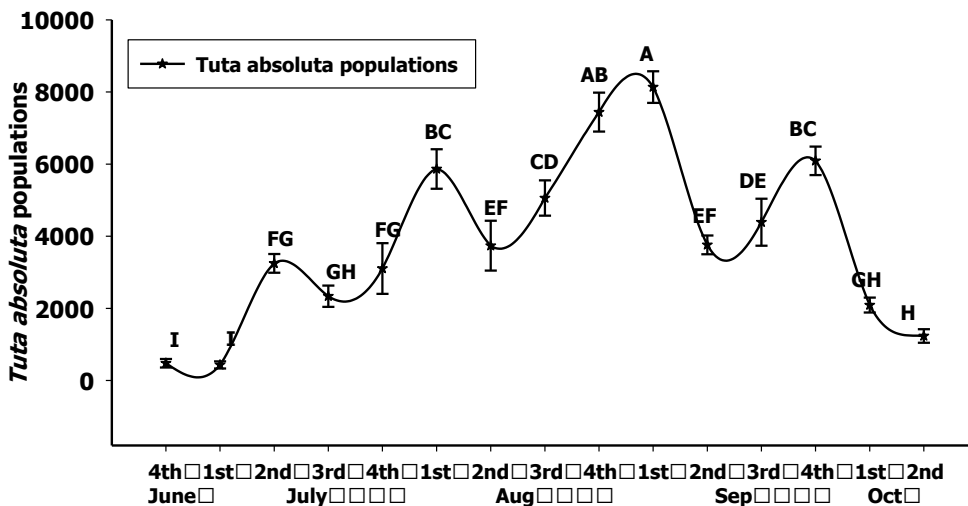


Figure 2: Variances between mean catches of *T. absoluta* during 15 weeks of estimation in summer plantations.

The results of the present findings matched with those found by other authors where the occurrence and increase in leaf miner captures during the crop season and the trapping intensity and the captures depended on the temperature [10, 11]. Monitoring of *Tuta absoluta* with pheromone traps and weekly sampling in the Bekalta cropping area (Tunisia) showed that the population dynamics of the insect can be separated into three phases: low infestation (from 25<sup>th</sup> March to 6<sup>th</sup> May), growing population phase (6<sup>th</sup> May to 27<sup>th</sup> May), then a decline phase (27<sup>th</sup> May to 3<sup>rd</sup> June) [12]. Also in mid-April *Tuta absoluta* has already occurred in Strumica region. Its numbers increased and by mid-June they have reached the maximum number. The population dynamics shows that the pest reach its maximum number in the beginning of August and it gradually decreases until the middle of October, when occurring in the lowest number [13, 14]. While in Southern Sardinia (Italy) the highest numbers of *Tuta absoluta* moths caught in traps were in September-October [15]. In Algeria, the highest number of *Tuta absoluta* males caught was recorded during the end of March, whereas the lowest number was recorded during November [16].

From the previous results, it is observed that there is an intensive relationship between environmental conditions (temperature and relative humidity) and the population of *Tuta absoluta*, this result is more obvious in Figures (3 and 4). In winter plantations, (Figure 3), the higher mean of catches of *T. absoluta* were recorded in moderate temperate weeks (3<sup>rd</sup> week of Feb., 3<sup>rd</sup> week of March and 2<sup>nd</sup> of April) while the

minimum population was recorded in the lower temperate week (2<sup>nd</sup> week of Jan.). This result could be assured statistically, where there are no significant differences between mean catches of *T. absoluta* adults in moderate temperate weeks (3<sup>rd</sup> week of Feb. and 3<sup>rd</sup> week of March) while highly significant differences between mean catches in moderate temperate weeks and other low temperate weeks were observed (Figure 3). In summer plantations the differences between mean catches in all weeks of observation were more obvious where there are slight significant differences in mean catches between 4<sup>th</sup> week of Aug. and 1<sup>st</sup> week of Sept. (hottest weeks of summer) while highly significant differences between these weeks and other weeks of observation were noticed (Figure 4).

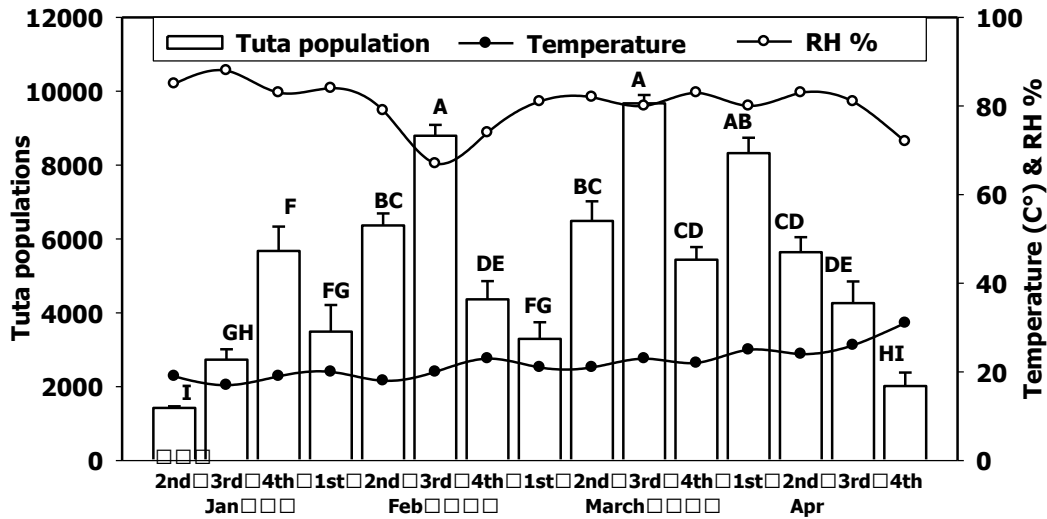


Figure 3: Mean catches of *Tuta absoluta* and their correlation with temperature and relative humidity during 15 weeks of estimation in winter plantation.

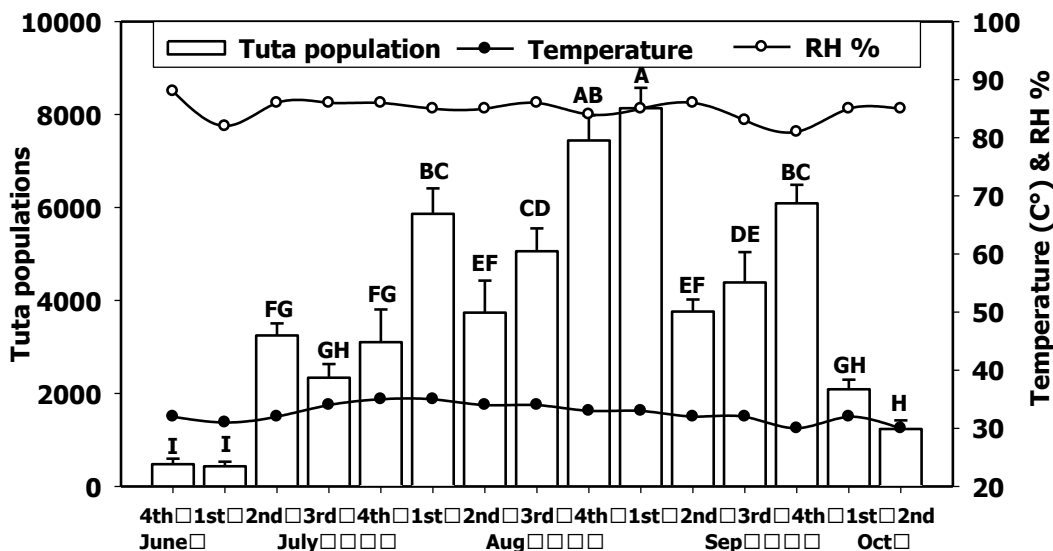


Figure 4: Mean catches of *Tuta absoluta* and their correlation with temperature and relative humidity during 15 weeks of estimation in summer plantation.

The present findings are in agreement with that on *T. absoluta* in Egypt where the population of *T. absoluta* in Qena governorate (hot governorate) gave the highest number of generations as compared to ElBeheira governorate (moderate governorate) [17]. Also, the high percentages of infestation of tomato by *T. absoluta* in Iraq were recorded in September as 100% infestation and the maximum catches of adults per week were recorded on 10/9/2012 [18].

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