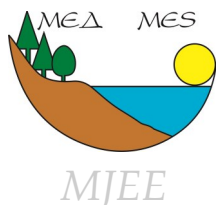


Earthworm (Oligochaeta: Lumbricidae) fauna from Pirin Macedonia (southwestern Bulgaria)

Фауната на дождовните црви (Oligochaeta: Lumbricidae) од Пиринска Македонија (југозападна Бугарија)

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The paper deals with contribution of the knowledge of earthworm fauna from Pirin Macedonia (Southwestern Bulgaria). During investigations eight earthworm taxa were registered. Two lumbricids *Aporrectodea longa* (Ude, 1885) and *Lumbricus terrestris* Linnaeus, 1758 are registered for the first time in Pirin Macedonia. In this paper we summarized our and previous published data for diversity of earthworms and established the list for the entire territory of the explored region. The list provide information about distribution and zoogeographical position of earthworms in Pirin Macedonia (Southwestern Bulgaria).

Keywords: earthworms, Lumbricidae, new records, Pirin Macedonia

Овој труд претставува придонес кон проучувањето на фауната на дождовните црви од Пиринска Македонија (југозападна Бугарија). Со истражувањата беа регистрирани осум таксони дождовни црви. Два од нив: *Aporrectodea longa* (Ude, 1885) и *Lumbricus terrestris* Linnaeus, 1758 се регистрирани за првпат во Пиринска Македонија. Во трудот се резимирани нашите и претходно објавените податоци за разновидност на дождовните црви и е прикажана листа со видови за целото истражувано подрачје. Кон видовите во листата е приклучена информација за распространувањето на зоогеографската припадност на дождовните црви во Пиринска Македонија.

Клучни зборови: дождовни глисти, Lumbricidae, нови податоци, Пиринска Македонија

Introduction

Pirin Macedonia is situated in Blagoevgrad province in Southwestern Bulgaria. The region has a territory of 6.449 km². Pirin Macedonia includes the Pirin Mountain with highest peak Vihren (2914 m), as well as part of border mountains with Macedonia and Greece: Slavyanka, Belasitsa, Vlahina, Maleshevska and Ograzhden Mountain. In the central part of the region is situated Sandanski-Petrich Valley with two major rivers Struma and Strumeshnitsa.

The early scientists who studied the earthworm fauna of Pirin Macedonia were Cernovitov (1934; 1937), Plisko (1963) and Sapkarev (1986). In the last decade, researchers from Serbia and Bulgaria organized exploration of some localities in Pirin Mountain, which contribute to the knowledge of earthworm fauna from the region (Stojanović et al. 2012).

Material and Methods

Investigations were carried out during March and May 2016. Earthworms were collected by the diluted formaldehyde method (Raw 1959) complemented with digging and hand-sorting. The combination of both methods provides a more complete sampling of species, because the formalin method alone is not efficient in collecting species living in a horizontal burrows. The specimens were killed in 70% ethanol, fixed in 4% formalin solution and in 70% ethanol. Six localities were investigated in Pirin Macedonia (South-western Bulgaria): Rupite and Sandanski in Sandanski-Petrich Valley, Melnik and Lilanovo in Pirin Mountain, Petrich and Samuilovo in Belasitsa Mountain.

The specimens were deposited in Institute of Soil Science, Agrotechnologies and Plant Protection "N. Poushkarov", Sofia, Bulgaria in private earthworm collection of Hristo Valchovski (PCHV). The earthworms were described and dissected under low power microscope. Identification of species was done in accordance to Mršić (1991).

Data about distribution in Bulgaria as well as zoogeographical position of earthworms in Pirin Macedonia are presented in Table 1. Zoogeographical evaluation was given following: Csuzdi et al. (2011) and Stojanović et al. (2012).

Abbreviations of legator: HV = Hristo Valchovski.

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Results

Class Oligochaeta

Family Lumbricidae Rafinesque-Schmaltz, 1815

Genus *Aporrectodea* Örley, 1885

Aporrectodea georgii (Michaelsen, 1890)

Allolobophora georgii Michaelsen, 1890: 3; Plisko 1963:431; Sapkarev 1986: 83.

Nicodrilus georgii: Perel 1979: 210.

Aporrectodea (Aporrectodea) georgii: Mršić 1991: 315.

Aporrectodea georgii: Valchovski 2012: 89.

Material examined: PCHV/79 two ex., south of Petrich in Belasitsa Mountain, 373 m, 41° 22' 58N 23° 11' 36E, 24.05.2016, leg. HV.

Previous occurrences in Pirin Macedonia: Petrich (Plisko 1963; Sapkarev 1986).

Aporrectodea handlirschi (Rosa, 1897)

Allolobophora handlirschii Rosa, 1897: 3; Šapkarev 1986: 84; Plisko 1963: 429.

Dendrobaena handlirschii: Mihailova 1966: 191.

Nicodrilus handlirschii: Perel 1979: 211.

Aporrectodea (Aporrectodea) handlirschi: Mršić & Šapkarev 1988: 27.

Aporrectodea handlirschi: Valchovski 2012: 89.

Material examined: PCHV/56 one ex., road between Lilanovo and Sandanski in Pirin Mountain, 323m, 41° 35' 05N 23° 17' 30E, 02.03.2016r, leg. HV; PCHV/57 two ex., Rupite in Sandanski-Petrishka Valley, near the church of Vanga, 95m, 41° 28' 00N 23° 15' 31E, 03.03.2016r, leg. HV.

Previous occurrences in Pirin Macedonia: Belasitsa Mt. (Plisko 1963), Petrich (Sapkarev 1986).

Aporrectodea jassyensis (Michaelsen, 1891)

Allolobophora jassyensis Michaelsen, 1891: 15; Mihailova 1966: 188; Sapkarev 1986: 83.

Aporrectodea jassyensis jassyensis: Valchovski 2014: 3.

Aporrectodea jassyensis: Szederjesi 2013: 77.

Material examined: PCHV/79 two ex., Samuilovo, Belasitsa Mountain, 351m, 41° 22' 14N 23° 04' 53E, 24.05.2016, leg. HV.

Previous occurrences in Pirin Macedonia: Petrich (Šapkarev 1986).

Aporrectodea longa (Ude, 1885)

Allolobophora longa Ude, 1885: 136.

Allolobophora f. longa typica: Mihailova 1966: 190.

Aporrectodea (Aporrectodea) longa: Mršić & Sapkarev 1988: 29.

Aporrectodea longa: Valchovski 2014: 3.

Material examined: PCHV/55 one ex., Sandanski in Sandanski-Petrich Valley, 283m, 41° 34' 36N 23° 17' 13E, 2.03.2016, leg. HV.

Remark. New for the fauna of Pirin Macedonia.

Aporrectodea rosea rosea (Savigny, 1826)

Enterion roseum Savigny, 1826: 182.

Allolobophora f. longa prashadi: Mihailova 1964:167.

Eisenia rosea var. *typica*: Mihailova 1966: 185.

Eisenia rosea var. *macedonica* (Rosa): Mihailova 1966: 186.

Eisenia rosea var. *bimastoides* (Rosa): Mihailova 1966: 186.

Allolobophora rosea: Plisko 1963: 428.

Allolobophora rosea rosea: Sapkarev 1986: 81.

Allolobophora rosea balcanica: Sapkarev 1986: 81.

Aporrectodea rosea rosea: Valchovski 2014: 3

Aporrectodea rosea: Stojanović *et al.* 2012: 9.

Material examined: two ex., Sandanski in Sandanski-Petrich Valley, 283m, 41° 34' 36N 23° 17' 13E, 2.03.2016, leg. HV; PCHV/56 two ex., road between Lilanovo and Sandanski in Pirin Mountain, 323m, 41° 35' 05N 23° 17'

30E, 02.03.2016r, leg. HV; PCHV/57 one ex., Rupite in Sandanski-Petrich Valley, near church of Vanga, 95m, 41° 28' 00N 23° 15' 31E, 03.03.2016r, leg. HV; PCHV/58 two ex., Melnik near Melnishka River before town in Pirin Mountain, 342m, 41° 31' 00N 23° 17' 04E, 03.03.2016r, leg. HV.

Previous occurrences in Pirin Macedonia: Razlog (Černosvitov 1937), Belasitsa Mt. (Plisko 1963), Petrich (Plisko 1963; Sapkarev 1986).

Genus *Lumbricus* Linnaeus, 1758

Lumbricus rubellus Hoffmeister, 1843

Lumbricus rubellus Hoffmeister, 1843: 187; Plisko 1963: 438; Mihailova 1966: 194; Zicsi & Csuzdi 1986: 120; Sapkarev 1986: 85; Stojanović *et al.* 2012: 9; Valchovski 2014: 5.

Material examined: PCHV/57 four ex., 95m, Rupite in Sandanski-Petrich Valley, near church of Vanga, 41° 28' 00N 23° 15' 31E, 03.03.2016r, leg. HV.

Previous occurrences in Pirin Macedonia: Belasitsa Mt. (Černosvitov 1934), Petrich (Sapkarev 1986), Pirin Mt. (Stojanović *et al.* 2012).

Lumbricus terrestris Linnaeus, 1758

Lumbricus herculeus: Bouché 1972: 352.

Lumbricus terrestris Linnaeus, 1758: 647; Černosvitov 1937: 90; Plisko 1963: 438; Šapkarev 1986: 85; Zicsi & Csuzdi 1986: 120; Stojanović *et al.* 2012: 9; Szederjesi 2013: 80; Valchovski 2014: 5.

Material examined: PCHV/58 two ex., Melnik near Melnishka River before town in Pirin Mountain, 342m, 41° 31' 00N 23° 17' 04E, 03.03.2016r, leg. HV.

Remark. This is the first record of *L. terrestris* from Pirin Macedonia.

Genus *Octolasion* Örley, 1885

Octolasion lacteum (Örley, 1881)

Lumbricus terrestris var. *lacteum* Örley, 1881: 584.

Octolasion lacteum: Mihailova 1966: 193; Valchovski 2012: 98, Szederjesi 2013: 81.

Material examined: PCHV/56 two ex., road between Lilanovo and Sandanski in Pirin Mountain, 323m, 41° 35' 05N 23° 17' 30E, 02.03.2016r, leg. HV; PCHV/58 two ex., Melnik near Melnishka River before town in Pirin Mountain, 342m, 41° 31' 00N 23° 17' 04E, 03.03.2016r, leg. HV.

Previous occurrences in Pirin Macedonia: Belasitsa Mt. (Plisko 1963; Sapkarev 1986), Pirin Mt. (Stojanović *et al.* 2012).

Discussion

In the current study 8 earthworm species are recorded in Pirin Macedonia. Two lumbricids *Aporrectodea longa* and *Lumbricus terrestris* are new for the earthworm fauna of the region. According to present study and previous literature data 23 earthworm species are known for Pirin Macedonia (Table 1). This is major part of Bulgarian earthworm fauna, which comprises 50 lumbricid taxa from the entire territory of the country (Valchovski 2012).

The zoogeographical position of earthworm fauna from Pirin Macedonia is highly peregrine. From the 23 species 12 taxa (52.17%) belongs to the Peregrine. Endemic species take part with four taxa = 17.3%. Also important components of earthworm biodiversity are Trans-Aegean (4 taxa = 17.3%). Mediterranean species (1 taxon = 4.34%), Central European (1 taxon = 4.34%) and Balkanic-Alpine (1 taxon = 4.34%) are less numerous.

More detailed investigation is needed because large areas of border region with Republic of Macedonia have

not been yet explored properly for earthworm diversity. It is to be expected that in future research new species will be found, especially in western parts of Pirin Macedonia.

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Table 1. Data about distribution in Bulgaria and zoogeographical position of earthworm species in Pirin Macedonia

Species	Distribution	Zoogeography
<i>Allolobophora chlorotica</i> (Savigny, 1826)	Belasitsa Mt. (Šapkarev 1986), Pirin Mt. (Stojanović et al. 2012).	Peregrine
<i>Allolobophora tuleshkovi</i> (Černosvitov, 1934)	Pirin Mt. (Černosvitov 1934)	Endemic
<i>Aporrectodea caliginosa</i> (Savigny, 1826)	Belasitsa Mt. (Plisko 1963) Pirin Mt. (Stojanović et al. 2012),	Peregrine
<i>Aporrectodea georgii</i> (Michaelsen, 1890)	Belasitsa Mt. (Plisko 1963; Šapkarev 1986; authors data)	Trans-Aegean
<i>Aporrectodea handlirschi</i> (Rosa, 1897)	Belasitsa Mt. (Plisko 1963; Šapkarev 1986) Sandanski-Petrich Valley (authors data)	Trans-Aegean
<i>Aporrectodea jassyensis</i> (Michaelsen, 1891)	Belasitsa Mt. (Šapkarev 1986; authors data),	Trans-Aegean
<i>Aporrectodea longa</i> (Ude, 1885)	Sandanski-Petrich Valley (authors data)	Peregrine
<i>Aporrectodea rosea</i> (Savigny, 1826)	Belasitsa Mt. (Černosvitov 1937; Plisko 1963; Šapkarev 1986) Sandanski-Petrich Valley, Pirin Mt. (authors data)	Peregrine
<i>Aporrectodea trapezoides</i> (Dugès, 1828)	Belasitsa Mt. (Šapkarev 1986), Pirin Mt. (Stojanović et al. 2012).	Peregrine
<i>Dendrobaena alpina</i> (Rosa, 1884)	Pirin Mt. (Uzunov 2010)	Balkan-Alpine
<i>Dendrobaena balcanica</i> (Černosvitov, 1937)	Slavyanka Mt. (Černosvitov 1937) Pirin Mt. (Zicsi & Csuzdi 1986).	Endemic
<i>Dendrobaena byblica</i> (Rosa, 1893)	Belasitsa Mt. (Plisko 1963)	Circum-Mediterranean
<i>Dendrodrilus rubidus rubidus</i> (Savigny, 1826)	Belasitsa Mt. (Černosvitov 1934)	Peregrine
<i>Dendrodrilus rubidus subrubicundus</i> (Eisen, 1874)	Pirin Mt. (Stojanović et al. 2012).	Peregrine
<i>Eisenia fetida</i> (Savigny, 1826)	Pirin Mt. (Stojanović et al. 2012).	Peregrine
<i>Eisenia lucens</i> (Waga, 1857)	Belasitsa Mt. (Černosvitov 1934)	Central-European
<i>Eisenia storkani</i> Černosvitov, 1934	Belasitsa Mt. (Černosvitov 1934)	Endemic
<i>Eiseniella tetraedra</i> (Savigny, 1826)	Belasitsa Mt. (Plisko 1963) Slavyanka Mt., Pirin Mt. (Černosvitov 1937)	Peregrine
<i>Lumbricus rubellus</i> Hoffmeister, 1843	Belasitsa Mt. (Černosvitov 1934) Pirin Mt. (Stojanović et al. 2012) Sandanski-Petrich Valley (authors data)	Peregrine
<i>Lumbricus terrestris</i> Linnaeus, 1758	Pirin Mt. (authors data)	Peregrine
<i>Octolasion lacteum</i> (Örley, 1881)	Belasitsa Mt. (Plisko 1963; Šapkarev 1986) Pirin Mt. (Stojanović et al. 2012; authors data)	Peregrine
<i>Proctodrilus tuberculata</i> (Černosvitov, 1935)	Belasitsa Mt. (Plisko 1963)	Trans-Aegean
<i>Spermophorodrilus antiquus</i> (Černosvitov, 1938)	Belasitsa Mt. Slavyanka Mt. (Delchev et al. 1998)	Endemic

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