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MONITORING THE POPULATION DEVELOPMENT AND THE INFESTATION DENSITY OF TOMATO MOTH (*TUTA ABSOLUTA* MEYRICK) (LEP.: GELECHIIDAE) IN GREENHOUSES

SUMMARY

The adult population development and infestation ratio of Tomato Moth (*Tuta absoluta* Meyrick) were studied in Çumra (Konya) district in three tomato greenhouses in 2011 and 2012. Two sexual pheromone traps were placed in greenhouses to monitor population development. Infestation density of tomato leaf and fruit was determined on 100 tomato plants by visual examination method. The number of adults in the traps was examined and recorded weekly. Additionally, as the mass trapping technique, ferolite traps were used to control this pest. Four generations of *T. absoluta* were determined in greenhouses and maximum adult numbers on pheromone traps in first, second and third greenhouse were found as 640, 626 and 154, respectively. While infestation ratio of tomato leaves in each greenhouses were determined as 70, 80 and 25%, fruit infestation ratios were 23, 25 and 5%, respectively. The maximum number of adult Tomato Moth in ferolite traps in the first and second greenhouse was as 1250 and 1525, respectively. Study results suggested that ferolite traps were found to be successfully used for mass trapping of the pest by decreasing adult population density.

Keywords: *Tuta absoluta*, pheromone, ferolite, greenhouse

INTRODUCTION

Tomato is one of the most widely grown vegetables in Turkey. It's grown both in field and greenhouse. In recent years, it's grown successfully in greenhouses especially located in Sugar Factory and some other places in Central Anatolia along with the greenhouses in Aegean and Mediterranean Regions.

According to data of 2011, tomato was grown a total of 136.276 t which include 91.936 t for table and 44.430 t for sauceboat in 17.343 ha field in Konya province. It was grown a total of 9.587 tomatoes which include 4.637 t for table and 4.950 t for sauceboat in 3.068 ha fields in Çumra district (Anonymous, 2011).

There are many pests that damage the leaves and the fruits of the tomato and one of them is Tomato Moth (*Tuta absoluta* Meyrick), in Lepidoptera order.

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The pest, first reported in South America, damaged the tomato plants in different parts of the world (Barrientos *et al.*, 1998; Estay, 2000). Although the larvae of the pest feed on all above-ground parts of the tomato plant, they mostly prefer the leaves and the fruits. Various researchers mentioned the importance of the pest all around the world (González-Cabrera *et al.*, 2010; Roditakis *et al.*, 2010; Seplyarsky *et al.*, 2010).

Tuta absoluta have led to yield loss and decrease the market value of tomato in recent years (Seplyarsky *et al.*, 2010; Roditakis *et al.*, 2010).

It was reported that the pest damaged the tomato in İzmir (Kılıç, 2010), Antalya (Erler *et al.*, 2010), Mersin (Karut *et al.*, 2011) and it caused damage to tomato (Ünlü, 2011) and potato (Unlu, 2012) in Konya. In this study, we studied population development of the pest with pheromone traps, infestation density on tomato leaves and fruits and ferolite traps for the control of the pest in greenhouses in Çumra district, Konya province.

MATERIALS AND METHODS

The study was carried out in Çumra Sugar Mill tomato greenhouses during the production seasons of 2011-2012 (period October 2011 to July 2012). Pheromone traps were used to monitor the adult population development and ferolite traps were used for mass trapping.

Experiment area

The study was conducted in three greenhouses in Çumra Sugar Mill. Two of them, 0.5 ha each, were hydroponic (soilless) tomato greenhouses (G1 and G2) and the third one, 0.2 ha in size, was terreous greenhouse (G3). One of the hydroponic tomato greenhouses was covered with glass and the other one with polycarbonate. The terreous greenhouse was covered with plastic.

Adult Population Development

Two pheromone traps were established for each greenhouse (greenhouse 1, 2 and 3) to monitor adult population. The pheromone capsules of the traps were replaced every two months; sticky sheets were replaced every 3-4 weeks. The trapped adults were counted and recorded, weekly.

Mass-trapping of Adults with Ferolite traps

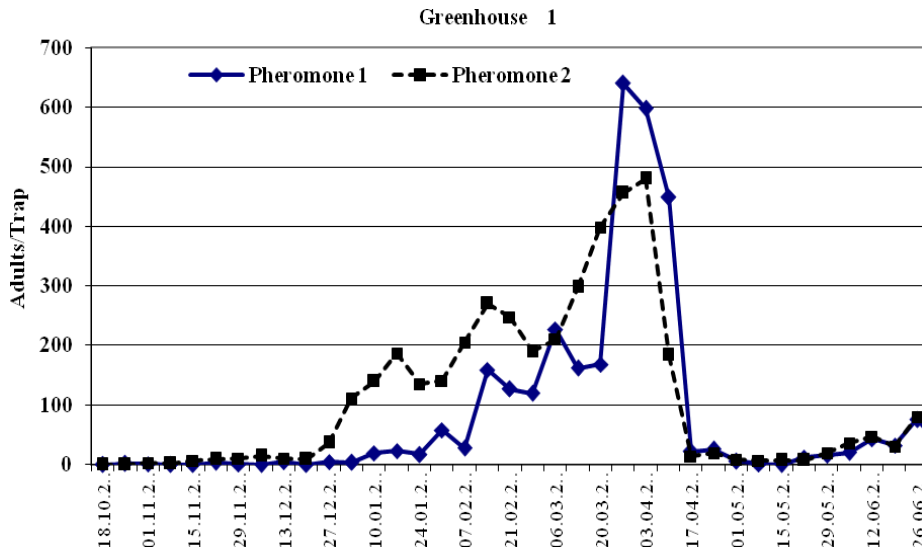
Ferolite traps, a combination of light and pheromone traps, were used for tomato moth mass-trapping. The power source of the traps maintained by a charged battery via solar panel on the top of the trap during the day time and thus the lamp of the trap can be on during the night time. In addition, there is a detergent water area in the base of the trap in order to catch the adult moths. One ferolite trap was established in each of greenhouse 1 and 2. The capsule of the traps was replaced with the new ones every two months; water was added weekly if needed. The trapped adults were recorded weekly.

Determination of the Infestation Density of the Tomato Moth

In order to determine the damage of the tomato moth on the leaves and fruits; 100 tomato plants were selected randomly in each greenhouse, every part of selected plants were monitored. Larvae and larvae damages were recorded.

RESULTS AND DISCUSSION

The weekly adult population development of the pest was monitored in Çumra Sugar Mill tomato greenhouses, October 2011 to July 2012, by pheromone traps. The results of the G1 were shown in the Graph 1.



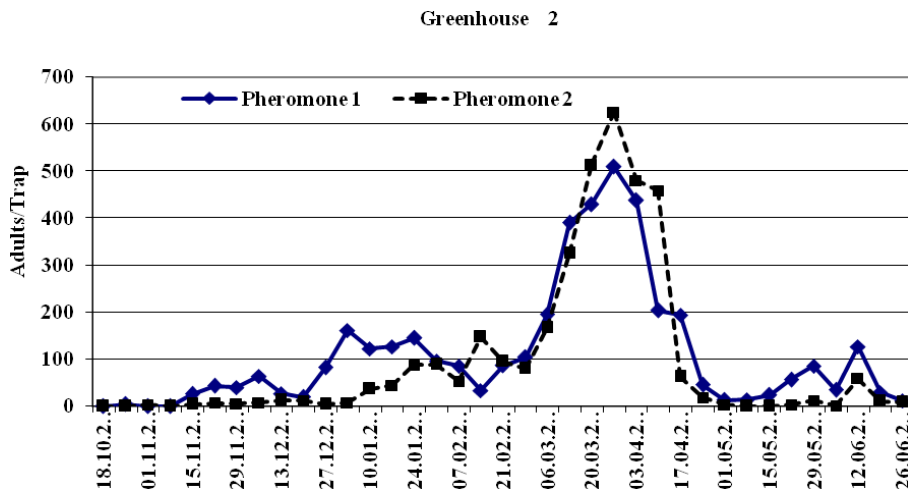
Graph 1. The adult population development of tomato moth in pheromone traps in G1

First *T. absoluta* adults were captured by pheromone traps on October 25th, 2011 in G1. The number of adults was less than twenty (5-15 adults/week) until December 20th 2011, density started to increase in the last week of December (27 December 2011) and reached the maximum (640 adults/week) on March 27th 2012. The population decreased during the last week of March and a new peak (47 adults/week) occurred on 12th of June. The numbers of trapped adults decrease in mid-June. As long as all the conditions are favorable, larvae do not enter diapause and produced 10-12 generations per year (EPPO, 2005). It has been detected that the pest population peaked 4-5 times in G1 throughout the tomato production season.

The results of the greenhouse 2 (G2), were shown in Graph 2.

First *T. absoluta* adults were captured by pheromone traps on 25th October 2011 in G2, similar to G1. There were no moths in the traps until November 08th, 2011. Adults appear and their density started to increase (26 adults/week) on

November 15th, 2011. The first peak of the pest population (64 adults/week) was detected on December 06th, 2011, the second peak (162 adults/week), with a more adults moth was on January 03th, 2012. The pest population density fluctuated throughout the season and reached the highest level (626 adults/week) on March 27th, 2012. After this date, the number of adults rapidly decreased making two peaks (86-127 adults/week) on May 29th and June 12th. The production cycle ends with the dismantling of the plants in greenhouse.



Graph 2. The adult population development of tomato moth in pheromone traps in G2

The results of the terreous greenhouse 3 (G3) were shown in the Graph 3.

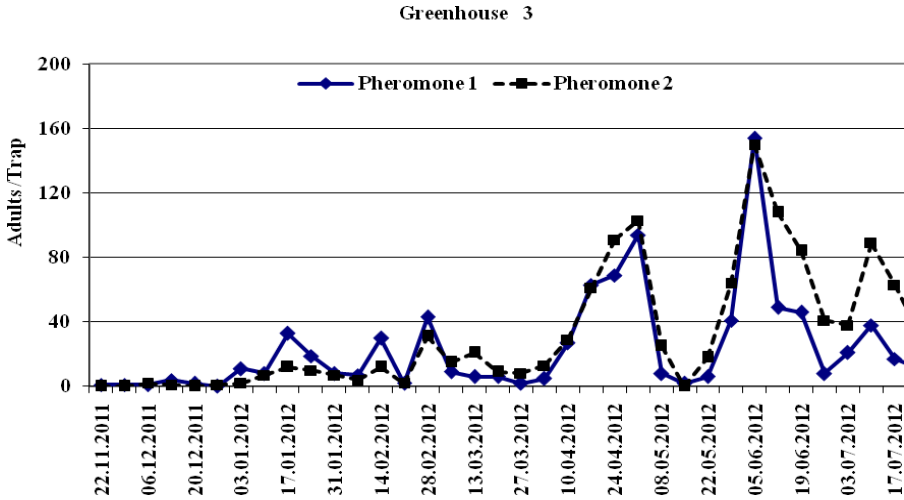
Tuta absoluta adults were captured by pheromone traps on November 22th, 2011 in G3. However the population of the pest had been low approximately for five months, the first peak of the pest (103 adults/week) was on May 01st, 2012. After this date the number of adults decreased and detected only 1 adult/week on May 15th, 2012. The pest peaked approximately in every four weeks and reached the highest level (154 adults/week) on June 05th, 2012 and the population of the pest declined steadily towards the end of the production season.

The number of adults trapped in ferolite traps is shown in Graph 4.

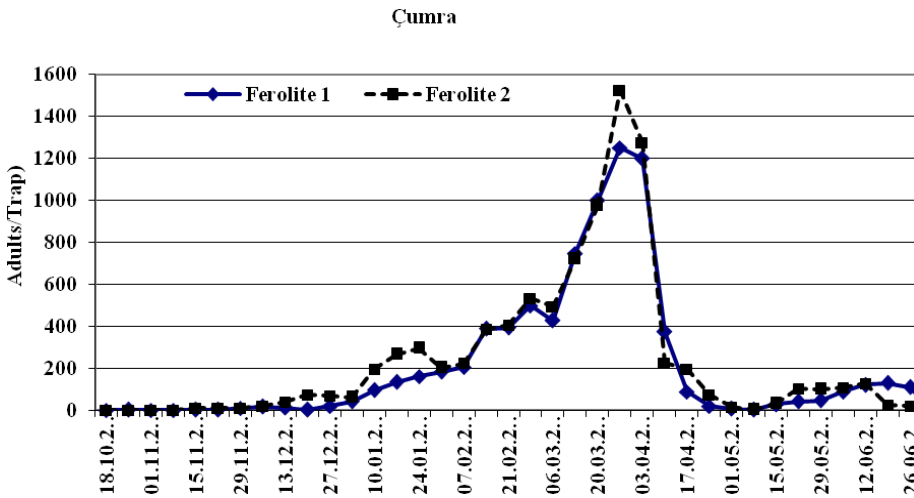
The first *T. absoluta* adults were captured by Ferolite traps in G1 and G2 on October 25th, 2011. The numbers of adults in the traps generally increased from November 15th 2011 to March 27th 2012, with a peak (1525 adults/week) on March 27th 2012. After this date, the number of adults rapidly decreased in the ferolite traps and the decrease in the population continued until 15 May 2012. The final peak of the moth was (129 adults/week) on June 19th, 2012 and the population of the pest declined gradually towards the end of June.

Also, cultural control (pruning the infected leaves) led to decrease in the pest populations in the traps. The pest population continued in low numbers from late May (May 22nd 2012) until early July (July 03rd 2012). Due to the lack of the

economic efficiency of the insecticide applications and coming to the end of spring production season in late May and early July, the greenhouse management stopped the insecticide application and it was considered that this contributed to an increase in the pest population.



Graph 3.The adult population development of tomato moth in pheromone traps in G3



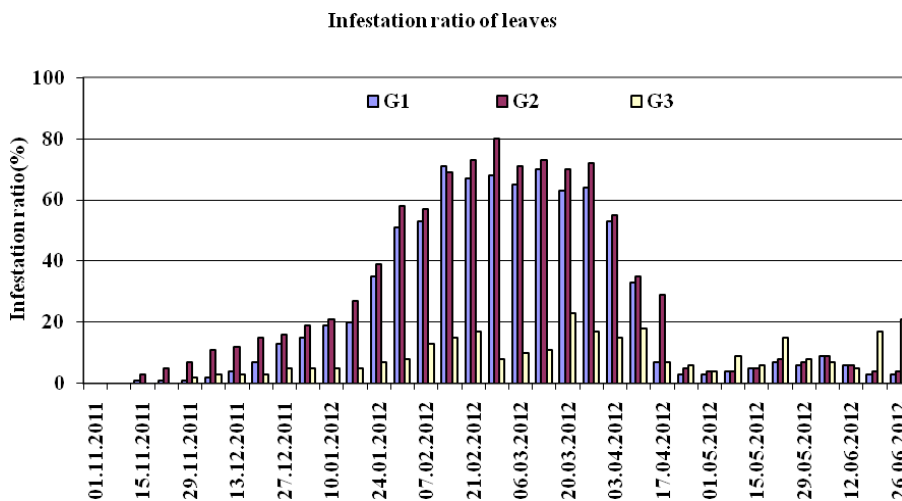
Graph 4.The adult population development of tomato moth in Ferolite traps in tomato greenhouses

Filho et al. (2000b), caught 869 adults per pheromone traps for three nights in succession in field trials, Ferrara et al. (2001), caught 201 male adults with

standard pheromone dose and it's up to 1200 adults when high pheromone dose applied. In this study, it was found that the highest number of adults caught in all three greenhouses was 473 adults per week.

It was found that ferolite traps were able to capture both male and female adults and capture more adult than pheromone traps, thus, they were judged as more effective than pheromone traps. Also, the numbers of adults in ferolite traps were twice or more than sex pheromone traps because ferolite traps acted as both light traps and pheromone traps

In order to determine the damage of the tomato moth on the leaves and fruits; tomato plants were selected randomly in each greenhouse, leaves and fruits of the tomato plants were checked and larvae and larvae damages were recorded. The infestation ratio of the leaves is shown in Graph 5.

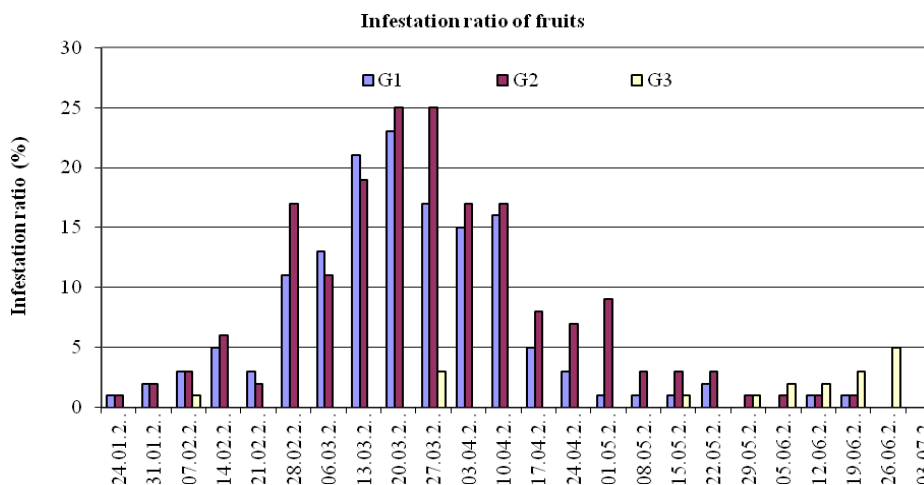


Graph 5. The infestation ratio of tomato moth on the leaves of tomatoes in greenhouses

The larvae and the damages of the pest were detected on November 15th, 2011 in G1 and G2, on November 29th, 2011 in G3 on the lower leaves of the plants. The infestation ratio started to increase on December 06th, 2011. Due to the prune of the lower leaves of the tomato plants, on January 03rd, 2012 in G1 and January 17th, 2012 in G2, the pest shifted to the middle leaves of the plants. The infestation rate was under 50% in both greenhouses until January 24th, 2012, then started to increase over 50% since January 31th, 2012. In G3, the infestation ratio increased over 50% on March 20th, 2012. The pupa was observed on the leaves and branches of tomato plants in greenhouses on February 21th, 2012. The infestation ratio peaked; on February 28th, 2012 in G1 and G2, and on March 20th, 2012 in G3. The infestation ratio of the pest decreased less than 50% on April 10th, 2012 in all greenhouses and continued to decline except G3. Towards the end of the production season, while the infestation ratio decreased in G1 and

G2, it was observed that the infestation amount increased, reached the highest level and peaked on July 03rd, 2012 in G3.

Data of the infested fruits were shown in Graph 6.



Graph 6. The infestation ratio of tomato moth on the fruits in greenhouses

The pest was determined on ripe and under ripe fruit in G1 and G2 on January 24th, 2012, in G3 on February 07th, 2012. The pupa was observed on the fruits on February 14th, 2012 and larvae damages were found on the sepals. The infestation intensity of the fruits was increased due to pruning in G1 and G2 on February 21th, 2012. It was observed that the highest infestation rate of G1 and G2 on March 20th, 2012 were 23 and 25%, respectively. Throughout the production season, the highest infestation rate in G3 was detected as 5% on 26 June 2012.

The highest infestation rate of the leaves was in G2. Fruit infestation rate was found high in G2 like infestation ratio of leaves. This can be resulted from pruning the leaves due to the infestation or for better plant growth. So, the pest able to pass from leaves to fruit. Karut et al. (2001) found that the highest infested tomato fruit ratio per plant was recorded as 38.4% in tomato greenhouse in Mersin province. In this study, it was found that the highest infestation ratio in tomato leaves and fruit was 80 and 25%, respectively.

It was determined that the number of adults was fewer in the terreous greenhouse (G3) than the other two hydroponic (soilless) tomato greenhouses (G1 and G2). Various types of vegetables located in (e.g. pepper and cucumber) and late planting of tomato seedlings can cause fewer numbers of adults in G3 and this led to decrease in the infestation ratio of leaves and fruits.

CONCLUSION

Study results revealed that tomato moth damaged the tomato plants in all greenhouses located in Çumra where the study was conducted. In the control of

the pest, establishing the pheromone or ferolite traps from the planting of tomato seedling better than would be better able to give us knowledge about the damage and early populations of the tomato moth. When the pest population was extremely high, increasing the number of traps for monitoring would also provide suppression on the number of the pest. It was advised that because of high temperatures in greenhouses during the growing season, the pheromone capsules which are replaced every five-six weeks for the efficiency of the traps.

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