Persian J. Acarol., 2020, Vol. 9, No. 3, pp. 255–277.
http://dx.doi.org/10.22073/pja.v9i3.61909
Journal homepage: http://www.biotaxa.org/pja

Article

Checklist of oribatid mites (Acari: Oribatida) of the Central Black Sea basin of Turkey with new records for the country

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ABSTRACT
Fifty two species/subspecies of oribatid mites are identified from forest areas in the central Black Sea basin and Central Anatolia. Seventeen species among them are new records for the country. For each species GPS coordinates, habitat, regional and global distribution data are provided and for new records additional remarks with taxonomic, ecological and/or regional peculiarities are given.

KEY WORDS: Biodiversity; forest; new records; Turkish mite fauna; zoogeography.

PAPER INFO.: Received: 21 May 2020, Accepted: 20 June 2020, Published: 15 July 2020

INTRODUCTION

Turkish Black Sea basin is stretched from west to east along the southern part of the Black Sea. Mountainous landscape from the east and the Black Sea from the north, create a transitional climatic profile with precipitation between 500 and 1000 mm; rich flora with intact forests are characterized by dominance of woody species such as *Fagus orinetalis* Lipsky, *Quercus* sp., *Carpinus betulus* L., *Pinus nigra* Arn. (Zeydanli 2020). Starting from north eastern Black Sea coast (which is a part of tertiary Colchis refugia) towards the east, climate gets drier supporting a wealth of habitat varieties and vegetation types (Williams *et al*. 2006). This landscape and habitat diversity is also reflected in soil animal communities which are also very high for any well studied animal taxa (Schütt 2005; Murvanidze and Mumladze 2016; Murvanidze *et al*. 2016). While oribatid fauna of the rest of Turkey is relatively poorely studied, from the Black Sea area more than 120 species are known (Ayyildiz 1988; Ayyildiz and Luxton 1989a, b; Dik *et al*. 1995, 1999; Baran and Ayyildiz 2000; Ayyildiz *et al* 2011a; Toluk and Ayyildiz 2011; Yalçin *et al*. 2013; Akman *et al*. 2018; Baran and Merve 2019); however, given the diversity of landscapes and habitats, many more species are expected to be found in this region. Here we report the species recorded in the central

How to cite: Murvanidze, M., Cilbircioğlu, C., Özdemir, E. & Inak, E. (2020) Checklist of oribatid mites (Acari: Oribatida) of the Central Black Sea basin of Turkey with new records for the country. *Persian Journal of Acarology*, 9(3): 255–277.

and eastern Black Sea areas of Turkey collected in soil and arboricolar habitats of pure pine stands and mixed deciduous forests covering three national parks close to the capital city Ankara and intact forest areas of Kastamonu region.

MATERIAL AND METHODS

Study sites

Study area including Aluçdağı, Tekkedağı and Şahinler national parks is located in transition zone of Central Anatolia and the Black Sea region with climate characteristic for the region (see above). Aluçdağı National Park was created in 2005 and covers a 90 ha area. Woody plants are represented by *Pinus nigra* Arn., *P. brutia* Ten., *Quercus* sp., *Juniperus* sp. Tekkedağı National Park was established in 2011 with a 100 ha area in total. Woody plants are represented mainly by *Pinus nigra*, *P. sylvestris* L., *Quercus* sp., *Juniperus* sp. Şahinler National Park was established in 2011 with a 40 ha area in total. Woody plants are represented mainly by *Pinus nigra*, *P. sylvestris*, *Quercus* sp., *Juniperus* sp., *Fagus* sp.

In Kastamonu region sampling was conducted in Taşköprü, Küre and Daday forests between September 2017 and December 2018. Forests are spread along transition zone of the Black sea and Küre mountain range and therefore share climate characteristics of both regions. Taşköprü forest covers 113.500 ha area, Daday forest occupies 63867 ha and Küre forest 73.693 ha area. Küre forests belong to Küre National Park, which was created in 7 July 2000 and is known as one of the diversity hotspots of Turkey because of its 930 plant, 129 bird, 48 mammal, 8 reptile and 9 amphibian registered species (Anonymous 2014).

Sampling procedures and laboratory treatment

Forty-five soil samples were taken in Aluçdağı National Park (Fig. 1), 50 samples were collected in Tekke dağı and 20 samples were collected in Şahinler by the Turkish co-authors. Each soil sample was collected randomly using a hand trowel at a depth of 0–30 cm; moss cover was taken together with soil where available. Each sample consisted of approximately 1.5 kg of soil collected by combining 3–4 sub-samples randomly taken mostly around trees. In total 115 soil samples were collected. For each site, GPS coordinates and sampling habitat description are provided.

In forests of Kastamonu region dead wood and parts of tree bark of *P. nigra* and *P. sylvestris* together with lichens (where available) were collected on 1.5 m height from the forest floor. In addition, several *P. abies* (L.) H. Karst. trunks were sampled from forest of Trabzon which is located in the Eastern Black Sea Region (Fig. 1).

All samples were placed in plastic bags, labeled and transported to the laboratory in refrigerators. Mites were extracted using Berlese-Tullgren funnels for one week and individuals were stored in 80% ethanol. For species identification temporary slides were prepared using lactic acid.

Species identification and characteristics

Only adult mites were identified to species level using mainly keys of Ghilarov and Krivolutsky (1975) and Weigmann (2006). Ecology for each species is provided after Weigmann (2006) and Murvanidze and Mumladze (2016), while global distribution data - after Subías (2004, 2020 update). Specific synonyms of the species are listed only as far as cited in Turkish literature. For each species, locations in Turkey are given based on existing literature. We could not refer to the early checklists of Turkish oribatid mites (Özkan *et al*. 1994; Erman *et al*. 2007), since these papers only indicate presence of listed species in Turkey, without any information about their location. Remarks referring to ecological, taxonomic and/or regional peculiarities are provided for each new record. For new records we also provide measurements of body length and width, rostral

(*ro*), lamellar (*le*), interlamellar (*in*), notogastral (*ng*) setae and sensilli (*ss*) in case these measures contradicted with available descriptions. Measurements were taken dorsally under Accu-Scope 3000-Led Series microscope.

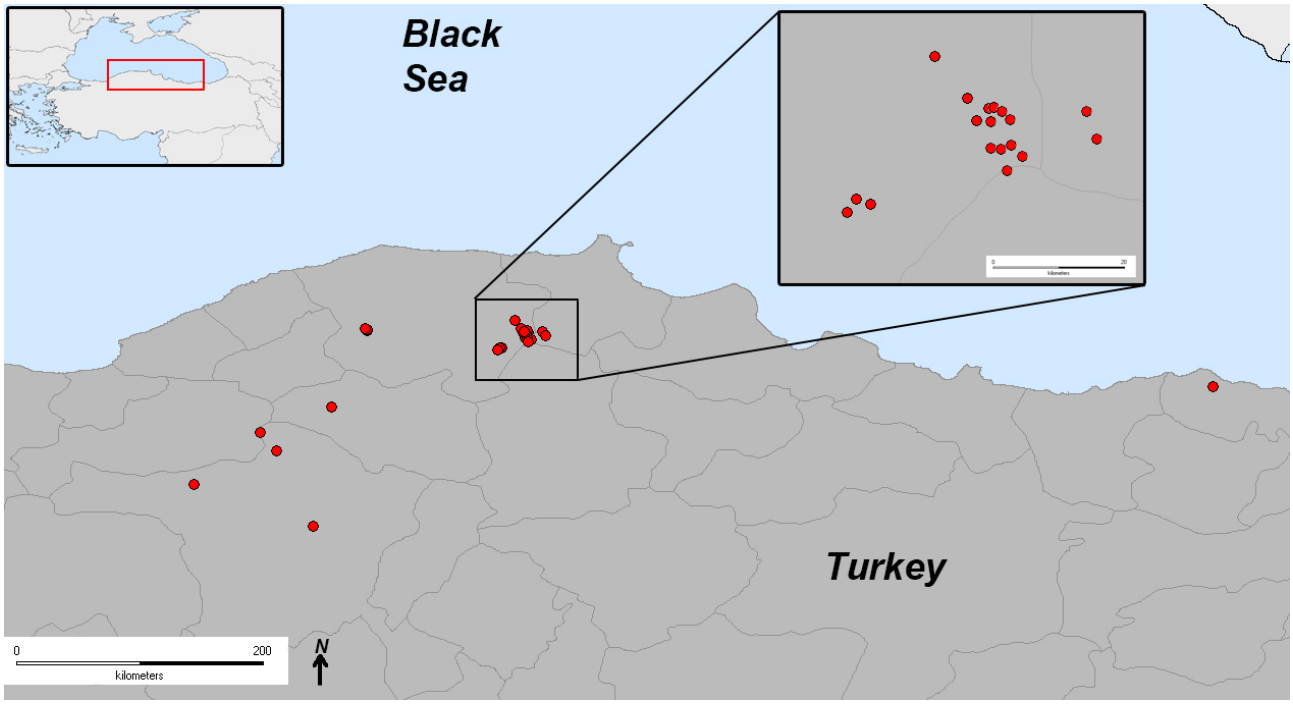

Figure 1. Map of study area with the points of data collection.

We followed systematic statement of Schatz *et al*. (2011). Species names are mostly provided after Weigmann (2006), for all ptyctimous mites catalogue of Niedbala and Liu (2018) was used. The new records for Turkey are marked with an asterisk (*)

RESULTS

Superfamily Epilohmannioidea Oudemans, 1923
Family Epilohmanniidae Oudemans, 1923

Epilohmannia (*Epilohmannia*) *cylindrica* (Berlese, 1904)

Material – One specimen in Saraycık forest processing area, Taşköprü forest, N 41° 20′ 46.25″, E 34° 33′ 15.72″, alt. = 1223 m, 20 June 2018, dead *P. nigra*.
Previous records in Turkey – Erzurum, Konya (Dik *et al*. 1999), Kayseri (Toluk and Ayyildiz 2008a), Kocaeli (Yaça and Baran 2019), Sakarya (Baran *et al*. 2015).
Global distribution – Cosmopolitan.
Ecology – Dry soils.

Superfamily Euphthiracaroidea Jacot, 1930
Family Euphthiracaridae Jacot, 1930

Acrotritia ardua (C.L. Koch, 1841)

Syn.: *Rhysotritia ardua* (C.L. Koch, 1841) *sensu* Baran and Ayyildiz (2000)

Material – One specimen in Taşköprü forest, N 41° 20′ 09.64″, E 34° 25′ 58.98″, alt. = 1327 m, 23 June 2018; one specimen in Taşköprü forest, N 41° 22′ 29.96″, E 34° 25′ 57.29″, alt. = 1200 m, 17 July 2018, tree bark and debris of *P. nigra.*
Previous records in Turkey – Artvin Province (Ayyildiz *et al*. 2011a), Erzincan, Ankara (Baran and Ayyildiz 2000).
Global distribution – Cosmopolitan.
Ecology – All types of habitats.

Superfamily Phthiracaroidea Perty, 1841
Family Phthiracaridae Perty, 1841

Phthiracarus (*Phthiracarus) ferrugineus* (C.L. Koch, 1841)*

Material – New record for Turkey. One specimen in Trabzon, N 40° 58′ 24.75″, E 39° 30′ 25.55″, alt. = 348 m, Yeşiltepe Forest Area, Akçabat. 06 June 2018, trunk of *P. abies.*
Global distribution – Holarctic.
Ecology – Forest soils.
Note – The species is known to be generally associated with forest soils (Weigmann 2006), however, is recorded for arboricolar habitats as well. It was found abundantly on twigs and leaves of *Rhododendron ponticum* L. (Murvanidze and Arabuli 2015).

Steganacarus (*Tropacarus*) *carinatus carinatus* (C.L. Koch, 1841)*

Material – New record for Turkey. Two specimens in Aluçdağı National Park, N 40° 49′ 75.37″, E 32° 58′ 26.46″, alt. = 1402 m, 17 July 2018, soil.
Global distribution – Palaearctic.
Ecology – All types of habitats.

Superfamily Crotonioidea Thorell, 1876
Family Crotoniidae Thorell, 1876

Camisia (*Camisia*) *horrida* (Hermann, 1804)

Material – One specimen in Aluçdağı National Park, N 40° 49′ 7537″, E 32° 58′ 2646″, alt. = 1402 m, 17 July 2018, soil.
Previous record in Turkey – Sivas (Toluk and Akın 2017).
Global distribution – Holarctic.
Ecology – Soil, moss, frequent on tree trunks and canopy.

Family Nothridae Berlese, 1896

Nothrus borussicus Sellnick, 1928

Material – One specimen in Aluçdağı National Park, N 40° 49′ 75.37″, E 32° 58′ 26.46″, alt. = 1402 m, 17 July 2018, soil.
Previous record in Turkey – Konya (Zeytun *et al*. 2017).
Global distribution – Palaearctic.
Ecology – Alpine meadows and mountain forests.

Superfamily Neoliodoidea Sellnick, 1928
Family Neolididae Sellnick 1928

***Poroliodes farinosus* (C.L. Koch, 1839)**

Material – One specimen in Taşköprü forest, N 41° 15′ 36.46″, E 34° 13′ 11.96″, alt. = 1236 m, 15 May 2018, tree bark and debris of *P. nigra.*
Previous record in Turkey – Uzunulok forest in Erzurum (Yalçin *et al*. 2013).
Global distribution – Palaearctic.
Ecology – Arboricolar, rare in forest and meadow soils.

Superfamily Plateremaeoidea Trägardh, 1931
Family Aleurodamaeidae Paschoal & Johnston, 1984

***Aleurodamaeus setosus* (Berlese, 1883)**

Material – One specimen in Çiftlik Village Tekçam Area, Taşköprü forest, N 41° 15′ 19.75″, E 34° 14′ 06.85″, alt. = 1329 m, 15 May 2018, tree bark and debris of *P. nigra.*
Previous record in Turkey – Cat forest, Sivas Province (Toluk and Akin 2017).
Global distribution – Palaearctic.
Ecology – Forest soils.

Superfamily Cepheoidea Berlese, 1896
Family Cepheidae Berlese, 1896

***Eupterotegaeus ornatissimus* (Berlese, 1908)**

Material – One specimen in Aluçdağı National Park, N 40° 49′ 75.37″, E 32° 58′ 26.46″, alt. = 1402 m, 15 July 2018, soil.
Previous record in Turkey – Sakarya (Susyal *et al*. 2018).
Global distribution – Holarctic.
Ecology – Forest soils.

Superfamily Ameroidea Bulanova-Zachvatkina, 1957
Family Eremulidae Grandjean, 1965

***Eremulus flagellifer* Berlese, 1908**

Material – One specimen in Daday forest, N 41° 23′ 55.18″, E 33° 13′ 09.44″, alt. = 1136 m, 19 October 2018, tree bark and debris from *P. nigra.*
Prevous record in Turkey – Yozgat Province (Per *et al*. 2018).
Global distribution – Cosmopolitan.
Ecology – Forest soils and meadows.

Superfamily Zetorchestoidea Michael, 1898
Family Eremaeidae Oudemans, 1900

Eueremaeus oblongus quadrilamellatus* (Hammer, 1952)

Material – New record for Turkey. One specimen in Aluçdağı National Park, Ankara, N 40° 49′ 75.37″, E 32° 58′ 26.46″, alt = 1402 m, 15 July 2018, soil.
Global distribution – Holarctic.
Ecology – Forest soils and litter. It was described from thick litter made of leaves and spruce needles (Hammer 1952).

Superfamily Gustavioidea Oudemans, 1900
Family Astegistidae Balogh, 1961

Cultroribula bicultrata (Berlese, 1905)

Material – One specimen in Taşköprü forest, Karadedeoğlu Village, N 41° 23′ 08.05″, E 34° 25′ 07.52″, alt. = 1126 m, 24 July 2018, tree bark and debris of *P. Nigra*; one specimen in Çamkonak Forest Processing Area, Daday forest. N 41° 23′ 55.18″, E 33° 13′ 09.44″, alt. = 1136 m, 30 May 2018, tree bark and debris of *P. nigra*.
Previous record in Turkey – Kocaeli (Baran and Merve 2019; Yaça and Baran 2019).
Global distribution – Holarctic.
Ecology – Forest soils.

Family Liacaridae Sellnick, 1928

Adoristes (*Adoristes*) *ovatus* (C.L. Koch, 1839)

Material – One specimen in Çiftlik Village Tekçam Area,Taşköprü forest, N 41° 14′ 39.56″, E 34° 12′ 19.57″, alt. = 1422 m, 15 May 2018, tree bark and debris of *P. nigra*.
Previous record in Turkey – Erzurum (Akman *et al*. 2018).
Global distribution – Holarctic.
Ecology – All types of soils with preference of forest habitats.

Liacarus (*Liacarus) brevilamellatus* Mihelčič, 1955

Material – One specimen in Çamkonak Forest Processing Area, Daday forest, N 41° 23′ 25.96″, E 33° 13′ 58.20″, alt. = 1271 m, 19 October 2018, dead *P. nigra*; one specimen in Saraycık Forest Processing Area, Taşköprü Forest, N 41° 22′ 51.20″, E 34° 32′ 18.21″, alt. = 1128 m, 15 July 2018, tree bark and debris of *P. nigra*.
Previous records in Turkey – Erzurum (Ocak *et al*. 2007), Kocaeli (Yaça and Baran 2019).
Global distribution – Palaearctic.
Ecology – Forest soils, moss, litter

Liacarus (*Liacarus*) *coracinus* (C.L. Koch, 1841)

Material – One specimen in Aluç Dağı (mountain) Natural Park, Ankara, N 40° 49′ 75.37″, E 32° 58′ 26.46″, alt. = 1402 m, 15 July 2018, soil.
Previous records in Turkey – Giresun, Mersin, Ordu and Samsun, Trabzon (Grobler *et al*. 2003), Kocaeli (Yaça and Baran 2019).
Global distribution – Palaearctic.
Ecology – Forest soils, moss, litter.

Family Peloppiidae Balogh, 1943

***Ceratoppia quadridentata* (Haller, 1882)**

Material – One specimen in Saraycık Forest Processing Area, Taşköprü forest, N 41° 22′ 51.20″, E 34° 32′ 18.21″, alt. = 1128 m, 15 July 2018, tree bark and debris of *P. nigra.*
Previous record in Turkey – Erzurum (Akman *et al*. 2018).
Global distribution – Holarctic.
Ecology – Forest soils.

Superfamily Carabodoidea C.L. Koch, 1837
Family Carabodidae C.L. Koch, 1837

***Carabodes* (*Carabodes*) *labyrinthicus* (Michael, 1879)**

Material – One specimen in Çiftlik Village Tekçam Area, Taşköprü forest, N 41° 14′ 39.56″, E 34° 12′ 19.57″, alt. = 1422 m, 15 May 2018; one individual in Alasökü Village,Taşköprü forest, N 41° 20′ 09.64″, E 34° 25′ 58.98″, alt. = 1327 m, 10 June 2018, tree bark and debris of *P. nigra.*
Previous record in Turkey – Bolu (Toluk and Ayyildiz 2016).
Global distribution – Holarctic.
Ecology – Forest soils, moss, litter, tree bark and canopy.

Superfamily Oppioidea Grandjean, 1951
Family Epimerellidae Ayyildiz & Luxton, 1989

***Epimerella smirnovi longisetosa* Kulijev, 1967**

Material – One specimen in Tekke Dağı Natural Park, Ankara, N 40° 16′ 96.96″, E 31° 91′ 72.68″, alt. = 1424 m, 25 July 2018, soil.
Previous record in Turkey – Amanos mountains (Ay and Ayyildiz 2019).
Global distribution – Mediterranean.
Ecology – Dry meadows and urban soils.
Remarks – Kulijev (1962) reported a longer size for sensilli for *E. smirnovi smirnovi* Kulijev, 1962 (94 µm), while in paper published in 1967, the size of sensilli is indicated as 54 µm, but no size of sensilli is indicated for *E. smirnovi longisetosa*. We measured sensilli for Turksih individual which equals 80 µm. For *Epimerella smirnovi smirnovi* found in Georgia, size of sensilli is between 75–80 µm and matches the size of Turkish specimen.

Family Oppiidae Grandjean, 1954

Graptoppia* (*Graptoppia*) *paraanalis* Subias and Rodriguez, 1985

Material – New record for Turkey. One specimen in Çiftlik Village, Tekçam Area, Taşköprü forest, Kastamonu, N 41° 27′ 39.53″, E 34° 19′ 42.99″, alt. = 898 m, 5 June2018; one specimen in Yeşiltepe Area, Akçaabat, Trabzon, 27 May 2018, N 40° 58′ 24.75″, E 39° 30′ 25.55″, alt. = 348 m; seven specimens in Alasökü Village,Taşköprü forest, Kastamonu, 16 June 2018, N 41° 20′ 09.64″, E 34° 25′ 58.98″, alt = 1327 m; three specimens in Çamkonak Forests, Daday, Kastamonu, 09 October 2018, N 41° 23′ 54.24″, E 33° 13′ 13.73″, alt. = 1147 m. Tree bark and debris of *P. abies* and *P. nigra.*
Global distribution – Palaearctic.
Ecology – Litter and soil.

Remarks – Turkish individuals are larger (285 × 155 µm) than reported by Subías and Rodriguez (1985) for Spanish and Italian specimens (232–245 µm). All other characters match the original description (Subías and Rodriguez 1985).

Lauroppia fallax (Paoli, 1908)

Material – One specimen in Aluç Dağı Natural Park, Ankara, N 40° 49′ 75.37″, E 32° 58′ 26.46″, alt. = 1402 m, 15 July 2018, soil.
Previous records in Turkey – Locality unknown (Toluk and Ayyildiz 2008).
Global distribution – Semicosmopolitan.
Ecology – All types of habitats.

Ramusella (Insculptoppia) insculpta (Paoli, 1908)

Material – One specimen in Saraycık Forest Processing Area, Taşköprü, N 41° 18′ 10.00″, E 34° 25′ 48.64″, alt. = 1277 m, 10 July 2018, *P. sylvestris,* dead tree; one specimen in Karadedeoğlu Village Tekkeyaylası Area, Taşköprü forest, N 41° 22′ 55.26″, E 34° 24′ 19.06″, alt. = 1177 m, 2 August 2018, *P. nigra,* dead tree; three specimens in Yeşiltepe Area, Akçaabat, Trabzon, N 41° 20′ 09.64″, E 34° 25′ 58.98″, alt. = 1327 m, 2 June 2018, tree trunk of *P. abies.*
Previous record in Turkey – Erzurum (Baran and Ayyildiz 2004), Trabzon, Samsun (Ayyildiz 1989), Ankara (Çobanoğlu and Bayram 1998).
Global distribution – Palaearctic.
Ecology – All types of habitats.

Superfamily Tectocepheoidea Grandjean, 1954
Family Tectocepheidae Grandjean, 1954

Tectocepheus punctulatus Djaparidze, 1985*

Material – New record for Turkey. Five specimens in Aluç Dağı Natural Park, Ankara. N 40° 49′ 75.37″, E 32° 58′ 26.46″, alt. = 1402 m. 15 July 2018, Soil.
Global distribution – Palaearctic.
Ecology – All types of habitats.

Tectocepheus velatus sarekensis Trägårdh, 1910
Syn.: *T. sarekensis sensu* Dik *et al*. (1999)

Material – One specimen in Alasökü Village, Taşköprü forest, N 41° 20′ 09.64″, E 34° 25′ 58.98″, alt. = 1327 m, 2 July 2018; one specimen in Çamkonak Forest Processing Area, Daday, N 41° 23′ 54.24″, E 33° 13′ 13.73″, alt. = 1147 m, 19 October 2018, tree bark and debris of *P. nigra.*
Previous record in Turkey – Konya (Dik *et al*. 1999).
Global distribution – Cosmopolitan.
Ecology – All types of habitats.

Superfamily Cymbaeremaeoidea Sellnick, 1928
Family Cymbaeremaeidae Sellnick, 1928

Cymbaeremaeus cymba (Nicolet, 1855)

Material – One specimen in Karadedeoğlu Village, Taşköprü forest, N 41° 23′ 08.05″, E 34° 25′

07.52″, alt. = 1126 m, 17 July 2018, tree bark and debris of *P. nigra.*
Previous records in Turkey – Ankara (Grobler *et al*. 2004), Izmir (Çobanoğlu 2009).
Global distribution – Palaearctic.
Ecology – All types of habitats. Frequent on tree barks and canopy.

Superfamily Licneremaeoidea Grandjean, 1931
Family Licneremaeidae Grandjean, 1931

Licneremaeus licnophorus (Michael, 1882)

Material – One specimen in Karadedeoğlu Village Tekkeyaylası Area, Taşköprü forest, N 41° 22′ 24.45″, E 34° 23′ 25.15″, alt. = 1224 m, 2 August 2018, tree trunk of *P. nigra*; one specimen in Karadedeoğlu Village, Taşköprü forest, N 41° 22′ 55.11″, E 34° 24′ 03.56″, alt. = 1201 m, 17 July 2018, tree bark and debris of *P. nigra*.
Previous record in Turkey – Bolu (Toluk and Ayyildiz 2011).
Global distribution – Holarctic.
Ecology – Moss, tree trunks.

Family Passalozetidae Grandjean, 1954

Passalozetes africanus Grandjean, 1932

Material – One specimen in Kalecik, N 40° 06′ 44.50″, E 33° 25′ 43.30″, alt. = 732 m, 20 July 2018, soil with litter in vineyard.
Previous record in Turkey – Erzurum (Ayyildiz 1988).
Global distribution – Palaearctic.
Ecology – Dry meadow soil.

Superfamily Phenopelopoidea Petrunkevitch, 1955
Family Phenopelopidae Petrunkevitch, 1955

Eupelops acromios (Hermann, 1804)

Material – Two specimens in Çiftlik Village, Tekçam Area, Taşköprü forest, N 41° 14′ 39.56″, E 34° 12′ 19.57″, alt. = 1422 m, 15 May 2018, tree bark and debris of *P. nigra*.
Previous record in Turkey – Konya (Dik *et al*. 1999).
Global distribution – Semicosmopolitan.
Ecology – All types of habitats.

Eupelops plicatus (C.L. Koch, 1835)*

Material – New record for Turkey. One specimen in Ankara university campus, N 39° 96′ 35.51″, E 32° 86′ 11.78″, alt. = 858 m, 25 July 2018, mushrooms.
Global distribution – Holarctic.
Ecology – All types of habitats.
Remarks – Measurements: The size of Turkish specimen (500 × 345 µm) is at the lower range provided in the literature (Weigmann 2006). All characters match previous descriptions (Ghilarov and Krivolutsky 1975; Beck and Woas 1991; Weigmann 2006).

***Peloptulus* (*Peloptulus*) *phaeonotus* (C.L. Koch, 1844)**

Material – One specimen in Köçekli Village, Taşköprü forest, N 41° 24′ 05.84″, E 34° 22′ 30.42″, alt. = 1193 m, 10 August 2018, tree bark and debris of *P. sylvestris.*
Previous record in Turkey – Kayseri (Seniczak *et al*. 2014)
Global distribution – Palaearctic.
Ecology – All types of habitats.

Superfamily Achipterioidea Thor, 1929
Family Achipteriidae Thor, 1929

***Parachipteria fanzagoi* (Jacot, 1929)**
Syn.: *Parachipteria willmanni* van der Hammen, 1952 *sensu* Per and Ercan (2018)

Material – Two specimens in Aluç Dağı Natural Park, Ankara, N 40° 49′ 75.37″, E 32° 58′ 26.46″, alt. = 1402 m, 15 July 2018, soil.
Previous record in Turkey – Kayseri (Per and Ercan 2015)
Global distribution – Holarctic.
Ecology – Forest moss, litter and soils.
Remarks – In the world catalogue of Subías (2020 update) this species is listed as *Campachipteria* (*Triachipteria*) *fanzagoi* (Jacot, 1929). In the ckecklist of Georgian oribatid mites (Murvanidze and Mumladze 2016), we explained the reasons of disagreements with this placement with the main reason of *Campachipteria* species having monodactylous legs (Aoki 1995) and *P. fanzagoi* being the tridactylous species. The name of the species is provided after Weigmann (2006).

Family Tegoribatidae Grandjean, 1954

***Lepidozetes singularis* Berlese, 1910**

Material – Two specimens in Çiftlik Village Tekçam Area, Taşköprü forest, N 41° 14′ 39.56″, E 34° 12′ 19.57″, alt. = 1422 m, 15 May 2018, tree bark and debris of *P. nigra.*
Previous record in Turkey – Erzurum (Ayyildiz *et al*. 2011b).
Global distribution – Holarctic.
Ecology – forest soils, moss, frequent on trees.

Superfamily Oripodoidea Jacot, 1925
Family Haplozetidae Grandjean, 1936

***Protoribates* (*Protoribates*) *capucinus* (Berlese, 1908)**

Material: Two specimens in Saraycık Forest Processing Area, Taşköprü forest, N 41° 22′ 51.20″, E 34° 32′ 18.21″, alt. = 1128 m, 3 July 2018; one specimen in Çamkonak Forest Processing Area, Daday, N 41° 23′ 54.24″, E 33° 13′ 13.73″, alt. = 1147 m, 30 May 2018, tree trunk of *P. nigra.*
Previous records in Turkey – Erzurum (Ayyildiz 1988), Kocaeli (Yaça and Baran 2019), Konya (Dik *et al*. 1999).
Global distribution – Cosmopolitan.
Ecology – All types of habitats with preference of humid forest soils.

Family Oribatulidae Thor, 1929

Oribatula (*Zygoribatula*) *exilis exilis* (Nicolet, 1855)

Material – Two specimens in Karadedeoğlu Village, Tekkeyaylası Area, Taşköprü forest, N 41° 22′ 24.45″, E 34° 23′ 25.15″, alt. = 1224 m, 2 August 2018, tree trunk of *P.nigra*; 8 specimens in Çiftlik Village, Tekçam Area, Taşköprü forest, 15 May 2018, N 41° 15′ 19.75″, E34° 14′ 06.85″, alt. = 1329 m, tree bark and debris of *P. nigra.*
Previous record in Turkey – Ankara (Grobler *et al*. 2005).
Global distribution – Holarctic.
Ecology – All types of habitats.

Oribatula (*Zygoribatula*) *frisiae* (Oudemans, 1900)

Material – Twenty specimens in Güdül, N 40° 2′ 03.34″, E 32° 15′ 23.28″, alt. = 729 m, 20 July 2018, soil with litter in vineyard.
Previous records in Turkey – Ankara (Kumral and Cobanoğlu 2016), Kocaeli (Yaça and Baran 2019).
Global distribution – Holarctic.
Ecology – Forest and urban soils.

Oribatula (*Zygoribatula*) *nicora* (Djaparidze, 1985)

Material – Twelve specimens in Karadedeoğlu Village, Taşköprü forest, N 41° 22′ 55.11″, E 34° 24′ 03.56″, alt. = 1204 m, 24 July 2018, tree bark and debris of *P. nigra*; 21 specimens in Yeşiltepe Area, Akçaabat, Trabzon, N 40° 58′ 24.75″, E 39° 30′ 25.55″, alt. = 348 m, 22 May 2018, tree bark and debris of *P. abies*; one specimen in Alasökü Village, Taşköprü, N 41° 19′ 56.66″, E 34° 24′ 24.72″, alt. = 1468 m, 16 June 2018, tree bark and debris of *P. sylvestris*; three specimens in Çamkonak Forest Processing Area, Daday forest, N 41° 23′ 3.74″, E 33° 14′ 02.03″, alt. = 1382 m, 19 October 2018, tree bark and debris of *P. nigra*.
Previous records in Turkey – Halaçli, Taşköprü Kabalar, Merkez Uzunkavak, Taşköprü Kızılcaören, Taşköprü Ağcıkişi, Merkez Çavundur, Hanönü Kornapa, Taşköprü Ağcıkişi villages in Kastamonu region (Murvanidze *et al*. 2018).
Global distribution – Caucasus.
Ecology – All types of habitats.

Oribatula (*Zygoribatula*) *propinqua* (Oudemans, 1900)*

Material – New record for Turkey. One specimen in Şahinler Natural Park, Ankara.Woody plants are represented by *Pinus nigra*, *P. sylvestris* L., *Quercus* sp., *Fagus* sp., N 40° 61′ 74.65″, E 32° 45′ 55.46″, alt. = 1660 m, 16 June 2018, soil with moss.
Global distribution – Palaearctic.
Ecology – On the trees, rare in dry soils.

Phauloppia rauschenensis (Sellnick, 1908)*

Material – New record for Turkey. Three specimens in Karadedeoğlu Village, Tekkeyaylası Forest Area, Taşköprü-Kastamonu, N 41° 22′ 23.26″, E 34° 24′ 22.11″, alt. = 1187 m, 17 July 2018, tree bark from *P. nigra* and *P. sylvestris*.
Global distribution – Palaearctic.
Ecology – Forest soils, frequent in canopy.

Remarks – Measurements: Body size: 400–430 × 195–215 µm. *ro* 45 µm, *in* 40 µm, *le* 45 µm, *ss* 25 µm, all *ng* setae except *dp* and *lp* 30–35 µm, *dp* and *lp* 40 µm.

Body size of Turkish individuals is at the upper range of the reported size, i.e. 310–390 µm (Weigmann 2006) or larger. Notogastral sculpture (foveolae) is evident at the sides of the notogaster. *Areae porosae* are round and small. Sensilli with short stalk and rounded head. Notogastral setae about 30–40 µm in length *versus* reported 25 µm (Weigmann 2006).

Species prefers canopy habitats (Weigmann 2006). This habitat preference is proved by Turkish findings on the bark of the pine trees. *Phauloppia rauschenensis* was found abundantly on branches of *Picea orientalis* and in lower numbers on *Fagus orientalis* in mixed forests of Borjom-Kharagauli National Park in Georgia (Murvanidze and Mumladze 2014). Presence of this species on beech bark was also reported by Wunderle *et al.* (1990). This shows that *P. rauschenensis* prefers canopy habitats in general, with no difference between coniferous or broad-leaved tree species.

Siculobata (*Paraleius*) *leontonycha* (Berlese, 1910)*

Material – New record for Turkey. Four specimens in Karadedeoğlu Village, Tekkeyaylası Forest Area, Taşköprü-Kastamonu, N 41° 22′ 23.26″, E 34° 24′ 22.11″, alt. = 1187 m, 23 August 2018; two specimens in Alasökü Village Forests, Taşköprü-Kastamonu N 41° 20′ 09.64″, E 34° 25′ 58.98″, alt. = 1327 m, 10 June 2018, tree bark and debris of *P. nigra* and *P. sylvestris.*
Global distribution – Holarctic.
Ecology – Bark debris around the trunks, in pathways of woodborer beetles.
Remarks – Measurements: Weigmann (2006) reports size of *S. leontonycha* as 435–500 µm. Travé (1960),Wunderle *et al*. (1990) and Perez-Iñigo (1993) also indicate larger individuals (440–500 µm, 435–480 µm and 440–500 µm respectively), while Ghilarov and Krivolutsky (1975) and Mahunka (1996) do not indicate body size at all. All Turkish individuals are smaller (360–365 × 215–220 µm) than reported. The rest of the characters match with provided descriptions.

The species is known to be arboricolar (Weigmann 2006). Turkish records prove this habitat preference by finding all individuals on bark of pine tree species. Checklist of oribatid mites of Georgia (Murvanidze and Mumladze 2016) report presence of this species in soils of alpine meadow after the catalogue of Caucasian oribatids of Shtanchaeva and Subias (2010), however, this report is a mistake, because the catalogue does not list *S. leontonycha* at all and Georgian record can be discarded.

Family Scheloribatidae Grandjean, 1933

Liebstadia (*Liebstadia*) *similis* (Michael, 1888)

Material – One specimen in Yeşiltepe Area, Akçaabat, Trabzon, N 40° 58′ 24.75″, E 39° 30′ 25.55″, alt. = 348 m, 27 May 2018, tree trunk of *P. abies*; five specimens in Saraycık Forest Processing Area, Taşköprü, 15 July 2018, tree bark and debris of *P. nigra.*
Previous records in Turkey – Erzurum (Ayyildiz 1988), Ankara (Grobler *et al*. 2004).
Global distribution – Holarctic.
Ecology – All types of habitats.

Scheloribates (*Scheloribates*) *barbatulus* Mihelčič, 1956*

Material – New record for Turkey. Two specimens in Çamkonak Forest Processing Area, Daday forest, N 41° 23′ 54.24″, E 33° 13′ 13.73″, alt. = 1147 m, 30 May 2018, tree bark of *P. nigra.*
Global distribution – Palaearctic.
Ecology – Forest soils.

Remarks – Although the species is known not to be adapted to arboricolar habitats (Perez-Iñigo 1993) we found them on bark of the pine tree. Other representative of genus *Scheloribates* [*S. latipes* (C.L. Koch, 1841)] has been reported in minor numbers on twigs of spruce and beech trees (Murvanidze and Mumladze 2014).

Scheloribates (*Scheloribates*) *laevigatus* (C.L. Koch, 1835)

Material – Sixteen specimens in Aluç Dağı Natural Park, Ankara, 19 July 2018, N 40° 49′ 75.37″, E 32° 58′ 26.46″, alt. = 1402 m, soil.
Previous records in Turkey – Erzincan (Dik *et al*. 1995), Konya (Dik *et al*. 1999), Kocaeli (Yaça and Baran 2019).
Global distribution – Semicosmopolitan.
Ecology – All types of habitats.

Scheloribates (*Scheloribates*) *latipes* (C.L. Koch, 1844)

Material – One specimen in Çiftlik Village, Tekçam Area, Taşköprü forest, N 41° 22′ 14.15″, E 34° 22′ 36.05″, alt. = 1272 m, 5 September 2018, tree trunk of *P. nigra*; three specimens in Karadedeoğlu Village, Taşköprü forest, N 41° 22′ 55.11″, E 34° 24′ 03.56″, alt. = 1204 m, 24 July 2018, tree trunk of *P. nigra*; one specimen in Çiftlik Village, Tekçam Area, Taşköprü forest, N 41° 15′ 19.75″, E 34° 14′ 06.85″, alt. = 1329 m, 15 May 2018, tree bark and debris of *P. nigra.*
Previous record in Turkey – Konya (Dik *et al*. 1999).
Global distribution – Semicosmopolitan.
Ecology – All types of habitats.

Superfamily Ceratozetoidea Jacot, 1925
Family Ceratozetidae Jacot, 1925

Ceratozetes (*Ceratozetes*) *colchicus* Murvanidze & Weigmann, 2003*

Material – New record for Turkey. One specimen in Alasökü Village, Taşköprü forest, N 41° 19′ 55.68″, E 34° 25′ 16.18″, alt. = 1369 m, 16 June 2018, tree trunk of *P. sylvestris;* one specimen in Şahinler Natural park, Ankara. N 40° 61′ 74.65″, E 32° 45′ 55.46″, alt. = 1670 m, 16 June 2018, soil.
Global distribution – Caucasus and Turkey.
Ecology – Humid forest soils.
Remarks – Measurements: Body size: 500 × 320 µm. *ro* 65 µm, *in* 130 µm, *le* 75 µm, *ss* 95 µm, *ng* vestigial.

Turkish specimens show smaller size compared to the original description (Murvanidze and Weigmann 2003): 1) body length in Turkish specimens is about 500–510 µm, while in description 540–580 µm is indicated; 2) lamellar setae 75 µm *vs* reported 85 µm; 3) *ss* 95 µm *vs*150 µm; 4) length of lamellar cuspides 50 µm *vs* 80 µm. The rest of the characters match the provided description and paratypes available in the collection of the Georgian Agricultural University.

Ceratozetes (*Ceratozetes*) *conjunctus* Mihelčič, 1956*

Material – New record for Turkey. One specimen in Alasökü Village, Taşköprü forest, N 41° 19′ 55.68″, E 34° 25′ 16.18″, alt. = 1369 m, 16 June 2018; one specimen in Alasökü Village, Taşköprü forest, N 41° 19′ 55.16″, E 34° 25′ 08.12″, alt. = 1408 m, 2 July 2018; one specimen in Çamkonak

forests, Daday, Kastamonu, N 41° 23′ 43.63″, E 33° 13′ 38.96″, alt. = 1215 m, 19 October 2018, tree trunk of *P. sylvestris.*
Global distribution – Palaearctic.
Ecology – Alpine meadow and forest soils.

Ceratozetes (*Ceratozetes*) *minutissimus* Willmann, 1951*

Material – New record for Turkey. One specimen in Yeşiltepe forest area, Akçabat, Trabzon, N 40° 58′ 24.75″, E 39° 30′ 25.55″, alt. = 348 m, 22 May 2018, soil under *P. sylvestris.*
Global distribution – Palaearctic.
Ecology – Forest and meadow soils.

Jugatala angulata (C.L. Koch, 1839)*

Material – New record for Turkey. One specimen in Karadedeoğlu Village, Tekkeyaylasi forest area, Taşköprü-Kastamonu, N 41° 22′ 23.26″, E 34° 24′ 22.11″, alt. = 1187 m, 17 July 2018, tree bark of *P. nigra.*
Global distribution – Europe.
Ecology – Arboricolar, mostly on coniferous trees (spruce and pine).
Remarks – Measurements: Body size: 600 × 370 µm.

All characters match the description provided by Weigmann (2006), however, Bayartogtokh and Schatz (2008) report a smaller size (486 µm) for individuals found in Austria. Up to now *J. angulata* was known from Europe only (Weigmann 2006; Bayartogtokh and Schatz 2008). Our record broadens the area of occurrence for this species. We confirm habitat preference of *J. angulata* by finding it on the bark of the pine tree as originally described, however, Sobek *et al*. (2008) indicate presence of the species on broadleaved trees (beech and oak) as well.

Trichoribates (*Trichoribates*) *myricus* Gjelstrup and Solhöy, 1994*

Material – New record for Turkey. Two specimens in Aluç Dağı Natural Park, Ankara, N 40° 49′ 75.37″, E 32° 58′ 26.46″, alt. = 1402 m, 15 June 2018, soil.
Global distribution – Euroatlantic.
Ecology – Humid meadows, forest soils.
Remarks – Measurements: Body size of Turkish individuals (570 × 345 µm) is smaller than provided in original description (650 × 420 µm) (Gjelstrup and Solhöy 1994), however Weigmann (2006) reports smaller size (555–670 µm), so that our findings match within the given range. Weigmann (2006) also indicates size of nogastral setae up to 60 µm, while for Turkish individuals these setae are even shorter, 45 µm.

This is the first record of the species out of Europe. Previous findings were known from Iceland (Gjelstrup and Solhöy 1994) and Germany (Weigmann 2006). The species was described from bogs and swamps in Island and was additionally found in Schleswig-Holstein and Odertal in Germany (Weigmann 2006). Finding site in forested area of Turkey adds more information about habitat preferences for this species.

Family Mycobatidae Grandjean, 1954

Punctoribates (*Punctoribates*) *punctum* (C.L. Koch, 1839)

Material – Nine specimens in Saraycik Forest Processing Area, Taşköprü, N 41° 19′ 15.36″, E 34° 26′ 57.46″, alt. = 1122 m, 27 June 2018; one individual in Karadedeoğlu Village, Taşköprü, N 41°

22′ 23.26″, E 34° 24′ 22.11″, alt. = 1187 m, 2 August 2018; one specimen in Saraycık Forest Processing Area, Taşköprü, N 41° 19′ 15.36″, E 34° 26′ 57.46″, alt. = 1122 m, 15 July 2018, tree trunk of *P. sylvestris*.
Previous records in Turkey – Demirli, Çarsamba (Bayartogtokh *et al*. 2002).
Global distribution – Cosmopolitan.
Ecology – All types of habitats.

Superfamily Galumnoidea Jacot, 1925
Family Galumnidae Jacot, 1925

Galumna (*Galumna*) *alata* (Hermann, 1804)*

Material – New record for Turkey. One specimen in Tekke Dağı (mountain) Natural Park, Ankara, N 40° 16′ 96.96″, E 31° 91′ 72.68″, alt. = 1485 m, 25 July 2018.
Global distribution – Semicosmopolitan.
Ecology – All types of habitats.
Remarks – Measurements: Body size of Turkish individual is a little smaller (450 × 345 µm) than reported by Perez-Iñigo (1993) and Weigmann (2006), 500–630 µm. All other characters match available descriptions. The species is easy to identify by shape of sensilli, rounded areae porosae which are almost similar in size and group of irregular spots on posterior part of notogaster.

Galumna (*Galumna*) *lanceata* (Oudemans, 1900)*

Material – New record for Turkey. One specimen in Saraycık forest area, Taşköprü forests, Kastamonu, N 41° 18′ 10.00″, E 34° 25′ 48.64″, alt. = 1277 m, 10 July 2018, tree bark and debris of *P. nigra.*
Global distribution – Palaearctic.
Ecology – Humid forest soils.

Pergalumna (*Pergalumna*) *nervosa* (Berlese, 1914)

Material – One specimen in Aluç dağı natural park, Ankara, N 40° 49′ 75.37″, E 32° 58′ 26.46″, alt. = 1402 m, 17 July 2018, soil.
Previous record in Turkey – Konya (Dik *et al*. 1999).
Global distribution – Holarctic.
Ecology – Forest and meadow soils. Frequent on dumps and reclaimed sites.

Pilogalumna crassiclava (Berlese, 1914)

Material – One specimen in Saraycık forest processing area, Taşköprü, N 41° 22′ 51.20″, E 34° 32′ 18.21″, alt. = 1128 m, 15 July 2018, tree bark and debris of *P. nigra.*
Previous record in Turkey – Ankara (Grobler *et al*. 2004).
Global distribution – Palaearctic.
Ecology – All types of habitats.

DISCUSSION

Investigations dealing with the oribatid diversity of Turkish fauna are generally concentrated around the northern part of the country adjacent to the Black Sea region (Ayyildiz 1988; Ayyildiz and

Luxton 1989a, b; Dik *et al*. 1995, 1999; Baran and Merve 1999; Baran and Ayyildiz 2000; Ayyildiz *et al*. 2011a; Toluk and Ayyildiz 2011; Yalçin *et al*. 2013; Akman *et al*. 2018); while the main part of the country still remains uninvestigated. Most samplings include soil, moss and litter habitats. Specific habitats like arboricolar ones are severely understudied. There is only one paper dealing with the records of oribatid mites inhabiting tree (*P. nigra*) trunks (Toluk and Akin 2017), whereas arboricolar habitats include twigs, leaves, suspended soil, moss, lichens, etc. (André 1985; Proctor *et al*. 2002; Lindo and Winchester 2006) and generally harbor high oribatid diversity (Behan-Pelletier and Winchester 1998; Winchester *et al*. 1999, 2008; Murvanidze and Arabuli 2015).

Here, 52 species of oribatid mites were identified while 17 species of them are new for the country. New records comprise 33% of total diversity and three of them (*Ph. rauschenensis*, *S.* (*Paraleius*) *leontonycha*, *J. angulata*) are specific to arboricolar habitats (Weigmann 2006). Canopy specific oribatids (10 species) make 19% of investigated fauna, while most of the identified species (19) are known as ecological ubiquists, found in all types of habitats, 16 species are forest specific and five are mostly found in meadows.

Generally, twigs and trunk of coniferous trees are known to be favorable for oribatid diversity due to cracks, grooves and furrows on them offering more food and shelter for mites (Prinzing 1997; Sobek *et al*. 2008). *Poroliodes farinosus*, *C. labyrinthicus* and *P. rauschensis* were found in abundance on twigs of spruce trees [*Picea orientalis* (Lipsky)] in Borjom-Kharagauli National Park in Georgia (Murvanidze and Mumladze 2014), while *C. cymba*, *C. labyrinthicus*, *P. rauschensis* and *J. angulata* were abundant on larch (*Larix deciduas* Mill.) and spruce (*Picea abies* L.) branches in Central European mixed forests in Switzerland (Sobek *et al*. 2008).

Among the new records there are some widespread and common species such as *P. ferrugineus*, *S. carinatus carinatus*, *E. flagellifer*, *E. plicatus*, *G. alata*, but also some quite rare species like *E. oblongus quadrilamellatus*, *J. angulosa* and *T. myrica* which were only known from Europe up to now. All these indicate the necessity and importance of continued sampling around the country including the wide range of possible habitats.

ACKNOWLEDGEMENTS

The first author would like to express cordial gratitute to Prof. Levan Mumladze for help in creating map of sampling locations and for proofreading early version of the manuscript. We also thank the editor, Prof. Alireza Saboori, Dr. Sergey Ermilov and two other anonymous reviewers for their valuable comments. This work was supported by Kastamonu University (The Coordinator of Scientific Research Projects) in Turkey (Grant No: KÜ-BAP01/2018-26).

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چک‌لیست کنه‌های اریباتید (Acari: Oribatida) حوزهٔ مرکزی دریای سیاه ترکیه همراه با گزارش‌های جدید برای آن کشور

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چکیده

پنجاه و دو گونه/زیرگونه از کنه‌های اریباتید از مناطق جنگلی حوزهٔ مرکزی دریای سیاه وآناتولیای مرکزی شناسایی شدند. هفده گونه از بین آنها برای ترکیه گزارش جدید محسوب می‌شوند. برای هر گونه، اطلاعات جغرافیایی ثبت شده با جی‌پی‌اس، زیستگاه، پراکندگی منطقه‌ای و جهان تهیه و برای گزارش‌های جدید بحث‌های آرایه‌شناختی، اکولوژیک و/یا ویژگی‌های منطقه‌ای ارایه شده است.

واژگان کلیدی: تنوع زیستی؛ جنگل؛ گزارش‌های جدید؛ فون کنه‌های ترکیه؛ جغرافیای جانوری.

اطلاعات مقاله: تاریخ دریافت: ۱۳۹۹/۲/۱، تاریخ پذیرش: ۱۳۹۹/۲/۳۱، تاریخ چاپ: ۱۳۹۹/٤/۲۵