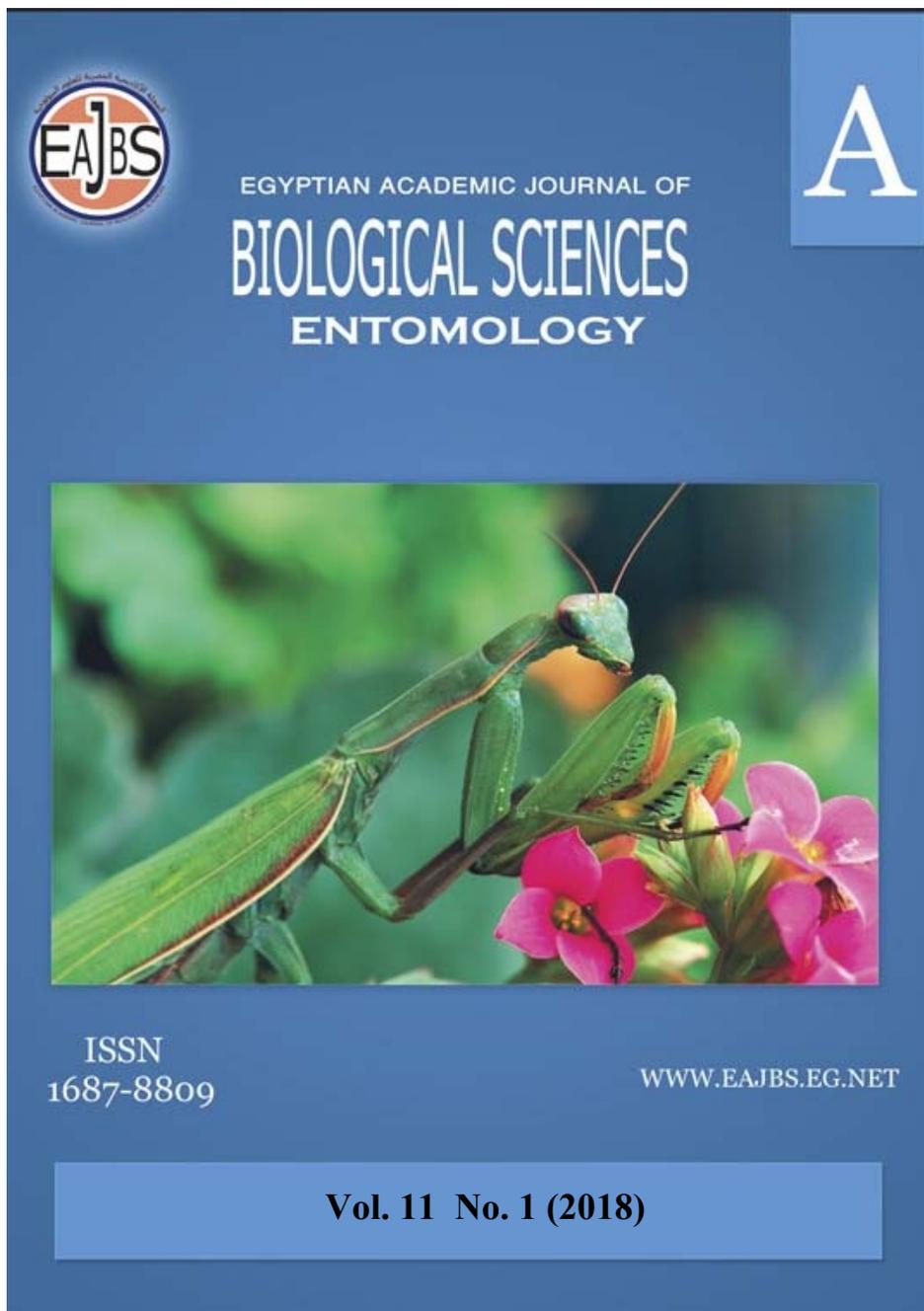


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Monitoring population of tomato leaf miner, *Tuta absoluta* during winter and summer evergreens of potato filed in Egypt

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ABSTRACT

Tuta absoluta (Meyrick) (Lepidoptera: Gelechiidae) tomato leaf miner is a major pest of the Solanaceae family, this study was carried out in the open field of three potato varieties (Espunta, Mondial and Pliny) at Al-Bustan, Nubaria Western Delta in Egypt in two evergreen (winter and Summer) using pheromone traps as an indicator to infestation by this pest. Also, the parasitoid *Trichogramma evanscens* (Hymenoptera: Trichogrammatidae) was evaluated to suppressing the infestation as a biological control. Also, the relationship between the adult moth of *T. absoluta* and temperature °C and relative humidity RH% through the winter and summer evergreens studied. The result indicated that the population of *T. absoluta* adult moth in pheromone traps increased in winter evergreen during October and November (19-22°C) and summer evergreen during May and June (23° -26° C) in warm climates. The results revealed that *Tr. evanscens* gave a high significant in reducing the *T. absoluta* in open field and greatly exacerbates role of natural enemies.

INTRODUCTION

The tomato leaf miner *Tuta absoluta* was identified just many years ago Agricultural Researcher, Agronomist and growers are using various methods including insecticides on a large scale for controlling of this difficult serious insect pest. The caterpillars of this moth cause deteriorated damage in all sorts of crops. The main host plant of *T. absoluta* is tomato (*Lycopersicon esculentum*), but it also attacks potato (*Solanum tuberosum*), eggplant (*S. melongena*) Jimson weed (*Datura stramonium*), pepper (*Capsicum annuum*), sweet pepper (*S. muricatum* L.), and Tobacco (*Nicotiana tabacum*) related to the family Solanaceae, Also, it infests *Physalis angulata* and *Phaseolus vulgaris*, *Datura ferox* and some Chenopodiaceae plants such as *Chenopodium album* (Vargas,1970; Garica and Espul, 1982; Fernandez and Montagne, 1990; and Portakaldali et al., 2013). Moreover it is registered on the Watermelon (*Citrullus lanatus*) in the family Cucurbitaceae, broad bean (*Vicia faba*) and alfalfa plant (*Medicago sativa*) related to family Fabaceae, (Mohamed et al. 2015).

This insect originates in the Mediterranean region (Tropea et al., 2012) and the Canary Islands, but it is also found in some countries of Africa, Asia Minor and North Western. The tomato leaf miner *Tuta absoluta* became a serious pest to tomato

cultivations in Egypt since 2009, where it causes great damage to the crop (Hussein *et al.*, 2015 and Moussa *et al.*, 2013). It started to invade tomato and potato plantations Egypt in the nearest governorate to Libya (Mersa Matrooh), in 2010 it had reached Giza, coming well established in all governorates and reaching the border and north part of Sudan in June 2011 (Tamerak *et al.*, 2011 and Gaffar, 2012).

In the present study, the detection of the moth and the larvae of *Tuta absoluta* in potato crop has been investigated under the field conditions by using the pheromones water traps and the parasitoid *Trichogramma evanscens* is release as abiological control. where the potato crop consider the preferred host to *Tuta absoluta*, when tomato absence as host (Levent, 2012).

Early detection, the hidden behavioral pattern of *Tuta absoluta* and the high chance of the insect flying into the field during aeration are reasons why early detection of the adult insect is extremely important to be able to decide the suitable timing of control operations against the next generation of *T. absoluta*. Pheromone traps give a good indication of the flight

MATERIALS AND METHODS

Three field experiments in complete randomized block design were conducted at Al-Bustan area, West Nubaria, El-Behaira Governorate, Egypt. Each experiment consisted three varieties of potato as Espunta -Mondial - Pliny and divided in to three replicates.

The experiment carried out during two evergreens (summer-winter) and the work started on the first decade of October, Which were preceded by a month ago of pre-farming operations (soil treatment, weeding, seed sorting, mixing of seeds with fungicides after determining infection levels and quality).

Tuta absoluta Pheromone traps were suspended 15 days before of planting and continued throughout the planting season to measure the extent of variability of infection and the appearance of generations. So that the traps were distributed at a height of 20 cm from the surface of the plant and are raised whenever the plant rose to maintain the distance mentioned. A trap has been placed for each treatment.

The used of pheromones in most butterfly species to excrete a sex pheromone. These pheromones can attract male butter flies. A pheromone trap is a fairly simple instrument to establish the *T. absoluta* that is present in the field, so pheromones are consider as a good indicator of infestation.

The parasitoid *Trichogramma evanscens* was released at the age of the plant from 40 to 45 days, using 30 cards/Fed., The cards released were the distance between the card and the other 12 meters, the distance between the edge of the field 6 meters, and the distance between first released followed by ten days Until the end of the season.

RESULTS AND DISCUSSION

Winter evergreen:

The date in Table (1) show that, the period of the winter evergreen was a fluctuation in the *Tuta absoluta* population from 22 Oct. to 12 Des., where the number of adult moth caught by pheromone traps were high in untreated experimental plots (100.16, 101.40 and 102.20/trap) for the tested Espunta, Mondial and Pliny varieties, respectively. Moreover, in the treated plots by *Trichogramma evanscens* the number of adult moth in pheromone traps recorded a high significant

decrease (25.00, 25.41 and 13.62/trap) in the three tested varieties, respectively. This result agrees with Luísa (2017) who provided that evaluating the potential of *Tr. achaeae* mass releases for the control of *T. absoluta* observed a reduction in the mean number of leaf mines and of eggs, larvae, and pupae of per leaflet, and an increase in the *Tr. achaeae* parasitism rate. Although, the date in Figure (1) referred to the population of *Tuta absoluta* adult moth in pheromone traps increased in the moderate temperatures during October and November (19-22°C), as approved in the meteorological in the area, In contrast the population density of the insect is decreased during the period of low temperatures during December and January where temperature averages during those months are ranging to (13°-15° C). Thus, it can be concluded that there is a positive relationship between the insect population and temperatures to a certain extent, especially in case of high temperature. Therefore, insect activity and its population increase in temperate temperatures or in warm climates. This result consistent with (Andrew *et al.* 2013), where it has been demonstrated that the optimum temperature for *Tuta absoluta* development ranged from (19°–23° C).

Table (1) *Tuta absoluta* adult moth population in pheromone traps in plots treatment with *Trichogramma evanscens* and untreated in winter evergreen

| Date | Potato Variety | | | | | |
|-------------------|--------------------|---------------------|--------------------|---------------------|--------------------|---------------------|
| | Sponta | | Pliny | | Mondial | |
| | Treated | Untreated | Treated | Untreated | Treated | Untreated |
| | Means of larvae | | Means of larvae | | Means of larvae | |
| 22/10 | 29 ^b | 129.66 ^b | 33.66 ^a | 137.33 ^a | 16 ^b | 142.33 ^a |
| 29/10 | 16.33 ^d | 149 ^a | 21.33 ^b | 137.33 ^a | 19 ^a | 141 ^a |
| 5/11 | 11.33 ^e | 125.33 ^b | 17.66 ^c | 132.66 ^a | 5.66 ^{lg} | 134 ^b |
| 12/11 | 20.33 ^c | 96.66 ^c | 34.66 ^a | 94.33 ^b | 11 ^d | 104.33 ^c |
| 19/11 | 35.33 ^a | 100.66 ^c | 33.66 ^a | 95.66 ^b | 13 ^c | 95 ^d |
| 26/11 | 8 ^f | 76 ^d | 10 ^d | 86 ^c | 4.66 ^g | 90 ^e |
| 3/12 | 6.33 ^f | 65.33 ^e | 9 ^d | 67.66 ^d | 7.33 ^{ef} | 84 ^f |
| 10/12 | 6.66 ^f | 58.66 ^f | 10 ^d | 60.33 ^e | 8 ^e | 74.33 ^g |
| Mean | 25 ^b | 100.16 ^a | 25.41 ^b | 101.41 ^a | 13.62 ^b | 102.20 ^a |
| LSD ₀₅ | 17.22 | | 9.00 | | 14.04 | |
| Significant | *** | | *** | | *** | |
| General Mean | 58.41 ^c | | 61.33 ^a | | 59.35 ^b | |
| LSD ₀₅ | 0.85 | | | | | |
| Significant | *** | | | | | |

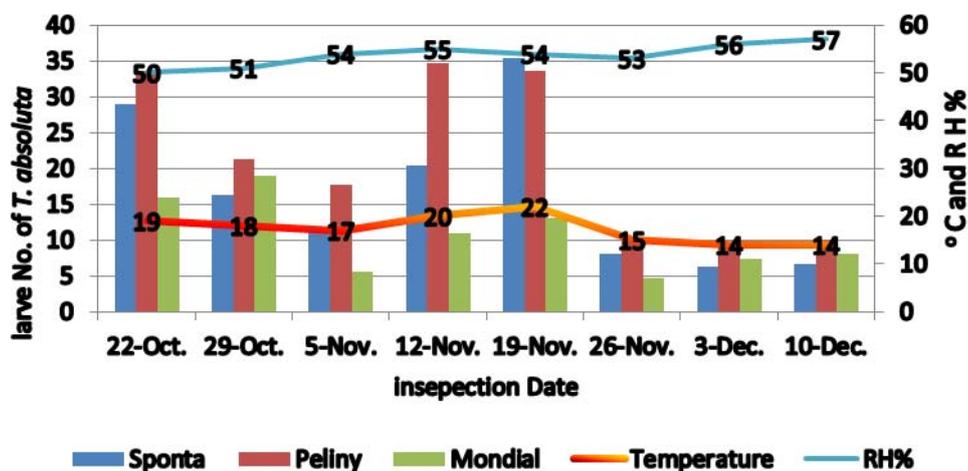


Fig (1): relationship between the adult moth of *T. absoluta* and temperature ° C, relative humidity RH% throws the winter evergreen.

Summer evergreen:

Also, the results in Table (2) explain the date in Summer evergreen are obviously show a high significant population of *Tuta absoluta* adult moth in pheromone traps in plots treated with *Trichogramma evanscens* (37.46, 38.56 and 49.56/trap) in the tested varieties compared with untreated plots (128.2, 125.00 and 127.93/trap) in the three tested varieties Espunta, Mondial and Pliny, respectively. This may be due to the use of the parasitoid *Trichogramma evanscens* which released in the absent used of insecticides greatly exacerbates the role of natural enemies. It is noted that the decrease in incidence during December may be due to low temperatures in addition to the good agricultural practices in the experimental parts of the varieties tested. . This is agreement with the result has endorsed reported by (Cabello *et al.* 2009 and 2010) they refereed to that the parasitoid *Trichogramma* can be a good weapon to control *T. absoluta* on greenhouses of Spain. Additionally, Zouba and Mahjoubi (2010) reported that the parasitoid *Trichogramma* is a good weapon to control *T. absoluta* on greenhouses of south western Tunisia. As well El-Arnaouty *et al.* (2014) showed that both *Trichogramma* species were significantly efficient, especially at higher doses, in keeping down *T. absoluta* miners during both experimental years in North African.

The results in Figure (2) explain the relationship between the adult moth of *T. absoluta* and temperature °C and relative humidity RH%, where it was homogenous throughout the April (19° -22° C) in the three tested Espunta, Mondial and Pliny potato varieties. On the other hand, the population of *T. absoluta* adult moth in pheromone traps started to be increase with warm weather and moderate temperatures during May and June (23° -26° C) in Espunta, Mondial and Pliny, but it is noticeable that the Mondial variety was higher than Espunta and Pliny. This may be due to the strong vegetable growth in Mondial variety, which was more attractive to insects than other species. In general, when the temperature rose during June, the insect adult moth population was decreased in pheromone traps. This explains that the insect preferred mild temperature (warm climates) as it was in the winter evergreen. This current works agreement with (Andrew *et al.*, 2013) where he had found that the most favorable temperature to *T. absoluta* was between 19 and 23 °C. Also these finding are parallel with (Jacobson, 2012) who have reported that population growth of *T. absoluta* was greatest in spring/early summer and in late summer/autumn with a period of respite in mid-summer.

Table (2) *Tuta absoluta* adult moth population in pheromone traps in plots treatment with *Trichogramma evanscens* and untreated in summer evergreen

| Date | Potato Variety | | | | | |
|-------------------|--------------------|----------------------|--------------------|----------------------|--------------------|---------------------|
| | Sponta | | Peliny | | Mondial | |
| | Treated | Untreated | Treated | Untreated | Treated | Untreated |
| | Means of larvae | | Means of larvae | | Means of larvae | |
| 12/4 | 16 ^e | 123.33 ^e | 11.33 ^g | 117.66 ^d | 13.66 ⁱ | 124.66 ^c |
| 19/4 | 21 ^f | 127.33 ^d | 14.33 ^f | 133 ^a | 18.33 ^h | 123.33 ^c |
| 26/4 | 16.33 ^g | 124.66 ^e | 16.66 ^f | 122.66 ^{bc} | 24.33 ^g | 134.66 ^a |
| 3/5 | 22 ^f | 127 ^d | 24.33 ^e | 112 ^c | 35.33 ^f | 124.33 ^c |
| 10/5 | 30 ^e | 130.66 ^c | 34 ^d | 125 ^b | 47 ^e | 128.33 ^b |
| 17/5 | 35.33 ^d | 134 ^a | 45 ^c | 134.66 ^a | 53.33 ^d | 134.33 ^a |
| 24/5 | 53 ^c | 123.33 ^e | 66.33 ^a | 125 ^b | 76 ^b | 123.66 ^c |
| 31/5 | 66.33 ^a | 133.33 ^{ab} | 67.33 ^a | 133.66 ^a | 84 ^a | 133.33 ^a |
| 7/6 | 61.33 ^b | 131.33 ^{bc} | 59.33 ^b | 125 ^b | 77.33 ^b | 128.33 ^b |
| 15/6 | 53.33 ^c | 127 ^d | 47 ^c | 121 ^c | 66.33 ^c | 124.33 ^c |
| Mean | 37.46 ^b | 128.2 ^a | 38.56 ^b | 125.00 ^a | 49.56 ^b | 127.93 ^a |
| LSD ₀₅ | 0.60 | | 1.05 | | 0.87 | |
| Significant | *** | | *** | | *** | |
| General Mean | 82.83 ^b | | 81.76 ^c | | 88.75 ^a | |
| LSD ₀₅ | | | 0.61 | | | |
| Significant | | | *** | | | |

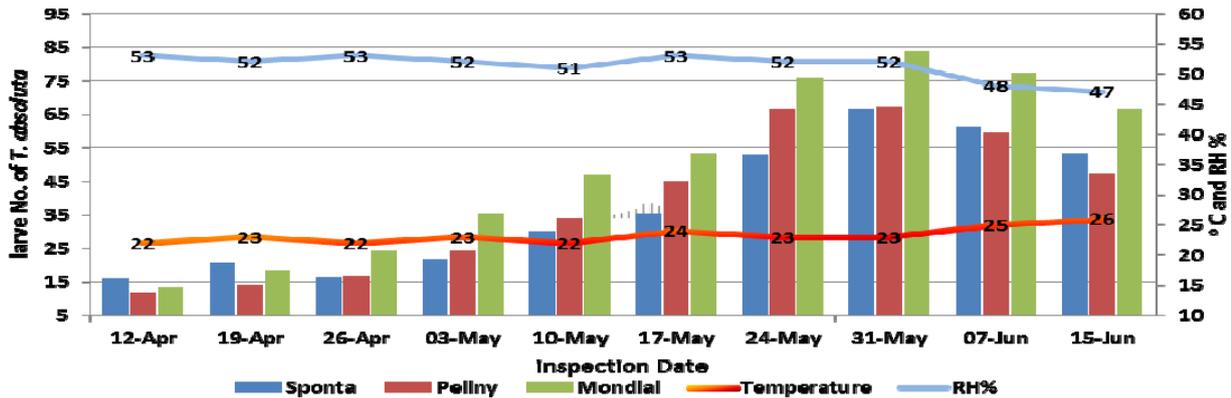


Fig (2): relationship between the adult moth of *T. absoluta* and temperature °C, relative humidity RH% through the winter evergreen

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ARABIC SUMMARY

رصد تعداد حافرة أوراق الطماطم وتطور نموها في العروتين الشتوي والصيفي بحقول البطاطس في مصر

حمدى أمين عوض، على زكريا النجار، هشام محمد البسيوني
معهد بحوث وقاية النباتات - مركز البحوث الزراعية - الجيزة - مصر

تُعد حافرة أوراق الطماطم من الآفات الرئيسية للعائلة الباذنجانية. وقد أجريت الدراسة في الحقل المفتوح لثلاثة أصناف من البطاطس (إسبونتتا و مونديال و بليني) في إقليم غرب الدلتا بمصر في العروة الشتوية والصيفية باستخدام المصائد الفرمونية كمؤشر للإصابة من قبل حافرة أوراق الطماطم وايضا استخدام طفيل التريكوجراما لإخماد أو تقليل الإصابة بهذه الآفة كمكافحة بيولوجية بدون استخدام مبيدات حشرات. أيضا، دراسة العلاقة بين الحشرات الكاملة حافرة أوراق الطماطم ودرجة الحرارة °م، الرطوبة النسبية % في كل من العروتين الشتوية والصيفية. وأظهرت النتائج أن عدد الحشرات الكاملة البالغة في المصائد الفرمونية قد ازداد في العروة الشتوية خلال شهري أكتوبر ونوفمبر (١٩-٢٢ °م) وفي العروة الصيفية خلال شهري مايو ويونيو (٢٣-٢٦ °م) في المناخ الدافئ. وكشفت النتائج أن طفيل التريكوجراما أعطى معنوية عالية في الحد من تعداد هذه الآفة في الحقل وكذلك أدى إلى تعظيم دور الأعداء الطبيعية