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Determination of Mite Fauna in Common Bean Plantations of Central Anatolia Region and Seasonal Population Fluctutation of Major Pest Species

Orta Anadolu Bölgesi Fasulye Ekiliş Alanlarında Akar Faunasının Tespiti ve Önemli Zararlı Türün Sezonsal Popülasyon Değişimi

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Abstract: Common bean (*Phaseolus vulgaris* L.), a member of the Fabaceae family, are annual herbaceous plant originating from Central America. Common beans are among the most consumed legumes worldwide. There are numerous biotic and abiotic factors that affect common bean yield, with mites forming a significant group of pests among the biotic factors. The aim of this study, conducted in three different provinces from 2017 to 2018, was to identify mite species as biotic factors and monitor population fluctuations of major mite pest species on common beans. The identified plant pest mite species were *Tetranychus urticae* Koch, *Tetranychus atlanticus* (McGregor), *Tetranychus solanacearum* (Cobanoglu & Ueckermann, 2015), and *Schizotetranychus asparagi* (Oudemans, 1928), with *T. urticae* being the most prevalent pest in beans. The populations of these pest species were monitored at 2-4 week intervals, and field infection rates (%), district average infection rates (%), and provincial average infection rates were determined. Additionally, the average mite density per leaf (mites/leaf) was calculated. In Ankara province, infection rates started at 22.31% and reached 100%, with mite density per leaf ranging from 0.0 to 1.92. In Konya province, infection rates started at 27.03% and reached 88.99%, with mite density per leaf ranging from 0.08 to 49.57. In Afyonkarahisar province, infection rates started at 5.55% and reached 100%, with mite density per leaf ranging from 0.83 to 27.57. This study is the first faunistic survey in the region, identifying *S. asparagi* in Türkiye for the first time among the harmful mite species, and *T. solanacearum* was detected for the first time on common bean.

Keywords: Acari, faunistic, first report, *Schizotetranychus asparagi*, *Tetranychus urticae*, phytophagus mite

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Öz: Fabaceae familyasından olan fasulye (*Phaseolus vulgaris* L.), Orta Amerika menşeli tek yıllık otsu bir bitki türüdür. Fasulye, bütün ülkelerde olduğu gibi ülkemizde de en fazla tüketilen baklagillerdendir. Fasulye verimini etkileyen çok sayıda biyotik ve abiyotik faktör bulunmakta olup, biyotik faktörler içerisinde ise akarlar önemli bir zararlı grubu oluşturmaktadır. Bu çalışmanın amacı 2017-2018 yılları arasında 3 farklı ilde biyotik faktör olarak fasulyede zararlı olan akar türlerini ve önemli türün popülasyon değişiminin belirlenmesidir. Bitki zararlısı akar türlerinden *Tetranychus urticae* Koch, *Tetranychus atlanticus* (McGregor), *Tetranychus solanacearum* (Cobanoglu&Ueckermann, 2015) ve *Schizotetranychus asparagi* (Oudemans, 1928) tespit edilmiştir. Bu türler arasında fasulyede en yaygın zarar yapan türün *T. urticae* olduğu belirlenmiştir. Zararlı türün popülasyonu 2-4 haftalık aralıklarla farklı tarihlerde yapılan sayımlarda tarla bulaşma oranı (%), ilçe ortalama bulaşma oranı (%) ve il ortalama bulaşma oranları saptanmıştır. Ayrıca yaprak başına düşen ortalama akar yoğunluğu (yaprak/adet) hesaplanmıştır. Buna göre Ankara ilinde bulaşma oranı %22.31 ile başlayıp %100'e kadar çıktığı, yaprak başına düşen akar sayısının 0.0 ile 1.92 adet arasında değiştiği; Konya ilinde ise %27.03 ile başlayan bulaşma oranının %88.99 kadar ulaştığı, yaprak başına düşen akar sayısının ise 0.08 ile 49.57 adet arasında değiştiği; Afyonkarahisar ilinde ise %5.55 ile başlayan bulaşma oranının %100'e kadar çıktığı, yaprak başına düşen akar sayısının ise 0.83 ile 27.57 adet arasında değiştiği belirlenmiştir. Fasulyede faunistik olarak bölgede yapılan ilk çalışma olup, ayrıca belirlenen zararlı akar türleri arasında Türkiye'de ilk kez *S. asparagi* tespit edilmiştir**.** Ayrıca *T. solanacearum* fasulye bitkisinde ilk tespiti yapılmıştır.

Anahtar Kelimeler: Acari, faunistik, ilk kayıt, *Schizotetranychus asparagi*, *Tetranychus urticae*, fitofag akar

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INTRODUCTION

Common bean (*Phaseolus vulgaris* L. Fabaceae), which can be consumed both fresh and dried, are an annual herbaceous plant species. Due to Türkiye's diverse climate and varying soil structures, beans can grow in almost every region with suitable conditions. Since they are not particularly selective regarding cultivation conditions, their production area is extensive. In Türkiye, fresh and dried beans are cultivated on a total area of 389.726 and 884.569 decares (da), respectively. In the provinces where the study was conducted (Ankara, Afyonkarahisar, Konya), this ratio is reported to be 22.270 da (fresh) and 105.596 da (dry) (Tuik, 2023).

Many mite species, including those affecting tomatoes, eggplants, cucumbers, and beans, have been reported to cause significant damage (Yoldaş et al., 1990; Estebanes-Gonzalez and Rodriguez-Navarro, 1991; Boom et al., 2003; Furtado et al., 2005; Sidumo et al., 2007; Petanovic and Vidovic, 2009; Canbay et al., 2011; Ozsisli and Cobanoglu, 2011; Kumar et al., 2013; Cobanoglu and Kumral, 2014; Razdoburdin et al., 2014; Meck et al., 2013). Although there is substantial record of both phytophagus and beneficial mite fauna of cultivated plants in Türkiye, there are very few records on phytophagous mites detected in bean fields. A comprehensive investigation of the harmful mite fauna associated with bean cultivation is very important. Mites can cause severe economic losses, particularly through damage to common beans that can lead to significant yield reductions.

The mite fauna in common bean cultivation in Türkiye is especially significant due to the widespread damage caused by species such as *Tetranychus urticae* Koch. (Acarina: Tetranychidae). *T. urticae* is a cosmopolitan species found in Europe, Asia, Africa, Australasia, Caribbean islands, and North America (Migeon et al., 2010). This pest feeds on many cultivated crops and over 1000 plant species in both greenhouse and field conditions (Migeon and Dorkeld, 2014). It feeds on the leaves of the plants, inhibiting their growth and development. Intensive damage can also lead to web formation, reduced photosynthesis, leaf wilting, drying, and shedding, ultimately resulting in yield losses and a decline in quality. Under favorable conditions and without adequate control measures, severe damage to fruits, twigs, leaves, and young shoots is common, leading to economic losses in common bean cultivation, a significant concern for producers. Consequently, a comprehensive understanding of this pest species impact and the development of effective control strategies are crucial. In addition to economic losses, mite damage to bean crops can have environmental impacts. The excessive use of chemical pesticides to control pest mites can harm the environment and disrupt the natural balance (Van Leeuwen et al., 2015; Guedes et al., 2016). Understanding the impact of mite fauna on common bean cultivation is essential to identify potential future threats from these pests.

Studying pest mite fauna can help reduce economic losses in common bean cultivation and promote sustainable agricultural practices. In conventional chemical control management, broad-spectrum acaricides are often sprayed to reduce population levels. However, these acaricides can also eliminate natural enemies, including native fauna. Knowledge of the population dynamics of a phytophagous insect and its natural enemies aid in identifying factors that can significantly contribute to regulating a pest insect. Such knowledge includes when the plants will be affected economically by the target insect pest and which sources of mortality are the most important in regulating the pest. By monitoring pest populations and considering natural enemy populations, unnecessary spraying can be avoided (Attia et al., 2012; Koca and Kütük, 2020). These studies also facilitate the development of environmentally friendly control strategies, supporting efforts to reduce the use of chemical pesticides.

The literature survey reveals that identifying the mite fauna, understanding the spatial distribution and population dynamics of common species, and assessing their damage potential are essential. For this purpose, the mite fauna was investigated for the first time in Ankara, Afyonkarahisar and Konya provinces. This information will contribute to the development of integrated pest management strategies and effective measures for sustainability in common bean production.

MATERIAL AND METHOD

Survey Areas

Population fluctuation studies of mite species were conducted in the villages of Çubuk (Dumlupınar, Taşpınar, and Gürdarpı), Kazan (Ciğir, İçören, Alpagut, and Merkez) and Ayaş (Başbereket, Ortabereket, Feruz, Çukurören, Canilli, and Pınaryaka) districts in Ankara in 2017. In Afyonkarahisar province, studies were carried out in 2018 in Merkez (Sülün and Halımoru), Şuhut (Merkez, Çakırözü, Akyuva), Emirdağ (Tezköy, Yavuzköy, Tabaklar). In Konya province, studies were carried out in 2018 in Altınekin (Akçaşar, Ölmez, Dedeler), Kadınhanı (Hacımemetli, Karahisarlı, Yaylayaka, Doğanlar and Karayürüklü), and Çumra (Beylerce, Merkez, Fethiye, İçeri Çumra) (Figure 1).

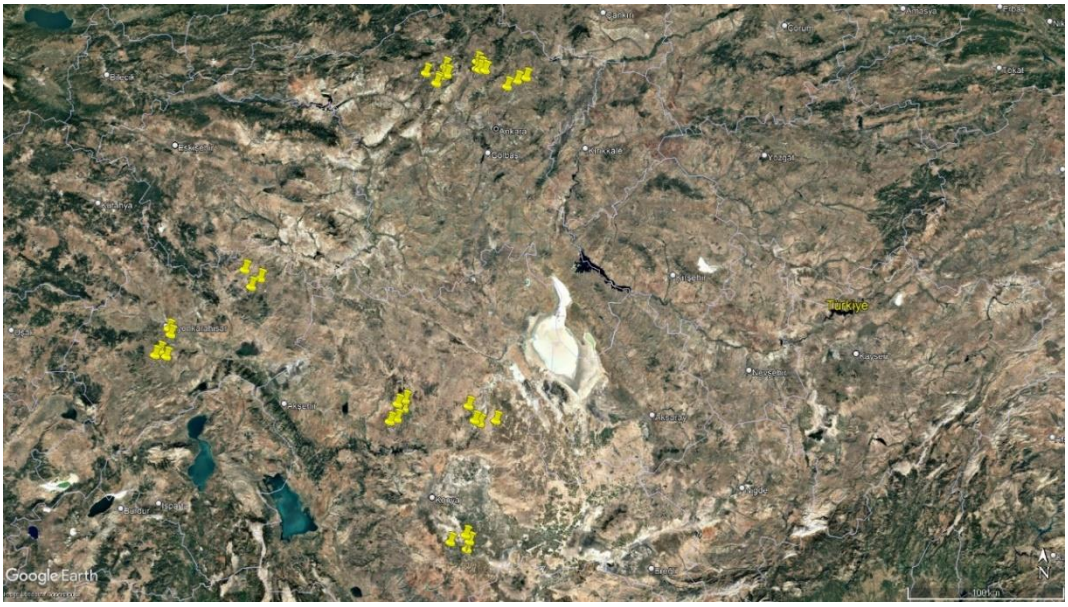

Figure 1. Satellite image of the places where fieldwork was carried out to determine the phytophagus acari fauna in Ankara, Afyonkarahisar, Konya provinces.

Şekil 1. Ankara, Afyonkarahisar, Konya illerinde fitofag akar faunasını belirlemek için saha çalışması yapılan yerlerin uydu görüntüsü.

Sample Collection And I*dentification of Mite Species*

Surveys were conducted between May and October, following the methodology outlined by Bora and Karaca (1970). A random sampling approach, encompassing 1% of the total common bean areas, were employed, with field selection based on the number of fields to be observed. To ensure representative sample and mite species identification, fields were surveyed diagonally, with 20 plants selected at random each decare. These plants were then examined visually, aided by a hand lens if needed. At least 60 leaves and stem samples collected from the lower, middle and upper leaves of these 20 different plant samples were placed in polyethylene bags in paper bags, labeled, placed in an ice box and brought to the laboratory (Cobanoglu and Kumral, 2014). Sampling was conducted at 2-4 week intervals for two years from the predetermined areas, following the specified methods.

The samples brought to the laboratory were stored at +4°C until the examination. The upper and lower surfaces of the leaves and stem specimens were first visually inspected with a stereo microscope. The mites collected were individually placed in Eppendorf tubes containing 70% alcohol and morphologically identified to species level under a microscope (Leica, LED 2000, Taiwan) according to Zhang (2003). Mite specimens were identified by Prof. Dr. Sultan Çobanoğlu and Prof. Dr. Nabi Alper Kumral.

Determination of Infestation Rates and Densities of Mite Species

To determine the infestation rate in the field, the number of infestation plants was counted from samples taken at various points across the common bean fields (Table 1). The rate was calculated relative to the total number of plants using the formula:

$$\text{Infestation rate} = \frac{\text{Number of infestation bean plants}}{\text{Total number of bean plants}} \times 100$$

The average infestation rate for each province (district) was calculated by multiplying the infestation rate for each field by its area, summing these products for all examined fields, and dividing by the total area (Bora and Karaca, 1970). The prevalence of mite species was determined by dividing the infected area by the total area, considering whether the field was infected or not, without factoring in density, while taking the field's size into account.

Common bean leaves (60 leaves) were collected from the fields at 7-10 day intervals to determine the density of pest species. These samples were immediately examined under a stereomicroscope, and all active stages of mites were counted. Additionally, the same samples were placed in a Berlese funnel for extraction, and the collected mites were counted and identified under a microscope. The area indices of the lower, middle, and upper leaves collected during the 1st, 2nd, and 3rd stages of common bean leaf sampling, were calculated. The number of mites per cm^2 was determined by dividing the total number of mites in the collected samples by the total area of the sampled bean leaves (Kumral and Cobanoglu, 2016).

Table 1. Number of plants sampled according to the size of the common bean fields.
Çizelge 1. Fasulye tarlalarında alanın büyüklüğüne göre örnekleme sayısı.

Field size (da)	Number of plants to be sampled
1-5	20
6-10	25
11-20	30
20 <	35

RESULTS AND DISCUSSION

In this study, we detected 6 mite species, belonging to the Tetranychidae and Tydeidae families (Table 2). *Tetranychus urticae* Koch, *Tetranychus turkestani* Ugarov & Nikolski, and *Tetranychus solanacearum* (Cobanoglu & Ueckermann 2015) were specifically identified. Additionally, two species from the family Tydeidae were recorded: *Tydeus caudatus* (Dugés, 1834) and *Tydeus californicus* (Banks, 1904). Among these, *T. urticae* was found to be the most prevalent species in bean fields across the provinces of Ankara, Konya, and Afyonkarahisar (Table 2).

Table 2. Mite species detected in common bean fields in 2017-2018.
Çizelge 2. Fasulye tarlalarında 2017-2018 yıllarında tespit edilen akar türleri.

Team	Family	Species	Identified location
Prostigmata	Tetranychidae	*Tetranychus urticae* Koch 1836	Ankara, Konya Afyonkarahisar
		Schizotetranychus asparagi (Oudemans, 1928)	Konya
		Tetranychus turkestani Ugarov & Nikolski	Ankara
		Tetranychus solanacearum (Cobanoglu & Ueckermann 2015)	Afyonkarahisar
	Tydeidae	*Tydeus caudatus* (Dugés, 1834)	Ankara
		Tydeus californicus (Banks,1904)	Ankara

Seasonal Dynamics, İnfection Rates, Densities of Harmful Mite Species

According to surveys conducted in Ankara in 2017, the infection rate started at 41.25% in July and increased to 100% by September. In Kazan district, the infection rate began at 29.70% and similarly reached 100% by September in Çubuk. In contrast, in the Ayaş district, the infection rate started at 22.31% and increased to 45.45%. Pest densities ranged from a low of 0.61 mites per leaf in Çubuk to a high of 1.77 mites per leaf in Kazan (Table 3, Figure 2). The surveys indicated that infection rates, prevalence, and pest densities per leaf increased steadily across the different observation dates.

Table 3. Infestation rate (%) of pest mites detected in the districts of Ankara province in 2017.
Çizelge 3. Ankara ili ilçelerinde 2017 yılında tespit edilen zararlı akarların bulaşma oranı (%).

Work location		July				September			
Province	District	Density (number of mites cm-2)	Total number of the mites per leaf	Infestation rate (%)	Prevalence rate (%)	Density (number of mites cm-2)	Total number of the mites per leaf	Infestation rate (%)	Prevalence rate (%)
Ankara	Çubuk	0.012	0.61	41.25	100.0	0.007	1.32	100.0	100.0
	Kazan	0.004	0.18	29.70	100.0	0.009	1.77	100.0	100.0
	Ayaş	0.002	0.13	22.31	100.0	0.006	1.09	45.45	100.0
Average		0.006	0.31	31.09	100.0	0.007	1.39	81.82	100.0

In 2018, the studies conducted in Afyonkarahisar province revealed varying infestation rates across different districts. In the central district, the infection rate started at 79.79% in June and reached 100% in both July and August. Similarly, in Şuhut district, the infestation rate was 78.20% in June and also reached 100% in July and August, remaining at that level until harvest. In Emirdağ district, the infection rate was 46.21% in June, increasing to 97.37% in July, and reached 100% in August. The number of mites per leaf started at 0.28 in Şuhut and 0.28 in Emirdağ, peaking at 18.92 and 16.47 mites per leaf, respectively. In the central district of Afyonkarahisar province, the highest number of pests per leaf was recorded at 19.25. It was observed that infestation rates, densities, prevalence, and pest numbers per leaf increased steadily across the different observation dates (Table 4, Figure 3).

Table 4. Infestation rate (%) of pest mites detected in the districts of Afyonkarahisar and Konya provinces in 2018.
Çizelge 4. Afyonkarahisar ve Konya illerinin ilçelerinde 2018 yılında tespit edilen zararlı akarların bulaşma oranı (%).

Work location		June				July				August			
Province	District	Density (number of mites cm-2)	Total number of the mites per leaf	Infestation rate (%)	Prevalence rate (%)	Density (number of mites cm-2)	Total number of the mites per leaf	Infestation rate (%)	Prevalence rate (%)	Density (number of mites cm-2)	Total number of the mites per leaf	Infestation rate (%)	Prevalence rate (%)
Afyonkarahisar	Merkez	0.0101	1.15	79.79	100.0	0.08	15.81	100	100.0	0.10	19.25	100.0	100.0
	Şuhut	0.008	0.28	78.20	100.0	0.07	13.55	100	100.0	0.10	18.92	100.0	100.0
	Emirdağ	0.0027	0.28	46.21	100.0	0.06	10.04	97.37	100.0	0.08	16.47	100.0	100.0
Average		0.0069	0.57	68.06	100.0	0.07	13.13	99.12	100.0	0.093	18.21	100.0	100.0
Konya	Altınekin	0.003	0.14	20.95	100.0	0.016	1.88	80.60	100.0	0.09	17.08	87.11	100.0
	Kadınhanı	0.003	0.15	24.95	100.0	0.021	2.35	93.53	100.0	0.08	14.46	87.01	100.0
	Çumra	0.008	0.41	34.96	100.0	0.026	2.96	89.45	100.0	0.10	18.62	100.0	100.0
Average		0.0035	0.233	26.95	100.0	0.021	2.396	87.86	100.0	0.09	16.72	91.373	100.0

In Konya province, the infestation rate started at 20.95% in June and increased to 80.60% in July in Altınekin district. The rate increased to 87.11% in August. In the Kadınhanı district, the infestation rate began at 24.95% in June, peaked at 93.53% in July, and decreased to 87.01% by the end of August. In the Çumra district, the infestation rate started at 34.96% in June, reached 89.45% in July, and hit 100% in August. The number of mites per leaf was initially 0.14 in the Altınekin district, rapidly increasing to 17.08. Similar trends were observed in the Kadınhanı and Çumra districts, where the highest densities reached 14.46 and 18.62 mites per leaf, respectively. Surveys conducted on different dates showed that infestation rates, densities, prevalence, and pest densities per leaf increased over time (Table 4, Figure 4).

In all three provinces, the highest infestation rates were observed in July and August. In Ankara province, the average rate began at 31.09% and increased to 81.82%. In Konya province, the average rate started at 26.95% and increased to 91.37% by August, just before harvest. In Afyonkarahisar province, the average infestation rate started at 68.06% in June, increased in July, and reached 100% in August.

The seasonal population of *T. urticae*, which began appearing at the end of June, increased significantly in July and August, reaching its highest level by the end of August. Studies indicated substantial damage due to this increase. By mid-July, the number of *T. urticae* surpassed the economic damage threshold (3 mites per leaf) in Afyonkarahisar and Konya provinces (Anonymous, 2008). In Ankara province, however, the pest population did not exceed the economic damage threshold. During our observations in common bean fields of Ankara, both *T. urticae* and *E. finlandicus* were detected together. Beneficial organisms, particularly *E. finlandicus*, are thought to have helped keep pest populations under control. Similarly, Soysal (2016) found that *E. finlandicus* with *T. urticae* in surveys of bean and cucumber fields in the open fields and greenhouses of the Ordu region.

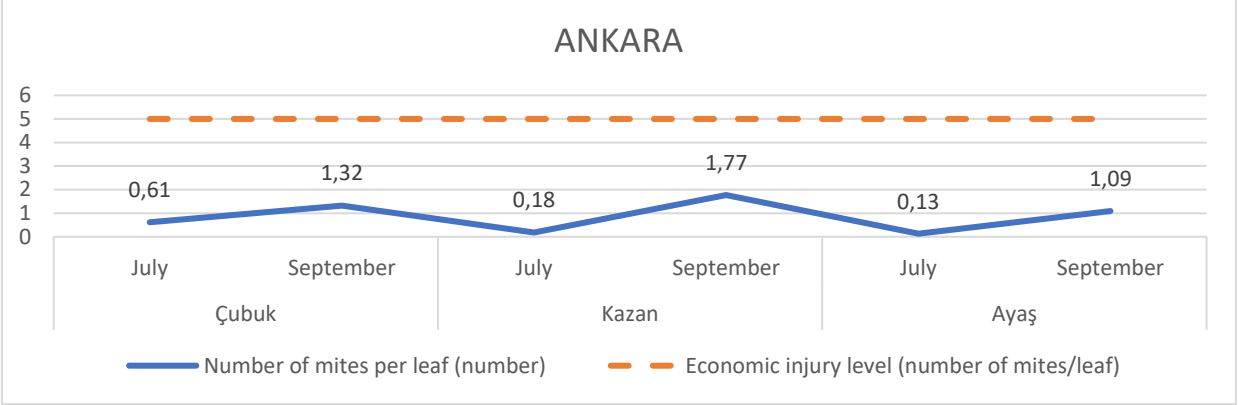

Figure 2. Average number of mites per leaf during the vegetation period in Ankara province in 2017.
Şekil 2. Ankara ilinde 2017 yılında vejetasyon dönemi boyunca yaprak başına düşen ortalama akar sayısı.

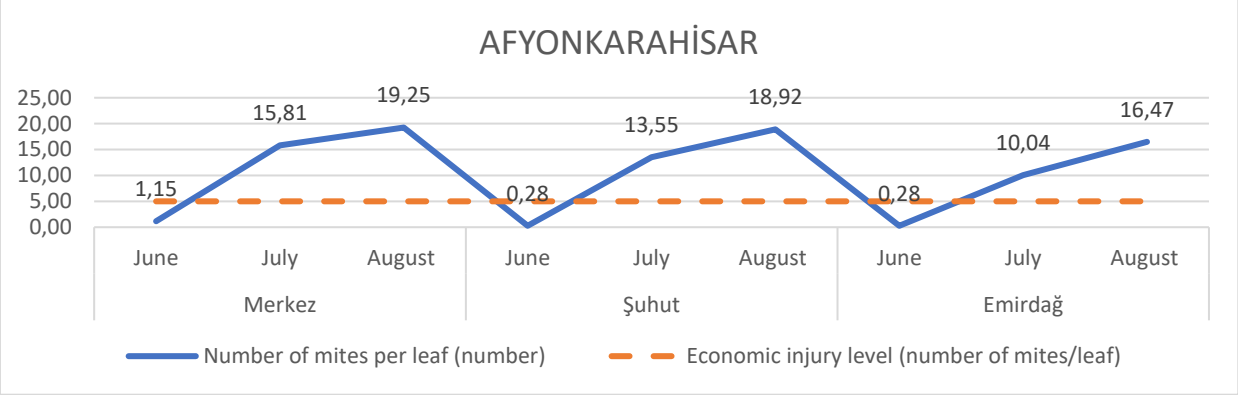

Figure 3. Average number of mites per leaf during the vegetation period in Afyonkarahisar province in 2018.
Şekil 3. Afyonkarahisar ilinde 2018 yılı vejetasyon dönemi boyunca yaprak başına düşen ortalama akar sayısı.

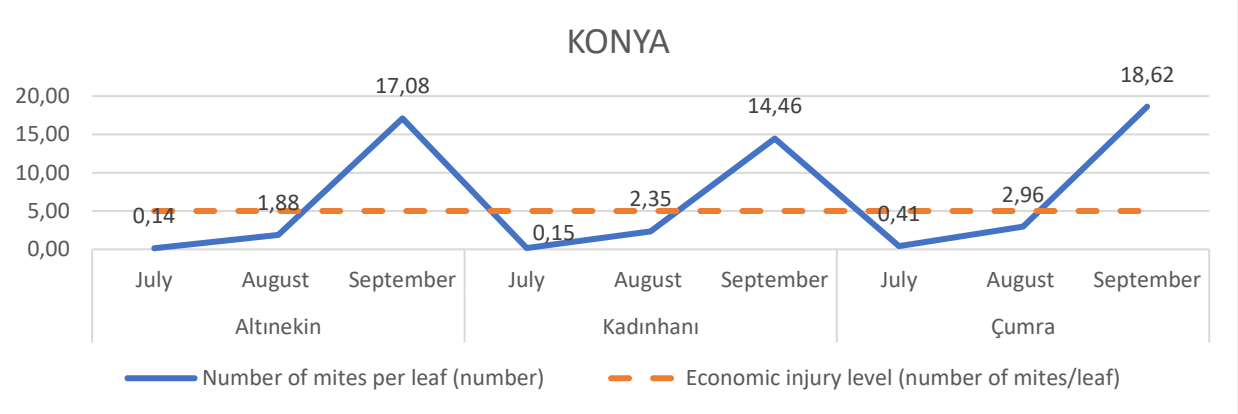

Figure 4. Average number of mites per leaf during the vegetation period in Konya province in 2018.
Şekil 4. Konya ilinde 2018 yılı vejetasyon dönemi boyunca yaprak başına düşen ortalama akar sayısı.

Tetranychus urticae is recognized as a common and economically significant pest species in common beans. Studies conducted in all three provinces confirmed the prevalence of *T. urticae* and its significant economic impact. Polat and Kasap (2011) reported that the population of *T. urticae* began increasing in July, reaching its peak by the end of September and into the first half of October. They observed that high populations of *T. urticae* caused plants to begin drying out during these periods. In another study, Kumar et al. (2013) assessed the population density of *T. urticae* on eggplant (*Solanum melongena* L.), bitter gourd (*Momordica*

charantia L.), okra (*Abelmoschus esculentus* L.), gourd (Cucurbitaceae), and cowpea (*Vigna chinensis* L.) plants. They reported mite populations per leaf as follows: eggplant (53.34 mites), cowpea (47.37 mites), okra (42.83 mites), and gourd (37.93 mites), respectively. As stated in previous studies, *T. urticae* has the potential to infest and damage various vegetables. Therefore, similar to the literature, the average number of mites per common bean leaf was lowest in Ankara (0.31 mites) and highest in Afyonkarahisar province (18.21 mites).

Tetranychus turkestani, also known as *Tetranychus atlanticus* McGregor, was detected in samples taken from the Altınekin district of Konya. This phytophagous mite is an important pest species in Türkiye and globally, particularly affecting crops such as strawberries, beans, cucumbers, eggplants, tomatoes, cowpeas, and squash (both in field and greenhouse settings), where it feeds by sucking cell contents (Jeppson et al., 1975; Ongoren et al., 1975; Helle and Sabelis, 1985; Bolland et al., 1998; Cıkman 1995; Cakmak et al., 2003; Zhang, 2003; Hoy, 2011; Ozsisli and Cobanoglu, 2011). This species can also be found under bark and among debris of trees (Mellott and Connell, 1965). Its presence has been documented in various studies conducted in Türkiye. Studies in the Aegean Region identified *T. urticae* as the most common mite species, with *Tetranychus cinnabarinus* (Boisduval, 1867) and *T. atlanticus* also found in beans (Ongoren et al., 1975). Cıkman (1995) reported *T. urticae, T. cinnabarinus,* and *T. atlanticus* in tomatoes among different vegetable crops in Şanlıurfa province. Ulusoy et al. (1999) identified phytophagus and beneficial arthropod species in cherry trees in Niğde and Adana, including *T. atlanticus*.

Tetranychus solanacearum was identified for the first time in common beans by Cobanoglu & Ueckermann, marking a new record for Türkiye and globally (Cobanoglu et al., 2015). Specimens were collected from solanaceous plants including *Solanum nigrum* L., *Solanum dulcamara* L., *Solanum melongena* L., *Solanum rostratum* Dunal., *Datura stramonium* L., and *Lycopersicon esculentum* L. in Ankara province. Subsequently, Kumral and Cobanoglu (2016) also detected this species in eggplant fields in Ankara and Bursa provinces. Limited information is available about this species, which thrives under favorable conditions for growth and development, feeding intensively on beans and rapidly multiplying, thereby causing significant leaf damage. Its feeding behavior on bean plants can lead to substantial yield reduction, eventually resulting in plant desiccation and death. Due to its recent discovery in Türkiye and globally, comprehensive studies are needed to understand its distribution, hosts, biology, and effective control methods.

The pineapple mite, *S. asparagi*, was identified for the first time in Türkiye. This species is distributed in Africa, Europe, the USA, Puerto Rico, and Hawaii. It typically forms large populations, especially during the summer months, and its hosts include *Protasparagus* species and occasionally pineapple. It is known to be phytophagus to crops grown both in field and greenhouse environments. This mite is characterized by its red coloration when alive and lays its eggs at the base of leaf branches. Feeding by *S. asparagi* causes leaf discoloration. Infected plants exhibit stunted growth, reduced fruit production, or even complete failure to set fruit, with severe infestations potentially leading to plant desiccation. It is suggested that infection can be prevented by using clean seedlings or saplings (Meyer, 1974, 1987, 1996; Jeppson et al., 1975; Ben-David et al., 2007). Its presence in Türkiye was documented for the first time in this study. In a similar study, another species, *Schizotetranychus ibericus* Reck, 1947 (Acari: Prostigmata), was reported from Ankara, Türkiye (Cobanoglu et al., 2023).

In this study, *T. caudatus* and *T. californicus* were found to exclusively in Ankara province. These species are reported to feed on pollen, honeydew, or sweet substances secreted by insects, and certain predatory mite species (Phytoseiidae) may feed on Tydeid species when their primary prey is absent (Jeppson et al., 1975). It has been suggested that *T. caudatus* could serve as an alternative food source for predatory mites, especially in orchards, where chemical control measures are not applied (Baker, 1970; Darbemamieh et al., 2010, 2016). While it is evaluated that *T. caudatus* does not cause significant economic damage due to its limited distribution and sparse occurrence on plants, it has been recognized as a pest requiring control measures because of its extensive infestations in raspberry, persimmon, and apricot crops in New Zealand, albeit not in our country (Jones et al., 1996). Therefore, it is considered essential to assess the population status and density of *Tydeus* spp.

As a result of this study, six phytophagous mite species belonging to the Tetranychidae and Tydeidae families were identified across three different provinces. In a similar study conducted in India, various mite species, including Tetranychidae, Tenuipalpidae, Tarsonemidae, and Eriophyidae, were identified in vegetables, with these phytophagous mite groups causing damage primarily between April to July and September to October during severe summer months. Mehrkhou et al. (2008) conducted a study in Tehran, Iran, in 2005 to assess the population density and distribution of *T. urticae* on cucumber and different bean varieties. Among the bean varieties studied, the highest number of mites per leaf was observed in Sunray (59.37 mites per leaf), while the lowest was found in Parastoo (4.73 mites per leaf).

T.urticae was found to be the most abundant and economically important species in all three provinces. The spider mite *T. urticae* has a worldwide distribution, mainly in Europe, Asia and North and South America, and feeds on approximately 1500 described plant species belonging to 70 genera (Bolland et al., 1998). When the population densities of the mite species were analysed, it was found that they did not exceed the economic damage threshold in Ankara province (Figure 2). Our study found *T. urticae* and *E. finlandicus* to be common in bean fields in Ankara. It was suggested that *E. finlandicus*, a beneficial species, may play a significant role in suppressing mite populations in Ankara. *E. finlandicus* feeds on various mite species, including Tetranychidae, Eriophyidae, Tyroglyphidae, and Tarsonemidae, as well as on pollen, fungal spores, hyphae, insect eggs and larvae, and honeydew. This predatory behavior underscores its importance in the biological control of spider and eriophyid mites (Kostiainen and Hoy, 1994; Schausberger, 1997, 1998; Broufas and Koveos, 2000; Abdallah et al., 2001; Broufas and Koveos, 2001).

In the provinces of Konya and Afyonkarahisar, the population of mites was found to exceed the economic damage threshold (Figure 3-4). However, studies conducted across all three provinces showed that the prevalence rate reached 100% depending on the month. This study was conducted in different districts of Afyonkarahisar, Ankara, and Konya provinces, where cultivation is intensive.

CONCLUSION

This study monitored phytophagus mite species in common bean fields throughout their growth cycle and determined their densities. Among the identified plant pest mite species were *T. urticae*, *T. atlanticus*, *T. solanacearum*, and *S. asparagi.* Additionally, neutral mites *T. caudatus* and *T. californicus* were detected in these fields. During the entire vegetation period of beans, the highest infestation rates were observed in July and August in all three provinces. This situation demonstrates that mite species can adapt rapidly despite the increase in temperature in our country, which is influenced by global warming. Especially with long-term adaptation, it is thought that mites can spread over a wider area andacross a wide range of environmental temperatures.

Our finding that *T. urticae* was identified as the most prevalent pest species in beans. Globally, *T. urticae* is recognized as one of the most destructive mite pests in agricultural crops. This pest poses significant challenges for control due to its exceptionally rapid reproductive rate and ability to develop resistance to chemical treatments. Therefore, continuous monitoring of its population throughout the growing season is essential, and efforts should be made to suppress its population using non-chemical control methods when necessary.

According to our findings, many mite species other than *T. urticae* were detected for the first time in bean fields. This study represents the first faunistic study on bean mites in the region, and *T. solanacearum* Ankara and *S. asparagi* were identified for the first time in Türkiye. It is important to know the phytophagus mite species in bean fields, to monitor their population densities, and to investigate their biology and natural enemies. It is thought that determining the effect of climate change on pest organisms and periodically monitoring and controlling the changes in pest populations over the years are of great importance in pest control, particularly because of the impact of developmental and reproductive temperatures.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

DECLARATION OF AUTHOR CONTRIBUTION

AB writing the original draft and review and editing, AB and NG field and laboratory studies, HD laboratory studies, NAK and SC identified the mite specimens and the review – editing.

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