Review Article

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Distribution and Biogeographical Significance of the Endemic Genera *Spermophorodrilus* Bouché, 1975 and *Healyella* Omodeo & Rota, 1989 (Oligochaeta: Lumbricidae): a Review

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Abstract: The species of the genera *Spermophorodrilus* Bouché, 1975 and *Healyella* Omodeo & Rota, 1989 posses a set of characters that distinguish them from any other group of the family Lumbricidae, i.e. absence of spermathecae, short annular clitellum devoid of tubercula and the area occupied by spermatophores attached near the male pores that open in the posterior part of segment 15. The members of these two genera are mainly endemic for Anatolia, with only three species being exception. *Healyella* comprises nine species, seven of them endemic for Turkey: *Healyella baloghi, H. boluana, H. mariae, H. michaelseni, H. naja, H. schweigeri* and *H. zapparolii.* In addition, one species is endemic for Israel (*H. jordanis*) and one is Levante-Anatolian (*H. syriaca*). *Spermophorodrilus* has three species and two of them are endemic for Turkey: *S. simsoni* and *S. vignai*; the third species (*S. antiquus*) is endemic for the south part of the Balkan Peninsula and has not been recorded in Turkey. The present review summarises the published information on the species diversity and distribution of earthworms of the endemic genera *Spermophorodrilus* and *Healyella*.

Key words: Earthworms, *Spermophorodrilus*, *Healyella*, Turkey, Balkan Peninsula

Introduction

The first study of the earthworm fauna of Turkey (Rosa 1893) provided the description of *Allolobophora syriaca* Rosa, 1893 from North Anatolia, a species currently considered a member of the genus *Healyella* Omodeo & Rota, 1989. Later on, Černosvitov (1938) studied earthworms from the Balkan Peninsula and described *Allolobophora* (*Eophila*) *antiqua* Černosvitov, 1938 from Vermio Mountain in northern Greece. Černosvitov (1940) emphasised some characters of *Eophila atheca* Černosvitov, 1940 unique among lumbricids, i.e. male and female openings situated between setae *a* and *b* instead of being between setae *b* and *c.* In the original description of *Eophila atheca kosswigi,* Omodeo (1952) remarked that the male ducts in this species opened in the posterior part of 15th segment as in species belonging to the families Criodrilidae and Hormogastridae. He also pointed out that *E. atheca,* together with several related species, constituted a homogeneous group differing from species of the genera *Bimastos* Moore, 1891 and *Eophila* Rosa, 1894. Bouché (1975) proposed the new genus *Spermophorodrilus* to accommodate *S. albanianus* Bouché, 1975 (currently considered a synonym of *S. antiquus*). However, Zicsi & Michalis (1981) and Zicsi (1981) suggested a suppression of the genus *Spermophorodrilus* and proposed to include its type species in *Bimastos.* However, after the discovery of two further species with characteristics similar to those of *S. albanianus*, Omodeo & Rota (1989) suggested the validation of *Spermophorodrilus*.

Zicsi (1981) described two further species of *Bimastos* currently placed in *Healyella*, *H. baloghi* and *H. schweigeri*. The most extensive study of the

Turkish Lumbricidae was carried out by Omodeo & Rota (1989, 1991). They (Omodeo & Rota 1989) erected the genus *Healyella* and placed it together with the closely related genus *Spermophorodrilus* into the new subfamily Spermophorodrilinae characterised by a peculiar pattern of copulation and the characteristic structure of clitellum, tubercula pubertatis spermatophores, seminal vesicles, oesophagus and gizzard. Csuzdi & Pavliček (1999) described *Bimastos jordanis* (currently *Healyella jordanis*) from Israel. Since then, mainly sporadic records of species of *Spermophorodrilus* and *Healyella* were published, dealing with *H. syriaca* (see Csuzdi & Pavliček 1999, 2002; Pavliček *et al.* 2003; Szederjesi *et al.* 2013, 2014), *H. jordanis* (see Csuzdi & Pavliček 2002; Pavlíček *et al.* 2003; Szederjesi *et al.* 2013) and *S. antiquus* (Szederjesi & Csuzdi 2012).

According to Zicsi & Michalis (1993), the genera *Healyella* and *Spermophorodrilus* are not valid and should be considered as synonyms of *Bimastos*. However, in this work we update the lumbricid nomenclature according to Csuzdi (2012) and add useful data from recent publications as well as from the Fauna Europaea database (Rota & de Jong 2015). In Csuzdi's database, several species described as members of *Bimastos* (*B. jordanis, B. schweigeri* and *B. baloghi*) were transferred to the genus *Healyella*. This standpoint was supported by Csuzdi *et al.* (2006), Misirlioğlu *et al.* (2008), Pavliček *et al.* (2010) and Szederjesi *et al.* (2013, 2014). On the other side, Domínguez *et al.* (2015) provided a comprehensive molecular phylogeny of the family Lumbricidae; their molecular data did not support the monophyly of the genus *Healyella*, thus rejecting the Balkan-Anatolian subfamily Spermophorodrilinae. According to Rota & de Jong (2015), "that issue remains pending due to limited sampling and the non-inclusion of the type genus and species". Additionally, the subfamily Spermophorodrilinae is preserved as valid in the recent update of the Fauna Europaea database.

The aim of this article is to summarize the published data on earthworms of the endemic genera *Spermophorodrilus* and *Healyella* in order to elaborate a comprehensive list of the known earthworm species and their geographical records.

Results

FAMILY LUMBRICIDAE

Genus *Healyella* Omodeo & Rota, 1989

Diagnosis. Body cylindrical, in fixed adults flattened or concave in ventral regions of segments 13-18. Setae distant. Sexual pores between ranges of setae *a* and *b*. Male pores open in posterior part of segment 15 (or extending over segments 14-16). Clitellum short and cylindrical (between segments 25 and 33), without tubercula pubertatis. Gizzard in segments 17-19. Two pairs of seminal vesicles in segments 11 and 12; no spermathecae. Testis sacs rudimentary or absent. Calciferous glands without lateral tubercles. Nephridial bladders club-shaped. Longitudinal muscles of pinnate type. Type species: *Healyella syriaca* (Rosa, 1893).

Review of species

***Healyella baloghi* (Zicsi, 1981)**

Bimastos baloghi Zicsi 1981: 435.

Healyella baloghi: Omodeo & Rota 1989: 178; Csuzdi 2012: 97–99.

Ecology. High mountain altitude, 1700-2400 m a.s.l. (Zicsi 1981; Omodeo & Rota 1989).

Distribution. Turkey: Zigana Dağı-Trabzon, Ilgaz Dağı-Karaköy, Ilgaz Dağı Geçidi, Abant Dağları-Bolu (Omodeo & Rota 1989).

Zoogeography. Endemic for Turkey (Csuzdi *et al*. 2006; Misirlioğlu 2011).

***Healyella boluana* Omodeo & Rota, 1989**

Healyella boluana Omodeo & Rota 1989: 176; Csuzdi 2012: 97–99.

Ecology. The clayey wet soil in mixed hornbeam, pine and beech forests, 900 m a.s.l. (Omodeo & Rota 1989).

Distribution. Turkey: Bolu dağı Geçidi-Bolu (Omodeo & Rota 1989).

Zoogeography. Endemic for Turkey (Csuzdi *et al.* 2006; Misirlioğlu 2009, 2010, 2011).

***Healyella jordanis* (Csuzdi & Pavliček, 1999)**

Bimastos jordanis Csuzdi & Pavliček 1999; Csuzdi & Pavliček 2002; Pavlíček *et al*. 2003: 456.

Healyella jordanis: Pavlíček *et al*. 2010: 1999; Csuzdi 2012: 97–99; Szederjesi *et al*. 2013: 206.

Ecology. Slopes of Jordan River (Csuzdi & Pavliček 1999).

Distribution. Israel: Jordan, Dalton, Migdal, Menahemya, Mt. Arbel, Galilee, Alma (Csuzdi & Pavliček 1999, 2002; Szederjesi *et al*. 2013).

Zoogeography. Endemic for Israel (Csuzdi & Pavliček 1999, 2002; Pavliček *et al.* 2010).

***Healyella mariae* Omodeo & Rota, 1989**

Healyella mariae Omodeo & Rota 1989: 175; Omodeo & Rota 1991: 173; Csuzdi 2012: 97–99.

Ecology. Oak and beech forests, under the bark or in the litter, mixed beech forests, hornbeam, oaks, pine forests, slightly humid brown soil, under big stones, dark soil on calcareous sandstones, 950 m a.s.l. (Omodeo & Rota 1991).

Distribution. Turkey: Bursa Uludağ (Omodeo &

Rota 1989); Bilecik, 75 km E. of Bursa, Bursa, Bolu (Omodeo & Rota 1991).

Zoogeography. Endemic for Turkey (Csuzdi *et al.* 2006; Misirlioğlu 2009, 2010, 2011).

***Healyella michaelseni* Omodeo & Rota, 1989**

Healyella michaelseni Omodeo & Rota 1989: 174; Csuzdi 2012: 97–99.

Ecology. Hornbeam coppice with rotten stumps, litter on humus soil in the upper horizons of the soil, 750 m a.s.l. It lives together with *H. syriaca*, which dwells much deeper in the soil (Omodeo & Rota 1989).

Distribution. Turkey: Samsun-Kavak (Omodeo & Rota 1989).

Zoogeography. Endemic for Turkey (Csuzdi *et al.* 2006; Misirlioğlu 2009, 2010, 2011).

***Healyella naja* Omodeo & Rota, 1989**

Healyella naja: Omodeo & Rota 1989: 176; Omodeo & Rota 1991: 173; Csuzdi 2012: 97–99.

Ecology. Mixed pine forests, beech forest near a stream, a litter of pine needles, dark brown loam on calcareous sandstones, 950 m a.s.l. (Omodeo & Rota 1991).

Distribution. Turkey: Bursa Uludağ (Omodeo & Rota 1989); Bursa N. face of Uludağ (Omodeo & Rota 1991).

Zoogeography. Endemic for Turkey (Csuzdi *et al*. 2006; Misirlioğlu 2009, 2010, 2011).

***Healyella schweigeri* (Zicsi, 1981)**

Bimastos schweigeri Zicsi 1981: 434.

Healyella schweigeri: Omodeo & Rota 1989: 174; Csuzdi 2012: 97–99.

Ecology. In alluvial soils and humid pasture with light brown loam, 1350- 2000 m a.s.l. (Omodeo & Rota 1989).

Distribution. Turkey: Çankırı, Ilgaz Dağı-Kastamonu (Zicsi 1981; Omodeo & Rota 1989).

Zoogeography. Endemic for Turkey (Csuzdi *et al*. 2006; Misirlioğlu 2011).

***Healyella syriaca* (Rosa, 1893)**

Allolobophora syriaca Rosa 1893: 461.

Dendrobaena syriaca: Zicsi 1973: 218.

Bimastos syriacus: Zicsi 1985: 329; Csuzdi & Pavlíček 1999: 471; Csuzdi & Pavlíček 2002: 109, Pavlíček *et al*. 2003: 456.

Healyella syriaca: Omodeo & Rota 1989: 173; Omodeo & Rota 1991: 173; Pavličeк *et al*. 2010: 1999; , Csuzdi 2012: 97–99; Szederjesi *et al*. 2013: 206; Szederjesi *et al.* 2014: 566.

Eophila atheca: Černosvitov 1940: 441.

Dendrobaena atheca typica: Omodeo 1956: 332.

Healyella kosswigi: Omodeo & Rota 1989: 174.

Ecology: In arid or humid pastures and meadows, in a hornbeam coppice, in steppe environment covered by overgrazed thin grass, in brown soil, in stony, steep slope with bare soil, in brown-reddish soft soil under stones and near a stream, in litter on humus soil (600-1500 m a.s.l.) (Omodeo & Rota 1989).

Distribution: Turkey: Ankara-Elmadağ, Çorum-İskilip, Çorum-Elvançelebi, Çorum-Sehler, Samsun-Kavak, Amasya, Şanlıurfa, Hatay (Omodeo & Rota 1989, 1991). Israel: Allone Abba, Har Horshan, Mt. Carmel, Mt. Hermon, Nablus, Nahal Pura, Nahal Oren, Nahal Kishon, Megiddo, Mt. Tavor, Jordan Valley, Galilee, Golan Heights (Zicsi 1985; Csuzdi & Pavlíček 1999, 2002; Szederjesi *et al.* 2013). Palestine (Černosvitov 1940), Lebanon (Omodeo 1956).

Zoogeography. Levante-Anatolian species recorded in Anatolia and Middle East (Csuzdi *et al.* 2006; Misirlioğlu 2011; Szederjesi *et al.* 2013, 2014).

***Healyella zapparolii* Omodeo & Rota, 1989**

Healyella zapparolii Omodeo & Rota 1989: 177; Csuzdi 2012: 97–99.

Ecology: In woods and pasture at high altitude pasture at high altitude (1470 m a.s.l.).

Distribution: Turkey: Ordu, Giresun (Omodeo & Rota 1989).

Zoogeography. Endemic for Turkey (Csuzdi *et al*. 2006; Misirlioğlu 2010, 2011).

Genus *Spermophorodrilus* Bouché, 1975

Diagnosis. Body unpigmented, cylindrical. Setae strictly paired. Male pores in posterior part of segment 15 near setae *b.* Clitellum ring-shaped, short, without tubercula pubertatis. No genital papillae. Two pairs of seminal vesicles in segments 11-12; no spermathecae. Gizzard in segments 17-19 (in 17-18 in *S. antiquus*). Morren's glands simple, in segments 10-11. Spermatophores flat, attached in zone of sexual pores. Nephridial bladders club-shaped. Longitudinal muscles of pinnate type. Type species: *Spermophorodrilus albanianus* Bouché, 1975, a junior synonym of *Spermophorodrilus antiquus* (Černosvitov, 1938).

Review of species

***Spermophorodrilus antiquus* (Černosvitov, 1938)**

Allolobophora (*Eophila*) *antiqua* Černosvitov 1938: 198.

Spermophorodrilus antiquus: Plisko 1963: 430; Zicsi & Csuzdi 1986: 114; Szederjesi & Csuzdi 2012: 40; Stojanović *et al.* 2012: 13; Csuzdi 2012: 97–99.

Bimastus antiquus antiquus: Zicsi & Michalis 1981: 244.

Allolobophora antiqua michalis: Karaman 1972:110.

Bimastus antiquus michalis: Zicsi & Michalis 1981: 244.

Spermophorodrilus albanianus: Bouché 1975: 3.

Bimastus antiquus bouchei: Zicsi & Michalis 1981: 244.

Ecology. Litter in mixed mountain forests, limestone gorge (Szederjesi & Csuzdi 2012).

Distribution: Bulgaria: Petric in Belasitca Mt., Slavyanka Mt. (Delchev *et al.* 1998); Greece: Kavala, Doxaton Dramas (Karaman 1972), Vermio Mt. (Michalis 1982); Xanthi, Epirus (Omodeo & Rota 1989); Sapka Mts., Xanthi., Vrondous Mts. (Szederjesi & Csuzdi 2012); Albania (Bouché 1975).

Zoogeography. Endemic for the south part of the Balkan Peninsula (Csuzdi & Zicsi 2003; Valchovski 2012).

***Spermophorodrilus simsoni* Omodeo & Rota, 1989**

Spermophorodrilus simsoni: Omodeo & Rota 1989: 172.

Ecology. Humid meadows with small shrubs. Dark soil (Omodeo & Rota 1989).

Distribution. Turkey: Bursa-Demirdere Village, 100 m a.s.l. (Omodeo & Rota 1989).

Zoogeography. Endemic for Turkey (Csuzdi *et al*. 2006; Misirlioğlu 2011).

***Spermophorodrilus vignai* Omodeo & Rota, 1989**

Spermophorodrilus vignai: Omodeo & Rota 1989: 171; Omodeo & Rota 1991: 172.

Ecology. Oak and beech woods, steppe highland, brown clayey soils, steppe pastures, mixed pine forests, 600-1150 m a.s.l. (Omodeo & Rota 1989, 1991).

Distribution. Turkey: Bursa Uludağ, Çorum-Elvançelebi, Bolu, Kütahya (Omodeo & Rota 1989); Bursa N. face of Uludağ, Bolu (Omodeo & Rota 1991).

Zoogeography. Endemic for Turkey (Csuzdi *et al.* 2006; Misirlioğlu 2011).

Discussion

Species of the genus *Spermophorodrilus* appear in the central and western parts of Anatolia, and only *S. antiquus* has been found in the south Balkan Peninsula. *S. simsoni* is restricted to a part of Asian Marmara, near Bursa, while *S. vignai* is an endemic species recorded from various regions of Turkey. The genus *Healyella* is distributed throughout Anatolia, Syria, Lebanon, Israel and Iran. Out of nine *Healyella* spp., eight are registered in Turkey and only two species, *H. syriaca* and *H. jordanis*, have been recorded outside Turkey (Pavlíček *et al.* 2003). *H. jordanis* lives only in Israel (Pavlíček *et al.* 2003). On the other hand, *H. syriaca* occupies a broad area (Anatolia, Iran, Syria, Lebanon and Israel). Because eight *Healyella* spp. are recognised in the central parts of the northern Anatolia, Omodeo & Rota (1999) pointed out that the distribution centre of *Healyella* spp. is in the central part of the northern Anatolia.

According to Omodeo & Rota (2008), species of the endemic genera *Spermophorodrilus* and *Healyella* are the most archaic among the earthworms inhabiting Anatolia. The species of those

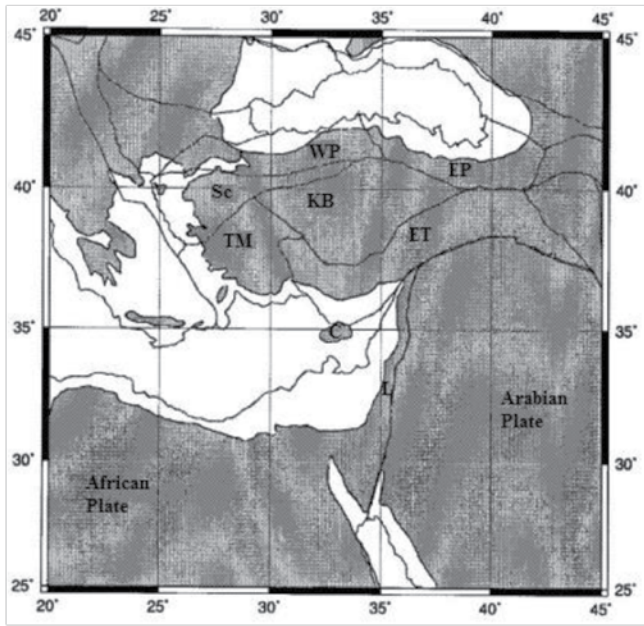

Fig. 1. Tectonic plates in Turkey based on the Ocean Drilling Stratigrahic Network (Hay et al. 1999). Codes in figure are Sc: Sakarya continent, TM: Taurus-Menderes Block, KB: Kırşehir Block, ET: East Taurus Block, WP: West Pondites, EP: East Pondites, C: Cyprus: L: Levant

genera have a set of characters that distinguish them from any other group of the family Lumbricidae. These characters include the absence of spermathecae, short annular clitellum devoid of tubercula, the area occupied by spermatophores attached near the male pores that open in the posterior part of segment 15. On the other hand, these endemic taxa exhibit some similarities to the species of the family Hormogastridae (see Omodeo & Rota 1989) in relation to the morphology of the digestive organs, the structure of clitellum and the location of copulation organs above the sexual pores. On the basis of these similarities, Omodeo & Rota (1991) pointed out that the subfamilies Spermophorodrilinae and Hormogastridae may have a common origin. Additionally, Omodeo & Rota (2008) suggested that the species of *Spermophorodrilus* and *Healyella* have affinities with the Hormogastridae inhabiting southwestern Europe, and with the Diporodrilinae inhabiting Sardo-Corsican system. All three taxa are relict of an old and distinct fauna which lived on the northern coasts of Palaeotethys. Considering the palaeogeographical scenarios provided by Rogl & Steininger (1983), Omodeo & Rota (2008) assumed that the Spermophorodrilinae inhabited Anatolia when Gondwana plate was connected with Eurasia during the Cretaceous and many species could migrate toward the south and settled the northern coastal area of Anatolia during the Pleistocene, when the

wider connection between the Balkans and Anatolia was established.

Considering that the East Mediterranean is composed of distinct tectonic plates, Misirlioğlu *et al*. (2008) reported that 75% of endemic earthworm species are presented on the Western Pondites tectonic plate situated in the northern part of Anatolia (Fig. 1). Also, four species of *Healyella* were recorded on other tectonic plates but in the relatively close localities to the region of Western Pondites (WP) tectonic plate. Only *H. jordanis* lives in distant localities out of the WP region. Also, the North Anatolian region has a temperate oceanic climate with cool, foggy summers and substantial rainfall throughout the year. Different climate conditions about the other regions of Turkey and the presence of dense natural forests are apparently important for the presence of high endemism rate in the northern part of Anatolia. Based on these data, Pavlíček *et al*. (2010) concluded that the area of the Western Pondites is a unique area of ancient earthworms in the East Mediterranean Region. However, in order to explain the presence of the genus *Spermophorodrilus* in the Balkan Peninsula and, as well, in northwest part of Anatolia, Pavlíček *et al*. (2010) assumed that its origin could be "somewhere in the continental area laying approximately between today's Rhodope Mts. and Kırşehir Block (KB) tectonic plate in central part of Turkey, but not in the WP area due to the fact that the Pondites were isolated islands by Tethys during the Maastrichtian". Also, they assumed that the earthworm fauna of the East Mediterranean region could have had its origin on the Taurus-Menderes (TM) plate in the western part of Turkey when the TM plate was part of the North Aegeids (today the Balkans).

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References

Bouché, M. B. 1975. La reproduction de *Spermophorodrilus albanianus* nov. gen. nov. sp. (Lumbricidae). – Zoologische Jahrbücher Abteilung für Systematik, 102: 1-12.

Csuzdi, C., Zicsi, A. & Misirlioğlu, M. 2006. An annotated checklist of the earthworm fauna of Turkey (Oligochaeta: Lumbricidae). – Zootaxa, 1175: 1-29.

Csuzdi, C. 2012. Earthworm species, a searchable database. – Opuscula Zoologica Budapest, 43 (1): 97-99.

Csuzdi, C. & Pavličeк. T. 2002. *Murchieona minuscula* (Rosa, 1906), a newly recorded earthworm from Israel, and distribution of the genera *Dendrobaena* and *Bimastos* in Israel (Oligochaeta, Lumbricidae). – Zoology in the Middle East, 25: 105-114.

Csuzdi, C. & Pavlíček, T. 1999. Earthworms from Israel and the neighbouring countries. I. Genera *Dendrobaena* Eisen, 1874 and *Bimastos* Moore, 1891 (Oligochaeta: Lumbricidae). – Israel Journal of Zoology, 45: 46-486.

Černosvitov, L. 1938. Zur Kenntnis der Oligochätenfauna des Balkans. V. Oligochäten aus Jugoslawien und Albanien. – Zoologischen Anzeiger, 122: 285-289.

Černosvitov, L. 1940. On some Oligochaeta from Palestine. – Annals and Magazine of Natural History, 6 (35): 438-447.

Delchev, C., Andreev, S., Golemansky, V., Milojkova, G., Peneva, V., Dobrev, D., Todorov, M. & Hubenov, Z. 1998. Invertebrates (non-Insecta) in Bulgaria. – In: Meine C. (ed): Bulgaria's Biological Diversity. Conservation Status and Needs Assessment. Sofia: Academy of Science (Sofia), pp. 109-161.

Domínguez, J., Aira, M., Breinholt, J., Stojanovic, M., James, S. & Pérez-Losada, M. 2015. Underground evolution: New roots for the old tree of lumbricid earthworms. – Molecular Phylogenetics and Evolution, 83: 7-19. DOI: 10.1016/j.ympev.2014.10.024

Hay, W. W., de Conto, R. M., Wold, C. N., Wilson, K. M., Voigt, S., Schulz, M., Wold, A. R., Dullo, W. C, Ronov, A. B., Balukhovsky, A. N. & Söding, E. 1999. An alternative global Cretaceous paleogeography. – Geological Society of America, 332: 1-47.

Karaman, S. 1972. Beitrag zur Kenntnis der Oligochaetenfauna Jugoslawiens. – Biološki vestnik, 20: 95-105.

Michalis, K. 1982. Katalog der Oligochaetenfauna Griechenlands. – Biologia Gallo-Hellenica, 9: 343-362.

Misirlioğlu, M. 2009. Current Checklist of Terrestrial Turkish Earthworms (Oligochaeta). – Megadrilogica, 13 (3): 21-24.

Misirlioğlu, M. 2010. Distribution of endemic earthworm species in Turkey. – Zoology in the Middle East, Supplementum, 2: 83-87.

Misirlioğlu, M. 2011. Topraksolucanları, Biyolojileri, Ekolojileri ve Türkiye Türleri. Eskişehir: Nobel Yayıncılık, 92 pp.

Misirlioğlu, M., Pavlíček, T. & Csuzdi, C. 2008. Earthworm biodiversity in Turkey: an overview. – In: pavlíček, T. & Cardet, P. (Eds). Advances in earthworm taxonomy III (Annelida: Oligochaeta). Nicosia: En Tipis Voula (Nicosia), pp. 139-161.

Omodeo, P. 1952. Oligocheti della Turchia. – Annuario dell'istituto Museo di Zoologia Della Universita di Napoli, 4: 1-20.

Omodeo, P. 1956. Oligocheti dell'Indocina e dell Mediterraneo Orientale. –Memorie dell Museo Civico di Storia Naturale di Verona, 5: 321-336.

Omodeo, P. & Rota, E. 1989. Earthworms of Turkey. – Bolletino di Zoologia, 56: 167-199.

Omodeo, P. & Rota, E. 1991. Earthworms of Turkey II. – Bolletino di Zoologia, 58: 171-181.

Omodeo, P. & Rota, E. 1999. Biogeographical patterns of terricolous oligochaetes in Turkey (Annelida: Clitellata: Lumbricidae, Enchytraeidae). – Biogeographia dell'Anatolia, 20: 61-79.

Omodeo, P. & Rota, E. 2008. Earthworm Diversity and Land Evolution in Three Mediterranean Districts. – Proceedings of the California Academy of Sciences (supplement 1), 59: 65-83.

Pavlíček, T., Csuzdi, C. & Nevo, E. 2003. Species richness and zoogeographic affinities of earthworms in the Levant. – Pedobiologia, 47: 452-457.

Pavlíček, T., Csuzdi, C., Misirlioğlu, M. & Vilenkin, B. 2010. Faunistic similarity and endemism of earthworms in East Mediterranean. – Biodiversity and Conservation, 19 (7): 1989-2001. DOI: 10.1007/s10531-010-9821-1

Plisko, J. 1963. Materialen zur Kenntnis der Regenwurmer (Oligochaeta, Lumbricidae) Bulgariens. – Fragmenta Faunistica Polskiej Acaddemii Nauk, 10: 425-440.

Rosa, D. 1893. Revisione dei Lumbricidi. – Memorie della Reale Academia delle Scienze di Torino, 43: 399-477.

Rota, E. & de Jong, Y. 2015. Fauna Europaea: Annelida - Terrestrial Oligochaeta (Enchytraeidae and Megadrili), Aphanoneura and Polychaeta. – Biodiversity Data Journal, 3: 2-48. DOI: 10.3897/BDJ.3.e5737.

RÖgl, F. & Steininger, F. F. 1983. Vom Zerfall der Terl1ys zu Mediterran und Paratethys. Die neogene Palaogeographie und Palinspastik des zirkum-mediterranen Raumes. – Annuale Naturhistorisches Museum Wien, 85: 135-163.

Stojanović, M., Tsekova, R. & Milutinović, T. 2012. Earthworms (Oligochaeta: Lumbricidae) of Bulgaria: Diversity and Biogeographical Review. – Acta Zoologica Bulgarica, 4: 7-15.

Szederjesi, T. & Csuzdi, C. 2012. New and little known earthworm species from Greece (Oligochaeta: Lumbricidae, Acanthodrilidae). – Zootaxa, 3304, 25-42.

Szederjesi, T., Pavlíček, T., Coşkun, Y. & Csuzdi, C. 2014. New earthworm records from Turkey, with description of three new species (Oligochaeta: Lumbricidae). – Zootaxa, 3764: (5): 555-570. DOI: 10.11646/zootaxa.3764.5.4

Szederjesi, T., Pavlíček, T. & Csuzdi, C. 2013. New data to the earthworm fauna of Israel (Oligochaeta, Lumbricidae). – Opuscula Zoologica Budapest, 44(2): 201-209.

Valchovski, H. 2012. Checklist of earthworms (Oligochaeta: Lumbricidae) from Bulgaria - a review. – Zootaxa, 3458: 86-102.

Zicsi, A. 1973. Regenwürmer (Oligochaeta: Lumbricidae) aus der Türkei. – Acta Zoologica Academiae Scientiarum Hungaricae, 19: 217-232.

Zicsi, A. 1981. Probleme der Lumbriciden. Systematik sowie die Revision zweier Gattungen (Oligochaeta). – Acta Zoologica Academiae Scientiarum Hungaricae, 27: 431-442.

Zicsi, A. 1985. Regenwürmer (Oligochaeta: Lumbricidae) aus Israel und den benachbarten Ländern. – Revue Suisse de Zoologie, 92: 323-331.

Zicsi, A. & Csuzdi, C. 1986. Regenwurmer aus Bulgarien (Oligochaeta, Lumbricidae). – Opuscula Zoologica Budapest, 22: 113-121.

Zicsi, A. & Michalis, K. 1981. Übersicht der regenwurm-fauna Griechenlands (Oligochaeta: Lumbricidae). – Acta Zoologica Academiae Scientiarum Hungaricae, 27: 239-264.

Zicsi, A. & Michalis, K. 1993. Zwei neue *Dendrobaena*-Arten aus Grichenland (Oligochaeta: Lumbricidae). – Acta Zoologica Academiae Scientiarum Hungaricae, 39: 301-310.

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