

NEW EARTHWORM SPECIES AND RECORDS
FROM THE SOUTHERN CARPATHIANS
(MEGADRILI: LUMBRICIDAE)

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Recent collecting trips to different parts of the Southern Carpathians resulted in reporting 26 earthworm species, among them two species new to science: *Dendrobaena cinerea* sp. n. and *Octodrilus banaticus* sp. n. Moreover, *Allolobophora pannonica* (Cognetti, 1906) has been resurrected from synonymy of *A. mehadiensis mehadiensis* Rosa, 1895 and reinstated as a separate species. With all these, the number of earthworm species and subspecies present in Romania is now 80.

Key words: earthworms, Lumbricidae, new species, Carpathians, Romania.

INTRODUCTION

The earthworm fauna of Romania is quite well-known. The research began at the end of the 19th century (ÖRLEY 1881, 1885) and continued during the 20th century (MICHAELSEN 1891, 1903, ČERNOSVITOV 1932, POP 1949, ZICSI & POP 1984). In his summarizing work VICTOR POP (1949) recorded the presence of 47 lumbricid taxa in the country, which was soon complemented to 50 (POP 1964). As a result of the continuous exploratory work, the number of earthworm species and subspecies has recently reached 71 (POP *et al.* 2012). Since then, a new faunistical record and description of five new taxa raised the number of earthworm species present in Romania to 77 (SZEDERJESI *et al.* 2014, 2016, 2017).

It is worth mentioning that most of the earlier researches focused mainly on Transylvania and the inner Carpathians, and not much collecting expeditions were led to the outer areas of the mountain range. However, this region harbours a special earthworm fauna with strong East Balkanic affinities (CSUZDI *et al.* 2011).

To explore these remote regions of the Carpathian chain we have led several expeditions between 2004 and 2009 resulted in recording altogether 41 earthworm taxa including a species new to science and a greyish specimen which phenetically looked similar to the *Dendrobaena platyura* species group

but had male pores on segment 15 (SZEDERJESI *et al.* 2014). Unfortunately we had only a single specimen of this interesting species therefore in 2016 we have visited the region again but our effort was unsuccessful. However, the first author (TSZ) during a visit to the Natural History Museum, Vienna discovered two well-preserved specimens of this interesting species collected by L. Ganglbauer in Mehadia, Romania. The aim of this paper is to present the results of the last earthworm collecting trips to different parts of the Southern Carpathians, with reinstatement of a formerly synonym species and description of two species new to science including the one which was reported as *Dendrobaena* sp. in our previous paper (SZEDERJESI *et al.* 2014).

MATERIAL AND METHODS

Earthworms were collected by the diluted formaldehyde method (Raw 1959), complemented with digging and hand-sorting. The specimens were killed and fixed in 96% ethanol and deposited in the earthworm collection of the Hungarian Natural History Museum (HNHM). Additional material housed in the Natural History Museum Vienna (NHMV) was also examined.

Altogether 16 partial 5.8 rDNA-ITS2-partial 28S rDNA (ITS2) sequences were used for the phylogenetic reconstruction (Table 1). The protocol described by SZEDERJESI *et al.*

Table 1. Codes, collecting localities and GenBank accession numbers of the specimens analysed.

Species	HNHM code	Locality	GenBank Accession No.
<i>Dendrobaena cinerea</i> sp. n.	16810	Romania: Măru	MH843156
<i>D. byblica</i>	16160	Albania: Korab Mts	KT823901
<i>D. byblica</i>	16214	Montenegro: Sinjajevina Mts	KT823902
<i>D. byblica</i>	16457	Serbia: Golubac	KT823903
<i>D. byblica</i>	16185	Greece: Karpathos	KT823898
<i>D. byblica</i>	16661	Greece: Crete	KT823899
<i>D. daghestanensis</i>	16105	Georgia: Borjomi	KT823900
<i>D. platyura</i>	16439	Hungary: Velem	KT823916
<i>D. depressa</i>	16379	Bulgaria: Stara Planina	KT823911
<i>D. carpathomontana</i>	15963	Romania: Ciumârna	KT823914
<i>D. olympiaca</i>	16629	Greece: Naxos	KT823905
<i>D. olympiaca</i>	15824	Greece: Sitena	KT823906
<i>D. annectens</i>	16249	Romania: Cerna Sat	KT823907
<i>D. transylvanica</i>	15497	Romania: Zarand Mts	KT823908
<i>D. herculis</i>	16231	Romania: Ponoarele	KT823904
<i>H. mozsaryorum</i>	16134	Hungary: Aggtelek karst	KT823922

(2017) was used for obtaining the ITS2 sequence of *Dendrobaena* sp. n. The new sequence has been uploaded to the GenBank database (BENSON *et al.* 2012). The alignment was performed using the online server of MAFFT v7 (KATO & STANDLEY 2013). The phylogenetic tree was constructed using Bayesian analysis. Estimations with MEGA V6.0 using the Bayesian information criterion (BIC) (SCHWARZ 1978) revealed that the best fitting model for ITS2 was GTR+G. Bayesian analysis was performed with MrBayes 3.2 (RONQUIST *et al.* 2012), using Metropolis Coupled Markov Chain Monte Carlo simulations for 10 million generations, sampling a tree every 1000 generations. After removing the first 2000 trees as burn-in, FigTree 1.4.0 (RAMBAUT 2012) was used for visualization.

TAXONOMY

Allolobophora pannonica (Cognetti, 1906) **stat. restit.**

Helodrilus ictericus var. *pannonica* Cognetti, 1906: 19.

Allolobophora mehadiensis var. *pannonica*: Pop 1948: 109.

Allolobophora icterica var. *pannonica*: Pop 1949: 63.

Serbiona pannonica: Mršić 1991: 198.

Allolobophora mehadiensis mehadiensis (part.): Pop *et al.* 2012: 63.

Material examined. NHMV/5009 1 ex. adult lectotypus + 1 ex. juvenile cut specimen, Südost-Siebenbürgen, Paring Gebirg (Southeast Transylvania, Parâng Mts), leg. L. Ganglbauer. HNHM/17191 1 ex., Parâng Mts, N of Novaci, 675 m, 45°12.0436'N 23°41.5426'E, pasture with alder and hawthorn, leg. Cs. Csuzdi, L. Dányi, V. V. Pop, T. Szederjesi, 12.11.2016. HNHM/17195 1 ex., Parâng Mts, between Novaci and Rânca, 722 m, 45°12.2333'N 23°41.8088'E, beech forest, leg. Cs. Csuzdi, L. Dányi, V. V. Pop, T. Szederjesi, 12.11.2016.

External characters. Length 63–109 mm and 4.5–5 mm wide. Number of segments 156–172 with secondary and tertiary annulations. Colour light greyish. Prostomium epilobous ½ closed. First dorsal pore at the intersegmental furrow 9/10. Setae closely paired. Setal arrangement behind clitellum: aa:ab:bc:cd:dd = 19.94:1.51:11.83:1:33.76. Male pores on segment 15, surrounded by glandular crescents, confined in its own segment. Nephridial pores invisible. Clitellum on segments ½34, 35–46. Tubercula pubertatis on segments 38–46. Glandular tumescence on segments 13, 15–20, 32–38 *ab*.

Internal characters. Septa 5/6–9/10 strongly, 10/11–13/14 slightly thickened. Testes and funnels paired in segments 10–11. Two pairs of seminal vesicles in 11–12. Two pairs of spermathecae in 9/10, 10/11 with external openings in setal line *d*. Calciferous glands in 10–12 with diverticula in segment 10. Paired hearts in segments 7–11. with a pair of small extraesophageal vessels in 12. Nephridial bladders J-shaped, proclinate. Crop in segments 15–16, and gizzard in segments 17–18. Typhlosolis multilobous. The cross-section of the longitudinal muscle layer of fasciculated type.

Remarks. COGNETTI (1906) described this species as a variety of *Aporrectodea icterica* (Savigny, 1826) based on a subadult specimen, mentioning only a few characteristics (e.g. the clitellum) and highlighting that all the others are similar to *Ap. icterica*. Since then the different authors revised this taxon based exclusively on the original description, without examining the type

Table 2. Distinguishing characters of *A. pannonica* and the *A. mehadiensis* subspecies.

Taxon	Body length × width	Segment number	Clitellum	Tubercles	Vesicles
<i>A. pannonica</i> (Cognetti, 1906)	63–109 mm × 4.5–5 mm	156–172	½34, 35–46	38–46	11, 12
<i>A. mehadiensis mehadiensis</i> Rosa, 1895	150–210 mm × 4–10 mm	200–270	35, 36–47, 48	41, 42–47, 48	9–12
<i>A. mehadiensis boscaiui</i> Pop, 1948	95–190 mm × 6–8 mm	228–248	33, 34–44, 45, 46	38–43, 44, 45	9–12
<i>A. mehadiensis oreophila</i> Pop, 1978	143–270 mm × 5–8 mm	260–299	34, 35–49, 50	39, 40, 41–45, 46	9–12

specimens. Pop (1948) while describing *A. mehadiensis* var. *boscaiui*, revised the morphologically similar taxa and regarded *pannonica* as a variety of *mehadiensis*, basically because it fits well the Dacian *mehadiensis* group with its type locality in the Parâng Mts, Southern Carpathians, instead of *Ap. icterica*, which is mostly found in France, Belgium, Switzerland and Italy. Pop also emphasized that even though *pannonica* has only two pairs of vesicles similarly to *Ap. icterica*, most *A. mehadiensis* subspecies have very small or reduced vesicles in segment 9 and 10, and here probably a transition can be observed between the 4 pairs type and the 2 pairs.

MRŠIĆ (1991), in his monograph, placed *pannonica* into the Carpatho-Balkan genus *Serbiona* and raised it to species level, but without any remark. On the other hand, Pop *et al.* (2012) regarded *pannonica* as a synonym of *A. mehadiensis mehadiensis* Rosa, 1895 because of the position of its clitellar organs, based on the original description.

Morphologically, some newly collected specimens from the Parâng Mts. showed high similarity with the syntypes housed in the earthworm collection of the Natural History Museum Vienna and revealed just slight differences from the original description, mainly in the position of the tubercles: 38–46 vs. 35–44 (the latter is similar to *Ap. icterica*). Its body dimensions, the number of vesicles, the position of the clitellum and the tubercles clearly differentiate *pannonica* from the *mehadiensis* subspecies (Table 2) and justify its species level status. From the two syntype specimens in the collection of the NHMV, the more or less adult specimen has been selected as lectotype.

Allolobophora robusta Rosa, 1895

Allolobophora robusta Rosa, 1895: 2. Pop *et al.* 2012: 63.

Material examined. HNHM/16710 1 ex., Țarcu Mts, beech forest on blacktop 3 km E of Borlova, 530 m, N45.35276 E22.3900, leg. I. Iorgu, R. Kleukers, B. Odé, G. Puskás, G.

Szövényi, L. Willemse, 09.07.2013. HNHM/16711 1 ex., Țarcu Mts, beech-spruce forest, 1.5 km NW of Cuntu hut, 1370 m, N45.30911 E22.48827, leg. I. Iorgu, R. Kleukers, B. Odé, G. Puskás, G. Szövényi, L. Willemse, 09.07.2013. HNHM/17237 4 ex., Țarcu Mts, between Măru and Poiana Mărului, 443 m, 45°26.0775'N 22°27.4282'E, mixed beech forest, leg. Cs. Csuzdi, L. Dányi, V.V. Pop, T. Szederjesi, 10.11.2016.

Aporrectodea caliginosa caliginosa (Savigny, 1826)

Enterion caliginosum Savigny, 1826: 180.

Aporrectodea caliginosa: Pop *et al.* 2012: 63.

Material examined. HNHM/17193 4 ex., Parâng Mts, N of Novaci, 675 m, 45°12.0436'N 23°41.5426'E, pasture with alder and hawthorn, leg. Cs. Csuzdi, L. Dányi, V.V. Pop, T. Szederjesi, 12.11.2016. HNHM/17198 2 ex., Parâng Mts, N of Novaci, bank of Gilort, 658 m, 45°13.388'N 23°40.22'E, mixed forest, leg. Cs. Csuzdi, L. Dányi, V.V. Pop, T. Szederjesi, 11.11.2016. HNHM/17215 1 ex., Parâng Mts, stream valley NW of Novaci, 505 m, 45°11.5962'N 23°39.95'E, chestnut forest patch, leg. Cs. Csuzdi, L. Dányi, V.V. Pop, T. Szederjesi, 13.11.2016. HNHM/17234 6 ex., Țarcu Mts, S of Măru, 399 m, 45°27.6147'N 22°26.7447'E, pasture, leg. Cs. Csuzdi, L. Dányi, V.V. Pop, T. Szederjesi, 10.11.2016.

Aporrectodea rosea (Savigny, 1826)

Enterion roseum Savigny, 1826: 182.

Aporrectodea rosea: Pop *et al.* 2012: 63.

Material examined. HNHM/17194 1 ex., Parâng Mts, N of Novaci, 675 m, 45°12.0436'N 23°41.5426'E, pasture with alder and hawthorn, leg. Cs. Csuzdi, L. Dányi, V.V. Pop, T. Szederjesi, 12.11.2016. HNHM/17220 2 ex., Vâlcan Mts, N of Vaidei, bank of Șușita Verde, 425 m, 45°11.6738'N 23°16.1299'E, beech forest, leg. Cs. Csuzdi, L. Dányi, V.V. Pop, T. Szederjesi, 11.11.2016. HNHM/17235 1 ex., Țarcu Mts, S of Măru, 399 m, 45°27.6147'N 22°26.7447'E, pasture, leg. Cs. Csuzdi, L. Dányi, V.V. Pop, T. Szederjesi, 10.11.2016. HNHM/17242 2 ex., Țarcu Mts, between Măru and Poiana Mărului, 443 m, 45°26.0775'N 22°27.4282'E, mixed beech forest, leg. Cs. Csuzdi, L. Dányi, V.V. Pop, T. Szederjesi, 10.11.2016.

Bimastos rubidus (Savigny, 1826)

Enterion rubidum Savigny, 1826: 182.

Dendrodrilus rubidus rubidus: Pop *et al.* 2012: 63.

Dendrodrilus rubidus subrubicundus: Pop *et al.* 2012: 63.

Bimastos rubidus: Csuzdi *et al.* 2017: 20.

Material examined. HNHM/17200 1 ex., Parâng Mts, N of Novaci, bank of Gilort, 658 m, 45°13.388'N 23°40.22'E, mixed forest, leg. Cs. Csuzdi, L. Dányi, V. V. Pop, T. Szederjesi, 11.11.2016. HNHM/17204 1 ex., Parâng Mts, between Novaci and Râncă, 1132 m, 45°13.885'N 23°41.2141'E, alpine pasture with scattered beech trees, leg. Cs. Csuzdi, L. Dányi, V. V. Pop, T. Szederjesi, 12.11.2016. HNHM/17210 2 ex., between Tismana and Peștișani, 182 m, 45°2.62'N 22°59.49'E, mixed hornbeam and oak forest, leg. Cs. Csuzdi, L.

Dányi, V. V. Pop, T. Szederjesi, 11.11.2016. HNHM/17217 1 ex., Parâng Mts, stream valley NW of Novaci, 505 m, 45°11.5962'N 23°39.95'E, chestnut forest patch, leg. Cs. Csuzdi, L. Dányi, V. V. Pop, T. Szederjesi, 13.11.2016.

Cernosvitovia rebeli (Rosa, 1897)

Allolobophora rebelii Rosa, 1897: 2.

Cernosvitovia rebelii: Pop *et al.* 2012: 63.

Cernosvitovia rebeli: Szederjesi *et al.* 2014: 91.

Material examined. HNHM/17209 1 ex., between Tismana and Peștișani, 182 m, 45°2.62'N 22°59.49'E, mixed hornbeam and oak forest, leg. Cs. Csuzdi, L. Dányi, V. V. Pop, T. Szederjesi, 11.11.2016. HNHM/17212 11 ex., between Borlova and Baia de Aramă, 216 m, 45°0.4919'N 22°48.8658'E, mixed hornbeam and oak forest with beech and chestnut, leg. Cs. Csuzdi, L. Dányi, V. V. Pop, T. Szederjesi, 11.11.2016. HNHM/17229 1 ex., Țarcu Mts, between Borlova and Muntele Mic, 495 m, 45°20.5163'N 22°24.4343'E, mixed beech forest, leg. Cs. Csuzdi, L. Dányi, V. V. Pop, T. Szederjesi, 10.11.2016.

***Dendrobaena cinerea* Szederjesi, Pop & Csuzdi sp. n.**
(Fig. 1)

Dendrobaena sp.: Szederjesi *et al.* 2014: 97.

Holotype. HNHM/16810 1 ex., Țarcu Mts, after Măru, beech forest, 501 m, N45°25.978' E22°27.550', leg. Cs. Csuzdi, J. Kontschán, V. V. Pop, 02.11.2007.

Paratypes. NHMV/4990 2 ex., Mehadia, leg. L. Ganglbauer.

Etymology. The name refers to the special colour of the specimens ('cinerea' = greyish).

Diagnosis. Length 113–132 mm, diameter 5–6 mm, setae distantly standing. Pigmentation grey with slight reddish hints. First dorsal pore in 8/9. Clitellum on 25–30, tubercles on $\frac{1}{2}$ 25– $\frac{1}{2}$ 29. Male pores hardly seen on segment 15. Nephridial pores aligned above setal line *b*. Four pairs of seminal vesicles in 9–12; spermathecae 9/10, 10/11 in setal line *d*. Calciferous glands with well-developed diverticula in 11. Hearts in segments 7–11, nephridial bladders biscuit-shaped.

External characters. Holotype 132 mm long and 6 mm wide. Number of segments 134. Paratypes 113–121 mm long and 5–5.5 mm wide. Number of segments 153–157. Pigmentation grey with slight reddish hints. Prostomium epilobous $\frac{1}{2}$ closed. First dorsal pore at the intersegmental furrow 8/9. Setae distantly standing. Setal arrangement behind clitellum: aa:ab:bc:cd:dd = 1.57:1.29:1.19:1.19:1.95. Male pores hardly seen on segment 15. Nephridial pores just above setal line *b*. Clitellum on segments 25–30. Tubercula pubertatis on segments $\frac{1}{2}$ 25– $\frac{1}{2}$ 29. Glandular tumescence on segments 10, 11, 13, 14, 26, 29, 30 *ab*.

Internal characters. Septa 6/7–7/8 and 11/12 slightly thickened, 8/9–10/11 thickened, 12/13–14/15 strongly thickened. Testes and funnels paired in segments 10–11, covered by

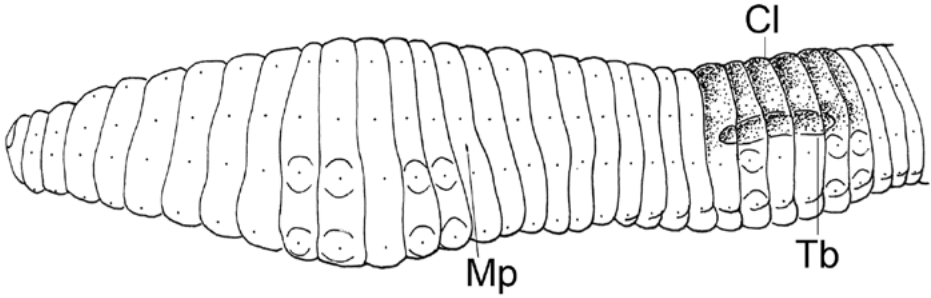


Fig. 1. Ventrolateral view of *Dendrobaena cinerea* sp. n. Mp = male pore, Cl = clitellum, Tb = tubercles

perioesophageal testis sac in segment 10–11. Four pairs of seminal vesicles in 9–12. Two pairs of spermathecae in 9/10, 10/11 with external openings in setal line *d*. Calciferous glands with well-developed diverticula in segment 11. Paired hearts in segments 7–11. with a pair of small extraesophageal vessels in 12. Nephridial bladders biscuit-shaped.

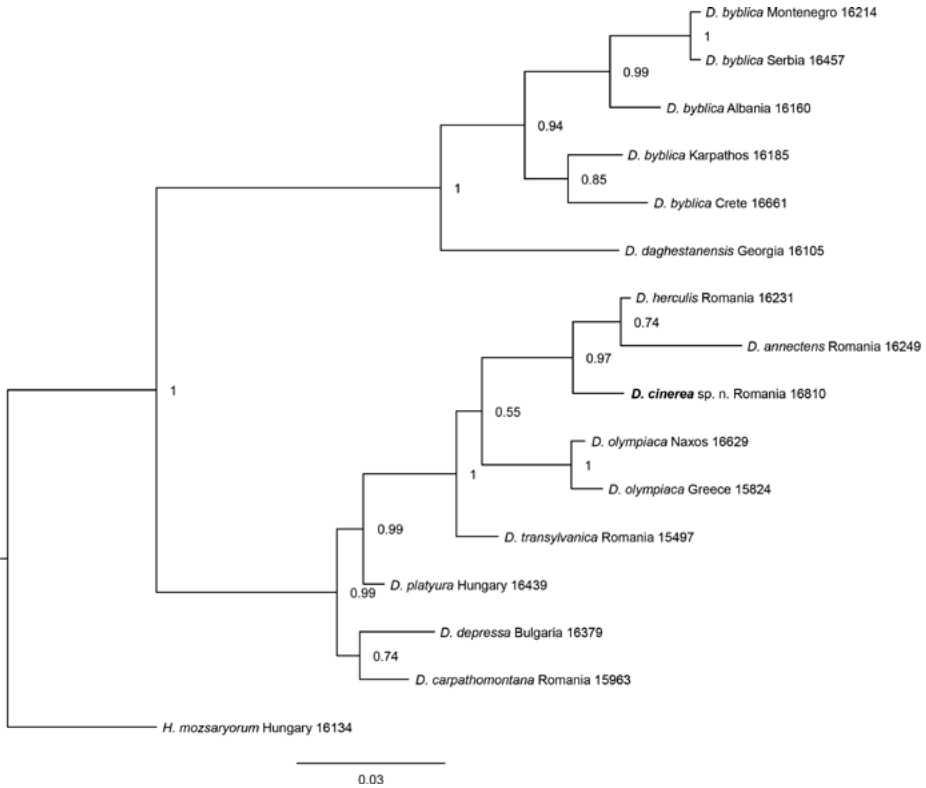


Fig. 2. Bayesian inference tree of *D. cinerea* sp. n. and the morphologically similar species, based on the ITS2 sequences. Numbers indicate the posterior probability values

Table 3. Distinguishing characters of the species similar to *D. cinerea* sp. n.

Species	Clitellum	Tubercles	Male pore	Vesicles	Spermathecae	Colour
<i>Dendrobaena cinerea</i> sp. n.	25–30	½ 25–½ 29	15	9–12	9/10, 10/11 <i>d</i>	greyish
<i>D. herculis</i> Szederjesi, Pop et Csuzdi, 2017	½ 24–½ 30	26–28	15	9–12	9/10, 10/11 <i>d</i>	dark red-violet
<i>D. transyloanica</i> Szederjesi, Pop et Csuzdi, 2017	25–29	26–28	15	9–12	9/10, 10/11 <i>d</i>	dark red-violet
<i>D. annectens</i> (Rosa, 1895)	25–½ 30, 30	26–28	23 or 24	9–12	9/10, 10/11 <i>d</i>	dark red-violet
<i>D. olympiaca</i> (Michaelsen, 1902)	25–30	26–28	15	9–12	9/10, 10/11 <i>d</i>	dark red-violet
<i>D. platyura</i> (Fitzinger, 1833)	½ 24, 25–30	25, 26–29	26 or 27	9, 11, 12 or 9–12	9/10, 10/11 <i>d</i>	red-violet
<i>D. depressa</i> (Rosa, 1893)	½ 24, 25–30	25, 26–29, 30	26	9, 11, 12 or 9–12	6/7, 7/8, 8/9–10/11 <i>d</i>	dark grey with reddish iridescence
<i>D. carpathomontana</i> (Szederjesi, Pop et Csuzdi, 2017)	½ 24, 25–½ 30, 30	½ 25–½ 30	25	11, 12	6/7, 7/8, 8/9–10/11 <i>d</i>	dark grey with reddish iridescence

Crop in segments 15–16, and gizzard in segments 17–18. Typhlosolis unilobous. The cross-section of the longitudinal muscle layer of pinnate type.

Remarks. According to the phylogenetic reconstruction based on the ITS2 sequences, the new species is placed into the clade of species bearing red-violet or greyish pigmentation and calciferous diverticula in segment 11 (Fig. 2). *Dendrobaena* sp. n. stands most closely to *D. herculis* Szederjesi, Pop et Csuzdi, 2017 and *D. annectens* (Rosa, 1895). Morphologically it most resembles *D. depressa* (Rosa, 1893) and *D. carpathomontana* (Szederjesi, Pop et Csuzdi, 2017) with its size and the clitellar organs, but differs from them in the position of the male pore and colouration. The most important morphological characteristics of the similar species are shown in Table 3.

Dendrobaena alpina alpina (Rosa, 1884)*Allolobophora alpina* Rosa, 1884: 28.*Dendrobaena alpina alpina*: Pop *et al.* 2012: 63.

Material examined. HNHM/17233 6 ex., HNHM/17246 5 ex., Țarcu Mts, between Măru and Poiana Mărului, 514 m, 45°25.739'N 22°27.95'E, beech forest, leg. Cs. Csuzdi, L. Dányi, V.V. Pop, T. Szederjesi, 09.11.2016. HNHM/17381 3 ex., Țarcu Mts, Borlova, beech forest, 847 m, N45°19.838' E22°27.512', leg. Cs. Csuzdi, J. Kontschán, V.V. Pop.

Dendrobaena alpina popi Šapkarev, 1971*Dendrobaena alpina popi* Šapkarev, 1971: 159. Pop *et al.* 2012: 63.

Material examined. HNHM/17203 10 ex., Parâng Mts, between Novaci and Râncea, 1132 m, 45°13.885'N 23°41.2141'E, alpine pasture with scattered beech trees, leg. Cs. Csuzdi, L. Dányi, V.V. Pop, T. Szederjesi, 12.11.2016. HNHM/17219 3 ex., Vâlcan Mts, N of Vaidei, bank of Șușita Verde, 425 m, 45°11.6738'N 23°16.1299'E, beech forest, leg. Cs. Csuzdi, L. Dányi, V. V. Pop, T. Szederjesi, 11.11.2016. HNHM/17222 15 ex., Parâng Mts, stream valley NW of Novaci, 505 m, 45°11.5962'N 23°39.95'E, chestnut forest patch, leg. Cs. Csuzdi, L. Dányi, V. V. Pop, T. Szederjesi, 13.11.2016.

Dendrobaena annectens (Rosa, 1895)*Allolobophora ganglbaueri* var. *annectens* Rosa, 1895: 7.*Fitzingeria annectens*: Pop *et al.* 2012: 64.*Dendrobaena annectens*: Szederjesi *et al.* 2017: 508.

Material examined. HNHM/17197 6 ex., Parâng Mts, N of Novaci, bank of Gilort, 658 m, 45°13.388'N 23°40.22'E, mixed forest, leg. Cs. Csuzdi, L. Dányi, V. V. Pop, T. Szederjesi, 11.11.2016. HNHM/17201 6 ex., Parâng Mts, stream valley NW of Novaci, 497 m, 45°11.8602'N 23°39.5161'E, mixed forest with hornbeam, beech and alder, leg. Cs. Csuzdi, L. Dányi, V. V. Pop, T. Szederjesi, 13.11.2016. HNHM/17213 9 ex., HNHM/17223 3 ex., Parâng Mts, stream valley NW of Novaci, 505 m, 45°11.5962'N 23°39.95'E, chestnut forest patch, leg. Cs. Csuzdi, L. Dányi, V. V. Pop, T. Szederjesi, 13.11.2016. HNHM/17226 4 ex., Vâlcan Mts, N of Vaidei, bank of Șușita Verde, 452 m, 45°11.8473'N 23°16.0514'E, beech forest, leg. Cs. Csuzdi, L. Dányi, V. V. Pop, T. Szederjesi, 11.11.2016. HNHM/17232 44 ex., Parâng Mts, stream valley NW of Novaci, 497 m, 45°11.8602'N 23°39.5161'E, mixed forest with hornbeam, beech and alder, leg. Cs. Csuzdi, L. Dányi, V. V. Pop, T. Szederjesi, 13.11.2016.

Dendrobaena attemsi (Michaelsen, 1902)*Helodrilus* (*Dendrobaena*) *attemsi* Michaelsen, 1902: 47.*Dendrobaena attemsi*: Pop *et al.* 2012: 63.

Material examined. HNHM/17206 1 ex., between Tismana and Peștișani, 182 m, 45°2.62'N 22°59.49'E, mixed hornbeam and oak forest, leg. Cs. Csuzdi, L. Dányi, V.V. Pop, T. Szederjesi, 11.11.2016.

Dendrobaena carpathomontana (Szederjesi, Pop et Csuzdi, 2017)

Octolasion montanum Černosvitov, 1932: 535.

Fitzingeria platyura montana: Pop et al. 2012: 64.

Dendrobaena carpathomontana: Szederjesi et al. 2017: 509.

Material examined. HNHM/17192 9 ex., Parâng Mts, N of Novaci, 675 m, 45°12.0436'N 23°41.5426'E, pasture with alder and hawthorn, leg. Cs. Csuzdi, L. Dányi, V. V. Pop, T. Szederjesi, 12.11.2016.

Dendrobaena herculis Szederjesi, Pop et Csuzdi, 2017

Dendrobaena herculis Szederjesi, Pop et Csuzdi, 2017: 510.

Material examined. HNHM/17224 6 ex., Cerna Valley, NE of Băile Herculane, 208 m, 44°58.3332'N 22°29.5154'E, beech forest, leg. Cs. Csuzdi, L. Dányi, V.V. Pop, T. Szederjesi, 10.11.2016. HNHM/17243 3 ex., Țarcu Mts, between Măru and Poiana Mărului, 514 m, 45°25.739'N 22°27.95'E, beech forest, leg. Cs. Csuzdi, L. Dányi, V.V. Pop, T. Szederjesi, 09.11.2016. HNHM/17247 4 ex., Țarcu Mts, between Măru and Poiana Mărului, 440 m, 45°25.97'N 22°27.561'E, mixed beech forest, leg. Cs. Csuzdi, L. Dányi, V.V. Pop, T. Szederjesi, 10.11.2016. HNHM/17254 10 ex., Țarcu Mts, between Măru and Poiana Mărului, 635 m, 45°25.05'N 22°29.19'E, young mixed beech forest, leg. Cs. Csuzdi, L. Dányi, V.V. Pop, T. Szederjesi, 09.11.2016.

Dendrobaena octaedra (Savigny, 1826)

Enterion octaedrum Savigny, 1826: 183.

Dendrobaena octaedra: Pop et al. 2012: 63.

Material examined. HNHM/17207 1 ex., between Tismana and Peștișani, 182 m, 45°2.62'N 22°59.49'E, mixed hornbeam and oak forest, leg. Cs. Csuzdi, L. Dányi, V. V. Pop, T. Szederjesi, 11.11.2016. HNHM/17365 1 ex., Argeș county, NW of Dâmbovițioara, along the road to Dâmbovițioara Cave, 920 m, N45.4464 E25.2207, leg. T. Asami, Z. Fehér, G. Katona, B. Páll-Gergely, 28.08.2018. HNHM/17368 1 ex., Dâmbovița county, 5 km NE of Glod, at the bridge of Valea Largă, 790 m, N45.2735 E25.5001, leg. T. Asami, Z. Fehér, G. Katona, B. Páll-Gergely, 27.08.2018. HNHM/17380 1 ex., Țarcu Mts, Borlova, beech forest, 847 m, N45°19.838' E22°27.512', leg. Cs. Csuzdi, J. Kontschán, V. V. Pop, 01.11.2007.

Dendrobaena virgata Szederjesi, Pop et Csuzdi, 2014

Dendrobaena virgata Szederjesi, Pop et Csuzdi 2014: 91.

Material examined. HNHM/16809 1 ex., Țarcu Mts, spring and its outlet at Cuntu Meteorological Station, 1465 m, leg. T. Kovács, D. Murányi, G. Puskás, 09.06.2011. HNHM/17230 14 ex., Țarcu Mts, between Borlova and Muntele Mic, 495 m, 45°20.5163'N 22°24.4343'E, mixed beech forest, leg. Cs. Csuzdi, L. Dányi, V. V. Pop, T. Szederjesi, 10.11.2016. HNHM/17239 8 ex., Țarcu Mts, between Măru and Poiana Mărului, 443 m, 45°26.0775'N 22°27.4282'E, mixed beech forest, leg. Cs. Csuzdi, L. Dányi, V.V. Pop, T. Szederjesi, 10.11.2016. HNHM/17244 2 ex., Țarcu Mts, between Măru and Poiana Mărului, 514 m, 45°25.739'N 22°27.95'E, beech forest, leg. Cs. Csuzdi, L. Dányi, V. V. Pop, T. Szederjesi, 09.11.2016. HNHM/17248 7 ex., Țarcu Mts, between Măru and Poiana Mărului, 440 m, 45°25.97'N 22°27.561'E, mixed beech forest, leg. Cs. Csuzdi, L. Dányi, V. V. Pop, T. Szederjesi, 10.11.2016. HNHM/17253 1 ex., Țarcu Mts, between Măru and Poiana Mărului, 635 m, 45°25.05'N 22°29.19'E, young mixed beech forest, leg. Cs. Csuzdi, L. Dányi, V. V. Pop, T. Szederjesi, 09.11.2016. HNHM/17382 1 ex., Țarcu Mts, Borlova, beech forest, 847 m, N45°19.838' E22°27.512', leg. Cs. Csuzdi, J. Kotschán, V. V. Pop.

Eisenia fetida (Savigny, 1826)

Enterion fetidum Savigny, 1826: 182.

Eisenia fetida: Pop *et al.* 2012: 63.

Material examined. HNHM/17363 1 ex., Braşov county, Poiana Braşov, near Coliba Haiducilor, forest, 1070 m N45.5885 E25.554, leg. T. Asami, Z. Fehér, 29.08.2018.

Eisenia lucens (Waga, 1857)

Lumbricus lucens Waga, 1857: 161.

Eisenia lucens: Pop *et al.* 2012: 63.

Material examined. HNHM/17196 1 ex., Parâng Mts, between Novaci and Râncea, 722 m, 45°12.2333'N 23°41.8088'E, beech forest, leg. Cs. Csuzdi, L. Dányi, V. V. Pop, T. Szederjesi, 12.11.2016. HNHM/17208 1 ex., between Tismana and Peştişani, 182 m, 45°2.62'N 22°59.49'E, mixed hornbeam and oak forest, leg. Cs. Csuzdi, L. Dányi, V. V. Pop, T. Szederjesi, 11.11.2016. HNHM/17216 1 ex., Parâng Mts, stream valley NW of Novaci, 505 m, 45°11.5962'N 23°39.95'E, chestnut forest patch, leg. Cs. Csuzdi, L. Dányi, V. V. Pop, T. Szederjesi, 13.11.2016. HNHM/17245 4 ex., Țarcu Mts, between Măru and Poiana Mărului, 514 m, 45°25.739'N 22°27.95'E, beech forest, leg. Cs. Csuzdi, L. Dányi, V. V. Pop, T. Szederjesi, 09.11.2016. HNHM/17250 2 ex., Țarcu Mts, between Măru and Poiana Mărului, 440 m, 45°25.97'N 22°27.561'E, mixed beech forest, leg. Cs. Csuzdi, L. Dányi, V. V. Pop, T. Szederjesi, 10.11.2016. HNHM/17255 3 ex., Țarcu Mts, between Măru and Poiana Mărului, 635 m, 45°25.05'N 22°29.19'E, young mixed beech forest, leg. Cs. Csuzdi, L. Dányi, V. V. Pop, T. Szederjesi, 09.11.2016. HNHM/17364 1 ex., Argeş county, NW of Dâmboviţioara, along the road to Dâmboviţioara Cave, 920 m, N45.4464 E25.2207, leg. T. Asami, Z. Fehér, G. Katona, B. Páll-Gergely, 28.08.2018. HNHM/17366 1 ex., Argeş county, E of Podu Dâmboviţei, Valea Cheii, 4.5 km from the junction in the village, 910 m, N45.4037 E25.2541, leg. T. Asami, Z. Fehér, G. Katona, B. Páll-Gergely, 28.08.2018.

Eiseniella tetraedra (Savigny, 1826)

Enterion tetraedrum Savigny, 1826: 184.

Eiseniella tetraedra: Pop *et al.* 2012: 63.

Material examined. HNHM/17227 1 ex., Vâlcan Mts, N of Vaidei, bank of Șușita Verde, 452 m, 45°11.8473'N 23°16.0514'E, beech forest, leg. Cs. Csuzdi, L. Dányi, V. V. Pop, T. Szederjesi, 11.11.2016. HNHM/17369 1 ex., Dâmbovița county, 5 km NE of Glod, at the bridge of Valea Largă, 790 m, N45.2735 E25.5001, leg. T. Asami, Z. Fehér, G. Katona, B. Páll-Gergely, 27.08.2018.

Lumbricus polyphemus (Fitzinger, 1833)

Enterion polyphemus Fitzinger, 1833: 552.

Lumbricus polyphemus: Pop *et al.* 2012: 64.

Material examined. HNHM/17211 5 ex., between Borlova and Baia de Aramă, 216 m, 45°0.4919'N 22°48.8658'E, mixed hornbeam and oak forest with beech and chestnut, leg. Cs. Csuzdi, L. Dányi, V. V. Pop, T. Szederjesi, 11.11.2016. HNHM/17228 2 ex., Țarcu Mts, between Borlova and Muntele Mic, 495 m, 45°20.5163'N 22°24.4343'E, mixed beech forest, leg. Cs. Csuzdi, L. Dányi, V. V. Pop, T. Szederjesi, 10.11.2016. HNHM/17238 4 ex., Țarcu Mts, between Măru and Poiana Mărului, 443 m, 45°26.0775'N 22°27.4282'E, mixed beech forest, leg. Cs. Csuzdi, L. Dányi, V. V. Pop, T. Szederjesi, 10.11.2016. HNHM/17249 1 ex., Țarcu Mts, between Măru and Poiana Mărului, 440 m, 45°25.97'N 22°27.561'E, mixed beech forest, leg. Cs. Csuzdi, L. Dányi, V. V. Pop, T. Szederjesi, 10.11.2016.

Lumbricus rubellus Hoffmeister, 1843

Lumbricus rubellus Hoffmeister, 1843: 187. Pop *et al.* 2012: 64.

Material examined. HNHM/17236 1 ex., Țarcu Mts, S of Măru, 399 m, 45°27.6147'N 22°26.7447'E, pasture, leg. Cs. Csuzdi, L. Dányi, V. V. Pop, T. Szederjesi, 10.11.2016.

Lumbricus terrestris Linnaeus, 1758

Lumbricus terrestris Linnaeus, 1758: 647. Pop *et al.* 2012: 64.

Material examined. HNHM/17214 4 ex., Parâng Mts, stream valley NW of Novaci, 505 m, 45°11.5962'N 23°39.95'E, chestnut forest patch, leg. Cs. Csuzdi, L. Dányi, V. V. Pop, T. Szederjesi, 13.11.2016. HNHM/17362 1 ex., Brașov county, Poiana Brașov, near Coliba Haiducilor, forest, 1070 m N45.5885 E25.554, leg. T. Asami, Z. Fehér, 29.08.2018.

***Octodrilus banaticus* Szederjesi, Pop et Csuzdi sp. n.**
(Fig. 3)

Holotype. HNHM/17361 Țarcu Mts, between Borlova and Muntele Mic, 495 m, 45°20.5163'N 22°24.4343'E, mixed beech forest, leg. Cs. Csuzdi, L. Dányi, V. V. Pop, T. Szederjesi, 10.11.2016. Paratypes. HNHM/17231 1 ex. praeadult + 6 ex. juvenile, locality and date same as that of the Holotype. HNHM/17240 1 ex. subadult + 2 ex. praeadult + 1 ex. juvenile, Țarcu Mts, between Măru and Poiana Mărului, 443 m, 45°26.0775'N 22°27.4282'E, mixed beech forest, leg. Cs. Csuzdi, L. Dányi, V. V. Pop, T. Szederjesi, 10.11.2016.

Etymology. The name refers to the geographic region of the type locality, the Banat region.

Diagnosis. Length 145–171 mm, diameter 6–7 mm, setae distantly standing. Pigmentation greyish. First dorsal pore in 11/12. Clitellum on $\frac{1}{2}$ 29– $\frac{1}{2}$ 39, $\frac{1}{2}$ 40, tubercles on 30– $\frac{1}{2}$ 39, $\frac{1}{2}$ 40. Male pores on segment 15. Nephridial pores aligned above setal line *b*. Three pairs of seminal vesicles in 9, 10, 12; spermathecae 7 (6–8) pairs in 5/6–11/12 (12/13) in setal line *d*. Calciferous glands with well-developed diverticula in 10. Hearts in segments 7–11, nephridial bladders ocarina-shaped.

External characters. Holotype 145 mm long and 7 mm wide. Number of segments 184. Paratypes 146–171 mm long and 6–6.5 mm wide. Number of segments 180–223. Pigmentation greyish. Prostomium epilobous $\frac{1}{3}$ closed. First dorsal pore at the intersegmental furrow 11/12. Setae distantly standing. Setal arrangement behind clitellum: aa:ab:bc:cd:dd = 3.38:2.13:1.22:1:5,07. Male pores on segment 15, small. Nephridial pores aligned above setal line *b*. Clitellum on segments $\frac{1}{2}$ 29– $\frac{1}{2}$ 39, $\frac{1}{2}$ 40. Tubercula pubertatis on segments 30– $\frac{1}{2}$ 39, $\frac{1}{2}$ 40.

Internal characters. Septa 6/7–8/9 thickened, 12/13–14/15 strongly. Testes and funnels paired in segments 10–11, covered by oesophageal testis sacs in segment 10. The dissepiments of 10/11 and 11/12 merged together, completely enclosing the male funnels of 11. Three pairs of seminal vesicles in 9, 10, 12. Usually seven (sometimes 6 or 8) pairs of spermathecae in 5/6–11/12 with external openings in setal line *d*. In some specimens asymmetrically missing from 5/6 or extra pair present in 12/13. Calciferous glands with

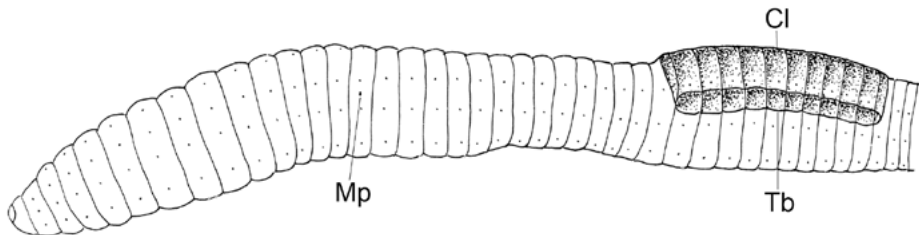


Fig. 3. Ventrolateral view of *Octodrilus banaticus* sp. n. Mp = male pore, Cl = clitellum, Tb = tubercles

Table 4. Distinguishing characters of the species similar to *Oc. banaticus* sp. n.

Species	Clitellum	Tubercles	Vesicles	Spermathecae	Testis sac	Nephridial pores
<i>Oc. banaticus</i> sp. n.	½ 29–½ 39, ½ 40	30–½ 39, ½ 40	9, 10, 12	7 (5/6– 11/12)	10 oeso	aligned in <i>b</i>
<i>Oc. aporus</i> Pop, 1989	½ 29, 30–40	30–40	9–12	6 (5/6– 10/11)	10, 11 perioeso	irregular
<i>Oc. hemiandrus</i> (Cognetti, 1901)	28–36, 37	28–38, 39	9, 10, 12	7 (6/7– 12/13)	11 oeso	irregular
<i>Oc. velebiticus</i> Mršić, 1991	½ 29–39	30–39	9–12	7 (6/7– 12/13)	10, 11 oeso	irregular
<i>Oc. complanatus</i> (Dugès, 1828)	28, 29–37	30–39, 40	9–12	7 (6/7– 12/13)	10, 11 oeso	irregular
<i>Oc. vallorus</i> (Bal- dasseroni, 1920)	30–39	29, 30–39	9–12	6 (6/7– 11/12)	10, 11 perioeso	irregular
<i>Oc. mimus</i> (Rosa, 1889)	28, 29–40, 41	28, 29–40, 41	9–12	7 (6/7– 12/13)	10, 11 perioeso	irregular
<i>Oc. pseudocomplanatus</i> (Omodeo, 1962)	1/n 29, 30–37, ½ 38	1/n 29, 30–39, 40	9–12	7 (6/7– 12/13)	10, 11 perioeso	aligned in <i>b</i>

well-developed diverticula in segment 10. Paired hearts in segments 7–11. with a pair of small extraoesophageal vessels in 12. Nephridial bladders ocarina-shaped. Crop in segments 15–16, and gizzard in segments 17–18. Typhlosolis lamelliform. The cross-section of the longitudinal muscle layer of pinnate type.

Remarks. Morphologically the new species is most close to *Oc. aporus* Pop, 1989 (cl: ½ 29, 30–40 and t: 30–40), but differs from it with the number of vesicles (3 vs. 4 pairs), spermathecae (7 vs. 6 pairs) and the type of the testis sacs (oesophageal vs. perioesophageal). *Oc. banaticus* sp. n. is similar to *Oc. hemiandrus* (Cognetti, 1901) with the lack of vesicles in segment 11, the number of spermathecae and the oesophageal testis sacs, but differs with the clitellar organs (cl: 28–36, 37, t: 28–38, 39). It is close to *Oc. velebiticus* Mršić, 1991 with its clitellum and tubercles (cl: ½ 29–39, t: 30–39), but differs with the number of vesicles (3 vs. 4 pairs). The tubercles of *Oc. complanatus* (Dugès, 1828) are quite similar (30–39, 40) but its clitellum is shorter (28, 29–37) and has 4 pairs of vesicles. *Oc. vallorus* (Baldasseroni, 1920) (cl: 30–39, t: 29, 30–39) and *Oc. mimus* (Rosa, 1889) (cl: 28, 29–40, 41 t: 28, 29–40, 41) are similar with their clitellar organs, but differ with the number of spermathecae (6 and 6–7 pairs), the number of vesicles (4 pairs) and the periesophageal testis sacs. *Oc. pseudocomplanatus* (Omodeo, 1962) is very similar to the new species with its tubercles (1/n 29, 30–39, 40) and the aligned nephridiopores, but differs with its shorter clitellum (1/n 29, 30–37, ½ 38), reddish colour, the perioesophageal

testis sacs and the four pairs of vesicles. The distinguishing characters of the similar species are shown in Table 4.

Octodrilus compromissus compromissus Zicsi et Pop, 1984

Octodrilus compromissus Zicsi et Pop, 1984: 245.

Octodrilus compromissus compromissus: Pop et al. 2012: 64.

Material examined. HNHM/17218 4 ex., Vâlcan Mts, N of Vaidei, bank of Șușita Verde, 425 m, 45°11.6738'N 23°16.1299'E, beech forest, leg. Cs. Csuzdi, L. Dányi, V. V. Pop, T. Szederjesi, 11.11.2016. HNHM/17251 2 ex., Țarcu Mts, between Măru and Poiana Mărului, 440 m, 45°25.97'N 22°27.561'E, mixed beech forest, leg. Cs. Csuzdi, L. Dányi, V. V. Pop, T. Szederjesi, 10.11.2016.

Octodrilus exacystis exacystis (Rosa, 1896)

Allolobophora exacystis Rosa, 1896: 3.

Octodrilus exacystis exacystis: Pop et al. 2012: 64.

Material examined. HNHM/17241 9 ex., Țarcu Mts, between Măru and Poiana Mărului, 443 m, 45°26.0775'N 22°27.4282'E, mixed beech forest, leg. Cs. Csuzdi, L. Dányi, V. V. Pop, T. Szederjesi, 10.11.2016. HNHM/17252 9 ex., Țarcu Mts, between Măru and Poiana Mărului, 440 m, 45°25.97'N 22°27.561'E, mixed beech forest, leg. Cs. Csuzdi, L. Dányi, V. V. Pop, T. Szederjesi, 10.11.2016. HNHM/17256 2 ex., Țarcu Mts, between Măru and Poiana Mărului, 635 m, 45°25.05'N 22°29.19'E, young mixed beech forest, leg. Cs. Csuzdi, L. Dányi, V. V. Pop, T. Szederjesi, 09.11.2016.

Octodrilus transpadanus (Rosa, 1884)

Allolobophora transpadana Rosa, 1884: 45.

Octodrilus transpadanus: Pop et al. 2012: 64.

Material examined. HNHM/17205 4 ex., between Tismana and Peștișani, 182 m, 45°2.62'N 22°59.49'E, mixed hornbeam and oak forest, leg. Cs. Csuzdi, L. Dányi, V. V. Pop, T. Szederjesi, 11.11.2016.

Octolasion lacteum (Örley, 1881)

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

Octolasion lacteum: Pop et al. 2012: 64.

Material examined. HNHM/17199 2 ex., Parâng Mts, N of Novaci, bank of Gilort, 658 m, 45°13.388'N 23°40.22'E, mixed forest, leg. Cs. Csuzdi, L. Dányi, V. V. Pop, T. Szederjesi, 11.11.2016. HNHM/17202 2 ex., Parâng Mts, N of Baia de Fier, bank of Galbenul, 654 m, 45°12.93'N 23°44.74'E, beech forest, leg. Cs. Csuzdi, L. Dányi, V. V. Pop, T. Szederjesi, 12.11.2016. HNHM/17221 1 ex., Vâlcan Mts, N of Vaidei, bank of Șușita Verde, 425 m,

45°11.6738'N 23°16.1299'E, beech forest, leg. Cs. Csuzdi, L. Dányi, V. V. Pop, T. Szederjesi, 11.11.2016. HNHM/17225 1 ex., Cerna Valley, NE of Băile Herculane, 208 m, 44°58.3332'N 22°29.5154'E, beech forest, leg. Cs. Csuzdi, L. Dányi, V. V. Pop, T. Szederjesi, 10.11.2016. HNHM/17367 1 ex., Braşov county, 1.2 km W of Poiana Braşov, Pârâul Poiana valley, forest, 960 m, N45.5953 E25.5367, leg. T. Asami, Z. Fehér, 29.08.2018.

DISCUSSION

The present research resulted in reporting altogether 26 earthworm species from different parts of the Southern Carpathians, among them two species new to science. With all these, the number of earthworm species and subspecies present in Romania is now 80.

Unfortunately only the ITS2 region was available for the molecular study of *D. cinerea* sp. n., but our results clearly show the separateness of this species. It fits well the clade of some Carpatho-Balkan *Dendrobaena* species revealed by SZEDERJESI *et al.* (2017) both morphologically and genetically. The presence of a certain kind of pigmentation, calciferous diverticula in segment 11 and the similar position of the clitellar organs make this group very uniform.

Morphologically *Oc. banaticus* sp. n. is quite similar to several species with different distribution, e.g. the Dacian *Oc. aporus*, the Circum-Mediterranean *Oc. complanatus* and also the West Balkanic *Octodrilus* species. Additional molecular studies should be carried out to clarify its exact phylogenetic connections.



Fig. 4. Type localities of the Southern Carpathian endemic earthworm species. 1 = *D. cinerea* sp. n. and *D. virgata*, 2 = *Oc. banaticus* sp. n., 3 = *C. getica*, 4 = *D. herculis*, 5 = *A. pannonica* (exact type locality is not known), 6 = *D. annectens*

A. pannonica (Cognetti, 1906) has been resurrected from synonymy of *A. mehadiensis mehadiensis* and reinstated as a separate species due to its unique characteristics. At the same time, morphologically this species is most close to the *A. mehadiensis* subspecies however, its general appearance is reminiscent of an *A. sturanyi dacica* specimen.

Several molecular phylogenetic analyses (POP *et al.* 2005, DOMÍNGUEZ *et al.* 2015, SZEDERJESI *et al.* 2016) revealed a well-defined Carpatho-Balkan clade consisting of the *A. sturanyi* subspecies, *A. gestroides*, *A. gestroi*, *A. zicsica*, the *A. mehadiensis* subspecies and the *Cernosvitovia* species. These endogeic taxa share common characteristics such as a long clitellum (usually more than 10 segments) and tubercles, large segment number, strongly thickened dissepiments and the occurrence of secondary or tertiary annulations. On morphological basis *A. pannonica* also belongs to this group, however further molecular phylogenetic analysis is needed to determine the exact phylogenetic position of this species.

The Southern Carpathians, and within it the Țarcu Mts and the Cerna valley has several endemic earthworm species, such as *Dendrobaena annectens*, *D. herculis*, *D. virgata*, *Cernosvitovia getica* and the three species discussed above (Fig. 4). The complex geohistory certainly played a significant role in the evolution of such high number of endemics in this region. From the Miocene, as the Carpathian arch emerged, the repeated regressions and transgressions of the Paratethys created an archipelago-like formation of the Carpathian palaeo-islands (HURDU *et al.* 2016, HARZHAUSER & PILLER 2007). The Pleistocene glacials affected the Carpathians only patchily, mostly concerning on the highest elevations, which led to the appearance of several refugial areas (SCHMITT 2009, MRÁZ & RONIÉKIER 2016). Besides, the Banat Mountains region and the Cerna valley seems to be an important biogeographical corridor and a meeting-place of different Mediterranean and Carpathian elements, as highlighted by CAMERON *et al.* (2016) with investigation of the forest land snail fauna. In case of earthworms, several East Balkanic and Mediterranean species, eg. *A. robusta*, *C. rebeli*, *D. byblica*, reach the Southern Carpathians through this region (CSUZDI *et al.* 2011). The Balkanic connections are also emphasised by the phylogenetic relationship between the Southern Carpathian *D. annectens*, *D. herculis*, *D. cinerea* sp. n. and the Balkanic *D. olympiaca*.

*

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