

## FURTHER CONTRIBUTION TO KNOWLEDGE OF THE EARTHWORMS OF ŠUMADIJA (SERBIA)

MIRJANA STOJANOVIĆ and SPASENIJA KARAMAN

*Institute of Biology and Ecology, Faculty of Science, Radoja Domanovića 12,  
34000 Kragujevac, Serbia and Montenegro*

**Abstract** - The authors present the results of recent investigations of earthworms from Šumadija. Research was carried out during 1996-2003 and included natural and cultivated biotopes from various parts of Šumadija. We found 27 taxa, including six species new for the earthworm fauna of Šumadija: *Dendrobaena alpina*, *Helodrilus cernosvitovianus*, *Octolasion cyaneum*, *Octodrilus complanatus*, *Serbiona serbica*, and *Serbiona paratuleskovi*. Up to 1995, the total number of earthworm taxa in Šumadija was 37. After our present study, this number has risen to 43 taxa. As for the zoogeographical position of the earthworms of Šumadija, the established taxa have the following types of distribution: European (11 taxa), cosmopolitan (10), Holarctic (eight), Palearctic (two), South European (five), Balkan (three) and endemic (four).

**Key words:** Earthworms, Lumbricidae, zoogeography, Šumadija, Serbia

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### INTRODUCTION

The middle part of Serbia is Šumadija. It is bounded by the Morava, Western Morava, Danube, and Kolubara Rivers. The most important morphological characteristics are low mountains (Rudnik, Avala, and Bukulja) and wide valleys. The climate is continental with microclimatic differences.

In the first papers about lumbricids in Šumadija, Šapkar (1980) and Karaman (1972, 1983, 1987) cited only eight taxa. In 1988, Šapkar found 16 taxa (with 14 species). Since then, the earthworm fauna of Šumadija has been widely studied (Karaman and Stojanović, 1993, 1994a, 1994b, 1995, 1996a, 1996b, 1998, 2002a, 2002b, 2003; Karaman, Stojanović and Pešić, 1998; Stojanović, 1989, 1996; Šapkar, 2002).

### MATERIALS AND METHODS

Our investigations were carried out in the central part of Serbia (Šumadija). In the last investigation period (1996-2004), we collected earthworms from various

habitats all over Šumadija, including both natural (river banks, meadows, *Quercetum-confertae cerris* and *Fagetum montanum* forest communities, and mountain pastures) and cultivated biotopes. Earthworms were collected by the formalin method and by digging 0,4x0,4m quadrates. Specimens were immediately fixed in 4% formalin and transferred to 90% ethanol.

### RESULTS AND DISCUSSION

Our investigations to 1995 indicated the total number of earthworm taxa found in Šumadija to be 37 (Stojanović, 1996). In our collections from this area after that period (1996-2003), we have identified 27 taxa, including six species new for the earthworm fauna of Šumadija: *Dendrobaena alpina*, *Helodrilus cernosvitovianus*, *Octolasion cyaneum*, *Octodrilus complanatus*, *Serbiona serbica* and *Serbiona paratuleskovi*. Thus, the total number of lumbricid taxa of Šumadija has risen to 43. The complete list of earthworm species from Šumadija is given in Table 1.

The most abundant lumbricids in Šumadija are *A. rosea*, *L. rubellus*, and *O. lacteum*. They occur very fre-

Table 1. Complete list of the earthworm species of Šumadija

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Fam. LUMBRICIDAE Udekem, 1855

Gen. *Allolobophora* Eisen, 1874  
-*A. chlorotica* (Savigny, 1826)

Gen. *Aporrectodea* Oerley, 1856  
-*A. caliginosa caliginosa* (Savigny, 1826)  
-*A. caliginosa trapezoides* (Dugès, 1826)  
-*A. georgii* (Michaelsen, 1890)  
-*A. handlirchi* (Rosa, 1897)  
-*A. jassiensis* (Michaelsen, 1891)  
-*A. leoni* (Michaelsen, 1881)  
-*A. rosea* (Savigny, 1826)  
-*A. rosea bimastoides* (Cognetti, 1906)  
-*A. rosea interposita* (Plisko, 1965)  
-*A. sineporis* (Omodeo, 1952)  
-*A. smaragdina* (Rosa, 1892)

Gen. *Serbiona* Mršić and Šapkarev, 1988  
-*S. dofleini* (Ude, 1922)  
-*S. kosowensis kosowensis* (Karaman, 1968)  
-*S. paratuleskovi* (Šapkarev, 1975)  
-*S. robusta serbica* (Karaman, 1983)  
-*S. serbica* (Šapkarev, 1977)

Gen. *Dendrobaena* Eisen, 1874  
-*D. alpina* (Rosa, 1844)  
-*D. attensi* (Michaelsen, 1903)  
-*D. byblica* (Rosa, 1893)  
-*D. hortensis* (Michaelsen, 1890)  
-*D. jastrebensis* (Mršić and Šapkarev, 1987)  
-*D. octaedra* (Savigny, 1826)  
-*D. vejnovskiyi* (Černosvitov, 1935)  
-*D. veneta veneta* (Rosa, 1886)  
-*D. veneta zebra* (Michaelsen, 1902)

Gen. *Dendrodrilus* Omodeo, 1956  
-*D. rubidus rubidus* (Savigny, 1826)  
-*D. rubidus subrubicundus* (Eisen, 1874)  
-*D. rubidus tenuis* (Eisen, 1874)

Gen. *Eisenia* Malm, 1874  
-*E. foetida* (Savigny, 1826)  
-*E. lucens* (Waga, 1857)

Gen. *Eiseniella* Michaelsen, 1990  
-*E. tetraedra tetraedra* (Savigny, 1826)

Gen. *Fitzingeria* Zicsi, 1978  
-*F. platyura platyura* (Fitzinger, 1883)

Gen. *Helodrilus* Hoffmeister, 1845  
-*H. cernosvitovianus* (Zicsi, 1967)

Gen. *Lumbricus* Linnaeus, 1758  
-*L. polyphemus* (Fitzinger, 1883)  
-*L. rubellus* (Hoffmeister, 1843)  
-*L. terrestris* (Linnaeus, 1758)

Gen. *Octolasion* Oerley, 1885  
-*O. lacteum* (Oerley, 1891)  
-*O. cyaneum* (Savigny, 1826)

Gen. *Octodrilus* Omodeo, 1956  
-*O. transpadanus* (Rosa, 1884)  
-*O. complanatus* (Duges, 1828)

Gen. *Proctodrilus* Zicsi, 1985  
-*P. antipai* (Michaelsen, 1891)  
-*P. tuberculatus* (Černosvitov, 1935)

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quently and are distributed almost everywhere.

The genera with the most species are *Aporrectodea* (eight species, 11 taxa) and *Dendrobaena* (eight species, nine taxa). Very interesting for the investigated territory is the finding of two endemic species from the genus *Serbiona*: *S. paratuleskovi* and *S. serbica*. Because it is their first finding in Šumadija, we give their descriptions.

#### SYSTEMATIC PART

##### *Allolobophora chlorotica* (Savigny, 1826)

Habitat: forest soils, cultivated soils, meadows.  
Localities: seven specimens, Jastrebac, 3.06.1995; three specimens, Jastrebac, 27.08.95.

##### *Aporrectodea caliginosa caliginosa* (Savigny, 1826)

Habitat: forest soils, wet meadows.  
Localities: one specimen, Goč, 28.06.1999; five specimens, Goč, 1.04.1999; 13 specimens, Gledičke planine, 3.07.1999.

##### *Aporrectodea caliginosa trapezoides* (Dugès, 1826)

Habitat: forest soils, cultivated soils.  
Localities: one specimen, Jastrebac, 3.06.1995; two specimens, Jastrebac, 27.08.95; five specimens, Goč, 28.06.1999.

##### *Aporrectodea leoni* (Michaelsen, 1881)

Habitat: wet meadows.  
Localities: one specimen, Jastrebac, 3.06.1995; 61 specimens, Jastrebac, 27.08.95; one specimen, Stolovi, 2.10.2002; three specimens, Stolovi, 3.10.2002.

##### *Aporrectodea rosea* (Savigny, 1826)

Habitat: forest soils, cultivated soils, meadows.  
Localities: two specimens, Jastrebac, 3.06.1995; four specimens, Jastrebac, 27.08.95; nine specimens, Kalenić, 7.06.1998; seven specimens, Goč, 28.06.1999; six specimens, Goč, 1.04.1999; 28 specimens, Gledičke planine, 3.07.1999; four specimens, Duleni, 17.04.2001; five specimens, Baljkovac, 26.04.2001; 31 specimens, Stolovi, 2.10.2002; 19 specimens, Stolovi, 3.10.2002.

##### *Serbiona dofleini* (Ude, 1922)

Habitat: hill pastures.  
Locality: two specimens, Jastrebac, 3.06.1995.

*Serbiona kosowensis kosowensis* (Karaman, 1968)

Habitat: meadows.

Locality: five specimens, Goč, 28.06.1999.

*Serbiona robusta serbica* (Karaman, 1983)

Habitat: pastures.

Locality: one specimen, Gledičke planine, 3.07.1999.

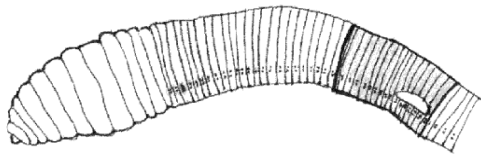


Fig. 1. Anterior part of the body of the species *Serbiona paratuleskovi* (after Šapkarev, 1987).

*Serbiona paratuleskovi* (Šapkarev, 1975) (Fig. 1).1975. *Alolobophora paratuleskovi*, Šapkarev, *Ann. Fac. Sci. Univ. Skopje* **27-28**, 55.1987. *Eophila paratuleskovi*, Šapkarev, *Mac. Acad. Sci. Art.* **9 (2)**, 94.1988. *Allolobophora paratuleskovi*, Mršić & Šapkarev, *Acta Mus. Mac. Sci.* **19**, 27.

The body is 98-150 mm long, consisting of 243-282 segments. The first dorsal pore is in intersegmental groove 12/13 or 13/14. The prostomium is epilobous, 1/3 open. The male apparatus with a small glandular atrium on the 15th segment.

The clitellum extends from segments 36, 37, 38-52, 53, 54, and tubercula pubertatis are present from segments 47-52, 53.

Two pairs of seminal vesicles are present in the 11th and 12th segments and two pairs of spermathecae in the 10th and 11th segments on septa 9/10 and 10/11. The calciferous glands are in the 11th segment. The septa are markedly thickened from 6/7-9/10, and thickened from 5/6 and 11/12. The nephridial bladder is hooked.

Habitat: meadow.

Locality: one specimen, Kragujevac, 19.04.1995.

*Serbiona serbica* (Šapkarev, 1977) (Fig. 2)1977. *Eophila serbica* Šapkarev, *Mac. Acad. Sci. Art.* **9 (2)**, 93.1988. *Allolobophora serbica* Mršić & Šapkarev, *Acta Mus. Mac. Sci.* **19**, 27.

The body is 125-132 mm long, consisting of 268-322 segments. It is dark brown in color. The first dorsal pore is in intersegmental groove 10/11 or 11/12. The prostomium is epilobous, 1/3 open. The male aperture is on the glandular atrium over the 15th segment. Glandular papillae surround setae *ab* on segments 16, 17, 47, or 49-55.

The clitellum extends from segments 39, 40-53, and tubercula pubertatis are present from segments 44, 45-51, 52. Four pairs of seminal vesicles are present in the ninth to the 12th segments and two pairs of spermathecae in the 10th and 11th segments on septa 9/10 and 10/11. The septa are markedly thickened from 5/6-11/12. The crop occupies the 15th and 16th segments, the gizzard the 17th to 19th segment. The nephridial bladder is U-shaped.

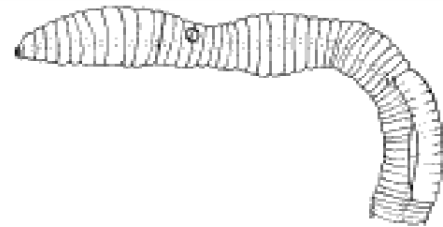


Fig. 2. Anterior part of the body of the species *Serbiona serbica* (after Šapkarev, 1977).

Habitats: river banks.

Locality: one specimen, Rasina, 7.04.2001.

*Dendrobaena alpina* (Rosa, 1844)

Habitat: forest soil.

Locality: one specimen, Kalenić, 16.05.1995.

*Dendrobaena attemsi* (Michaelsen, 1903)

Habitats: forest soils, meadows.

Localities: three specimens, Jastrebac, 3.06.1995; 12 specimens, Stolovi, 3.10.2002.

*Dendrobaena byblica* (Rosa, 1893)

Habitat: forest soils, meadows, river bank.

Locality: two specimens, Jastrebac, 3.06.1995.

*Dendrobaena hortensis* (Michaelsen, 1890)

Habitats: forest soils, hill meadows.

Locality: three specimens, Kalenić, 7.06.1998.

*Dendrobaena jastrebensis* (Mršić and Šapkarev, 1987)

Habitats: forest soils, hill meadows.

Localities: two specimens, Jastrebac, 3.06.1995; 10

specimens, Jastrebac, 27.08.1995.

*Dendrobaena octaedra* (Savigny, 1826)

Habitats: forest soils, meadows.

Localities: three specimens, Kalenić, 27.08.1995; eight specimens, Goč, 28.06.1999; one specimen, Rasina, 7.04.2001.

*Dendrobaena vej dovskyi* (Černosvitov, 1935)

Habitats: forest soils, meadows.

Localities: three specimens, Kalenić, 27.08.1995; four specimens, Goč, 28.06.1999; one specimen, Stolovi, 2.10.2002.

*Dendrodrilus rubidus rubidus* (Savigny, 1826)

Habitat: forest soils.

Locality: four specimens, Jastrebac, 3.09.1995.

*Dendrodrilus rubidus tenuis* (Eisen, 1874)

Habitat: hill meadows.

Locality: one specimen, Jastrebac, 27.08.1995.

*Eisenia lucens* (Waga, 1857)

Habitats: forest soils, pastures.

Localities: one specimen, Jastrebac, 3.09.1995; two specimens, Stolovi, 2.10.2002.

*Eiseniella tetraedra tetraedra* (Savigny, 1826)

Habitats: wet meadows, river bank.

Localities: seven specimens, Jastrebac, 3.06.1995; three specimens, Jastrebac, 27.08.1995.

*Fitzingeria platyura platyura* (Fitzinger, 1883).

Habitats: wet forest soils, river bank, meadows.

Localities: 10 specimens, Jastrebac, 3.09.1995; one specimen, Goč, 28.06.1999; four specimens, Stolovi, 2.10.2002.

*Helodrilus cernosvitovianus* (Zicsi, 1967)

Habitat: forest soil.

Locality: one specimen, Bukulja, 10.05.2003.

*Lumbricus rubellus* (Hoffmeister, 1843)

Habitats: forest soils, cultivated soils, meadows.

Localities: seven specimens, Jastrebac, 3.06.1995; 11 specimens, Jastrebac, 27.08.1995; 11 specimens, Kalenić, 7.06.1998; six specimens, Goč, 28.06.1999; nine specimens, Goč, 1.04.1999; six specimens, Gledičke planine, 3.07.1999; seven specimens, Stolovi, 2.10.2002; 12 specimens, Stolovi,

3.10.2002; one specimen, Rasina, 7.04.2001; 17 specimens, Duleni, 17.04.2001; 12 specimens, Baljkovac, 26.04.2001.

*Octolasion lacteum* (Oerley, 1891)

Habitats: forest soils, cultivated soils, meadows.

Localities: four specimens, Jastrebac, 3.06.1995; 15 specimens, Jastrebac, 27.08.1995; three specimens, Kalenić, 7.06.1998; two specimens, Goč, 28.06.1999; two specimens, Goč, 1.04.1999; 16 specimens, Gledičke planine, 3.07.1999; 11 specimens, Stolovi, 2.10.2002; two specimens, Duleni, 17.04.2001; four specimens, Baljkovac, 26.04.2001.

*Octolasion cyaneum* (Savigny, 1826)

Habitat: forest soil.

Locality: two specimens, Stolovi, 3.10.2002.

*Octodrilus complanatus* (Dugès, 1828)

Habitat: forest soil.

Locality: two specimens, Kalenić, 8.06.1998.

Regarding the zoogeographical position of the lumbricid fauna in Šumadija, it can be stated that:

Ten taxa (24%) are almost cosmopolitan:

*Eisenia foetida*

*Eiseniella tetraedra tetraedra*

*Aporrectodea caliginosa caliginosa*

*Aporrectodea caliginosa trapezoides*

*Aporrectodea rosea*

*Allolobophora chlorotica*

*Octolasion lacteum*

*Octolasion cyaneum*

*Dendrobaena veneta zebra*

*Lumbricus terrestris*

Eight taxa (19,1%) are Holarctic:

*Dendrobaena veneta veneta*

*Dendrobaena hortensis*

*Dendrobaena octaedra*

*Dendrodrilus rubidus rubidus*

*Dendrodrilus rubidus tenuis*

*Dendrodrilus rubidus subrubicundus*

*Dendrobaena attemsi*

*Lumbricus rubellus*

Two taxa (4,8%) are Palearctic:

*Octodrilus transpadanus*

*Proctodrilus antipae*

Eleven taxa (26,2%) are mainly European:

*Dendrobaena alpina*  
*Dendrobaena vej dovskyi*  
*Aporrectodea handlirchi*  
*Aporrectodea jassiensis*  
*Aporrectodea georgii*  
*Octodrilus complanatus*  
*Aporrectodea rosea bimastoides*  
*Aporrectodea rosea interposita*  
*Fitzingeria platyura platyura*  
*Lumbricus polyphemus*  
*Proctodrilus tuberculatus*

Five taxa (11,9%) are South European:

*Aporrectodea leoni*  
*Eisenia lucens*  
*Dendrobaena byblica*  
*Aporrectodea smaragdina*  
*Aporrectodea sineporis*

Three taxa (7,1%) are Balkan:

*Serbiona dofleini dofleini*  
*Helodrilus cernosvitovianus*  
*Serbiona robusta serbica*

Four taxa (9,5%) are endemic:

*Dendrobaena jastrebensis*  
*Serbiona kosowensis kosowensis*  
*Serbiona paratuleskovi*  
*Serbiona serbica*

It can be seen that cosmopolitan, Holarctic, and mainly European species make up more than half of the total of lumbricid species in Šumadija. Endemic species take part with only 9,5% in the total number of species. However, on the wider territory of Serbia (Stojanović, 1996), 30% of the species are endemic. There are only four endemic species (9,5%) on the territory of Šumadija. The real reason for this situation is that Šumadija is under strong human influence. The low presence of endemic species is a result of destruction of the forests (as the strongest influence), accelerating steppification of this area, and destruction of microclimatic habitats.

#### CONCLUSION

In the last investigation period (1996-2004), the authors collected earthworms from various habitats on plains, hills, and mountains throughout Šumadija. We

found 27 taxa, including six species which are new for the earthworm fauna of Šumadija: *Dendrobaena alpina*, *Helodrilus cernosvitovianus*, *Octolasion cyaneum*, *Octodrilus complanatus*, *Serbiona serbica*, and *Serbiona paratuleskovi*.

The genera with the greatest number of species are *Aporrectodea* (eight species, 11 taxa), *Dendrobaena* (eight species, nine taxa), and *Serbiona* (five species). The most frequent species were *Aporrectodea rosea*, *Lumbricus rubellus*, and *Octolasion lacteum*.

Zoogeographically, it can be stated that in the lumbricid fauna of Šumadija, ten taxa (21,4%) are cosmopolitan, eight (19,1%) are Holarctic, two (4,8%) are Palaearctic, twelve (28,6%) are mainly European, five (11,9%) are South European, three (7,1%) are Balkan, and four (9,5%) are endemic. The low presence of endemic species is a result of strong anthropogenic influence and the existence of very few real natural biotopes in Šumadija.

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## ДАЉИ ПРИЛОГ ПОЗНАВАЊУ КИШНИХ ГЛИСТА (OLIGOSCHAETA, LUMBRICIDAE) ШУМАДИЈЕ, СРБИЈА

МИРЈАНА СТОЈАНОВИЋ И СПАСЕНИЈА КАРАМАН

*Институт за биологију и екологију, Природно-математички факултет,  
Радоја Домановића 12, 34000 Кragујевац, Србија и Црна Гора*

Дугогодишња истраживања фауне кишних глиста широм Шумадије (1980-2003) омогућила су да установимо присуство 43 таксона. У последњим истраживањима (1996-2003) регистровано је по први пут 6 нових врста за подручје Шумадије: *Dendrobaena alpina*, *Helodrilus cernosvitovianus*, *Octolasion cyaneum*, *Octodrilus complanatus*, *Serbiona serbica* и *Serbiona paratuleskovi*. У састав лумбрицидне фауне Шумадије улазе представници 13 родова. Највећи број врста припада роду *Aporrectodea* (11 таксона са 8 врста), *Dendrobaena* (9 таксона са 8 врста) и *Serbiona* (5 врста).

У зоогеографском погледу најприсутније су врсте које имају углавном европско (26,2%) и космополитско (21,4%) распрострањење, што још

једном доказује да је подручје Шумадије под изразитим антропогеним дејством. Присутно је свега 9,5% ендемичних врста. Две новооткривене ендемичне врсте *Serbiona serbica* и *Serbiona paratuleskovi* су регистроване са по јединим примерком, што показује да још увек у Шумадији постоје ретки локалитети где се могу наћи ове драгоцене врсте за фауну, али због јаког антропогеног утицаја (крчење шума, индустријализација, насељеност, неконтролисана употреба пестицида и сл.), оне су јако угрожене и ретко се налазе.