

Species richness of the earthworm fauna (Clitellata: Acanthodrilidae, Lumbricidae) of the marmara region in Turkey: Zoogeographical overview

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Abstract. A list of the earthworms from the Marmara region in Turkey is presented. Comprehensive information on the distribution and zoogeographical type of all earthworm species are given to establish the definitive list of known taxa from Marmara region. The list comprises 30 species and subspecies, belonging to 15 genera of the family Lumbricidae and one genus of the family of Acanthodrilidae. With respect to the zoogeographic location, the largest number of them are categorized as Endemic, Peregrine, and Trans-Aegean species, respectively. The endemic species take part with 23.4% in the total number of the species. Summing up the Endemic, Caucaso-Anatolian, Levantine-Anatolian, Balkanic-Anatolian, Trans-Aegean and Mediterranean taxa, with about 60% of the total lumbricid fauna of Marmara region show a strong autochthonous character.

Key words: earthworms, Marmara region, Anatolia, Balkan Peninsula.

Turkey is a huge country which partly comprises two continents. Marmara region lies on the northwest corner of Turkey, connecting Europe and Asia and forms a passage between the Balkan Peninsula and Anatolia. It covers 8.5 percent of the country with a surface area of 67,000 km².

The Marmara region is one of the seven geographical regions of Turkey. It is bordered by Greece and the Aegean Sea to the west, Bulgaria and the Black Sea to the north, the Black Sea region to the east, the Central Anatolia region to the southeast and the Aegean region to the south. The most important soils are alluvial, yellow-podzolic, red earth, and rendzina. Colchic evergreen species grow on all of these soil types. The climate in the Marmara region ranges from a Mediterranean, humid subtropical (on the southern Marmara Sea coast), to a humid continental in the interior. This causes a variety of ecological conditions in the region (Fig. 1).

The first record of the earthworm fauna of Turkey, done by Rosa (1893), referred to the species *Allolobophora syriaca* (= *Healyella syriaca*) from Samsun (North Anatolia). In 1905, the same author published the first earthworm record - *Lumbricus rubellus* Hoffmeister, 1843- from Büyükada-İstanbul which located in the Marmara region in Turkey. After that, Michaelsen (1907, 1910) and Pop (1943) added some new records, and a few years later Omodeo (1952, 1955), Zicsi (1973), Zicsi and Michalis (1981) published more detailed papers about the earthworms from Marmara and Aegean areas. The most extensive study of the Turkish Lumbricidae was carried out by Omodeo & Rota (1989). They explored 52 localities and identified 51 species, 14 of which new to science. In 1991, Omodeo & Rota presented samples from another 34 localities in Turkey and added three new species records to the earthworm list. Subsequently, in 1999 Omodeo & Rota discussed the biogeography and distribution patterns of the earthworm fauna of Turkey. The first native study was done by Mısırlıoğlu (2002) about the earthworms inhabiting the area of Eskişehir City (Inner Anatolia). A summary on the earthworms of Turkey was published by Csuzdi et al. (2006), critically reviewing the previously published data and documenting the presence of altogether 66 lumbricid taxa. After this, Mısırlıoğlu (2007) recorded two megas-

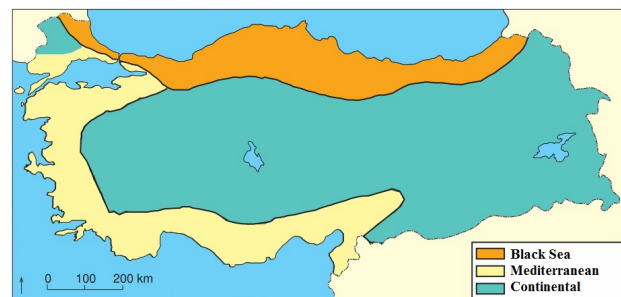


Figure 1. Climate map of Turkey (Atalay & Mortan 1995).

colecid species, new for the country. Csuzdi et al. (2007) added in the records four new species. In 2009, Mısırlıoğlu updated the current checklist of the Turkish earthworms. Finally, Szederjesi et al. (2014a, 2014b) recorded four additional new species for the country.

The aim of this paper is to summarize all published data on earthworms from Marmara region of Turkey in order to establish the definitive list of known earthworm taxa. The list underlines the diversity of earthworms and provides a general overview of their distribution and zoogeographical type. Moreover, considering that the Marmara region is the nearest to the Balkan Peninsula we examined the faunal similarities between the Marmara earthworm fauna and those of the Balkan Peninsula and Anatolia, based on comparison of autochthonous species.

Here, we exhaustively collected all literature on the earthworms of Turkey and made a summary of the biogeographical patterns of earthworms from the whole Marmara region of Turkey. According to the distribution types given by several authors (Omodeo 1952, Mršić 1991, Omodeo & Rota 1991, 1999, Csuzdi & Zicsi 2003, Pop et al. 2010, Csuzdi et al. 2011, Valchovski 2012, Valchovski & Szederjesi 2016), the review shows the occurrence of the following zoogeographic categories: Peregrine: Trans-Aegean (distributed from the European Alps to the Ural Mts., Anatolia, the Levant, and Mesopotamia); Circum-Mediterranean: Atlanto-Mediterranean: Caucaso-Anatolian: Balkanic-Anatolian: Levantine-Anatolian: and Endemics (distributed throughout Turkey).

The complete list of earthworm taxa on the Marmara region of Turkey comprises 30 species and subspecies, belonging to 15 genera (29 taxa) of the family Lumbricidae and one genus (one taxon) of the family Acanthodrilidae (Table 1). Fifteen of them were found in European Marmara (one Acanthodrilidae species and 14 Lumbricidae species and subspecies). Twenty-seven species were recorded in Asian Marmara of which 15 species were not recorded in European Marmara (Eastern Thrace) until now (Misirlioğlu 2012, 2017).

Analyzing the frequency of occurrence of the identified species in all the explored localities in the investigated area, *Aporrectodea trapezoides* and *Ap. rosea* appear to be the most common and widespread. They occur in the whole studied region, and include as well, some of the rare species, such as *Healyella mariae* Omodeo & Rota, 1989, *H. naja* Omodeo & Rota, 1989, *Spermophorodrilus simsoni* Omodeo & Rota, 1989 and *Fitzingeria loebli* Zicsi, 1985. Most recorded species belong to the genera *Dendrobaena* (9 taxa) and *Aporrectodea* (5 taxa).

The zoogeographical composition of the earthworm fauna inhabiting the whole study area are categorized as follows: Peregrine (36.7%), Endemics (23.4%), and Trans-Aegean (16.7%) and not so numerous Circum-Mediterranean (6.6%), Casasio-Anatolian (6.6%), Atlanto-Mediterranean (3.3%), Levantine-Anatolian (3.3%) and Balkanic-Anatolian (3.3%) taxa.

Marmara region shares six autochthonous species with Greece and 13 with the remaining part of Turkey (Table 1).

Considering that the East Mediterranean is composed of different tectonic plates, Misirlioğlu et al. (2008) reported that 75% of endemic earthworm species are represented on the Western Pontides tectonic plate out of the seven tectonic plates that underlie Turkey. They concluded that the Pontides seem to be an important corridor of faunal migration and exchange with Transcaucasian. Based on these considerations Pavlíček et al. (2010) pointed out that the Marmara region (being part of the western Pontides and Sakarya continent tectonic plates) is characterized by the presence of the genera *Cernosvitovia* and *Spermophorodrilus* as well as endemic species belonging to *Aporrectodea* and *Dendrobaena* genera. At the same time, Central Anatolia is characterized by poor autochthonous earthworm fauna and the lack of endemic species. Therefore, Pavlíček et al. (2010) concluded that Marmara region and the rest of Western Pontides in the North Turkey are unique areas of ancient earthworm fauna in the East Mediterranean region. Also, they speculated that the earthworm fauna of the East Mediterranean region could have had its origin on the Taurus-Menderes (TM) plate in the Western Turkey when the TM plate was part of the North Aegeids (today the Balkans). This situation leads us to understand the settling of the area of Anatolia by the speciose European genus *Dendrobaena* in both Anatolia and the Balkan Peninsula. Additionally, Omodeo and Rota (2008) also assumed that many species migrated toward the south and settled the northern coastal area of Anatolia during the Pleistocene, when the connection between Thrace and Anatolia was established.

In the distribution area of endemic lumbricids, Csuzdi & Zicsi (2003) recognized four large biogeographic domains (the Franco-Iberian, Aegean, Turanian, and North American domains). The Marmara region belongs to the Aegean do-

main in which the endemic species represent 23.4% of the total number of the species and belong to the genera *Cernosvitovia*, *Dendrobaena*, *Healyella*, *Spermophorodrilus*, and *Aporrectodea*. The high number of endemics for the relatively small part of Turkey such as Marmara region is especially remarkable (Misirlioğlu 2010).

The species of the genus *Spermophorodrilus* occur in the central, north and western part of Anatolia. The only exception is *Spermophorodrilus antiquus* that has been found in Northern Greece, Albania and Southern Bulgaria (Omodeo & Rota 1989). Of the two *Spermophorodrilus* species living in Turkey, one is exclusively endemic, *Spermophorodrilus simsoni*, being restricted to a narrow area of Asian Marmara, near Bursa. *Spermophorodrilus vignai* is a broadly endemic species recorded from different regions of Turkey (Omodeo & Rota 1989, 1991, Misirlioğlu & Stojanovic 2017).

The genus *Healyella* has its distribution centre, probably, in the central part of Northern Anatolia (Omodeo & Rota 1999). It has not been found in Transcaucasia, where extensive collections have been carried out. Seven *Healyella* species live in Turkey and only two species are recorded outside of the country (Pavlíček et al. 2003). *Healyella mariae* is a restricted endemic registered in the areas of Bursa and Bilecik, both cities are closely located in East Marmara. *Healyella naja* is another exclusively endemic species that lives in a small area of Asian Marmara (Bursa-Uludağ).

The genus *Dendrobaena*, with nine species, is the dominant faunal component of the earthworm fauna of the Marmara region. Anatolia is one of the most important diversity hotspot of the genus *Dendrobaena* (Omodeo & Rota 2008, Szederjesi et al. 2014b). In Turkey, there are 30 taxa that belong to the genus *Dendrobaena* with 12 endemics to Turkey (Misirlioğlu 2017). In the Marmara region, one endemic subspecies, two Casasio-Anatolian and one Levantine-Anatolian taxa have been recorded up to now: *Dendrobaena fridericae uludaqi* is a restricted endemic subspecies recorded only in Bursa-Uludağ. The Levantine-Anatolian species *Dendrobaena hauseri* was recorded from only one locality in the European side of İstanbul. There was no record of it in Anatolia, but it has been found in the Levant (Pavlíček et al. 2003, Misirlioğlu 2017). *Dendrobaena pentheri* is a Casasio-Anatolian species recorded in a few localities in the Aegean and Asian Marmara and also in Greece. *Dendrobaena alpina armeniaca* is a Casasio-Anatolian subspecies recorded especially in forested areas of North Anatolia. Additionally, it was recorded in Inner Anatolia, in the locality of Sivas, and in Asian Marmara, in the mountain areas covered with forests.

The species of the genus *Cernosvitovia* spread primarily throughout the Rhodopes (Balkan) tectonic plates (Csuzdi & Pop 2007, Stojanović et al. 2013) and also Getica craton (Csuzdi & Pop 2007). Eight species are endemic to the Balkans. It seems that, one species *Cernosvitovia schweigeri* lives in the Marmara region and all localities which it has been recorded are in this area, on the Asian side.

Aporrectodea handlirschi mahnerti is a rare endemic subspecies recorded in the east part of Anatolia. *Fitzingeria loebli* is a Balkanic-Anatolian species described from the area of Asian Marmara and only recently found in Northern Greece (Szederjesi & Csuzdi 2012a).

Besides the endemic species, the earthworm fauna of the

Table 1. List of earthworms from Marmara region in Turkey.

	Family	European Marmara	Asian Marmara	Zoo-geographical Category
<i>Allolobophora chlorotica</i> (Savigny, 1826)	Lumbricidae	-	Omodeo & Rota 1989 (W); Misirlioğlu 2002 (C); Misirlioğlu 2008a (W); Misirlioğlu 2008b (W); Misirlioğlu & Szederjesi 2015 (W).	Peregrine
<i>Aporectodea handlirschi mahneri</i> (Zicsi, 1973)	Lumbricidae	-	Zicsi 1973 (W, N); Szederjesi et al. 2014 (N).	Endemic
<i>Aporectodea jassyensis</i> (Michaelsen, 1891)	Lumbricidae	Zicsi 1973	Zicsi 1973 (N, W); Omodeo & Rota 1989 (C, N, E, W); Omodeo & Rota 1991 (S, W, N); Misirlioğlu 2002 (C); Csuzdi et al. 2007 (S); Misirlioğlu 2007 (W); Pavlíček et al. 2009 (E); Misirlioğlu & Szederjesi 2015 (C, S).	Trans-Aegean
<i>Aporectodea rosea</i> (Savigny, 1826)	Lumbricidae	Misirlioğlu & Szederjesi 2015	Rosa 1905 (C); Pop 1943 (C); Omodeo 1952 (C); Omodeo 1956 (W, E); Omodeo 1955 (E); Zicsi 1973 (S, W, N, C, E); Omodeo & Rota 1989 (W, C, N, E); Omodeo & Rota 1991 (C, W, S, N); Misirlioğlu 2002 (C); Csuzdi et al. 2007 (S); Misirlioğlu 2007 (W); Misirlioğlu 2008a (W); Szederjesi et al. 2014 (S, E); Pavlíček et al. 2009 (S, E); Misirlioğlu & Szederjesi 2015 (C, W, N).	Peregrine
<i>Aporectodea trapezoides</i> (Dugès, 1828)	Lumbricidae	Misirlioğlu & Szederjesi 2015	Omodeo 1952 (W, C, S, E); Omodeo 1955 (S); Zicsi 1973 (W, N, C, E); Omodeo & Rota 1989 (W, N, C, S, E); Omodeo & Rota 1991 (W, S, N); Misirlioğlu 2002 (C); Misirlioğlu 2002 (C); Misirlioğlu 2004 (W, S); Misirlioğlu 2004 (W, C); Csuzdi et al. 2007 (S); Misirlioğlu 2007 (W); Misirlioğlu 2008a (W); Szederjesi et al. 2014 (S, E); Pavlíček et al. 2009 (S, E); Misirlioğlu & Szederjesi 2015 (C, W, N).	Peregrine
<i>Cernosvitovia schwaegeri</i> (Zicsi, 1973)	Lumbricidae	-	Zicsi 1973 (N); Omodeo & Rota 1991 (W); Misirlioğlu 2007 (W)	Endemic
<i>Dendrobaena alpina armeniaca</i> (Rosa, 1884)	Lumbricidae	-	Omodeo & Rota 1989 (W, N, E, C); Csuzdi et al. 2006 (E); Misirlioğlu 2008b (C); Szederjesi et al. 2014 (N, C).	Caucaso-Anatolian
<i>Dendrobaena attensi</i> (Michaelsen, 1902)	Lumbricidae	-	Omodeo 1952 (W); Omodeo & Rota 1989 (W, N); Omodeo & Rota 1991 (W).	Trans-Aegean
<i>Dendrobaena hyblaea</i> (Rosa, 1893)	Lumbricidae	Szederjesi et al. 2014	Zicsi 1973 (W, S, N); Omodeo & Rota 1989 (E); Csuzdi et al. 2007 (S); Pavlíček et al. 2009 (E); Szederjesi et al. 2014 (W, E, S).	Circum-Mediterranean
<i>Dendrobaena cognettii</i> (Michaelsen, 1903)	Lumbricidae	Szederjesi et al. 2014.	-	Atlanto-Mediterranean
<i>Dendrobaena fridericæ uludagi</i> Omodeo & Rota, 1991	Lumbricidae	-	Omodeo & Rota 1991 (W).	Endemic
<i>Dendrobaena itauseri</i> Zicsi, 1973	Lumbricidae	Zicsi 1973 (W)	-	Levantine-Anatolian
<i>Dendrobaena hortensis</i> (Michaelsen, 1890)	Lumbricidae	Szederjesi et al. 2014	Omodeo 1955 (W); Omodeo & Rota 1989 (W, C, N); Omodeo & Rota 1991 (S, W, N); Misirlioğlu 2007 (W); Szederjesi et al. 2014 (W, E); Misirlioğlu & Szederjesi 2015 (C, W).	Peregrine
<i>Dendrobaena pentheri</i> (Rosa, 1905)	Lumbricidae	-	Rosa 1905 (C); Zicsi 1973 (N); Omodeo & Rota 1989 (C, N, E, W); Misirlioğlu 2004 (W, C); Csuzdi et al. 2006 (E); Csuzdi et al. 2007 (S); Misirlioğlu 2008b (W); Szederjesi et al. 2014 (C, E).	Aegean-Caucaso-Anatolian
<i>Dendrobaena veneta veneta</i> (Rosa, 1884)	Lumbricidae	Szederjesi et al. 2014	Rosa 1905 (C); Pop 1943 (C); Omodeo 1952 (W, C, E, S); Omodeo 1955 (W); Zicsi 1973 (W, N, S, C, E); Omodeo & Rota 1989 (W, N, E); Omodeo & Rota 1991 (S, W); Misirlioğlu 2002 (C); Misirlioğlu 2004 (W, C, E); Csuzdi et al. 2007 (S); Misirlioğlu 2008a (W); Misirlioğlu 2008b (W, S, N); Pavlíček et al. 2009 (E); Szederjesi et al. 2014 (W, E, S); Misirlioğlu & Szederjesi 2015 (W, N, C).	Peregrine

Table 1. (continued)

	Family	European Marmara	Asian Marmara	Zoo-geographical Category
<i>Dendrodrilus rubidus rubidus</i> (Savigny, 1826)	Lumbricidae	Szedlerjesi et al. 2014a	Zicsi 1973 (W); Omodeo & Rota 1989 (N); Omodeo & Rota 1991 (W); Szedlerjesi et al. 2014a (W, N).	Peregrine
<i>Eisenia fetida</i> (Savigny, 1826)	Lumbricidae	Szedlerjesi et al. 2014	Omodeo 1955 (W); Omodeo & Rota 1989 (N, W); Misirlioglu 2002 (C); Misirlioglu 2004 (C); Misirlioglu 2008b (S); Pavlicek et al. 2009 (E); Szedlerjesi et al. 2014 (W, E); Misirlioglu & Szedlerjesi 2015 (W).	Peregrine
<i>Eiseniella tetraedra</i> (Savigny, 1826)	Lumbricidae	-	Rosa 1905 (C); Omodeo 1952 (W, E, S); Omodeo 1952 (W); Omodeo 1955 (S); Omodeo & Rota 1989 (W, N, E); Omodeo & Rota 1991 (W, S, N); Omodeo & Rota 1991 (W); Misirlioglu 2002 (C); Misirlioglu 2002 (C); Csuzdi et al. 2007 (S); Misirlioglu 2008b (W); Pavlicek et al. 2009 (E); Misirlioglu 2008b (C); Szedlerjesi et al. 2014a (E).	Peregrine
<i>Fitzingeria loebli</i> Zicsi, 1985	Lumbricidae	-	Zicsi, 1985 (W)	Balkan-Anatolian
<i>Hedylella mariae</i> Omodeo & Rota, 1989	Lumbricidae	-	Omodeo & Rota, 1989 (W); 1991 (W)	Endemic
<i>Hedylella najta</i> Omodeo & Rota, 1989	Lumbricidae	-	Omodeo & Rota, 1989 (W); 1991 (W)	Endemic
<i>Lumbricus rubellus</i> Hoffmeister, 1843	Lumbricidae	Misirlioglu & Szedlerjesi 2015	Rosa 1905 (W); Omodeo 1952 (W); Zicsi 1973 (N, W, C); Omodeo & Rota 1989 (W, N); Omodeo & Rota 1991 (W); Misirlioglu 2002 (C); Misirlioglu 2004 (W); Misirlioglu 2007 (W); Misirlioglu 2008b (N); Misirlioglu & Szedlerjesi 2015 (C, W, N).	Omodeo & Peregrine
<i>Murchieona minuscula</i> (Rosa, 1896)	Lumbricidae	-	Omodeo & Rota 1991 (W, N); Csuzdi et al. 2007 (S); Szedlerjesi et al. 2014a (S)	Trans-Aegean
<i>Octodrilus complanatus</i> (Dugès, 1828)	Lumbricidae	Szedlerjesi et al. 2014a; Misirlioglu & Szedlerjesi 2015.	Zicsi 1973 (W); Omodeo & Rota 1989 (W); Omodeo & Rota 1991 (W); Szedlerjesi et al. 2014a (W); Misirlioglu & Szedlerjesi 2015 (W).	Circum-Mediterranean
<i>Octodrilus transpadanus</i> (Rosa, 1884)	Lumbricidae	Zicsi 1973	Zicsi 1973 (W); Omodeo & Rota 1989 (N, W); Omodeo & Rota 1991 (N, S, W); Misirlioglu 2002 (C); Misirlioglu 2002 (C); Csuzdi et al. 2007 (S); Misirlioglu 2007 (W); Misirlioglu 2008b (W, S); Pavlicek et al. 2009 (E); Szedlerjesi et al. 2014a (E); Misirlioglu & Szedlerjesi 2015 (W).	Trans-Aegean
<i>Octolasion lacteum</i> (Orley, 1885)	Lumbricidae	-	Omodeo & Rota 1989 (W, N); Omodeo & Rota 1991 (W); Misirlioglu 2002 (C); Misirlioglu 2004 (C); Misirlioglu & Szedlerjesi 2015 (C).	Peregrine
<i>Proctodrilus tuberculatus</i> (Černosvitov, 1935)	Lumbricidae	Omodeo & Rota 1989	Omodeo & Rota 1989 (W); Omodeo & Rota 1991 (W); Misirlioglu 2002 (C); Misirlioglu 2004 (C).	Trans-Aegean
<i>Spermophorodrilus simsoni</i> Omodeo & Rota, 1989	Lumbricidae	-	Omodeo & Rota, 1989 (W)	Endemic
<i>Spermophorodrilus vignai</i> Omodeo & Rota, 1989	Lumbricidae	-	Omodeo & Rota, 1989 (W, C, N); Omodeo & Rota, 1991 (W, N)	Endemic
<i>Microcolex phosphoreus</i> (Dugès, 1837)	Acanthodrilidae	Omodeo 1952	-	Peregrine

W - Western part of Turkey; C - Central part of Turkey; E - Eastern part of Turkey; S - South part of Turkey; N - North part of Turkey

Marmara Region is enriched by other zoogeographical types. One of the most important elements is the widely distributed Trans-Aegean group, whose species (*Murchieona minuscula*, *Dendrobaena attemsi*, *Octodrilus transpadanus* and *Proctodrilus tuberculatus*) show a range extending from Italy to Turkey (Misirlioğlu 2008, Valchovski & Misirlioğlu 2017). In Turkey *Dendrobaena attemsi* shows a North-Anatolian distribution. *Aporroctodea jassyensis* has some records from Inner Anatolia, the Mediterranean region and East and Southeast Turkey, but it is most widespread in North Anatolia and also in the region of Marmara. *Murchieona minuscula*, *Octodrilus transpadanus*, and *Proctodrilus tuberculatus* were recorded in the Marmara region as well as in almost all regions in Turkey (Mrsic 1991, Misirlioğlu 2017, Valchovski & Misirlioğlu 2017).

The presence of three species with Mediterranean distribution is not surprising. *Dendrobaena byblica* was recorded in several cities of both sides of the Marmara region and also in the Aegean region. It was also recorded in the Mediterranean, north, east and southeastern part of Anatolia. *Octodrilus complanatus* shows Marmara-Aegean distribution in Turkey. It seems there is no record of the species except in these regions. The Atlanto-Mediterranean species, *Dendrobaena cognettii*, has been recently recorded from Turkish Thrace (Szederjesi et al. 2014a).

There are ten peregrine species. *Dendrobaena hortensis* was recorded in several localities of the Marmara and rarely in the Aegean and Mediterranean region. It is common especially in Northern Anatolia. *Dendrobaena veneta* and *Aporroctodea trapezoides* are one of the most common peregrine species in Turkey. *Dendrodrilus rubidus rubidus* is a relatively rare species in Turkey, recorded in several localities in Northern Anatolia, except one in the Mediterranean region. In Marmara it was recorded in Asian and Thracian area. The localities where *Allolobophora chlorotica* was recorded are especially in the Aegean and Asian Marmara regions and rarely in Central Anatolia. This lack of records in Thrace may be due to the lack in sampling effort. The same situation is observed for the very common *Aporroctodea rosea*. *Octolasion lacteum* was recorded on a few localities in Turkey (Marmara, Northeastern Anatolia and Inner Anatolia near Marmara) (Misirlioğlu 2017, Misirlioğlu & Valchovski 2017, Valchovski & Misirlioğlu 2017).

A comparison of autochthonous species could indicate the higher faunal affinities between Marmara region and the rest part of Turkey than between Marmara and the Balkan areas. Namely, six autochthonous species are present in both the Marmara region and Greece and other adjacent Balkan areas. But, those species are mainly Trans-Aegean and only *Fitzingeria loebli* is exclusively for the both areas. However, in the remaining part of Turkey and Marmara region there are 13 common autochthonous species and out of them there are eight taxa exclusive to both areas. Moreover, in support of those data is the fact that genus *Healyella*, recorded in Marmara, seems to be absent in the Balkan Peninsula, while the genera such as *Spermophorodrilus* and *Cernosvitovia* are quite different. For instance, only *Cernosvitovia schweigeri* inhabits the Marmara region (in the Anatolian parts) but it is absent in the Balkan Peninsula. On the other hand, the other *Cernosvitovia* species, namely *Cernosvitovia biserialis* (Černosvitov, 1937), *Cernosvitovia bulgarica* (Černosvitov, 1939), *Cer-*

nosvitovia dobrogeana (Pop, 1938), *Cernosvitovia dudichi* (Zicsi and Šapkarev, 1982), *Cernosvitovia getica* (Pop, 1947), *Cernosvitovia krainensis* (Šapkarev, 1987), *Cernosvitovia munteniana* (Zicsi and Pop, 1991), *Cernosvitovia opisthocystis* (Rosa, 1895), *Cernosvitovia rebeli* (Rosa, 1897) are present in the Balkan Peninsula.

Meanwhile, *Spermophorodrilus simsoni* and *S. vignai*, common for the Marmara region and Anatolia, are not represented in the Balkans, while *S. antiquus* is recorded in Greece, Albania and Bulgaria. Additionally, out of the nine *Dendrobaena* species four are autochthonous for Marmara region and Anatolia. Otherwise, there are no common autochthonous *Dendrobaena* species for the Marmara and Greece, Bulgaria and other countries in the Balkan Peninsula. Therefore, in the Marmara region the record of the Balkanic-Anatolian endemics (*Fitzingeria loebli*) testify for a limited faunal connection between the Balkans and Anatolia. On the other hand, the presence of Anatolian endemics, Caucaso-Anatolian and Anatolian-Levantine species indicate the zoogeographic affinities of the very complex earthworm fauna from Marmara region and its considerable connection with Anatolia.

Even though our knowledge about the distribution and diversity of earthworms in Marmara region is far from complete, our data show that the degree of endemism is relatively high, exceeding 23.4%. Summing up the Endemics, Caucaso-Anatolian, Levantine-Anatolian, Trans-Aegean and Mediterranean taxa, about 60% of the total lumbricid fauna of Marmara region shows a strong native character.

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