



Araştırma Makalesi

Determination The Damage Rate of *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae) in Different Tomato Varieties Grown in The Open Field in Diyarbakır Province

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ABSTRACT

Tomato ranks first among tradable agricultural products in terms of production-consumption amounts in the world. Tomato is one of the most important vegetables in the world and in our country due to its importance in human nutrition and its wide range of uses in the food industry such as frozen, canned, tomato paste, ketchup, tomato pickle, tomato juice. *Tuta absoluta* (Meyrick, 1917) (Lepidoptera: Gelechiidae) is the main pest in tomatoes. In 2022, a study was carried out on 3 tomato varieties (Alaturka F1, Falcon, Eastern H-2274) and Lice tomato and Karacadağ tomato genotypes specific to the region in order to determine the damage rate of different tomato varieties cultivated in open field in Diyarbakır province. The fruits and leaves of at least 20 random plants of each tomato variety and genotype were checked and the damage rate was determined. In the fruits of tomato varieties that are commercially grown in Diyarbakır Province; The damage rate was 29.09% in Falcon variety, 32.55% in H-2274 variety and 27.14% in Alaturka F1 variety. Among genotypes; It was 37.83% in Lice tomatoes and 33.33% in Karacadağ tomatoes. In the leaves of tomato varieties that are commercially grown in Diyarbakır Province; The damage rate was 49.26% in Falcon variety, 58.68% in H-2274 variety and 45.45% in Alaturka F1 variety. Among genotypes; It was 47,52% in Lice tomatoes and 54.06% in Karacadağ tomatoes. It is known that the rate of damage varies depending on many factors. The damage rate data obtained at the end of our study were also compared with the characteristic features of the varieties and genotypes. The hardness of the flesh of Alaturka F1 variety was the hardest and Falcon, H-2274, Karacadağ and Lice were ranked respectively. It was determined that the flesh thickness of the fruits of Lice genotype was softer than the fruits of other varieties and genotypes. For this reason, it is thought that the damage to the fruits of Lice genotype is higher. According to the findings, hairiness was the highest in Lice genotype, followed by Karacadağ, Falcon, H-2274, Alaturka F1. In this context, when the leaf damage rate and hairiness structure were evaluated, it was determined that Lice genotype was the most resistant species after Alaturka F1 variety. The fact that Alaturka F1 variety is more resistant than Lice genotype can be explained by the fact that this variety is a hybrid variety.

Keywords: Damage rate, Diyarbakır, Tomato, *Tuta absoluta*

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Diyarbakır ilinde, Açık Alanda Yetiştiriciliği Yapılan Farklı Domates Çeşitlerinde *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae)'nın Zarar Oranının Belirlenmesi

ÖZ

Domates, dünyada üretim-tüketim miktarı, ticarete konu olan tarım ürünleri arasında ilk sırada yer almaktadır. İnsan beslenmesinde önemi ve gıda sanayinde; dondurulmuş, konserve, salça, ketçap, domates turşusu, domates suyu gibi çok çeşitli kullanım alanlarına sahip olması nedeniyle dünyada ve ülkemizde önemli sebzelerin başında gelmektedir. *Tuta absoluta* (Meyrick, 1917) (Lepidoptera: Gelechiidae) domateste ana zararlı konumundadır. 2022 yılında, Diyarbakır ilinde açık alanda yetiştiriciliği yapılan farklı domates çeşitlerinde zarar oranını belirlemek amacıyla, 3 domates çeşidi (Alaturka, Falcon, Eastern H-2274) ve bölgeye özgü Lice domatesi, Karacadağ domatesi genotipleri üzerinde çalışma yapılmıştır. Her domates çeşidi ve genotipinden rastgele en az 20 bitkinin meyve ve yaprakları kontrol edilerek zarar oranı belirlenmiştir. Diyarbakır ilinde ticari olarak yetiştirilen domates çeşitlerinin meyvelerinde; Falcon çeşidinde %29,09, H-2274 çeşidinde %32,55 ve Alaturka F1 çeşidinde %27,14 oranında zarar tespit edilmiştir. Genotipler arasında ise; Lice domatesinde %37,83 ve Karacadağ domatesinde %33,33 olmuştur. Diyarbakır ilinde ticari olarak yetiştirilen domates çeşitlerinin yapraklarında; Falcon çeşidinde %49,26, H-2274 çeşidinde %58,68 ve Alaturka F1 çeşidinde %45,45 oranında zarar tespit edilmiştir. Genotipler arasında ise; Lice domatesinde %47,52 ve Karacadağ domatesinde %54,06 olarak tespit edilmiştir. Zarar oranının birçok faktöre bağlı olarak değiştiği bilinmektedir. Çalışmamız sonunda elde edilen zarar oranı verileri çeşit ve genotiplerin karakteristik özellikleri ile de karşılaştırılmıştır. Alaturka F1 çeşidinin meyve eti sertliğinin en sert olduğu ve sırasıyla Falcon, H-2274, Karacadağ ve Lice'nin sıralandığı görülmüştür. Lice genotipine ait meyvelerin et kalınlığının diğer çeşit ve genotiplere ait meyvelere göre daha yumuşak olduğu tespit edilmiştir. Bu nedenle Lice genotipinin meyvelerindeki zararın daha yüksek olduğu düşünülmektedir. Elde edilen bulgulara göre tüylülük Lice genotipinde en yüksek olurken, bunu Karacadağ, Falcon, H-2274, Alaturka F1 takip etmiştir. Bu bağlamda yaprak zarar oranı ve tüylülük yapısı değerlendirildiğinde Lice genotipinin Alaturka F1 çeşidinden sonra en dayanıklı tür olduğu tespit edilmiştir. Alaturka F1 çeşidinin Lice genotipine göre daha dayanıklı olması, bu çeşidin melez bir çeşit olması ile açıklanabilir.

Anahtar Kelimeler: Hasar oranı, Diyarbakır, Domataes, *Tuta absoluta*

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Introduction

Tomato ranks first among tradable agricultural products in terms of production-consumption amounts in the world. Tomato is one of the most important vegetables in the world and in our country due to its importance in human nutrition and its wide range of uses in the food industry such as frozen, canned, tomato paste, ketchup, tomato pickle, tomato juice. Worldwide tomato production exceeded 186 million tonnes in 2020. China ranked first in production and cultivation areas in 2020. In general, tomato imports and exports decreased in 2020 due to the COVID-19 outbreak. In 2021, Mexico was the largest exporter, while the USA was the largest importer (Anonymous 2021).

Tomato production in Turkey was 13.2 million tons in 2020 and 13.095 million tons in 2021. In 2021, Antalya, Bursa and Manisa took the first place in production. Turkey ranked fifth in exports with a 7% share in 2020. The countries with the largest share in Turkey's tomato exports were Syria, Romania and Russia. In the first four months of 2022, Turkey's tomato exports amounted to approximately 205 thousand tons. According to the estimates of Turkish Statistical Institute; tomato production in Turkey is estimated to decrease to 12.8 million tonnes in 2022 (Anonymous 2022a).

In 2021, 90,151 tons of tomatoes were produced in Diyarbakır. The share of production in Turkey was 0.68%. It is estimated that irrigation opportunities will increase significantly with the finalisation of the dam projects under construction in our region. With the meeting of agricultural land with water, it is expected that there will be changes in production pattern and that many producers will grow vegetables. In this context; an increase is expected in tomato production areas due to its high market value and width. (Anonymous 2022b).

The origin of the tomato moth *Tuta absoluta*, which has an important place in our country in terms of production area and production amount, causes yield and quality losses of tomato and is the main pest of tomato, is South America. Since the 1960s, it has been the main pest of tomatoes in South American countries. In the tomato production areas on the Mediterranean coast, the

population has increased rapidly and reached the level of economic damage (Desneux et al. 2010). For an economical agricultural production, it is necessary to implement a conscious agricultural struggle program as well as the use of modern techniques. For this reason, selection the appropriate method and time of control against the pest to be controlled is only possible by knowing that pest well and correctly.

In this study, the damage rate of Tomato Moth (*T. absoluta*), which is a pest that causes low quality and yield loss in tomato, one of the most widely grown vegetables in Turkey, and directly affects our domestic consumption and exports, was determined in tomato varieties and genotypes commonly grown in Diyarbakır province. Thus, it was ensured that the producers were directed to more resistant varieties or genotypes and production was ensured with less struggle costs.

In addition, by including Lice and Karacadağ tomato genotypes, which are called Diyarbakır local tomatoes, in the study; it was aimed to contribute to the registration process of these genotypes as tomato varieties. In addition, by comparing the damage rate of these genotypes against *T. absoluta* and other commercial varieties, it was aimed to help them to be promoted as a variety and to be used in large areas.

Materials and Menhods

In order to determine the damage rate; In 2021, 3 tomato varieties (Alaturka F1, Falcon, Eastern H-2274) used in Diyarbakır determined as a result of the preliminary study conducted in tomato production areas and Lice tomato, Karacadağ tomato genotypes specific to the region were tested under field conditions.

In March 2022, seed sowing was carried out in 90-mesh viols using a suitable mixture of peat, perlite and soil. When the seedlings were ready for planting, they were planted in the field on 14.05.2022, taking into account the weather conditions.

Tomato varieties trial was established in Çınar district of Diyarbakır with 5 characters and 4 replications according to coincidence blocks experimental design. Each trial plot was 50 m² and the total trial area was 1000 m². Each variety

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was planted according to the inter-row and over-row planting distances suitable for their characteristics.

Chemical fertilizers are necessary for efficient and economical tomato cultivation, but organic fertilizers should also be used to improve tomato fruit quality (Turhan and Özmen 2021).

In the period from sowing to harvest; humic, fulvic acid rooting practices were applied. In addition, a mixture of nutrients rich in trace elements with Nitrogen, Phosphorus Pentoxide (P₂O₅) and Potassium Oxide (K₂O) was used. Thus, the strengthening of the root system, increased development of branches, leaves and shoots is ensured and stunted development is prevented. Growth and development is supported by trace elements (zinc, iron, copper, manganese) contained in the composition of the fertilizer used.

Among plant protection products, 25 g l-1 Fludioxonil + 10 g l-1 Metalaxyl-M was used as a preservative against Root Rot (*Pythium* spp., *Rhizoctonia* spp., *Fusarium* spp.) when seedlings were surprised at the trial area. In addition, during the plant development period, 250 g l-1 Difenconazole + 250 g L-1Mandipropamide

was applied against Early Leaf Blight (*Alternaria solani*).

Before harvesting, the fruits were checked in at least 20 plants randomly taken from each variety taken into the trial on 20.08.2022 and the damage rate was determined according to the following formula. (Harizanova et al. 2009; Cetiner 2009; Cocco et al. 2013; Aksoy 2014).

$$(\%) \text{ Loss Rate} = \frac{\text{Amount of Contaminated Fruit/Leaf}}{\text{Total Number of Fruit/Leaf Checked}} \times 100$$

Results and Discussion

The fruits of at least 20 plants randomly taken from each variety were checked and the damage rate was determined. The rate of damage caused by *T. absoluta* on fruits in tomato varieties and genotypes that were the subject of our study is presented in Table 1.

Table 1. Damage Rate on Tomato Varieties (Fruits)

Variety/Genotype	Total Number of Fruits Checked (pcs)	Amount of Contaminated Fruits (pcs)	(%) Loss Rate
Falcon	110	32	29,09
H-2274	86	28	32,55
Alaturka F1	140	38	27,14
Lice	89	31	34,83
Karacadağ	84	28	33,33

In our study, unlike many other studies, the varieties were determined by preliminary study and tested in the next production period. Thus, the effects arising from the differences in ecological conditions between the regions have been prevented. In addition, since all varieties and genotypes were planted in the same area, all cultural processes such as irrigation, hoeing, fertilization, etc. were applied to all varieties with the same method. Plant protection practices were applied to the entire trial area where

necessary. Insecticide group plant protection products were not applied because they would affect the population development of *T. absoluta*.

The rate of damage caused by *T. absoluta* on leaves in tomato varieties and genotypes that were the subject of our study is presented in Table 2.

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Table 2. Damage Rate on Tomato Varieties (Leaves)

Variety/Genotype	Total Number of Leaves Checked (pcs)	Amount of Contaminated Leaves (pcs)	(%)Loss Rate
Falcon	186	92	49,26
H-2274	167	98	58,68
Alaturka F1	198	90	45,45
Lice	202	96	47,52
Karacadağ	172	93	54,06

It is known that the rate of damage varies depending on many factors. The character of tomato varieties is one of these factors. Fruit peel thickness and plant hairiness can be given as examples. In the selection of varieties, at least according to the hairiness of the leaves which is reported as resistance character, paying attention to the selection of varieties that are thought to be resistant may contribute to the reduction damage.

In the fruits of tomato varieties that are commercially grown in Diyarbakır Province; The damage rate was 29.09% in Falcon variety, 32.55% in H-2274 variety and 27.14% in Alaturka F1 variety. Among genotypes; It was 34.83% in Lice tomatoes and 33.33% in Karacadağ tomatoes.

As a result of the survey field studies; the hardness of the flesh of Alaturka F1 variety was the hardest and Falcon, H-2274, Karacadağ and Lice were ranked respectively. It was determined that the flesh thickness of the fruits of Lice genotype was softer than the fruits of other varieties and genotypes. For this reason, it is thought that the damage to the fruits of Lice genotype is higher. In addition, when the fragmentation (cracking) of the fruit was examined, it was determined that this situation was more in Lice and Karacadağ genotypes. Fragmentation (cracking) status and damage rate in the fruit can be related between the two genotypes.

In other studies on fruit damage, different results were obtained according to the method of the study and the regions. In a study conducted in Karataş (Adana), Portakaldalı et al. (2013) reported that the first fruits were seen in the trial area on 12.05.2011 and the highest number of fruit dishes in weekly fruit counts was detected on 06.07.2011 with 4.4 pieces / plant. In the studies conducted in tomato greenhouses in

Mersin province, it was stated that the percentage of infested plants, which was low in the first weeks of May, increased by the end of May and the beginning of June in both the autumn season (September-January) of 2009 and the spring season (February-June) of 2010. Furthermore, it was found that the fruit damage caused by *T. absoluta* larvae was highest at 38.4% per plant (Karut et al. 2011).

Erdoğan et al. (2014) reported that *T. absoluta* had an 18% contamination of fruits in Central Anatolia. As can be seen from these results, loss ratios show a highly variable situation. Depending on the plant variety, the ecological conditions of the region where the production is made, the cultural processes applied, the methods of struggle and the effectiveness, it varies in terms of places and years. Polat, E., Özgökçe, M. S., & Gözel, U. (2015). Determination of Potential Hosts of Tomato Leaf Miner [*Tuta absoluta* (Meyrick, 1917) (Lepidoptera: Gelechiidae)] in Çanakkale Province in 2012-2013. In the study conducted by examining cultivated plants at 10-day intervals and weeds in non-cultivated areas at 10-15 day intervals, *T. absoluta* was detected in all the examined tomato fields, with an infestation rate of 88% involving different life stages of the pest (Polat et al. 2015).

In the leaves of tomato varieties that are commercially grown in Diyarbakır Province; The damage rate was 49.26% in Falcon variety, 58.68% in H-2274 variety and 45.45% in Alaturka F1 variety. Among genotypes; It was 47,52% in Lice tomatoes and 54.06% in Karacadağ tomatoes.

Physiological structures of the plants were evaluated during the study. According to the findings, hairiness was the highest in Lice genotype, followed by Karacadağ, Falcon, H-2274, Alaturka F1. In this context, when the leaf

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damage rate and hairiness structure were evaluated, it was determined that Lice genotype was the most resistant species after Alaturka F1 variety. The fact that Alaturka F1 variety is more resistant than Lice genotype can be explained by the fact that this variety is a hybrid variety. In a study, Sohrabi et al. (2016) reported that pest resistance emerged in tomatoes depending on the density of trichome (downiness) in the leaf. It was determined that as the trichome density increased, the resistance also increased. In the study conducted in Kale village of Mezitli district in Mersin province, it was reported that *T. absoluta* caused the highest damage on tomato leaves in the Elibol variety in 2015, while the least damage was observed in the No:14397 variety. It was also stated that the damage on the stem was higher in the No:14397 variety compared to the Elibol and Süper Lapçin varieties. It was emphasized that including varieties with smaller leaflet size in tomato cultivation is important for the control of *T. absoluta* (Aygel and Aslan, 2023). The study conducted by Çaylak (2021) aimed to determine the population dynamics, damage, and natural enemies of *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae) in potato and tomato fields during the first and second crop seasons in Tire and Ödemiş districts of Izmir province in 2019-2020. The highest damage was found to be 4.50 galleries/compound leaf in tomatoes. In addition, the infestation rate in tomato fruits ranged from 19.4% to 24.4% (Çaylak, 2021). Azadi et al. (2018) reported that varieties with trichome density in leaves were more resistant to the pest. In addition, Vursavuş (2017) reported that tomato hardness can be determined without damage using tomato color values with a high prediction percentage.

The pest resistance of the grown varieties can be considered an important factor. As a matter of fact, Çekin and Yaşar (2014) prepared the life charts of *T. absoluta* on four tomato varieties in the laboratory and determined that the pest laid fewer eggs, the egg opening time was longer and the opening rates were lower on the Şimşek tomato variety compared to other varieties. Therefore, it was reported that this variety had unfavourable characteristics for the reproduction and survival of the pest and it was stated that this

variety could be preferred as a cultural measure in the control of *T. absoluta* in tomato agriculture. In another study, Sohrabi et al. (2016) reported that pest resistance appeared in tomatoes depending on the density of trichome (feathers) in the leaf. It has been found that as the density of trichome increases, the endurance also increases. Azadi et al. (2018) reported in their study that varieties with trichome density in their leaves are more resistant to pests.

Conclusions

There is no comprehensive study in our country on the resistance of tomatoes grown in greenhouse and field conditions to *T. absoluta*. The fact that the production capacities of commercial varieties change from years to years and this situation causes frequent changes in the production plans of tomato producers seems to be a constraint for the studies to be carried out in this regard.

With the increase in the number of studies, it can be recommended to determine the varieties resistant to *T. absoluta* damage and to direct the producers to these varieties so that they can produce more with less agricultural control cost.

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