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***Research Article***

**Ayçin AKSU ALTUN[1a*]**

**Emine ÇIKMAN[2a]**

[1]GAP Agricultural Research Institute, Department of Plant Health, Sanliurfa

[2]Harran University, Faculty of Agriculture, Department of Plant Protection, Sanliurfa

**[1a]ORCID**: 0000-0002-9425-281X

**[2a]ORCID**: 0000-0003-4375-5043

[*]Corresponding author:

aycinaksu@hotmail.com

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# Determination of The Prevalence and Population Development of Tomato Leafminer [*Tuta absoluta* (Meyrick, 1917) (Lepidoptera: Gelechiidae)] in Tomato (*Lycopersicon esculentum* Mill.) Planting Areas of Sanliurfa Province

## Abstract

This study was carried out to determine the extensity, development of population and the state of damage of tomato leaf miner (*Tuta absoluta* (Meyrick, 1917) (Lepidoptera: Gelechiidae)) in total eight tomato fields located in the villages of Goktepe of Central Sanliurfa, Meteler of Birecik, Kepirce of Bozova, Yalcinkaya of Ceylanpinar, Ovacik of Hilvan, Kucuk Yucelen of Siverek, Aligor of Suruc and Ciftciler of Viransehir in 2011. To determine the extensity of tomato leaf miner each of the 5 districts in the village tomato field was checked by observation whether adult or larvae found in fields *T. absoluta*. The result showed that tomato leaf miner was common in all the districts. The highest density of tomato leaf miner adult population quantities were 630, 800, 400, 965, 211, 600, 215 and 96 pcs/week in Goktepe of Central Sanliurfa, Meteler of Birecik, Kepirce of Bozova, Yalcinkaya of Ceylanpinar, Ovacik of Hilvan, Kucuk Yucelen of Siverek, Aligor of Suruc and Ciftciler of Viransehir, respectively. Tomato leaf miner harmed the fruits, particularly total in 1st and 2nd harvest of tomato (the end of August- the beginning of September) , if precautions were not taken. Moreover, it was recorded that if the adult population was quite dense in the fields study conducted, there aren't any undamaged leaves and fruits from *T. absoluta*.

## INTRODUCTION

Being a one-year vegetable in the Solanaceae family, tomato has gained an important place in our country and in the world due to the existence of different usage areas (tomato paste, canned, dried tomato, tomato juice, ketchup, sauce, etc.) and its rich nutritional values. is a cultivated plant (Bergougnoux, 2014; Canpolat, 2016; Gölükçü et al., 2016). In addition, tomato fruit's high content of vitamins A, E and C, minerals such as potassium, phenolic compounds and vegetable fiber increases the value of the fruit in terms of health, causes it to have protective properties against many diseases and consequently increases its consumption (Abak, 2016). It is estimated that the tomato, whose homeland is known as South America, was first cultivated by the Mexican natives. The first records of the arrival of tomatoes in Europe were kept in 1554 by Italian herbalist Pier Andrea Mattioli (Tigchelaar, 1986). It took a long time for the tomato, which is not consumed as a poison, to be accepted as a vegetable here and to gain value as a cultivated plant. The records regarding the cultivation of tomatoes in North America date back to 1710 (Tigchelaar, 1986). In this continent, tomatoes were included in the seed catalogs in 1817. Although it has been cultivated later than many other cultivated plants, today tomato has an indispensable position in the cuisine of many countries (Anonymous, 2013). pests every year in the world and Turkey, crop losses caused by weeds and pathogens is approximately 35% of total production (Canpolat, 2016; Duman, 2016). There are more than 77 pest species that can negatively affect tomato cultivation in our country, and the leading ones are White fly, Leaf Gallery, Red Spider etc. are the main pests (Uygun et al., 1998).

Tomato leaf gallery moth, *Tuta absoluta* (Meyrick, 1917) (Lepidoptera: Gelechiidae) entered our country in 2009 and has become an economically important pest in provinces where tomato cultivation is intense. first time in Turkey in 2009, the province of Izmir Urla district of *T. absoluta* detected, especially in the Mediterranean and Aegean regions the population has created greenhouse tomatoes (Kılıç, 2010). Appropriate climatic conditions and the presence of alternative hosts in the flora of the Mediterranean Region make the region suitable for pests (Eppo, 2005). Since the pest feeds by opening galleries under the leaf epidermis, its chemical control is quite difficult (Cabello et al., 2009). In addition, the fact that it gives off as many as 10-12 per year causes it to develop resistance against some insecticides very quickly (Siqueira et al., 2001; Lietti et al., 2005). *T. absoluta*, originating from South America, was first detected in Peru. It has been detected since 1980 in Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Paraguay, Uruguay and Venezuela (Barrientos et. al., 1998; Estay, 2000). The pest was only reported in South America and the Easter Islands before it spread to Europe (Ripa et. al., 1995). *T. absoluta* was first detected in Europe in 2006 in tomatoes grown under greenhouse in Spain. It has been detected in tomatoes in the southern parts of Italy, France, Greece, Portugal, Morocco, Algeria and Tunisia in 2008 and 2009 (Potting, 2009). Finally, in southern Germany, Cyprus and the tomato greenhouse in Romania, Bulgaria (EC Report, 2009), Turkey (Kılıç, 2010; Erler et. al., 2010), Lithuania and the Central Asian countries (Bahrain, Kuwait) open its presence in field and greenhouse tomato production has been reported (Eppo, 2010). It was first detected on tomato plants in Urla, a province of Izmir, in the Aegean Region in 2009 for the first time in our country. In the same year, pheromone traps were detected in Çanakkale and Muğla provinces (Kılıç, 2010). In the Mediterranean Region, it was detected in a commercial tomato greenhouse in Antalya-Kumluca in January 2010 (Erler et. al., 2010). *T. absoluta* adult is approximately 6-7 mm in length, and its wingspan is 10 mm. It has an adult, thread-

shaped antenna. The front wings of the adult are silvery-gray-brown scaly with characteristic black spots on the wings. The egg is oval, cream-yellow in color, very small, 0.4 mm in length and 0.2 mm in width. Eggs are left under the leaf, mostly on the stem, stem, buds and sepals of immature tomato fruits and open within 4-5 days when conditions are suitable. The pest, which undergoes four larval stages, is 0.9 mm tall at the beginning and reaches 8 mm when it adults. After the first period, the color of the larva turns green and towards the last period, the top of its body appears pinkish. The adulting larva's head turns brown and the dark-colored thin band in the prothorax is the most important distinguishing feature of the larva. The larval period lasts 13-15 days. Completing the larval stage, the pest usually throws itself into the soil to pupate with the filamentous web it creates. Pupa is about 5-6 mm in length, while initially greenish in color, it turns brown when it becomes adult. Pupa period lasts 9-11 days. It spends its pupal period in the galleries it creates on the leaf or plant, or in the soil in a white cocoon it creates. *T. absoluta* butterflies hide among the leaves during the day and move around at night or at dusk. In places with a Mediterranean climate and a high reproductive capacity, the pest produces 10-12 offspring per year as long as the conditions are suitable. It completes the life cycle in 28-29 days, depending on environmental conditions. A female can lay 250-260 eggs during her lifetime. 73% of the eggs are left on the leaves. As long as the larva finds food, it does not diapause. It spends the winter as an egg, pupa or adult. Low temperature and altitude are important factors that limit the life of the pest. *T. absoluta*, which is a temperate climate pest, cannot grow below 6-9 ºC. It can survive year-round in places with a Mediterranean climate. *T. absoluta* larvae feed on all parts of the tomato except the subsoil part. The larvae hatched into leaves, stalks, shoots and fruits begin to feed. It forms transparent galleries by feeding between the two epidermis of the leaf. These transparent voids then become necrotic, turning brown and drying. Due to the galleries opened in the green part of the plant, the plant may dry out completely. In the galleries opened on the leaf and fruit, the pest's feces in the form of black sawdust can be seen. Especially in the galleries opened on the leaves, the black colored stools in clusters are quite striking. It is also possible to see the larvae in the gallery. The pest usually prefers fresh shoot tips to flower and new fruit for feeding. It can cause damage in every period of tomato fruit. Entrance holes under the sepals are quite typical in the immature green tomato fruit. When secondary microorganisms settle in the galleries opened on the fruit, rotting can be seen. The economic damage threshold can prevent 50-100% of tomato production unless the pest, which has 3 eggs or larvae in 100 plants, is not treated (Eppo, 2009). 45 adults caught in pheromone traps in Brazil, 100 adults in Chile It is indicated as the threshold of struggle. In Colombia, 2 adult females or 26 larvae per plant are accepted as the economic damage threshold (Desneux et al., 2010). The rapid increase of the population in the world and in our country and the inability of agricultural production to respond to this increase brings about insufficient and unbalanced nutrition problems. At the same time, great importance is attached to studies aimed at increasing efficiency in agricultural production in order to provide suitable and sufficient raw materials for the industrial sector and to obtain sufficient and quality products for export. Tomato is one of the most important vegetables in the world because it is one of the most produced, consumed and traded agricultural products, is an indispensable product in human nutrition and has a wide range of uses such as frozen, canned, tomato paste, ketchup and pickles in the food industry. Although tomatoes grown in many countries in the world, Turkey is one of the major producing countries due to favorable climate conditions tomato production in Turkey can be made both in the greenhouse field. 11.85

million tons of Turkey took place as the world's fourth largest supplier of tomatoes (Anonymous, 2016). In Turkey, 3.4% of the total 23.8 million hectares of agricultural land that average 804 thousand hectares are scheduled vegetables. Turkey does not show a balanced distribution according to the cultivation and production of vegetables, especially vegetable production is concentrated in the coastal areas. The largest share in cultivation area is in the Mediterranean and Aegean Regions, followed by the Marmara, Black Sea and Southeastern Anatolia Regions. Southeastern Anatolia Region of Turkey from 6% in vegetable production areas in the land that is 546 thousand tons of vegetables are grown. In the Southeastern Anatolia Region, tomato cultivation ranks second in the total vegetable amount with 26% total vegetable production, 148 thousand cultivation area and 655 thousand tons of production (Anonymous, 2018). Vegetable production in the Southeastern Anatolia Region is widely carried out as field vegetable cultivation. Especially in tomato production, both field cultivation and cover cultivation are available in our region. Sanliurfa in the GAP Region is the capital of tomato production. While 41% of the total tomato production area and 58% of the production amount in the GAP Region is located in Sanliurfa, this province is followed by Diyarbakır with 23% production area and 19% production share. Turkey is also 1774,741 tomato production area. Within this area, Sanliurfa province has the highest production area among the provinces of the GAP Region with 83799 da. as the amount of tomato production Turkey, it has 12750.000 tons of production. Among this amount, Sanliurfa is the 1st with 471.148 tons. The aim of this study was to determine the prevalence and population growth of the tomato moth causing damage to the tomato plant in Sanliurfa province (Anonymous, 2018).

## MATERIAL and METHODS

### Material

The main material of the study; Tomato production areas in Sanliurfa, Central district, Birecik, Bozova, Ceylanpinar, Hilvan, Siverek, Suruc and Viransehir districts, adult, eggs and larvae of the tomato moth, tomato leaves and fruit samples were formed. Delta type sexual attractive pheromone traps and binoculars were used in the study.

**Figure 1.** Larvae of *Tuta absoluta* and their damages in tomato fruit

## Method

### Determination of *Tuta absoluta* population development

In order to determine the population development of the tomato moth, a total of 8 tomato fields, each more than 4 decares, were selected. The study was carried out in Goktepe in Sanliurfa Central district, Meteler in Birecik district, Kepirce in Bozova district, Yalçinkaya in Ceylanpinar district, Ovacik in Hilvan district, Kücük Yücelen in Siverek district, Aligör in Suruc district and Ciftçiler villages in Viransehir district. Table tomato variety was used in all districts except Hilvan district, and tomato paste for tomato paste was used in Hilvan. Sexually attractive pheromone traps were used to determine the population development of tomato moth adults. The traps were placed in each field after the seedlings were planted. The official climate data of Sanliurfa Regional Directorate of Meteorology Station were used to determine the relationship between the population development of adults caught in sexual attractive pheromone traps with temperature and humidity.

### Sampling with sexually attractive pheromone traps

Delta-type sexual attractive pheromone traps were suspended on wooden stakes 15 cm higher than the height of the plant, and wooden stakes were raised as the plants grew. The sexual attractive pheromone traps suspended in this way were checked once a week and the numbers of the adults caught were recorded. The sexually attractive pheromone capsules of the traps were changed every two months, and the sticky portion was changed when necessary, depending on the tomato moth density.

**Figure 2.** Delta type sexual attractive pheromone trap used in tomato moth population monitoring

### Determining the prevalence and contamination rate of *Tuta absoluta*

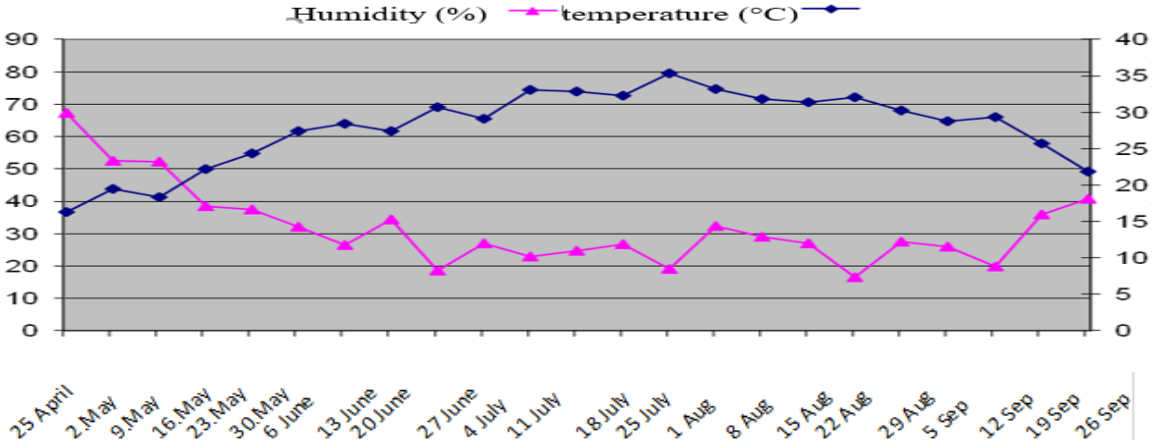
In order to determine the prevalence of *Tuta absoluta* in Sanliurfa province, tomato fields in 5 villages belonging to each district were checked through observation and the presence of *T. absoluta* adult or larvae in the fields was determined. These villages; Akcahisar, Asagiciftlik, Bezirci, Goktepe and Hortum in the central district, Abdalli, Diktepe, Divrigi, Güvenir and Meteler in the district of Birecik, İkizköy, Kepirce,

Sanliavşar, Tozluca and Zivanlı in the district of Bozova, Damlacik, Dikili, Gümüs, Muratli and Yalcınkaya in the district of Ceylanpinar, Hilvankaya in the district of Ceylanpinar Arpalı, Buğur, Ovacık, Omerli and Uzuncuk are Altinpinar in Siverek district, Asagialinca, Karakeci, Kucuk Yucelen, Hosca, in Suruc district Akören, Aligör, Balaban, Binatli and Boztepe, in Viransehir district Groomed, Farmers, Eser, Nergizli and Yaban villages.

## RESULT and DISCUSSION

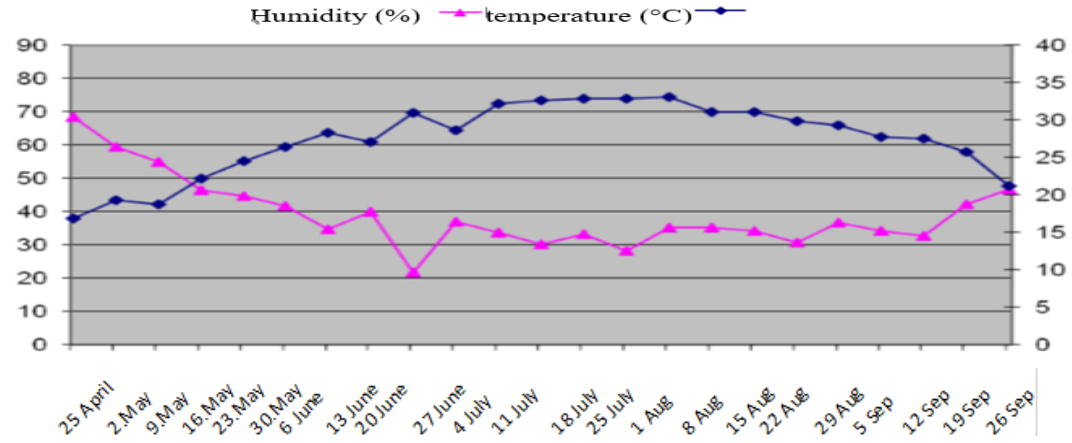
To examine the relationship of tomato moth with temperature and humidity; Weekly average temperature and humidity values of Sanliurfa provinces and districts in 2011 are given in Tables 1, 2, 3, 4, 5, 6, 7 and 8.

**Table 1.** Weekly average temperature and humidity values of the central district of Sanliurfa for 2011



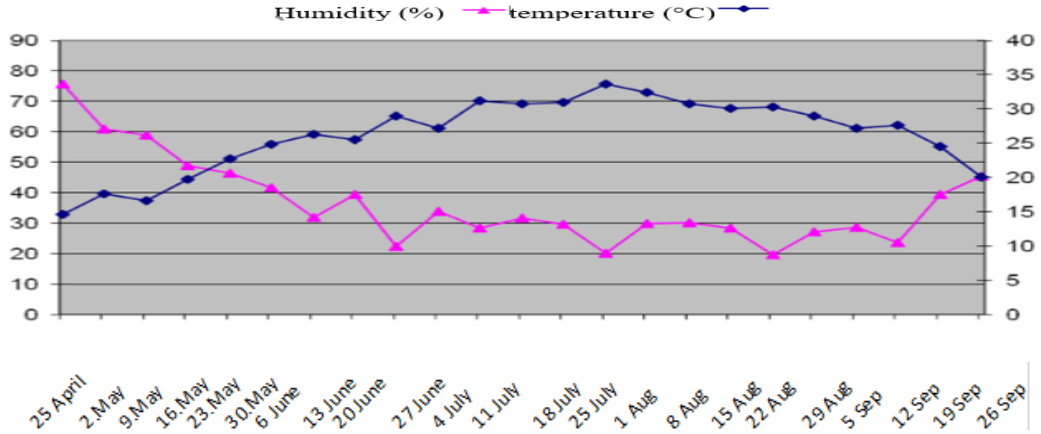

Weekly average temperature and humidity values of the central district between 25.04.2011-26.09.2011 are shown in Table 1. Accordingly, the highest temperature was experienced in the week of 25 July-31 August, and the highest humidity in the week of April 25-May 1. While the temperatures increased from May until the end of July, it continued to decrease from the end of July until the end of September. Humidity values, on the other hand, decreased from May until the end of July, and increased from the end of July until the end of September.

**Table 2.** Weekly temperature and humidity values of Sanliurfa Birecik district for 2011



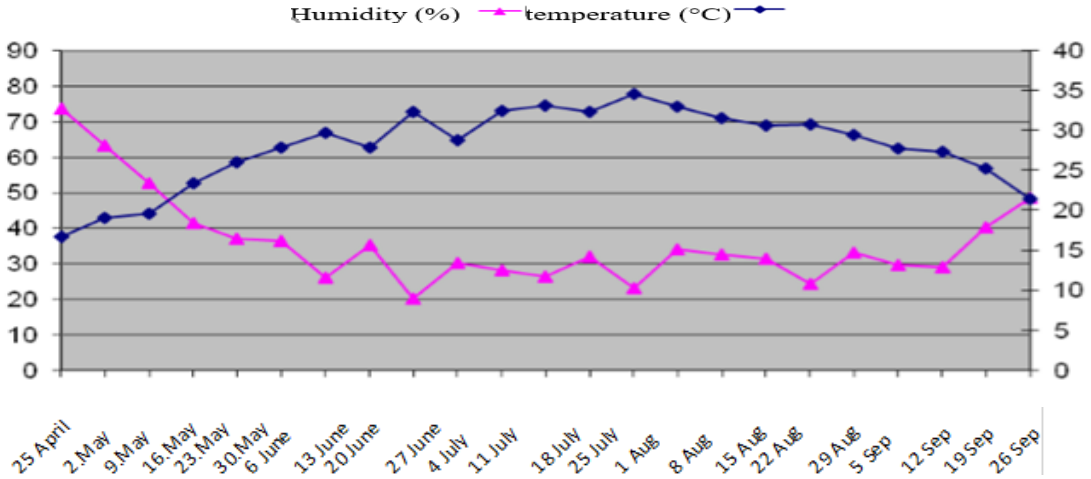
Weekly average temperature and humidity values of Birecik district between 25.04.2011-26.09.2011 are shown in Table 2. The temperature started to increase since May and decreased since August. Humidity has increased since August. Accordingly, the highest temperature was recorded in the week of 1-7 August and the highest humidity in the week of 25 April-2 May.

**Table 3.** Weekly average temperature and humidity values of Sanliurfa Bozova district for 2011



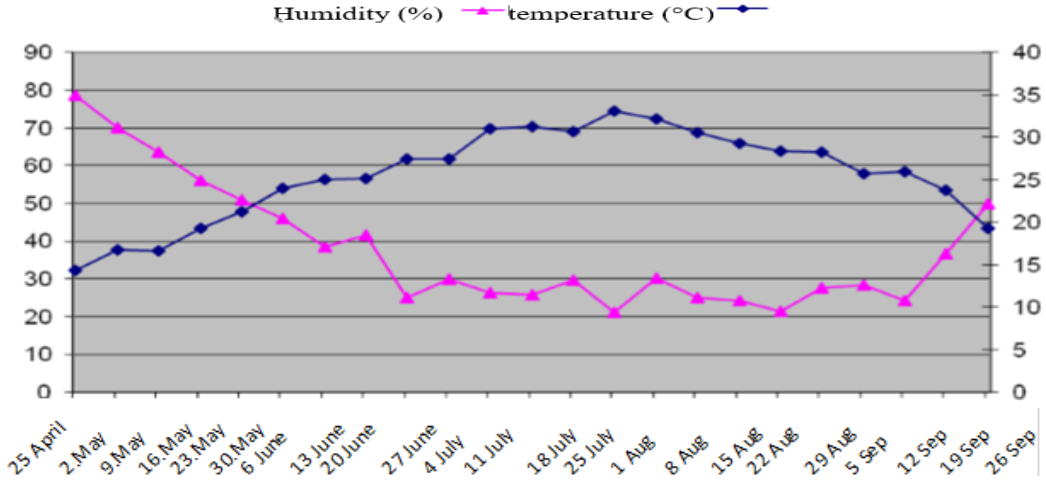

Weekly average temperature and humidity values of Bozova district between 25.04.2011-26.09.2011 are given in Table 3. The temperature has increased since May and has decreased since the end of July. Humidity values started to decrease from the week of April 25 to May 1, and increased from the week of July 25 to August 31.

**Table 4.** Weekly average temperature and humidity values of Sanliurfa Ceylanpinar district for 2011



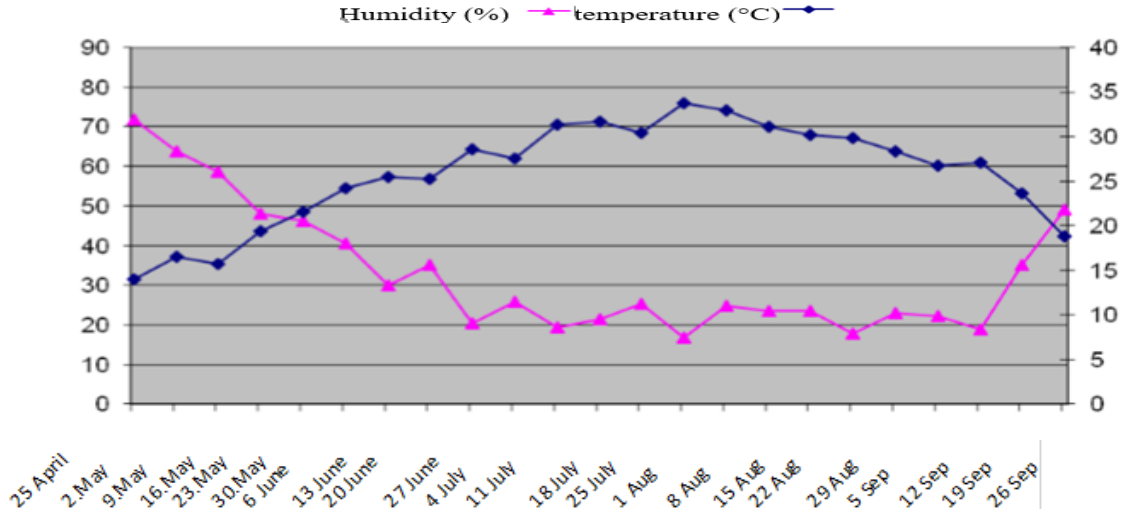

Weekly average temperature and humidity values of Ceylanpinar district between 25.04.2011-26.09.2011 are shown in Table 4. As in other districts, the temperature increased in May in this district, while the humidity decreased; At the end of July, while the temperature decreased, the humidity increased.

**Table 5.** Weekly average temperature and humidity values of Sanliurfa Hilvan district for 2011



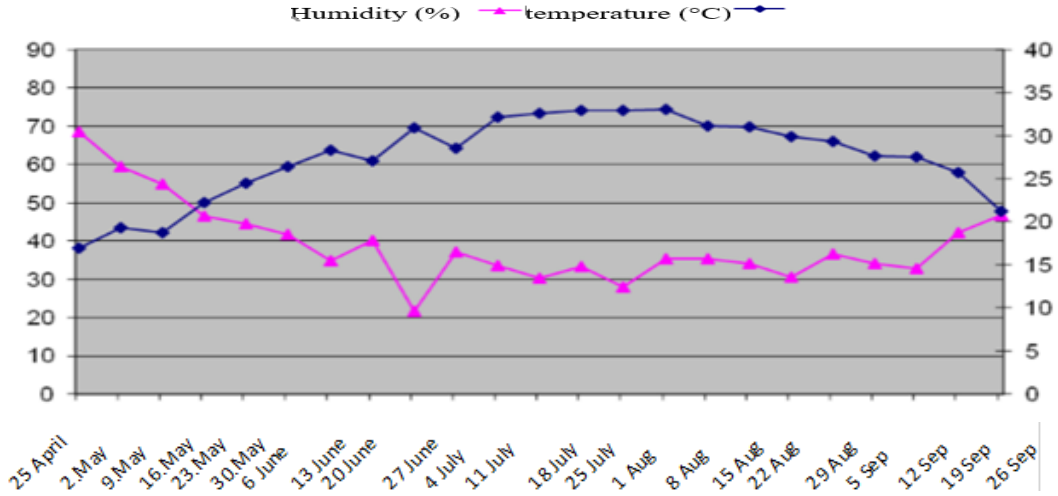

Weekly average temperature and humidity values of Hilvan district between 25.04.2011-26.09.2011 are shown in Table 5. On the 25th of April, the lowest weekly average temperature value of 5 months was observed. The temperature values, which have increased since May, have decreased again after August. Humidity values started to decrease in May, contrary to temperature values, and increased after August.

**Table 6.** Weekly average temperature and humidity values of Sanliurfa Siverek district for 2011



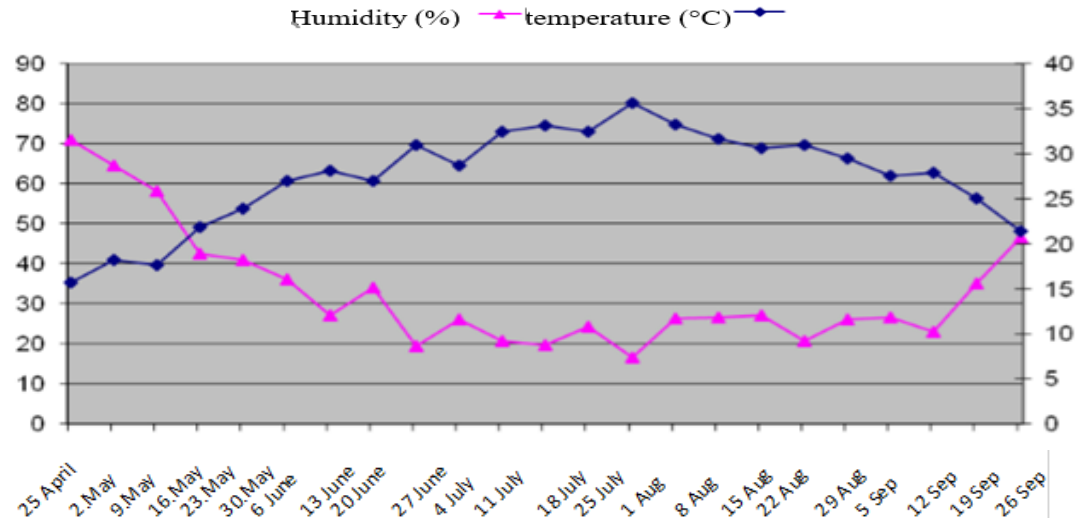

Weekly average temperature and humidity values of Siverek district between 25.04.2011-26.09.2011 are shown in Table 6. Accordingly, it was determined that the hottest week is 1-7 August and the most humid week is 25 April-1 May.

**Table 7.** Weekly average temperature and humidity values of Sanliurfa Suruc district for 2011




Weekly average temperature and humidity values of Suruc district between 25.04.2011-26.09.2011 are shown in Table 7. In the 20th of June, the weekly average humidity value has decreased up to 20%. On the 1st of August, the weekly average temperature increased above 30 °C.

**Table 8.** Weekly average temperature and humidity values of Sanliurfa Viransehir district for 2011



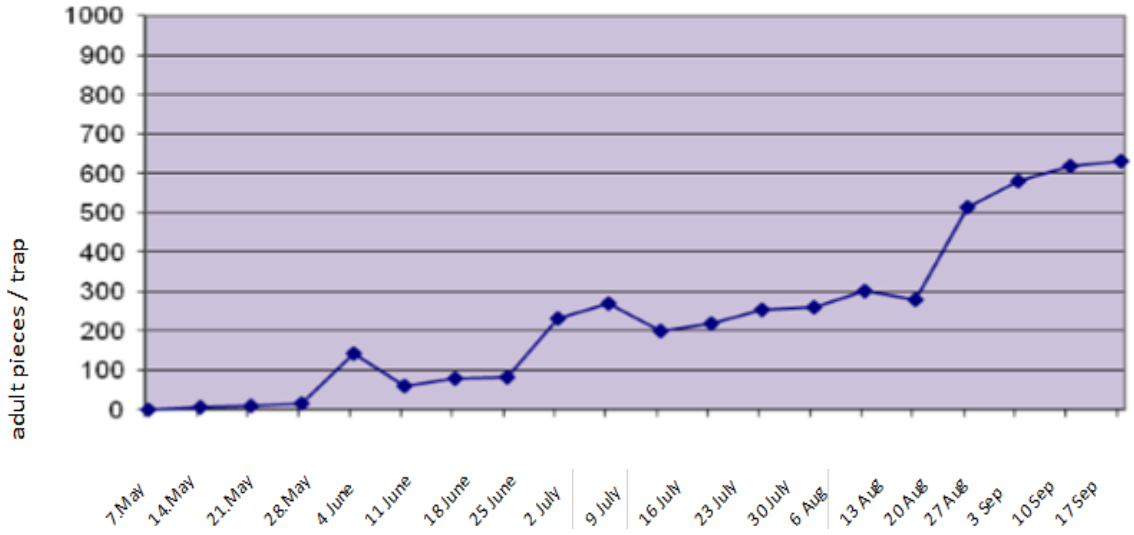

Weekly average temperature and humidity values of Viransehir district between the dates of 25.04.2011-26.09.2011 are shown in Table 8. Temperatures have reached 25$^0$C since May and humidity values have decreased accordingly. It reached the highest temperature value on the 25th of July and exceeded 35$^0$C.

**Population development of *Tuta absoluta***

Sexual attractive pheromone trap has been used to monitor the population growth of *Tuta absoluta*. Sexually attractive pheromone traps, in 2011; In Central district Goktepe on 7 May, Birecik district Meteler on 2 June, Bozova district Kepirce on 23 June, Ceylanpinar district Yalcınkaya on 26 May, Hilvan district Ovacik on 28 April, It was established in 8 villages in Kücük Yücelen in Siverek district on 22 June, in Aligör in Suruc district on 2 June and in Ciftciler in Viransehir district on 26 May. *T. absoluta* adults were first in the

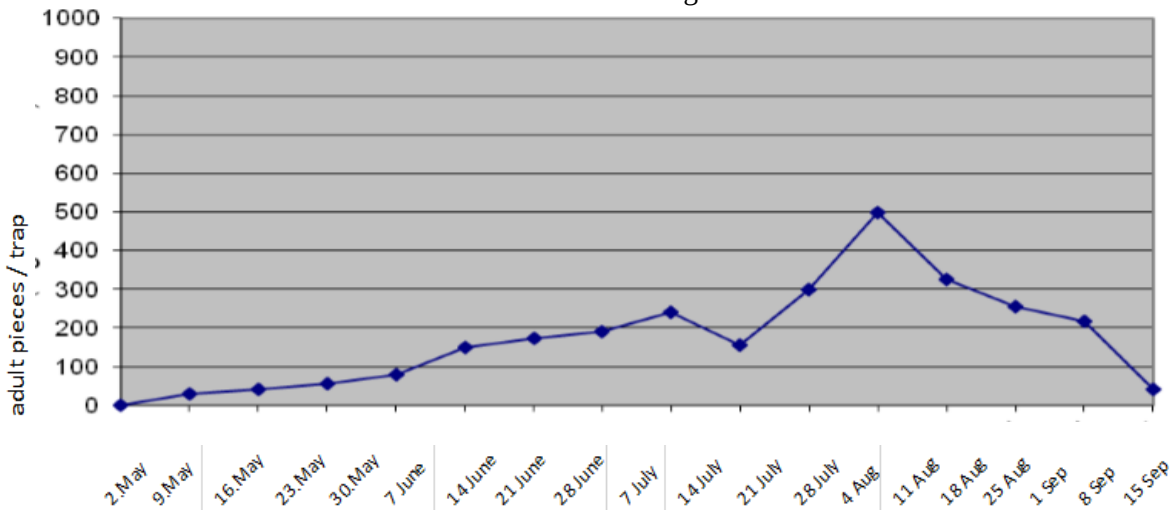
Central district Goktepe on June 14, in Meteler in Birecik district on June 9, in Bozova district Kepirce on July 7, in Yalcınkaya in Ceylanpinar district on June 5, on June 2. in Hilvan district Ovacik, Siverek district Kücük Yücelen on 29 June, Suruc district Aligör on 9 June and Viransehir district Ciftciler village on 2 June. Although there is variation in the adult population according to the districts, there was an increase generally during the end of August and September.

**Table 9.** Sexual attractive pheromone of *Tuta absoluta* belonging to 2011, Sanliurfa Province Central District Goktepe Village Population development in its traps



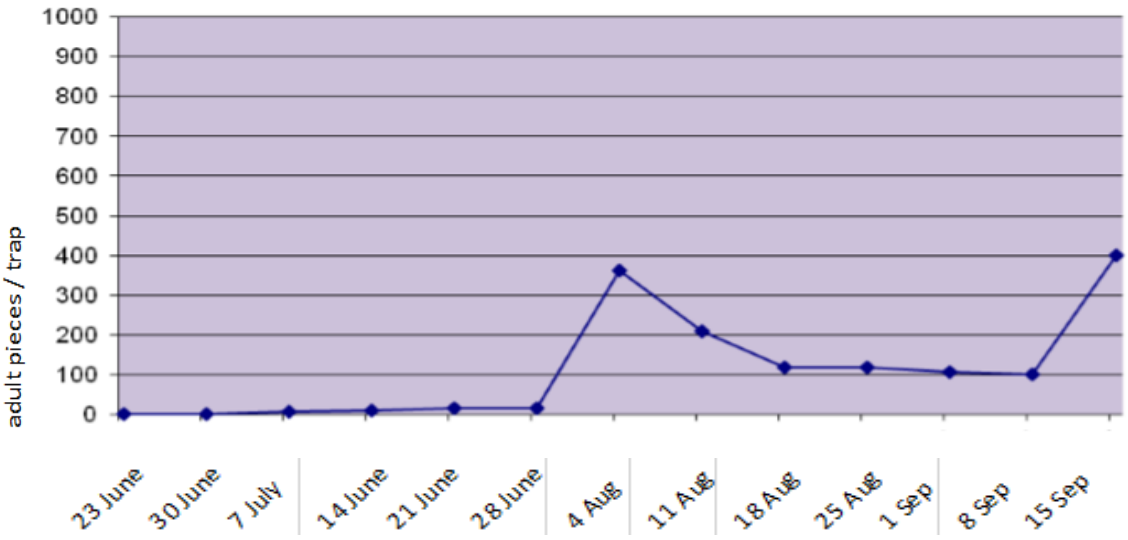

The first adults were seen in the sexual attractive pheromone trap as of May 14 in Goktepe village of the central district of Sanliurfa province (Table 9). The adult population increased until 17 September, when the sexual attractive pheromone trap was removed. Three peaks of the adult population were recorded on the 4th of June (144 adults / traps), 9 July (270 adults / traps) and 17 September (630 adults / traps).

**Table 10.** Population development in sexual attractive pheromone traps of *Tuta absoluta* of Birecik district Meteler Village 2011



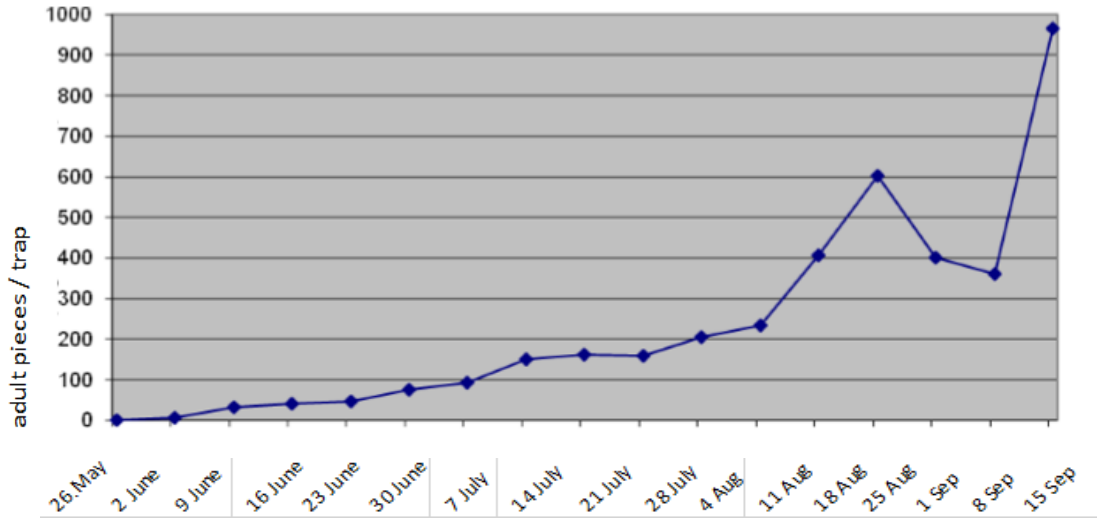
In the Village of Meteler in Birecik district, the adult was detected in the trap from the establishment of the sexual attractive pheromone trap until the second week of September (Table 10). The highest adult was recorded on 28 July (240 adults / trap) and 18 August (800 adults / trap), and it was determined that the pest formed 2 peaks.

**Table 11.** Population development in sexual attractive pheromone traps of *Tuta absoluta* of Bozova district Kepirce Village 2011



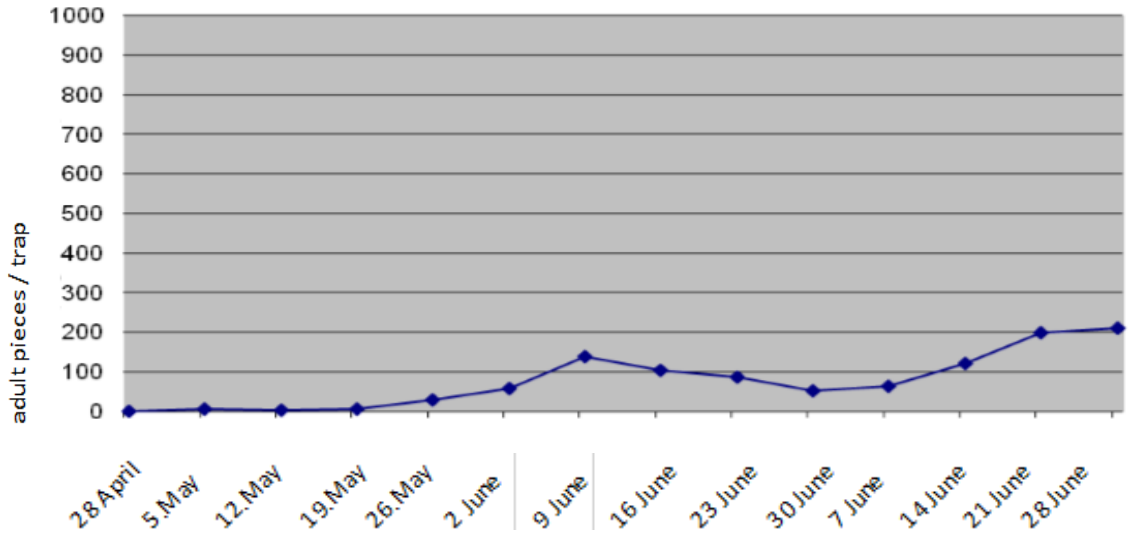

In the village of Kepirce, Bozova district, the population remained low in traps until August (Table 11). The highest number of adults was recorded on 4 August (363 adults / traps) and 15 September (400 adults / traps). It has been determined that the adult population of the pest has 2 peaks.

**Table 12.** Population development in sexual attractive pheromone traps of *Tuta absoluta* of Ceylanpinar district Yalçinkaya Village 2011



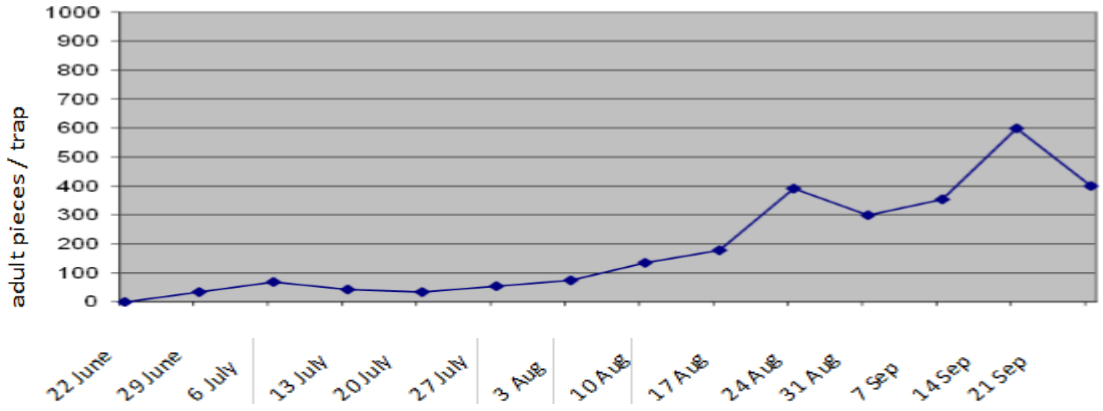
In Ceylanpinar district, Yalçinkaya village, an increase was observed in the adult population of *T. absoluta* in July (Chart 12). The highest population was detected in August and September. The highest number of adults was recorded on 25 August (602 adults / traps) and 15 September (965 adults / traps). It has been noted that the adult population of the pest forms 2 peaks.

**Table 13.** Population development in sexual attractive pheromone traps of *Tuta absoluta* of Hilvan district Ovacik Village 2011



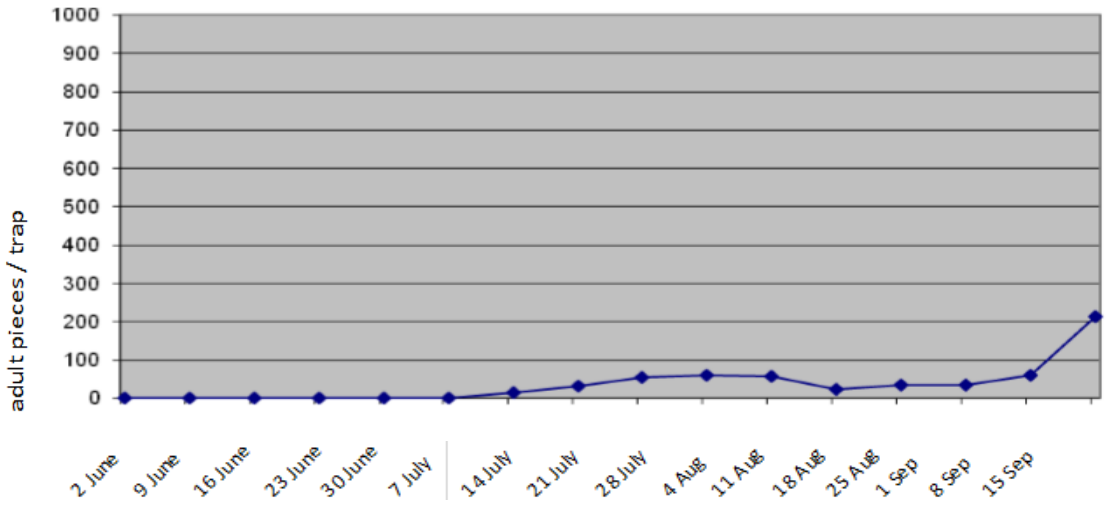

The adult population of *T. absoluta* started to increase in the Village of Ovacik in Hilvan district in June (Table 13). In the traps, until the date of the dismantling of the tomato plant (28.07.2011), adults were intensely caught. On the 9th of June (140 adults / traps) and the 28th of July (211 adults / traps), the maximum number of adults was reached, that is, it was determined that the adult population formed 2 peaks.

**Table 14.** Population development in sexual attractive pheromone traps of *Tuta absoluta*, Siverek district Kücük Yücelen Village 2011



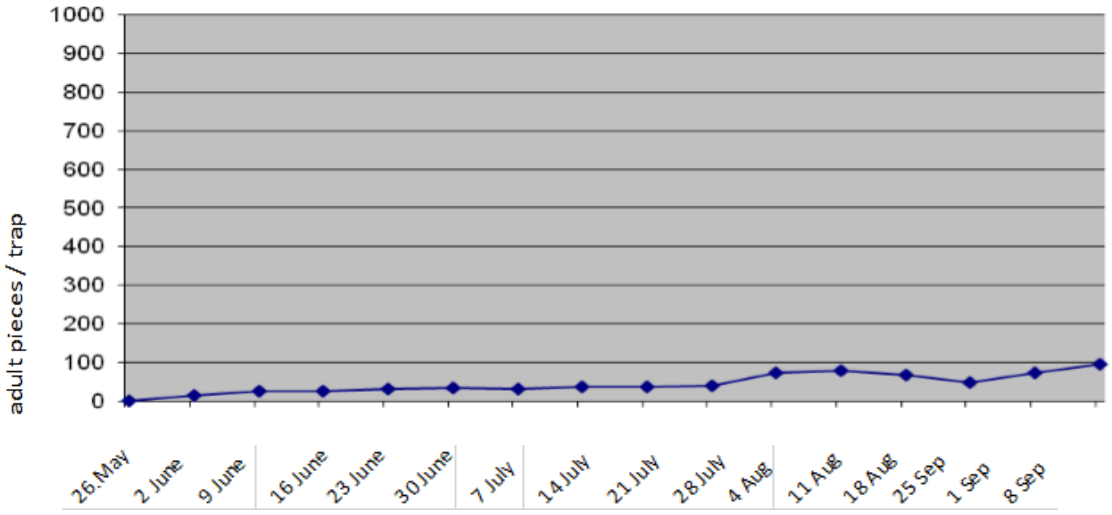
In the sexual attractive pheromone trap established in Kücük Yücelen Village, which is connected to Siverek district, the adult population started to increase on June 29 and the population growth continued until the end of September (Table 14). It was determined that the adult population formed 2 peaks on 24 August (390 adults / traps) and 14 September (600 adults / traps).

**Table 15.** Population development in sexual attractive pheromone traps of *Tuta absoluta* belonging to the Village of Aligör, Suruc district, 2011




In the sexual attractive pheromone trap established in the village of Aligör in Suruc district, the first adult was seen (1 adult / trap) on June 9 (Table 15). But then, until July 14, no adolescents were found in the trap. On the 15th of September, the adult population (215 adults / traps) was the highest due to the decrease in temperatures. It was recorded that the adult population formed 2 peaks on 4 August (60 adults / traps) and 15 September (215 adults / traps).

**Table 16.** Population development in sexual attractive pheromone traps of *Tuta absoluta* of Viransehir district, Ciftciler Village



The first adult was registered on June 2 (15 adults / traps) in the Ciftciler Village of Viransehir district. The adult population has increased since this date and formed a peak in mid-August (Table 16). As Kılıç (2010) stated, it is sensitive to harmful heat. In fact, a decrease was observed in the population due to the increase in temperature, but this decrease was replaced by an increase in September with the decrease in temperatures. It was determined that the adult population formed 2 peaks on 11 August (80 adults / traps) and 8 September (96 adults / traps). Tatlı and Göçmen (2010) reported that in their studies on the adult population of *T. absoluta*, the highest adult count in traps was in Antalya Center (240 adults / traps) on 22.03.2010. Researchers have determined that *T. absoluta* is widespread throughout the Western Mediterranean Region, the adult population generally increases in spring and autumn, and decreases in summer and winter. As supported by these results, the adult population of *T. absoluta* in our study was determined as 965 adults / traps on 15.09.2011 in the province of Sanliurfa (Figure 4). As a result of the observations made, it was determined that the adult population of *T. absoluta* reached the highest number of adults in the weeks when the temperature was 30-35ºC and the humidity was 10-20%. According to another observation made, it was determined that *T. absoluta* preferred more table tomato varieties than tomato paste for tomato paste. It has been observed that the table tomato varieties are especially fed with less hairy varieties.

## CONCLUSIONS and RECOMMENDATIONS

According to the data obtained from this study, tomato moth (*T. absoluta*) is an important pest of tomato production areas in Sanliurfa province. The dates when the tomato moth adult population was the highest; September 17 (630 pieces / week) in central district Goktepe, August 18 (800 pieces / week) in Birecik district Meteler, September 15 in Bozova district Kepirce (400 pieces / week), Ceylanpinar district Yalcınkaya (965 pieces) / week) and in Suruc district Aligör (215 pieces / week), 28 July (211 pieces / week) in Hilvan district Ovacik, 14 September (600 pieces / week) in Kücük Yücelen, Siverek district and Ciftciler It was recorded as September 8 (96 units / week). Adult population densities reached the highest level at the end of August and the beginning of September in all districts. The least contamination rate on leaves was recorded in Ciftciler village of Viransehir district with 32.50%, while the least contamination rate in fruits was recorded in Aligör Village of Suruç district with 10.00%. The reason for this low rate of tomato fruits in Suruc district is thought to be due to the fact that the producer used local tomato seeds. As a result of the study, it was determined that all of the tomato fields in the districts were contaminated with this pest. As a result of the observations made in 5 separate villages of each district, *T. absoluta* was found widespread in all districts. The highest prevalence was found in Goktepe Village of the Merkez district, the least prevalence was found in the tomato production areas in Ciftciler Village of Viransehir district. The drip irrigation system used in this production area has been seen as the reason for the high population density, prevalence and contamination rate in the central district. It has been observed that the drip irrigation system provides an environment for *T. absoluta* since it keeps the humidity at a lower rate than the flood and furrow irrigation systems. During the tomato production season, the crop may suffer 100% damage due to the 1st (end of August)

and 2nd (early September) mass tomato harvest coinciding with the period when the pest population increases. It is necessary to follow the adult population very well to combat the pest. As the adult population increases, the population density of eggs and larvae in tomato leaves and fruits should be controlled. When *T. absoluta* reaches the number of 3 eggs or larvae (Eppo, 2009) per 100 plants, which is the economic loss threshold, it should be sprayed with one of the pesticides licensed within the framework of integrated control against the pest. Whether the spraying is effective or not should be determined by checking the land again. If the number of live larvae is higher than the economic damage threshold, spraying should be repeated. Considering that the pest can give 10-12 offspring; land should be constantly controlled throughout tomato production. Leaves and fruits contaminated with the pest should be removed from the production area. Since the pest can open a gallery in the epidermis layer in the leaf, it is important that the drugs that are discarded are systemic. As a result, if the pest is in a concentration that requires combat, the aim should be to take into account the negative effects of chemicals on humans and the environment within the scope of integrated combat. For this reason, by using other methods of struggle and applying chemical control at the appropriate time and at the appropriate dose, the amount of drugs consumed against the pest can be reduced and the negative effects of chemicals on the environment can be minimized. The producers who grow tomatoes for commercial purposes or for their own consumption should know this pest well and apply an economical method of struggle against the pest.

## REFERENCES

Abak, K. 2016. Tomatoes yesterday in Turkey, Today and Tomorrow. Turkey Seed Growers. Association Journal (Erciyas, M., Bağcılar, A.S. Edits.) 17: 8-13. Koza Yayın, Dağıtım A.Ş., Ankara.

Anonymous, 2013. Turkey Statistical Institute data.

Anonymous, 2016. Turkey Statistical Institute data. Access: www.tuik.gov.tr.

Anonymous, 2018. Turkey Statistical Institute data. Access: www.tuik.gov.tr

Barrientos Z., H. Apablaza, S. Norero, P. Estay, 1998. Temperatura base constante te'rmica de desarrollo de la polilla del tomate, Tuta absoluta (Lepidoptera: Gelechiidae). Ciencia e Investigacio'n Agraria, 25: 133-137.

Bergougnoux, V., 2014. The history of Tomato: From domestication to biopharming. Biotechnology Advances, 32(1): 170-189.

Cabello, T., Gallego, J.R., Fernandez-Maldonado, F.J., Soler, A., Beltran, D., Parra, A.,Vilas, E., 2009. The Damsel Bug Nabis pseudoferus (Hem.: Nabidae) as a New Biological Control Agent of The South American Tomato Pinkworm, Tuta absoluta (Lep. Gelechiidae), in Tomato Crops of Spain. IOBC/WPRS Bulletin, 49: 219-223.

Canpolat, S., 2016. Important Diseases Seen in Tomato and Its Control. Turkey Seed Association Journal.

Desneux, N., Wajnberg, E., Wyckhuys, K.A.G., Burgio, G., Arparia, S., Narvaez-Vasquez, C. A., Gonzalezcabrera, J., Ruescas, D.C., Tabone, E., Frandon, J., Pizzol, J., Poncet, C., Cabello, T., Urbaneja, A., 2010. Biological invasion of European tomato crops by Tuta absoluta: ecology, geographic expansion and prospects for biological control. J. Pest. Sci., 83:197-215.

Duman, İ., 2016. Industrial tomato growing. Turkey Seed Growers Association Journal, 17: 18-21.

Eppo, 2005. Data sheets on quarantine pests, Tuta absoluta. Eppo Bulletin, 35: 434-435.

Eppo, 2009. EPPO reporting service 2009/169. New additions to the EPPO list. Resource document. European and

Mediterranean Plant Protection Organization, http://archives.eppo.org/EPPOReporting/2009/Rse

Eppo, 2010. EPPO Reporting Service-Pest & Diseases. No: 1, Paris.

Erler, F., Can, M., Erdoğan, M., Ateş, A.Ö., Pradier, T., 2010. New Record of Tuta absoluta (Meyrick) (Lepidoptera: Gelechiidae) on greenhouse-grown tomato in Southwestern Turkey (Antalya). Journal of Entomological Science, 45(4): 1-2.

Estay, P., 2000. Polilla del Tomate Tuta absoluta (Meyrick). http: //alerce.inia.cl/docs/Informativos/Informativo09.pdf.

Gölükçü, M., Toker, R., Tokgöz, H., 2016. Nutritional properties of tomato and its evaluation in food industry. http://turktob.org.tr. (Accessed date: 05.01.2020).

Kılıç, T., 2010. First record of Tuta absoluta in Turkey. Phytoparasitica, 38(3): 243-244.

Lietti, M.M.M., Botto, E., Alzogaray, R.A., 2005. Insecticide resistance in Argentine populations of Tuta absoluta (Lep. Gelechiidae). Neotropical Entomology, 34: 113-119.

Potting, R. 2009. Pest risk analysis, *Tuta absoluta*, tomato leaf miner moth. Plant protection service of the Netherlands, 24 pp.

Ripa, S., Rojas, P., Velasco, G., 1995. Releases of biological control agents of insect pests on Easter Island (Pacific Ocean). Entomophaga, 40: 427-440.

Siqueira, H.A.A., Guedes, R.N.C., Fragoso, D.B., Magalhae, S., 2001. Abamectin resistance and synergism in Brazilian populations of Tuta absoluta (Meyrick) (Lepidoptera: Gelechiidae). International Journal of Pest Management, 47(4): 247-251.

Tatlı, E., Göçmen, H., 2010. Domates güvesi, Tuta absoluta (Meyrick) (Lepidoptera: Gelechiidae)'nın Batı Akdeniz Bölgesi domates üretim alanlarında yayılışının ve populasyon değişiminin izlenmesi. Türkiye IV. Bitki Koruma Kongresi Bildirileri, 28-30 Haziran 2011, Kahramanmaraş, 225.

Tigchelaar, E.C., 1986. Tomato Breeding. Breeding Vegetable Crop, 135-171.

Uygun, N., Ulusoy, M.R., Başpınar, H., 1998. Vegetable Pests. Ç.Ü. Faculty of Agriculture, General Publication No: 213. Textbooks No: A- 68, Adana I. Edition, 168.