Türk. entomol. derg., 2023, 47 (2): 199-213
DOI: http://dx.doi.org/10.16970/entoted.1221736

ISSN 1010-6960
E-ISSN 2536-491X

Original article (Orijinal araştırma)

Soft scale (Hemiptera: Coccomorpha: Coccidae) species on fruit orchards of Diyarbakır and Elazığ provinces in Türkiye[1]

Diyarbakır ve Elazığ illeri meyve bahçelerindeki Koşnil (Hemiptera:Coccomorpha: Coccidae) türleri

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Abstract

This study was carried out in order to determine the soft scale insects (Hemiptera: Coccomorpha: Coccidae) species, their host plants, distribution areas, densities and infestation rates on fruit production areas of Diyarbakır and Elazığ Provinces in 2017-2018. As a result of the study, 7 soft scale species were determined on 12 fruit plants. The most common species and the widest host plant range was *Parthenolecanium corni* (Bouché, 1844) in the study areas. *Sphaerolecanium prunastri* (Boyer de Fonscolombe, 1834) and *Didesmococcus unifasciatus* (Archangelskaya, 1923) were determined to be the most important species in the region. *Didesmococcus unifasciatus* caused heavy infestation on almond, *Prunus dulcis* (Mill.) (Rosales: Rosaceae) trees (Scale 4) at rates of 3.1% and 0,9% in Çınar district of Diyarbakır and Sivrice district of Elazığ, respectively. *Sphaerolecanium prunastri* caused heavy infestation on apricots, *Prunus armeniaca* L. (Rosales: Rosaceae) at rates of 3.8% and 4.6% in Elazığ's Central and Baskil districts, which have significant apricot production areas.

Keywords: Density, host plant, infestation rate, soft scale insect, Türkiye

Öz

Bu çalışma 2017-2018 yılları arasında, Diyarbakır ve Elazığ illeri meyve üretim alanlarındaki Koşnil (Hemiptera: Coccomorpha: Coccidae) türleri ile bu türlerin konukçuları, yayılış alanları, yoğunlukları ve bulaşma oranlarının belirlenmesi amacıyla yürütülmüştür. Çalışma sonucunda, 12 konukçu bitki üzerinde 7 Coccidae türü tespit edilmiştir. Sürvey alanlarında görülen en yaygın ve konukçu dizisi en geniş türün *Parthenolecanium corni* (Bouché, 1844) olduğu belirlenmiştir. *Sphaerolecanium prunastri* (Boyer de Fonscolombe, 1834) ve *Didesmococcus unifasciatus* (Archangelskaya, 1923)'un bölgedeki en önemli türler oldukları belirlenmiştir. *Didesmococcus unifasciatus*'un Diyarbakır'ın Çınar ilçesinde bademde, *Prunus dulcis* (Mill.) (Rosales: Rosaceae) %3,1 oranında Elazığ'ın Sivrice ilçesinde ise %0,9 oranında aşırı bulaşma oranına (Skala 4) sebep olduğu, *S. prunastri*'nin ise Elazığ'ın Merkez ve Baskil ilçelerinde kayısıda, *Prunus armeniaca* L. (Rosales: Rosaceae) sırasıyla %3,8 ve %4,6 oranında aşırı bulaşma oranına sebep olduğu tespit edilmiştir.

Anahtar sözcükler: Yoğunluk, konukçu bitki, bulaşma oranı, koşnil, Türkiye

[1] This study is a part of the first author's doctoral thesis and was presented as abstract in International Symposium of Scientific Research and Innovative Studies (22-25 February 2021, Online, Bandırma, Balıkesir, Türkiye).

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Received (Alınış): 21.12.2022 Accepted (Kabul ediliş): 07.07.2023 Published Online (Çevrimiçi Yayın Tarihi): 17.07.2023

Introduction

Soft scale insects (Hemiptera: Coccomorpha: Coccidae) constitute the third most species-rich group in the infraorder Coccomorpha with 1221 species belonging to 173 genera (García Morales et al., 2016). The habitats, colors, shapes and forms differ among species of Coccidae (Ben-Dov, 1997; Kondo, 2022). They are plant-feeding insects which develop mostly on perennial, but rarely on annual plants (Hodgson, 1994). Coccids feed on nearly any part of the host plant, including the roots, even though many species develop on the leaves or twigs or the trunk. Actual take-up of nutrients is from the phloem and thus all species of Coccidae produce honeydew (Ben-Dov, 1997). Species of Coccidae include noxious insects, causing direct injury by depleting the host plant of nutrients and damaging tissues, and indirectly through honeydew secretion which accumulates on crops. The consequent cover of sticky honeydew and the development of black sooty mold on crops decreases significantly their market value (Öncüer, 1974; Hodgson, 1994; Ben-Dov, 1997). In order to prevent their damages, it is important to study the species of Coccidae which are found on crops (Kosztarab & Kozár, 1988).

In studies carried out in cultivated and non-cultivated areas in Türkiye, 72 Coccid species belonging to 30 genera have been identified so far (Ülgentürk et al., 2022). In addition, the studies conducted in fruit production areas in different geographical regions of Türkiye have revealed that many of Coccid species belonging to genera such as *Anapulvinaria* Borchsenius, 1952, *Ceroplastes* Gray, 1828, *Coccus* L., 1785, *Didesmococcus* Borchsenius,1953, *Eulecanium* Cockerell, 1893, *Filippia* Targioni Tozzetti, 1868, *Palaeolecanium* Šulc, 1908, *Parthenolecanium* Šulc, 1908, *Saissetia* Deplanche, 1859, *Sphaerolecanium* Šulc, 1908 (Hemiptera: Coccidae) cause damage on different fruit tree species and, they can cause economic losses if they are not kept under control (Altay et al., 1972; Öncüer, 1974; Soylu, 1976; İren, 1977; Kozar et al., 1979; Ecevit et al., 1987; Kılıç & Aykaç, 1989; Erol & Yaşar, 1996; Özgökçe et al., 1999; Bolu & Uygun, 2003; Kumral & Kovancı, 2004; Zeki et al., 2004; Özgen & Bolu, 2009; Ülgentürk et al., 2009; Bolu, 2012; Kaçar et al., 2012; Akşit & Apak, 2013; Yiğit, 2013; Ayaz et al., 2015; Kaplan & Turanlı, 2016; Şimşek & Bolu, 2017; Gülmez et al., 2022).

Along with the improvement in irrigation opportunities, fruit plantations have increased in Southeastern Anatolia and Eastern Anatolia Regions. For example, the apricot orchards area in Elazığ have increased from 3535 ha to 10211.2 ha between 2004 and 2021. Similarly, the almond production area in Diyarbakir province increased from 661 ha to 1984.9 ha between 2004 and 2021 (TURKSTAT, 2022). Since the increase in fruit diversity and production areas may cause proliferation of many harmful insect species, including coccids, it is important to conduct surveys of harmful insect species at regular intervals and to reveal their damage levels.

This paper deals with Coccidae species, their host plants, distributions, densities and infestation rates on fruit orchards of Diyarbakır and Elazığ provinces in Türkiye.

Materials and Methods

The study was carried out in the fruit orchards of Diyarbakır (Çermik, Çüngüş, Eğil, Ergani, Çınar) and Elazığ (Center district, Baskil, Keban, Sivrice) in April-September, in 2017-2018 (Figure 1). The fruit trees were examined every two weeks and the number of trees examined in the sampled orchards was determined according to Lazarov & Grigorov (1961). Specimens were slide mounted for light microscopy by using the methodology of Kosztarab & Kozár (1988). Dry and mounted material were deposited at the Plant Protection Research institution, Diyarbakır, Türkiye. In order to determine the densities of Coccidae species, individuals on 10 cm shoots or branches of the host plant were counted and evaluated according to the density scale determined by Kozár & Viktorin (1978) (Table 1), infestation rates of the species were calculated according to the formula “number of infested trees/total number of trees examined x100” for each host plant in the survey district.

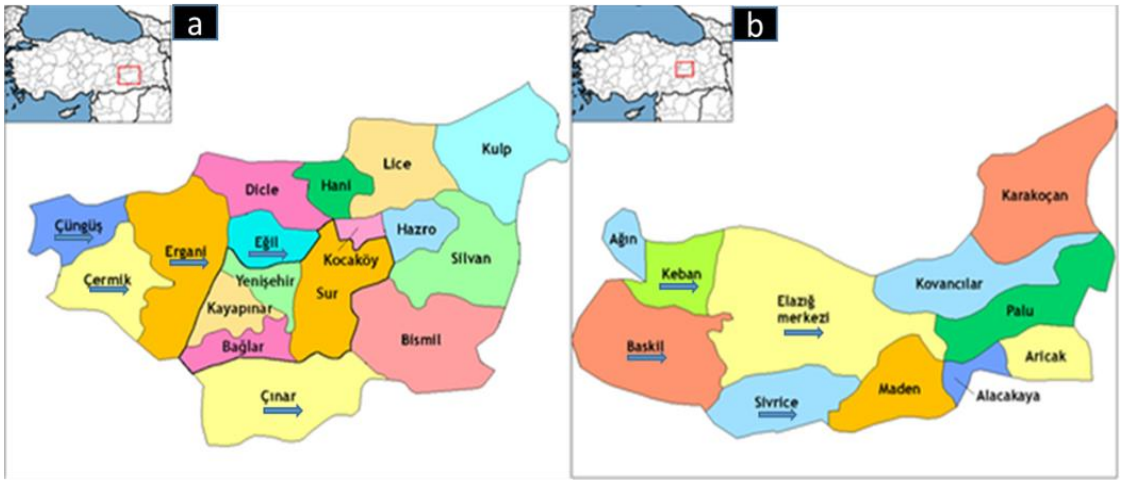

Figure 1. Survey districts of a) Diyarbakır and b) Elazığ.

Table 1. Density scales of scale insects on fruit trees

Scale	Individual number/10'cm shoot or branch	Evaluation
0	0	Clean
1	1-5	Low infestation
2	6-20	Small colony
3	21-50	Large colony
4	More than 50	Heavy infestation

Results and Discussion

Soft scale species on fruit plants in Diyarbakır Elazığ Provinces

As a result of the study carried out, it was determined that 26 of the 97 orchards surveyed in Diyarbakır were clean and 71 were infested with soft scale insects. In Elazığ, 47 out of 126 orchards were found to be clean and 79 infested. 7 Coccidae species belonging to 7 genera were determined on 12 host plants, and these species and their hosts are given in Table 2.

Table 2. Coccidae species and their hosts in the orchards of Diyarbakır and Elazığ provinces in 2017-2018

Coccidae species	Host plant
Anapulvinaria pistaciae (Bodenheimer, 1926)	*Pistacia vera* L. (Sapindales: Anacardiaceae)
Didesmococcus unifasciatus (Archangelskaya, 1923)	*Prunus dulcis* (Mill.), *Prunus persica* (L.) (Rosales: Rosaceae)
Eulecanium tiliae (L., 1758)	*Pistacia vera*, *Cydonia oblonga* Mill., *Malus domestica* Baumg, *Prunus domestica* A.Sav., *Prunus armeniaca* Blanco (Rosales: Rosaceae)
Parthenolecanium corni (Bouché, 1844)	*Cydonia oblonga, M. domestica, P. vera, P. dulcis, P. persica, P. domestica*, *P. armeniaca*, *Prunus avium* (L.), *Prunus cerasus* Scop., (Rosales: Rosaceae), *Diospyros kaki* Thunb., (Ericales: Ebenaceae), *Juglans regia* L. (Fagales: Juglandaceae), *Morus alba* Bureau (Rosales: Moraceae)
Palaeolecanium bituberculatum (Signoret, 1873)	*Malus domestica*
Pulvinaria vitis (L., 1758)	*Juglans regia*
Sphaerolecanium prunastri (Boyer de Fonscolombe, 1834)	*Prunus domestica*, *P. armeniaca*

***Anapulvinaria pistaciae* (Bodenheimer, 1926)**

Adult female approximately broadly circular with raised short oval central area and transverse wrinkles. Length 2.8-3.4 mm. Color light to dark brown, ovisac "cottony" white, length 4-5 mm width 3-4 mm (Figure 2a). The egg is oval and light green in color, crawlers and first-instar nymphs are also green, but second instar nymphs turn to red brown (Santas, 1985).

Material examined. Diyarbakır: Çınar, Aktepe, 37°43'15.6"N 40°34'10.6"E, 13.vii.2017, 2♀♀, *P. vera*; Çınar, Ekinveren, 37°41'10.6"N 40°25'51.5"E, 10.vii.2018, 3♀♀, *P. vera*.

Distribution in Türkiye. the pest has been detected in Central Anatolia, Eastern Anatolia and Southeastern Anatolia regions (Ülgentürk et al., 2022).

Distribution in the world. Afghanistan, Armenia, China, Iran, Lebanon, Mongolia, Pakistan, Tajikistan, Türkiye, Turkmenistan, Uzbekistan (García Morales et al., 2016).

***Didesmococcus unifasciatus* (Archangelskaya, 1923)**

The body of young females is elliptical, oval in shape. Body color is reddish brown, with an orange-yellowish band in the middle of the body (Figure 2b). Egg-laying adult females swell and take on a spherical shape (Hodgson, 1994).

Material examined. Diyarbakır: Çüngüş, Karşıyaka, 38°12'57.7"N 39°17'39.5"E, 16.VIII.2017, 4♀♀, *P. persica*; Çınar, Altınakar, 37°44'51.7"N 40°24'57.1"E, 20.IX.2017, 3♀♀, *P. dulcis*; Çüngüş, Keleşevler, 38°12'20.2"N 39°19'11.1"E, 10.V.2018, 3♀♀, *P. dulcis*; Çınar, Bağacık, 37°40'13.2"N 40°26'29.4"E, 16.VIII.2018, 5♀♀, *P. dulcis*; Elazığ: Sivrice, Günay, 38°29'14.2"N 39°20'01.1"E, 16.IV.2018, 4♀♀, *P. dulcis*; Sivrice, Cevizdere, 38°29'50.6"N 39°22'27.1"E 24.IV.2018, 4♀♀, *P. dulcis*; Sivrice, Şirinyazı, 38°27'17.6"N 39°17'44.4"E, 22.V.2018, 5♀♀, *P. dulcis*.

Distribution in Türkiye. It has been reported that the pest has been detected in Eastern Anatolia and Southeastern Anatolia regions (Kaydan & Kozár, 2010; Bolu, 2012; Çiftçi & Bolu, 2021).

Distribution in the world. Afghanistan, Armenia, China, Iran, Lebanon, Mongolia, Pakistan, Tajikistan, Türkiye, Turkmenistan, Uzbekistan (García Morales et al., 2016).

***Eulecanium tiliae* (L., 1758)**

The body of the young female is oval in shape and there are red and white colored bands extending from length to end on the dorsal (Figure 2c). The length of the young females is 3313±15.6 (2440-4200) µm, and the width is 3163±17.7 (2120-4320) µm. After oviposition periods, these colored bands disappear and color of body turns into a uniform yellowish light brown or brown. The bodies of adult females become swollen during ovulation and take the shape of a sphere (Ülgentürk, 1998). The body of first-instar nymphs is oval, brownish orange in color, and the young individuals of them are 0.43-0.59 µm length and 0.27-0.30 µm width; before molting, they are 800-960 µm length and 420-590 µm width. In Second instar nymphs, the body is elongated oval, greenish yellow. There are 10 reddish orange thin lines extending from the head to the anal lobe. the males of it are 1.2-2.05 mm length, 0.56-1.08 mm width and females are 1.02-1.08 mm tall, 0.6-0.8 mm wide (Đurović, 2015).

Material examined. Diyarbakır: Çınar, Aktepe, 37°43'57.4"N 40°33'49.7"E, 13.VII.2018, 2♀♀, *P. vera*; Çınar, Aktepe, 37°43'15.6"N 40°34'10.6"E, 13.VII.2018, 5♀♀, *P. vera*; Çınar, Yaprakbaşı, 37°38'37.3"N 40°33'43.0"E, 13.VII.2018, 2♀♀, *P. vera*; Çınar, Ekinveren, 37°41'09.7"N 40°25'51.8"E, 12.IV.2018, 4♀♀, *P. vera*; Çınar, Öncülü, 37°42'48.6"N 40°31'55.2"E, 12.IV.2018, 4♀♀, *P. vera*; Çınar, Öncülü, 37°42'45.3"N 40°32'21.6"E, 12.IV.2018, 2♀♀, *P. vera*; Eğil, Bahşilar, 38°14'00.2"N 40°03'51.7"E, 24.IV.2018, 3♀♀, *P. vera*; Eğil, Ilgın, 38°16'07.4"N 40°05'44.0"E, 12.VII.2018, 2♀♀, *P. vera*; Çınar, Bilmece, 37°33'21.5"N

40°13'08.9"E, 27.viii.2018, 5♀♀, *P. vera*; Elazığ: Baskil, Alangören, 38°27'41.4"N 38°37'31.1"E, 20.VII.2017, 2♀♀, *P. armeniaca*; Baskil, Hacımehmetli, 38°30'00.8"N 38°32'06.5"E, 20.VII.2017, 4♀♀, *P. domestica*; Center district, Veran, 38°40'59.3"N 39°08'35.1"E, 09.IV.2018, 2♀♀, *M. domestica*, 2♀♀, *C. oblonga*; Central district, Sarıcubuk, 38°40'59.3"N 39°06'18.0"E, 03.v.2018, 4♀♀, *P. domestica*.

Distribution in Türkiye. The pest spreads in the Mediterranean, Eastern Anatolia, Black Sea, Marmara and Central Anatolia Regions (Ülgentürk et al., 2022).

Distribution in the world. Armenia, Austria, Bulgaria, Canada, Canary Corsica, Croatia, Czechia, Denmark, England, France, Georgia, Germany, Greece, Hungary, Iran, Iraq, Ireland, Islands, Israel, Italy, Latvia, Luxembourg, Malta, Moldova, Netherlands, Northern Ireland, Pakistan, Poland, Portugal, Romania, Russia, Sardinia, Scotland, Slovenia, Spain, Sweden, Switzerland, Türkiye, Turkmenistan, Ukraine, United States,Yugoslavia (García Morales et al., 2016).

***Parthenolecanium corni* (Bouché, 1844)**

The body shape and color of the pest may vary depending on the age of the individual, species of host plant and the region. Young females are usually grayish yellow, light brown colors, and are 3550±20.2 (2200-5320) µm length, 2862±22.3 (1240-4600) µm width. there are longitudinal 2 dark-colored apparent stripes and latitudinal vague lines on dorsum (Figure 2e). Adult females which have completed ovulation are dark brown and varies from slightly swollen or spherical. On dorsum, there is a distinct longitudinal carina on mid-dorsum of the body (Ülgentürk, 1988).

Material examined. Diyarbakır: Çınar, Aktepe, 37°43'57.4"N 40°33'49.7"E, 13.VII.2017, 2♀♀, *P. vera*; Eğil, Dere, 38°13'45.5"N 40°05'16.6"E, 19.VII.2017, 4♀♀, Eğil, Dere, 38°14'13.1"N 40°04'14.1"E, 19.VII.2017, 3♀♀, *P. dulcis*;*P. dulcis*; Çermik, Karamusa, 38°08'52.3"N 39°29'25.8"E, 01.VIII.2017, 3♀♀, *P. armeniaca*, 2♀♀, *P. domestica*; Çermik, Tepe, 38°07'57.3"N 39°28'41.5"E, 01.VIII.2017, 3♀♀, *P. domestica*; Çermik, Sinek, 38°10'04.3"N 39°28'00.1"E, 01. VIII.2017, 4♀♀, *P. persica*, 2♀♀, *M. domestica*; Çermik, Haburman, 38°08'17.5"N 39°28'19.4"E, 01.VIII.2017, 3♀♀, *P. dulcis*; Ergani, Sanayi, 38°14'21.9"N 39°47'13.7"E, 03.VIII.2017, 5♀♀, *P. armeniaca*; Ergani, Şirinevler, 38°15'37.8"N, 39°44'27.1"E, 03.VIII.2017, 3♀♀, *M. domestica*, 3♀♀, *P. avium*; Çüngüş, Değirmensuyu, 38°13'07.7"N 39°15'05.9"E, 16.VIII.2017, 2♀♀, *P. domestica*; Çüngüş, Hindibaba, 38°13'27.3"N 39°13'14.9"E, 16.VIII.2017, 2♀♀, *M. domestica*, 3♀♀, *P. persica*; Çınar, Altınakar, 37°46'02.4"N 40°24'48.8"E 20.IX.2017, 3♀♀, *P. dulcis*; Ergani, Yukarı karbuzlu, 38°11'48.4"N 39°50'33.8"E, 21.IX.2017, 2♀♀, *P. dulcis*; Ergani, Kömürtaş, 38°13'28.3"N 39°48'08.4"E, 21.IX.2017, 3♀♀, *M. domestica*, 3♀♀, *P. domestica*; Ergani, Bahçekaşı, 38°15'31.8"N 39°43'59.8"E, 21.IX.2017, 3♀♀, *P. armeniaca*, 2♀♀, *M. domestica*; Çermik, Karakaya, 38°03'51.5"N 39°18'43.0"E 05.IV.2018, 5♀♀, *M. domestica*, 2♀♀, *P. domestica*; Çermik, Kırmatepe, 05.IV.2018, 3♀♀, *J. regia*, 5♀♀, *P. armeniaca*, ♀, *P. domestica*, 38°03'46.2"N 39°19'37.3"E; Çermik, Göktepe, 38°04'53.8"N 39°20'39.8"E, 05.IV.2018, 3♀♀, *P. armeniaca*, 3♀♀, *P. persica*; Çınar, Beşpınar köyü, 12.IV.2018, 5♀♀, *P. dulcis*, 3♀♀, *P. armeniaca*, 2♀♀, *M. domestica*, 6♀♀, *P. domestica*, 2♀♀, *J. regia*, 4♀♀, *M. alba*, 37°46'38.5"N 40°21'51.8"E; Çınar, Beşpınar, 12.IV.2018, 2♀♀, *M. domestica*, 37°46'05.4"N 40°22'23.5"E; Çınar, Beşpınar, 12.IV.2018, 4♀♀, *M. alba*, 2♀♀, *M. domestica*, 2♀♀, *P. armeniaca*, 37°46'05.4"N 40°22'23.5"E; Çınar, Öncülü, 12.IV.2018, 2♀♀, *P. vera*, 37°42'48.6"N 40°31'55.2"E; Ergani, Tevekli, 17.IV.2018, 4♀♀, *P. armeniaca*, 3♀♀, *P. domestica*, 38°11'37.2"N 39°50'39.6"E; Ergani, Kavurmaköprü, 17.IV.2018, 5♀♀, *P. domestica*, 38°17'34.2"N 39°44'04.5"E; Ergani, Kavurmaköprü, 17.IV.2018, 4♀♀, *M. domestica*, 38°18'02.1"N 39°43'20.4"E; Ergani, Ortaağaç, 17.IV.2018, 2♀♀, *P. armeniaca* 38°18'09.9"N 39°42'55.4"E; Çüngüş, Oyuklu, 18.IV.2018, 2♀♀, *P. armeniaca* 38°11'36.2"N 39°22'33.5"E; Çüngüş, Oyuklu, 18.IV.2018, 2♀♀, *P. armeniaca*, 38°11'45.4"N 39°21'17.2"E; Çüngüş, Keleşevleri, 18.IV.2018, 3♀♀, *P. avium*, 38°11'47.8"N 39°20'58.4"E; Çüngüş, Keleşevleri, 38°11'48.4"N 39°21'01.3"E, 18.IV.2018, 2♀♀, *P. domestica*, 3♀♀, *J. regia*; Eğil, Kırkkuyu, 38°13'06.6"N 40°03'28.9"E, 24.IV.2018, 2♀♀, *P. dulcis*; Eğil, Kırkkuyu, 38°13'12.9"N 40°03'39.0"E, 24.IV.2018, 3♀♀, *P. dulcis*; Eğil, Kırkkuyu, 38°13'39.3"N 40°03'51.7"E, 24.IV.2018, 2♀♀, *P.*

dulcis; Ergani, Kavurmaköprü, 38°19'58.7"N 39°43'47.8"E, 17.V.2018, 4♀♀, *J. regia*, 3♀♀, *P. armeniaca*; Ergani, Ortaağaç, 38°18'26.0"N 39°42'45.3"E, 17.V.2018, 3♀♀, *P. armeniaca*; Ergani, Bahçekaşı, 38°17'01.0"N 39°43'59.0"E, 17.V.2018, 4♀♀, *M. domestica*, 3♀♀, *P. armeniaca*; Çermik, Sinek, 38°10'04.3"N 39°28'00.1"E, 21.V.2018, 4♀♀, *C. oblonga*; Çüngüş, Handere, 38°14'02.5"N 39°10'37.9"E, 21.V.2018, 3♀♀, *J. regia*; Çüngüş, Karşıyaka, 38°12'49.1"N 39°17'37.8"E, 21.V.2018, 4♀♀, *M. domestica*; Çınar, Höyükdibi, 37°42'51.4"N 40°15'34.8"E, 23.V.2018, 2♀♀, *P. domestica*; Çınar, Kazıktepe, 37°48'38.0"N 40°15'36.7, 30.V.2018, 3♀♀, *P. persica*; Çınar, Şeyhçoban, 37°41'13.6"N 40°14'18.6"E, 30.V.2018, 3♀♀, *P. dulcis*; Çınar, Karababa, 37°39'53.5"N 40°13'42.2"E, 30.V.2018, 4♀♀, *P. domestica*, 3♀♀, *M. domestica*; Çınar, Öncülü, 37°43'02.5"N 40°31'55.5"E, 30.V.2018, 4♀♀, *M. domestica*; Eğil, Ilgın, 38°16'07.4"N 40°05'46.0"E, 12.VII.2018, 2♀♀, *P. dulcis*; Çüngüş, Geçitköy, 38°11'00.8"N 39°15'59.3"E, 03.VIII.2018, 3♀♀, *P. dulcis*; Çüngüş, ibikkaya, 38°07'24.4"N 39°16'21.2"E, 03.VIII.2018, 4♀♀, *P. vera*; Çüngüş, Karşıyaka, 38°12'47.7"N 39°17'42.3"E, 03.VIII.2018, 6♀♀, *M. domestica*; Çermik, Sinek, 38°09'59.2"N 39°27'36.6"E, 09.VIII.2018, 6♀♀, *M. domestica*; Çermik, Çukur, 38°08'05.2"N 39°27'05.6"E, 09.VIII.2018, 2♀♀, *P. armeniaca* 2♀♀, *P. domestica*; Çermik, Tepe, 38°08'21.3"N 39°27'24.2"E, 09.VIII.2018, 2♀♀, *P. armeniaca*, ♀, *P. dulcis*; Çınar, Yıllarca, 37°44'19.9"N 40°08'27.3"E, 16.VIII.2018, 4♀♀, *P. domestica*; Çınar, Akçomak, 37°39'29.7"N 40°27'44.9"E, 16.VIII.2018, 4♀♀, *J. regia*, 3♀♀, *P. armeniaca*; Çınar, Bağacık, 37°40'13.2"N 40°26'29.4"E, 16.VIII.2018, 3♀♀, *P. dulcis*; Çınar, Tilver, 37°37'19.6"N 40°14'27.8"E, 27.VIII.2018, 6♀♀, *M. domestica*; 2♀♀, *P. domestica*; Elazığ: Central districts, Öküzuşağı, 38°28'02.1"N 39°03'05.3"E, 26.VII.2018, 4♀♀, *J. regia*; Central district, Sinan, 38°37'17.4"N 39°02'11.0"E, 14.VII.2017, 5♀♀, *P. armeniaca*; Central district, Sinan, 38°37'13.8"N 39°02'11.1"E, 14.VII.2017, 2♀♀, *M. domestica*; Sivrice, Hazar, 14.VII.2017, 3♀♀, *M. domestica*, 4♀♀, *P. domestica* 38°27'35.3"N 39°17'11.4"E; Baskil, Hacımehmetli, 38°30'00.8"N 38°32'06.5"E, 20.VII.2017, 3♀♀, *P. domestica*; Keban, Nimri, 38°49'43.5"N 38°41'26.5"E, 02.viii.2017, 4♀♀, *P. dulcis*; Keban, Nimri, 38°48'18.8"N 38°41'04.6"E, 02.08.2017, 4♀♀, *M. domestica*; Central district, Yenicami, 38°33'02.3"N 39°02'04.9"E 15.VIII.2017, 2♀♀, *J. regia*; Sivrice, Üçgöz, 15.VIII.2017, ♀, *P. persica*, 38°27'22.5"N 39°17'38.1"E; Baskil, Canbeyler, 38°33'47.8"N 38°48'47.9"E, 18.IX.2017, 3♀♀, *P. armeniaca*: Baskil, Şahaplı, 38°32'27.7"N, 38°47'46.4"E, 18.IX.2017, 4♀♀, *J. regia*; Baskil, Şahaplı, 38°32'01.0"N 38°47'36.7"E, 18.IX.2017, 3♀♀, *P. armeniaca*; Keban, Sağdıclar, 38°47'02.6"N 38°49'56.0"E, 19.IX.2017, 4♀♀, *P. armeniaca*, 3♀♀, *M. domestica*, 4♀♀, *D. kaki*; Baskil, Odabaşı, 38°34'36.8"N 38°48'13.8"E, 04.IV.2018, 3♀♀, *P. armeniaca*; Central district, Veran, 09.IV.2018, 4♀♀, *M. domestica*, 2♀♀, *P. cerasus*, 3♀♀, *C. oblonga*, 4♀♀, *J. regia*, 38°40'59.3"N 39°08'35.1"E; Centtal district, Cipköy, 09.IV.2018, 2♀♀, *J. regia*, 38°41'19.3"N 39°03'41.8"E; Central district, Sarıcubuk, 09.IV.2018, 2♀♀, *P. avium*, 38°40'59.3"N 39°06'18.0"E; Central district, Poyraz, 09.IV.2018, 3♀♀, *M. domestica*, 3♀♀, *J. regia*, 38°41'15.0"N 39°02'38.8"E; Sivrice, Kürk, 16.IV.2018, 3♀♀, *P. avium*, 38°25'24.2"N 39°13'57.0"E; Baskil, Habibuşağı, 38°26'18.6"N 38°46'45.9"E, 26.IV.2018, 2♀♀, *P. armeniaca*; Baskil, Habibuşağı, 38°26'16.5"N 38°46'16.0"E, 26.IV.2018, 3♀♀, *P. armeniaca*; Baskil, Pınarlı, 38°26'28.6"N 38°44'48.9"E, 26.IV.2018, 3♀♀, *P. armeniaca*; Central district, Dilek, 38°34'46.7"N 39°02'11.1"E, 02.V.2018, 3♀♀, *P. armeniaca*; Central district, Dilek, 38°34'46.7"N 39°02'11.1"E, 02.v.2018, 4♀♀, *M. domestica*; Central district, Dilek, 38°34'33.2"N 39°03'13.6"E, 02.V.2018, 2♀♀, *P. armeniaca*; Central district, Durupınar, 38°33'28.3"N 39°02'58.7"E, 02.V.2018, 3♀♀, *P. armeniaca*; Central district, Işıkyolu, 38°31'53.9"N 39°02'08.2"E, 02.V.2018, 3♀♀, *P. armeniaca*; Central district, Yolçatı, 38°32'06.8"N 39°03'12.9"E, 02.V.2018, 3♀♀, *J. regia*; Sivrice, Şirinyazı, 38°27'17.6"N 39°17'44.4"E, 02.V.2018, 3♀♀, *M. domestica*; Baskil, Pınarlı, 38°26'16.4"N 38°45'39.1"E, 16.V.2018, 3♀♀, *P. armeniaca*; Baskil, Gedebük, 38°26'29.7"N 38°43'01.0"E, 16.V.2018, 3♀♀, *P. armeniaca*; Baskil, Kuşsarayı, 38°26'45.3"N 38°40'01.6"E, 16.V.2018, 2♀♀, *P. armeniaca*; Central district, Öküzuşağı, 38°28'01.7"N 39°03'01.5"E, 31.V.2018, 2♀♀, *M. domestica*: Central district, Öküzuşağı, 38°28'38.9"N 39°03'03.6"E, 31.V.2018, 2♀♀, *J. regia*; Central district, Bölüklü, 38°28'17.2"N 39°02'11.5"E, 31.V.2018, 2♀♀, *J. regia*; Central district, Sakabaşı, 38°28'21.0"N 39°01'30.5"E, 31.V.2018, 3♀♀, *J. regia*; Keban, Ulupınar, 38°44'30.9"N 38°51'10.7"E, 06.VI.2018, 3♀♀, *J. regia*; Keban, Ulupınar, 38°44'49.4"N 38°51'18.3"E, 06.VI.2018, 3♀♀, *P. armeniaca*;

Keban, Sağdıçlar, 38°47'19.6"N 38°49'53.4"E, 06.VI.2018, 2♀♀, *J. regia*; Baskil, Alangören, 38°27'21.2"N 38°38'48.5"E, 08.VI.2018, 3♀♀, *P. armeniaca*; Central district, Öksüzuşağı, 38°27'41.8"N 39°03'05.2"E, 26.VII.2018, 4♀♀, *M. domestica*: Central district, Küllük, 38°28'01.2"N 39°01'32.2"E, 26.VII.2018, 3♀♀, *P. armeniaca*; Central district, Çaydaçıra, 38°41'12.2"N 39°10'09.0"E, 02.VIII.2018, 3♀♀, *P. armeniaca*; Central district, Bölüklü, 38°28'49.1"N 39°02'30.3"E, 02.VIII.2018, 3♀♀, *J. regia*; Baskil, Karaali, 38°27'46.5"N 38°53'32.9"E, 10.VIII.2018, 2♀♀, *P. armeniaca*; Central district, Yalındamlar, 38°28'33.5"N 38°58'41.2"E, 10.VIII.2018, 3♀♀, *P. armeniaca*; Baskil, Kuşsarayı, 38°27'07.3"N 38°40'05.0"E, 17.VIII.2018, 3♀♀, *P. armeniaca*; Baskil,Alangören, 38°26'57.4"N 38°39'27.6"E, 17.VIII.2018, 2♀♀, *P. armeniaca*; Baskil, Gemici, 38°29'18.1"N 38°33'34.5"E, 17.VIII.2018, 4♀♀, *P. armeniaca*; Baskil, Çiğdemlik, 38°30'01.1"N 38°30'21.5"E, 17.VIII.2018, 5♀♀, *P. armeniaca*; Central district, Temürköy, 38°29'46.1"N 39°03'04.5"E, 31.VIII.2018, 2♀♀, *J. regia*; Central district, Aşağıdemirtaş, 38°36'52.7"N 39°05'55.1"E, 31.VIII.2018, 3♀♀, *J. regia*; Central district, Sarıcubuk, 38°40'22.6"N 39°07'05.8"E, 06.IX.2018, 3♀♀, *J. regia*; Central district, Sarıcubuk, 38°40'08.0"N 39°07'26.0"E, 06.IX.2018, 2♀♀, *J. regia*.

Distribution in Türkiye. The pest was reported in the Mediterranean, Eastern Anatolia, Southeastern Anatolia, Aegean, Black Sea, Marmara and Central Anatolia regions (Ülgentürk et al., 2022).

Distribution in the world. Afghanistan, Albania, Algeria, Argentina, Armenia, Australia, Austria, Azerbaijan, Balearic Islands, Belarus, Belgium, Brazil, Bulgaria, Canary Islands, Chile, China, Corsica, Croatia, Cyprus, Czechia, Denmark, Egypt, Ethiopia, Finland, France, Georgia, Germany, Hungary, India, Iran, Ireland, Israel, Italy, Japan, Kazakhstan, Kyrgyzstan, Latvia, Lebanon, Libya, Lithuania, Luxembourg, Malta, Mexico, Moldova, Mongolia, Netherlands, New Zealand, North Korea, Norway, Pakistan, Peru, Poland, Portugal, Romania, Russia, Serbia, Slovakia, Slovenia, South Korea, Spain, Sweden, Switzerland, Syria, Tajikistan, Türkiye, Turkmenistan, Ukraine, United Kingdom, USA, Uzbekistan, Yugoslavia (García Morales et al., 2016).

***Palaeolecanium bituberculatum* (Signoret, 1873)**

The body of the young adult females on the leaves is quite thin, flat and oval, and the color is greenish yellow. On the dorsal, brown bands that expand transversely and towards the body edge are seen. The body color turns brown after settle on branches in autumn. Young females are 3140±12.9 (2863-3390) µm long, 2559±11.9 (2331-2797) µm wide. As it gets older, the body becomes swollen, and after ovulation the color becomes darker and sclerotized. Indistinct bands formed by white spots in the middle part of the body can also be seen. There are two pairs of knoblike tubercles on dorsum (Figure 2e). The pair of these anterior tubercles is larger than posterior ones (Ülgentürk, 1998).

Material examined. Elazığ: Sivrice, Gözeli, 38°25'43.3"N 39°04'54.1"E, 22.V.2018, 9♀♀, *M. domestica*; Central district, Öksüzuşağı, 38°27'41.8"N 39°03'05.2"E, 26.VII.2018, 2♀♀, *M. domestica*; Sivrice, Şirinyazı, 38°27'17.6"N 39°17'44.4"E, 26.VII.2018, 2♀♀, *M. domestica*.

Distribution in Türkiye. It has been reported that *Palaeolecanium bituberculatum* is distributed in the Mediterranean, Eastern Anatolia, Southeastern Anatolia, Aegean, Black Sea, Marmara and Central Anatolia regions (Ülgentürk et al., 2022).

Distribution in the world. Afghanistan, Armenia, Azerbaijan, Bulgaria, Croatia, Cyprus, Czechia, Denmark, France, Georgia, Germany, Hungary, Iran, Iraq, Israel, Italy, Kazakhstan, Kyrgyzstan, Luxembourg, Moldova, Netherlands, Poland, Romania, Russia, Sardinia, Slovenia, Spain, Sweden, Switzerland, Tajikistan, Türkiye, Turkmenistan, UK, Ukraine, USA, Uzbekistan, Yugoslavia (García Morales et al., 2016).

***Pulvinaria vitis* (L., 1758)**

The body of young adult females is yellowish-brown, the body shape is elongated, elliptical and oval (Figure 2f). Body shape can vary depending on the host and the shape of the place where it is settled (Ülgentürk, 1988).

Material examined. Diyarbakır: Ergani, Kavurmaköprü, 38°19'58.7"N 39°43'47.8"E, 17.V.2018, 2♀♀, *J. regia*; Elazığ: Central district, Yolçatı, 38°32'06.8"N 39°03'12.9"E, 02.V.2018, 3♀♀, *J. regia*; Central district, Bölüklü, 38°28'17.2"N 39°02'11.5"E, 31.V.2018, 2♀♀, *J. regia*; Keban, Ulupınar, 38°28'17.2"N 39°02'11.5"E, 06.VI.2018, ♀, *J. regia*; Central district, Bölüklü, 38°28'49.1"N 39°02'30.3"E, 02.VIII.2018, ♀, *J. regia*; Central district, Sarıcubuk, 38°40'57.7"N 39°07'15.5"E, 06.IX.2018, 2♀♀, *J. regia*; Central district, Sarıcubuk, 38°40'08.0"N 39°07'26.0"E, 06.IX.2018, 2♀♀, *J. regia*.

Distribution in Türkiye. *Pulvinaria vitis* has been detected in the Mediterranean, Eastern Anatolia, Southeastern Anatolia, Aegean, Black Sea, Marmara and Central Anatolia regions (Ülgentürk et al., 2022).

Distribution in the world. Algeria, Argentina, Armenia, Austria, Brazil, Bulgaria, Canada, China, Corsica, Crete island, Croatia, Czechia, Denmark, Finland, France, Georgia, Germany,GreeceHungary, Iran, Ireland, Israel, Italy, Japan, Jordan, Kazakhstan, Latvia, Lithuania, Luxembourg, Malta, Moldova, Mongolia, Morocco, Netherlands, New Zealand, Norway, Poland, Portugal, Romania, Russia, Sardinia, Slovenia, Spain, Sweden, Switzerland, Tajikistan, Türkiye, Turkmenistan, UK, Ukraine, USA, Uzbekistan, Yugoslavia (García Morales et al., 2016).

***Sphaerolecanium prunastri* (Boyer de Fonscolombe, 1834)**

The postovipositon females are round, almost spherical, dark brownish black in color (Figure 2g). It is smaller than similar species. It is 2297±16 (1680-3400) µm length and 2077±20 (1320-3200) µm width (Ülgentürk, 1998).

Material examined. Diyarbakır: Ergani, Bahçekaşı, 38°17'01.0"N 39°43'59.0"E, 17.V.2018, 4♀♀, *P. domestica*; Elazığ: Baskil, Gemici, 38°28'27.1"N 38°34'20.5"E, 20.VII.2017, 2♀♀, *P. armeniaca*; Baskil, Alangören, 38°27'41.4"N 38°37'31.1"E, 20.VII.2017, 2♀♀, *P. armeniaca*; Baskil, Cumhuriyet, 38°34'22.3"N 38°49'50.9"E, 20.VII.2017, 4♀♀, *P. armeniaca*; Central district, Sarıcubuk, 38°40'59.3"N 39°06'18.0"E, 09.IV.2018, 4♀♀, *P. domestica*; Baskil, Pınarlı, 38°26'28.6"N 38°44'48.9"E, 26.IV.2018, 2♀♀, *P. armeniaca*; Baskil, Pınarlı Köyü, 38°26'12.1"N 38°44'11.2"E, 26.IV.2018, 3♀♀, *P. armeniaca*; Baskil, Gedebük, 38°26'28.2"N 38°43'35.2"E, 26.IV.2018, 3♀♀, *P. armeniaca*; Baskil, Karaali, 38°27'41.5"N 38°52'52.3"E, 02.V.2018, *P. armeniaca*, 3♀♀; Baskil,Pınarlı, 38°26'16.4"N 38°45'39.1"E, 16.V.2018, 4♀♀, *P.* armeniaca; Cental district, Sürsürü, 38°39'53.9"N 39°12'36.7"E, 16.V.2018, 4♀♀, *P. armeniaca*; Baskil, Gedebük, 38°26'29.7"N 38°43'01.0"E, 16.V.2018, 3♀♀, *P. armeniaca*; Baskil, Kuşsarayı, 38°26'45.3"N 38°40'01.6"E, 16.V.2018, 3♀♀, *P. armeniaca*; Baskil, Kuşsarayı, 38°27'11.5"N 38°40'38.1"E, 16.V.2018, 2♀♀, *P. armeniaca*; Baskil, Deliktaş, 38°27'47.2"N 38°36'15.7"E, 08.VI.2018, 4♀♀, *P. armeniaca*; Baskil, Alangören, 38°27'21.2"N 38°38'48.5"E, 08.VI.2018, 4♀♀, *P. armeniaca*; Baskil, Alangören, 38°27'29.4"N 38°38'15.0"E, 08.VI.2018, 3♀♀, *P. armeniaca*; Baskil, Sinan, 38°28'49.5"N 38°34'40.8"E, 20.VII.2018, 3♀♀, *P. armeniaca*; Baskil, Alibaba, 38°29'01.2"N 38°33'25.1"E, 20.VII.2018, 3♀♀, *P. armeniaca*; Baskil, Konacık, 38°29'32.9"N 38°33'00.9"E 20.VII.2018, 3♀♀, *P. armeniaca*; Central district, Ortaçalı, 38°28'04.9"N 39°01'27.8"E, 26.07.2018, 3♀♀, *P. armeniaca*; Baskil, Karaali, 38°27'44.1"N 38°53'09.4"E, 02.VIII.2018, 3♀♀, *P. armeniaca*; Central district, Yalındamlar, 38°28'33.5"N 38°58'41.2"E, 10.VIII.2018, 5♀♀, *P. armeniaca*; Central district, Kuşsarayı, 38°27'07.3"N 38°40'05.0"E, 17.VIII.2018, 2♀♀, *P. armeniaca*; Baskil, Güllüce, 38°26'57.4"N 38°39'27.6"E, 17.VIII.2018, 4♀♀, *P. armeniaca*; Baskil, Alibaba, 38°29'18.1"N 38°33'34.5"E, 17.VIII.2018, 3♀♀, *P. armeniaca*; Baskil, Çiğdemlik, 38°30'01.1"N 38°30'21.5"E, 17.VIII.2018, 3♀♀, *P. armeniaca*; Baskil, Şahinkaya, 38°40'56.1"N 39°07'38.4"E, 06.IX.2018, 3♀♀, *P. armeniaca*.

Distribution in Türkiye. *Sphaerolecanium prunastri* have distributed in the Mediterranean, Eastern Anatolia, Southeastern Anatolia, Aegean, Black Sea, Marmara and Central Anatolia regions (Ülgentürk et al., 2022).

Distribution in the world. Armenia, Austria, Azerbaijan, Balaer Islands, Belgium, Bulgaria, China, Crete island, Croatia Iran, Czechia, France, Georgia, Germany, Greece, Hungary, Israel, Italy, Moldova, Poland, Romania, Russia, Sardinia, Slovenia, South Korea, Spain, Switzerland, Syria, Türkiye, Turkmenistan, Ukraine, USA, Uzbekistan, Yugoslavia (García Morales et al., 2016).

Figure 2. Coccidae species determined in Diyarbakır and Elazığ; a) *Anapulvinaria pistaciae*; b) *Didesmococcus unifasciatus*; c) *Palaeolecanium bituberculatum*; d) *Eulecanium tiliae*; e) *Parthenolecanium corni*; f) *Pulvinaria vitis*; g) *Sphaerolecanium prunastri*.

The density levels and infestation rates of the Coccidae species in the Diyarbakır and Elazığ fruit orchards

In Çınar district of Diyarbakır, *A. pistaciae, P. corni, D. unifasciatus* and *E. tiliae* were identified. *Anapulvinaria pistaciae* was detected only in pistachio trees, and it was determined that 1.3% of the 377 examined trees were infested at scale 1 density level. *Eulecanium tiliae* was also detected only in pistachio

and 9% of pistachio trees were infested at scale 1, and 6.4% of them were infested at scale 2 and 2.1% of them were infested at scale 3. *Didesmococcus unifasciatus* was detected only on almond trees and it was found that 4.4% of the 318 examined almond trees were infested at scale 1, 14.7% at scale 2, 15.6% at scale 3 and 3.8% at scale 4 density. In addition, this species caused drying in the shoots and branches of almond trees, where it was heavily infested. *Parthenolecanium corni* was found to be the most common Coccidae species with the widest host range in Çınar district. Although *P. corni* was able to form large colonies (scale 3) at limited infestation rates on apple, mulberry and plum trees, it was found in low population densities such as scale 1 and scale 2 on walnut, pistachio, apricot, almond and peach trees in Çınar (Table 3).

Table 3. Density levels and infestation rates of the Coccidae species in Çınar

Host plant	Number of trees sampled	Infestation rate (%)																
		Anapulvinari pistaciae					*Didesmococcus unifasciatus*				*Eulecanium tiliae*				*Parthenolecanium corni*			
		0	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
J. regia	51	86.3	0	0	0	0	0	0	0	0	0	0	0	0	5.9	7.8	0	0
M. domestica	68	50.0	0	0	0	0	0	0	0	0	0	0	0	0	14.7	17.7	17.7	0
M. alba	25	92.0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	4	0
P. vera	377	75.3	1.3	0	0	0	0	0	0	0	9	6.4	2.1	0	5.8	0	0	0
P. armeniaca	56	62.5	0	0	0	0	0	0	0	0	0	0	0	0	26.8	10.7	0	0
P. avium	33	100.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
P. domestica	75	53.3	0	0	0	0	0	0	0	0	0	0	0	0	20	24	2.7	0
P. dulcis	318	55.3	0	0	0	0	4.4	14.7	15.6	3.8	0	0	0	0	4.1	2.2	0	0
P. persica	27	92.6	0	0	0	0	0	0	0	0	0	0	0	0	7.4	0	0	0

0: Clean, 1: Low infestation, 2: Small colony, 3: Large colony, 4: Heavy infestation.

In the orchards of Çermik district of Diyarbakır, only the *P. corni* was detected on almond, apricot, apple, peach plum, quince and walnut trees. *Parthenolecanium corni* could infest at a scale 3 density level besides scale 1 and scale 2 on apple and walnut trees in Çermik. The pest was commonly seen in the orchards of Çermik district, it could form dense populations and therefore it is a potential pest that could cause economic damage in future.

Table 4. Density levels and infestation rates of the Coccidae species in Çermik

Host plant	Number of trees sampled	Infestation rate (%)				
		Parthenolecanium corni				
		0	1	2	3	4
C. oblonga	27	77.8	7.4	14.8	0	0
J. regia	34	82.4	0	11.8	5.9	0
M. domestica	64	64.1	17.2	12.5	6.3	0
P. vera	108	100.0	0	0	0	0
P. armeniaca	65	61.5	9.2	29.2	0	0
P. avium	41	100.0	0	0	0	0
P. domestica	35	68.6	8.6	22.9	0	0
P. dulcis	81	91.4	8.6	0	0	0
P. persica	22	81.8	18.2	0	0	0

0: Clean, 1: Low infestation, 2: Small colony, 3: Large colony, 4: Heavy infestation.

In Çüngüş district of Diyarbakır, *D. unifasciatus* and *P. corni* were detected. it was found that 2.4% of the examined almond trees were infested at scale 1, 1.2% at scale 2, 2.4% at scale 3 density and 3.6% of the peach trees were infested at scale 2 with *D. unifasciatus*. *Parthenolecanium corni* was found at different infestation rates and density levels (Scale1,2,3) on its host plants (Table 5). Consequently, both of these soft scale insects did not have heavy population density which can cause serious damage on their hosts.

Table 5. Density levels and infestation rates of the Coccidae species in Çüngüş

Host plant	Number of trees sampled	Infestation rate (%)								
		Didesmococcus unifascitus					*Parthenolecanium corni*			
		0	1	2	3	4	1	2	3	4
C. oblonga	24	100.0	0	0	0	0	0	0	0	0
J. regia	41	82.9	0	0	0	0	7.3	9.8	0	0
M. domestica	81	74.1	0	0	0	0	3.7	13.6	8.6	0
P. vera	22	90.9	0	0	0	0	9.1	0	0	0
P. armeniaca	48	89.6	0	0	0	0	10.4	0	0	0
P. avium	168	98.8	0	0	0	0	1.2	0	0	0
P. domestica	44	68.2	0	0	0	0	13.6	18.2	0	0
P. dulcis	84	83.3	2.4	1.2	2.4	0	8.3	2.4	0	0
P. persica	55	90.9	0	3.6	0	0	5.5	0	0	0

0: Clean, 1: Low infestation, 2: Small colony, 3: Large colony, 4: Heavy infestation.

Eulecanium tiliae and *P. corni* were identified as a result of the surveys carried out in Eğil district of Diyarbakır. It was determined that 3.6% of the examined almond trees were infested at scale 1 and 1.4% at scale 2 density with *P. corni* and 2.3% of pistachios were also infested at scale 1 density with *E. tiliae* (Table 6). Infestation rates and population densities of both pests were low in Eğil district.

Table 6. Density levels and infestation rates of the Coccidae species in Eğil

Host plant	Number of trees sampled	Infestation rate (%)								
		Eulecanium tiliae					*Parthenolecanium corni*			
		0	1	2	3	4	1	2	3	4
P. vera	85	97.7	2.3	0	0	0	0	0	0	0
P. domestica	83	100.0	0	0	0	0	0	0	0	0
P. dulcis	560	95.0	0	0	0	0	3.6	1.4	0	0

0: Clean, 1: Low infestation, 2: Small colony, 3: Large colony, 4: Heavy infestation.

Parthenolecanium corni, *P. vitis* and *S. prunastri* were determined in the Ergani district of Diyarbakır. *Parthenolecanium corni* could create scale 3 population density besides scale 1 and scale 2 on apple and walnut trees, it was also found at low population densities such as scale 1 and scale 2 on almond, apricot, cherry, peach and plum trees in Ergani. Moreover, it was determined that 5.1% of the examined plum trees were infested at scale 1 and 2.6% at scale 2 density with *S. prunastri* and 1.3% of walnut trees were also infested at scale 1 density with *P. vitis* (Table 7). *Pulvinaria vitis* was found only on walnut in Ergani, in study areas.

Table 7. Density levels and infestation rates of the Coccidae species in Ergani

Host plant	Number of trees sampled	Infestation rate (%)												
		Parthenolecanium corni					*Pulvinaria vitis*				*Sphaerolecanium prunastri*			
		0	1	2	3	4	1	2	3	4	1	2	3	4
C. oblonga	21	100.0	0	0	0	0	0	0	0	0	0	0	0	0
J. regia	77	74.0	14.3	7.8	2.6	0	1.3	0	0	0	0	0	0	0
M. domestica	151	83.4	8.0	6.0	2.7	0	0	0	0	0	0	0	0	0
P. armeniaca	143	64.3	25.2	10.5	0	0	0	0	0	0	0	0	0	0
P. avium	97	96.9	3.1	0	0	0	0	0	0	0	0	0	0	0
P. cerasus	14	100.0	0	0	0	0	0	0	0	0	0	0	0	0
P. domestica	39	61.5	15.4	15.4	0	0	0	0	0	0	5.1	2.6	0	0
P. dulcis	137	93.4	4.4	2.2	0	0	0	0	0	0	0	0	0	0
P. persica	42	100.0	0	0	0	0	0	0	0	0	0	0	0	0

0: Clean, 1: Low infestation, 2: Small colony, 3: Large colony, 4: Heavy infestation.

Eulecanium tiliae, *P. corni*, and *S. prunastri* were determined in Baskil district of Elazığ. It was detected that 6.2% of plum trees were infested at scale 1, 3.6% at scale 2 and 0.4% of the apricot trees were infested at scale 1 with *E. tiliae*. It did not reach population densities that could cause damage on its hosts. As in other districts, *P. corni* was the most common species and have the largest host range in Baskil, but it could

not create dense populations on its hosts. The density of *S. prunastri* was scale 1 in 14.2%, scale 2 in 11.4%, scale 3 in 4.6% and scale 4 in 3.3% of the examined apricot trees. it was also scale 1 in 6.2%, scale 2 in 10,6%, scale 3 in 1.8%, scale 4 in 0.9% of the plum trees (Table 8).

Table 8. Density levels and infestation rates of the Coccidae species in Baskil

Host plant	Number of trees sampled	Infestation rate (%)												
		Eulecanium tiliae					*Parthenolecanium corni*				*Sphaerolecanium prunastri*			
		0	1	2	3	4	1	2	3	4	1	2	3	4
J. regia	33	84.9	0	0	0	0	9.1	6.1	0	0	0	0	0	0
M. domestica	38	81.6	0	0	0	0	10.5	5.3	2.6	0	0	0	0	0
P. armeniaca	1297	60.7	0.4	0	0	0	3.7	1.7	0	0	14.2	11.4	4.6	3.3
P. domestica	113	53.1	6.2	3.5	0	0	8.0	9.7	0	0	6.2	10.6	1.8	0.9
P. persica	39	100.0	0	0	0	0	0	0	0	0	0	0	0	0

0: Clean, 1: Low infestation, 2: Small colony, 3: Large colony, 4: Heavy infestation.

In the Keban district of Elazığ, *P. corni* and *P. vitis* species were detected. *Pulvinaria vitis* was found only on walnut trees and it was determined that 0.9% of the 114 trees examined were infested with the pest at scale 1 density. *Parthenolecanium corni* was generally detected at scale 1 and scale 2 density levels on almond, apricot, apple, cherry, persimmon and walnut trees (Table 9). Both pests could not create dense populations, and thus did not cause any economic damage in Keban.

Table 9. Density levels and infestation rates of the Coccidae species in Keban

Host plant	Number of trees sampled	Infestation rate (%)								
		Parthenolecanium corni					*Pulvinaria vitis*			
		0	1	2	3	4	1	2	3	4
D. kaki	11	81.8	18.2	0	0	0	0	0	0	0
J. regia	114	86.8	10.5	1.8	0	0	0.9	0	0	0
M. domestica	88	88.6	9.1	2.3	0	0	0	0	0	0
P. armeniaca	189	96.3	3.7	0	0	0	0	0	0	0
P. avium	23	100.0	0	0	0	0	0	0	0	0
P. dulcis	212	98.6	1.4	0	0	0	0	0	0	0

0: Clean, 1: Low infestation, 2: Small colony, 3: Large colony, 4: Heavy infestation.

In the studies carried out in the Sivrice district of Elazığ, *D. unifasciatus*, *P. bituberculatum* and *P. corni* species were found. The density of *D. unifasciatus* was scale 1 in 7.7%, scale 2 in 5.8%, scale 3 in 3.9% and scale 4 in 1% of the examined almond trees. *Didesmococcus unifasciatus* was observed to cause drying in the branches and shoots of the trees, which are heavily infested. *P. bituberculatum* was determined only in apple trees and its density was scale 1 in 3.6%, scale 2 in 2.8%, scale 3 in 2% of the examined apple trees. *Parthenolecanium corni* was able to form scale 3 population density besides scale 1 and scale 2 on apple, it was also detected at low population densities such as scale 1 and scale 2 on the almond, apricot, cherry, peach, plum and sour cherry trees (Table 10).

Table 10. Density levels and infestation rates of the Coccidae species in Sivrice

Host plant	Number of trees sampled	Infestation rate (%)												
		Parthenolecanium corni					*Palaeolecanium bituberculatum*				*Didesmococcus unifasciatus*			
		0	1	2	3	4	1	2	3	4	1	2	3	4
M. domestica	252	84.5	5.6	1.2	0.4	0	3.6	2.8	2.0	0	0	0	0	0
P. avium	168	91.1	5.4	3.6	0	0	0	0	0	0	0	0	0	0
P. dulcis	104	73.1	5.8	2.9	0	0	0	0	0	0	7.7	5.8	3.9	1.0
J. regia	78	100.0	0	0	0	0	0	0	0	0	0	0	0	0
P. armeniaca	64	100.0	0	0	0	0	0	0	0	0	0	0	0	0
P. domestica	59	74.6	18.6	6.8	0	0	0	0	0	0	0	0	0	0
P. cerasus	48	100.0	0	0	0	0	0	0	0	0	0	0	0	0
P. persica	38	97.4	2.6	0	0	0	0	0	0	0	0	0	0	0

0: Clean, 1: Low infestation, 2: Small colony, 3: Large colony, 4: Heavy infestation.

Eulecanium tiliae, *P. bituberculatum*, *P. corni*, *P. vitis* and *S. prunastri* were determined in the studies carried out in the central district of Elazığ (Table 11). It was determined that 0.5% of the examined apple trees were infested with *E. tiliae* at a scale 1 density, 4.26% of plum trees at a scale 2 density, and 3.85% of quince trees at a scale 1 density. *Palaeolecanium bituberculatum* was detected only in apple trees and the density of it was scale 1 in 2.1%, scale 2 in 1% of the examined apricot trees. *Parthenolecanium corni* was generally found at low infestation rates and density levels (Scale1 and 2) on the apple, apricot, cherry, peach, plum, walnut trees. 3.9% and 0.8% of the walnut trees were infested with *P. vitis* at scale 1 and scale 2, respectively. The density of *S. prunastri* was scale 1 in 6%, scale 2 in 8%, scale 3 in 4.4% and scale 4 in 3.8% of the examined apricot trees (Table 10). The highest number of Coccidae species were found in Elazığ Central district. Considering the population densities in the orchards and the drying of the branches and shoots, as well as the damages such as sooty moulds, which are caused by the honeydew they secrete, *S. prunastri* was the most destructive species in the region.

Table 11. The density levels and infestation rates of the Coccidae species in Central district of Elazığ

Host plant	Number of trees sampled	Infestation rate (%)																			
		Eulecanium tiliae					*Palaeolecanium bituberculatum*				*Parthenolecanium corni*				*Pulvinaria vitis*				*Sphaerolecanium prunastri*			
		0	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
C. oblonga	26	96.2	3.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J. regia	390	76.9	0	0	0	0	0	0	0	0	15.1	3.3	0	0	3.9	0.8	0	0	0	0	0	0
M. domestica	195	84.1	0.5	0	0	0	2.1	1.0	0	0	7.7	3.6	1.0	0	0	0	0	0	0	0	0	0
P. armeniaca	552	70.7	0	0	0	0	0	0	0	0	5.8	1.5	0	0	0	0	0	0	6.0	8.0	4.4	3.8
P. avium	105	95.2	0	0	0	0	0	0	0	0	1.9	2.9	0	0	0	0	0	0	0	0	0	0
P. cerasus	28	96.4	0	0	0	0	0	0	0	0	3.6	0	0	0	0	0	0	0	0	0	0	0
P. domestica	47	87.2	0	4.3	0	0	0	0	0	0	6.4	2.1	0	0	0	0	0	0	0	0	0	0
P. persica	39	97.4	0	0	0	0	0	0	0	0	2.6	0	0	0	0	0	0	0	0	0	0	0

0: Clean, 1: Low infestation, 2: Small colony, 3: Large colony, 4: Heavy infestation.

Sphaerolecanium prunastri and *D. unifasciatus* were the most important Coccidae species among the species detected in the survey districts as both could infest their own host plants heavily (density of scale 4), and caused drying of shoot and branches. It is thought that because the number of apricot trees is very high compared to other districts, apricot orchards are established in certain regions, and these orchards are mostly very close to each other, *S. prunastri* can spread and create dense populations in the apricot production areas in the Central and Baskil districts. In many studies carried out in Türkiye, it has been reported that *S. prunastri* substantially gives rise to damage on stone fruit such as peach, plum and apricot (Kılıç & Aykaç 1989; Zeki et al., 2004; Özgen & Bolu, 2009; Akşit & Apak, 2013; Yiğit, 2013; Ayaz et al., 2015). Özgen & Bolu (2009) stated that the highest infestation rate and population density of *S. prunastri* was in the apricot areas in the Yazıhan district of Malatya province. In addition, they detected that 3.14% of the trees examined in the district were infested with *S. prunastri* at low level, 7.05% at medium level and 2.86% at high level. Akşit & Apak (2013) reported that 2.26% of the examined 1942 trees were infested with *S. prunastri* at scale 1 (low infestation), 2.57% at scale 2 (small colony), 3.34% at scale 3 (large colony) and 8.67% at scale 4 (heavy infestation) in the plum orchards of Aydın.

Didesmococcus unifasciatus was previously detected on peach and almond in Eastern and Southeastern Anatolia regions (Kaydan & Kozár, 2010; Bolu, 2012). However, this study revealed that *D. unifasciatus* has the potential to create overpopulation on those host plants and can cause problems especially in almond production areas.

Coccidae species, which is in the all the study districts and have the broadest host range was *P. corni*. Although *P. corni* can form large colonies (scale 3) at limited rates in some hosts such as apple and walnut, it was observed that it cannot form heavy infestation in general and does not cause significant damage to its host plants. However, *Parthenolecanium corni* is a species that should be observed and kept

under control because it is a polyphagous species and can form large colonies in some hosts. *A. pistaciae, E. tiliae, P. vitis, P. bituberculatum* were seen as rare species and they did not cause any economic damage in the surveyed districts.

As a result of this study, seven the soft scale insect species were identified with information on their host plants, distribution areas, densities and infestation rates on the fruit orchards of Diyarbakır and Elazığ Provinces. The findings of this study will contribute to revealing Coccidae fauna of Southeastern Anatolia and Eastern Anatolia Regions, understanding potential damage they can cause and development of measures for their control. It will be of great benefit to carry out detailed studies on the bioecology and control of *S. prunastri* and *D. unifasciatus,* which are were determined to be important pest species in the studied area.

Acknowledgements

We thank the General Directorate of Agricultural Research and Policies (Project No: BSAD/A/19/A2/P1/1370) for supporting this study.

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