

Scale insect (Hemiptera: Coccoidea) species on pine trees of Turkey

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Received: 12.12.2011 • Accepted: 18.03.2012

Abstract: Coccoidea species on pine trees (*Pinus brutia*, *P. halepensis*, and *P. pinea*) were collected from natural pine forests, mainly in the Aegean, Mediterranean, and some neighboring (Central Anatolian, Marmara) regions of Turkey in 2008–2011. A total of 14 species were determined from Coccidae (2 species), Diaspididae (8 species) Marchalinidae (1 species), Matsucoccidae (1 species), Monophlebidae (1 species), and Pseudococcidae (1 species), and 2 of them (*Gomezmenoraspis pinicola* Leonardi and *Poaspis intermedia* Goux) are new records for Turkish fauna. While the most common pests were respectively *Leucaspis pusilla* Löw, *Marchalina hellenica* Gennadius, *Matsucoccus josephi* (Bodenheimer and Harpaz), *G. pinicola*, and *Palaeococcus fuscipennis* Burmeister on pine trees, *Coccus hesperidum* Linnaeus, *Lepidosaphes ulmi* Linnaeus, *Diaspidiotus jaapi* Leonardi, *Phenacoccus yerushalmi* Ben-Dov, and *Torosaspis turcica* Ülgentürk and Kozár were minor species.

Key words: Coccoidea, pest, pine trees, scale insect, host, distribution, Turkey

Introduction

There are 5 naturally growing pine species that compose either stand-alone or mixed forests in Turkey, namely, in the order of commonness, *Pinus brutia* (Ten.) (Turkish pine), *Pinus nigra* J.F.Arnold (the European black pine), *Pinus sylvestris* (L.) (Scots pine), *Pinus pinea* L. (Stone pine), and *Pinus halepensis* Mill. (Aleppo pine) (Pinaceae). The natural distribution of Turkish red pine is in the East Mediterranean basin and stand-alone Turkish pine forests in Turkey comprise approximately 3,729,866 ha. According to the geographical distribution regions of Turkey, 47% are in the Mediterranean

region, 40% in the Aegean region, and 10% in the Marmara region and singularly or in clusters in the western Black Sea region (Neyişçi, 1987). A total of 33,742 ha of Stone pine is present in forests, either stand-alone or mixed. Furthermore, Aleppo pine is scattered within forests or in clusters (Kayacık, 1954).

There are over 100 of coccoid species reported to be feeding on pine trees (Ben-Dov et al., 2011). Among them, species like *Matsucoccus feytaudi* Ducasse, 1941, *M. josephi* Bodenheimer and Harpaz, 1955, and *M. pini* Green, 1925 (Hemiptera: Matsucoccidae) are reported to cause defoliation, shortening of the leaves, weak trunk formation,

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chlorosis, and deformation in mature trees and to kill young trees in the forests of Mediterranean countries such as Algeria, Morocco, France, Spain, Italy, Portugal, and Israel (Gill, 1993; Foldi, 2004). *M. josephi* was a destructive pest to Aleppo pine, *P. halepensis*, in Israel (Bodenheimer and Harpaz, 1955; Ben-Dov, 1981; Golan et al., 1983). *M. feytaudi* is considered as the primary agent causing decline of *Pinus maritimus* in France (Foldi, 2004).

Coccoid species, pests of conifer trees in Turkey, were studied and 40 species were reported by Bodenheimer (1949, 1953), Çanakçıoğlu (1977), Selmi (1979), Özkazanç and Yücel (1985), Ülgentürk et al. (2004); Ülgentürk et al. (2012), and Ülgentürk and Kozár (2011). Among them, 18 species were found on pine trees (Bodenheimer, 1949, 1953; Çanakçıoğlu, 1977; Zeki et al., 2004; Ben-Dov et al., 2006; Kaydan et al., 2007; Ülgentürk et al., 2008; Ülgentürk and Kozár, 2011).

In this study, coccoid pest species on pine trees in natural forests and reforestation areas from the Mediterranean, Aegean, and Marmara regions and part of the Central Anatolian region of Turkey were surveyed and collection data are given, and their distribution is given and discussed.

Materials and methods

Surveys were conducted in natural pine forests and reforestation areas of the Mediterranean, Aegean, and Marmara regions and Coccoidea species were collected between 2008 and 2011. Samplings were done in spring and autumn, randomly chosen trees were examined by eye, and infected branches and needles were collected and brought to the laboratory in plastic bags. Collected samples were inspected by a stereomicroscope and coccoids were put into 70% alcohol. Samples were prepared by the method of Kosztarab and Kozár, (1988) and identification was done according to Balachowsky (1953), Bodenheimer (1949), Bodenheimer and Harpaz (1955), Ben-Dov (1985), and Foldi (2004). Dry and mounted materials were deposited in the Plant Protection Department of the Agricultural Faculty of Ankara University, Dışkapı, Ankara, Turkey.

Results

A total of 14 species were identified belonging to the families of Coccidae (2), Diaspididae (8) Marchalinidae (1), Matsucoccidae (1) Monophlebidae (1), and Pseudococcidae (1).

Coccus hesperidum Linnaeus, 1758

Material examined: Çanakkale/Biga (40°14'65"N, 27°14'59"E), 20 m, 6 ♀♀, 14.vii.2010; Çanakkale/Ezine (39°46'59"N, 26°20'28"E), 64 m, 8 ♀♀, 15.vii.2010 (Figure 1).

Distribution: Cosmopolite. Widely distributed in the Mediterranean region, but in continental climate it can survive only in indoors conditions.

Host: Polyphagous. *Abies concolor*, *A. nordmanniana* subsp. *bornmuelleriana*, *Cedrus atlantica*, *C. libani*, *Cephalotaxus harringtonia*, *Pinus pinaster*, *P. pinea*, and *Taxus baccata* in Turkey (Çanakçıoğlu, 1977; Selmi, 1979; Ben-Dov et al., 2011; Ülgentürk et al., 2012).

Poaspis intermedia Goux, 1939

Material examined: Bursa/Mudanya (40°18'53.44"N, 28°56'01.63"E), 196 m, *Pinus brutia*, 9 ♀♀, 17.vi.2009 (Figure 1).

Distribution: Palaearctic: France, Hungary (Koteja, 1979; Kozár, 1986).

Host: *P. intermedia*, *Juniperus* sp., *Dactylis glomerata* (Koteja, 1979; Kozár, 1986).

Comment: *P. intermedia* lives on grass; on trees it appears accidentally.

New record for Turkish scale insect fauna.

Aonidia mediterranea Lindinger, 1910

Material examined: Burdur, *P. brutia* (37°46'05.50"N, 30°33'17.31"E), 888 m, 5 ♀♀, 14.viii.2009 (Figure 1).

Host: *Cupressus sempervirens*, *Juniperus* sp. in Turkey (Erler et al., 1996; Kaydan et al., 2009).

Distribution: Palaearctic: Algeria, Armenia, France, Greece, Morocco, Spain, Turkey, Uzbekistan (Gómez-Menor, 1937; Balachowsky, 1951; Martín-Mateo, 1983; Erler et al., 1996; Foldi, 2002; Kaydan et al., 2009).

Diaspidiotus jaapi Leonardi, 1918

Material examined: Muğla/Yukarı Mazi, *P. brutia* (37°00'38.18"N, 27°44'06.42"E), 139 m, 3 ♀♀,

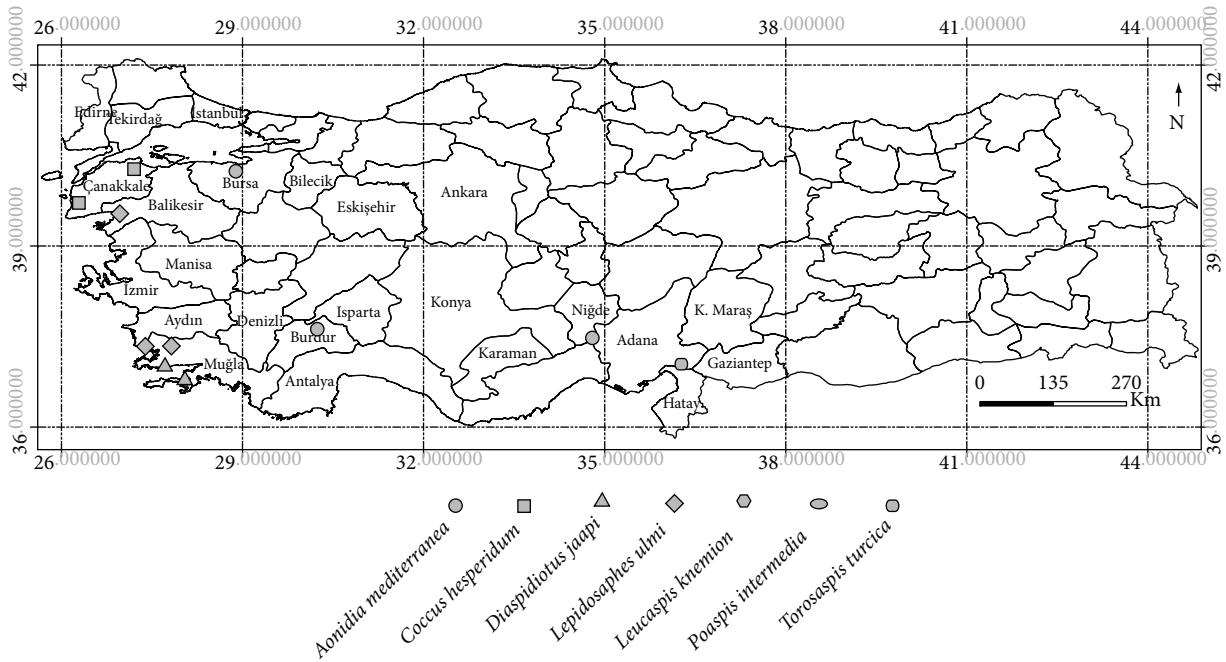


Figure 1. Geographical distribution of some scale insects in the western part of Turkey.

23.v.2009; Muğla/Marmaris (İnbükü), *P. brutia* (36°47'50.28"N, 28°04'59.94"E), 10 m, 5 ♀♀, 2.v.2009 (Figure 1).

Host: *Cedrus libani*, *Cytisus laburnum*, *Genista cinerea*, *G. pilosa*, *G. scorpionis*, *Olea europaea*, *Retama sphaerocarpa*, *Salicornia* sp., *Salsola longifolia*, *Ulex* sp., *U. boeticus*, *Santolina chamacyparissus* (Ben-Dov et al., 2011; Ülgentürk et al., 2012).

Distribution: Palaearctic: France, Italy, Spain, Turkey (Ben-Dov et al., 2011; Ülgentürk et al., 2012).

Gomezmenoraspis pinicola Leonardi, 1906

Material examined: Adana/Pozantı, *P. brutia* (37°27'27.34"N, 34°52'33.59"E), 810 m, 6 ♀♀, 28.x.2009; Adana, *P. halepensis* (37°02'17.88"N, 35°22'19.29"E), 72 m, 3 ♀♀, 2.vii.2011; Antalya/Akseki, *P. brutia* (37°02'49.05"N, 31°47'25.80"E), 1078 m, 7 ♀♀, 23.v.2011; Antalya/İbradı, *P. brutia* (37°09'51"N, 31°59'55"E), 1000 m, 8 ♀♀, 19.viii.2011, 23.v.2011; Antalya/İslamlar, *P. brutia* (36°19'07.76"N, 29°24'50.74"E), 638 m, 7 ♀♀, 13.viii.2010; Antalya/Kalkan, *P. brutia* (36°17'20.69"N, 29°24'32.03"E), 199 m, 5 ♀♀, 13.viii.2010; Antalya/Alanya, Mahmutlar, *P. brutia* (36°30'24"N, 32°10'34"E), 625 m, 3 ♀♀, 21.iv.2009; Aydın/Didim (Akbük), *P. brutia*

(37°24'01.42"N, 27°25'54.01"E), 2 m, 5 ♀♀, 26.iv.2009; Aydın/Güzelçamlı, *P. pinea*, *P. brutia* (37°42'02.61"N, 27°13'44.71"E), 162 m, 10 ♀♀, 3.ix.2009; Aydın/Söke, *P. brutia*, *P. pinea* (37°45'17.01"N, 27°24'29.05"E), 43 m, 4 ♀♀, 20.iv.2009; Balıkesir/Bandırma, *P. brutia* (40°21'46.28"N, 27°59'42.87"E), 63 m, 8 ♀♀, 17.vi.2009; Balıkesir/Pelitköy, *P. brutia* (39°26'27.55"N, 26°53'53.91"E), 160 m, 3 ♀♀, 19.vi.2009; Balıkesir/Altınoluk Zeytinli, *P. pinea*, (39°36'50.05"N, 26°56'50.09"E), 65 m, 8 ♀♀, 15.vii.2010; Balıkesir/Ayvalık, *P. brutia* (39°18'43.45"N, 26°41'17.38"E), 6 m, 3 ♀♀, 16.vii.2010; Balıkesir/Gömeç, *P. pinea* (39°23'09.38"N, 26°50'20.30"E), 15 m, 4 ♀♀, 16.vii.2010; Balıkesir/Burhaniye, *P. brutia* (39°29'26.61"N, 26°57'23.33"E), 13 m, 6 ♀♀, 16.vii.2010; Burdur, *P. brutia* (37°46'05.50"N, 30°33'17.31"E), 888 m, 15 ♀♀, 18.viii.2009; Bursa/Mudanya (Zeytin Bağı) (40°09'51.86"N, 29°12'59.32"E), 427 m, 5 ♀♀, 13.vii.2010; Çanakkale, *P. brutia* (40°09'02.05"N, 26°24'21.51"E), 11 m, 11 ♀♀, 15.vii.2010; Çanakkale/Biga, *P. brutia* (40°17'57.50"N, 27°27'53.75"E), 133 m, 12 ♀♀, 17.vi.2009; Çanakkale/Lapseki, *P. brutia* (40°20'28.33"N, 26°41'06.37"E), 85 m, 5 ♀♀, 18.vi.2009; Çanakkale/

Gelibolu, *P. brutia* (40°24'32.80"N, 26°40'38.55"E), 15 m, 4 ♀♀, 8.viii.2011; Isparta/Şarkikaraağaç, *P. brutia* (37°41'35.44"N, 31°18'53.75"E), 1789 m, 5 ♀♀, 14.v.2010; İstanbul/Büyükdada, *P. brutia* (40°52'04.48"N, 29°07'18.64"E), 44 m, 9 ♀♀, 10.viii.2011; İzmir/Kozbeyli, *P. pinea* (38°06.35"N, 26°53'36.42"E), 40 m, 5 ♀♀, 20.vi.2009; İzmir/Menemen, *P. brutia* (38°37'02.26"N, 27°03'54.64"E), 7 ♀♀, 17.vi.2010; İzmir, *P. brutia* (38°25'33.29"N, 27°08'39.94"E), 36 m, 5 ♀♀, 16.vii.2010; İzmir/Kabakum, *P. pinea* (39°07'53.69"N, 26°53'31.23"E), 15 m, 3 ♀♀, 16.vii.2010; İzmir/Aliağa, *P. brutia*, *P. halepensis* (38°49'37.13"N, 26°59'03.86"E), 10 m, 4 ♀♀, 17.vii.2010; İzmir/Dikili, *P. brutia* (39°03'42.06"N, 26°52'04.18"E), 27 m, 6 ♀♀, 18.vii.2010; İzmir/Çeşme, *P. brutia* (38°19'18.75"N, 26°18'47.62"E), 52 m, 3 ♀♀, 17.vii.2010; Kahramanmaraş/Tekir, *P. brutia* (37°52'32.87"N, 36°37'33.09"E), 1300 m, 8 ♀♀, 27.vi.2011; Manisa/Sabuncubeli, *P. brutia* (38°30'34.22"N, 27°16'17.14"E), 368 m, 3 ♀♀, 16.vi.2010; Manisa/Spiladağı, *P. brutia* (38°36'04.90"N, 27°26'40.72"E), 390 m, 2 ♀♀, 16.vi.2010; Muğla/Marmaris (İnbükü), *P. brutia* (36°47'50.28"N, 28°04'59.94"E), 10 m, 12 ♀♀, 13.iv.2009; Muğla/Datça, *P. brutia* (36°43'06.07"N, 27°27'38.02"E), 669 m, 4 ♀♀, 13.iv.2009; Osmaniye/Zorkun Yaylası, *P. brutia* (37°00'29.69"N, 36°17'40.84"E), 729 m, 11 ♀♀, 2.vii.2011.

Host: *Pinus* sp., *P. halepensis*, *P. sylvestris* (Gómez-Menor, 1937; Balachowsky, 1953) (Figure 2).

Distribution: Palaearctic: Cyprus, Spain (Gómez-Menor, 1937; Balachowsky, 1953).

New record for Turkish scale insect fauna, and *P. brutia* is new record as host plant of *G. pinicola*.

***Leucaspis knemion* Hoke, 1925**

Material examined: Adana/Pozantı, *P. brutia* (37°27'27.34"N, 34°52'33.59"E), 810 m, 6 ♀♀, 28.x.2009 (Figure 1).

Host: *P. brutia*, *P. canariensis*, *P. halepensis*, *P. nigra*, *P. pinea* (Ben-Dov et al., 2011).

Distribution: Australasian: New Zealand; Palaearctic: Cyprus, Israel, Lebanon, Syria, Turkey (Balachowsky, 1953; Gerson et al., 1976; Ülgentürk et al., 2008; Şişman and Ülgentürk, 2010).

***Leucaspis pini* Hartig, 1839**

Material examined: Adana/Bahçe, *P. brutia* (36°36'51.60"N, 35°26'57.40"E), 17 m, 9 ♀♀, 2.vii.2011; Adana (Çukurova University), *P. brutia* (37°01'37.82"N, 35°20'38.96"E), 40 m, 4 ♀♀, 2.vii.2011; Antalya/Manavgat, *P. brutia* (36°73'149"N, 31°59'690"E), 19 m, 11 ♀♀, 19.viii.2011; Antalya/Akseki, Emiraşıklar Köyü (37°02'827"N, 31°94'859"E), 930 m, 8 ♀♀, 19.viii.2011; Burdur, *P. brutia* (37°46'05.50"N, 30°33'17.31"E), 1047 m, 3 ♀♀, 14.viii.2009; Bursa/İznik, *P. brutia* (40°25'51.09"N, 29°42'52.35"E), 91 m, 7 ♀♀, 16.vi.2009; Bursa/Kestel, *P. brutia* (40°10'10.82"N, 29°12'25.11"E), 647 m, 5 ♀♀, 13.vii.2010; Bursa/

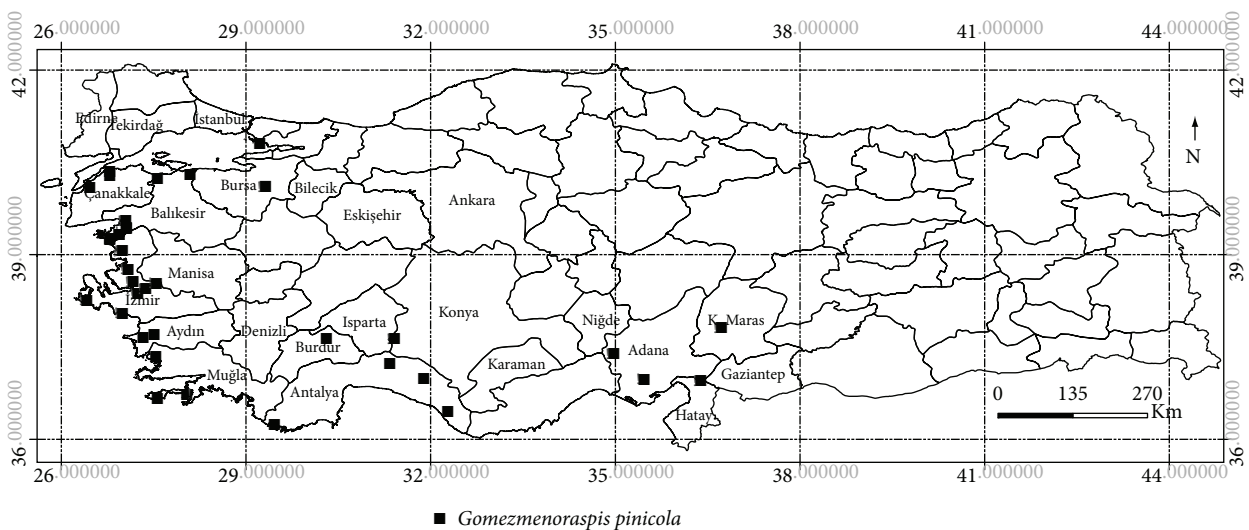


Figure 2. Geographical distribution of *Gomezmenoraspis pinicola* Leonardi in the western part of Turkey.

Gemlik, *P. brutia* (40°22'55.33"N, 28°50'18.35"E), 44 m, 3 ♀♀, 17.vi.2009; Çanakkale/Gökçeada, *P. pinea* (40°11'54.56"N, 25°54'45.84"E), 71 m, 7 ♀♀, 8.viii.2011; Çanakkale, *P. brutia* (40°09'02.05"N, 26°24'21.51"E), 11 m, 11 ♀♀, 15.vii.2010; Balıkesir/Ayvalık, *P. brutia*, *P. pinea* (39°18'43.45"N, 26°41'17.38"E), 6 m, 6 ♀♀, 16.vii.2010; Eskişehir, *P. brutia* (39°47'26.09"N, 30°30'14.00"E), 809 m, 6 ♀♀, 23.iii.2010; Kahramanmaraş/Tekir, *P. brutia* (37°52'32.87"N, 36°37'33.09"E), 1300 m, 8 ♀♀, 27.vi.2011; Manisa/Turgutlu, *P. brutia* (38°30'35.19"N, 27°42'30.70"E), 69 m, 2 ♀♀, 17.vi.2009; Manisa/Ahmetli, *P. pinea* (38°30'52.67"N, 27°56'41.67"E), 100 m, 17.vii.2010; Niğde, *P. brutia* (37°57'55.52"N, 34°38'37.69"E), 1243 m, 15 ♀♀, 12.ix.2010; İzmir/Bozdoğan (38°22'37.98"N, 27°17'47.67"E), 693 m, 7 ♀♀, 17.vii.2010; Muğla, *P. brutia* (37°10'04.33"N, 28°22'27.94"E), 672 m, 10 ♀♀, 27.xi.2008; Muğla/Yusufça, *P. brutia* (37°19'15.47"N, 27°50'28.79"E), 171 m, 3 ♀♀, 12.iv.2009; Osmaniye/Zorkun, *P. brutia* (37°00'29.69"N, 36°17'40.84"E), 729 m, 11 ♀♀, 2.vii.2011 (Figure 3).

Hosts: *Cedrus libani*, *Pinus* sp., *P. austriaca*, *P. brutia*, *P. halepensis*, *P. laricio*, *P. pinea*, *P. pumilio*, *P. mugo*, *P. nigra*, *P. ponderosa*, *P. sylvestris* (Bodenheimer, 1949; Danzig and Pellizzari, 1998; Ülgentürk et al., 2012).

Distribution: Palaearctic: Austria, Bulgaria, Croatia, Cyprus, Czech Republic, Egypt, France,

Georgia, Germany, Greece, Hungary, Italy, Lebanon, Malta, Morocco, Netherlands, Norway, Poland, Portugal, Romania, Sicily, Slovakia, Spain, Sweden, Switzerland, Syria, Turkey, Ukraine (Danzig and Pellizzari, 1998; Ülgentürk et al., 2008; Şişman and Ülgentürk, 2010; Ülgentürk et al., 2012).

Leucaspis pusilla Löw, 1883

Material examined: Adana/Pozanti, *P. brutia* (37°27'27.34"N, 34°52'33.59"E), 810 m, 6 ♀♀, 28.x.2009; Adana, *P. brutia*, *P. halepensis* (37°02'17.88"N, 35°22'19.29"E), 72 m, 12 ♀♀, 2.vii.2011; Antakya/İskenderun, *P. brutia* (36°34'51.65"N, 36°09'09.49"E), 5 m, 3 ♀♀, 27.x.2009; Antakya, *P. brutia*, *P. pinea* (36°11'58.13"N, 36°09'24.76"E), 88 m, 2 ♀♀, 21.xi.2009; Antakya/Samandağ, *P. brutia* (36°05'46.12"N, 35°57'39.54"E), 18 m, 3 ♀♀, 1.xi.2011; Antalya/Merkez, *P. brutia*, Antalya/Elmalı, *P. brutia* (36°44'24.49"N, 29°55'16.25"E), 1129 m, 6 ♀♀, 12.v.2010; Antalya/Korkuteli, *P. brutia* (37°05'50.72"N, 30°09'59.12"E), 1118 m, 3 ♀♀; Antalya/Kaş, *P. brutia*, *P. pinea* (36°12'08.52"N, 29°38'04.73"E), 12 m, 4 ♀♀; Antalya/Kumluca, *P. brutia* (36°21'26.28"N, 30°18'24.71"E), 201 m, 5 ♀♀; Antalya/Alanya, Mahmutlar, *P. brutia* (36°30'24"N, 32°10'34"E), 625 m, 3 ♀♀, 21.iv.2009; Antalya/İslamlar, *P. brutia* (36°19'07.76"N, 29°24'50.74"E), 638 m, 7 ♀♀, 13.viii.2010; Antalya/Kalkan, *P. brutia* (36°17'20.69"N, 29°24'32.03"E), 199 m, 5 ♀♀, 13.viii.2010; Antalya/Finike, *P.*

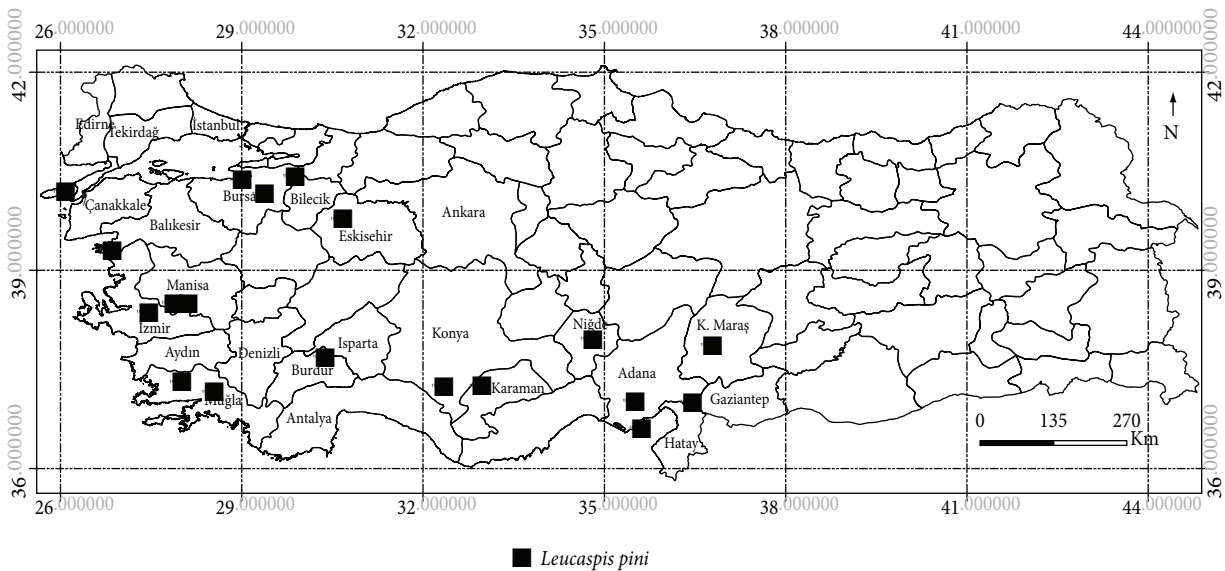


Figure 3. Geographical distribution of *Leucaspis pini* Hartig in the western part of Turkey.

brutia (36°17'48.01"N, 30°08'47.77"E), 3 m, 8 ♀♀, 22.iv.2009; Antalya/Alanya, Mahmutlar, *P. brutia* (36°30'24"N, 32°10'34"E), 625 m, 3 ♀♀, 21.iv.2009; Aydın/Didim (Akbük), *P. brutia* (37°24'01.42"N, 27°25'54.01"E), 2 m, 7 ♀♀, 26.iv.2009; Aydın/Güzelçamlı, *P. pinea*, *P. brutia* (37°41'48.44"N, 27°14'46.57"E), 284 m, 10 ♀♀, 3.ix.2009; Balıkesir/Bandırma, *P. brutia* (40°21'46.28"N, 27°59'42.87"E), 63 m, 8 ♀♀, 17.vi.2009; Balıkesir/Pelitköy, *P. brutia* (39°26'27.55"N, 26°53'53.91"E), 56 m, 2 ♀♀, 19.vi.2009; Balıkesir/Altınoluk Zeytinli, *P. pinea* (39°36'50.05"N, 26°56'50.09"E), 65 m, 8 ♀♀, 15.vii.2010; Balıkesir/Ayvalık, *P. brutia* (39°18'43.45"N, 26°41'17.38"E), 6 m, 3 ♀♀, 16.vii.2010; Balıkesir/Gömeç, *P. pinea* (39°23'09.38"N, 26°50'20.30"E), 15 m, 16.vii.2010; Balıkesir/Burhaniye, *P. brutia* (39°29'44.70"N, 26°57'00.25"E), 13 m, 16.vii.2010; Bilecik, *P. nigra* (40°20'01.89"N, 29°57'08.70"E), 531 m, 16.vi.2009; Burdur, *P. brutia* (37°46'05.50"N, 30°33'17.31"E), 1047 m, 14.viii.2009; Burdur/Yeşilova (Salda), *P. nigra*, *P. brutia* (37°31'19.22"N, 29°40'01.73"E), 1153 m, 5 ♀♀, 3.viii.2008; Burdur/Söğüt, *P. nigra* (37°01'09.12"N, 29°49'38.33"E), 1690 m, 4 ♀♀, 29.vii.2010; Bursa/İznik, *P. brutia*, *P. pinea* (40°25'31.23"N, 29°13'33.27"E), 93 m, 5 ♀♀, 16.vii.2009; Bursa/Kestel (Derekızık), *P. brutia* (40°10'10.82"N, 29°12'25.11"E), 647 m, 4 ♀♀, 13.vii.2010; Bursa/Gemlik, *P. brutia* (40°26'15.57"N, 29°08'55.79"E), 20 m, 4 ♀♀, 17.vii.2009; Bursa/Mudanya (Zeytin Bağı) (40°09'51.86"N, 29°12'59.32"E), 35 m, 5 ♀♀, 13.vii.2010; Çanakkale, *P. brutia* (40°09'02.05"N, 26°24'21.51"E), 10 m, 11 ♀♀, 15.vii.2010; Çanakkale/Biga, *P. brutia* (40°17'57.50"N, 27°27'53.75"E), 133 m, 12 ♀♀, 17.vi.2009; Çanakkale/Lapseki, *P. brutia* (40°20'28.33"N, 26°41'06.37"E), 85 m, 5 ♀♀, 18.vi.2009; Denizli/Kale, *P. brutia* (37°24'41.71"N, 28°49'45.79"E), 974 m, 3 ♀♀, 21.viii.2009; Denizli/Serinhisar, *P. brutia* (37°34'27.44"N, 29°14'53.98"E), 1225 m, 4 ♀♀, 21.viii.2009; Edirne/Keşan (Sazlıdere) (40°649'20"N, 26°740'45"E), 31 m, 5 ♀♀, 7.viii.2011; Edirne/Keşan (Gökçetepe), *P. brutia* (40°655'74"N, 26°627'34"E), 150 m, 3 ♀♀, 7.viii.2011; Isparta/Kovada National Park, *P. brutia* (37°38'42.50"N, 30°51'53.42"E), 960 m, 3 ♀♀, 16.iv.2010; Isparta/Eğirdir, *P. nigra* (37°50'51.49"N, 30°53'25.18"E), 986 m, 5 ♀♀, 16.iv.2010; Isparta/Şarkikaraağaç, *P. brutia* (37°41'35.44"N, 31°18'53.75"E), 1789

m, 5 ♀♀, 14.v.2010; İstanbul/ Büyükada, *P. brutia* (40°52'04.48"N, 29°07'18.64"E), 35 m, 7 ♀♀, 10.viii.2011; İzmir/Kozbeyli, *P. pinea* (38°06.35"N, 26°53'36.42"E), 40 m, 5 ♀♀, 20.vi.2009; İzmir/Menemen, *P. brutia* (38°37'02.26"N, 27°03'54.64"E), 7 ♀♀, 17.vi.2010; İzmir/Kabakum, *P. pinea* (39°07'53.69"N, 26°53'31.23"E), 15 m, 2 ♀♀, 16.vii.2010; İzmir/Aliağa, *P. brutia*, *P. halepensis* (38°49'37.13"N, 26°59'03.86"E), 10 m, 4 ♀♀, 16.vii.2010; İzmir/Dikili, *P. brutia* (39°03'42.06"N, 26°52'04.18"E), 27 m, 3 ♀♀, 16.vii.2010; İzmir/Foça, *P. brutia* (38°40'16.50"N, 26°46'09.22"E), 97 m, 2 ♀♀, 16.vii.2010; İzmir/Çeşme, *P. brutia* (38°19'18.75"N, 26°18'47.62"E), 52 m, 6 ♀♀, 17.vii.2010; İzmir/Ödemiş, *P. brutia* (38°17'08.82"N, 28°00'50.86"E), 573 m, 3 ♀♀, 16.vi.2011; Kahramanmaraş/Tekir, *P. brutia* (37°52'52.87"N, 36°37'33.09"E), 1300 m, 3 ♀♀, 27.vi.2011; Manisa/Spiladağı, *P. brutia*, *P. pinea* (38°36'04.90"N, 27°26'40.72"E), 390 m, 2 ♀♀, 16.vii.2010; Manisa/Salihli, *P. brutia* (38°28'34.90"N, 28°09'06.28"E), 119 m, 3 ♀♀, 17.vi.2009; Manisa/Turgutlu, *P. brutia* (38°30'35.19"N, 27°42'30.70"E), 69 m, 3 ♀♀, 17.vi.2009; Manisa/Sart, *P. brutia* (38°28'21.54"N, 28°06'52.58"E), 354 m, 21.vi.2009; Muğla (37°10'04.33"N, 28°22'27.94"E), 672 m, 2 ♀♀, 21.iv.2009; Muğla/Marmaris (İnbükü), *P. brutia* (36°47'50.28"N, 28°04'59.94"E), 10 m, 12 ♀♀, 13.iv.2009; Muğla/Datça, *P. brutia* (36°43'06.07"N, 27°27'38.02"E), 669 m, 4 ♀♀, 13.iv.2009; Muğla/Alatepe, *P. brutia* (37°02'16.29"N, 28°00'27.55"E), 388 m, 7 ♀♀, 21.v.2008; Muğla/Akbük National Park, *P. brutia* (37°02'12.51"N, 28°05'38.88"E), 76 m, 3 ♀♀, 13.iv.2009; Muğla/Yatağan, *P. brutia* (28°09'19.95"N, 37°20'53.52"E), 446 m, 2 ♀♀, 20.v.2009; Muğla/Geyik (37°24'41.71"N, 28°36'27.48"E), 646 m, 4 ♀♀, Muğla/Bodrum (Mazı), *P. brutia* (37°00'38.18"N, 27°44'06.42"E), 139 m, 4 ♀♀, 23.v.2009; Muğla/Fethiye (Hisarönü) (36°35'40.96"N, 29°09'03.93"E), 316 m, 4 ♀♀, 28.xi.2008; Muğla/Datça, *P. brutia* (36°43'06.07"N, 27°27'38.02"E), 669 m, 7 ♀♀, 13.iv.2009; Osmaniye/Zorkun, *P. brutia* (37°02'44.52"N, 36°27'60"E), 830 m, 5 ♀♀, 3.viii.2011; Tekirdağ/Şarköy, *P. brutia* (40°62'679"N, 26°92'827"E), 44 m, 6 ♀♀, 7.viii.2011 (Figure 4).

Hosts: *Cedrus atlantica*, *C. libanotica atlantica*, *Pinus* sp., *P. austriaca*, *P. brutia*, *P. canariensis*, *P. caricio*, *P. filifolia*, *P. halepensis*, *P. insignis*, *P. laricio*, *P.*

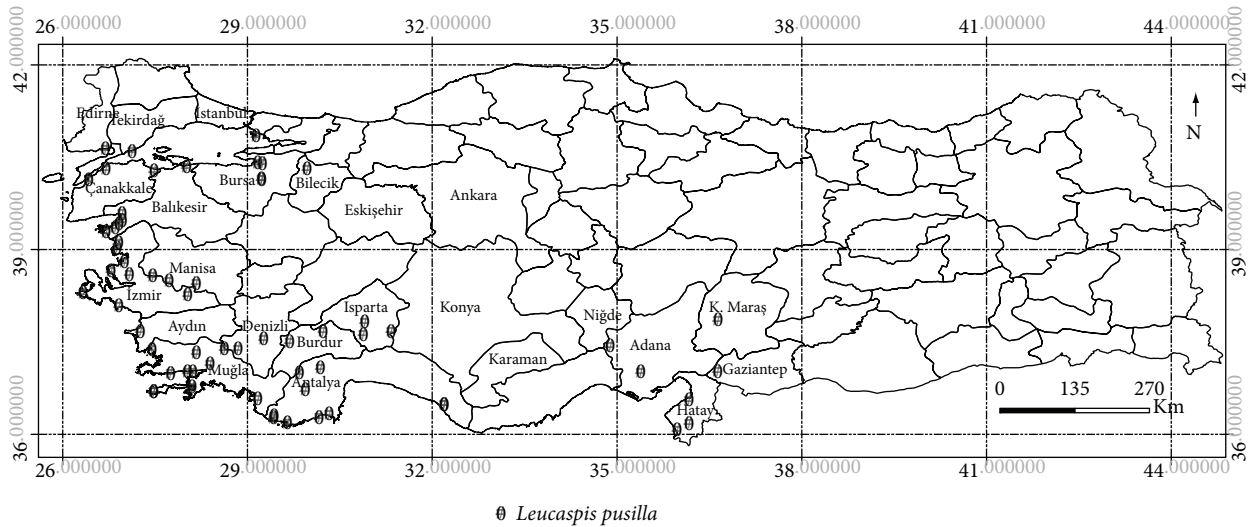


Figure 4. Geographical distribution of *Leucaspis pusilla* Löw in the western part of Turkey.

longifolia, *P. maritima*, *P. monspeliensis*, *P. montana*, *P. mugo*, *P. nigra*, *P. picea*, *P. pinaster*, *P. pinea*, *P. pinifolia*, *P. pithyusa*, *P. pyrenaica*, *P. radiata*, *P. sylvestris* (Danzig and Pellizzari, 1998; Miller and Davidson, 2005).

Distribution: Neotropical: Argentina (Danzig and Pellizzari, 1998; Miller and Davidson, 2005). Palaearctic: Albania, Algeria, Austria, Bulgaria, Canary Islands, Corsica, Croatia, Cyprus, Czech Republic, Egypt, France, Georgia, Greece, Hungary, Iran, Iraq, Israel, Italy, Madeira Islands, Malta, Morocco, Poland, Portugal, Romania, Sardinia, Sicily, Spain, Switzerland, Syria, Turkey, Ukraine (Crimea Oblast) (Ben-Dov et al., 2011).

Lepidosaphes ulmi Linnaeus, 1758

Material examined: Balıkesir/Zeytinli, *P. brutia* (39°36'50.05"N, 26°56'50.09"E), 65 m, 8 ♀♀, 15.vii.2010; Muğla/Yusufça, *P. brutia* (37°19'15.47"N, 27°50'28.79"E), 171 m, 5 ♀♀, 12.iv.2009; Muğla/Marmaris (İnbükü), *P. brutia* (36°47'50.28"N, 28°04'59.94"E), 10 m, 12 ♀♀, 13.iv.2009; Aydın/Didim (Akbuluk), *P. brutia* (37°24'01.42"N, 27°25'54.01"E), 2 m, 8 ♀♀ 26.iv.2009 (Figure 1).

Host: Polyphagous, *Abies* sp., *Abies firma*, *Picea* sp., *Tsuga* sp. (Miller and Davidson, 2005).

Distribution: Cosmopolite (Ben-Dov et al., 2011).

P. brutia is a new record as a host plant of *L. ulmi*.

Torosaspis turcica Ülgentürk & Kozár, 2011

Material examined: Osmaniye/Zorkun, *P. brutia* (37°01'41.97"N, 36°16'56.25"E), 729 m, 8 ♀♀, 2.vii.2011 (Figure 1).

Host: *Pinus brutia* (Ülgentürk and Kozár, 2011).

Distribution: Palaearctic: Turkey (Ülgentürk and Kozár, 2011).

Marchalinidae

Marchalina hellenica Gennadius, 1883

Material examined: Adana/Kozan (Gedikli), *P. brutia* (37°30'58.52"N, 35°52'21.31"E), 375 m, 5 ♀♀, 25.xi.2010; Antalya/Akseki, *P. brutia*, 1000 m, 7 ♀♀, 23.v.2011; Antalya/İbradı, *P. brutia* (37°09'514"N, 31°59'555"E), 1000 m, 8 ♀♀, 19.viii.2011; Antalya/Akseki, *P. brutia* (37°04'759"N, 31°78'995"E), 1100 m, 6 ♀♀, 24.viii.2011; Antalya/İslamlar, *P. brutia* (36°19'07.76"N, 29°24'50.74"E), 638 m, 3 ♀♀, 13.viii.2010; Antalya/Kalkan, *P. brutia* (36°17'20.69"N, 29°24'32.03"E), 199 m, 7 ♀♀, 13.viii.2010; Aydın/Didim (Akbuluk), *P. brutia* (37°24'01.42"N, 27°25'54.01"E), 2m, 8 ♀♀, 26.iv.2009; Aydın/Güzelçamlı, *P. pinea*, *P. brutia* (37°41'48.44"N, 27°14'46.57"E), 284 m, 15 ♀♀, 3.ix.2009; Aydın/Söke, *P. brutia*, *P. pinea* (37°45'17.01"N, 27°24'29.05"E), 43 m, 3 ♀♀, 20.iv.2009; Aydın/Sultanhisar, *P. pinea* (37°53'17"N, 28°09'41"E), 100 m, 6 ♀♀, 22.viii.2011; Aydın/Merkez, *P. pinea* (37°84'201"N,

27°85'599"E), 75 m, 7 ♀♀, 22.viii.2011; Balıkesir/Bandırma, *P. brutia* (40°21'46.28"N, 27°59'42.87"E), 63 m, 11 ♀♀, 17.vi.2009; Balıkesir/Pelitköy, *P. brutia* (39°26'27.55"N, 26°53'53.91"E), 56 m, 3 ♀♀, 19.vi.2009; Balıkesir/Altınoluk Zeytinli, *P. pinea* (39°36'50.05"N, 26°56'50.09"E), 65 m, 13 ♀♀, 15.vii.2010; Balıkesir/Ayvalık, *P. brutia* (39°18'43.45"N, 26°41'17.38"E), 6 m, 7 ♀♀, 16.vii.2010; Balıkesir/Gömeç, *P. pinea* (39°23'09.38"N, 26°50'20.30"E), 15 m, 3 ♀♀, 16.vii.2010; Balıkesir/Burhaniye, *P. brutia* (39°29'44.70"N, 26°57'00.25"E), 13 m, 3 ♀♀, 16.vii.2010; Balıkesir/Edincik, *P. brutia* (40°20'55.55"N, 27°51'23.93"E), 122 m, 5 ♀♀, 16.vii.2010; Balıkesir/Edremit, *P. brutia* (39°36'07.95"N, 27°01'16.10"E), 66 m, 5 ♀♀, 16.vii.2010; Burdur, *P. brutia* (37°41'41.05"N, 30°12'08.31"E), 888 m, 17 ♀♀, 14.viii.2009; Bursa/Mudanya (Zeytin Bağı) (40°09'51.86"N, 29°12'59.32"E), 35 m, 3 ♀♀, 13.vii.2010; Bursa/İznik, *P. brutia* (40°25'54.75"N, 29°44'07.47"E), 90 m, 1 ♀, 30.x.2008; Çanakkale, *P. brutia* (40°09'02.05"N, 26°24'21.51"E), 10 m, 10 ♀♀, 15.vii.2010; Çanakkale/Biga, *P. brutia* (40°17'57.50"N, 27°27'53.75"E), 133 m, 4 ♀♀, 17.vi.2009; Çanakkale/Bozcaada, *P. brutia* (39°50'04.85"N, 26°04'17.04"E), 3 m, 5 ♀♀, 14.ix.2011; Çanakkale/Gökçeada, *P. brutia* (40°11'54.56"N, 25°54'45.84"E), 63 m, 10 ♀♀, 9.viii.2011; Çanakkale/Gökçeada, Uğurlu, *P. brutia* (40°07'11.51"N, 25°42'16.62"E), 150 m, 5 ♀♀, 9.viii.2011; Çanakkale/Gökçeada, Şirinköy, *P. brutia* (40°07'52.98"N, 25°44'30.76"E), 150 m, 4 ♀♀, 9.viii.2011; Çanakkale/Eceabat/Kabatepe, *P. brutia* (40°11'56.75"N, 26°16'03.88"E), 4 m, 5 ♀♀, Çanakkale/Lapseki, *P. brutia* (40°20'28.33"N, 26°41'06.37"E), 11 m, 15 ♀♀, 18.vi.2009; Denizli, *P. pinea* (37°48'16.19"N, 29°13'39.89"E), 300 m, 11 ♀♀, 22.viii.2011; Denizli/Karahayıt, *P. brutia* (37°58'07.67"N, 29°06'09.79"E), 319 m, 7 ♀♀, 22.viii.2011; Edirne/Keşan (Sazlıdere) (40°39'50.55"N, 26°40'38.29"E), 165 m, 5 ♀♀, 7.viii.2011; Edirne/Keşan (Gökçetepe), *P. brutia* (40°39'50.55"N, 26°40'38.29"E), 150 m, 3 ♀♀, 7.viii.2011; İstanbul/Büyükdada, *P. brutia* (40°52'04.48"N, 29°07'18.64"E), 35 m, 8 ♀♀, 10.viii.2011; İzmir/Kozbeyli, *P. pinea* (38°06.35"N, 26°53'36.42"E), 40 m, 5 ♀♀, 20.vi.2009; İzmir/Menemen, *P. brutia* (38°37'02.26"N, 27°03'54.64"E), 7 ♀♀, 17.vi.2010; İzmir/Kabakum, *P. pinea* (39°07'53.69"N, 26°53'31.23"E), 15 m, 5 ♀♀,

16.vii.2010; İzmir/Aliağa, *P. brutia*, *P. halepensis* (38°49'37.13"N, 26°59'03.86"E), 10 m, 6 ♀♀, 16.vii.2010; İzmir/Dikili, *P. brutia* (39°03'42.06"N, 26°52'04.18"E), 27 m, 4 ♀♀, 16.vii.2010; İzmir/Foça, *P. brutia* (38°40'16.50"N, 26°46'09.22"E), 97 m, 3 ♀♀, 12.vii.2009; İzmir/Çeşme, *P. brutia* (38°19'18.75"N, 26°18'47.62"E), 52 m, 6 ♀♀, 17.vii.2010; İzmir/Ödemiş, *P. brutia* (38°17'08.82"N, 28°00'50.86"E), 573 m, 3 ♀♀, 23.vii.2010; Manisa/Sabuncubeli (38°30'34.22"N, 27°16'17.14"E), 368 m, 5 ♀♀, 19.vi. 2009; Manisa/Spiladağı, *P. brutia*, *P. pinea* (38°36'04.90"N, 27°26'40.72"E), 390 m, 5 ♀♀, 16.vii.2010; Manisa/Salihli, *P. brutia* (38°28'34.90"N, 28°09'06.28"E), 119 m, 7 ♀♀, 17.vi.2009; Manisa/Turgutlu, *P. brutia* (38°30'35.19"N, 27°42'30.70"E), 69 m, 4 ♀♀, 17.vi.2009; Muğla, *P. brutia* (37°10'04.33"N, 28°22'27.94"E), 672 m, 12 ♀♀, 5.v.2010; Muğla/Marmaris (İnbükü), *P. brutia* (36°47'50.28"N, 28°04'59.94"E), 10 m, 15 ♀♀, 13.iv.2009; Muğla/Datça, *P. brutia* (36°43'06.07"N, 27°27'38.02"E), 669 m, 11 ♀♀, 13.iv.2009; Muğla/Alatepe, *P. brutia* (37°02'16.29"N, 28°00'27.55"E), 388 m, 3 ♀♀, 21.v.2008; Muğla/Akbük National Park, *P. brutia* (37°02'12.51"N, 28°05'38.88"E), 76 m, 6 ♀♀, 13.iv.2009; Muğla/Bodrum (Mazı), *P. brutia* (37°00'38.18"N, 27°44'06.42"E), 139 m, 14 ♀♀, 23.v.2009; Muğla/Fethiye (Hisarönü) (36°35'40.96"N, 29°09'03.93"E), 316 m, 8 ♀♀, 28.xi.2008; Muğla/Datça, *P. brutia* (36°43'06.07"N, 27°27'38.02"E), 669 m, 17 ♀♀, 13.iv.2009 (Figure 5).

Hosts: Pinaceae: *Abies cephalonica*, *A. nordmanniana*, *Picea engelmanni*, *P. brutia*, *P. orientalis*, *P. halepensis*, *P. laricio tauricus*, *P. pinea*, *P. sosnowskyi*, *P. sylvestris* (Bodenheimer, 1953; Hadzibejli, 1969; Çanakçıoğlu, 1977; Bacandritsos, 2002; Ben-Dov et al., 2011).

Distribution: Palaearctic: Armenia, Georgia, Greece, Italy, Russia, Turkey (Bodenheimer, 1953; Gounari, 2003; Ben-Dov et al., 2011).

Matsucoccidae

Matsucoccus josephi Bodenheimer and Harpaz, 1955

Material examined: Adana/Kozan (Gedikli), *P. brutia* (37°30'58.52"N, 35°52'21.31"E), 375 m, 2 ♀♀, 1.vii.2011; Antakya/Dörttyol, *P. brutia* (36°49'44.35"N, 36°15'14.84"E), 225 m, 7 ♀♀,

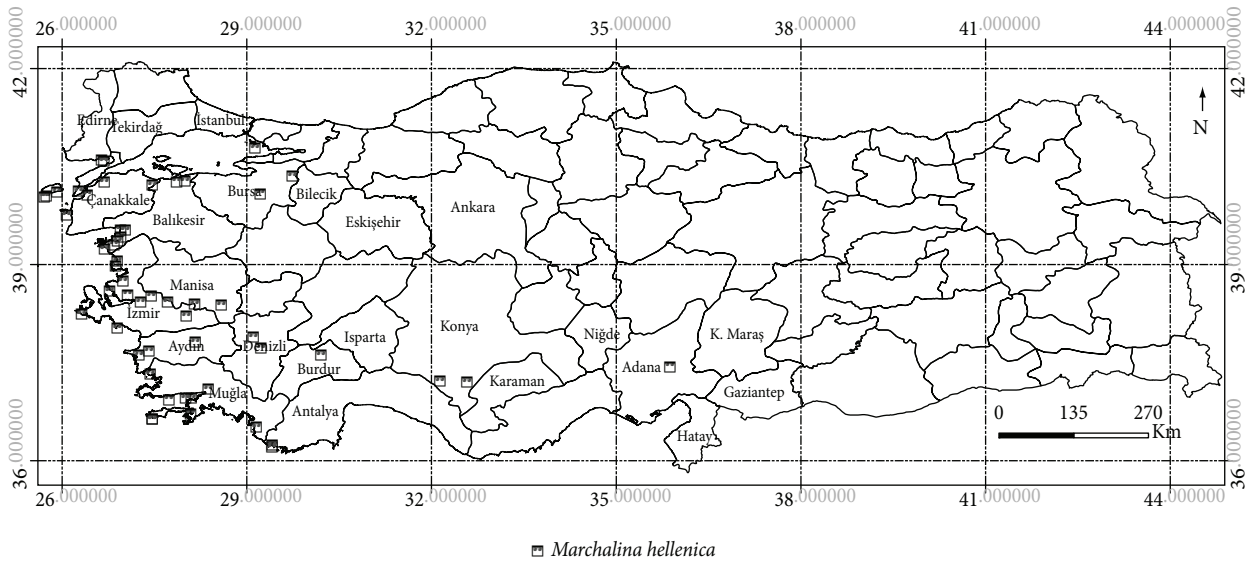


Figure 5. Geographical distribution of *Marchalina hellenica* Gennadius in the western part of Turkey.

3.vii.2011; Antalya/Alanya, Mahmutlar, *P. brutia* (36°30'24"N, 32°10'34"E), 625 m, 2 ♀♀, 21.iv.2009; Antalya/Merkez, *P. brutia* (36°54'07"N, 30°41'13"E), 35 m, 7 ♀♀, 12.v.2010; Antalya/Kaş, *P. brutia*, *P. pinea* (36°11'42.11"N, 29°38'49.41"E), 25 m, 2 ♀♀, 14.v.2010; Antalya/Kumluca, *P. brutia* (36°22'53.51"N, 30°15'54.30"E), 170 m, 2 ♀♀, 14.v.2010; Antalya/Kaş, İslamlar, *P. brutia* (36°19'07.76"N, 29°24'50.74"E), 638 m, 5 ♀♀, 13.viii.2010; Antalya/Kalkan, *P. brutia* (36°17'20.69"N, 29°24'32.03"E), 199 m, 2 ♀♀, 13.viii.2010; Antalya/Finike, *P. brutia* (36°17'48.01"N, 30°08'47.77"E), 3 m, 18 ♀♀, 22.iv.2009; Aydın/Didim (Akbük), *P. brutia* (37°24'01.42"N, 27°25'54.01"E), 2 m, 9 ♀♀, 26.iv.2009; Aydın/Güzelçamlı, *P. pinea*, *P. brutia* (37°41'48.44"N, 27°14'46.57"E), 284 m, 5 ♀♀, 3.ix.2009; Balıkesir/Pelitköy, *P. brutia* (39°26'27.55"N, 26°53'53.91"E), 65 m, 3 ♀♀, 19.vi.2009; Balıkesir/Altınoluk Zeytinli, *P. pinea* (39°36'50.05"N, 26°56'50.09"E), 65 m, 6 ♀♀, 15.vii.2010; Balıkesir/Ayvalık, *P. brutia* (39°18'43.45"N, 26°41'17.38"E), 6 m, 13 ♀♀, 16.vii.2010; Balıkesir/Gömeç, *P. pinea* (39°23'09.38"N, 26°50'20.30"E), 15 m, 5 ♀♀, 16.vii.2010; Balıkesir/Burhaniye, *P. brutia* (39°29'44.70"N, 26°57'00.25"E), 13 m, 11 ♀♀, 16.vii.2010; Burdur, *P. brutia* (37°43'28.56"N, 30°16'25.28"E), 931 m, 7 ♀♀, 14.viii.2009; Bursa/Mudanya (Zeytin Bağı) (40°09'51.86"N, 29°12'59.32"E), 35 m, 2 ♀♀, 13.vii.2010; Bursa/Kestel (Derekızık), *P. brutia* (40°10'10.82"N, 29°12'25.11"E),

647 m, 3 ♀♀, 13.vii.2010; Bursa/Gemlik, *P. brutia* (40°25'31.23"N, 29°13'33.27"E), 1 ♀, 17.vii.2009; Çanakkale/Biga, *P. brutia* (40°17'57.50"N, 27°27'53.75"E), 133 m, 6 ♀♀, 17.vi.2009; Çanakkale/Lapseki, *P. brutia* (40°20'28.33"N, 26°41'06.37"E), 85 m, 3 ♀♀, 18.vi.2009; Çanakkale/Gelibolu, *P. brutia* (40°24'32.80"N, 26°40'38.55"E), 15 m, 4 ♀♀, 8.viii.2011; Çanakkale/Eceabat, *P. brutia* (40°21'98.2"N, 26°41'65.3"E), 12 m, 3 ♀♀, 8.viii.2011; Çanakkale/Bozcaada, *P. brutia* (39°50'04.85"N, 26°04'17.04"E), 3 m, 5 ♀♀, 14.ix.2011; İstanbul/Büyükdada, *P. brutia* (40°52'04.48"N, 29°07'18.64"E), 44 m, 3 ♀♀, 10.viii.2011; İzmir/Kozbeyli, *P. pinea* (38°06.35"N, 26°53'36.42"E), 40 m, 3 ♀♀, 20.vi.2009; İzmir/Menemen, *P. brutia* (38°37'02.26"N, 27°03'54.64"E), 11 ♀♀, 17.vi.2010; İzmir/Kabakum, *P. pinea* (39°07'53.69"N, 26°53'31.23"E), 15 m, 1 ♀, 16.vii.2010; İzmir/Aliağa, *P. brutia*, *P. halepensis* (38°49'37.13"N, 26°59'03.86"E), 10 m, 4 ♀♀, 16.vii.2010; İzmir/Dikili, *P. brutia* (39°03'42.06"N, 26°52'04.18"E), 27 m, 3 ♀♀, 16.vii.2010; İzmir/Çeşme, *P. brutia* (38°19'18.75"N, 26°18'47.62"E), 52 m, 4 ♀♀, 17.vii.2010; Kahramanmaraş, *P. brutia* (37°34'41.23"N, 36°56'05.17"E), 2 ♀♀, 1.vii.2011; Manisa/Spiladağı, *P. brutia*, *P. pinea* (38°36'04.90"N, 27°26'40.72"E), 390 m, 4 ♀♀, 16.vii.2010; Manisa/Salihli, *P. brutia* (38°28'34.90"N, 28°09'06.28"E), 119 m, 2 ♀♀, 17.vi.2009; Manisa/Turgutlu, *P. brutia* (38°30'35.19"N, 27°42'30.70"E), 69 m, 4

♀♀, 17.vi.2009; Muğla, *P. brutia* (37°10'04.33"N, 28°22'27.94"E), 672 m, 5 ♀♀, Muğla/Marmaris (İnbükü), *P. brutia* (36°47'50.28"N, 28°04'59.94"E), 10 m, 4 ♀♀, 13.iv.2009; Muğla/Datça, *P. brutia* (36°43'06.07"N, 27°27'38.02"E), 669 m, 6 ♀♀, 13.iv.2009; Muğla/Alatepe, *P. brutia* (37°02'16.29"N, 28°00'27.55"E), 388 m, 8 ♀♀, 21.v.2008; Muğla/Akbük National Park, *P. brutia* (37°02'12.51"N, 28°05'38.88"E), 76 m, 13 ♀♀, 13.iv.2009; Muğla/Geyik Kanyonu, *P. brutia* (37°24'41.71"N, 28°36'27.48"E), 646 m, 3 ♀♀, 21.viii.2010; Muğla/Bodrum (Mazı), *P. brutia* (37°00'38.18"N, 27°44'06.42"E), 139 m, 2 ♀♀, 23.v.2009; Muğla/Fethiye (Hisarönü), *P. brutia* (36°35'40.96"N, 29°09'03.93"E), 316 m, 7 ♀♀, 28.xi.2008; Tekirdağ/Şarköy, *P. pinea* (40°39'01.25"N, 27°05'22.94"E), 44 m, 4 ♀♀, 9.viii.2011 (Figure 6).

Hosts: *P. brutia brutia*, *P. brutia eldarica*, *P. halepensis* (Bodenheimer and Harpaz, 1955; Mendel, 1992; Foldi, 2004).

Distribution: Palaearctic: Crete, Cyprus, Israel, Jordan, Lebanon, Turkey (Bodenheimer and Harpaz, 1955; Ben-Dov, 1981; Mendel, 1992; Foldi, 2004).

Monophlebidae

Palaeococcus fuscipennis Burmeister, 1835

Material examined: Adana/Kozan (Gedikli), *P. brutia* (37°30'58.52"N, 35°52'21.31"E), 375 m, 5 ♀♀, 1.vii.2011; Adana, *P. brutia* (37°02'17.88"N, 35°22'19.29"E), 72 m, 3 ♀♀, 2.vii.2011; Antalya/

İslamlar, *P. brutia* (36°19'07.76"N, 29°24'50.74"E), 638 m, 3 ♀♀, 13.viii.2010; Antalya/Kalkan, *P. brutia* (36°17'20.69"N, 29°24'32.03"E), 199 m, 7 ♀♀, 13.viii.2010; Antalya/İbradı, *P. brutia* (37°09'514"N, 31°5'555"E), 1000 m, 8 ♀♀, 19.viii.2011; Antalya/Akseki, *P. brutia* (37°04'759"N, 31°78'995"E), 1100 m, 3 ♀♀, 24.vii.2011; Aydın/Didim (Akbük), *P. brutia* (37°24'01.42"N, 27°25'54.01"E), 2 m, 8 ♀♀, 26.iv.2009; Aydın/Güzelçamlı, *P. pinea*, *P. brutia* (37°41'48.44"N, 27°14'46.57"E), 284 m, 15 ♀♀, 3.ix.2009; Aydın/Söke, *P. brutia*, *P. pinea* (37°45'17.01"N, 27°24'29.05"E), 43 m, 3 ♀♀, 20.iv.2009; Balıkesir/Bandırma, *P. brutia* (40°21'46.28"N, 27°59'42.87"E), 63 m, 11 ♀♀, 17.vi.2009; Balıkesir/Altınoluk Zeytinli, *P. pinea* (39°36'50.05"N, 26°56'50.09"E), 65 m, 13 ♀♀, 15.vii.2010; Balıkesir/Ayvalık, *P. brutia* (39°18'43.45"N, 26°41'17.38"E), 6 m, 7 ♀♀, 16.vii.2010; Balıkesir/Gömeç, *P. pinea* (39°23'09.38"N, 26°50'20.30"E), 15 m, 3 ♀♀, 16.vii.2010; Bursa/Mudanya (Zeytin Bağı) (40°09'51.86"N, 29°12'59.32"E), 35 m, 3 ♀♀, 13.vii.2010; Çanakkale, *P. brutia* (40°09'02.05"N, 26°24'21.51"E), 10 m, 10 ♀♀, 15.vii.2010; Çanakkale/Biga, *P. brutia* (40°17'57.50"N, 27°27'53.75"E), 133 m, 4 ♀♀, 17.vi.2009; Çanakkale/Bozcaada, *P. brutia* (39°50'04.85"N, 26°04'17.04"E), 3 m, 5 ♀♀, 14.ix.2011; Çanakkale/Eceabat, *P. brutia* (40°21'982"N, 26°41'653"E), 12 m, 3 ♀♀, 8.viii.2011; Çanakkale/Gelibolu, *P. brutia* (40°24'32.80"N, 26°40'38.55"E), 15 m, 2 ♀♀, 8.viii.2011; Çanakkale/Gökçeada, *P. pinea* (40°21'240"N, 25°93'120"E),

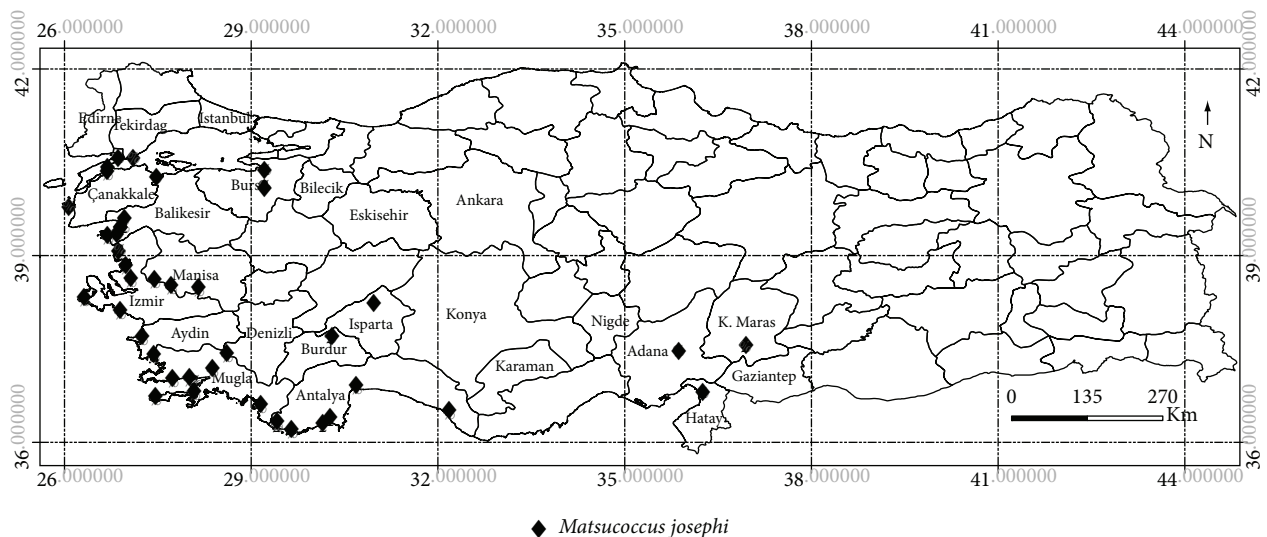


Figure 6. Geographical distribution of *Matsucoccus josephi* Bodenheimer and Harpaz in the western part of Turkey.

71 m, 8 ♀♀, 8.viii.2011; Çanakkale/Gökçeada, *P. brutia* (40°11'54.56"N, 25°54'45.84"E), 63 m, 10 ♀♀, 9.viii.2011; Çanakkale/Gökçeada, Uğurlu, *P. brutia* (40°07'11.51"N, 25°42'16.62"E), 150 m, 5 ♀♀, 9.viii.2011; Çanakkale/Lapseki, *P. brutia* (40°20'28.33"N, 26°41'06.37"E), 85 m, 15 ♀♀, 18.vi.2009; Edirne/Keşan (Sazlıdere), *P. brutia* (40°39'50.55"N, 26°40'38.29"E), 31 m, 5 ♀♀, 7.viii.2011; Edirne/Keşan (Gökçetepe), *P. brutia* (40°40'50.55"N, 26°38'30.29"E), 150 m, 3 ♀♀, 7.viii.2011; İstanbul/Büyükdada, *P. brutia* (40°52'04.48"N, 29°07'18.64"E), 35 m, 8 ♀♀, 10.viii.2011; İzmir/Kozbeyli, *P. pinea* (38°06.35"N, 26°53'36.42"E), 40 m, 5 ♀♀, 20.vi.2009; İzmir/Menemen, *P. brutia* (38°37'02.26"N, 27°03'54.64"E), 7 ♀♀, 17.vi.2010; İzmir/Aliağa, *P. brutia*, *P. halepensis* (38°49'37.13"N, 26°59'03.86"E), 10 m, 6 ♀♀, 16.vii.2010; İzmir/Dikili, *P. brutia* (39°03'42.06"N, 26°52'04.18"E), 27 m, 4 ♀♀, 16.vii.2010; İzmir/Çeşme, *P. brutia* (38°19'18.75"N, 26°18'47.62"E), 52 m, 6 ♀♀, 17.vii.2010; Kahramanmaraş, *P. brutia* (37°34'41.23"N, 36°56'05.17"E), 8 ♀♀, 1.vii.2011; İstanbul/Büyükdada, *P. brutia* (40°86'438"N, 29°12'674"E), 35 m, 7 ♀♀, 10.viii.2011; Manisa/Spiladağı, *P. brutia*, *P. pinea* (38°36'04.90"N, 27°26'40.72"E), 390 m, 5 ♀♀, 16.vii.2010; Manisa/Turgutlu, *P. brutia* (38°30'35.19"N, 27°42'30.70"E), 69 m, 4 ♀♀, 17.vi.2009; Muğla (37°10'04.33"N, 28°22'27.94"E), 672 m, 12 ♀♀; Muğla/Marmaris (İnbükü), *P. brutia* (36°47'50.28"N, 28°04'59.94"E),

10 m, 15 ♀♀, 13.iv.2009; Muğla/Datça, *P. brutia* (36°43'06.07"N, 27°27'38.02"E), 669 m, 11 ♀♀, 13.iv.2009; Muğla/Alatepe, *P. brutia* (37°02'16.29"N, 28°00'27.55"E), 388 m, 3 ♀♀, 21.v.2008; Muğla/Akbük National Park, *P. brutia* (37°02'12.51"N, 28°05'38.88"E), 76 m, 6 ♀♀, 13.iv.2009; Muğla/Bodrum (Mazı), *P. brutia* (37°00'38.18"N, 27°44'06.42"E), 139 m, 14 ♀♀, 23.v.2009; Muğla/Fethiye (Hisarönü) (36°35'40.96"N, 29°09'03.93"E), 316 m, 8 ♀♀, 28.xi.2008; Muğla/Datça, *P. brutia* (36°43'06.07"N, 27°27'38.02"E), 669 m, 17 ♀♀, 13.iv.2009; Osmaniye/Zorkun, *P. brutia* (37°024'452"N, 36°27'608"E), 830 m, 11 ♀♀, 2.vii.2011; Tekirdağ/Şarköy, *P. pinea* (40°62'679"N, 25°73'617"E), 44 m, 11 ♀♀, 9.viii.2011 (Figure 7).

Hosts: *Acer* sp., *Quercus* sp., *Abies* sp., *Picea* sp., *Pinus* sp., *P. brutia brutia*, *P. canariensis*, *P. halepensis*, *P. pinea*, *P. sylvestris* (Martin-Mateo, 1985; Mendel, 1992; Eizaguirre et al., 2002).

Distribution: Palaearctic: Algeria, Cyprus, France, Germany, Israel, Poland, Spain, Switzerland, Turkey (Schimitschek, 1944; Kosztarab and Kozár, 1988; Mendel et al., 1991; Foldi, 1998; Şişman and Ülgentürk, 2010).

Pseudococcidae

Phenacoccus yerushalmi Ben-Dov, 1985

Material examined: Adana/Kozan (Gedikli), *P. brutia* (37°30'58.52"N, 35°52'21.31"E), 375 m, 3

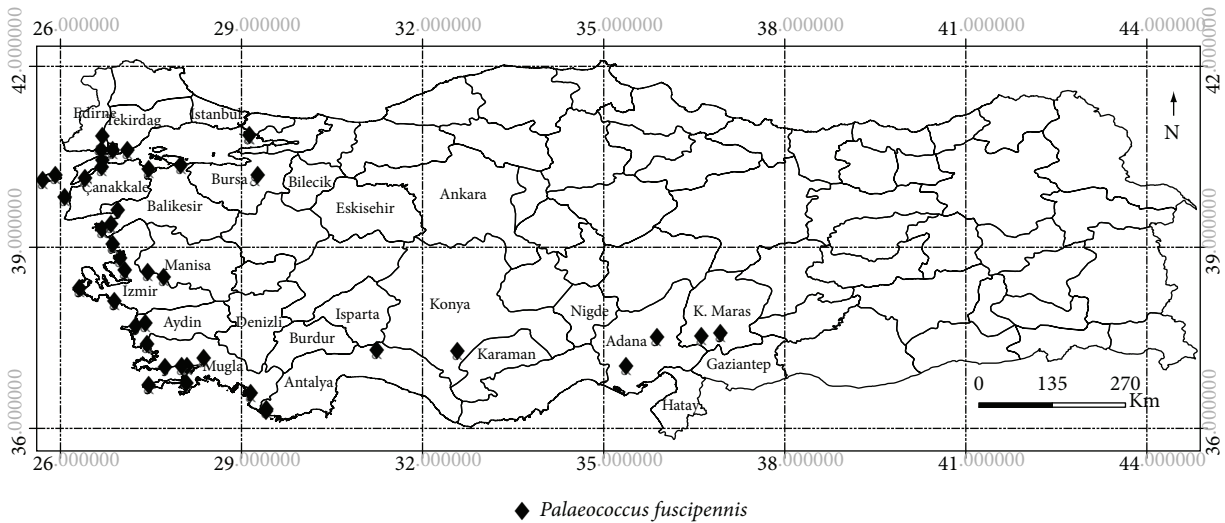


Figure 7. Geographical distribution of *Palaeococcus fuscipennis* Burmeister in the western part of Turkey.

♀♀, 1.vii.2011; Antakya/İskenderun (Belen), *P. brutia* (36°34'04.24"N, 36°09'22.69"E), 22 m, 3 ♀♀, 3.vii.2011; Aydın/Didim (Akbük), *P. brutia* (37°24'01.42"N, 27°25'54.01"E), 2 m, 8 ♀♀, 26.iv.2009; Balıkesir/Havran, *P. brutia* (39°33'33.59"N, 27°06'03.56"E), 43 m, 10 ♀♀, 18.vi.2009; Balıkesir/Gömeçler, *P. pinea* (39°23'11.25"N, 26°50'19.32"E), 15 m, 5 ♀♀, 16.vii.2010; Çanakkale/Eceabat, *P. brutia* (40°21'982"N, 26°41'653"E), 12 m, 3 ♀♀, 8.viii.2011; İstanbul/Büyükdada, *P. brutia* (40°52'04.48"N, 29°07'18.64"E), 44 m, 9 ♀♀, 10.viii.2011; Manisa/Sabuncubeli, *P. brutia* (38°30'34.22"N, 27°16'17.14"E), 368 m, 12 ♀♀, 19.vi.2009; Muğla/Fethiye, *P. brutia* (36°35'40.96"N, 29°09'03.93"E), 316 m, 5 ♀♀, 19.vi.2009; Osmaniye/Zorkun, *P. brutia* (37°024'452"N, 36°27'608"E), 830 m, 8 ♀♀, 2.vii.2011 (Figure 8).

Hosts: *P. halepensis*, *P. pinaster*, *P. sylvestris* (Ben-Dov et al., 2006).
Distribution: Palaearctic: Corsica, France, Greece, Israel, Italy, Sicily, Spain, Tunisia, Turkey (Ben-Dov et al., 2011).

Discussion

Fourteen species belonging to the superfamily Coccoidea were determined on pine trees in the Mediterranean, Aegean, and Marmara regions of Turkey. *Coccus hesperidum* and *P. intermedia* were only determined from pine trees in Çanakkale and

Bursa, respectively. Although previously reported on pine trees (Koteja, 1979), *P. intermedia* is thought to get into the cracks of pine bark to lay eggs (personal comm., F. Kozár). It was observed that *L. pusilla* was the most common species in all of the sampling sites. Population levels of *L. pini* were higher in the Mediterranean region's forests, namely in Isparta (Kovada National Park), Antalya, and Adana, but lower in the Aegean region's forests. *L. knemion* was recovered only in Adana and İstanbul. *G. pinicola* was determined in all regions surveyed and the population levels of this species, which feeds on the young shoot's needle bases, were observed to be high. *Lepidosaphes ulmi* and *D. jaapi* were recovered in low numbers only in Muğla. Both of these species were observed to colonize on the branches. A source of honeydew for the bees that produce pine honey, *M. hellenica* was naturally distributed to the Aegean shores, starting from the Marmara coastal region to Kaş and Kalkan, as well as İbradı and Akseki (Antalya). It was also recovered from the red pine forests of Burdur Lake and the Kozan region of Adana, but it was infected artificially from production of pine honey by honey producers in both areas. It is well distributed in Burdur, but its population levels were low in Adana in 2010 and 2011. *M. hellenica* has the highest population levels among all of the species and was observed to destroy young trees. It is of great significance to apiculture in Greece and Turkey (Santas, 1989; Gounari, 2003),

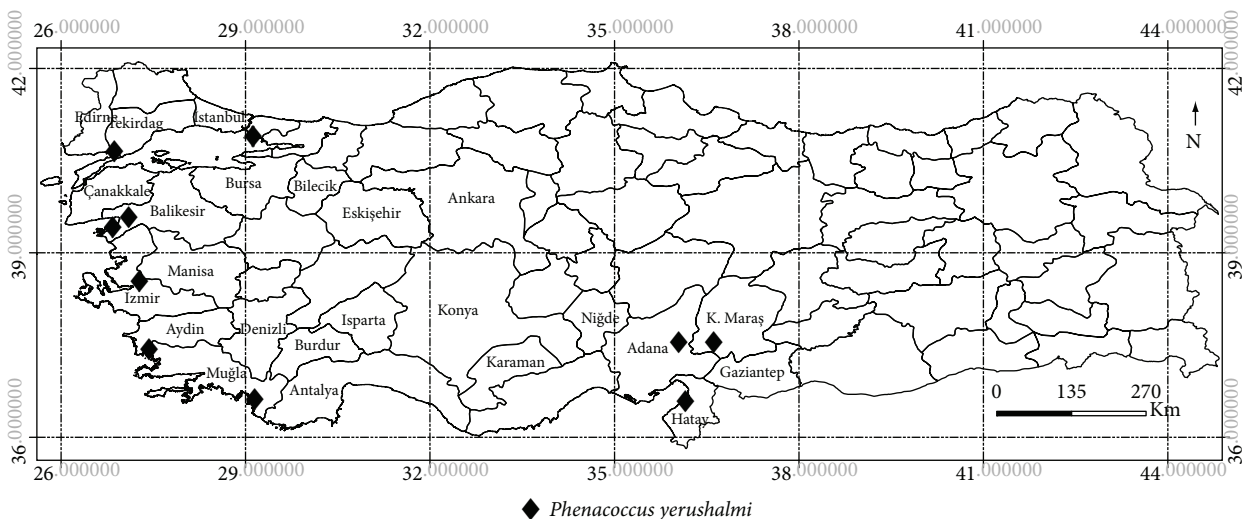


Figure 8. Geographical distribution of *Phenacoccus yerushalmi* Ben-Dov in the western part of Turkey.

and it also was reported to damage *P. pinea* trees on Ischia Island, Naples Province, Italy (Marotta and Priore, 1994). *P. fuscipennis* and *M. josephi* were well distributed in Mediterranean, Aegean, and Marmara forests, but were observed to have higher populations in Adana, Bursa, and Çanakkale forests. In this study, *P. yerushalmi* was only recovered from the Aegean region, but its presence was previously reported in the Mediterranean region (Ben-Dov et al., 2006).

Chionaspis austriaca Lindinger, 1912, *Dynaspidiotus abietis* Schrank, 1776, *Dynaspidiotus britannicus* (Newstead, 1896), *Lepidosaphes juniperi* Lindinger, 1912, *L. newsteadi* Šulc, 1895, and *Leucaspis lowi* Colvée, 1882, which were reported in previous studies of Turkish pine forest (Kaydan et al., 2007), were not recovered in the current study.

The number of coccoid species known to be present in Turkish forests rose to 42 with this study. These

species feed on needles and bark tissues, suck the sap, cause wilt symptoms and early fall of the needles, and may be deadly to the young trees. Mature trees may cope with coccoid pests but become vulnerable to bark beetles and other pests and diseases. It is important to monitor coccoid pests of the forests to maintain the balance of the ecosystem.

Acknowledgments

This project was supported by the Scientific and Technological Research Council of Turkey (TÜBİTAK-TOVAG, 108-O-359). The authors wish to thank Dr F. Kozár for identification of *Poaspis intermedia* (Department of Zoology, Plant Protection Institute, Hungarian Academy of Sciences, Budapest, Hungary) and Dr B. Kurtuluş, who made maps for collection localities (Geological Engineering Department, Muğla University).

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