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Research Article

A New Pest Thrips Species in Citrus in Adana Province, Türkiye: *Scirtothrips dorsalis* Hood (Thysanoptera: Thripidae)

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ABSTRACT
The chili thrips, *Scirtothrips dorsalis* Hood (Thysanoptera: Thripidae), was detected for the first time on blueberry fruits in 2020 in Adana Province, Türkiye. In 2024, it was found to damage citrus plants in Adana, specifically affecting fresh shoots in July, leading to stunted growth, leaf curling, and discoloration, all of which negatively impacted tree development. The surveys conducted on different citrus varieties (orange, mandarin, lemon, grapefruit) revealed that almost all shoots were infested, with all developmental stages of the pest, except the pupal stage, being observed. The thrips fed on young fruits, causing silvery ring-like scar tissue around the calyx of fruit and on fruit surface. It was noted that the population density of the pest was closely related to the growth and density of young shoots on trees. In this regard, these thrips caused considerable damage, particularly in the W. Murcott mandarin and Meyer lemon groves. The thrips were not found on leaves of older shoots. Several control measures were proposed, and the results were discussed.
Keywords: Chili thrips, citrus, new pest, Adana, Türkiye.

Adana İlinde Turunçgillerde Yeni Bir Zararlı Thrips Türü: *Scirtothrips dorsalis* Hood (Thysanoptera: Thripidae)

ÖZ
Acı biber thripsi, *Scirtothrips dorsalis* Hood (Thysanoptera: Thripidae), ilk olarak 2020 yılında Adana ilinde yaban mersini meyvelerinde tespit edilmiştir. Adana İlinde 2024 yılında turunçgillerde temmuz ayında oluşan taze sürgünlerdeki yapraklarda gelişme geriliği, yaprakların kıvrılması ve renk açılması gibi ağaç gelişmesini olumsuz bir şekilde etkileyen zarara neden olmuştur. Sürvey yapılan farklı turunçgil çeşitlerinde sürgünlerin neredeyse tamamının bulaşık olduğu belirlenmiş olup, zararlı thripsin pupa dönemi hariç diğer dönemleri saptanmıştır. Thrips beslenerek, genç meyvelerde gerek meyve yüzeyinde ve gerekse kaliks etrafında hale şeklinde gümüşümsü yara dokusu oluşturmuştur. Zararlının popülasyon yoğunluğunun ağaçlarda genç sürgün gelişmesi ve yoğunluğuyla yakından ilgili olduğu, bu bağlamada, özellikle W. Murcott mandarin ve Meyer limon bahçelerinde bu thripsin önemli düzeyde zararı gözlenmiştir. Bu thrips yaşlı sürgünlerdeki yapraklarda bulunamamıştır. Zararlının mücadelesinde bazı öneriler sunulmuş olup, sonuçlar tartışılmıştır.
Anahtar kelimeler: Acı biber thripsi, turunçgil, yeni zararlı, Adana, Türkiye.

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A New Pest Thrips Species in Citrus in Adana Province, Türkiye: *Scirtothrips dorsalis* Hood (Thysanoptera: Thripidae)

Introduction

Citrus fruits, which include economically valuable varieties such as oranges, mandarins, lemons, and grapefruits, are primarily grown in the Mediterranean region due to their sensitivity to cold climates (Aygören, 2023). Citrus production was carried out on 8.7 million hectares worldwide. A significant portion of global citrus production, 45%, comprises oranges (FAO, 2023). In 2024, 82% of Türkiye's total orange production, 87% of mandarin production, 91% of lemon production, and 96% of grapefruit production took place in the Mediterranean region (TÜİK, 2024). In 2023, citrus production was conducted on 744,986 decares in Adana Province, Türkiye, yielding 3.115.733 tons of produce (TÜİK, 2024). That same year, Türkiye's total citrus production amounted to 7.977.982 tons, covering approximately 40% of the nation's output for 2022 (TÜİK, 2024).

In Türkiye, citrus production is negatively affected by numerous diseases, pests, and weeds, which lead to economic losses (Uygun, 2001). Among these factors, thrips species from the order Thysanoptera have gained increasing importance in recent years. Globally, certain thrips species from the genera *Frankliniella*, *Thrips*, and *Scirtothrips* have been reported to be causing damage to citrus varieties (Blank and Gill 1997; Childers and Nakahara 2006). Pest thrips species feed on leaves, flowers, and fruits, causing typical silvery superficial scars, thereby reducing fruit quality and market values (Morse and Hoddle 2006). Until 2015, thrips species identified in citrus groves in Türkiye were not considered economically significant (Nas et al., 2007; Tekşam and Tunç, 2006; Ölçülü and Atakan, 2013; Atakan et al., 2016). However, in 2015, the Hawaiian flower thrips *Thrips hawaiiensis* Morgan (Thysanoptera: Thripidae) was detected for the first time in the everbearing lemon varieties in the Erdemli district of Mersin Province, Türkiye, bringing a significant attention to the thrips damage. In the first year of its infestation, over 80% of the fruits showed typical damage (Atakan et al., 2015). There are three thrips species from genera *Scirtothrips* known damaging citrus, and they are included in Türkiye's quarantine list: *Scirtothrips auranti* Faurei, *Scirtothrips citri* Moulton, and *Scirtothrips dorsalis* Hood (Thysanoptera: Thripidae). Among these species, *S. dorsalis* was detected for the first time in 2020 in Adana Province on the blueberry plants (Atakan and Pehlivan, 2021a). Shortly after, it was reported damaging the fresh shoots of Washington orange trees in the Finike district of Antalya Province, Türkiye (Atakan and Pehlivan, 2021b).

In 2024, during the summer (starting in July), numerous complaints were received from citrus growers in Adana Province regarding significant damage observed on the young shoots and fruits of various citrus varieties. Based on both morphological analysis and microscopic slides, the pest was identified as *S. dorsalis*, and the damage was directly related to this thrips species. Short-term surveys were conducted in October to assess the problem acrossing different citrus varieties. The plant samples were collected to analyze the distribution of various developmental stages within the thrips population, and also to check for its possible predators or parasitoids. Besides, the damage patterns and severity on the fresh leaves of shoots and fruits in the sampled groves were observed. The preliminary information on its some control tactics were also provided, along with some recommendations.

Materials and Methods

Field survey

Short-term surveys were conducted in Seyhan and Yüreğir districts of Adana Province, Türkiye, where most complaints regarding this thrips species were reported in 2024. Intensive samplings for thrips were performed on October 2 and 8, visiting 14 citrus groves across seven central villages in the region (Table 1). Samples were taken from groves cultivating Enterdonat and Meyer lemons, Miho-Wase, Nova, Okitsu, and W. Murcott mandarines, Washington and Kara Kara (local variety) oranges, and Star Ruby grapefruits. At least ten newly developed shoots from 20 trees were randomly collected in each orchard, and these

were placed in tubes (50 ml) containing 60% ethanol. Thrips damage on shoots and fruits was inspected on the sampled trees.

Identification of thrips

The fresh shoots preserved in plastic tubes (50 ml) with ethanol (70%) were transferred into glass Petri dishes. The leaves from the fresh shoots were dissected and washed with 70% ethanol. Thrips individuals (larvae and adults) were counted and transferred into the Eppendorf tubes (2 ml) containing 70% ethanol. Representative samples comprised 10% of the adult individuals collected were prepared for the microscopic slides. For this purpose, the samples were placed in a 5% sodium hydroxide solution and kept under laboratory conditions at 25±1°C and 50±10% relative humidity until slight color changes were obtained. The samples were then transferred into Petri dishes containing 70% ethanol, and emptied. The individuals were washed in ethanol and then mounted on microscopic slides in HOYER's medium. Since the detailed description of the species has been provided in Atakan and Pehlivan (2021a), this study presents only some practical information for identifying the species by photographing the natural appearances of the adults and larvae under a microscope.

Results and Discussion

Thrips Description

The systematic characteristics for identifying *S. dorsalis* have been thoroughly detailed in Atakan and Pehlivan (2021a). In this study, some morphological features that can roughly distinguish between the pre-adult and adult stages are presented in Figure 1. These species are smaller and more delicate thrip species found on citrus so far than other morphologically described thrips species found on citrus. Adult females and males are yellowish in color (Figure 1).

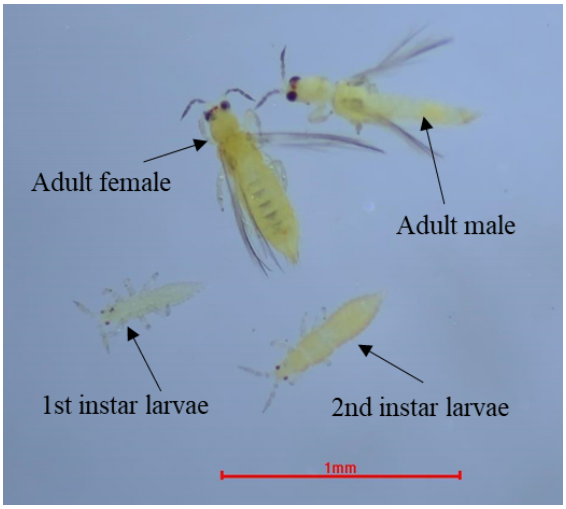

Figure 1. Views of different biological stages of *Scirtothrips dorsalis* collected from citrus fruits in Adana Province in 2024

The most distinctive feature for identifying adult females is the presence of dark bands on the thoracic segments (tergites) and a dark spot in the middle of the segment (Figure 1).

Males are smaller than females. Several systematic features are used to distinguish species from genera *Scirtothrips*. Multiple species from the same genus can coexist in the same habitat (Mound and Palmer, 1981), making accurate identification of samples crucial for planning laboratory and field studies.

Demographic Status

Microscopic examination confirmed that the species was *S. dorsalis*, with no previously recorded thrips species found in the samples. Many abiotic and biotic factors influence the population densities of insects. In this study, *S. dorsalis* mainly established its population between July and October, occurrence of new shoots. Since there were no flowers on the trees, including lemon trees, after July, no evaluation could be made during this period. Pest densities were higher in W. Murcott mandarin and Meyer lemon varieties due to their abundant fresh shoots. At the same time, fewer individuals were found in varieties with less fresh shoot growth, like Nova and Satsuma/Okitsu (Table 1). No thrips individuals were found on the randomly sampled young fruits that exhibited typical thrips damage, possibly due to the adult thrips on the fruit surfaces being more affected by pesticide applications.

Table 1. Numbers of various biological stages of *Scirtothrips dorsalis* acording to citrus varieties

Citrus group	Location	Citrus species	Female	Male	First instar larvae	Second instar larvae	Total
Lemon	Alihocalı	Enterdonat	16	4	64	45	129
	Zeytinli	Meyer	16	2	82	65	165
	Karakuyu	Meyer	11	4	76	26	117
Mandarin	Yakapınar	Nova	2	7	0	0	9
	Büyükçıldırım	Nova	6	4	3	0	13
	Gökçeler	Okitsu	5	0	15	0	20
	Gökçeler	Miho-Wase	3	4	23	10	40
	Zeytinli	W. Murcott	29	2	28	12	71
	Karaköy	W. Murcott	12	3	26	14	55
	Yakapınar	W. Murcott	8	4	42	20	74
	Alihocalı	W. Murcott	33	6	25	22	86
Orange	Zeytinli	Washington	13	5	10	3	31
	Gökçeler	Kara Kara	11	4	76	26	117
Greyfruit	Yakapınar	Star Ruby	12	12	62	9	95
		Total	177	61	532	252	1022

The demographic structure of *S. dorsalis* in different citrus varieties is shown in Table 1. The generally higher larval density compared to adult density suggests that *S. dorsalis* does not consider citrus trees as a temporary habitat or food source, and on the contrary, it reproduces intensively.

In the pre-adult stage, the first instar larvae were more abundant than the second instar larvae (Table 1). No pupae were found in the shoot samples. It has been reported that the pest pupates in leaf curls, fallen plant debris on the ground, and the calyx of flowers and fruits (Kumar et al., 2013). Additionally, the numbers of female individuals on citrus varieties sampled were higher than the males (Table 1).

Previous studies identified the following thrips species in citrus flowers, listed in order of importance: *T. hawaiiensis*, *Frankliniella occidentalis* (Pergande), *Thrips major* Uzel, *Thrips tabaci* Lindeman, and *Pezothrips kellyanus* (Bagnall) (Thysanoptera: Thripidae) (Nas et al., 2007; Tekşam and Tunç, 2006; Ölçülü and Atakan, 2013; Atakan et al., 2015; Atakan et al., 2016). Given that a new thrips species has entered the citrus ecosystem in Adana and caused significant damage to fresh shoots and fruits within approximately four years of the its first detection in Türkiye, it is anticipated that the species composition and densities of thrips in citrus groves may be change. Minaei and Bagherian (2016) reported that this species emerged intensively on citrus trees during spring and summer in Fars, Iran. Therefore, to determine the importance of this species, it is necessary to reassess thrips species on different citrus groups, varieties, and their presence in spring and June flowers and fruits.

Damage

It was determined that almost all fresh shoots formed by July exhibited typical thrips damage in the sampled orchards (Figure 2). As shown in the Figure, leaves of the young shoots displayed noticeable symptoms such as slight curling, deformities, tissue hardening, and the formation of silvery spots (Figures 2a and b). Damaged leaves often fall off completely, leaving the fresh shoots leafless (Figure 2b). These young shoots play a crucial role in the developments of the fruits, so ensuring their healthy growth is essential. Due to the dense damage associated with new shoot formation, typical thrips damage was also observed on the fruits (Figures 2c and d). Light silvery spots appear on the fruit surface, which darkens into typical wound tissue. These damage symptoms have also been documented in previous studies performed in citrus groves (Minaei and Bagherian, 2016; Atakan and Pehlivan, 2021b). The silvery, broad, or

scattered wound tissues on the fruits are primarily superficial, and while they do not significantly affect fruit quality, they reduce market and commercial values.

Figure 2. Damage caused by *Scirtothrips dorsalis* on young shoots (a) and fruits of W. Murcott mandarin (c), young shoots of Meyer lemon (b), and fruits of Nova mandarin (d) in Adana Province, Türkiye in 2024

In Adana, citrus growers have been intensively applying insecticides against pest thrips for many years, starting from the flowering period. Studies conducted in Adana and Mersin Provinces reported that pesticide applications against thrips (primarily *T. hawaiiensis*) were significant only for certain lemon varieties that bloom year-round, such as the 'yediveren group' (such as Lamas and Kütdiken) (Atakan et al., 2021). The chemical control of thrips is challenging due to their cryptic behavior, which includes laying eggs inside plant tissues, having pupae in the soil or hidden places, and their feedings in areas like leaf curls and behind of calyxs of flowers or fruits where agricultural chemicals cannot easily reach (Immaraju et al., 1992). It remains unknown whether *S. dorsalis*, recorded as a harmful species on citrus, is present in spring and June flowers, as well as the effects of climatic factors (temperature,

humidity, and rainfall) on their development, the presence of natural enemies, and their other cultivated or wild host plants. Primary research is needed in these issues. Based on observations, the reproduction and development of this pest thrips are closely related to the presence of summer fresh shoots. Therefore, practices encouraging excessive shoot development on trees should be avoided whenever possible. Damaged, infected shoots should be pruned away from the orchards. Identifying alternative and, most importantly, reproductive hosts around citrus orchards is important for preventing infestations on citrus trees. Notably, its intense damage were observed in the fields of peppers neighboring the surveyed orchards. Beneficial insects actively feed on these thrips, particularly the predatory bug *Orius* spp. (Hemiptera: Anthocoridae), were not observed. However, the larvae of predatory insects *Chrysopa* sp. (Neuroptera: Chrysopidae), and adult and larval forms of *Oenopia conglobata* (L.) (Coleoptera: Coccinellidae) were recorded in small numbers alongside the pest on the fresh young shoots.

Conclusions

Chemical control is the primary method for managing pest thrips in citrus groves. The cryptic behavior of thrips complicates its chemical control. Following the significant damage caused by *S. dorsalis*, citrus growers in Adana frequently apply various insecticides, either individually or in mixtures, against this pest. Such an approach can promote the pest's rapid development of resistance to the pesticides used and negatively impact human and environmental health. Some active ingredients of the insecticides, such as azadirachtin, cyantraniliprole, spirotetramat, and spinosad, are temporarily licensed for use against thrips in citrus groves. Although these temporary licenses will expire in August 2024, they are also licensed for some pests in citrus in Türkiye. The presence of leaf deformities and curlings on the young shoots creates a more suitable feeding environment for the pest, making it difficult for insecticides to reach the thrips. Therefore, sampling should coincide with fresh shoot development and pesticide applications should be strategically planned for a effective control. Additionally, studies are needed on the economic injury threshold of this pest in citrus. Since this thrips species causes severe damage at high population densities during the summer-fall of 2024, integrated pest management solutions should be sought, prioritizing methods that protect the natural ecosystem. This study suggests that it is crucial to plan fundamental studies to guide pest management efforts.

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