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Determination of tomato leafminer (*Tuta absoluta*) population in open field and greenhouse tomato growing areas on Turkish Republic of Northern Cyprus

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Abstract

Tomato is a very important vegetable crop in the world. It is consumed as fresh table tomato and as raw material for food processing industries. The tomato leafminer, Tuta absoluta (Meyrick) (Lepidoptera: Gelechiidae) is the most destructive pest attacking tomato plant, Lycopersicon esculentum. The tomato leafminer was recorded in Crete (Greece) for the first time in June 2009. Under heavy infestation yield loss in the range of 80-100% is common. During this research, a total of 10 (ten) different tomato growing areas (5 open fields in Güzelyurt and 5 greenhouses in Girne) have been visited. The 5 greenhouses are found in Girne region and related, district villages [Tepebaşı 1(K1), Tepebaşı 2 (K2), Çamlıbel (K7), Geçitköy 1(K9) and Geçitköy 2 (K10)] and 5 open field areas are found in Güzelyurt region and related, district villages [Yeşilırmak (K3), Çamlıköy (K5), Yeşilyurt (K6), Aydınköy (K11) and Yayla (K13)]. 5 (five) pheromone traps were used for each village and each area. To make this trap, it has been used a 62 cm x 19 cm plastic container by putting approximately 100 ml. olive oil to prevent the catching of adult tomato leafminer and a steel line over the top of the container. The pheromone traps were hung on that line as an attractant. The highest adult population of adult Tuta absoluta was recorded from K9 plot and the second highest population was found in K10 plot in Girne region for greenhouses, which was occurring in Geçitköy. The highest population of Tuta absoluta for open field was recorded from K13 plot which was occurring in Yayla village and the second highest population was determined in K6 plot which was occurring in Yeşilyurt village for Güzelyurt region. When all datas were evaluated, the population was recorded highest in K13 plot (Yayla village) for open field and greenhouse tomato growing.

Key words: Greenhouse, open field, pheremone, population, *Tuta absoluta*

Introduction

Tomato is the second largest vegetable crop consumed as crude and processed food worldwide. Originating in the Andes, the tomato (*Solanum lycopersicum* L.) was imported to Europe in the 16th century. At present, it is an important crop plant cultivated all over the world, and its production and consumption continue to increase (Al-Remi et al., 2018). The major tomato pests in Mediterranean region are; root swelling nematodes (*Meloidogyne* spp.), Aphid (*Myzus persicae*, *Aculops lycopersici* and *Aphis gosspyii*), Spider mite (*Tetranychus cinnebarinus*), Yellow mite (*Polyphagotarsonemus latus*), Beet root weevil (*Bothynoderes punctiventris*), greenworm (*Heliothis armigera*), cotton leaf worm (*Spodoptera littoralis*), thrips (*Thrips tabaci*, *Frankliniella occidentalis*), leaf hoppers (*Empoasca decipiens*, *Asymmetresca decedens*), whitefly (*Trialeurodes vaporarium*, *Bemisia tabaci*), American serpentine leafminer (*Liriomyza trifolii*, *Liriomyza huidobrensis*, *Liriomyza bryoninae*) (Uygun et. al. 1998).

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The Tomato leafminer (*Tuta absoluta* Meyrick) (Lepidoptera: Gelechiidae) was a pest for tomato cultivations in South America until 2006, when it arrived to Spain probably with tomato imported from central Chile. Afterward, it spread rapidly to other counties of Europe, Africa and Asia, becoming a very serious worldwide threat for green-house and open-field tomato crops (Michailidis et al. 2019).

The tomato leafminer, *Tuta absoluta* (Meyrick) is a crucial tomato pest distributed from South America to Europe and introduced in Turkey in 2009 (Genç, 2017). In early infestation, newly emerged neonates (First instar) penetrate the leaf into the mesophyll layer and feed between the lower and upper surfaces of the leaf to form small and transparent mines (Moussa et al., 2013). Under heavy infestation yield loss in the range of 80-100% is common. Regarding its life cycle, this pest has high rate of reproduction and short life cycle. The damaging stage of tomato leaf miner is the larval stage. After egg hatching, the larvae make a way into tomato fruits, leaves, flower buds and young shoots on which they feed and develop creating mines and galleries (Gebremariam, 2015). Megido et al (2012) were studied the first evidence of deuterotokous parthenogenesis in the tomato leafminer, *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae) and evaluated the preventing pest mating control methods. They found that all these methods achieve only a poor success rate in controlling *T. absoluta* populations under greenhouse conditions and reported for the first time laboratory evidence of deuterotokous parthenogenesis, an asexual reproduction where both males and females are produced from unfertilized eggs. Tome et al (2013) researched the Azadirachtin avoidance by larvae and adult females of the tomato leafminer *Tuta absoluta* and determined Azadirachtin caused the avoidance of egg-laying and affected the walking of larvae, but not affected the leaf-mining. Results indicated the potential of azadirachtin not only as an insecticide potentially important for organic farming, but also as an egg-laying deterrent minimizing *T. absoluta* infestation. In Egypt, El-Aassar et al. (2015) were aimed to find the efficiency of pheromone traps on population dynamics of *Tuta absoluta*, to determine the most suitable insecticide and rate of some selected bio and chemical insecticides against *Tuta absoluta* larvae, and to estimate the damaged area of tomato leaves and fruits infested with *T. absoluta* after the second spray of the tested insecticides. Results showed that the population dynamics of captured *Tuta absoluta* male have three stages and the first stage made a peak from 1st week of April to 1st week of May (477.7 male/trap/week), the second stages made peak during May (210.7 male/trap/week) and the third stage began 4th week of May and 4th week of July (95.7 male/trap/week). The most effective bio-pesticides against the *T. absoluta* larvae were found Biovar with 69.4% damage. The tomato leafminer, *Tuta absoluta* (Lepidoptera: Gelechiidae), is now considered to be one of the most damaging invasive pests of tomatoes in the world. Tomato is regarded as the main host of *T. absoluta*, but the pest can also feed, develop and reproduce on other cultivated Solanaceae, such as potato (*Solanum tuberosum* L) (Megido et al. 2013). This study was carried out at 10 different tomato growing areas to determine the population fluctuation of Tomato leafminer in open field and greenhouse tomato growing areas on TRNC.

Material and Methods

During this research, a total of 10 (ten) different tomato growing areas have been visited. The 5 greenhouses are found in Girne region and related, district villages [Tepebaşı 1(K1), Tepebaşı 2 (K2), Çamlıbel (K7), Geçitköy 1(K9) and Geçitköy 2 (K10)] and 5 open field areas are found in Güzelyurt region and related, distrinct villages [Yeşilırmak (K3), Çamlıköy (K5), Yeşilyurt (K6), Aydınköy (K11) and Yayla (K13)]. 5 (five) pheromone traps were used for each village and each area. For each growing areas, 500 g./L. Pirimiphos methyl and 5% Emamectin benzoate and 500 g./L. Pirimiphos methyl and 150 g./L Indoxacarb active ingerident insecticides were applied in both previous season and season of the research. To make this trap, it has been used a 62 cm x 19 cm plastic container by putting approximately 100 ml. olive oil to prevent the catching of adult tomato leafminer and a steel line over the top of the container. The capsules were hung on that line as an attractant. The olive oil which was found inside the plastic container was changed every week and adults were counted to determine the population fluctuation of Tomato leafminer weekly. Tomato leafminer is included in the EPPO (European and Mediterranean Plant Protection Organization) A2 quarantine list (Karut et al. 2011). Species identification was made by using EPPO A2 quarantine list.

Table 1. Details tomato growing areas in Girne region (Greenhouses)

No.	Producer Name	Variety	Size of area (da.)
1	Necati Kararlı (K1)	Bursa, Keban	15
2	Mürsel Çakır (K2)	6515	16
3	Emine Beyitler (K7)	6515, Galina,3019	8
4	Mahmut Akmehmet (K9)	6515,3019,Mardo	8
5	Alim Duman (K10)	6515,Mardo,3019	10

Table 2. Details tomato growing areas in Güzelyurt region (Open fields)

No.	Producer Name	Variety	Size of area (da.)
1	Salih Çınar	6515	22
2	Ahmet Osman Karadayı	6515, 3019,Mardo	10
3	İzzet Savaroğlu	6515, Galina, 3019	6
4	Niyazi Kasman	6515, Mardo, 3019	3
5	Salih Efendi	6515, Mardo, 3019	11

Results and Discussions

A total of 10 (ten) different tomato growing areas have been visited and pheromone traps were established to

determine the population fluctuations of adult Tomato leafminer. The traps with pheromones (provided or not with a source of light) captured more insects than all the other types of traps (Refki et al., 2016). For this purpose, the 5 greenhouses which are found in Girne region and related, district villages [Tepebaşı 1 (K1), Tepebaşı 2 (K2), Çamlıbel (K7), Geçitköy 1 (K9) and Geçitköy 2 (K10)] and 5 open field areas which are found in Güzelyurt region and related, district villages [Yeşilırmak (K3), Çamlıköy (K5), Yeşilyurt (K6), Aydınköy (K11) and Yayla (K13)]. One pheromone trap was used for each area. The highest population of adult *Tuta absoluta* was recorded from K9 plot and the second highest population was found in K10 plot in Girne region for greenhouses, which was occurring in Geçitköy. The highest population of *Tuta absoluta* for open field was recorded from K13 plot which was occurring in Yayla village and the second highest population was determined in K6 plot which was occurring in Yeşilyurt village for Güzelyurt region. When all datas were evaluated, the population was recorded highest in K13 plot/trap 5 (Yayla village) for open field and K10 plot/trap 5 (Geçitköy) greenhouse tomato growing. *Tuta absoluta*, known as the South American tomato pinworm, is one of the most disastrous pests of tomato cultivations, presently menacing tomato cultivations worldwide (Michailidis et al. 2019). In TRNC, Tomato leafminer is the most destructive pest in both open field and greenhouse tomato production areas. Mass trapping using traps baited with the female produced sex pheromone is an attractive alternative for the management of this pest (Lobos et al. 2013). Generally, pheromone traps are used both tomato production areas and after the chemical application, traps are effective management methods in TRNC. The traps with pheromones captured more insects than all the other types of traps. Indeed the insects are attracted by the sexual pheromone more than the light, even when the source of light was doubled (Ettaib et al. 2016).

Therefore, pheromone traps were used during this research and the highest population was determined in open field tomato production than greenhouse production areas.

Table 3. Captured and considered number of *Tuta absoluta* in Girne region

	Tepebaşı K 1	**Tepebaşı K 2**	**Çamlıbel K 7**	**Geçitköy K 9**	**Geçitköy K 10**
Trap 1	683	-	-	-	-
Trap 2	-	718	-	-	-
Trap 3	-	-	354	-	-
Trap 4	-	-	-	1208	-
Trap 5	-	-	-	-	920

Table 4. Captured and considered number of *Tuta absoluta* in Güzelyurt region

	Yeşilırmak K3	**Çamlıköy K 5**	**Yeşilyurt K 6**	**Aydınköy K 11**	**Yayla K 13**
Trap 1	936	-	-	-	-
Trap 2	-	1048	-	-	-
Trap 3	-	-	1277	-	-
Trap 4	-	-	-	1159	-
Trap 5	-	-	-	-	2168

Conclusions

The aim of this study was to determine the population fluctuations of Tomato leafminer in Güzelyurt and Girne regions. The pheromone traps were used because these traps capture more insects than other traps. The highest population of Tomato leafminer was determined in Yayla village where open field tomato is cultivated and belongs to Güzelyurt region (K13/trap5). Observation of the results, the pheromone traps were more effective in open field areas than greenhouses. Pheromone traps are used to develop effective control methods to develop further spread. Although the insecticides appeared more effective, the use of the pheromone traps could be recommended within the framework of a management method against Tomato leafminer in greenhouses than open field.

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