

Taxonomic and biogeographic analysis of the *Allolobophora sturanyi* species group (Oligochaeta, Lumbricidae)

Cs. CSUZDI¹ and V.V. POP²

Abstract. Morphometric and biogeographic analysis of the *Allolobophora sturanyi* species group – containing *A. sturanyi* Rosa, 1895, *Eophila dacica* Pop, 1938 and *A. sturanyi dacidooides* Bouché, 1973 – proved that these taxa are distinct; consequently the proposed synonymy by Perel (1979) should be rejected. However, these taxa are morphologically close enough to regard them as subspecies of the polytypic *Allolobophora sturanyi*. The analysis also revealed a fourth, well separated group that represents a new species to science, *Allolobophora prosellodacica* sp. n.

INTRODUCTION

The species *Allolobophora sturanyi* was described by Rosa (1895) from Croatia and later, together with some other Central European earthworm species (*Eophila dacica* Pop, 1938, *Allolobophora dugesi* var. *getica* Pop, 1947, *Allolobophora opisthocystis* Rosa, 1895) was regarded by Pop (1949) as subspecies or variety of the Franco-Iberian species, *Allolobophora dugesi* (Rosa, 1886). In the early seventies Bouché (1973) added a further species to this group of earthworms, *Allolobophora sturanyi dacidooides*.

Zicsi (1995) examining the type specimens of *A. opisthocystis* revealed that their male pores are situated near to the clitellum and consequently this species belongs to the genus *Cernosvitovia*. Later Csuzdi and Pop (2007) proved the same for *Allolobophora dugesi* var. *getica*. Due to the high variability of the morphological characters the other species/subspecies were treated taxonomically quite differently by different authors (Černosvitov, 1935; Perel, 1979; Mrsic, 1991), however the most extreme view was proposed by Perel (1979) who regarded all the other species names as synonyms of *Allolobophora sturanyi*. Therefore, in the present study we aimed to cla-

rify the taxonomic status of these species or subspecies and analyze their distribution patterns.

MATERIALS AND METHODS

During the revision we used the materials housed in the Hungarian Natural History Museum Budapest, in the Institute of Biological Research, Cluj-Napoca and in the earthworm collection of the Zoological Museum, Babes-Bolyai University, Cluj-Napoca (Pop's collection). In addition, new materials collected in various regions of Romania (Maramures Mts., Cerna valley, etc.) were also examined. The members of the *sturanyi* species group were morphometrically analyzed with ordination (NMDS) and Cluster Analysis using euclidean distance of six somatic characters, namely: *first segment of the clitellum, last segment of the clitellum, first segment of the tubercles, last segment of the tubercles, number of spermathecae and total segment number*.

RESULTS

The NMDS (and also the CA) resulted in four well differentiated groupings of the specimens which are geographically separated as well (Figs 1–2). The first group comprises specimens distrib-

¹Dr. Csaba Csuzdi, Systematic Zoology Research Group of the Hungarian Academy of Sciences, and Department of Zoology, Hungarian Natural History Museum, 1088 Budapest, Baross u. 13, Hungary. E-mail: csuzdi01@elte.hu.

²Dr. Victor V. Pop, Institute of Biological Research, 48 Republicii. PO Box 229, 400015 Cluj-Napoca, Romania. E-mail: victorvpop@yahoo.com.

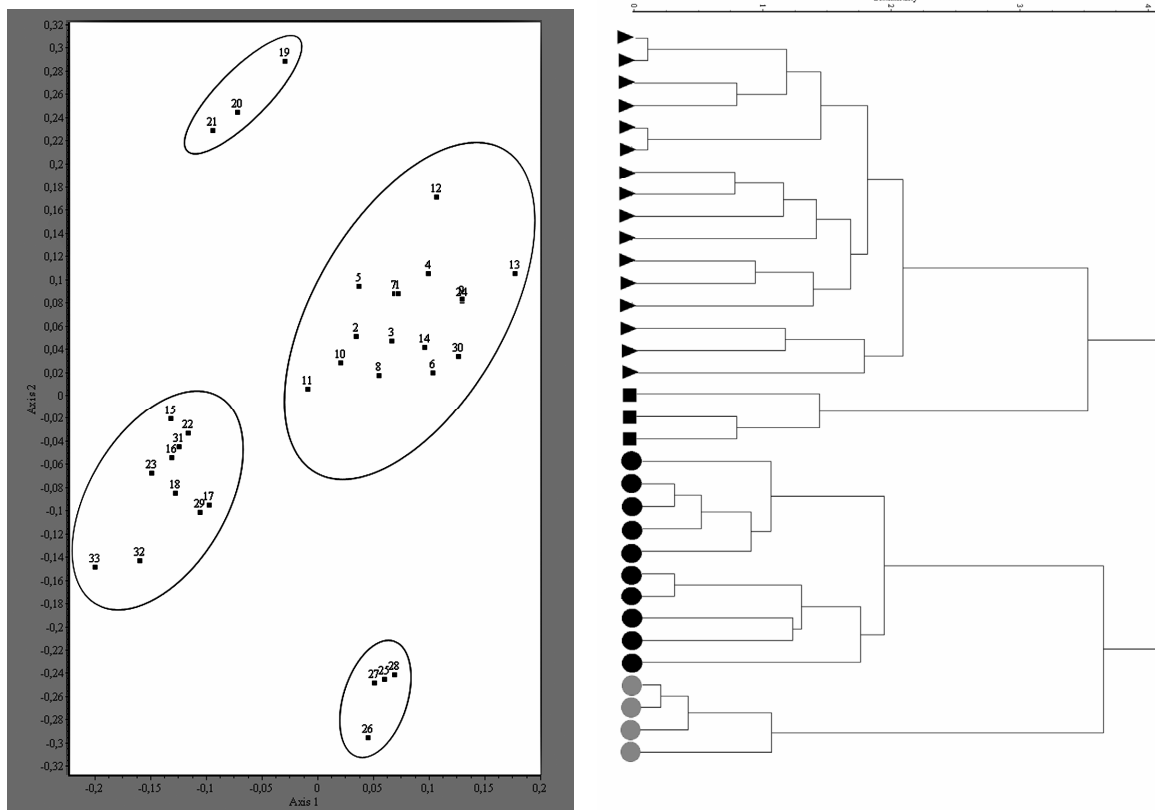


Figure 1. Ordination plot (left) and dendrogram (right) of the *Allolobophora sturanyi* species groups' specimens analysed. Numbers represent specimen numbers in Table 2, triangle = *A. s. dacica*, square = *A. s. sturanyi*, black circle = *A. s. dacidoides*, grey circle = *A. prosellodacica* sp. nov.

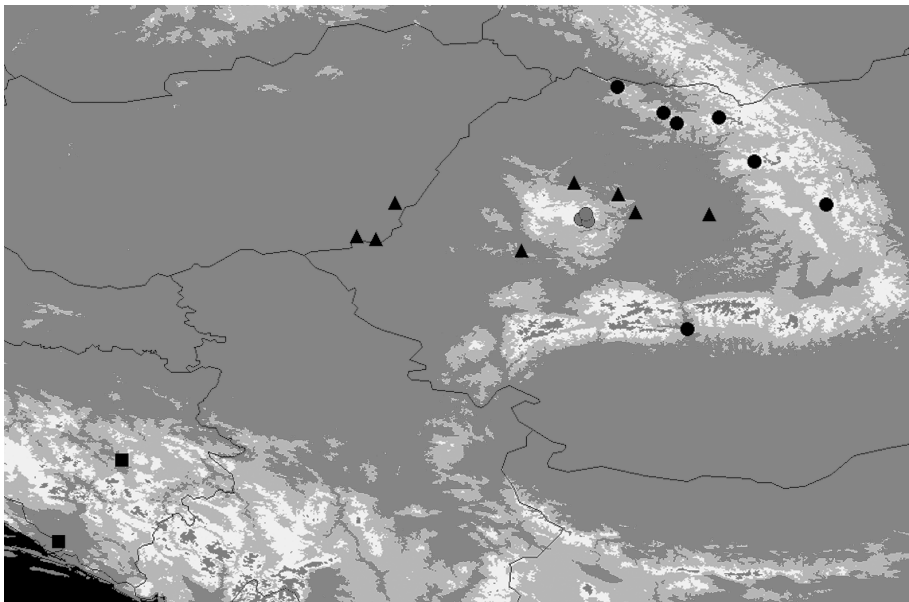


Figure 2. Distribution of the species of *A. sturanyi* species group. Legends are same as in Fig. 1

uted in the Transylvanian basin and the Apuseni Mts. Specimens collected in Hungary also belong to this group. The second group contains the specimens occurring in the Dinara and Kozara Mts., the third group consists of specimens from the Northern Carpathians, whereas the fourth group is distributed in the higher region of the Vladeasa Mountain (Apuseni Mts.) between 1000–1500 m asl. Taxonomically, the first group corresponds to the taxon *Eophila dacica* Pop, 1938, the second to *Allolobophora sturanyi* Rosa, 1895 and the third one to *Allolobophora sturanyi dacidoides* Bouché, 1973; therefore the synonymy proposed by Perel (1979) should not be accepted. Nevertheless, due to the morphological proximity of these taxa their independent specific statuses are not justified. Actually, they represent three subspecies of the polytypic *Allolobophora sturanyi*: *A. sturanyi sturanyi* Rosa, 1895, *A. sturanyi dacica* (Pop, 1938) and *A. sturanyi dacidoides* Bouché, 1973. The fourth group according to the clitellar characters is quite distinct and represents a new species.

TAXONOMY

Allolobophora prosellodacica sp. n.

Material examined. Holotype: Z/15335 Romania, Vladeasa Mts. cca 1400 m, 30. X. 1968. Leg. V.V. Pop (deposited in the Natural History Museum, Budapest). *Paratypes*: ICB-93 1 ex. Locality same as that of the Holotype (Institute of Biological Research, Cluj), Z/15336 1 ex., ICB-158 1 ex. Romania, Vladeasa Mts. cca 1400 m, 6. VIII. 1965. V. V. Pop, ICB-160 1 ex. Romania, Vladeasa Mts., 17. IX. 1965. Leg. V. V. Pop.

Etymology. The new species' epithet refers to its forward placed clitellum.

Diagnosis. Length: 63–98 mm, diameter: 3–4 mm, setae closely paired. Pigmentation lacking. Clitellum on *xxv–xxxvi*, tubercles on *xxix–½xxxv*. Male pore on *xv* large. Dissepiments 5/6–9/10 strongly thickened. Two pairs of vesicles in *xi*, *xii* and three pairs of spermathecae in 9/10–11/12. Calciferous glands with small lateral diverticula in

x. Nephridial bladders proclinate, hook-shaped, longitudinal musculature fasciculated.

Description. Holotype: length 63 mm, diameter just after the clitellum 4 mm. Number of segments 161. Paratypes: 65–98 mm long and 3–4 mm wide. Number of segments 167–173. Colour pale, pigmentation lacking. Prostomium epilobous ½ open. First dorsal pore at the intersegmental furrow 5/6. Setae closely paired, setal formula at segment *xi*: aa:ab:bc:cd:dd = 20:1.5:7:1:27.5. Male pore large, ventral on the segment *xv* intruding also in the neighbouring segments. Nephridial pores irregularly alternated between setal line *b–d*. Clitellum on segments ½*xxiv*, *xxv–xxxvi*. Tubercula pubertatis on segments ½*xxix*, *xxx–½xxxv* (Fig. 3). Nephridial pores irregularly alternate between *b* and above *d*. Genital papillae on 11–13, 15, 17, 23, 26–28, 30–34 *cd*.

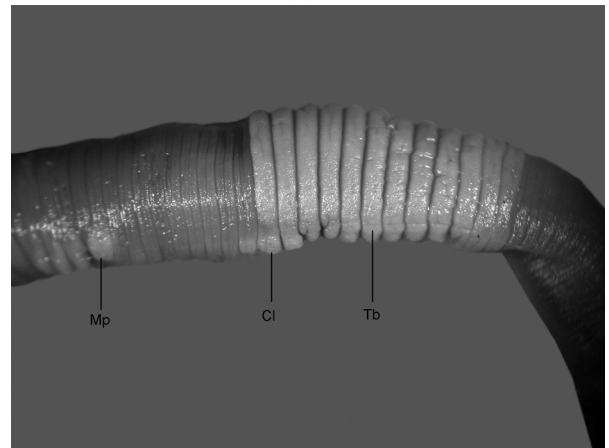


Figure 3. *Allolobophora prosellodacica* sp. n. Mp = male pore, Cl = clitellum, Tb = tubercles

Internal characteristics: Septa 5/6–9/10 strongly thickened. Free testes and funnels paired in segments *x–xi*. Seminal vesicles present in segments *xi* and *xii*. Three pairs of spermathecae in 9/10–11/12. Calciferous glands with lateral diverticula in segment *x*. Hearts appeared in segments *vi–xi* and a pair of extraoesophageal vessel in *xii*. Nephridial bladders proclinate, hook-shaped. Crop in segments *xv–xvi*, and gizzard in

segments *xvii-xviii*. Typhosolis large, bilobed. Longitudinal muscle layer is of fasciculated type.

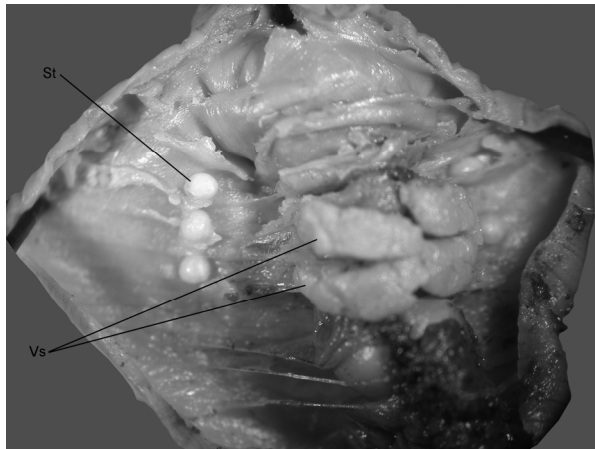


Figure 4. *Allolobophora prosellodacica* sp. n. St = spermathecae, Vs = vesicles

Remarks. The new species is close to *Allolobophora sturanyi dacica* (Pop, 1938), but differs from it by the more forward position of the clitellum and the shorter tubercula.

***Allolobophora sturanyi sturanyi* Rosa, 1895**

Allolobophora sturanyi Rosa, 1895: 5.
Allolobophora sturanyi: Zicsi 1982: 439.
Allolobophora (*A.*) *sturanyi*: Perel 1979: 188. (part).
Karpatodinariona sturanyi: Mršić, 1991: 250.

Material examined. Z/6637 1 ex. Croatia, Metkovič, 07.05.1969., Leg. A. Zicsi. Z/6660 2 ex. Bosnia & Herzegovina, Semizovac, 08.05.1969. Leg. A. Zicsi.

Diagnosis. Length: 70–110 mm, diameter: 3–4 mm, setae closely paired. Pigmentation lacking. Clitellum on *xxvii*, *xxviii*–*1/n xxxix*, *xxxix*, tubercles on *xxix*–*xxxviii*, *1/n xxxix*. Male pore on 15 large. Dissepiments 5/6–9/10 strongly thickened. Two pairs of vesicles in *xi*, *xii* and three pairs of spermathecae in 9/10–11/12. Calciferous glands with small lateral diverticula in *x*. Nephridial bladders proclinate, hook-shaped, longitudinal musculature fasciculated.

Remarks. This species is distributed in the North-Western Balkan and missing from the Carpathians. Perel's (1979) data from the North-East Carpathians probably refers to *A. sturanyi dacidoidea*.

***Allolobophora sturanyi dacica* (Pop, 1938)**

Eophila dacica Pop, 1938: 142.
Allolobophora dugesi var. *dacica*: Pop 1949: 440.
Allolobophora dacica: Zicsi 1982: 427.
Scherotheca (*Scherotheca*) *dacica*: Omodeo 1988: 81.
Karpatodinariona dacica: Mršić, 1991: 246.

New records: Z/14759 1 ex. Romania, Lake Rosu, 25.07.2002. Leg. Cs. Csuzdi., Z/14760 3 ex. Romania, Turda Gorge, 23.07.2003. Leg. Cs. Csuzdi., Z/14763 4 ex. Romania, Stana, 01.08.2003. Leg. Cs. Csuzdi.

Diagnosis. Length: 70–130 mm, diameter: 3–4 mm, setae closely paired. Pigmentation lacking. Clitellum on *xxviii*, *xxix*–*xxxvii*, (*1/n xxxviii*), tubercles on (*xxix*), *xxx*–*xxxvii*, (*1/n xxxviii*). Male pore on 15 large. Dissepiments 5/6–9/10 strongly thickened. Two pairs of vesicles in *xi*, *xii* and four or five pairs of spermathecae in 9/10–12/13, 13/14. Calciferous glands with small lateral diverticula in *x*. Nephridial bladders proclinate, hook-shaped, longitudinal musculature fasciculated.

Remarks. This subspecies is distributed mainly in inner Transylvania and in the eastern part of the Great Hungarian Plain.

***Allolobophora sturanyi dacidoidea* Bouché, 1973**

Allolobophora sturanyi dacidoidea Bouché, 1973: 327.
Karpatodinariona dacidoidea: Mršić, 1991: 248.

New records: Z/14745 10 ex. Romania, St. Anna Lake, 27.07.2002. Leg. Cs. Csuzdi., Z/15016 1 ex. Romania, Spermezeu 20.09.2005. Leg. V.V. Pop & Cs. Csuzdi., Z/15244 1 ex. Romania, Lapus, Valeni Secatura, 23.05.2006. Leg. J. Kotschán, L. Dányi & D. Murányi.

Diagnosis. Length: 60–110 mm, diameter: 3–4 mm, setae closely paired. Pigmentation lacking. Clitellum on 1/n xxvii, xxvii–xxxvi, xxxvii, tubercles on (1/n xxviii), xxviii–xxxvi, (1/n xxxvii). Male pore on 15 large. Dissepiments 5/6–9/10 strongly thickened. Two pairs of vesicles in xi, xii and three or four pairs of spermathecae in 9/10–11/12, 12/13. Calciferous glands with small diverticula in x. Nephridial bladders proclinate, hook-shaped,

longitudinal musculature fasciculated.

Remarks. This species is distributed in the eastern Carpathians only in higher altitudes.

Acknowledgements – This study was supported by the Hungarian Scientific Research Fund No. T42745, the National Office for Research and Technology, Hungary (grant No. 3B/023/04) and by the Romanian Scientific Grant CEEEx No. 05-D11-82.

Table 1. Distinguishing characters of *A. prosellodacica* and the subspecies of *A. sturanyi*

Species/subspecies	Clitellum	Tubercles	Receptacles	Segments
<i>A. sturanyi sturanyi</i>	27, 28 –1/n 39, 39	29 –38, 1/n39	3 ; 9/10–11/12	170–210
<i>A. sturanyi dacica</i>	28, 29–37 (1/n38)	29, 30–37 , 1/n38	5 (4); 9/10–12/13, 13/14	165–182
<i>A. sturanyi dacidoides</i>	1/n27, 27–36 , 37	1/n28, 28–36 , 1/n37	3,4 ; 9/10–11/12, 12/13	119–152
<i>A. prosellodacica</i> sp.n.	1/n24, 25 –½36, 36	30 –½35, 35	3 ; 9/10–11/12	160–170

REFERENCES

- BOUCHÉ, M. B. (1973): Observations sur les lombriciens. *Revue d'Écologie et de Biologie du Sol*, 10(3): 307-316.
- ČERNOSVITOV, L. (1935): Monographie der tschechoslovakischen Lumbriciden. *Archiv pro Prirodovedcky Vyzkum Cech*, 19: 1-86.
- CSUZDI, CS. & POP, V. V. (2007): Redescription of *Allolobophora dugesi* var. *getica* Pop, 1947 and its allocation to the genus *Cernosvitovia* Omodeo, 1956 (Oligochaeta Lumbricidae). *European Journal of Soil Biology*, 43S: 19-23.
- MRŠIĆ, N. (1991): *Monograph on earthworms (Lumbricidae) of the Balkans I-II*. Slovenska Akademija Znanosti in Umetnosti, Zazred za Naravoslovne Vede Opera. 31. Ljubljana, pp. 757.
- OMODEO, P. (1988): The genus *Eophila* (Lumbricidae, Oligochaeta). – *Bolletino di Zoologia*, 55: 73-88.
- PEREL, T.S. (1979): *Range and regularities in the distribution of earthworms of the USSR fauna*. Nauka, Moscow pp. 272. (In Russian.)
- POP, V. (1938): Neue Lumbriciden aus Rumänien. *Buletinul Societatii de Stiinte din Cluj*, 9: 134-152.
- POP, V. (1949): Lumbricidele din România. *Analele Academiei Republicii Populare Române*, 1(9): 383-505.
- ROSA, D. (1895): Nuovi lombrichi dell'Europa orientale. *Bollettino dei Musei di Zoologia ed Anatomia comparata della R. Università di Torino*, 10(21):1-8.
- ZICSI, A. (1982): Verzeichnis der bis 1971 beschriebenen und revidierten Taxa der Familie Lumbricidae (Oligochaeta). *Acta zoologica hungarica*, 28: 421-454.
- ZICSI, A. (1995): Über die systematische Stellung von *Allolobophora opisthocystis* Rosa, 1895 (Oligochaeta: Lumbricidae). *Annalen des Naturhistorischen Museums in Wien*, 97B: 125-129.

Table 2. Locality data of the investigated *A. prosellodacica* and *A. sturanyi* specimens

No.	Locality
1	Hungary, Mezőhegyes, 13. VI. 1961. Leg. Zicsi, Szombathelyiné
2	Hungary, Mezőhegyes, 14. VI. 1961. Leg. Zicsi, Szombathelyiné
3	Hungary, Mezőhegyes, 13. VI. 1961. Leg. Zicsi, Szombathelyiné
4	Romania, Turda, 04. VIII. 1934. Leg. V. Pop
5	Hungary, Mezőhegyes, 13. VI. 1961. Leg. Zicsi, Szombathelyiné
6	Hungary, Mezőhegyes, 14. VI. 1961. Leg. Zicsi, Szombathelyiné
7	Hungary, Battonya, 15. VI. 1961. Leg. Zicsi, Szombathelyiné
8	Hungary, Mezőhegyes, 13. VI. 1961. Leg. Zicsi, Szombathelyiné
9	Romania, Manastur, 29. VIII. 1930. Leg. V. Pop
10	Hungary, Dombegyháza, III. 1956. Leg. Zsemberi
11	Romania, Targu Mures, 31. VIII. 1974. Leg. Zicsi
12	Moldova Leg. Perel
13	Romania, Cheile Turzii, 23. VII. 2002. Leg. Csuzdi
14	Romania, Stana, 01. VIII. 2003. leg. Csuzdi
15	Romania, Vadu Izei, 21. IX. 2005. Leg. Kontschán, Murányi
16	Romania, Varful Țiganului, 21. IX. 2005. Leg. Kontschán, Murányi
17	Románia, Spermezeu, 20. IX. 2005. leg. Pop, Csuzdi
18	Románia, Lapus, Valeni Secatura, 23. V. 2007. Leg. Kontschán, Murányi, Dányi
19	Croatia, Metkovic, 07. V. 1969. Leg. Zicsi
20	Bosnia and Herzegovina, Semizovac, 08. V. 1969. Leg. Zicsi
21	Bosnia and Herzegovina, Semizovac, 08. V. 1969. Leg. Zicsi
22	Ukraine, Leg. Perel
23	Ukraina, Kevell. Leg. Cernosvitov, 08. VIII. 1938.
24	Romania, Vata de Jos, 17. IX. 1971. Leg. V. V. Pop
25	Romania, Vladeasa, 06. VIII. 1965. Leg. V.V. Pop
26	Romania, Vladeasa, 17. IX. 1965. Leg. V.V. Pop
27	Romania, Vladeasa, 30. X. 1968. Leg. V.V. Pop
28	Romania, Vladeasa, 04. VIII. 1965. Leg. V.V. Pop
29	Romania, Mtii Hajmas, Poiana Alba, 08. VIII. 1992. Leg. T. Pasca
30	Romania, Cheile Turului, 06. VI. 1995. Leg. V.V. Pop
31	Romania, Mtii Calimani, 19. VI. 1997. Leg. V.V. Pop
32	Romania, Mtii Rodnei, 18. VI. 1997. Leg. V.V. Pop
33	Romania, Mtii Cozia, Faget, 07. VI. 2001. leg. T. Pasca