EARTHWORMS OF HUNGARY
(ANNELIDA: OLIGOCHAETA, LUMBRICIDAE)

PEDOZOOLOGICA HUNGARICA

Taxonomic, zoogeographic and faunistic studies on the soil animals

Editors

Csaba Csuzdi and Sándor Mahunka

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Hungarian Natural History Museum
and
Systematic Zoology Research Group of the Hungarian Academy of Sciences

BUDAPEST, 2003

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EDITORIAL

The organised soil zoological research in Hungary began in the early years of the 1950s headed by Endre Dudich, at that time professor in the Department of Systematic Zoology of the Eötvös Loránd University (Budapest). After the excellent preliminary results the Hungarian Academy of Sciences initiated the establishment of a general soil biology research team which in the last years of the 1950s was named as the Soil Zoological Research Group of the HAS and the ELU, headed by János Balogh. The primary aim was to create sound scientific basis for one of the most important branches of science of the Hungarian Academy, namely soil zoology. The conditions were given, since the up-and-coming new generation of the Dudich School – in close collaboration with the research workers of the Institute of Systematic Zoology – began to study animals inhabiting mainly the soil. Each researcher had the task to deal with one of the significant groups of soil inhabiting animals, thus, the study of Lumbricidae, soil inhabiting Nematodes, Collembola and Oribatida. With the passing of time each member of the research group became renown specialist, recognised all over the world. In the beginning the group was led by J. Balogh, followed by I. Loksa and subsequently, between the years of 1986 and 1998, by A. Zicsi. After some smaller reorganisations the group was renamed as Systematic Zoology Research Group and is now led by S. Mahunka. Although the composition of the group has somewhat changed over the years, nevertheless, from among the founding members I. Andrássy and A. Zicsi are still active, to whom first Cs. Csuzdi joined, later he was followed by some younger collaborators without altering the initially set aim of the group: the exploration of the meso- and macrofauna of the soil.

Meanwhile the workers of the group established close links with the curator of the Arachnoidea Collection of the Hungarian Natural History Museum, the significant part of which comprises the mesofauna. The fundamental section of this Collection was further urinated by various soil samples deriving from all over the world, basic collections of different groups of mites, and the purchased collections of nematodes from I. Andrássy, those of spiders and mites from J. Balogh, and the earthworm collection from A. Zicsi.

The Andrássy and the Zicsi collections are among the biggest of their kind in the world. On the other hand, the Balogh collection includes also a huge number of soil samples coming from different parts of the world. Thus, these large collections yield for study all those soil inhabiting animals which scientifically belong to the meso- and the macrofauna, in other words, the Arachnoidea (specifically the mites), the Nematoda, and the Oligochaeta (primarily the free-living nematodes and earthworms), the Tradigrada and some primitive groups of insects. And we do this with a world-wide collecting and research programme.

This given physical and mental capacity offers an opportunity to endeavour, in following our predecessors, to continuously explore the world material and publish our results gained thereby. We feel that nowadays we reached a period when the summarizing and the surveying works have come. Thus catalogues, monographs and comprehensive identification keys have to be written, on the other hand, in spite of their importance, the publication of such works is not easy. This is why we decided to start a series of books with the title of *Pedozoologica Hungarica* enjoying the help of the Biological Section of the Hungarian Academy of Sciences, the Hungarian Scientific Research Programme (OTKA) and the Hungarian Natural History Museum. In this series any results of research embracing world material may appear which fall in line with our intentions.

Series editors

PREFACE

Hungary represents the only country in the World where continuous earthworm research has been carried out from the end of the 19th century till now. This 120 years of faunistic and taxonomic research have required a summary for a long time, but publishing a comprehensive book depends on at least three conditions; the scientific background, willingness to write a book and the financial support. However, these three conditions are rarely given simultaneously. This is the reason why a book on Hungarian earthworms is still missing, whilst all the surrounding countries have published their own faunistic work (Černosvitov 1935, Graff 1953, Mršić 1991, Perel 1979, 1997, Plisko 1973, Pop 1949).

Today, it seems that all the conditions are fulfilled. The material is given, the huge collection of the second author, result of 50 years of activity, contains some 35.000 specimens from almost 1000 different localities across the country. The beginning of the new millennium (and the 75th birthday of the second author) mentally forced us to summarize our research done on the Hungarian earthworms. And last, the financial support from different organizations made it possible to publish our results.

We are indebted to many colleagues who helped us with valuable comments while preparing the manuscript. In particular Sándor Mahunka and István Andrássy who took the tedious task to read the manuscript thoroughly and besides their useful remarks corrected a lot of typing mistakes as well. We wish to thank Lajos Zombori not only for linguistically polishing the text, but for his several useful editorial suggestions. We are most grateful to Zsuzsanna Ádám and Szilvia Gesztesi for the technical assistance in preparing and maintaining the earthworm database and handling the collection. The hand-drawings have been prepared by Maria Csuzdi.

The preparation of the computer-based earthworm database and the recent collecting activity were supported by a grant of the Ministry of Environment and Water, Hungary (KAC 0439352001), and by the Hungarian Scientific Research Found (OTKA T042745).

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Budapest, August 2003.

Csaba Csuzdi

1. INTRODUCTION

The beginning of the earthworm research in Hungary goes back to the end of the 19th century, when László Örley was commissioned by the Hungarian Academy of Sciences in 1879 to survey and make a study of the home fauna. This work „A magyarországi Oligochaeták faunája I. Terricolae" [The fauna of Oligochaeta of Hungary I. Terricolae] was published in 1881 (Örley 1881a). This survey was soon followed by a comprehensive revision (Örley 1885), and thereby Hungary became a definitive country in earthworm research.

The commission of the Academy was more than timely since all over Europe planned faunistic researches started (D'Udekem 1865, Eisen 1871, Perrier 1872, Vejdovszky 1884), and the increase of knowledge with the numerous genera valid to day (*Dendrobaena* Eisen, 1873, *Eisenia* Malm, 1877, *Allolobophora* Eisen, 1873) brought radical changes in the study of this family. In this work László Örley played significant role in establishing the genera of *Octolasion* Örley, 1885 and *Aporrectodea* Örley, 1885, but more particularly in the ecological typisation of the lumbricids, by which he distinguished three large groups: **1**. Large-bodied species penetrating to 3–4 feet deep in the soil of forests and meadows (e.g. *Lumbricus terrestris*, *Octolasion platyurum* [= *Fitzingeria platyura*]). **2**. Smaller species living in wood and other vegetable matter (*Allurus submontanus* [= *Eisenia lucens*], *Octolasion boeckii* [= *Dendrobaena octaedra*]). **3**. The species inhabiting the clayey soil and mud of riparian banks and standing waters (*Allurus tetraedrus* [= *Eiseniella tetraedra*], *Allolobophora dubiosa* [= *Aporrectodea dubiosa*]). During his collecting activity of several years Örley ascertained in Hungay 19 species of Lumbricidae (Table 1.1), of which he described six as new. He furthermore analysed in detail the distribution of the accepted 37 species (Örley 1885 p. 33, Table l).

Andor Szűts continued the work of Örley. He by following the concept of Michaelsen (1900a) surveyed the Hungarian fauna and adapted Örley's species lists (Örley 1881a, 1885) to the modern nomenclature and complementing with his own collecting data listed 19 species and varieties together with distribution data (Szűts 1909). He studied the anatomy of lumbricids in detail (Szűts 1911) and on the basis of the digestive system for *Allolobophora dubiosa* he erected the genus of *Archaeodrilus* and with the genus *Criodrilus* he established the subfamily name of Archaeodrilinae (Szűts 1913).

The arduous works of Örley and Szűts resulted in a rich earthworm collection which was deposited in the Hungarian Natural History Museum and through the years was further enriched by Hungarian and foreign materials collected by L. Méhely, L. Soós, E. Csíki, E. Dudich, G. Kolosváry, Á. Soós and others. The collection was revised by Viktor Pop (1943a) who also added numerous specimens to it. Though the earthworm collection survived the hazards of the Second World War, unfortunately during the events of 1956 the building of the Museum was hit and the collection was destroyed.

After the Second World War a new chapter was opened in the research of earthworms of Hungary. First, it was István Andrássy (1955), the renown Nematoda specialist, who summarised the Hungarian annelids for the series of Magyarország Állatvilága [The fauna of Hungary], then subsequently, András Zicsi (1959) critically analysed the literature data, and after five years of intensive faunistic exploration made the list of earthworm species of Hungary up to date (Table 1.2).

This work is continuing ever since and the results of the faunistics had been published in several papers (e.g. Zicsi 1968a, 1991) (Table 1.3), but the some fifty years of fauna research – in which the first author took up work in 1980s – yet a summarised evaluation has been missing. This gap is intended to be filled in by the present book, wherein all the distribution data of the ascertained earthworm species recorded so far from Hungary is shown in a UTM grid system (Dévai et al. 1997, Miskolczi et al. 1997). Owing to the rather complicated nomenclature of earthworm taxonomy (cf. Chapter 2) a detailed synonymy is presented under each species marking the Hungarian references in bold type.

Table 1.1. Earthworm species reported from Hungary before the Second World War

Örley 1885	Szüts 1909	Pop 1943	Valid name
Octolasion complanatus	*Octolasium complanatum*		*Octodrilus complanatus**
Octolasion rubidum			*Octolasion lacteum*
Octolasion frivaldszkyi			*Octodrilus frivaldszkyi**
Octolasion gracile			*Octolasion lacteum*
Octolasion transpadanum	*Octolasium transpadanum*	*Octolasium transpadanum*	*Octodrilus transpadanus*
Octolasion Boeckii		*Dendrobaena octaedra* f. *typica*	*Dendrobaena octaedra*
Octolasion lacteum	*Octolasium lacteum*	*Octolasium lacteum*	*Octolasion lacteum*
Octolasion platyurum		*Dendrobaena platyura* f. *typica*	*Fitzingeria platyura platyura*
	Helodrilus (Dendrobaena) platyurus		*Fitzingeria platyura depressa*
Aporrectodea chlorotica	*Helodrilus (Allolobophora) chloroticus*	*Allolobophora chlorotica*	*Allolobophora chlorotica*
Aporrectodea trapezoides	*Helodrilus (Allolobophora) caliginosus trapezoides*	*Allolobophora caliginosa* var. *trapezoides*	*Aporrectodea caliginosa*
	Helodrilus (Allolobophora) caliginosus typicus	*Allolobophora caliginosa* f. *typica*	
		Allolobophora dugesi var. *gestroi*	*Allolobophora* (s.l.) *gestroides*
Allolobophora dubiosa	*Helodrilus (Allolobophora) dubiosus*	*Allolobophora dubiosa* f. *typica*	*Aporrectodea* (s.l.) *dubiosa*
		Allolobophora handlirschi	*Aporrectodea handlirschi*
Allolobophora mucosa	*Eisenia rosea* var. *typica*	*Allolobophora rosea* f. *typica*	*Aporrectodea rosea*
	Eisenia rosea var. *budensis*		*Aporrectodea rosea*
	Eisenia rosea var. *croatica*	*Eisenia submontana*	*Eisenia lucens*
Allolobophora foetida	*Eisenia foetida*	*Eisenia foetida*	*Eisenia fetida*
Allurus tetraedrus	*Eiseniella tetraedra* var. *typica*	*Eiseniella tetraedra* f. *typica*	*Eiseniella tetraedra*
	Eiseniella t. hercynia		*Eiseniella tetraedra*
		Eiseniella balatonica	*Eisenia balatonica*
Allolobophora Fraissei	*Helodrilus (Bimastus) constrictus*	*Dendrobaena rubida* var. *tenuis*	*Dendrodrilus rubidus rubidus*
		Dendrobaena rubida var. *subrubicunda*	*Dendrodrilus rubidus subrubicundus*
Allolobophora mediterranea			*Aporrectodea rosea*
	Helodrilus (Allolobophora) smaragdinus		*Aporrectodea smaragdina**
	Helodrilus (Dendrobaena) rubidus		*Species incertae sedis*
Lumbricus rubellus	*Lumbricus rubellus*	*Lumbricus rubellus*	*Lumbricus rubellus*
Lumbricus castaneus			*Lumbricus castaneus*
	Lumbricus polyphemus	*Lumbricus polyphemus*	*Lumbricus polyphemus*
Lumbricus terrestris	*Lumbricus terrestris*	*Lumbricus herculeus*	*Lumbricus terrestris*

* *Species not recorded for the present territory of Hungary*

Table 1.2. Earthworm species reported from Hungary by ANDRÁSSY (1955) and ZICSI (1959a, 1968a)

ANDRÁSSY 1955	ZICSI 1959a	ZICSI 1968a	Present species
Allolobophora dugesi var. *dacica*	*Allolobophora dugesi* var. *dacia*	*Allolobophora dugesi* var. *dacica*	*Allolobophora* (s.l.) *dacica*
	Allolobophora dugesi var. *gestroi*	*Allolobophora dugesi* v. *gestroi*	*Allolobophora* (s.l.) *gestroides*
Allolobophora dugesi var. *getica*			*?Allolobophora* (s.l.) *getica*[*]
		Allolobophora hrabei	*Allolobophora* (s.l.) *hrabei*
Allolobophora leoni	*Allolobophora leoni*	*Allolobophora leoni*	*Allolobophora* (s.l.) *leoni*
Allolobophora mehadiensis var. *boscaiui*			*Allolobophora* (s.l.) *m. boscaiui*[*]
Allolobophora mehadiensis	*Allolobophora mehadiensis*	*Allolobophora mehadiensis*	*Allolobophora* (s.l.) *m. mehadiensis*
		Allolobophora bellicosa	*Allolobophora* (s.l.) *nematogena*
Allolobophora robusta			*Allolobophora* (s.l.) *robusta*[*]
Allolobophora dugesi var. *sturanyi*	*Allolobophora dugesi* var. *sturanyi*[+]		*Allolobophora* (s.l.) *sturanyi*[*]
	Allolobophora chlorotica	*Allolobophora chlorotica*	*Allolobophora chlorotica*
Eisenia parva	*Eisenia parva*	*Eisenia eiseni*	*Allolobophoridella eiseni*
Allolobophora dubiosa	*Allolobophora dubiosa f. typica*	*Allolobophora dubiosa*	*Aporrectodea* (s.l.) *dubiosa*
Allolobophora dubiosa var. *pontica*	*Allolobophora dubiosa* var. *pontica*		*Aporrectodea* (s.l.) *dubiosa*
Allolobophora caliginosa var. *trapezoides*			*Aporrectodea caliginosa*
Allolobophora caliginosa	*Allolobophora caliginosa*	*Allolobophora caliginosa*	*Aporrectodea caliginosa*
	Allolobophora terrestris		*Aporrectodea caliginosa*
Allolobopgora georgii var. *transylvanica*		*Allolobophora georgii*	*Aporrectodea georgii*
Allolobophora handlirschi	*Allolobophora handlirschi*	*Allolobophora handlirschi*	*Aporrectodea handlirschi*
Dendrobaena handlirschi var. *rhenani*			*Aporrectodea handlirschi*
Allolobophora jassyensis	*Allolobophora jassyensis*	*Allolobophora jassyensis*	*Aporrectodea jassyensis*
Allolobophora longa		*Allolobophora longa*	*Aporrectodea longa*
Allolobophora rosea	*Allolobophora rosea*	*Allolobophora rosea*	*Aporrectodea rosea*
	Allolobophora rosea var. budensis		*Aporrectodea rosea*
Allolobophora dugesi var. *opisthocystis*	*Allolobophora dugesi* v. *opisthocystis*	*Allolobophora dugesi* v. *opisthocystis*	*Cernosvitovia (Zicsiona) opisthocystis*
Dendrobaena alpina	*Dendrobaena alpina*[+]		*Dendrobaena alpina*[*]
Dendrobaena attemsi			*Dendrobaena attemsi*[*]
		Dendrobaena auriculata	*Dendrobaena auriculata*
		Dendrobaena clujensis	*Dendrobaena clujensis*
	Dendrobaena pygmaea	*Dendrobaena pygmaea*	*Dendrobaena cognettii*
Dendrobaena byblica	*Dendrobaena byblica*	*Dendrobaena byblica*	*Dendrobaena ganglbaueri*
Eisenia veneta var. *hortensis*	*Dendrobaena veneta* v. *hortensis*	*Dendrobaena hortensis*	*Dendrobaena hortensis*
Dendrobaena octaëdra	*Dendrobaena octaëdra* f. *typica.*	*Dendrobaena octaedra*	*Dendrobaena octaedra*
Dendrobaena octaëdra var. *quadrivesiculata*	*Dendrobaena octaëdra* v. *quadrivesiculata*		*Dendrobaena octaedra*

ANDRÁSSY 1955	ZICSI 1959a	ZICSI 1968a	Present species
	Dendrobaena octaëdra v. *filiformis*	*Dendrobaena vejdovskyi*	*Dendrobaena vejdovskyi*
	Dendrobaena veneta	*Dendrobaena veneta*	*Dendrobaena veneta*
Dendrobaena rubida	*Dendrobaena rubida*	*Dendrobaena rubida*	*Dendrodrilus rubidus*
Eiseniella balatonica	*Eiseniella balatonica*	*Eiseniella balatonica*	*Eisenia balatonica*
Eisenia foetida	*Eisenia foetida*	*Eisenia foetida*	*Eisenia fetida*
Eisenia submontana	*Eisenia submontana*	*Eisenia lucens*	*Eisenia lucens*
Eisenia spelaea		*Eisenia spelaea*	*Eisenia spelaea*
Eiseniella tetraëdra	*Eiseniella tetraëdra* f. *typica.*	*Eiseniella tetraedra* f. *typ.*	*Eiseniella tetraedra*
Eiseniella tetraëdra var. *hercynia*	*Eiseniella tetraëdra* v. *hercynia*	*Eiseniella tetraedra* v. *hercynia*	*Eiseniella tetraedra hercynia*
	Eiseniella tetraëdra v. *hercynia* f. *intermedia*	*Eiseniella tetraedra* v. *intermedia*	*Eiseniella tetraedra intremedia*
		Eiseniella tetraedra v. *popi*	*Eiseniella tetraedra*
Dendrobaena platyura	*Dendrobaena platyura* f. *typica*	*Dendrobaena platyura* f. *typ*	*Fitzingeria pl. platyura*
	Dendrobaena platyura v. *depressa*	*Dendrobaena platyura* v. *depressa*	*Fitzingeria pl. depressa*
		Dendrobaena platyura v. *montana*	*Fitzingeria pl. montana*
		Allolobophora cernosvitoviana	*Helodrilus cernosvitovianus*
		Lumbricus baicalensis	*Lumbricus baicalensis*
Lumbricus castaneus	*Lumbricus castaneus*	*Lumbricus castaneus*	*Lumbricus castaneus*
	Lumbricus festivus¤		*Lumbricus festivus**
Lumbricus polyphemus	*Lumbricus polyphemus*	*Lumbricus polyphemus*	*Lumbricus polyphemus*
Lumbricus rubellus	*Lumbricus rubellus*	*Lumbricus rubellus*	*Lumbricus rubellus*
Lumbricus herculeus	*Lumbricus terrestris*	*Lumbricus terrestris*	*Lumbricus terrestris*
	Octolasium complanatum	*Octolasium kamnense*	*Octodriloides karawankensis*
Octolasium complanatum			*Octodrilus complanatus**
Octolasium lissaense		*Octolasium lissaense*	*Octodrilus compromissus*
Octolasium frivaldszkyi			*Octodrilus frivaldszkyi**
Octolasium gradinescui		*Octolasium gradinescui*	*Octodrilus gradinescui*
		Octolasium exacystis	*Octodrilus gradinescui*
		Octolasium hemiandrum	*Octodrilus pseudotranspadanus*
Octolasium transpadanum	*Octolasium complanatum* v. *transpadanum*	*Octolasium transpadanum*	*Octodrilus transpadanus*
Octolasium cyaneum	*Octolasium cyaneum*	*Octolasium cyaneum*	*Octolasion cyaneum*
		Octolasium lacteovicinum	*Octolasion lacteovicinum*
Octolasium lacteum	*Octolasium lacteum*	*Octolasium lacteum*	*Octolasion lacteum*
		Octolasium montanum	*Octolasion montanum*
Allolobophora antipai	*Allolobophora antipai*	*Allolobophora antipai* f. *typica*	*Proctodrilus antipai*
	Allolobophora antipai v. *tuberculata*	*Allolobophora antipai* v. *tuberculata*	*Proctodrilus tuberculatus*

* Species not recorded for the present territory of Hungary
\+ These species were included into the fauna list after ANDRÁSSY (1955)
¤ This species was included after APÁTHY (1920) but without any corroboration

Table 1.3. Earthworm species reported from Hungary by Zicsi (1991) and in the present work.

	Zicsi 1991	Present work	
1.	*Allolobophora dacica*	*Allolobophora* (s. l.) *dacica*	**1.**
2.	*Allolobophora gestroides*	*Allolobophora* (s. l.) *gestroides*	**2.**
3.	*Allolobophora hrabei*	*Allolobophora* (s. l.) *hrabei*	**3.**
4.	*Allolobophora leoni*	*Allolobophora* (s. l.) *leoni*	**4.**
5.	*Allolobophora mehadiensis*	*Allolobophora* (s. l.) *m. mehadiensis*	**5.**
6.	*Allolobophora nematogena*	*Allolobophora* (s. l.) *nematogena*	**6.**
7.	*Allolobophora chlorotica*	*Allolobophora chlorotica chlorotica*	***7.***
8.	*Allolobophora eiseni*	*Allolobophoridella eiseni*	**8.**
9.	*Allolobophora dubiosa*	*Aporrectodea* (s. l.) *dubiosa*	**9.**
10.	*Allolobophora caliginosa caliginosa*	*Aporrectodea caliginosa*	**10.**
11.	*Allolobophora georgii*	*Aporrectodea georgii*	**11.**
12.	*Allolobophora handlirschi*	*Aporrectodea handlirschi*	**12.**
13.	*Allolobophora jassyensis*	*Aporrectodea jassyensis*	**13.**
14.	*Allolobophora longa*	*Aporrectodea longa*	**14.**
15.	*Allolobophora rosea rosea*	*Aporrectodea rosea*	**15.**
16.	*Allolobophora* cf. *sineporis*	*Aporrectodea sineporis*	***16.***
17.	*Allolobophora opisthocystis*	*Cernosvitovia (Zicsiona) opisthocystis*	**17.**
18.	*Dendrobaena auriculata*	*Dendrobaena auriculata*	**18.**
19.	*Dendrobaena clujensis*	*Dendrobaena clujensis*	**19.**
20.	*Dendrobaena cognettii*	*Dendrobaena cognettii*	**20.**
21.	*Dendrobaena ganglbaueri*	*Dendrobaena ganglbaueri*	**21.**
22.	*Dendrobaena hortensis*	*Dendrobaena hortensis*	**22.**
23.	*Dendrobaena octaedra*	*Dendrobaena octaedra*	**23.**
24.	*Dendrobaena vejdovskyi*	*Dendrobaena vejdovskyi*	**24.**
25.	*Dendrobaena veneta veneta*	*Dendrobaena veneta veneta*	**25.**
26.	*Dendrodrilus rubidus rubidus*	*Dendrodrilus rubidus rubidus*	**26.**
27.	*Dendrodrilus rubidus tenuis*	*Dendrodrilus rubidus rubidus*	
28.	*Dendrodrilus rubidus subrubicundus*	*Dendrodrilus rubidus subrubicundus*	**27.**
29.	*Eiseniella balatonica*	*Eisenia balatonica*	**28.**
30.	*Eisenia foetida*	*Eisenia fetida*	**29.**
31.	*Eisenia lucens*	*Eisenia lucens*	**30.**
32.	*Eisenia spelaea*	*Eisenia spelaea*	**31.**
33.	*Eiseniella tetraedra tetraedra*	*Eiseniella tetraedra tetraedra*	**32.**
34.	*Eiseniella tetraedra hercynia*	*Eiseniella tetraedra hercynia*	**33.**
35.	*Eiseniella tetraedra intermedia*	*Eiseniella tetraedra intermedia*	**34.**
36.	*Fitzingeria platyura platyura*	*Fitzingeria platyura platyura*	**35.**
37.	*Fitzingeria patyura depressa*	*Fitzingeria platyura depressa*	**36.**
38.	*Fitzingeria platyura montana*	*Fitzingeria platyura montana*	**37.**
39.	*Helodrilus cernosvitovianus*	*Helodrilus cernosvitovianus*	**38.**
40.	*Helodrilus deficiens*	*Helodrilus deficiens*	**39.**
41.	*Helodrilus mozsaryorum*	*Helodrilus mozsaryorum*	**40.**
42.	*Lumbricus baicalensis*	*Lumbricus baicalensis*	**41.**
43.	*Lumbricus castaneus*	*Lumbricus castaneus*	**42.**
44.	*Lumbricus polyphemus*	*Lumbricus polyphemus*	**43.**
45.	*Lumbricus rubellus*	*Lumbricus rubellus*	**44.**
46.	*Lumbricus terrestris*	*Lumbricus terrestris*	**45.**
47.	*Octodriloides karawankensis*	*Octodriloides karawankensis*	**46.**
48.	*Octodrilus lissaensis*	*Octodrilus compromissus*	**47.**
49.	*Octodrilus gradinescui*	*Octodrilus gradinescui*	**48.**
50.	*Octodrilus exacystis*	*Octodrilus gradinescui*	
51.	*Octodrilus lissaensioides*	*Octodrilus lissaensioides*	**49.**
		Octodrilus pseudolissaensioides	**50.**
52.	*Octodrilus pseudotranspadanus*	*Octodrilus pseudotranspadanus*	**51.**
53.	*Octodrilus transpadanus*	*Octodrilus transpadanus*	**52.**
54.	*Octolasion cyaneum*	*Octolasion cyaneum*	**53.**
55.	*Octolasion lacteovicinum*	*Octolasion lacteovicinum*	**54.**
56.	*Octolasion lacteum*	*Octolasion lacteum*	**55.**
57.	*Octolasion montanum*	*Octolasion montanum*	**56.**
58.	*Proctodrilus antipai*	*Proctodrilus antipai*	**57.**
59.	*Proctodrilus opisthoductus*	*Proctodrilus opisthoductus*	**58.**
60.	*Proctodrilus tuberculatus*	*Proctodrilus tuberculatus*	**59.**

2. SURVEY OF THE CLASSIFICATIONS OF EARTHWORMS

The classification of the family Lumbricidae within the class Oligochaeta presents one of the greatest problems to the specialists (MICHAELSEN 1910a, POP 1941, ZICSI 1974a). Since the fundamental work of MICHAELSEN (1900a) no comprehensive manual has appeared on this family, furthermore, no one has even attempted to tackle the classification of lumbricids based on up-to-date methods reflecting real relationships.

The first attempts to classify the family on relationship criteria sufficed principally with external morphological characteristics, as for example, the colour and shape of the body, the position of the clitellum, tubercles and the setae. One of the first modern research workers of the family was EISEN (1873) who distinguished four genera: *Lumbricus* LINNAEUS, 1758, *Allolobophora* EISEN, 1873, *Dendrobaena* EISEN, 1873, *Allurus* EISEN, 1873.

This system yet prior to the turning of the 19th and 20th centuries was complemented by further genera: *Eisenia* MALM, 1877, *Octolasion* and *Aporrectodea* (ÖRLEY 1885), *Notogama* and *Eophila* (ROSA 1893a) and *Bimastos* MOORE, 1893.

Substantial changes were brought by the work of MICHAELSEN (1900a), in which, besides the external morphology, the specialist also considered the structure of the internal genitalia on which bases he tried to explain the lineages of interfamilial relationships. The decreased number of vesicles and the dorsal shift of the spermathecal pores were characters (today we might say synapomorphy) with special importance, thus they received significant weight in defining these genera. The mentioned features were supplemented with a series of so far unused characteristics, as e.g. the development of calciferous glands, the position of the hearts, the number of the thickened dissepiments. Basing his conception on these features, MICHAELSEN (1900a) separated five genera and three subgenera within the family of Lumbricidae (Table 2.1).

This seemingly phylogenetically based system of MICHAELSEN (1900a) suffered only slight changes until the beginning of the 1940s, and was applied far and wide, since the subgenera reaching generic level the meanwhile (SVETLOV 1924), the eight genera could clearly be distinguished from one another. The genera of *Lumbricus* and *Dendrobaena* possessed three pairs of vesicles, but at the same time the former had even, the latter odd setal ratio. The genera of *Allolobophora*, *Eiseniella*, *Eisenia* and *Octolasium* taken to be more ancient possessed four pairs of vesicles. The species of *Eisenia* were clearly unified by the dorsal shift of the receptacula, the members of *Octolasium* by having perioesophageal testis sacs, while the genus of *Eiseniella* by showing up a muscular gizzard in one segment. Only the genus *Allolobophora* appeared to be morphologically heterogeneous.

Owing to the great deal of information that accumulated over the years on the anatomical structure of earthworms, the accepted division gradually became less applicable. It was MICHAELSEN (1910b) himself who pointed out that the separation of the genera is difficult on genitalic structure alone. Later it became that the number of vesicles in closely allied species, and even within one and the same species, may vary (POP 1941, 1943b).

Meanwhile POOL (1937) studied a new character: the structure of the longitudinal musculature, and found that on the basis of the arrangement of muscle fibres two large groups may be distinguished, the first group of species displaying fasciculate, the second group pinnate structure. Based on the findings of Pool (1937) it was Pop (1941) who revised the individual genera and proved that the number of vesicula seminalis and the position of the receptacula seminis are wholly unsuitable to define interfamilial relationships. According to him the family of Lumbricidae may be divided into two main groups of species, those possessing red pigmentation and those without such pigmentation. Of the former group showing wide setal ratio he relegated into the genus of *Dendrobaena*, while those with close setal ratio and having tanylobic head into *Lumbricus*, those with epilobic head into the genus *Eisenia*. Of the latter group, without pigmentation, the species showing wide setal ratio were put into the genus *Octolasium*, while the species with close setal ratio were relegated into the genera of *Allolobophora* and *Eiseniella*. The rather characteristic tetraedric body end could separate off the representatives of this latter genus and the very muscular gizzard localised in a single segment. Pop (1941) also pointed out that according to the structure of the longitudinal musculature only the *Lumbricus* and the *Octolasium* are homogenous (having pinnate musculature), while in the other genera both types are represented, consequently, these genera might be polyphyletic, in fact, these catch-all genera show up convergent evolutionary lines. Since Pop (1941) had only information on the structure of the longitudinal musculature of a limited number of species he did not venture to phylogenetically interpret the pinnate or the fasciculate types.

Omodeo (1956) acknowledged the simplicity of Pop's system but he could not accept the lack of phylogenetical bases of these catch-all genera. According to him, from evolutionary point of view the fasciculated longitudinal musculature is a plesiomorphic, while the pinnate type is a derived apomorphic characteristic. When revising the family of Lumbricidae he considered a series of new features, as e.g. the number of chromosomes, the structure of diverticula of the calciferous glands, the specificity of embryogenic development. Consequently, Omodeo (1956) divided the family of Lumbricidae into two subfamilies: Eiseniinae having 11 chromosomes (with only one genus: *Eisenia*), and Lumbricinae having 18 chromosomes (the rest of the genera).

A great disadvantage in the utility of Omodeo's division into genera and subgenera was the small number of taxa that he examined. The majority of the species has been known to him only from the literature, thus, his newly introduced characteristics could not be appreciated since these descriptions lacked reference to many of such data. In many instances when relegating species he simply used the traditional features (e.g. genitalia) or simply relied on his "taxonomic intuitions". Owing to these shortcomings a big share of the taxonomists (Plisko 1973, Šapkarev 1972, Zicsi 1968a) returned to the classification of Pop (1941).

The comprehensive revisionary work of Bouché (1972) unfortunately, relied on a very small number of studied species, thereby the system of the family Lumbricidae was entirely dissipated. Bouché in his work described some 70 new species, subspecies and varieties (although the valid nomenclatorial codes definitely prohibited such practice). Furthermore, many species names published from the territory of France he synonymised without heed to the law of priority. He erected seven new genera and subgenera in his revision, separated a total of 17 genera and subgenera within the family frequently based on quite inapplicable criteria (Table 2.1). Since his division practically relied on the fauna of France, and it was not quite clear what features were employed in the separation of the genera, it proved to be wholly inapplicable (Perel 1979).

A few years after the publication of Bouché' work (1972) a specialist of exotic earthworm families (Megascolecidae, Octochaetidae) Gates (1975) drew the attention to new characteristics in elucidating the systematic conditions of Lumbricidae: the nephridial bladders that have been suitable features in other families (Pickford 1937). By considering the shape of the bladders and the structure of the calciferous glands new diagnoses were given for the genera of *Eiseniella*, *Octolasion*, *Bimastos* and *Helodrilus* (Gates 1975), and erected the genera of *Eisenoides* Gates, 1969, *Satchellius* Gates, 1975) and *Murchieona* Gates, 1978.

In accepting the suggestion of Gates (1975) it was Perel (1976a, b, 1979) who examined the nephridial bladders of at least one-third of the species and attempted to elucidate the evolutionary processes within the family of Lumbricidae. She supposed that the lack of nephridial bladders indicates a plesiomorphic state, and through evolution new and intricate types of bladders developed.

However, the shape of the nephridial bladders alone was not sufficient to unambiguously distinguish the genera, so complementary characteristics had to be considered, like the setal ratio, colour, prostomium, musculature. This new system had again several drawbacks. Apparently, unambiguously monophyletic genera were *Lumbricus* and *Eseniella* as specified by Pop (1941) and the *Allolobophora* (*Svetlovia*) erected by her. The other hand, the genus *Allolobophora* comprised some half of the described species, and clearly was a very heterogeneous group, which held true also for *Dendrobaena*. Both genera incorporated groups of species displaying differently structured calciferous glands and musculature, which obviously conclude to polyphyly. The other problem with the revision of Perel was that she repeated the mistakes committed by her predecessors in endeavouring to accomplish an overall family revision, mainly on the basis of the fauna of the Soviet Union, obviously not knowing about half of the species involved. So, the North-American genera of *Eisenoides*, *Bimastos*, the South-European *Satchellius*, *Murchieona*, furthermore all the species relegated by Bouché (1972) into the genera of *Prosellodrilus*, *Ethnodrilus*, *Orodrilus* and *Scherotheca* were wholly left out, thus, in spite of all the valuable parts of this work her experiment proved to be rather unsuccessful.

Fortunately, a few years later successful steps were made (Zicsi 1978, 1981a, 1985) in the revision of the genera *Allolobophora* and *Dendrobaena* causing most of the consternation, still no final solution was really offered. This fact inspired in the 1980s and 1990s the earthworm research workers of Yugoslavia to revise, first, the genus *Allolobophora* (Mršić and Šapkarev 1988), then the whole of the family. The work of Mršić (1991) has not yet been critically assessed. The 38 genera and subgenera (11 new) (Table 2.1) were revised deriving again from a restricted, comparatively small area. In fact, it is restricted to the fauna of the Balkan Peninsula, at a time, when the phylogenetic evaluation of the features and the employment of the up-to-date systematic (cladistic, phenetic) methods were used far and wide, but had been left out of consideration here. This new system was adopted and complemented in examining the West-European fauna by Qiu and Bouché (1998b) in a new family revision, and it was the first occasion when the degrees of relationship among the genera were to be shown. Thus, within the family of Lumbricidae the genera were shared among three subfamilies and 16 tribes by following the classification of the phenetic method. The system obviously bears all the disadvantages of phenetics, e.g. the lack of weighting the characters, which result in the appearance of para- and polyphyletic groups (Wiley 1981, Mayr and Aschlock 1991). So such groups may come into a common subfamily, as for example, *Fitzingeria* Zicsi, 1978 and *Cernosvitovia* Omodeo, 1956, which, according to our standing knowledge have represented two different evolutionary lineages. The species in the genus *Fitzingeria* possess widely paired setae, red pigmentation, pinnate musculature and nephridial bladders of the octaedra type, on the other hand, those of the genus *Cernosvitovia* lack red pigmentation, possess closely paired setae, the musculature is fasciculated, and the nephridial bladders are U-shaped. The only common feature is that in both groups the male pore is shifted back, toward the clitellum, which is supposedly homoplasy in this case.

Unfortunately the authors have not even attempted to carry out a species-group revision however since the last comprehensive work of such a nature (Zicsi 1982a) – wherein of the so far published 561 specific name 268 proved to be valid – the number of the described species has risen by a further 400. These almost 700 species names are shared among 63 genera considering the work of Qiu and Bouché (1998b) (Table 2.2).

Since the so far completed revisionary works (Omodeo 1956, Bouché 1972, Mršić 1991, Qiu and Bouché 1998b) were based on materials deriving from rather localised regions, obviously only parts of the known species were truly studied. So it was not surprising that no phylogenetically correct system could be elaborated for the family of Lumbricidae. This concluded to the fact that by reading any one of the works the clear species interpretation remained for those in the inner circle, i.e. only for the intimate taxonomists of earthworms (Reynolds 1998).

In our present book neither we had even attempted to make a revision, so in the relegation of the Hungarian species we considered only those genera which had been accepted in one of our previous works, which by now are taken to be well outlined (Zicsi and Csuzdi 1999).

Table 2.1. Classification of the family Lumbricidae by different authors.

Michaelsen 1900	Pop 1941	Omodeo 1956	Bouché 1972	Gates 1975	Perel 1979	Zicsi 1978–1986	Omodeo 1988–1991	Mršić 1991
Lumbricus	*Lumbricus*	*Lumbricus*	*Lumbricus*	*Lumbricus*	*Lumbricus*	*Lumbricus*	*Lumbricus*	*Lumbricus*
Eiseniella	*Eiseniella*	*Eiseniella*	*Eiseniella*	*Eiseniella*	*Eiseniella*	*Eiseniella*	*Eiseniella*	*Eiseniella*
Octolasium	*Octolasium*	*Octolasium*	*Octolasium*	*Octolasion*	*Octolasium*	*Octolasium*	*Octolasium*	*Octolasion*
		-Octodrilus	*Octodrilus*			*Octodrilus*	*Octodrilus*	*Octodrilus*
						Octodriloides		*Octodriloides*
Eisenia	*Eisenia*	*Eisenia*	*Eisenia*	*Eisenia*	*Eisenia*	*Eisenia*	*Eisenia*	*Eisenia*
								Allolobophoridella
				Eisenoides				*Eisenoides*
		Eophila	*Eophila*	*Eophila*			*Eophila*	*Eophila?*
Helodrilus		*Helodrilus*		*Helodrilus*	*Helodrilus*	*Helodrilus*	*Helodrilus*	*Helodrilus*
						Proctodrilus		*Proctodrilus*
-Dendrobaena	*Dendrobaena*	*Dendrobaena*	*Dendrobaena*	*Dendrobaena*	*Dendrobaena*	*Dendrobaena*	*Dendrobaena*	*Dendrobaena*
						Fitzingeria	*?Fitzingeria*	*Fitzingeria*
		-Dendrodrilus	*-Dendrodrilus*	*Dendrodrilus*	*Dendrodrilus*		*Dendrodrilus*	*Dendrodrilus*
				Satchellius				*Satchellius*
			Kritodrilus		*Kritodrilus*		*Kritodrilus*	*Kritodrilus*
-Bimastus		*Bimastus*		*Bimastos*		*Bimastus*	*Bimastus*	*Bimastos*
							Spermophorodrilus	*Spermophorodrilus*
							Healyella	*Haelyella*
-Allolobophora	*Allolobophora*	*Allolobophora*	*Allolobophora*	*Allolobophora*	*Allolobophora*	*Allolobophora*	*Allolobophora*	*Allolobophora*
					-Svetlovia			*Perelia*
			Nicodrilus	*Aporrectodea*	*Nicodrilus*		*Nicodrilus*	*Aporrectodea*
			-Rhodonicus					*-Creinella*
			Scherotheca				*Scherotheca*	*Scherotheca*
			-Opothedrilus				*-Opothedrilus*	*-Opothedrilus*
		-Cernosvitovia				*Cernosvitovia*	*Cernosvitovia*	*Cernosvitovia*
								-Zicsiona
		-Microeophila						*Microeophila*
								Pannoniona
								Karpatodinariona
								Italobalkaniona
								Alpodonaridella
								-Dinaridella
								Serbiona
								Meroandriella
			Prosellodrilus					*Prosellodrilus*
			Ethnodrilus					*Ethnodrilus*
			Orodrilus					*Orodrilus*
		Eiseniona					*Eiseniona*	

Table 2.2. Classification of the family Lumbricidae by Qiu & Bouché (1998b)

subfamily	**tribe**	**genus**	**subgenus**
Lumbricinae	Prosellodrilini	*Prosellodrilus*	*Prosellodrilus* *Pyrenodrylus* *Kenleenus*
		Italobalkaniona	
	Zophoscolexini	*Zophoscolex*	*Zophoscolex* *Aquilonibericus* *Euibericus* *Castillodrilus*
		Ethnodrilus	
		Kritodrilus	
		Cataladrilus	*Cataladrilus* *Latisetinella*
	Scherothecini	*Scherotheca*	*Scherotheca* *Corsicadrilus* *Rosanus* *Opothedrilus*
		Eumenescolex	
		Pietromodeona	
		Eophila	*Eophila* *Trapezonscolex*
	Avelonini	*Avelona*	
		Koinodrilus	
		Eiseniona	
		Nicodrilus	*Nicodrilus* *Rhodonicus*
	Heraclescolexini	*Heraclescolex*	
	Eisenini	*Eisenia*	
	Allolobophorini	*Allolobophora*	*Allolobophora* *Gatesona* *Pannoniona*
		Serbiona	
	Microeophilini	*Microeophila*	
		Perelia	
		Alpodinaridella	*Alpodinaridella* *Dinaridella*
		Karpatodinariona	
	Eisenoidini	*Eisenoides*	
	Lumbricini	*Lumbricus*	
	Octolasionini	*Octolasion*	
		Octodrilus	
		Octodriloides	
	Debdrobaenini	*Dendrobaena*	
		Satchellius	
		Dendrodrilus	
		Iberoscolex	
	Eiseniellini	*Eiseniella*	
		Orodrilus	
		Meroandriella	
		Reynoldsia	
	Helodrilini	*Helodrilus*	*Helodrilus* *Acystodrilus*
		Proctodrilus	
Spermophorodrilinae	Spermophorodrilini	*Spermophorodrilus*	
		Healyella	
		Hydrilus	
	Bimastosini	*Bimastos*	
		Murchieona	
Postandrilinae		*Postandrilus*	*Postandrilus* *Merandrilus* *Galicianadrilus*
		Cernosvitovia	*Cernosvitovia* *Zicsiona*
		Fitzingeria	

3. NOTES ON THE TAXONOMIC CHARACTERS

3.1. EXTERNAL CHARACTERS

Body size and number of segments

The body size and segment number could vary in a great extent in a species; therefore these data are regarded only as informative ones. However OMODEO (1956) called the attention, when a group of earthworms has extremely large size that corresponds to a great number of segments sometimes attaining 4–500. This group of species occurs mainly in the Mediterranean region and thought to be very archaic, originating from the tertiary (OMODEO 1956). It seems that the large body size and the great number of segments are plesiomorph characters, so it is not surprising, that the genus *Eophila* delimited by these characters (OMODEO 1956) subsequently was found to be incorrect (MRŠIĆ 1991).

Pigmentation

A part of the earthworm species possesses porphyrin based purple pigments located in pigment cells in the subcuticular muscle layers (KOBAYASHI 1928). The evolutionary significance of the presence of this pigment was recognized by POP (1941) who successfully used this character to delimit earthworm genera such as *Dendrobaena* and *Eisenia*. This character is generally used since then by earthworm taxonomists but its monophyletic origin is yet to be proved.

Prostomium

The prostomium is an anterior lobe covering dorsally the mouth. There are three main types of prostomium (fig. 3.1A, B) that might represent a transformation series from the most primitive prolobous that is independent from the peristomium (the first true segment) to the tanylobous form that has a tongue completely dividing the peristomium. The overwhelming majority of the species possess epilobous prostomium. The most primitive prolobous state could be found in several species of the "archaic" *Allolobophora* sensu lato, and the tanylobous form is characteristic for the genus *Lumbricus*, but rarely it could also be observed in other species provided with purple pigment.

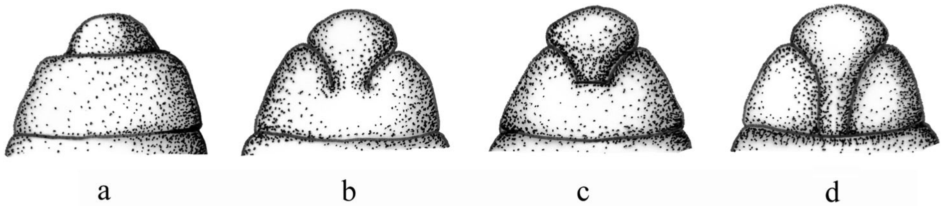

Fig. 3.1.A. Different types of head of earthworms: ***a***. prolobic, ***b.*** epilobic open, ***c.*** epilobic closed, ***d.*** tanylobic.

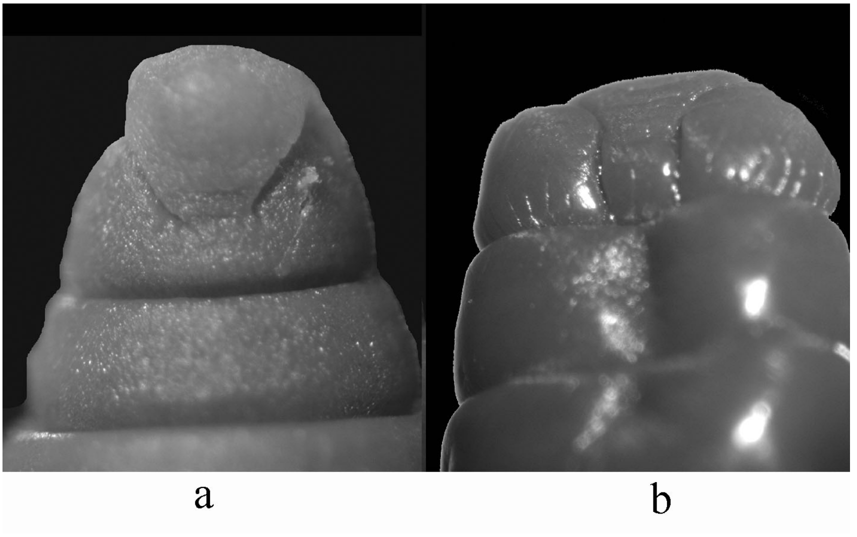

Fig. 3.1.B. Epilobic open head of *Allolobophora chlorotica* (***a.***), tanylobic head of *Lumbricus rubellus* (***b.***).

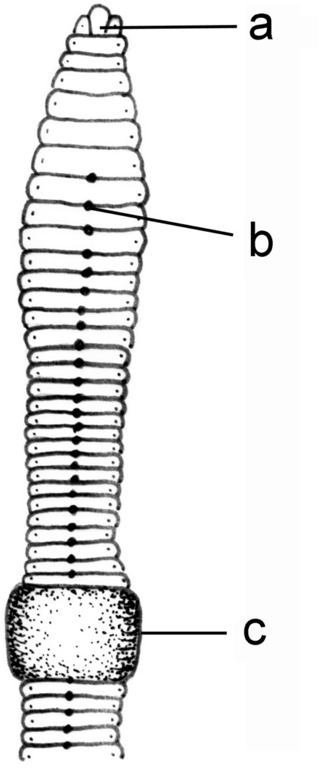

Fig. 3.2. Dorsal view of an earthworm: ***a.*** head, ***b.*** dorsal pore, ***c.*** clitellum.

Dorsal pores

The body cavity communicates with the exterior by the dorsal pores (fig. 3.2). The position of the first pore within a species is more or less constant. In Lumbricidae most of the species have the first dorsal pore around intersegmental furrow 5/6, but sometimes it may be difficult to find. Occasionally it is missing, and rarely it shows a great variation even within a population (Fender, 1982), so it has only a limited use in taxonomy.

Nephropores

The nephropores are the external openings of the nephridia. Usually they are located at the anterior margin of each segment beginning with segment iii. The position of the pores is constant within a species and could follow a straight line just above setae *b* (aligned) or variable above setae *b* and far dorsal to *d*. In several species the variation of the position of nephropores are quite regular being ...BdBdBdBd... in each consecutive segments (alternating) but most frequently they are randomly distributed (irregular). In other families such as Acanthodrilidae the distribution of nephropores is used to define monophyletic groups (Pickford 1937). Several attempts have been made to use this character in Lumbricidae as well (Fender 1982, Qiu & Bouché 1998d) but a thorough investigation of this character is still missing. Qiu & Bouché (1998d) regard the aligned nephropores in setal line *b* as primitive and the irregularly alternating ones as derived.

Male pores

The usual location of male pores in Lumbricidae is on segment *xv*, but in the species of the genera *Fitzingeria*, *Octodriloides*, *Cernosvitovia*, *Postandrilus* its position moved backwards toward the clitellum. This phenomenon is regarded as synapomorphy for the species of the above-mentioned genera (Zicsi 1978, 1986, Mršić 1991, Qiu & Bouché 1998a), but its homoplasious nature for the genera listed already has been demonstrated (Mršić 1991). In spite of this, recently Qiu & Bouché (1998a) united into a separate subfamily (Postandrilinae) the genera possessing male pores on the clitellum (*Fitzingeria*, *Cernosvitovia*, *Postandrilus*) creating so a polyphyletic taxon, that is simply unacceptable.

The position of the male pores sometimes is shifted forwards as in *Eiseniella*. In such a case it could be found on the segment *xiv* or *xiii*, but it is highly variable even within a specimen (i.e. there are specimens with asymmetric male pore positions). Because of this variability Perel (1997) criticized the use of male pores as taxonomic character and she rejected all of the above-mentioned genera.

We have to agree with Zicsi (1978, 1986) and Mršić (1991) that in a distinct evolutionary lineage the backwards shifting of the male pores might be interpreted as synapomorphy and the genera so defined are monophyletic ones.

Besides the location of the male pore, its size and segmental position also show variation to some extent. The size of the male pore could vary from the minute, hardly seen state to the extreme large ones (fig. 3.3), but it is usually constant within a species. Sometimes, mainly in species with tendency toward parthenogenesis, the male pore is variable in size even inside a population (for example *D. octaedra*).

The male pore is usually found ventro-laterally aligned with, and between setae *b* and *c*, but in most of the species of the genus *Bimastos* (and *Healyella*) the male pore is situated more ventrally and post-setally between setae *a* and *b* (fig. 3.4).

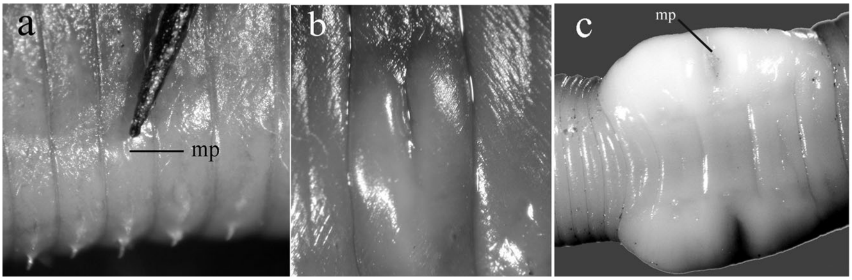

Fig. 3.3. Male pores of earthworms: ***a.*** minute male pore of *Lumbricus rubellus*, ***b.*** male pore with glandular crescent of *Lumbricus terrestris*, ***c.*** outsized male pore of a *Bimastos* species.

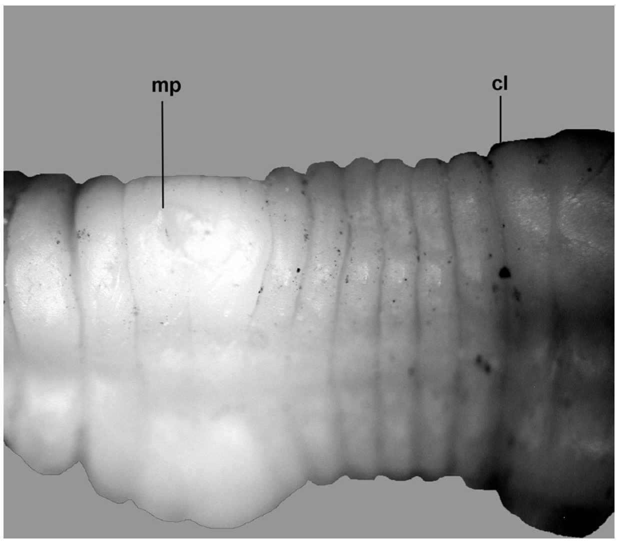

Fig. 3.4. Post-setal male pore of *Bimastos palustris*: ***mp***. male pore, ***cl***. clitellum.

Female pores

The female pores frequently inconspicuous, are on segment xiv just above setae *b* except *Eiseniella* where they are in or ventral to setal line *a*. This unique feature well characterises the genus *Eiseniella*.

Spermathecal pores

The spermathecal pores when present, open in the intersegmental furrows of the preclitellar part of the body. They could usually be found in setal line *cd* but in several cases a dorsal shifting up to the mid-dorsal line could also be observed (fig. 3.5).

The external openings of spermathecae always had a great importance in earthworm taxonomy. In earlier systems this character has been used to separate genera (Rosa 1893a, Michaelsen 1900a), but later Pop (1941) demonstrated that the position of spermathecal pores is in a continuous transition from setal line *c* to the mid-dorsal line even between different populations of *D. byblica* (considered now to be superspecies). Furthermore the dorsal shifting of the spermathecal openings may have arisen convergently so it is erroneous to place, for example, *Enterion roseum* representing the

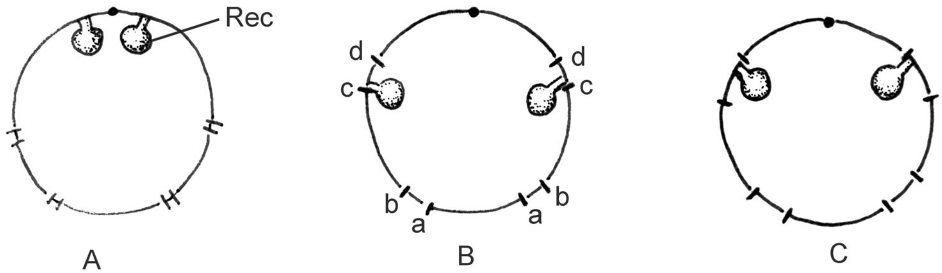

Fig. 3.5. Setal arrangements and receptacle openings in earthworms: ***A.*** closely paired setae, receptacles open dorsally, ***B.*** widely paired setae, receptacles open in setal line c, ***C.*** separate setae, receptacles open in setal line d. ***Rec*** = receptacles, ***a, b, c, d***, = setal lines.

unpigmented "*Allolobophora* s.l." forms to the genus *Eisenia* apparently belonging to a completely different evolutionary lineage.

Clitellum

The shape and the position of the clitellum and the number of segments occupied by it belong to the most important characters in lumbricid taxonomy. Without a fully developed clitellum the exact identification of a species is almost impossible. We have to emphasize that the stability of the clitellar positions may be variable in different genera. For example in the genera *Lumbricus* and *Octolasion* almost no variation could be observed. One segment difference in the position of the clitellum represents an other species (e.g. *L. rubellus* 27–32, *L. castaneus* 28–33). In the genera *Allolobophora* (s.l.) and *Aporrectodea* there is a higher variation, but we must stress that the great fluctuation found sometimes in the literature might be in close connection with the incomplete maturity of the specimens in question (Zicsi 1963).

The clitellum is usually saddle-shaped, i.e. ventrally interrupted, but in several species a more or less equally developed ring-shaped clitellum could also be observed. The complete ring shaped clitellum as synapomorphy led Zicsi (1981a) to define the genus *Bimastos*, uniting unique worms from Asia Minor and North America into the same genus (fig. 3.6). It is difficult to decide which of the two states should be regarded as apomorph, but in the

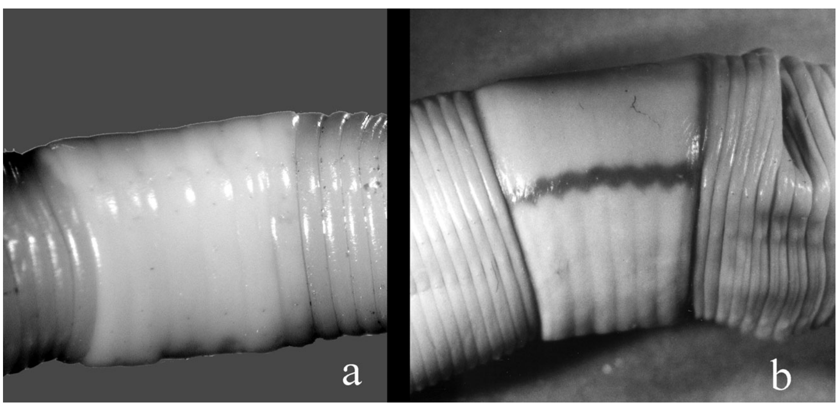

Fig. 3.6. Ring shaped clitellum of ***a.*** *Bimastos* sp. from North America and ***b.*** *Bimastos* (?Healyella) *syriacus* from Israel.

more primitive Oligochaeta families such as Moniligastridae, Enchytraeidae etc. the ring-shaped clitellum is universal, so this might be the plesiomorph state.

Tubercles

Besides the clitellum the tubercles are the other important characters defining earthworm species. Its position and the number of segments occupied by them are more stable than that of the clitellum and it appears in an earlier stage of sexual maturity. There are differently shaped tubercles, but its taxonomic and phylogenetic affinities are unknown. The simplest forms are the band-like tubercles that are more or less continuous glandular swellings on the ventral edge of the clitellum (fig. 3.7a). A second stage when the bands possess ventral knobs at the two edges and finally these could be separated. This transition could easily be observed in the different forms of *Ap. caliginosa* (fig. 3.7b-d). The other form is the sucker-like tubercles, when several distantly standing suckers represent the tubercula pubertatis. The hump-shaped tubercle where the central hollow is missing should be regarded as the variation of the sucker-like ones (fig. 3.8a, b).

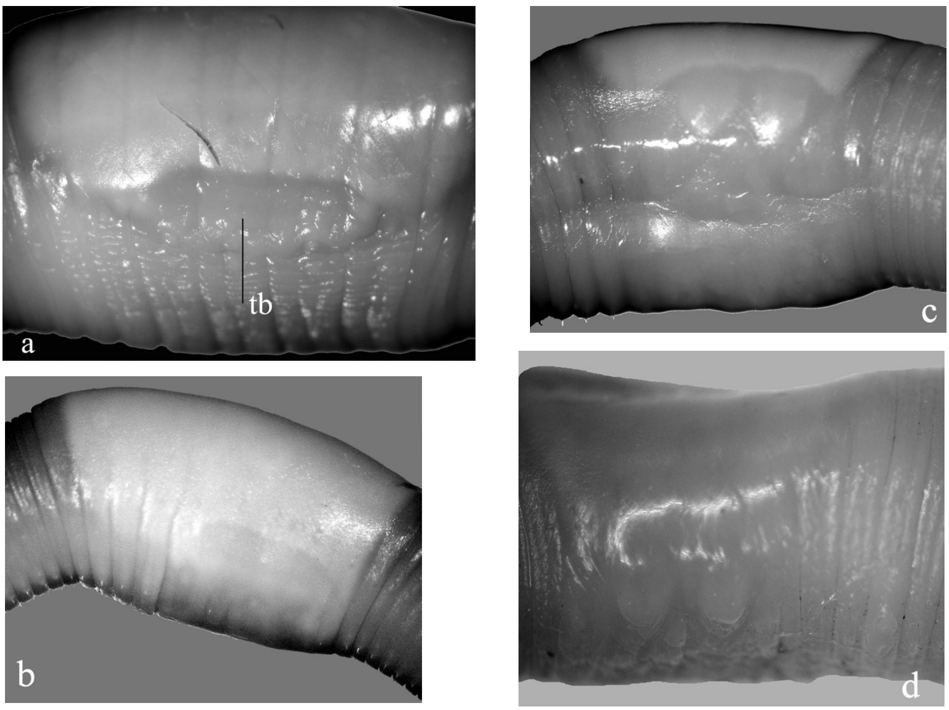

Fig. 3.7. Different types of tubercles of earthworms: ***a.*** band-like tubercles of *Eisenoides loennbergi*, ***b.*** band-like tubercles of *Aporrectodea caliginosa* (morph trapezoides), ***c.*** band-like tubercles with knobs of *Aporrectodea caliginosa*, ***d.*** distinct knob-shaped tubercles of *Aporrectodea caliginosa* (morph tuberculata). ***tb.*** = tubercle

Setal ratio

In Lumbricid earthworms there are eight setae on a segment, arranged either into close pairs or wide pairs or they are evenly distributed over the segment (fig. 3.5). Pop (1941) was the first, who recognised that the setal arrangement is a useful character to delimit

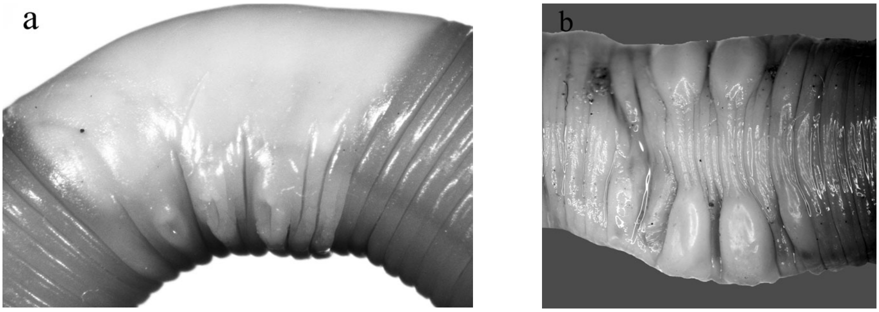

Fig. 3.8. Sucker-like tubercles: ***a.*** true suckers of *Allolobophora chlorotica*, ***b.*** hump-like tubercles of *Allolobophora* (s. l.) *leoni*.

earthworm genera. Conventionally the closely paired state of the setae is regarded as primitive and the distantly standing as derived one (Mršić 1991).

It is in use even today, but there are some uncertainties because in some cases a continuous transition could be observed from the closely paired state to the distantly standing one. For example the only difference between the genera *Dendrobaena* and *Eisenia* lies in the different setal arrangement. But in the Caucasus region the different subspecies of *Eisenia grandis* show a continuous transition of this character from the closely paired state (*E. grandis perelae* Kvavadze, 1973) through the widely paired ones (*E. grandis ganjiensis* Kvavadze, 1985, *E. grandis grandis* Michaelsen 1907) to the distantly standing (*Dendrobaena veneta*) dissolving the traditional delimitation of the two genera. The same situation was recorded by Zicsi (1981a) within the Turkish species of the genus *Bimastos*.

Genital tumescenses

In Lumbricidae there are glandular swellings associated with particular setae or setal pairs. They are usually found in the preclitellar segments around setae *ab* or rarely *cd* (fig. 3.9). The number and segmental position of these papillae are highly variable even among the different specimens of the same population, furthermore, its number strongly corresponds with the sexual activity of the specimens in question. The taxonomic value of this character thought to be very limited (Bouché 1972, Zicsi 1974a, Perel 1979).

Copulatory setae

In Lumbricidae there are two types of setae. The general setae are sigmoid in shape with sharply pointed tip. There is an other type of setae associated with the genital tumescences. They are called copulatory (or genital) setae because they take part in the process of copulation. A copulatory seta is straight with grooved ectal part (fig. 3.10). Depending on the number of furrows the ectal part of a copulatory seta could be trihedral or tetrahedral (Kvavadze 1993).

Rota and Erseus (1997) investigated the length distribution and the ectal-part / ental-part ratio of the copulatory setae in different population of *D. attemsi* and found significant geographical differences.

Unfortunately we have data only of a few species on the copulatory setae, therefore we could not form an opinion of its taxonomic and systematic value yet.

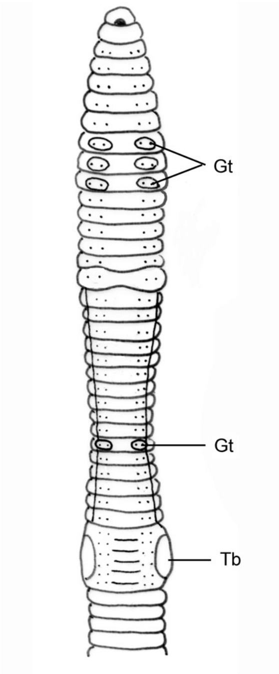

Fig. 3.9. Ventral view of earthworms. ***Gt*** = genital tumescences, ***Tb*** = tubercle.

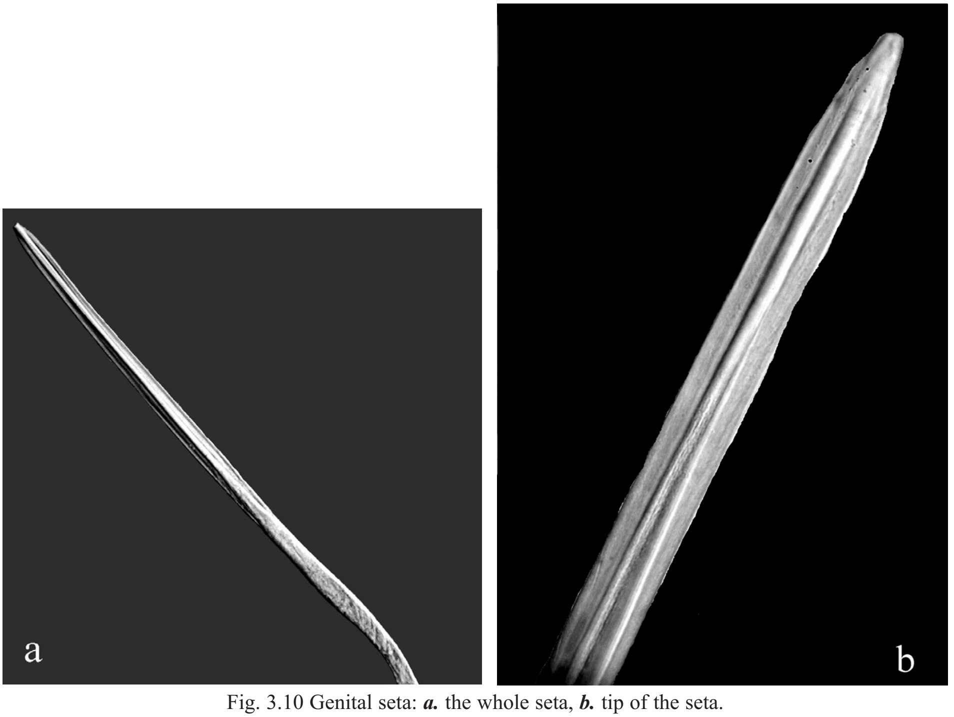

Fig. 3.10 Genital seta: ***a.*** the whole seta, ***b.*** tip of the seta.

3.2. INTERNAL CHARACTERS

Dissepiments

The segments are internally separated by the dissepiments or septa. Usually these septa are thin, but after the pharynx several dissepiments might be thickened and highly muscular. The muscularization of the septa is connected with the subterranean movements of the earthworms (MICHAELSEN 1928) and so it may correspond with the ecological characteristics of the species.

Hearts

The anterior commissures between the dorsal and ventral vessels contain contractile filaments responsible for the blood circulation. These commissures are called hearts or pseudohearts. They usually are situated between segments *vi–xi*. A so-called extraoesophageal vessel could be found in segment *xii* that runs ahead (fig. 3.11). In several cases the hearts of segments *x* or *xi* disappear and the extraoesophageal vessels are also missing. These characters are quite useful to delimit natural groups in the genus *Dendrobaena*.

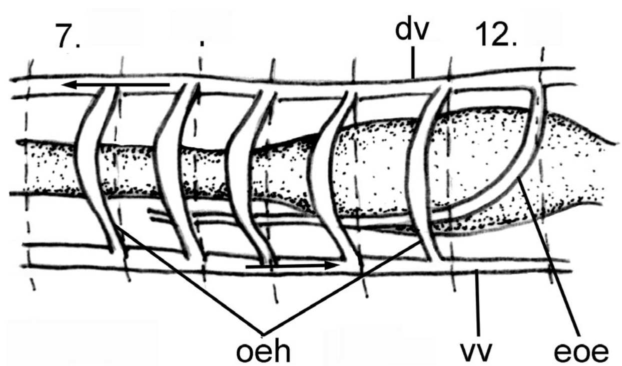

Fig. 3.11. Vascular system of earthworms. ***dv*** = dorsal vessel, ***eoe*** = extraoesophageal vessel, ***vv*** = ventral vessel, ***oeh*** = oesophageal hearts, ***arrows*** indicate the direction of blood flow.

Calciferous glands

The location and structure of calciferous or Morren's glands are among the most important characters in earthworm taxonomy. Usually the glands are situated in segments *x–xiv* and open either via a dilatation (calciferous sac) in segment *x* or directly in segment *xi* and/or *xii* into the oesophagus. The calciferous sac, if present, may open laterally or posterio-laterally into the oesophagus (fig. 3.12). In our opinion the two types of calciferous glands (open via calciferous sac vs. open directly) might represent independent evolutionary lineages, and the sac opening posterio-laterally might represent one of the apomorph states.

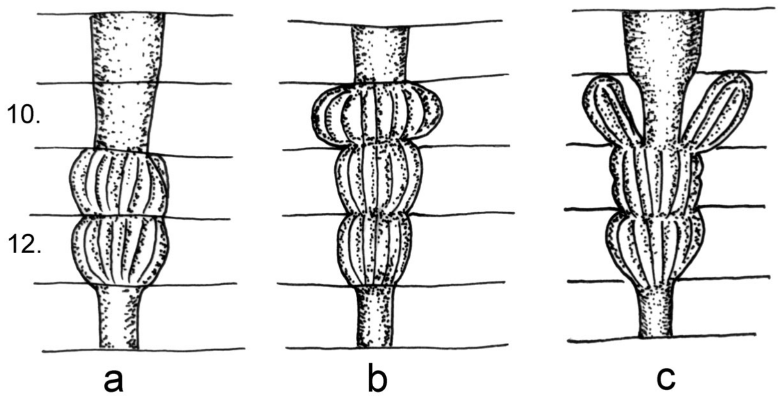

Fig. 3.12. Different types of calciferous glands: ***a.*** calciferous glands open directly in 11, 12, ***b.*** calciferous glands open via vertical calciferous sacs, ***c.*** calciferous glands open via posteriolateral calciferous sacs.

Gizzards

The presence or absence and the location of muscular gizzards are of high systematic importance in all families of earthworms. Regarding its location on the digestive canal basically two main types of muscular gizzards may be distinguished: the oesophageal and the intestinal gizzards. In Lumbricidae intestinal gizzard may be observed at the beginning of the intestine. Usually it occupies two to four segments in the region of *xvii-xx*. In *Eiseniella* and in several species of *Bimastos* the gizzard occupies the segment xvii only. In all other genera the gizzard has a larger extension, but the exact dimension is sometimes very difficult to determine. This might be the main reason for the different data in the literature.

Thyphlosoles

The use of the shape of typhlosoles in earthworm taxonomy has long been debated. Szüts (1913) was the first who assigned evolutionary importance to this character. Subsequent authors regarded the shape of typhlosoles as ecological adaptations with limited taxonomic value (Zicsi 1974a, Bouché 1972, Perel 1979, Mršić 1991).

Three main types of typhlosoles could be distinguished, the trifid typhlosole with three lobes that themselves may be branched, the bifid one with two lobes, that also may further be branched and the simple lamelliform type (fig. 3.13a-c)

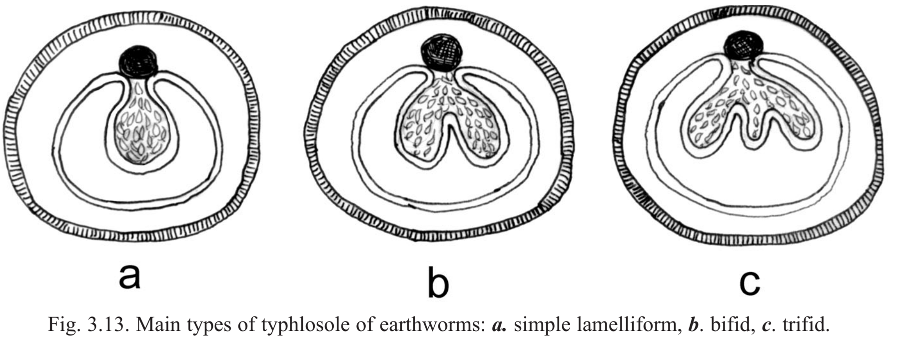

Fig. 3.13. Main types of typhlosole of earthworms: ***a.*** simple lamelliform, ***b***. bifid, ***c***. trifid.

In surveying the literature it seems that the trifid typhlosoles represent the more plesiomorph state and the simple lamelliform is the apomorph one, but the homoplasic evolution of these forms in the species belonging to different lineages is highly probable.

Excretory system

The structure of the excretory system is the most widely used character to draw evolutionary conclusion of earthworm taxa.

The excretory system may be exonephric when each nephridium discharges through a nephropore, or enteronephric when the nephridia discharge via a common collecting canal opening into the intestine before the anus (fig. 3.14).

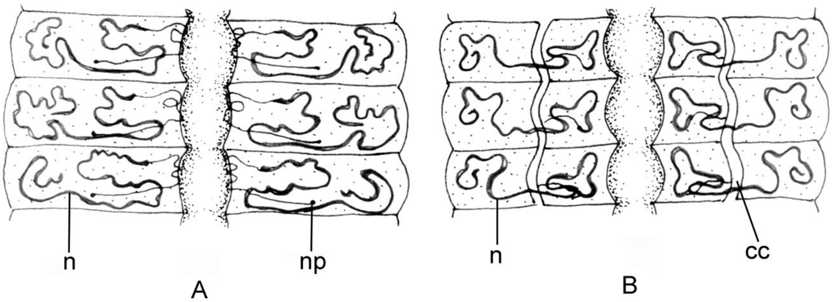

Fig. 3.14. Excretory system of earthworms. ***A.*** exonephric excretory system without nephridial bladders, ***B.*** enteronephric excretory system. ***n*** = nephridium, ***np*** = nephridiopore, ***cc*** = collecting canal.

The exonephric nephridia may possess a nephridial bladder that has a variety of forms. The simplest and perhaps the most primitive state is the saccular nephridial bladder that might be a real sac-like or sausage-like formation. The biscuit-shaped (or *octaedra* type) nephridial bladder represents a modification of the sac-shaped bladder that sometimes may alternate in a specimen. The other main type is the curved nephridial bladder where the end of the bladder is bent, either forwards (cephalad) or backwards (caudad) dividing the bladder into an ectal (closer to the nephropore) and an ental part. The ectal and ental part may partially or completely be fused creating the fishing-hook shaped, ocarina-shaped the bilobate and the sigmoide nephridial bladder (fig. 3.15A-E).

Several authors (Perel 1979, Mršić 1991) attribute a great importance to the position of the ental limb, dividing the genera into two groups one with ental limbs bent ahead and an other with limbs bent tailwards. We agree with Omodeo (2000) that the evolutionary implication of this attribute is a bit overestimated and further (supposedly molecular) investigations are required to clear its importance in systematics.

The lack of nephridial bladders is usually thought to be a primitive condition (Perel 1979, Mršić 1991), but all of the possible outgroups of Lumbricidae possess nephridial bladders. In *Hormogaster* they are backward bent, U-shaped in the front of the body and becoming bilobate toward the tail end.

Structure of the longitudinal muscle layer

The characteristic arrangement of the longitudinal muscle bundles was one of the first somatic characters initiated to replace the highly variable sexual ones (Pool 1937). Pop (1941) successfully used this property to affiliate correctly several earthworm species. He

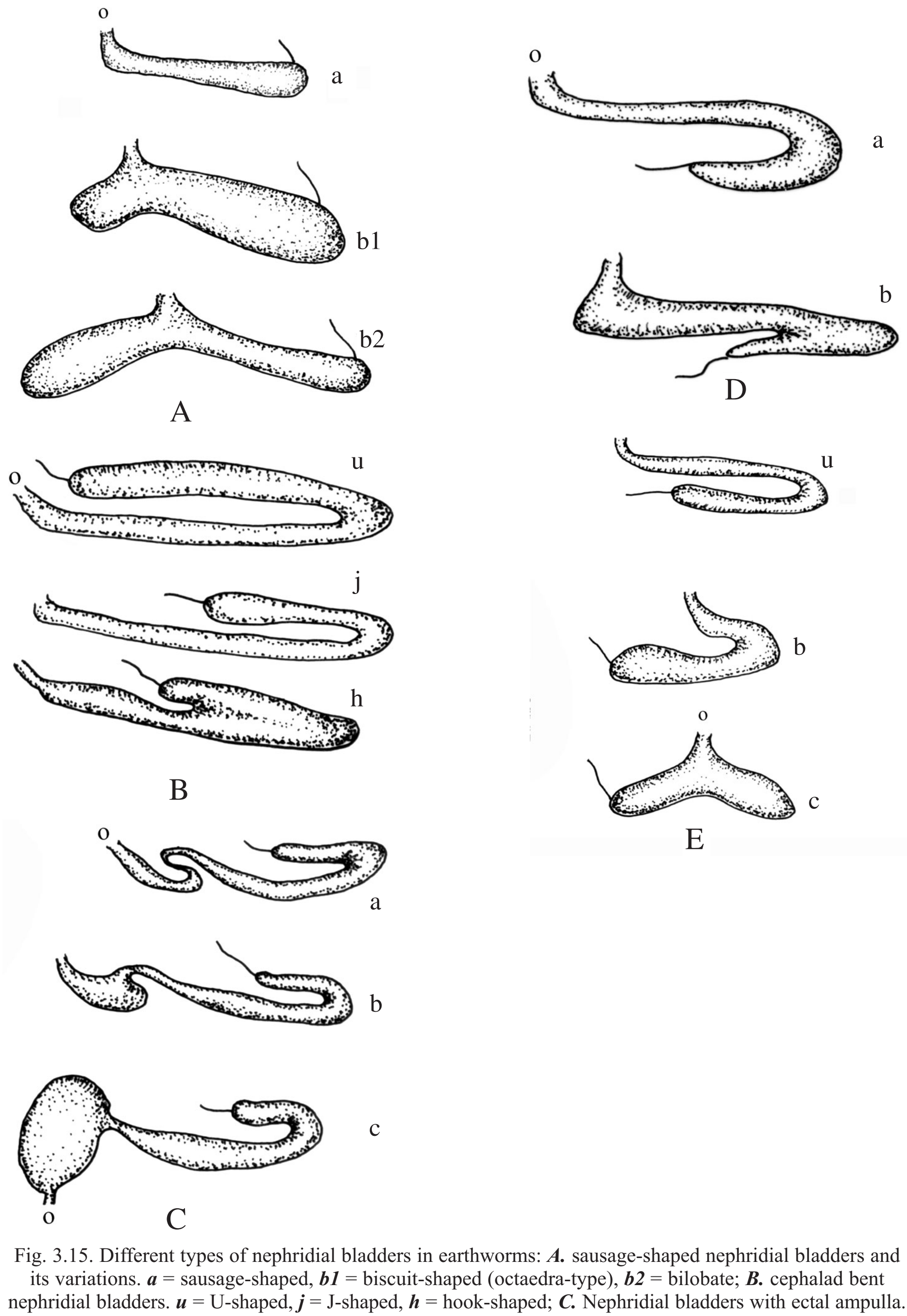

Fig. 3.15. Different types of nephridial bladders in earthworms: ***A.*** sausage-shaped nephridial bladders and its variations. ***a*** = sausage-shaped, ***b1*** = biscuit-shaped (octaedra-type), ***b2*** = bilobate; ***B.*** cephalad bent nephridial bladders. ***u*** = U-shaped, ***j*** = J-shaped, ***h*** = hook-shaped; ***C.*** Nephridial bladders with ectal ampulla. ***a*** = nephridial bladder from the anteclitellar segments, ***b*** = nephridial bladder from the postclitellar segments of *A*. (s. l.) *leoni*, ***c*** = sigmoide nephridial bladder from the postclitellar segments of *Allolobophora* (s. l.) *nematogena*, ***o*** = opening to the nephridiopore. ***D***. Caudad bent nephridial bladders. ***a*** = J-shaped, ***b*** = ocarina-shaped, ***o*** = opening to the nephridiopore. ***E.*** Caudad bent nephridial bladders. ***u*** = U-shaped, ***b*** = inverse J-shaped, ***c*** = bilobate, ***o*** = opening to the nephridiopore.

regarded the two types of musculature (the fasciculated and the pinnate type) as two independent evolutionary lineages. Subsequent authors (OMODEO 1956, PEREL 1968) regarded the fasciculated type to be more primitive and the pinnate type the more advanced one, and described a series of intermediate forms (fig. 3.16).

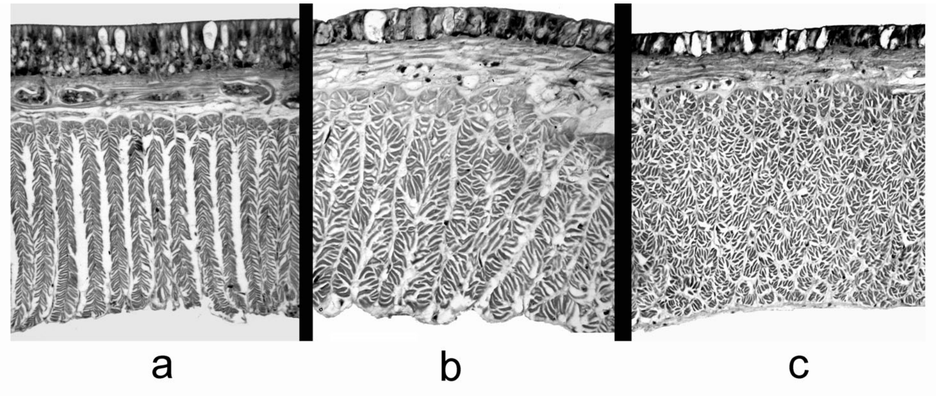

Fig. 3.16. Different types of the longitudinal musculature of earthworms: ***a.*** pinnate, ***b***. intermediate, ***c***. fasciculated.

Testes

Earthworms usually possess two pairs of testes in segments 10 and 11 (holoandric condition) (fig. 3.17). They are minute and hardly seen, therefore data on testes found in the literature are mostly conclusions drawn from the number of male funnels that are more evident iridescent organs. In some cases the number of testes (and the corresponding male funnels) is reduced (meroandric condition). If the testes in segment 10 are missing then it is a metandric condition, if the testes in segment 11 are lacking then it is a proandric condition (fig. 3.18A, B). From evolutionary point of view meroandry is an apomorph state, but it has evolved independently several times in Lumbricidae.

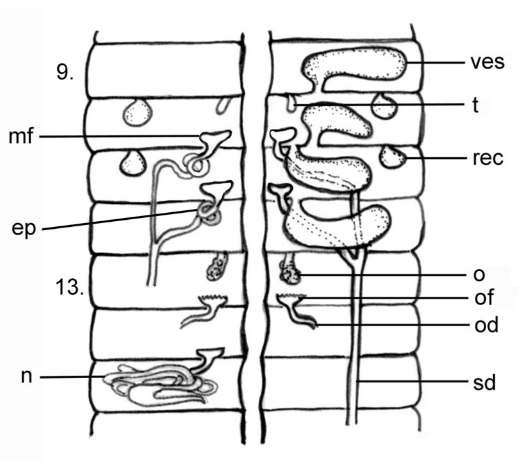

Fig. 3.17. Genital organs of earthworms. ***ep*** = epididymis, ***mf*** = male funnel, ***n*** = nephridium, ***od*** = oviduct, ***o*** = ovary, ***of*** = ovarian funnel, ***rec*** = receptacle, ***sd*** = sperm duct, ***t*** = testis, ***ves*** = vesicle.

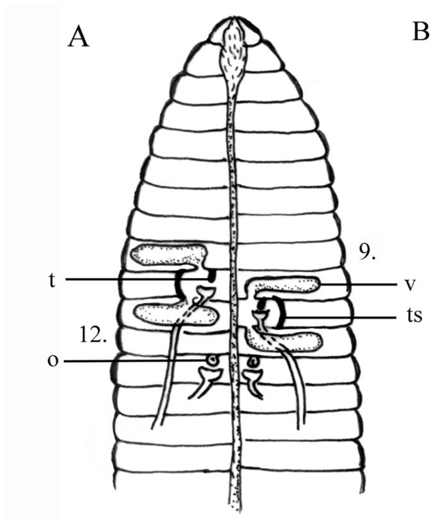

Fig. 3.18. Reductions of male genitalia: ***A***. proandry, ***B***. metandry. ***o*** = ovary, ***t*** = testis, ***ts*** = testis sac, ***v*** = vesicle.

Vesicles

The sperms produced by the testes are stored in the vesicula seminalis or simply vesicles. The number of vesicles in case of holoandry could be two, three or four pairs in segments 11, 12; 9, 11, 12 or 9–12. Because the vesicles are in close association with the testes, in case of meroandry the number of vesicles is also reduced, but in a special way. In proandry the vesicles from segments 10 and 12 are missing because the testes in 11 supply sperms to these vesicles. In metanrdy the vesicles from segments 9 and 11 are missing because the testes in 10 supply sperms to vesicles in 9, 11 (fig. 3.18A, B). It is clear that these arrangements of vesicles are apomorph states, but it is yet to be decided that from the classical situations which represents the plesiomph condition. Pop (1941) presumed a reduction from the four pairs (9–12) condition to the two pairs (11, 12) condition, but Omodeo (1956) argued for just the opposite process. Because all of the possible outgroups of Lumbricidae (*Vignisa*, *Ailoscolex*, *Hormogaster*) possess only two pairs of vesicles in segments 11 and 12 we have to conclude that this might be the plesiomorph condition but in several cases a reversion from the apomorph four pairs state (9–12) should not be excluded.

Testis sacs

The testis sacs are coats of connective tissue covering the testes, male funnels and sometimes also the vesicles and hearts in a segment. If the testis sac covers only the testis and male funnel then it is called oesophageal testis sac, if it covers the heart and the vesicle (if present) then it is called perioesophageal testis sac. The presence of testis sac may cause the reduction of vesicles and consequently the testes (Zicsi 1971a) (fig. 3.18A, B). Unfortunately the testis sac is one of the first organs perishing owing to bad preservation and in such a case only the remnants of the testis sacs may be observed. It is uncertain that the so-called free sperms or "aufgefranste Testikelblasen" are the remnants of the true testis sac or really free sperms stored in the cavity of the testis segments.

Receptacles

Receptacles or spermathecae are invagination of the peritoneum with function of storing sperms from another individual received during copulation. The number and position of receptacles had a primary importance in the early Lumbricid systems, until Pop (1941) demonstrated that its position is highly variable even within a species (or superspecies). Usually they open in setal line *cd* but frequently a dorsal shift may be observed up to the mid-dorsal line (Omodeo 1956 fig. 2.). In all likelihood the ancestral condition is opening in the *cd* line because this is the case also in *Vignisa*, *Ailoscolex* and *Hormogaster*.

The situation is more complicated regarding the number of the spermathecae. Most frequently there are two pairs of spermathecae in segments 9 and 10, but in several cases the number of receptacles may be up to ten pairs between segments 6 and 18. Omodeo (1956) regarded the most derived feature the presence of two pairs of receptacles in 9/10–10/11 and it has been (though implicitly) accepted by Mršić (1991) as well. The outgroup analysis is not so obvious. In *Ailoscolex* there are two pairs of spermathecae in 8/9, 9/10, in *Hormogaster* 2-4 pairs between 8/9 and 12/13, and in *Vignisa* two pairs in 9/10, 10/11.

Epididimys

The ental part of the sperm duct just under the male funnel is sometimes coiled (fig. 3.17). This more or less developed clew is named epididimys. Omodeo (1956) was the first who called the attention to this structure, and found it quite stable in closely related species. Unfortunately this character is scarcely mentioned in species descriptions, therefore its usefulness is yet to be decided.

4. REMARKS ON THE PHYLOGENY OF LUMBRICIDAE

The phylogeny of earthworms seems to be a rather neglected field of research. In the last hundred years of earthworm taxonomy quite a few scientists dealt also with systematics. The first among them was Michaelsen (1910b) who thought that the phylogeny of earthworm genera went through two independent lineages. One of them stemmed from the archaic earthworms and led to the genus *Eisenia* and therefrom to genus *Eiseniella*. This lineage is characterised by the presence of porphyrin-based red pigment, the closely paired setae and spermathecae open above setal line *d*. The other main lineage is suggested to have run towards *Allolobophora* and therefrom into three directions. One leading to *Dendrobaena* and afterwards to the genus *Lumbricus* (line with red pigment), the other to *Eophila* and then *Bimastus* (decreasing the number of vesicles from four to two). The third line led from the genus *Allolobophora* directly to *Octolasium* (pigment lacking, setae distantly standing). According to contemporary views, Michaelsen (1910b) hypothesised the phylogeny going through recent groups, therefore the tree presented (fig. 4.1) is not directly comparable to the subsequent ones (for easy use we have moved the recent taxa to terminal position).

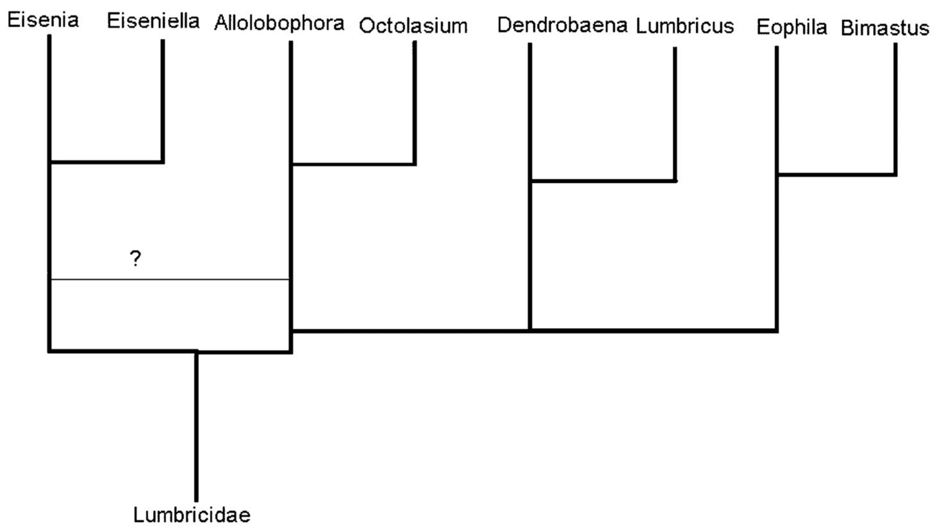

Fig. 4.1. Phylogeny of earthworms according to Michaelsen (1910) (modified).

Pop (1941, 1943b) emphasised that the system proposed by Michaelsen (1910b) is not natural, because it is based on polyphyletic groups. In the revision of the family Lumbricidae Pop (1941) argued that the phylogeny could better be revealed by using somatic characters such as the setal arrangement, pigmentation and the structure of longitudinal musculature instead of the anatomy of the genitalia. In his widely cited work, Pop (1941) did not deal with the phylogeny of earthworm in detail, but in the book on earthworms of Romania (Pop 1949) he presented a remarkable analysis of the subject. He proposed to divide the family into two subfamilies on the basis of the presence or absence of subepidermal red pigment, but he failed to erect the subfamilies formally. In the two lineages (subfamilies?) he made a further division on the basis of the setal arrangement (fig. 4.2). He was well aware of the problem that his classification could not solve all the questions raised by the previous systems (ROSA 1893a, MICHAELSEN 1910b) because of the polyphyly of some genera such as *Allolobophora* and *Eisenia*.

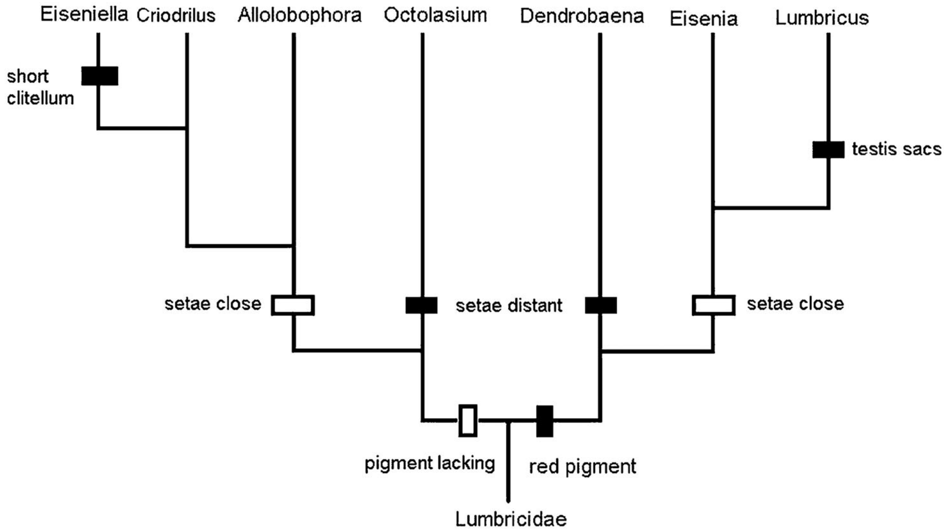

Fig. 4.2. Phylogeny of Lumbricidae according to POP (1949) (modified).

The other drawback of the phylogeny proposed by POP was the inclusion of a quite independent earthworm group, namely the *Criodrilus* that perhaps belongs to Almidae (JAMIESON 1988).

OMODEO (1956) in revising the family Lumbricidae rearranged a number of species placed by POP (1941) into polyphyletic catch-all groups and erected several new monophyletic subgenera such as *Dendrodrilus* within *Dendrobaena* and *Octodrilus* within *Octolasium*.

During the revision he emphasised the importance of the chromosome number in the evolution, and on the basis of this phenomenon he divided the family into two basic evolutionary lineages. Into the first and more primitive subfamily Eiseniinae belongs the genus *Eisenia* with eleven pairs of chromosomes. This chromosome number correlates with that of some primitive semi-aquatic worms such as *Drilocrius*, *Alma*, *Criodrilus* and *Sparganophilus,* therefore OMODEO (1956) proposed that the possible ancestor of the family Lumbricidae might be similar to the primitive *Sparganophilus*. The other lineage possesses basically eighteen pairs of chromosomes, but polyploidy does occur. Most of the genera belong into this lineage: the subfamily Lumbricinae. Among Lumbricinae genera the evolution went through two directions. The more primitive *Helodrilus* and *Dendrobaena* are characterised by lacking calciferous diverticula in segment 10, while it is present in all the other genera. Among the genera provided with calciferous diverticula the most primitive is the *Cernosvitovia* from which a number of other genera had arisen (fig. 4.3).

The detailed analysis of OMODEO (1956) has revealed several interesting relationships such as the basal position of the genus *Helodrilus* in respect of Lumbricinae, the possible connection between *Dendrodrilus* and the *Octolasium–Octodrilus* line and the relative apomorph position of the genus *Eiseniella*, but the two basic lineages of evolution hypothesised, has not been approved by the subsequent studies (MRŠIĆ 1991, QIU & BOUCHÉ 1998b).

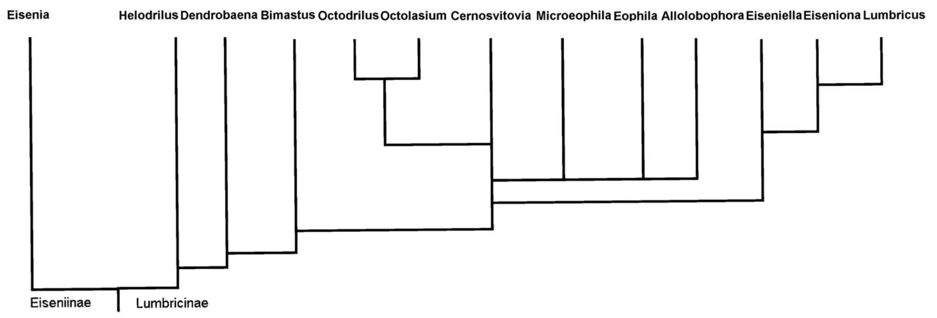

Fig. 4.3. Phylogeny of Lumbricidae according to OMODEO (1956) (modified)

Recently MRŠIĆ (1991) and QIU & BOUCHÉ (1998b) dealt in detail with the phylogeny in the family Lumbricidae. MRŠIĆ (1991) analysed thoroughly the structure of the excretory system, and tried to reconstruct the phylogeny of earthworms in agreement with the proposed evolution of this organ. Where the nephridia did not give enough information other characters such as the position of male pore, calciferous glands, spermathecae were also used. The main advantage of the work of MRŠIĆ (1991) was the applying weight to the characters used, and so adopting a basic cladistic technique. He differentiated four main evolutionary lineages. The first one comprises the genera *Helodrilus*, *Proctodrilus* and perhaps *Dipoprodrilus* characterised by the lack of nephridial bladders, the second the genera with simple (sausage-shaped or its variations) nephridial bladders. The third line contains the so-called western genera possessing U- or J-shaped nephridial bladders with backward-bent ental limb, and the fourth one the eastern forms with forward-bent ental limb. This scenario did not take into account the possible convergent evolution of the shape of nephridial bladders. Unfortunately the methodological and technical development of the phylogenetic methods (HENNIG 1966, WILEY 1981, FARRIS 1988, FELSENSTEIN 1989, 2002, SWOFFORD 1990) has also not been utilized therefore the tree proposed (fig. 4.4) seems hardly better established than the previous ones.

QIU and BOUCHÉ (1998b) presented a thorough analysis of the phylogeny of earthworms after a series of phenetic analysis of the groups in question. The results of the ordination and the subsequent classification produced a remarkable phylogenetic tree (QIU & BOUCHÉ 1998b p. 182.) that suffers from all the drawbacks the method involves (WILEY 1981, WILEY et al. 1991, FOREY et al. 1992). All of the three subfamilies proposed (Table 2.2) are apparently poly- or paraphyletic as results of the lack of character evaluations. In the subfamily Postandrilinae are united for example the genus *Fitzingeria* with red-violet pigmentation, sausage-shaped nephridial bladders, distant setae and pinnate type of

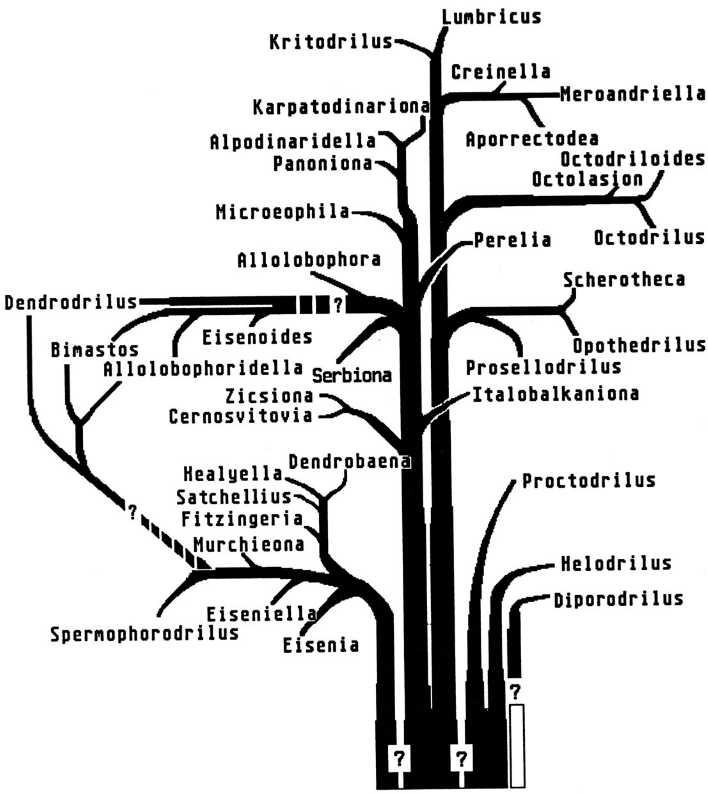

Fig. 4.4. Phylogeny of Lumbricidae according to Mršić (1991).

musculature and genus *Cernosvitovia* with U-shaped nephridial bladders, closely paired setae, lack of red pigment and fasciculated musculature. The only common attribute of these genera is the backward shifted male pore that is most probably a homoplasy. The situation is the same regarding the subfamily Spermophorodrilinae that includes *Bimastos*, *Murchieona*, *Healyella*, *Spermophorodrilus*, *Hydrilus*. These genera differ from each other in the shape of nephridial bladders, pigmentation, setal arrangement and in the structure of longitudinal musculature; the only common characteristics is the lack of spermathecae. The third subfamily is surely paraphyletic (if not polyphyletic) because it does not involve the genera *Murchieona* and *Postandrilus* (fig. 4.5).

It is rather interesting that a cladistic analysis of Lumbricidae has not been carried out so far. One of the main reasons for this might be the difficulty of character evaluation and the high number of homoplasious characters (Jamieson 1988).

We have performed a preliminary phylogenetic analysis of 33 species representing 25 genera proposed by different authors. The cladistic relationships were computed using the Hennig86 software. The characters employed (Table 4.1) were the generally accepted ‘generic characters’ of Lumbricidae. To determine the character polarities the observations in the 3rd chapter were used. The data matrix obtained is presented in the table 4.2. The characters 19 and 24 were regarded as unordered, because the different orientation and shape of the curved nephridial bladders are clearly derivable independently from the plesiomorph state.

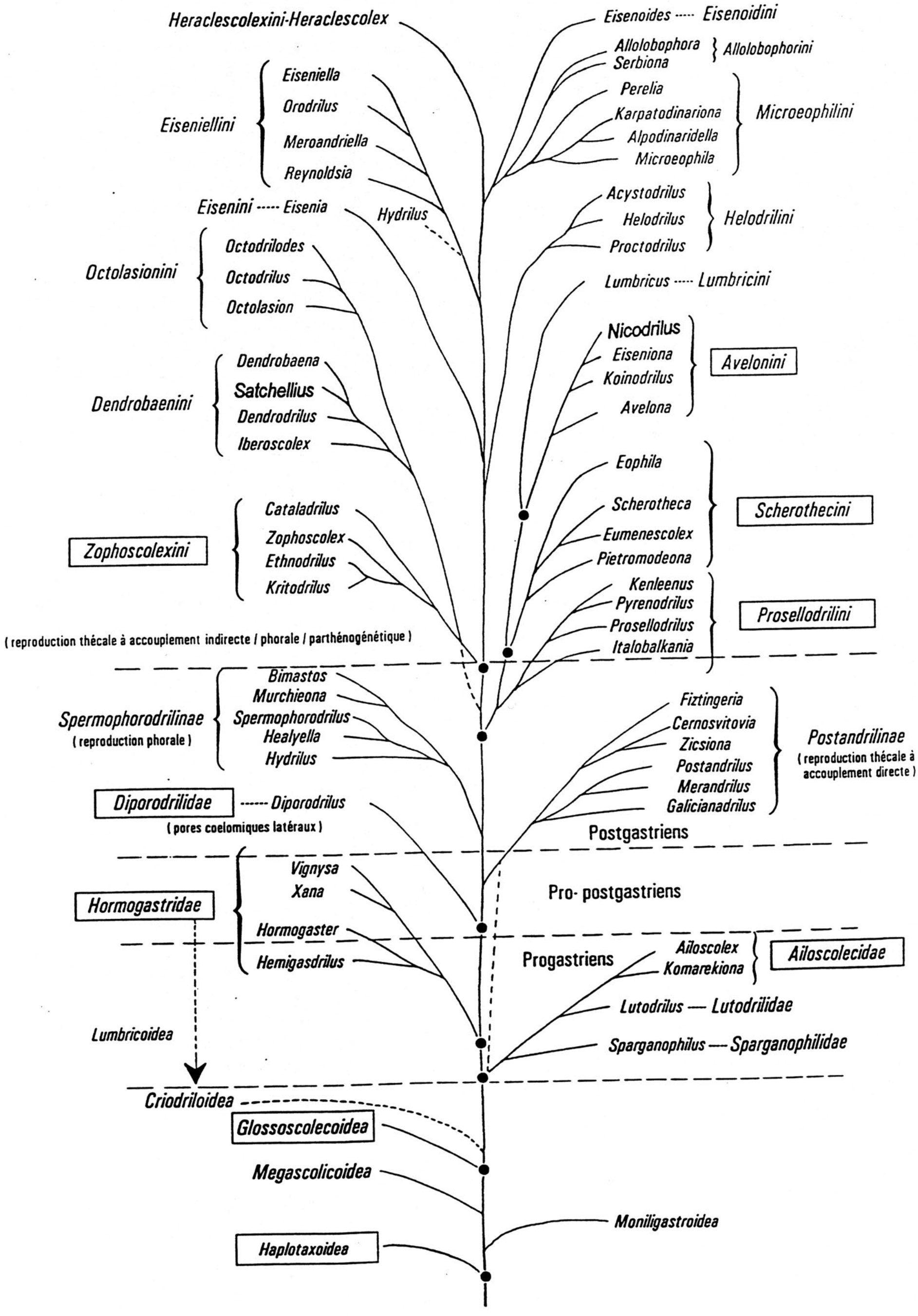

Fig. 4.5. Phylogeny of Lumbricidae according to Qiu and Bouché (1998b).

Because of the large data matrix an exact answer (ie* option) could not be computed, instead the branch-swapping method (mh*; bb*) was used. The initial analysis resulted nearly 3000 most parsimonious trees of 70 steps with moderate consistency and retention indices (CI = 0.44, RI = 0.71). In order to improve the fit of the characters we have carried out the successive weighting procedure of the Henning86 package (xsteps w;mh*bb*;cc;). This analysis resulted 128 trees (CI = 62, RI = 81) for which the consensus tree is presented in fig. 4.6.

We are well aware that this preliminary analysis does not allow us to draw a far-reaching conclusion, but examining the cladogram obtained several interesting observations could be made.

It is interesting to note, that contrary to the widely accepted view, the lack of nephridial bladders in *Helodrilus* and *Proctodrilus* seem to be a derived character, and the most primitive might be the forward-bent one. This is supported by the fact that in the family Hormogastridae (a possible outgroup of Lumbricidae) forward-bent nephridial bladders are found in the several first segments (Rota 1993). The ring-shaped clitellum is also proved to be a derived character, and the possible homoplasy of backward shifting of the male pores is well supported. It had taken place at least in three independent lines, at nodes 49, 25, and 37.

The close relationship between *Scherotheca* and *Eophila* (Omodeo 1988) and the relatively independent position of *Dendrodrilus rubidus* are not surprising, but the clade formed by *E. balatonica*, *E. fetida*, *Ai. eiseni*, *D. veneta* and *E. lucens* is remarkable. Although the close relationship between the *Dendrobaena* and *Eisenia* species with fasciculated musculature has been presumed yet (Kvavadze 1985), but this grouping has never formally been proposed, maybe because it clearly brakes down the last stronghold of the Pop (1941) system: the phylogenetic significance of the setal arrangement. The last clade (46) is formed from the former *Dendrobaena* species with completely resolved topology. The close affinity of the *Bimastos* species (as proposed by Zicsi & Michalis 1993) is supported by several synapomorphy, so the present classification into two relatively divergent genera (Omodeo & Rota 1991, Qiu & Bouché 1998b) seems to be unsupported, although this brings up further zoogeographic problems to be solved. The figuring of *A. hrabei* in this clade might be a sampling error, because several *Allolobophora* sensu lato species due to the lack of comparative material have not been considered in this preliminary analysis.

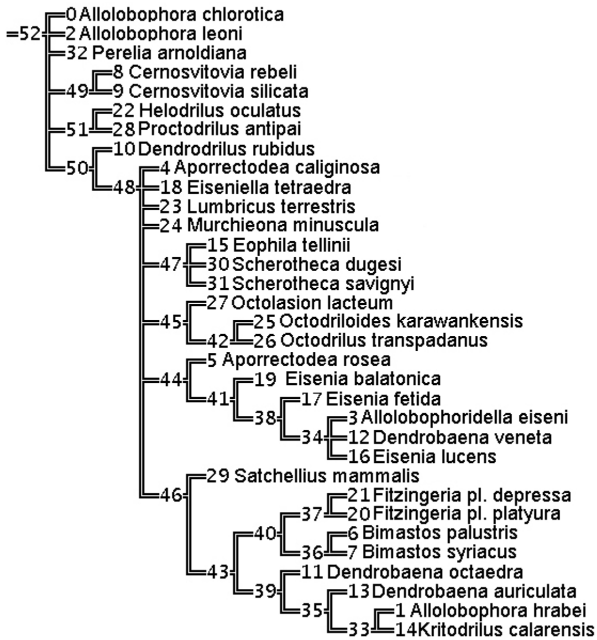

Fig. 4.6. Nelson consensus tree derived from the 128 most parsimonious cladograms produced by successive weighting.

Table 4.1. Characters employed.

No.	Characters	ci	ri	weight
1.	Setae closely pared **0**, setae widely pared **1**, setae distantly standing **2**	22	68	2
2.	Porphyrin-based red pigment absent **0**, present **1**	16	58	2
3.	Clitellum ring-shaped **0,** ventrally less developed **1,** saddle-shaped **2**	66	80	5
4.	Tubercles lacking **0**, present **1**	50	50	2
5.	Head prolobous **0,** epilobous **1,** tanylobous **2**	66	0	0
6.	Segment number more than 250 **0,** less than 200 **1**	50	75	3
7.	Body cylindrical throughout **0**, tail tetrahedral **1**	50	0	0
8.	Female pore in *b* **0**, in *ab* **1,** in *a* **2**	66	0	0
9.	Male pore in *bc* **0,** in *ab* **1**	100	100	10
10.	Male pore setal **0**, postsetal **1**	100	100	10
11.	Male pore on 15 **0,** shifted backward **1**	33	50	1
12.	Nephropores in *b* **0**, in *b* and above *d* **1**	50	80	4
13.	Spermathecal pores in *cd* **0** above *d* **1**.	100	100	10
14.	Last pair of hearts in 11 **0**, in 10 or before **1**	100	100	10
15.	Calciferous sacs in 10 absent **0**, present **1**	25	70	4
16.	Calciferous vesicles opening directly either in 11 or 12 absent **0**, present **1**	33	81	4
17.	Nephridial bladders absent **0,** present **1**	100	100	10
18.	Collective nephridial canal absent **0**, present **1**	100	100	10
19.	Nephridial bladders in the front of the body sausage-shaped **0,** curved cephalad **1,** curved caudad **2**	28	70	3
20.	Opening of the nephridial bladder simple **0**, through a dilatation **1**	50	0	10
21.	Gizzard one segment **0**, two or more **1**	50	0	0
22.	Longitudinal musculature fasciculated **0**, intermediate **1,** pinnate **2**	25	73	2
23.	Spermathecae in (8/9), 9/10, 10/11 **0**, spermathecae elsewhere **1**	25	25	0
24.	Nephridial bladders after the clitellum U- or J-shaped **0,** ocarina-shaped **1**, bilobate **2**	100	100	10

Table 4.2. Data matrix used for the phylogenetic analysis

Species name/ character No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Allolobophora ch. chlorotica	0	0	2	1	1	1	0	0	0	0	0	1	0	0	1	0	1	0	1	0	1	0	1	0
Allolobophora* (s.l.) *hrabei	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	2	0	1	2	1	2
Allolobophora* (s.l.) *leoni	0	0	2	1	1	1	0	0	0	0	0	1	0	0	1	0	1	0	1	1	1	0	1	0
Allolobophoridella eiseni	0	1	2	0	2	1	0	0	0	0	0	1	?	0	0	1	1	0	1	0	1	0	?	0
Aporrectodea caliginosa	0	0	2	1	1	1	0	0	0	0	0	1	0	0	1	0	1	0	2	0	1	2	1	0
Aporrectodea rosea	0	0	2	1	1	1	0	0	0	0	0	1	1	0	1	0	1	0	2	0	1	2	0	0
Bimastos palustris	2	1	0	0	1	1	0	0	1	1	0	1	?	0	1	0	1	0	1	0	0	2	?	0
Bimastos syriacus	2	1	0	0	1	1	0	1	1	1	0	1	?	0	0	1	1	0	0	0	1	2	?	?
Cernosvitovia rebeli	0	0	2	1	1	1	0	0	0	0	1	0	0	0	1	0	1	0	1	0	1	0	1	0
Cernosvitovia silicata	0	0	2	1	1	1	0	0	0	0	1	0	0	0	1	0	1	0	1	0	1	0	0	0
Dendrodrilus rubidus	1	1	2	1	1	1	0	0	0	0	0	1	0	0	1	0	1	0	1	0	1	1	1	0
Dendrobaena octaedra	2	1	2	1	1	1	0	0	0	0	0	0	0	1	0	1	1	0	0	0	1	2	1	?
Dendrobaena veneta	2	1	2	1	1	1	0	0	0	0	0	1	1	0	0	1	1	0	0	0	1	0	1	?
Dendrobaena auriculata	2	0	2	1	1	1	0	0	0	0	0	0	0	0	1	1	1	0	0	0	1	2	1	2
Kritodrilus calarensis	2	0	2	1	1	0	0	0	0	0	0	0	0	0	0	1	1	0	2	0	1	0	0	2
Eophila tellinii	0	1	2	1	1	0	0	0	0	0	0	1	0	0	1	0	1	0	2	0	1	2	1	0
Eisenia lucens	0	1	2	1	1	1	0	0	0	0	0	1	1	0	0	1	1	0	0	0	1	0	1	?
Eisenia fetida	0	1	2	1	1	1	0	0	0	0	0	1	1	0	0	1	1	0	0	0	1	2	1	?
Eiseniella tetraedra	0	0	1	1	1	1	1	2	0	0	0	1	0	0	1	0	1	0	0	0	0	2	1	?
Eisenia balatonica	0	0	2	1	1	1	1	0	0	0	0	1	1	0	0	1	1	0	0	0	1	2	1	?
Fitzingeria p. platyura	2	1	1	1	1	1	0	0	0	0	1	1	0	0	0	1	1	0	0	0	1	2	1	?
Fitzingeria p. depressa	2	1	1	1	1	1	0	0	0	0	1	1	0	0	0	1	1	0	0	0	1	2	1	?
Helodrilus oculatus	0	0	2	1	1	1	0	0	0	0	0	?	0	0	1	0	0	0	?	?	1	0	1	?
Lumbricus terrestris	0	1	2	1	2	1	0	0	0	0	0	1	0	0	1	0	1	0	2	0	1	2	1	0
Murchieona minuscula	0	0	2	1	1	1	0	0	0	0	0	1	0	0	1	0	1	0	2	0	1	1	1	0
Octodriloides karawankensis	2	0	2	1	1	1	0	0	0	0	1	1	0	0	1	0	1	0	2	0	1	2	0	1
Octodrilus transpadanus	2	0	2	1	1	1	0	0	0	0	0	1	0	0	1	0	1	0	2	0	1	2	0	1
Octolasion lacteum	1	0	2	1	1	1	0	0	0	0	0	1	0	0	1	0	1	0	2	0	1	2	1	1
Proctodrilus antipai	0	0	2	1	1	1	0	0	0	0	0	?	0	0	1	0	0	1	?	?	1	0	1	?
Satchellius mammalis	2	1	2	1	1	1	0	0	0	0	0	1	0	0	1	0	1	0	0	0	1	2	1	?
Scherotheca dugesi	0	0	2	1	1	0	0	0	0	0	0	1	0	0	1	0	1	0	2	0	1	1	1	0
Scherotheca savginyi	0	0	2	1	1	0	0	0	0	0	0	1	0	0	1	0	1	0	2	0	1	2	1	0
Perelia arnoldiana	0	0	2	1	1	1	0	0	0	0	0	1	0	0	1	0	1	0	1	1	1	0	1	0

5. KEY TO THE EARTHWORM SPECIES OF HUNGARY

1. Setae closely paired **2**
   Setae widely paired or distant **29**

2. Pigment brown, clitellum circular (but ventrally less developed), the tail end tetrahedral. The muscular gizzard occupies only one segment. [***Eiseniella*** MICHAELSEN, 1900] **3**
   Clitellum saddle-shaped, muscular gizzard occupies at least two segments **4**

3. Male pore on 13 . . . .***Eiseniella tetraedra tetraedra*** (SAVIGNY, 1826)
   Male pore on 14 . . . .***Eiseniella tetraedra intermedia*** (ČERNOSVITOV, 1934)
   Male pore on 15 . . . .***Eiseniella tetraedra hercynia*** (MICHAELSEN, 1890)

4. Pigment red-violet, head tanylobic **5**
   Pigment red-violet, brown, green or lacking, head epilobic **9**

5. Tubercula pubertatis and spermhecae present. [***Lumbricus*** LINNAEUS, 1758] . . . **6**
   Tubercula pubertatis and spetmathecae lacking . . . .***Allolobophoridella eiseni*** (LEVINSEN, 1884)

6. Body large 10–40 cm, clitellum begins behind segment 30 . . . . **7**
   Body small or medium-sized, clitellum begins on or around segment 27 . . . . **8**

7. Clitellum on 37, 38, 39–43, 44, 45, 47, tubercles on 38, 39, 40–43, 44, 45 . . . .***Lumbricus polyphemus*** (FITZINGER, 1833)
   Clitellum on 32–37, tubercles on 33–36 . .***Lumbricus terrestris*** LINNEAUS, 1758

8. Clitellum on 26, 27–32, tubercles on 28–31 .***Lumbricus rubellus*** HOFFMEISTER, 1843
   Clitellum on 28–33, tubercles on 29–32 . . .***Lumbricus castaneus*** (SAVIGNY, 1826)
   Clitellum on 28–32, tubercles on 29–31 . . ***Lumbricus baicalensis*** MICHAELSEN, 1900

9. Male pore obvious, opens on segment 15 . . . . **10**
   Male pore hardly visible, shifted backwards toward the clitellum. Spermathecae from 13/14 backwards . . .***Cernosvitovia*** (***Zicsiona***) ***opisthocystis***? (ROSA, 1895)

10. Nephridial bladders simple, sausage-shaped, pigment usually red-violet . . . . . . [***Eisenia*** MALM, 1877] **11**
    Pigment brown, green or lacking, never intensive red-violet, nephridial bladders curved **13**
    Nephridial bladders lacking **26**

11. Tail end quadrangular, clitellum on 24, 25–30 . .***Eisenia balatonica*** (POP, 1943)
    Tail end circular, clitellum ends on or after segment 32 . . . . **12**

12. Clitellum on 25, 26, 27–32, 33, spermathecae open in the mid-dorsal line . . . .***Eisenia fetida*** (SAVIGNY, 1826)
    Clitellum on 25, 26, 27–33, 34, spermathecae open just above setal line *d*. Colour dark red with dorsal stripes. Upon irritation the living worms produce yellowish bioluminescent fluid. . . . .***Eisenia lucens*** (WAGA, 1857)
    Clitellum on 25, 26, 27–33, 34, spermathecae open between *d* and the mid-dorsal line. Slightly coloured, without bioluminescence .***Eisenia spelaea*** (ROSA, 1901)

13. Nephridial bladders with forward oriented ental part (at least in the first few segments). [***Allolobophora*** EISEN, 1873] **14**
Nephridial bladders with caudad-bent ental part. [***Aporrectodea*** ÖRLEY, 1885] **19**

14. Nephridial bladders after the clitellum bilobous, clitellum on 29, 30–57, 58, 60, 63. Long (up to 500 mm), dark brown species. . . . . ***Allolobophora*** (s.l.) ***hrabei*** (ČERNOSVITOV, 1935)
Nephridial bladders U or J shaped **15**

15. Ectal part of the nephridial bladders subdivided possessing a saccular dilatation before the nephridiopore **16**
Nephridial bladders entire, not subdivided **17**

16. Clitellum on 26–34, tubercles on 30, 32, two pairs of scale-like protuberances . . . . ***Allolobophora*** (s.l.) ***leoni*** MICHAELSEN, 1891
Clitellum on 25, 26–33, 34, tubercles band like on 29, 30–32, 33. . . . . ***Allolobophora*** (s.l.) ***nematogena*** ROSA, 1903

17. Tubercles sucker like, nephridial bladders U-shaped. Colour frequently green or greenish-brown. . . . . . ***Allolopbophora chlorotica chlorotica*** (SAVIGNY, 1826)
Tubercles band-like **18**

18. Nephridial bladders at the loop coalescent resembling a fishing-hook, clitellum on 28, 29, (30)–37, 38, 39, tubercles on 1/2 29, 29–37, 38, 39 . . . . ***Allolobophora*** (s.l.) ***dacica*** (POP, 1938)
Nephridial bladders J-shaped, clitellum on 35, 36–47, 48, tubercles on 42–47, ... ***Allolobophora*** (s.l.) ***mehadiensis mehadiensis*** ROSA, 1895
Nephridial bladders J-shaped, clitellum on segments 29, 30–40, 41, tubercles on 35–40, 41 . . . . ***Allolobophora*** (s.l.) ***gestroides***, ZICSI, 1970

19. Clitellum ends behind segment 40 . . ***Aporrectodea*** (s.l.) ***dubiosa*** (ÖRLEY, 1881)
Clitellum ends before segment 36 . . . . **20**

20. Tubercles sucker-like, two pairs on 31, 33 . . ***Aporrectodea georgii*** (MICHAELSEN, 1890)
Tubercles band- or scale-shaped **21**

21. Colour slightly red-violet at least dorsally on the anterior part of the body **22**
Colour brown, brownish-grey or pigmentation lacking **23**

22. Tubercles on 27–29, with knobs on 27, 29, clitellum on 24, 25–30, 31 . . . . ***Aporrectodea sineporis*** (OMODEO, 1952)
Tubercles on ½ 28, 28–½ 32, 32, clitellum on 26, 27–32, 33. . . . . ***Aporrectodea handlirschi*** (ROSA, 1897)

23. Colour usually brown or brownish at least dorsally on the anterior part of the body . . . **24**
Pigmentation lacking, colour white or pinkish **25**

24. Clitellum on 26, 27, 28–33, 34, tubercles on 31–33 . . . . ***Aporrectodea caliginosa*** (SAVIGNY, 1826)
Clitellum on 27, 28–35, tubercles on 32–34 . . . ***Aporrectodea longa*** (UDE, 1885)

25. Clitellum on 24, 25–32, 33, tubercles on 29–1/n 31, 31 . . . . ***Aporrectodea rosea*** (SAVIGNY, 1826)
Clitellum on 29–35, tubercles on 32–34 . . ***Aporrectodea jassyensis*** (MICHAELSEN, 1891)

26. Nephridial bladders lacking, nephridia discharge separately into the exterior in each segment. [***Helodrilus*** HOFFMEISTER, 1845] **27**
Nephridial bladders lacking, nephridia discharge into the intestine via a longitudinal collecting canal (enteronephric). [***Proctodrilus*** ZICSI, 1985] **28**

27. Clitellum on 21, 22–28, 29, tubercles on 26–28 . . . . ***Helodrilus cernosvitovianus*** (ZICSI, 1967)
Clitellum on 26–33. Scale-like tubercles on 30, 31 . . ***Helodrilus deficiens*** ZICSI, 1985
Clitellum on 25–35, tubercles on 31–½ 34 . . ***Helodrilus mozsaryorum*** (ZICSI, 1974)

28. Clitellum on 25 (26)–33. Scale-like tubercles segmental on 30, 31 . . . . ***Proctodrilus antipai*** (MICHAELSEN, 1891)
Clitellum on segments 25 (26)–33. Two pairs of scale-like tubercles intersegmental in 30/31 and 31/32 . . . . ***Proctodrilus tuberculatus*** (ČERNOSVITOV, 1935)
Clitellum on segments 25–33. Tubercula pubertatis band-like, strongly protuberant on segment 30–31 . . . . ***Proctodrilus opisthoductus*** ZICSI, 1985

29. Pigment red, nephridial bladders U shaped. [***Dendrodrilus*** OMODEO, 1956] **30**
Nephridial bladders sausage-, biscuit-, ocarina-shaped or bilobate but not U-shaped . . **31**

30. Clitellum on 26–31, tubercles on 29–31, sometimes hardly seen or lacking . . . . ***Dendrodrilus rubidus rubidus*** (SAVIGNY, 1826)
Clitellum on 26–31, well-developed tubercles on 28–30 . . . . ***Dendrodrilus rubidus subrubicundus*** (EISEN, 1873)

31. Nephridial bladders biscuit- or sausage-shaped **32**
Nephridial bladders bilobate or ocarina-shaped **37**

32. Male pore on segment 15. [***Dendrobaena*** EISEN, 1873] **33**
Male pore shifted back, behind segment 15. [***Fitzingeria*** ZICSI, 1978] **39**

33. Spermathecae open close to the mid-dorsal line **34**
Spermathecae open around setal line *d* **35**

34. Tubercles on 31–½ 32, calciferous lamellae in 11–13 . . . . ***Dendrobaena hortensis*** (MICHAELSEN, 1890)
Tubercles on 30–31, calciferous lamellae in ½ 10–11 ***Dendrobaena veneta*** (ROSA, 1886)

35. Tubercles interrupted, disc-shaped on 31, 32 . . . . ***Dendrobaena vejdovskyi*** (ČERNOSVITOV, 1935)
Tubercles band-shaped **36**

36. Clitellum on ½ 23, 24–29, tubercles on 25–27 ***Dendrobaena ganglbaueri*** (ROSA, 1894)
Clitellum on 27, 28–33, tubercles on 30–32 . . ***Dendrobaena clujensis*** (POP, 1938)
Clitellum on 28, 29–33, tubercles on 31–33 ***Dendrobaena octaedra*** (SAVIGNY, 1826)

37. Nephridial bladders bilobate **38**
Nephridial bladders ocarina-shaped **41**

38. Clitellum on 33–37, tubercles and receptacles lacking . . . . ***Dendrobaena cognettii*** (MICHAELSEN, 1903)
Clitellum on 24–34, tubercles on 31–33 . . . ***Dendrobaena auriculata*** (ROSA, 1897)

39. Colour red-violet, spermathecae two pairs . . . . ***Fitzingeria platyura platyura*** (FITZINGER, 1833)
    Colour brownish, spermathecae more than two pairs **40**

40. Three pairs of vesicles in 9, 11, 12 . . . . . . ***Fitzingeria platyura depressa*** (ROSA, 1893)
    Two pairs of vesicles in 11, 12 . . ***Fitzingeria platyura montana*** (ČERNOSVITOV, 1932)

41. Spermathecae two pairs in 9/10, 10/11. [***Octolasion*** (ÖRLEY, 1885)] **42**
    Spermathecae 5–9 pairs **45**

42. Clitellum begins on 29 . . . . **43**
    Clitellum begins on 30 or farther back **44**

43. Clitellum on 29–34, tubercles on 30–33 . . . . . . ***Octolasion cyaneum*** (SAVIGNY, 1826)
    Clitellum on 29–35, tubercles on ½ 29–½ 35 . . ***Octolasion lacteovicinum*** ZICSI, 1968

44. Clitellum on 30–35 . . . . ***Octolasion lacteum*** (ÖRLEY, 1881)
    Clitellum on 32–36 . . . . ***Octolasion montanum*** (WESSELY, 1905)

45. Male pore on 15. [***Octodrilus*** OMODEO, 1956] **46**
    Male pore shifted back toward the clitellum . ***Octodriloides karawankensis*** (ZICSI, 1969)

46. Metandric, vesicles in 10, 12 . . . . **47**
    Holoandric, vesicles in 9, 11, 12 or in 9–12 . . . . **48**

47. Clitellum and tubercles on 29–36 . . . . . . ***Octodrilus pseudolissaensioides*** ZICSI, 1994
    Clitellum and tubercles on 30–37 . . . . . ***Octodrilus pseudotranspadanus*** (ZICSI, 1971)

48. Receptacles 6 pairs **49**
    Receptacles 5 pairs **50**

49. Tubercles on 29–37, vesicles in 9, 11, 12 . . . . . ***Octodrilus lissaensioides*** (ZICSI, 1971)
    Tubercles on 29–37, vesicles in 9–12 . . . . . ***Octodrilus compromissus*** ZICSI & POP, 1984

50. Clitellum and tubercles on 30–37 . . . . . . ***Octodrilus transpadanus*** (ROSA, 1884)
    Clitellum and tubercles on 30–38 . . . . ***Octodrilus gradinescui*** (POP, 1938)

6. DESCRIPTION OF SPECIES

Genus *Allolobophora* Eisen, 1873

Enterion (part.) Savigny, 1826 Mem Ac. Fr., 5: 179.
Allolobophora (part.) Eisen, 1873 Öfv. Akad. Förh., 30(8): 46.
Allolobophora (part.): Örley 1881a Math. és term. tud. közlemények, 16: 593.
Allolobophora (part.): Örley 1885 Értek. term. tud. köréből, 15(18): 23.
Aporrectodea (part.): Örley 1885 Értek. term. tud. köréből, 15(18): 22.
Allolobophora (part.): Rosa 1893a Mem. Acc. Torino, 43: 424.
Helodrilus (*Allolobophora*) (part.): Michaelsen 1900a Das Tierreich, 10: 479.
Allolobophora (part.): Pop 1941 Zool. Jb. Syst., 74: 518.
Allolobophora (part.): Pop 1949 Anal. Acad. R.P.R., 1(9): 432.
Allolobophora (part.): Omodeo 1956 Arch. zool. Ital., 41: 180.
Allolobophora (part.): Bouché 1972 Inst. Nat. Rech. Agron., p. 417.
Allolobophora (part.): Perel 1976b Zool. Zh., 55: 833.
Allolobophora (part.): Perel 1979 Range and regularities in the distr. earthworms, p. 186.
Allolobophora (part.): Zicsi 1982a Acta Zool. Hung., 28: 444–445.
Allolobophora (part.): Easton 1983 Earthworm Ecology, p. 475–476.
Allolobophora: Mršić & Šapkarev 1988 Acta Mus. Mac. Sci. Nat., 19: 21.
Allolobophora: Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 209.
Allolobophora (part.): Perel 1997 Earthworms of Russia, p. 56.
Allolobophora (Allolobophora): Qiu & Bouché 1998b Doc. pedozool. integrol., 3: 199.

Type species: *Enterion chloroticum* Savigny, 1826 by subsequent designation (Omodeo 1956)

Diagnosis – *External* – Setae closely paired, pigmentation usually lacking, sometimes with greyish or greenish colour. Prostomium epilobous, first dorsal pore around 5/6. Male pore on 15, great, with glandular crescent intruding into the neighbouring segments. Spermathecae open in setal line *c*, nephridial pores irregularly alternate between *b* and above *cd*. *Internal* – Two pairs of testes free in 10, 11, and four (rarely three) pairs of seminal vesicles in 9–12 (9, 11, 12). Receptacula seminis two or three (rarely four) pairs situated from 10/11 ahead. Calciferous glands with diverticula in 10. Excretory system holonephridial, nephridial bladders U- or J-shaped with forward oriented ental part. The cross-section of longitudinal muscle layer is of fasciculated (or intermediary) type.

Remarks. After the revision of Pop (1941) the genus *Allolobophora* became a catch-all genus. Several attempts have been made to recognize monophyletic groups and to separate them into independent genera (Omodeo 1956, Bouché 1972, Perel 1976a, Mršić & Šapkarev 1988, Qiu & Bouché 1998b) but a phylogenetically well-grounded solution is still missing. Unfortunately Eisen (1873) describing the genus *Allolobophora* has not selected a type species. Subsequently Omodeo (1956) designated *Allolobophora chlorotica* (Savigny, 1826) as type of the genus, resulting exclusion from *Allolobophora* the majority of the species that has previously been attributed to it (Gates 1975).

The present work does not permit us to carry out a detailed revision of this problematic group. In the case of species that have been transferred into a well-defined genus such as

Aporrectodea, *Helodrilus* etc. we accept this classification; in the case when the situation is more complicated we use the name *Allolobophora* (sensu lato).

Table 6.1. Distinguishing characters of the *Allolobophora* species in Hungary.

Species	**Clitellum**	**Tubercles**	**Vesicles**	**Spermathecae**	**Nephridial bladders**	**Musculature**
A. chlorotica	29–37	31, 33, 35	9–12	8/9–10/11 *d*	U, forward	fasciculated
A.* (s.l.) *dacica	28, 29–37, 38, 39	29–37, 38 39	11, 12	9/10–13/14 *cd*	hook, forward	fasciculated
A.* (s.l.) *gestroides	29, 30–40, 41	35–40, 41	11, 12	9/10–11/12 *cd*	J, forward	fasciculated
A.* (s.l.) *hrabei	29, 30–57, 58, 60	49–53, 54	11, 12	9/10, 10/11 *cd*	bilobate	pinnate
A.* (s.l.) *leoni	25, 26–34	30, 32	11, 12	9/10, 10/11 *cd*	J, forward + loop	fasciculated
A.* (s.l.) *mehadiensis	35, 36–47, 48	42–47	9–12	9/10, 10/11 *cd*	J, forward	fasciculated
A.* (s.l.) *nematogena	25, 26–33, 34	29, 30–32, 33	11, 12	9/10, 10/11 *cd*	J, forward + loop	fasciculated

6.1 *Allolobophora chlorotica chlorotica* (Savigny, 1826)

(Figs. 3.8a, 6.1.1–2.)

Enterion chloroticum Savigny, 1826 Mem. Acad. Sci. Inst. Fr., 5: 182.
Enterion virescens Savigny, 1826 Mem. Acad. Sci. Inst. Fr., 5: 182.
Lumbricus anatomicus Dugés, 1828 Ann. Nat. Sci., 15: 289.
Lumbricus riparius Hoffmeister, 1843 Arch. Naturg., 9(1): 189.
Lumbricus communis v. *luteus* Hoffmeister, 1845 Regenwürmer p. 29.
Lumbricus viridis Johnston, 1865 Cat. Brit. Non-paras, Worms, p. 60.
Lumbricus riparius pallescens Eisen, 1871 Öfv. Akad. Förh., 27: 966.
Lumbricus riparius rufescens Eisen, 1871 Öfv. Akad. Förh., 27: 966.
***Allolobophora riparia*: Örley 1881a Math. és term. tud. közlemények, 16: 591.**
Allolobophora neglecta Rosa, 1882 Atti. Acad. Torino, 18: 170.
***Aporrectodea chlorotica*: Örley 1885 Értek. Term. Tud. Köréből, 15(18): 22.**
Allolobophora cambrica Friend, 1892a Essex. Nat., 6: 31.
Allolobophora chlorotica curiosa Ribaucourt, 1896 Rev. suisse. Zool., 4: 46.
Allolobophora chlorotica morgensis Ribaucourt, 1896 Rev. suisse. Zool., 4: 46.
Allolobophora nusbaumi Ribaucourt, 1896 Rev. suisse. Zool., 4: 83.
Helodrilus (Allolobophora) chloroticus: Michaelsen 1900a Das Tierreich, 10: 486.
Octolasium hortensis Bretscher, 1901 Rev. suisse Zool., 9: 221.
***Helodrilus (Allolobophora) chloroticus*: Szüts 1909 Állattani Közlemények, 8: 136.**
***Allolobophora chlorotica*: Pop 1943 Ann. Hist.-Nat. Mus. Hung., 36: 13.**
Allolobophora (Allolobophora) chlorotica: Omodeo 1956 Arch. Zool. Ital., 41: 181.
***Allolobophora chlorotica*: Zicsi 1968a Opusc. Zool. Budapest, 8: 158.**
Allolobophora vardarensis Šapkarev, 1971 Fragm. Balc. Skopje, 8(18): 157. **syn. nov**.
Allolobophora (s. str.) *chlorotica*: Bouché 1972 Inst. Nat. Rech. Agron., p. 263.
Allolobophora chlorotica kosovensis Šapkarev, 1975 Ann. Fac. Sci. Univ. Skopje, 27–28: 43.
Allolobophora (*Allolobophora*) *chlorotica*: Perel 1979 Range and regularities in the distr. earthworms, p. 186.
Allolobophora chlorotica: Zicsi 1982a Acta Zool. Hung., 28: 444.
Allolobophora chlorotica: Easton 1983 Earthworm Ecology p. 475.
***Allolobophora chlorotica*: Zicsi 1991 Opusc. Zool. Budapest, 24: 187.**
Allolobophora chlorotica: Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 211.
Allolobophora chlorotica kosovensis: Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 214. **syn. nov.**
Allolobophora vardarensis: Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 216.
Allolobophora chlorotica chlorotica + *A. chlorotica anatomica*: Qiu & Bouché 1998a Doc. pedozool. integrol., 4: 190. **syn. nov.**

Description – *External* – Body length 30–70 mm, diameter 2–4 mm, 60–140 segments. Colour greenish, sometimes brown or yellow. Head epilobous, first dorsal pore 4/5. Glandular tumescence usually on 10 *cd.* Setae closely paired, setal arrangement after the clitellum: aa:ab:bc:cd:dd = 12.5:1.25:8.5:1:25 Clitellum extends on segments 29(30)–37 saddle-shaped. Tubercula pubertatis sucker-shaped discs on 31, 33, 35 (fig. 3.8a) but variable extra numbers not uncommon. Male pore on 15, great, with large glandular papillae protruding into the neighbouring segments. Nephropores irregularly alternating. *Internal* – Dissepiments 6/7–13/14 slightly thickened. Crop in 15–16, gizzards in 17–18. Two pairs of testes free in 10, 11, and four pairs of seminal vesicles in 9–12. Spermathecae three pairs in 8/9, 9/10, 10/11 open in the setal line *cd*. Calciferous glands in 10–12 with lateral pouches in 10. Last pair of hearts in 11 and a pair of extraoesophageal vessel in 12. Excretory system holonephridial. Nephridial bladders U-shaped, with ahead oriented ental part. The cross-section of longitudinal muscles is of fasciculated type (fig. 6.1.1).

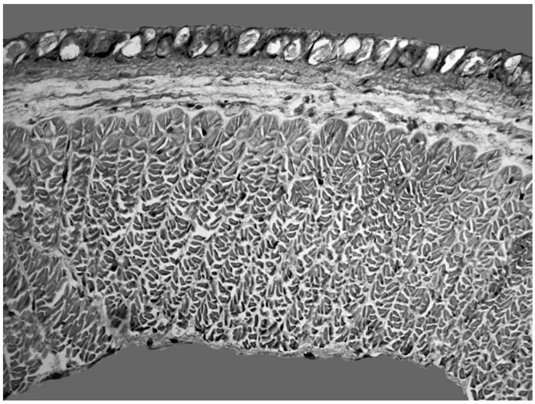

Fig. 6.1.1. Longitudinal musculature of *Allolobophora chlorotica*.

Remarks – The variation in the number of suckers could be observed even within one population. This sometimes appears also on the different side of a species. There are specimens with normal (31,33,35) arrangement of tubercles on one side, and with a continuous row of suckers on the other side (31,32,33,34,35). This high variability query the validity of the subspecies *Allolobophora chlorotica kosovensis* ŠAPKAREV, 1977 that is regarded here as a synonym of the nominal species. The other two subspecies, *A. chlorotica waldensis* RIBAUCOURT, 1896 and *A. chlorotica postepheba* BOUCHÉ, 1972 should be regarded as valid, because in the first case there are differences in the position of the clitellum (30–36) and in the number of spermathecae (7/8, 8/9, 9/10, 10/11), and in the second, the extension of the clitellum is greater (30–38) and the position of the suckers are different (32,34,36).

Ecology – *A. chlorotica* is a typical synanthropic species. It could be found in pastures, gardens and forests as well. It has almost no preferences for soil type, but usually they are more abundant in moist, highly organic soils. According to the ecological characterization *A. chlorotica* belongs to the endogeic group, living and feeding in the mineral soil layer. Defecation takes place also in the soil.

Distribution – *A. chlorotica* is native in the Palearctis but widely introduced extratropically by man. Its present range covers Europe, North America, South America, Africa, and New Zealand.

Distribution in Hungary (fig. 6.1.2.) – **BS79** *No.* 11396 Balatonszéplak; *No.* 737 Siófok; **BT80** *No.* 745, 11373, 11409 Balatonaliga; *No.* 11403 Balatonvilágos; **BT81** *No.* 11249 Balatonkenese; **BT89** *No.* 1114 Komárom; **CR49** *No.* 5013, 5016 Gara; **CS48** *No.* 626, 652, 799 Dunaföldvár; **CT03** *No.* 2885 Székesfehérvár; **CT09** *No.* 1172 Süttő; **CT19** *No.* 1099, 1165 Lábatlan; *No.* 1095, 1164 Nyergesújfalu; **CT23** *No.* 4559 Velence; **CT32** *No.* 1552 Adony; **CT36** *No.* 4434 Páty; **CT37** *No.* 4402 Perbál; *No.* 10035 Piliscsaba; **CT43** *No.* 552 Ercsi; **CT45** *No.* 2938, 10204 Budaörs; *No.* 3257, 7319 Törökbálint; *No.* 7372 Érd; **CT47** *No.* 4426 Budapest Botanical Garden; *No.* 7062 Budapest, Juliannamajor; **CT48** *No.* 9999 Pilis Mts. Apátkuti-völgy; *No.* 10410 Pilis Mts. Szentlászló-völgy; **CT49** *No.* 1078, 1143 Dömös; *No.* 10028 Lepence-patak; *No.* 1149 Pilismarót; *No.* 1071, 1074, 1134 1140 Visegrád; *No.* 1321 Zebegény; **CT56** *No.* 4163 Farkas-völgy; *No.* 1759 Margitsziget; **CT57** *No.* 1540 Budakalász; *No.* 702 Pomáz; **CT58** *No.* 7188, 7272 Pilis Mts. Lajosforrás; *No.* 1376, 1470, 1494,11749, 1474 Szentendre; **CT59** *No.* 1534 Dunabogdány; **CT64** *No.* 11778 Ócsa; **CT75** *No.* 4956 Maglód; **CT77** *No.* 5557 Gödöllő; **CT79** *No.* 3204, 3213, 3219, 3224, 3270 Csővár; **CT87** *No.* 2803, 3057, 3077, 7205 Bag Petőfi-forrás; **CU50** *No.* 11769 Szendehely; **CU61** *No.* 5243 Rétság.; **CU71** *No.* 8989 Kétbodony; **CU72** *No.* 5278 Ipolyszög; **DS32** *No.* 1776 Szeged; **DS37** *No.* 5198 Csongrád; **DS69** *No.* 5067 Szarvas; **DT08** *No.* 7222 Hatvan; **DT19** *No.* 4796 Mátrafüred; **DT42** *No.* 5223 Tiszapüspöki; **DT49** *No.* 5567, 4451, 10212, 10213 environ of Kápolna; **DT52** *No.* 5209 Törökszentmiklós; **DU00** *No.* 4217 Mátrakeresztes; **DU03** *No.* 5253 Karancslapujtő; **DU32** *No.* 2891 Tarnalelesz; **DU33** *No.* 6939 Ivád; **DU50** *No.* 5181 Eger; **DU51** *No.* 9223 Felsőtárkány; *No.* 4662 Bükk Mts. Szarvaskő; *No.* 8560 Bükk Mts. Teréz-forrás; **DU52** *No.* 9875 Bükk Mts. Határhordó; *No.* 9913 Bükk Mts. Hármaskút; *No.* 788, 4668 Szilvásvárad; **DU55** *No.* 4498 Kelemér; **DU61** *No.* 5671, 5675, 5681 Cserépfalu; **DU62** *No.* 2232, 2975 Bükk Mts. Garadna-völgy; *No.* 2217 Bükk Mts. Teknős-völgy; **DU66** *No.* 525, 529, 672, 1577, 3943, 4421, 4455, 4458, 500 Aggtelek; **DU67** *No.* 3278, 3298, 3303, 3314, 4680, 5542, 7212 Jósvafő; **DU72** *No.* 2172, 2180, 2186, 2191 Bükk Mts. Garadna-völgy; **DU85** *No.* 517 Szendrőlád; **ES27** *No.* 5062 Sarkad; **ET23** *No.* 9057, 9013 Sáp; **ET38** *No.* 5376 Hajdúböszörmény; **ET51** *No.* 5393 Ártánd; **EU46** *No.* 3099 Sátoraljaújhely; **WM99** *No.* 4711 Szakonyfalu; **XM25** *No.* 9141 Dobri; **XM42** *No.* 5428 Őrtilos; **XM48** *No.* 4693 Zalaegerszeg; **XM78** *No.* 1192, 1430 Gyenesdiás; *No.* 753, 1410, 1774, 1775, 2096 Keszthely; *No.* 1385, 1421 Balaton, Szent Mihály kápolna; **XM87** *No.* 12381 Balatonfenyves; *No.* 10073 Balatonmária-fürdő; **XM88** *No.* 4526, 4535, 4542 Badacsonytördemic; *No.* 11261, 14346 Szigliget; **XN18** *No.* 5707 Brennbergbánya; **XN25** *No.* 11427 Zsira; **XN28** *No.* 13114 Fertőrákos; **XN36** *No.* 861, 881, 886, 1203, 1327, 1329, 1346, 1352, 11850 Sopronhorpács; **XN45** *No.* 13057, 13073 Csáfordjánosfa; **XN79** *No.* 13084 Lébény; **XN80** *No.* 10194 Felsőnyirád; **XN99** *No.* 1314 Medve; **YL28** *No.* 4738 Csányoszró; **YL38** *No.* 4748 Vajszló; **YM08** *No.* 664, 716, 1955 Balatonboglár; **YM09** *No.* 14331 Balatonszepezd; **YM19** *No.* 747, 2884 Tihany; **YM29** *No.* 12391 Balatonendréd; **YN10** *No.* 14370, 14340 Koloska-patak; **YN14** *No.* 3379 Bakony; **YN19** *No.* 1124 Gönyű; **YN26** *No.* 5504 Bakonyszombathely.

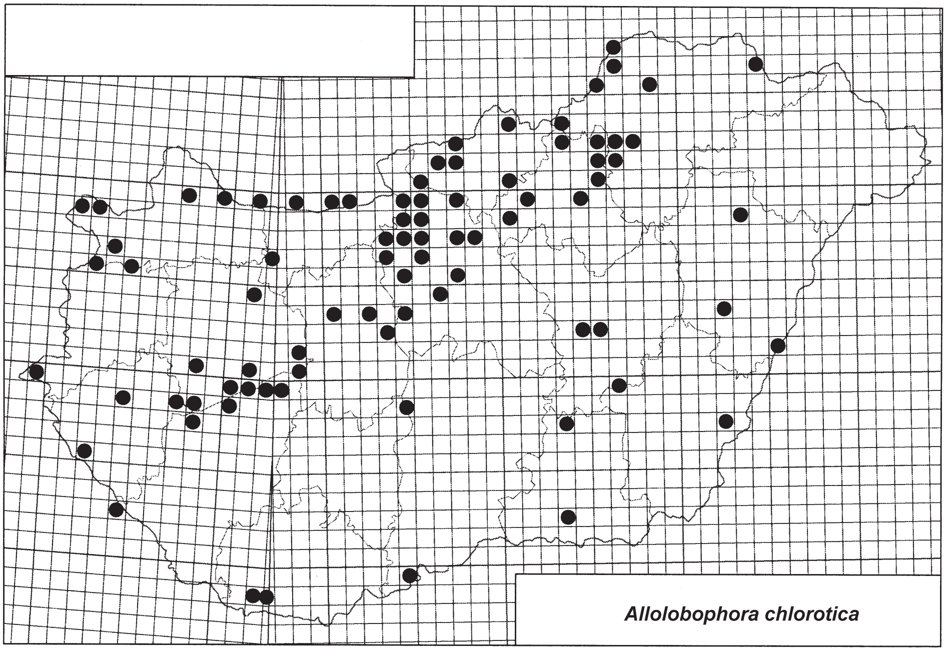

Fig. 6.1.2. Distribution of *Allolobophora chlorotica* in Hungary.

6.2 *Allolobophora* (s. l.) *dacica* (Pop, 1938)

(Figs. 3.15Bh, 6.2.1–4.)

Eophila dacica Pop, 1938 Bul. Soc. Sti. Cluj, 9: 142.
Allolobophora dugesi var. *dacica*: Pop 1949 Anal. Acad. R.P.R., (1)9: 440.
***Allolobophora dugesi* v. *dacia* (laps.): Zicsi 1959 Acta zool. hung., 5: 438.**
***Allolobophora dugesi* v. *dacica*: Zicsi 1968a Opusc. Zool. Budapest, 8: 158.**
Allolobophora sturanyi (Rosa, 1895) (part.): Perel 1979 Range and regularities in the distr. earthworms, p 188.
Allolobophora dacica: Zicsi 1982a Acta zool. hung., 28: 445.
Allolobophora dacica: Easton 1983 Earthworm Ecology, p. 475.
Scherotheca (*Scherotheca*) *dacica*: Omodeo 1988 Boll. Zool., 55: 81.
Karpatodinariona dacica: Mršić & Šapkarev 1988 Acta Mus. Mac. Sci. Nat., 19(1/154): 20.
Karpatodinariona dacica: Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 246.
***Allolobophora dacica*: Zicsi 1991 Opusc. Zool. Budapest, 24: 186.**
Karpatodinariona dacica: Qiu & Bouché 1998a Doc. pedozool. integrol., 4: 192.

Description – *External* – Body length 70–160 mm, diameter 4–7 mm, 165–200 segments. Colour pale, pigmentation lacking. Head epilobous, first dorsal pore between 8/9–9/10. Glandular tumescence usually on 11–14, 16, 17, 24–27, 30–38 *ab*. Setae closely paired, setal arrangement after the clitellum: aa:ab:bc:cd:dd = 29.3:1.3:17.5:1:53.3. Clitellum extends on segments 28, 29, (30)–37, 38, 39 saddle-shaped. Tubercles on 1/2 29, 29–37, 38, 39 two bands alongside the edge of the clitellum. Male pore on 15, between setae *b–c*, surrounded by a glandular crescent, confined within its own segment. Nephropores irregularly alternate between setal line *b* and above *d*. *Internal* – Dissepiments 5/6–9/10 thickened. Crop in 15–16, gizzards in 17–18. Two pairs of testes free in 10, 11, and two pairs of seminal vesicles in 11, 12. Receptacula seminis five pairs in 9/10–13/14 open in setal line *cd*. Calciferous glands in 10–13 with lateral pouches in 10. Last pair of hearts in 11 and a pair of extraoesophageals in 12. Excretory system holonephridial with ahead oriented fishing-hook shaped nephridial bladders (fig. 3.15B). Typhlosole trifid, the cross-section of longitudinal muscle layer is of fasciculated type (fig. 6.2.1, 6.2.2).

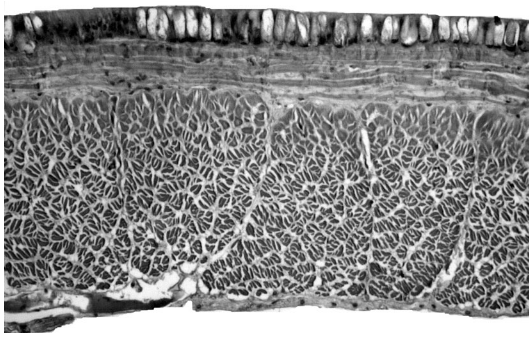

Fig. 6.2.1. Longitudinal musculature of *Allolobophora* (s. l.) *dacica.*

Fig. 6.2.2. Typhlosole of *Allolobophora* (s. l.) *dacica*.

Remarks – Perel (1979) united this species with *A. sturanyi* (Rosa, 1895) because of the overlapping position of the clitellar organs. Zicsi (1982a) and Mršić (1991) took the view that the differences in the number of spermatecae (2–3 vs. 5) justify its specific status.

Ecology – *A.* (s. l.) *dacica* according to the Bouché's ecological characterisation belongs to the endogeic group, living and feeding in the mineral soil layer. It casts mainly into the soil, but a smaller quantity (17%) is put onto the surface as well. The cast production is about 58.1 mg/day (dry mass) for an animal.

Distribution – *A.* (s. l.) *dacica* is a Dacian endemism, distributed in Hungary, Romania, Moldavia, Serbia, Bosnia and Croatia (fig. 6.2.3).

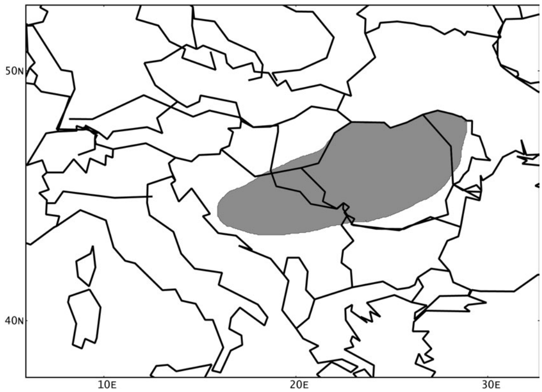

Fig. 6.2.3. Distribution of *Allolobophora* (s. l.) *dacica*.

Distribution in Hungary (fig. 6.2.4) – **DS73** *No.* 5035 Pitvaros; **DS82** *No.* 925, 934, 938, 954, 1014, 1181, 1184, 1195, 1220, 1230, 1240, 1244, 1249, 1272, 1286, 5635, 5642 Mezőhegyes; **DS83** *No.* 4788 Végegyháza; **ES02** *No.* 976, 1771 Battonya; **ES13** *No.* 10869 Dombegyháza.

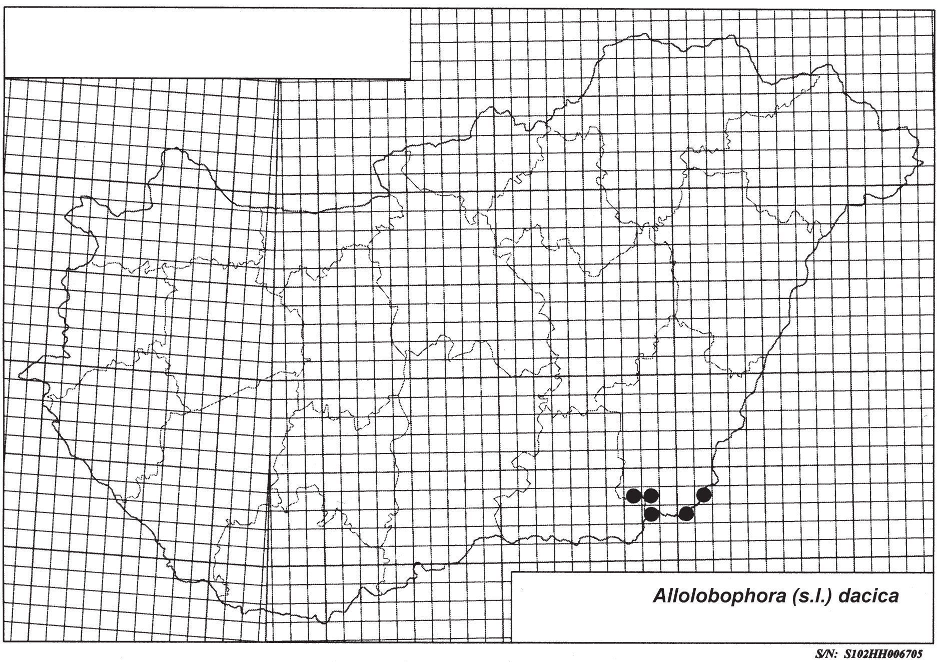

Fig. 6.2.4. Distribution of *Allolobophora* (s. l.) *dacica* in Hungary.

6.3 *Allolobophora* (s. l.) *gestroides* Zicsi, 1970

(Figs. 6.3.1–3.)

***Allolobophora dugesi* var. *gestroi:* Pop 1943a Ann. Hist.-Nat. Mus. Hung., 36: 13.**
***Allolobophora dugesi* v. *gestroi*: Zicsi 1968a Opusc. Zool. Budapest, 8: 158.**
***Allolobophora gestroides* Zicsi, 1970 Opusc. Zool. Budapest, 10: 365.**
Allolobophora gestroides: Zicsi 1982a Acta. zool. hung., 28: 445.
Allolobophora (s. l.) *gestroides* Easton 1983 Earthworm Ecology p. 476.
? *Alpodinaridella (?Alpodinaridella) gestroides*: Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 239.
***Allolobophora gestroides*: Zicsi 1991 Opusc. Zool. Budapest, 24: 186.**
Alpodinaridella (Alpodinaridella) gestroides: Qiu & Bouché 1998a Doc. pedozool. integrol., 4: 192.

Description – *External* – Body length 55–98 mm, diameter 4.3–5.2 mm, 163–201 segments. Colour usually white without any pigment. Head epilobous 1/3 closed, first dorsal pore in the intersegmental furrow 6/7, rarely in 5/6. Segments from 10 with secondary annulations. Glandular papillae usually on 13, 16–20, 29, 32, 33, 38, 39, 40 *ab*. Setae closely paired, setal arrangement after the clitellum: aa:ab:bc:cd: = 20:1.5:10:1:30. Clitellum extends on segments (29), 30–40, 41 saddle-shaped. Tubercles ventral on 35–40, 41. Male pore on 15, great slit between setae *b–c*, surrounded with an elevated glandular crescent, protruding into the neighbouring segments. Nephropores, because of the secondary annulations difficult to observe, but seem to be irregularly alternating. *Internal* – Dissepiments 5/6–9/10 strongly thickened. Crop in 15–16, gizzards in 17–19. Two pairs of testes enclosed in perioesophageal testis sacs in 10, 11. Two pairs of seminal vesicles in 11, 12. Spermathecae three pairs in 9/10, 10/11, 11/12 open in the setal line *cd*. Calciferous glands with lateral pouches in 10. Excretory system holonephridial. Nephridial bladders J-shaped with very short ental part. The orientation of the ental part of the nephridial bladders is not uniform; most of the limbs are forward oriented, but several dorsal or backward oriented limbs could also be observed. Typhlosole trifid, the cross-section of longitudinal muscle layer is of fasciculated type (fig. 6.3.1, 6.3.2).

Fig. 6.3.1. Longitudinal musculature of *Allolobophora* (s. l.) *gestroides.*

Fig. 6.3.2. Typhlosole of *Allolobophora* (s. l.) *gestroides*.

Remarks – Mršić (1991) placed *A. gestroides* into the genus *Alpodinaridella* on the condition, that the structure of nephridial bladders requires corroboration. A detailed investigation of this character, in a series of specimens from different parts of the country, revealed that *A. gestroides* possesses almost straight nephridial bladders with variably oriented very small ental limbs. As most of the limbs oriented ahead or dorsad, we place this species to *Allolobophora* (s.l.).

Ecology – This species occurs in shallow rendzina soils.

Distribution – This species is endemic in Hungary (fig. 6.3.3).

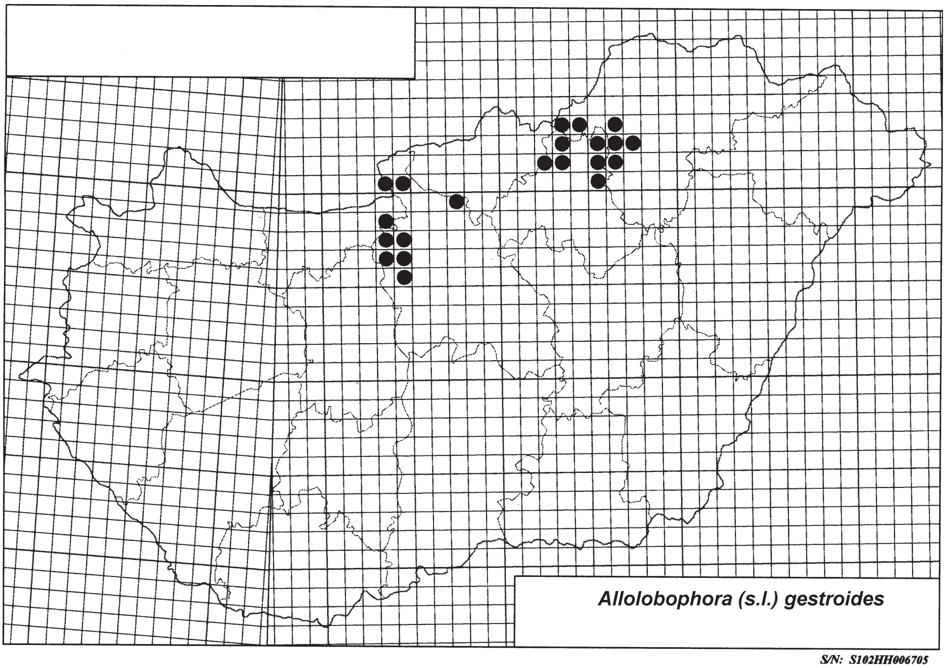

Fig. 6.3.3. Distribution of *Allolobophora* (s. l.) *gestroides*.

Distribution in Hungary – CT36 *No.* 3261 Budajenő; *No.* 4411 between Zsámbék and Budakeszi; **CT37** *No.* 1772, 4407 Perbál; **CT38** *No.* 10221 Pilis Mts. Fekete-hegy; *No.* 11520, 11721, 11737, 11739 Kesztölc; **CT45** *No.* 6447, 7375 Érd; **CT46** *No.* 3348 Buda Hills; **CT47** *No.* 7326 Juliannamajor; **CT79** *No.* 3229, 3234, 3241, 3251 Csővár; **CU30** *No.* 4007 Letkés; **CU40** *No.* 4589 Börzsöny Mts. Oltár-patak; **DU21** *No.* 7546, 7547, 7548, 7549, 7550 Nádújfalu; **DU31** *No.* 6933, 8113, 8262, Pétervására; **DU32** *No.* 5666 Szentdomonkos; **DU33** *No.* 6936, 6945, 6952, 8977, 10336 Ivád; **DU43** *No.* 7385, 9181 Borsodnádasd; **DU50** *No.* 5565 between Eger and Lillafüred; **DU51** *No.* 9211, 9212 Bükk Mts. Szarvaskő; *No.* 9224 Felsőtárkány, **DU52** *No.* 4599 Bükk Mts. Peskő; *No.* 5621, 10497 Bükk Mts. Bélkő; *No.* 10787 Leányka-völgy; **DU61** *No.* 5677, 5685, 7554, 7610 Cserépfalu; **DU62** *No.* 2220 Bükk Mts. Teknős-völgy; *No.* 4617 Bükk Mts. Belházi-víznyelő; *No.* 4645, 10331 Bükk Mts. Jávorkút; *No.* 7621 Répáshuta, Csúnya-völgy; **DU63** *No.* 3333, 4391, 4647 Bükk Mts. Örvénykő; **DU72** *No.* 7625 Bükkszentkereszt; *No.* 2170, 2171, 7228 Bükk Mts. Tógazdaság; *No.* 3363, 4166, 4810, 5178, 5566, 10873 Bükk Mts. Lillafüred.

6.4 *Allolobophora* (s. l.) *hrabei* (Černosvitov, 1935)

(Figs. 3.15E, 6.4.1–3.)

Eophila hrabei Černosvitov, 1935 Arch. Prirod. Cech., 19: 59.
Eophila hrabei: Omodeo 1956 Arch. Zool. Ital., 41: 186.
Allolobophora hrabei: Zajonc 1958 Acta Soc. Zool. Bohem., 22: 65.
Allolobophora hrabei: Zicsi 1964b Opusc. Zool. Budapest, 5: 120.
***Allolobophora hrabei*: Zicsi 1966a Ann. Univ. Sci. Budapest, 8: 397.**
***Allolobophora hrabei*: Zicsi 1968a Opusc. Zool. Budapest, 8: 168.**
Allolobophora hrabei: Zicsi 1982a Acta zool. hung., 28: 445.
Allolobophora (s. l.) *hrabei:* Easton 1983 Earthworm Ecology, p. 476.
Eophila hrabei: Omodeo 1988 Boll. Zool., 55: 80.
***Allolobophora hrabei*: Zicsi 1991 Opusc. Zool. Budapest, 24: 169.**
Eophila (Eophila) hrabei: Qiu & Bouché 1998a Doc. pedozool. integrol., 4: 187.

Description – *External* – Body length 400–500 mm, diameter 4–6 mm, 500–600 segments. Colour dark grey at least dorsally, the tail end whitish. Head prolobous, first dorsal pore in 6/7. Glandular tumescence usually on 17, 18, 19, 40–43, 44, 45 *ab*. Setae closely paired, setal arrangement after the clitellum: aa:ab:bc:cd:dd = 29:2:14:1:40. Clitellum saddle-shaped extends on segments 29, 30–57, 58, 59, 60 (63, 65). Tubercles on 49–53, 54, two broken bands alongside the ventral edge of the clitellum. Male pore on 15 between setae *b–c*, surrounded by a glandular crescent, occupying the neighbouring segments as well. Nephropores in a straight line above setal line *b*. *Internal* – Dissepiments 5/6–10/11 strongly thickened, entwined with each other. Crop in 15–16, gizzards in 17–20. Two pairs of testes free in 10, 11, and two pairs of seminal vesicles in 11, 12. Receptacula seminis two pairs in 9/10–10/11 open in setal line *cd*. Calciferous glands with diverticula in 11. Last pair of hearts in 11 and a pair of small extraoesophageals in 12. Excretory system holonephridial, in the several first segment with backwards bent U-shaped nephridial bladders that become bilobate toward the tail end (fig. 3.15E). The cross-section of longitudinal muscle layer is of pinnate type (fig. 6.4.1).

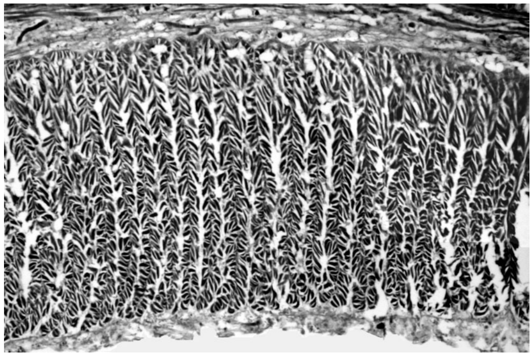

Fig. 6.4.1. Longitudinal musculature of *Allolobophora* (s. l.) *hrabei.*

Remarks – OMODEO (1988) classified this species to the genus *Eophila* but the differences in the nephridial bladders prevent us from accepting his proposition. MRŠIĆ (1991) failed to examine any specimen from this species therefore, he could not take a position in this question.

Ecology – *A. hrabei* prefers exclusively the shallow alluvial-borne para-chernozem soils. As this type of soil runs dry rapidly its activity is restricted to the vernal and autumnal period. In this time *A. hrabei* makes very characteristic cast heaps on the surface that could easily be recognized. The amount of cast deposited are quite significant, up to 930 g/m^2 in a season, but only 52.5 % of the excrements are put onto the surface (ZICSI 1964b, ZICSI 1974a).

Distribution – This is a highly restricted endemic species, occurring only in the border regions of Hungary, Austria and Slovakia (fig. 6.4.2).

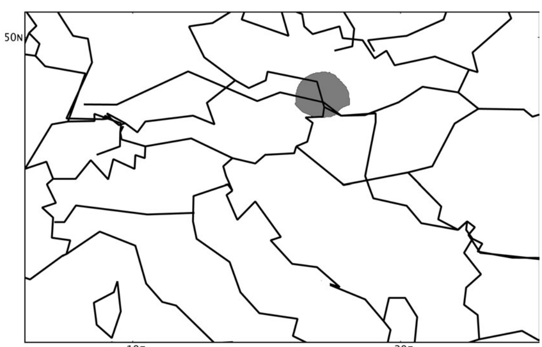

Fig. 6.4.2. Distribution of *Allolobophora* (s. l.) *hrabei*.

Distribution in Hungary (fig. 6.4.3) – **XP50** *No*. 6015 Várbalog; **XP60** *No*. 3975, 5597 Hegyeshalom; No. 3983 Mosonmagyaróvár; *No*. 5617 Levél; *No* 6011 Mosonszolnok; **XP61** *No* 6020 between Bezenye and Hegyeshalom; *No.* 9201, 9202, 9203, 9204 Bezenye.

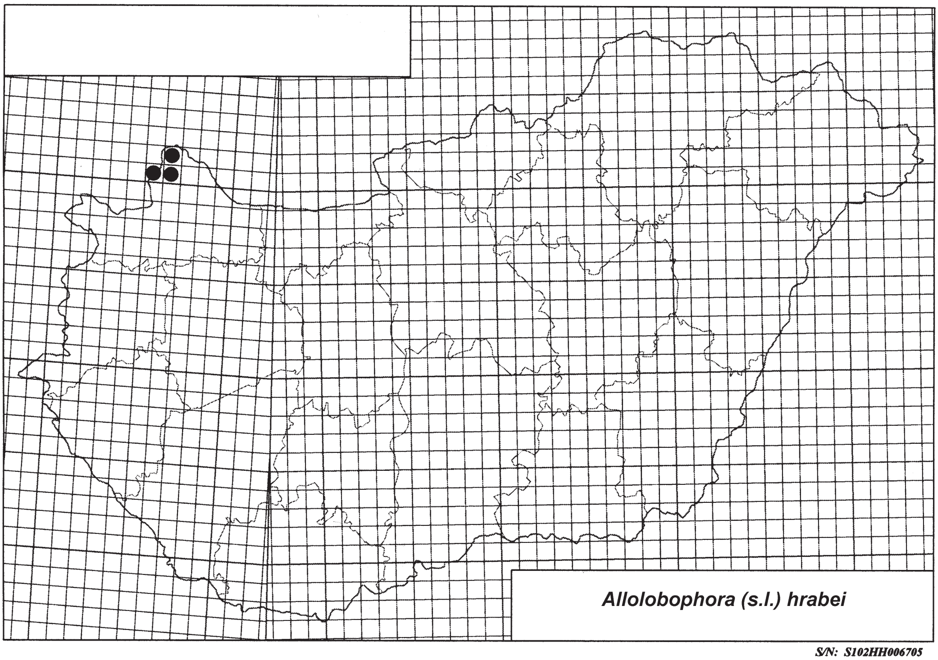

Fig. 6.4.3. Distribution of *Allolobophora* (s. l.) *hrabei* in Hungary.

6.5 *Allolobophora* (s. l.) *leoni* Michaelsen, 1891

(Figs. 3.8.b, 3.15C.a–b, 6.5.1–4.)

Allolobophora leoni Michaelsen, 1891 J. Hamb. Wiss., 8: 15.
Helodrilus (Helodrilus) leoni: Michaelsen 1900a Das Tierreich., 10: 498.
Eophila leoni: Omodeo 1956 Arch. Zool. Ital., 41: 184.
***Allolobophora leoni*: Zicsi 1959 Acta zool. hung., 5: 439.**
***Allolobophora leoni:* Zicsi 1968a Opusc. Zool. Budapest, 8: 153.**
Allolobophora (Allolobophora) leoni: Perel 1979 Range and regularities in the distr. earthworms, p. 188.
Allolobophora leoni: Zicsi 1982a Acta zool. hung., 28: 445.
Allolobophora leoni: Easton 1983 Earthworm Ecology, p. 475.
Pannoniona leoni: Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 227.
***Allolobophora leoni*: Zicsi 1991 Opusc. Zool. Budapest, 24: 185.**
Allolobophora (Pannoniona) leoni: Qiu & Bouché 1998a Doc. pedozool. integrol., 4: 190.

Description – *External* – Body length 65–150 mm, diameter 5–8 mm, 148–180 segments. Colour usually pale, pigmentation lacking. Head proepilobous, first dorsal pore in the intersegmental furrow 4/5. Glandular tumescence usually on 11–13, 16, 17, 27–29 *ab*. Setae closely paired, setal arrangement after the clitellum: aa:ab:bc:cd:dd = 15.5:1.5:10:1:30. Clitellum extends on segments 25, 26–34 saddle-shaped. Tubercles on 30, 32 as two pair of hump-like protuberances (fig. 3.8 b). Male pore on 15, surrounded by a glandular crescent, confined into own segment. *Internal* – Dissepiments 5/6–9/10 strongly thickened. Crop in 15–16, gizzards in 17–18. Two pairs of testes free in 10, 11, and two pairs of seminal vesicles in 11, 12. Receptacula seminis two pairs in 9/10, 10/11 open in setal line *cd*, frequently duplicate or triplicate. Calciferous glands with lateral pouches in 10. Excretory system holonephridial with J-shaped nephridial bladders, hook forwards. The ectal part of the bladder is subdivided by a small constriction (fig. 3.15C a, b). Typhlosole trifid, the cross-section of longitudinal muscle layer is of fasciculated type (fig. 6.5.1, 6.5.2).

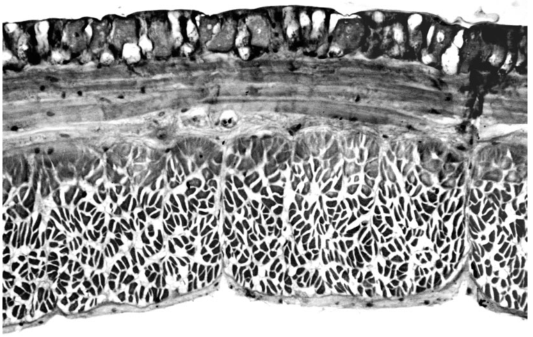

Fig. 6.5.1. Longitudinal musculature of *A.* (s. l.) *leoni.*

Fig. 6.5.2. Typhlosole of *Allolobophora* (s. l.) *leoni*.

Remarks – The shape of nephridial bladders of *A. leoni* is somewhat similar to that of some *Perelia* species from Central Asia. But examining this character thoroughly from the head to the posterior part of the body, we concluded, that the origin of the ectal dilatation is somewhat different. In case of *Perelia* it arises from the fusing of the outer curve of an S-shaped nephridial bladder, in *A. leoni* it originates from a looping in the middle of the nephridial bladders.

Ecology – *Allolobophora leoni* is an endogeic species preferring clayey soils with good water balance. It casts exclusively into the soil. Daily excrement production in average 44.3 mg dry mass by an animal (Zicsi 1974a).

Distribution – This species has a Trans-Aegean distribution. It occurs in Central Europe from Italy to Ukraine and there is an other area-body around the eastern shore of the Black Sea (fig. 6.5.3).

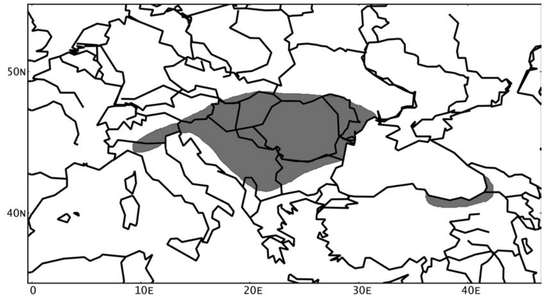

Fig. 6.5.3. Distribution of *Allolobophora* (s. l.) *leoni*.

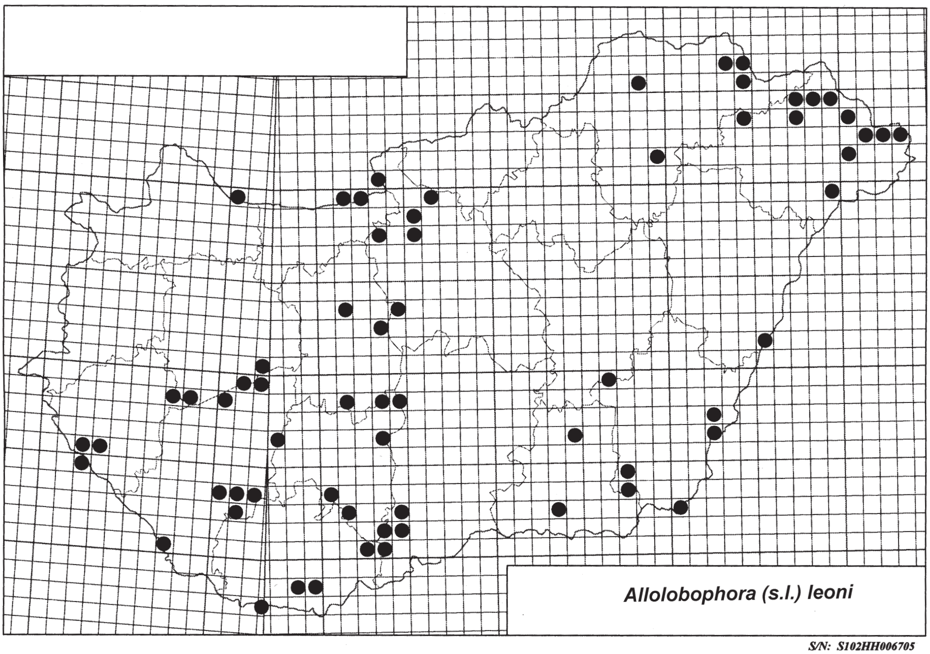

Fig. 6.5.4. Distribution of *Allolobophora* (s. l.) *leoni* in Hungary.

Distribution in Hungary (fig. 6.5.4) – **BR88** *No.* 1961 Harkány; **BR88** *No.* 3131 Turony; **BR98** *No.* 7311 Szársomlyó; **BS76** *No.* 12880 Somogydöröcske; **CS03** *No.* 2156 Bonyhád; **CS12** *No.* 14451 Bátaapáti; **CS18** *No.* 3042 Cece; **CS20** *No.* 1825 Bár; **CS30** *No.* 4846 Nagybaracska; **CS31** *No.* 5003 Pörböly; **CS36** *No.* 757 Paks; *No.* 1891 Dunaszentbenedek; **CS38** *No.* 1986 Előszállás; **CS41** *No.* 4856 Máriakönnye; **CS42** *No.* 1056 Érsekcsanád; **CS48** *No.* 544, 623, 631, 647, 796, 1869, 1976, 4520, Dunaföldvár; **CT13** *No.* 1439 Pátka; **CT19** *No.* 809, 1102, 1168, 10874 Lábatlan; **CT29** *No.* 7099 Tát; **CT32** *No.* 1818, 1978 Adony; **CT37** *No.* 4397 Perbál; **CT43** *No.* 598 Sinatelep; **CT57** *No.* 1548 Budakalász; **CT58** *No.* 1371, 1490, 1500, 1656, 11750 Szentendre; **CT69** *No.* 8985 Penc; **CU30** *No.* 11747, 4005, 2083, Letkés; **DS32** *No.* 2082, 4792 Szeged; **DS46** *No.* 11593 Szentes; **DS69** *No.* 5199 between Szarvas and Szentes; **DS73** *No.* 5034 Pitvaros; **DS74** *No.* 5043 Tótkomlós; **DU85** *No.* 2852, 3019 Szendrőlád; **DU91** *No.* 4720

Sajószöged; **ES02** *No.* 940, 981 Battonya; **ES26** *No.* 2162 Gyula; **ES27** *No.* 5060 Sarkad; **ET51** *No.* 5395 Ártánd; **ET99** *No.* 11157, 11161, 11173, 11179, 11185 Bátorliget; **EU36** *No.* 5464 Kishuta; **EU43** *No.* 2111 Körtvélyes; **EU45** *No.* 3082 Sárospatak; *No.* 3491, 3495, 3496, 3497 Végardó; **EU46** *No.* 3090 Sátoraljaújhely; **EU73** *No.* 3666 Ajak; **EU74** *No.* 3610 Tiszakanyár; **EU84** *No.* 3596, 3625 Kisvárda; **EU94** *No.* 3537, 3538, 3539, 3661 Mezőladány; *No.* 4896 Tiszakerecseny; **FU01** *No.* 4078, 4079, 14357 Tunyogmatolcs; *No.* 4089, 4110 Kocsord; **FU03** *No.* 4882, 4884, 4892, 8009 Vámosatya, Bockerek-erdő; *No.* 4901 Csaroda; *No.* 8012 Tákos; **FU12** *No.* 4021, 4025 Kisar; *No.* 4053, 4060 Kömörő; *No.* 4033, 8023 Tarpa; *No.* 4041 Tivadar; **FU22** *No.* 4875, 4045, 4049, 7141 Tiszacsécse; *No.* 7131 Tiszakóród; *No.* 4894, 4081, 4086, Túristvándi; **FU32** *No.* 10394 Tiszabecs; **XM24** *No.* 4112, 4130, 4144, 9117, 9118 Murarátka; **XM25** *No.* 9128 Szemenyecsörnye; *No.* 5432, 5433, 5440 Tormafölde; *No.* 14475 Kányavár; **XM35** *No.* 14474 Lasztonya; **XM70** *No.* 4768 Heresznye; **XM78** *No.* 1428 Gyenesdiás; **XM88** *No.* 4525, 4540 Badacsonytördemic; *No.* 11260, 14349 Szigliget; **YL37** *No.* 4756 Vejti; **YM03** *No.* 10435, 10437, 7151, 10433 Bőszénfa; *No.* 7298 Dennapuszta; **YM08** *No.* 3010, 9194 Balatonboglár; **YM12** *No.* 2912, 7172, 7290, 9192, 9219, 10428 Ropolyapuszta; *No.* 2951 Simonfa; **YM13** *No.* 2932, 10449 Zselicszentpál; **YM19** *No.* 1066 Balatonföldvár; **YM23** *No.* 10452 Szentbalázs; **YM29** *No.* 12388, 12395 Balatonendréd; *No.* 1650 Zamárdi; **YN09** *No.* 1255 Vének; **YN20** *No.* 11244 Palóznak.

6.6 *Allolobophora* (s. l.) *mehadiensis mehadiensis* Rosa, 1895

(Figs. 6.6.1–4.)

Allolobophora mehadiensis Rosa, 1895 Boll. Mus. Torino, 10(215): 3.
Helodrilus (*Allolobophora*) *mehadiensis*: Michaelsen 1900a Das Tierreich, 10: 485.
***Allolobophora mehadiensis*: Pop 1943a Ann. Hist.-Nat. Mus. Hung., 36: 14.**
Allolobophora mehadiensis f. typica: Pop 1949 Anal. Acad. R.P.R., 1(9): 448.
Eophila mehadiensis: Omodeo 1956 Arch. Zool. Ital., 41: 187.
***Allolobophora mehadiensis*: Zicsi 1959 Acta zool. hung., 5: 438.**
***Allolobophora mehadiensis*: Zicsi 1968a Opusc. Zool. Budapest, 8: 160.**
Allolobophora mehadiensis mehadiensis: Pop 1978 Trav. Mus. Hist. Nat. G. Antipa, 19: 255.
Allolobophora mehadiensis mehadiensis: Zicsi 1982a Acta zool. hung., 28: 445.
Eophila mehadiensis mehadiensis: Easton 1983 Earthworm Ecology, p. 481.
Eophila mehadiensis: Omodeo 1988 Boll. Zool., 55: 80.
Serbiona mehadiensis mehadiensis: Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 185.
***Allolobophora mehadiensis*: Zicsi 1991 Opusc. Zool. Budapest, 24: 187.**
Serbiona mehadiensis mehadiensi (laps.): Qiu & Bouché 1998a Doc. pedozool. integrol., 4: 191.

Description – *External* – Body length 150–210 mm, diameter 4–10 mm, 200–270 segments. Colour dark grey at least dorsally. Head epilobous, first dorsal pore in 9/10 or 10/11. Glandular tumescence usually on 13–20, 32, 39, 40, 41 *ab*. Setae closely paired, setal arrangement after the clitellum: aa:ab:bc:cd:dd = 15.2:1.2:7.6:1:32. Clitellum saddle-shaped extends on segments 35, 36–47, 48. Tubercles on 42–47, two bands alongside the ventral edge of the clitellum. Male pore on 15 between setae *b–c*, surrounded by a glandular crescent, confined within its own segment. Nephridiopores irregularly alternate between setal line *b* and above *d*. *Internal* – Dissepiments 6/7–9/10 thickened. Crop in 15–16, gizzards in 17–19. Two pairs of testes free in 10, 11, and four pairs of seminal vesicles in 9–12. Receptacula seminis two pairs in 9/10–10/11 open in setal line *cd*. Calciferous glands in 10–15 with lateral pouches in 10. Excretory system holonephridial with forwards oriented J-shaped nephridial bladders. Typhlosole trifid, the cross-section of longitudinal muscle layer is of fasciculated type (fig. 6.6.1, 6.6.2).

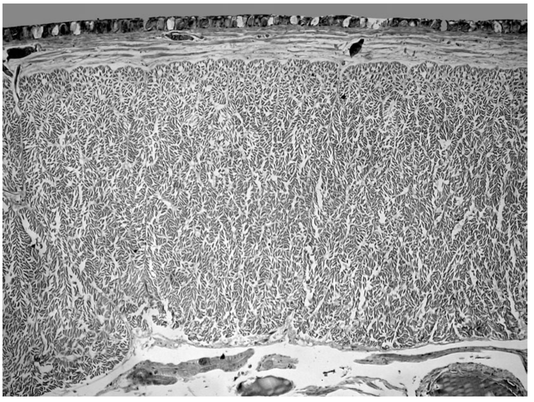

Fig. 6.6.1. Longitudinal musculature of *Allolobophora* (s. l.) *mehadiensis mehadiensis.*

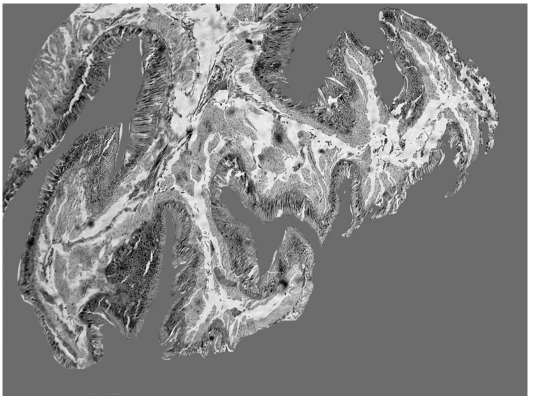

Fig. 6.6.2. Typhlosole of *Allolobophora* (s. l.) *mehadiensis mehadiensis*.

Remarks – Omodeo (1988) placed this species to the genus *Eophila*, where he united species representing completely different evolutionary lineages. As the type species, *Eophila tellinii* (Rosa, 1888) has a pinnate type musculature and backwards-oriented J-shaped nephridial bladders, *A. mehadiensis* could not belong to this genus.

At present *A. mehadiensis* has four subspecies – *A. m. mehadiensis*, *A. m. boscaiui* (Pop, 1948), *A. m. oreophila* Pop, 1978 and *A. m. voivodinensis* Šapkarev, 1989 – differing from each other by the position of the clitellar organs. Whereas these characters could vary to some extent during maturation (Zicsi 1963), the validity of some of these subspecies is in question.

Ecology – *A. mehadiensis* according to the Bouché's ecological characterization belongs to the endogeic group, living and feeding in the mineral soil layer. It casts almost equally onto the surface and into the soil. The cast production is about 491 mg/day (dry matter) for an animal and 57.5% of them are put into the soil up to 1 m depth (Zicsi 1982b).

Distribution – *A. mehadiensis* seems to be a Dacian element. It is distributed in Hungary, Romania and Serbia. There is a record from Bulgaria (Mihailova 1965) as well, but it requires further corroboration (fig. 6.6.3).

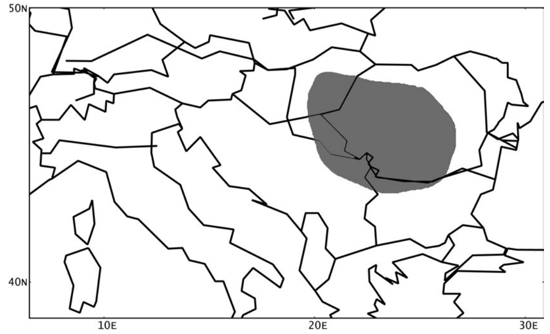

Fig. 6.6.3. Distribution of *Allolobophora* (s. l.) *mehadiensis mehadiensis*.

Distribution in Hungary (fig. 6.6.4) – **DS46** *No.* 11592 Szentes; **DS73** *No.* 5041, 5042 Nagyér; **DS82** *No.* 918, 922, 928, 948, 967, 988, 1210, 1222, 1223, 1224, 5636, 5639, 9230 Mezőhegyes; **DS84** *No.* 10871 Kaszaper; **DT63** *No.* 5344, 5382 Szapárfalu; **DT73** *No.* 5296 Kenderes; **DU60** *No.* 8101 Síkfőkút; **ET77** Nyírlugos (Pop 1943a).

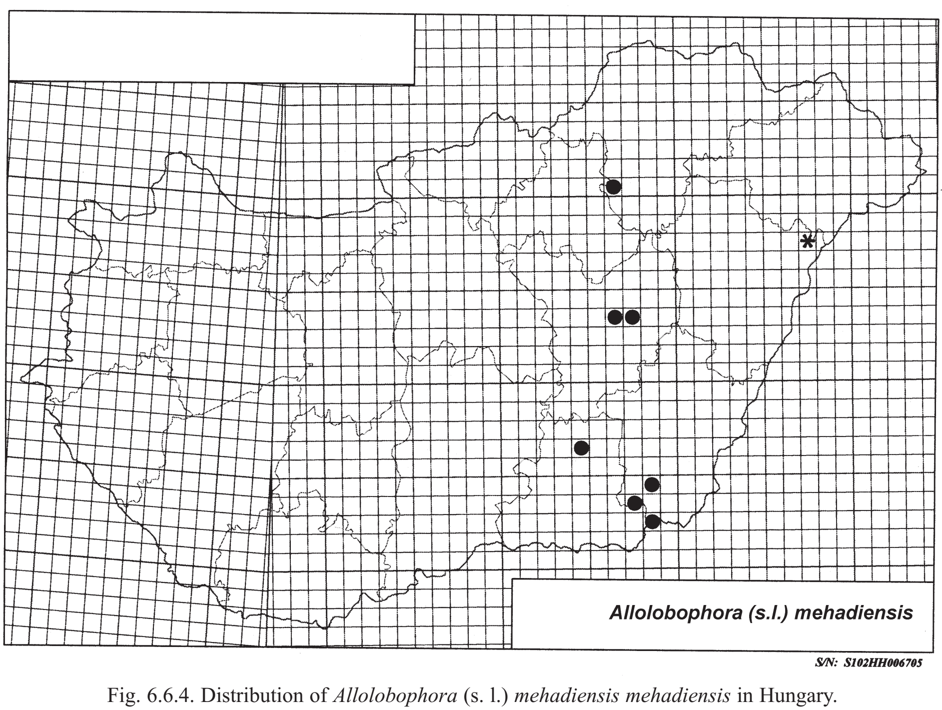

Fig. 6.6.4. Distribution of *Allolobophora* (s. l.) *mehadiensis mehadiensis* in Hungary.

6.7 *Allolobophora* (s. l.) *nematogena* Rosa, 1903

(Figs. 6.7.1–3., 6.8.4.)

Allolobophora (*Eophila*) *nematogena* Rosa, 1903 Atti. Soc. Modena, (5(36): 11.
Helodrilus meledaensis Michaelsen, 1908 Mitt. Natw. Ver. Univ. Wien, 6: 117.
Helodrilus (*Eophila*) *bellicosus* Ude, 1922 Arch. Naturg., 88(7): 160.
Eophila bellicosa: Černosvitov 1942 Proc. Zool. Soc. London, 111: 228.
Allolobophora (Microeophila) nematogena + *Allolobophora (Microeophila) bellicosa* + *Allolobophora (Microeophila) meledaensis*: Omodeo 1956 Arch. Zool. Ital., 41: 184.
***Allolobophora dudichiana* Zicsi, 1966 Opusc. Zool. Budapest, 6: 188.**
***Allolobophora bellicosa*: Zicsi 1968a Opusc. Zool. Budapest, 8: 150.**
***Allolobophora nematogena*: Zicsi 1971b Ann. Univ. Sci. Budapest, 13: 344.**
Allolobophora nematogena: Zicsi 1982a Acta zool. hung., 28: 445.
Microeophila nematogena: Easton 1983 Earthworm Ecology, p. 482.
Allolobophora bellicosa: Omodeo & Rota 1991 Boll. Zool., 58: 177.
Microeophila nematogena: Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 221.
***Allolobophora nematogena*: Zicsi 1991 Opusc. Zool. Budapest, 24: 187.**
Microeophila nematogena: Qiu & Bouché 1998a Doc. pedozool. integrol., 4: 191.

Description – *External* – Body length 40–100 mm, diameter 4–5 mm, 90–165 segments. Colour pale, pigmentation lacking. Head pro-epilobous or epilobous, first dorsal pore in 3/4, 4/5. Glandular tumescence variable, surrounds setae *ab* usually on 10–12, 13, 22, 25, 26, 28, 31. Setae closely paired, setal arrangement after the clitellum: aa:ab:bc:cd:dd = 13:1.8:8.2:1:24.7. Clitellum saddle-shaped developed on segments 25, 26–33, 34. Tubercles on 29, 30–32, 33 on the ventral edge of the clitellum. Male pore on 15 between setae *b–c*, surrounded by a glandular crescent, occupying the neighbouring segments as well. Nephropores hardly seen, irregularly alternate. *Internal* – Dissepiments 5/6–9/10 strongly thickened 10/11–13/14 less so. Crop in 15–16, gizzards in 17–19. Two pairs of testes free in 10, 11, and two pairs of seminal vesicles in 11, 12. Receptacula seminis two pairs in 9/10–10/11 open in setal line *cd*. Calciferous glands with diverticula in 10. Excretory system holonephridial with J-shaped nephridial bladders, hook forwards. The ectal part of the bladder is provided with a terminal ampulla (fig. 6.7.1). The cross-section of longitudinal muscle layer is of fasciculated type (fig. 6.7.2).

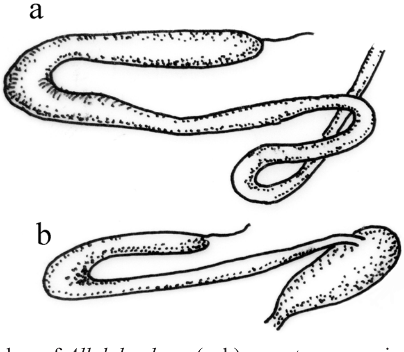

Fig. 6.7.1. Nephridial bladders of *Allolobophora* (s. l.) *nematogena*: ***a***. in segment 7, ***b***. after the clitellum.

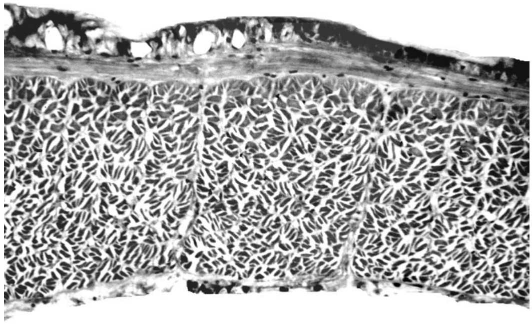

Fig. 6.7.2. Longitudinal musculature of *A*. (s. l.) *nematogena*.

Remarks – We have examined a series of specimens from Italy and localities from the former Yugoslavia as well, but have not found any differences in the structure of nephridial bladders.

OMODEO & ROTA (1991) argue for the validity of *A. bellicosa* because, according to the position of the clitellar organs it seems to be different from *A. nematogena* and they could not found specimens showing transitory characters. On the other hand, ZICSI (1971b) investigated large series of specimens from different countries (Italy: *A. nematogena*, Yugoslavia: *A. meledaensis* and *A. bellicosa*, and Hungary: *A. dudichiana*) and found that the position of the clitellar organs could vary even between specimens from the same locality, and a complete overlap was demonstrated for the material from different regions. The positions of the genital papillae show also a great variation, therefore the three latter names should be placed into synonymy of *A. nematogena*.

Unfortunately OMODEO & ROTA (1991) have not given a detailed description of their specimens from Turkey. Data about very important characters, such as the shape of the nephridial bladders, the type of the musculature are missing; therefore the exact taxonomic position of this specimen located far beyond the known range of *A. nematogena* remained in question.

Ecology – *A. nematogena* belongs to the endogeic group, living in the mineral soil layer.

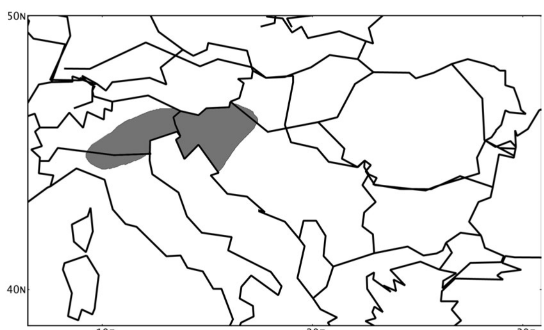

Fig. 6.7.3. Distribution of *Allolobophora* (s. l.) *nematogena*.

Distribution – This species occurs in Hungary, Bosnia, Croatia and in Italy that represents a Southern-Alpine distribution type. The only specimens attributed to this species from Turkey would extend this distribution area to afar east, but it requires further corroboration (fig. 6.7.3).

Distribution in Hungary (fig. 6.8.4) – **XM24** *No*. 4122, 4132, 4135, 4136, 9120, 11851 Murarátka; **XM35** *No*. 5403 Lasztonya.

Genus *Allolobophoridella* Mršić, 1990 emend.

Lumbricus (part.): Levinsen 1884 Vidd. Medd., p. 241.
Helodrilus (Bimastus) (part.): Michaelsen 1900a Das Tierreich, 10: 501.
Eisenia (part.): Pop 1941 Zool. Jb. Syst., 74: 518.
Bimastus (part.): Omodeo 1956 Arch. Zool. Ital., 41: 178.
Eisenia (s. l.) (part.): Bouché 1972 Inst. Nat. Rech. Agron., p. 378.
Allolobophora (Allolobophora) (part.): Perel 1976b Zool. Zh., 55: 833.
Allolobophora (Allolobophora) (part.): Perel 1979 Range and regularities in the distr. earthworms, p. 186.
Eisenia (part): Zicsi 1982a Acta Zool. Hung., 28: 443–444.
Allolobophora (part.): Easton 1983 Earthworm Ecology p. 475.
Allolobophora (Allolobophoridella) Mršić, 1990 Biol. vestn., 38: 49.
Allolobophoridella: Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 252.
Allolobophoridella: Zicsi & Csuzdi 1999 Rev. suisse Zool., 106: 998.
Bimastos (part.): Qiu & Bouché 1998b Doc. pedozool. integrol., 3: 211.

Type species – *Lumbricus eiseni* Levinsen, 1884 by original designation Mršić (1990).

Diagnosis – *External* – Setae closely paired, pigmentation dark red or reddish-brown. Prostomium tanylobous, first dorsal pore around 5/6. Male pore on 15 small. Spermathecae and tubercles lacking. Nephridial pores irregularly alternate between *b* and above *cd*. *Internal* – Two pairs of testes free in 10, 11, and two pairs of seminal vesicles in 11, 12. Calciferous glands with diverticula in 10–12. Excretory system holonephridial, nephridial bladders U-shaped with forward-oriented ental part. The cross-section of longitudinal muscle layer is of fasciculated type.

Remarks – Mršić (1990) erected the genus *Allolobophoridella* for the species *Lumbricus eiseni* Levinsen, 1884 and *Bimastus parvus* Eisen, 1874. These species have long been problematic in earthworm taxonomy. Pop (1941) placed them into the genus *Eisenia*. Later Perel (1976a, b) showed that the nephridial bladders of these species are markedly different from that of *Eisenia* being U-shaped with ahead turning ental part, and classified them into *Allolobophora*. Mršić (1990) pointed out, that in the pigmentation and in the position of the calciferous diverticula *L. eiseni* and *B. parvus* considerably differ from the species of the genus *Allolobophora*, and erected the new genus *Allolobophoridella*. Unfortunately he has not recognized that the North-American *B. parvus* and the Eurasian *L. eiseni* belong into different genera. The former shows typical *Bimastos* characteristics (U-shaped, ahead bent nephridial bladders and pinnate musculature) and the latter, although has the same type of nephridium, possesses a fasciculated musculature.

The restricted diagnosis above excludes *B. parvus* that hereby we place back to *Bimastos*. Therefore the genus *Allolobophoridella* at the moment contains the type species *Ai. eiseni* and *Ai. xilophila* (Omodeo and Martinucci, 1987) that should be transferred from *Eisenia* to *Allolobophoridella*.

6.8 *Allolobophoridella eiseni* (Levinsen, 1884)

(Figs. 6.8.1–4.)

Lumbricus eiseni Levinsen, 1884 Vidd. Meddel. Nat. Foren., (4)5: 241.
Allolobophora eiseni: Rosa 1893a Mem. Acc. Torino, 43: 462.
Allolobophora (Bimastus) eiseni: Michaelsen 1900a Das Tierreich, 10: 503.
Allolobophora rubra Bretscher, 1900 Rev. suisse Zool., 8: 454.
Dendrobaena merciensis Friend, 1911c Zoologist, (4)15: 192.
Bimastos eiseni gracilis Friend, 1911b Zoologists, (4)15: 368.
Bimastus oltenicus Pop, 1938 Bull. Soc. Sti. Cluj, 9: 146.
Eisenia parva f. *typica* (part.): Pop 1949 Anal. Acad. R.P.R., 1(9): 89.
Bimastus eiseni: Omodeo 1956 Arch. Zool. Ital., 41: 178.
***Eisenia parva*: Zicsi 1959 Acta zool. hung., 5: 182.**
***Eisenia eiseni*: Zicsi 1968a Opusc. Zool. Budapest, 8: 132.**
Allolobophora (*Allolobophora*) *eiseni*: Perel 1979 Range and regularities in the distr. earthworms, p. 187.
Eisenia eiseni: Zicsi 1982a Acta zool. hung., 28: 443.
Allolobophora eiseni: Easton 1983 Earthworm Ecology, p. 475.
Bimastos eiseni: Fender 1985 Megadrilogica, 4(5): 110.
***Allolobophora eiseni*: Zicsi 1991 Opusc. Zool. Budapest, 24: 182.**
Allolobophoridella eiseni: Mršić, 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 255.
Allolobophoridella eiseni: Reynolds 1995 Earthworm Ecol. Biogeogr., p. 10.
Allolobophoridella eiseni: Zicsi & Csuzdi 1999 Rev. suisse Zool., 106: 999.
Bimastos eiseni: Qiu & Bouché 1998a Doc. pedozool. integrol., 4: 197.

Description – *External* – Body length 30–85 mm, diameter 2–4 mm, 75–111 segments. Colour dark red, dorsally violet. Head tanylobous, first dorsal pore in 5/6. Glandular tumescence usually on 16 *ab.* Setae closely paired, setal arrangement after the clitellum: aa:ab:bc:cd:dd = 4.8:1.2:4:1:20. Clitellum extends on segments 24, 25–32 saddle-shaped. Tubercula pubertatis lacking. Male pore on 15, surrounded by a small glandular crescent. Nephropores irregularly alternate between *b* and above *d*. *Internal* – There are no dissepiments notably thickened. Crop in 15–16, gizzards in 17–18. Two pairs of testes free in 10, 11. Two pairs of seminal vesicles in 11, 12. Spermathecae lacking. Calciferous glands in 10–12 with diverticula in 10–11. Excretory system holonephridial. Nephridial bladders U-shaped with forward-oriented ental part. Typhlosole lamelliform, the cross-section of longitudinal muscle layer is of fasciculated type (fig. 6.8.1, 6.8.2).

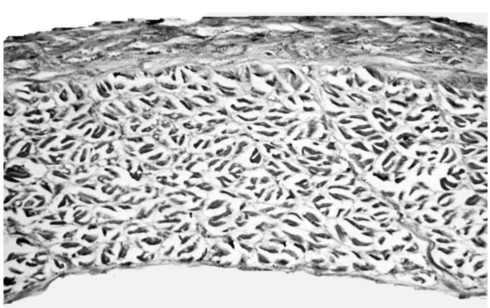

Fig. 6.8.1. Longitudinal musculature of *Allolobophoridella eiseni.*

Fig. 6.8.2. Typhlosole of *Allolobophoridella eiseni*.

Remarks – There is a confusion regarding the species *Ai. eiseni*, as Pop (1941) erroneously synonymyzed it with *Bimastos parvus*. Perel (1979) demonstrated, that the two species should not be identical because *Ai. eiseni* has a fasciculated and *B. parvus* a pinnate type of musculature, furthermore the head of *Ai. eiseni* is tanylobous and not epilobous as in the case of *B. parvus*.

Ecology – In Hungary this species lives solely under barks of decaying logs.

Distribution – This is a peregrine species of Atlantic origin (fig. 6.8.3).

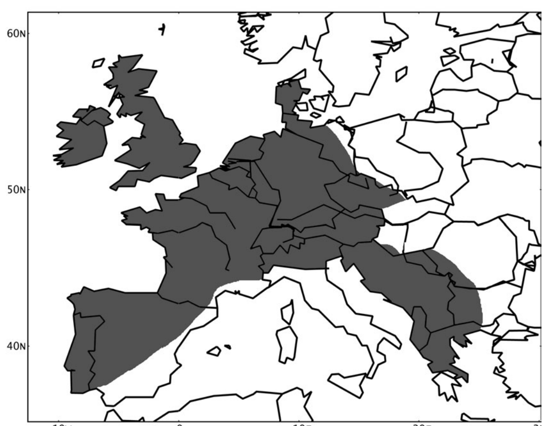

Fig. 6.8.3. Distribution of *Allolobophoridella eiseni* in Europe.

Distribution in Hungary (fig. 6.8.4) – **BS71** *No*. 3201 Mecsek Mts. Szuado-völgy; *No*. 14316 Mecsek Mts. Orfü; **BS80** *No*. 817 Mecsek Mts. Tubes; *No*. 826, 10919 Mecsek Mts. Misina; *No*. 3167 Mecsek Mts. Fehérkút; *No*. 3187 Mecsekszabolcs; **BS81** *No*. 3195 Mecsek Mts. Mély-völgy; **CS12** *No*. 14450 Bátaapáti; **YM13** *No*. 4780 Zselice.

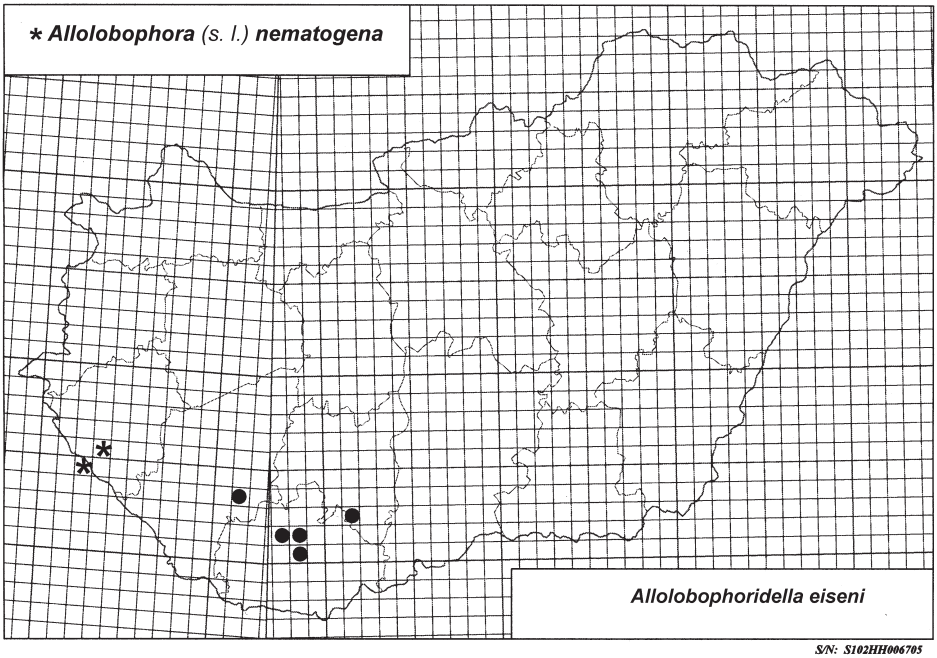

Fig. 6.8.4. Distribution of *Allolobophora* (s. l.) *nematogena* and *Allolobophoridella eiseni* in Hungary.

Genus *Aporrectodea* Örley, 1885

Enterion (part.) Savigny, 1826 Mem Ac. Fr., 5: 179.
Allolobophora (part.) Eisen, 1873 Öfv. Akad. Förh., 30(8): 46.
Allolobophora (part.): Örley 1881a Math. és term. tud. közlemények, 16: 593.
Allolobophora (part.): Örley 1885 Értek. term. tud. köréből, 15(18): 23.
Aporrectodea (part.): Örley, 1885 Értek. term. tud. köréből, 15(18): 22.
Allolobophora (part.): Rosa 1893a Mem. Acc. Torino, 43: 424.
Helodrilus (Allolobophora) (part.): Michaelsen 1900a Das Tierreich, 10: 479.
Helodrilus (Dendrobaena) (part.): Michaelsen 1900a Das Tierreich, 10: 488.
Helodrilus (Helodrilus) (part.): Michaelsen 1900a Das Tierreich, 10: 496.
Allolobophora (part.): Pop 1941 Zool. Jb. Syst., 74: 518.
Allolobophora (part.): Omodeo 1956 Arch. zool. Ital., 41: 180.
Nicodrilus Bouché, 1972 Inst. Nat. Rech. Agron., p. 315.
Aporrectodea: Gates 1975 Megadrilogica, 2(1): 4.
Nicodrilus: Perel 1976b Zool. Zh., 55: 834.
Nicodrilus: Perel 1979 Range and regularities in the distr. earthworms, p. 206.
Allolobophora (part.): Zicsi 1982a Acta Zool. Hung., 28: 444-445.
Aporrectodea: Easton 1983 Earthworm Ecology, p. 476–477.
Nicodrilus + *Allolobophora* (part.): Omodeo & Rota 1989 Boll. Zool., 56: 181.
Aporrectodea (Aporrectodea): Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 276.
Aporrectodea (part.): Perel 1997 Earthworms of Russia, p. 62.
Aporrectodea: Zicsi & Csuzdi 1999 Rev. suisse Zool., 106: 995.
Koinodrilus Qiu & Bouché, 1998b Doc. pedozool. integrol., 3: 196. **syn. nov.**
Nicodrilus (Nicodrilus): Qiu & Bouché 1998b Doc. pedozool. integrol., 3: 196.

Type species – *Lumbricus trapezoides* Dugés, 1828 (see Gates, 1975).

Diagnosis – *External* – Setae closely paired, pigmentation lacking, sometimes with grey or brown colour. Prostomium epilobous, dorsal pore variable. Male pore on 15, fairly visible, sometimes with glandular crescent intruding into the neighbouring segments. Spermathecae open in setal line *cd*, nephropores aligned or irregularly alternate between *b* and above *cd*. *Internal* – Two pairs of testes in 10, 11, and three or four (rarely two) pairs of seminal vesicles in 9–12 or 9, 11, 12 (rarely only in 11, 12). Receptacula seminis two pairs situated in intersegmental furrow 9/10, 10/11. Calciferous glands with lateral diverticula in 10. Excretory system holonephridial, nephridial bladders U- or J-shaped with backward-oriented ental part. The cross-section of longitudinal muscle layer is of pinnate type.

Remarks – Because of the unfortunate type designation of the genus *Allolobophora* (Omodeo 1956), all of the species previously referred to it should have been removed (Gates 1975). One of the possible genera to accept a part of these species is *Nicodrilus* Bouché, 1972, but Gates (1975) pointed out, that *Nicodrilus* is a junior synonym of the genus *Aporrectodea* Örley, 1885 that have been accepted almost unequivocally by the earthworm taxonomists (Easton 1983, Fender 1985, Mršić 1991, Perel 1997, Zicsi & Csuzdi 1999, but Qiu & Bouché 1998b). Unfortunately a well-defined diagnosis of this genus is still missing (Mršić 1991, Zicsi & Csuzdi 1999). Qiu & Bouché (1998b) in revising the family Lumbricidae described a new genus, *Koinodrilus* and gave an emended diagnosis of *Nicodrilus*. Both of the genera possess backward bent nephridial bladders and calciferous diverticula in segment 10. There is no mention of the structure of longitudinal musculature, but both type species (*Allolobopohora georgii* for *Koinodrilus* and *Enterion terrestre* for *Nicodrilus*) possess pinnate musculature.

The only difference between the two genera is the position of the nephropores that is aligned at *Koinodrilus* and irregularly alternate at *Nicodrilus* (Qiu & Bouché 1998b p. 196). This slight difference does not justify an independent genus, taking into account, that this character varies even within one species (or species group like the different forms of *D. byblica* (Rosa, 1893a)). In addition to these, Qiu & Bouché (1998c) themselves described a *Koinodrilus* species with irregularly alternating nephropores (*Koinodrilus pseudoantipai* Qiu & Bouché, 1998) eliminating the differences between the two genera.

In the present work we use the name *Aporrectodea* (senior synonym of *Nicodrilus*) in a restricted sense, classifying to this genus only the species corresponding to the diagnosis above. In case when a species differs from this description we use "*Aporrectodea* s.l." to refer that it does not belong to *Aporrectodea* restricted.

Table 6.2. Distinguishing characters of the *Aporrectodea* species in Hungary.

Species	**Clitellum**	**Tubercles**	**Vesicles**	**Spermathecae**	**Nephridial bladders**	**Musculature**
Ap. caliginosa	25, 26,	31–33	9–12	9/10, 10/11 *cd*	J, backward	pinnate
Ap. georgii	29–34, 35 28, 29–35	31, 33	9–12	9/10, 10/11 *cd*	J, backward	pinnate
Ap. handlirschi	26, 27–32, 33	½ 28, 28–½ 32	9, 11, 12	9/10, 10/11 *cd*	J, backward	pinnate
Ap. jassyensis	28, 29–35	1/n 31, 32–34, 1/n 35	9–12	9/10, 10/11 *cd*	J, backward	pinnate
Ap. longa	27, 28–35	32–34	9–12	9/10, 10/11 *cd*	J, backward	pinnate
Ap. rosea	24, 25, 26–32, 33	29–31 (30)	9–12, (11, 12)	9/10, 10/11 M	U, backward	pinnate
Ap. sineporis	24, 25–30, 31	27–29	9, 11, 12	9/10, 10/11 *cd*	J, backward	pinnate
Ap.* (s.l.) *dubiosa	36, 37–47, 48	43, 44–47, 48	9–12	8/9–10/11 *cd*	J, backward	fasciculated

6.9 *Aporrectodea caliginosa* (Savigny, 1826)

(Figs. 3.7b–d, 6.9.1–3.)

Enterion caliginosum Savigny, 1826 Mem. Acad. Sci. Inst. Fr., 5: 180.
Enterion carneum Savigny, 1826 Mem. Acad. Sci. Inst. Fr., 5: 180.
Lumbricus trapezoides Dugés, 1828 Ann. Sci. Nat.,15: 289.
Lumbricus gordianus Templeton, 1836 Ann. Mag. Nat. Hist., 9: 235.
Lumbricus lividus Templeton, 1836 Ann. Mag. Nat. Hist., 9: 235.
Lumbricus purus Dugés, 1837 Ann. Sci. Nat., (2)8: 17.
Lumbricus capensis Kinberg, 1867 Öfv. Akad. Förh., 23: 100.
Lumbricus hortensiae Kinberg, 1867 Öfv. Akad. Förh. 23: 98.
Lumbricus novaehollandiae Kinberg, 1867 Öfv. Akad. Förh., 23: 99.
Lumbricus olivaceus Eisen, 1871 Öfv. Akad. Förh. 27: 964.
Lumbricus pellucidus Eisen, 1871 Öfv. Akad. Förh. 27: 964.
Allolobophora turgida Eisen, 1873 Öfv. Akad. Förh. 30(8): 46.
Allolobophora turgida tuberculata Eisen, 1874 Öfv. Akad. Förh. 31(2): 43.
Lumbricus levis Hutton, 1877 Trans. N.Z. Inst., 9: 351.
***Allolobophora turgida*: Örley 1881a Math. és term. tud. közlemények, 16: 595.**
Lumbricus australiensis Fletscher, 1886 Proc. Linn. Soc. N.S. Wales, 1: 539.
Allolobophora (Allolobophora) caliginosa: Rosa 1893a Mem. Acc. Torino, 43: 424.
Allolobophora beddardi Ribaucourt, 1896 Rev. suisse Zool., 4: 53.
Allolobophora inflata Michaelsen, 1899 Zool. Jb. Syst., 12: 124.
Helodrilus (Allolobophora) caliginosus: Michaelsen 1900a Das Tierreich, 10: 482.
Helodrilus borellii Cognetti, 1904 Boll. Mus. Torino, 19(476): 2.
***Helodrilus (Allolobophora) caliginosus*: Szüts 1909 Állattani Közlemények, 8: 135.**
Allolobophora similis Friend, 1910b Gardener's Chron., 48: 99.
Helodrilus mariensis Stephenson, 1917 Rec. Ind. Mus., 13: 414.
Allolobophora remyi Černosvitov, 1929 Bull. Mus. Nat. Hist. Nat., (2)1: 149.
Eophila augilensis Sciacchitano, 1931 Ann. Mus. Genova, (3)55: 302.
Eophila obscuricola Černosvitov, 1936 Arch. Zool. Exp. Gen., 78: 5.
***Allolobophora caliginosa*: Pop 1943a Ann. Hist. Nat. Mus. Hung., 36: 13.**
Allolobophora caliginosa hellenica Tzelepe, 1943: Erg. z. Dol. Panepis Athinan Kavig., p. 1.
Dendrobaena samarigera graeca Černosvitov, 1938 Zool. Anz., 123(7/8): 191.
Allolobophora nocturna Evans, 1946 Ann. Mag. Nat. Hist., 13: 98.
Allolobophora iowana Evans, 1948 Ann. Mag. Nat. Hist., 14: 515.
Allolobophora arnoldi Gates, 1952 Breviora, 9: 1.
Allolobophora molita Gates, 1952 Breviora, 9 : 3.
***Allolobophora caliginosa*: Zicsi 1968a Opusc. Zool. Budapest, 8: 153.**
Nicodrilus (Nicodrilus) caliginosus caliginosus paratypicus Bouché, 1972 Inst. Nat. Rech. Agron., p. 327.
Nicodrilus (Nicodrilus) caliginosus meridionalis Bouché, 1972 Inst. Nat. Rech. Agron., p. 334.
Nicodrilus (Nicodrilus) caliginosus meridionalis pseudolongus Bouche, 1972 Inst. Nat. Rech. Agron., p. 335.
Nicodrilus (Nicodrilus) caliginosus alternisetosus Bouché, 1972 Inst. Nat. Rech. Agron., p. 333.

Nicodrilus caliginosus: Perel 1979 Range and regularities in the distr. earthworms, p. 209.
Allolobophora caliginosa: Zicsi 1982a Acta zool. hung., 28: 425.
Aporrectodea trapezoides+*Aporrectodea tuberculata*+*Aporrectodea turgida*: Gates 1982 Megadrilogica, 4: 28.
Aporrectodea caliginosa: Easton, 1983: Earthworm Ecology, p. 476.
***Allolobophora caliginosa*: Zicsi 1991 Opusc. Zool. Budapest, 24: 185.**
Aporrectodea (Aporrectodea) caliginosa: Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 321.
Aporrectodea trapezoides+*Aporrectodea tuberculata*+*Aporrectodea turgida*: Reynolds 1995 Earthworm Ecology and Biogeography, p. 10–11.
Aporrectodea caliginosa caliginosa + *Ap. caliginosa trapezoides*: Perel 1997 Earthworms of Russia, p. 63–64.
Aporrectodea caliginosa caliginosa + *Ap. caliginosa trapezoides*: Zicsi & Csuzdi 1999 Rev. suise Zool., 106: 996.
Nicodrilus (Nicodrilus) caliginosus caliginosus + *N. (N.) caliginosus tuberculatus* + *N. (N.) caliginosus meridionalis* + *N. (N.) trapezoides* + *N. (N.) noctunus* (laps.): Qiu & Bouché 1998a Doc. pedozool. integrol., 4: 188.
Nicodrilus monticola Pérez & Rodriguez, 2002 J. Nat. Hist., 36: 517. **syn. nov.**
Nicodrilus carochensis Pérez & Rodriguez, 2002 J. Nat. Hist., 36: 520. **syn. nov.**
Nicodrilus tetramuralis Pérez & Rodriguez, 2002 J. Nat. Hist., 36: 521. **syn. nov.**

Description – *External* – Body length 50–150 mm, diameter 2–4 mm, 100–180 segments. Colour usually brown, sometimes greenish. Some pigmentation almost always present, at least dorsally at the front of the body. Head epilobous, first dorsal pore between 5/6–9/10. Glandular tumescence usually on (9) 10–12 *ab*. Setae closely paired, setal arrangement after the clitellum: aa:ab:bc:cd:dd = 11.7:1.6:6.8:1:24. Clitellum extends on segments 25, 26, (29)–34, 35 saddle-shaped. Tubercles on 31–33 as two pairs of knob-shaped protuberances, or a continuous pad-like organ, but all of the transitory stages could be found (fig. 3.7 b-d). Male pore on 15, great slit between setae *b–c*, surrounded by a glandular crescent, frequently protruding into the neighbouring segments. Nephropores irregularly alternate between setal line *b* and above *cd*. *Internal* – Dissepiments 5/6–9/10 moderately thickened. Crop in 15–16, gizzards in 17–18. Two pairs of testes free in 10, 11, and four pairs of seminal vesicles in 9–12. Receptacula seminis two pairs in 9/10, 10/11 open in setal line *cd*. Calciferous glands in 10–12 with lateral pouches in 10. Excretory system holonephridial with S-shaped nephridial bladders, hook backwards. Typhlosole trifid, the cross-section of longitudinal muscle layer is of pinnate type (fig. 6.9.1, 6.9.2).

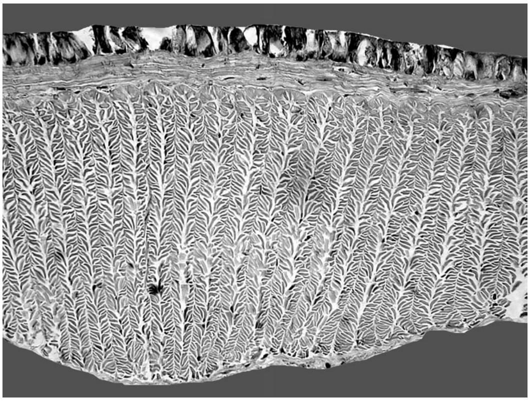

Fig. 6.9.1. Longitudinal musculature of *Aporrectodea caliginosa.*

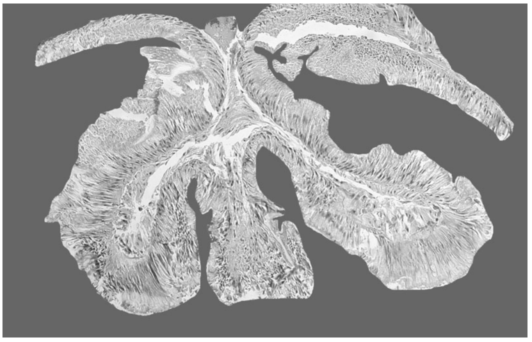

Fig. 6.9.2. Typhlosole of *Aporrectodea caliginosa*.

Remarks – This species is one of the most widely distributed earthworms with different parthenogenetic and polyploid morphs described as separate species. Unfortunately a comprehensive study of the species or species group is still wanting. Pending this is to be done we do believe that the different subspecies and species, regarded by some authors (Gates 1982, Bouché 1972, Reynolds 1995) as valid, better to treat as synonyms of *Ap. caliginosa* (Savigny, 1826).

Recently Pérez and Rodríguez (2002) have described three species differing from each other and from the *trapezoides* morph of *Ap. caliginosa* in the number and position of the genital papillae. This character is highly variable even among the different specimens of the same population and its number strongly corresponds with the sexual activity of the specimens in question (Gerard 1964, Bouché 1972, Zicsi 1974a, Perel 1979,) so to describe new species differing solely in this character is unjustifiable.

Ecology – *Ap. caliginosa* is a typical synanthropic species. It thrives in pastures, gardens and forest as well. It could be found in every type of substrate even in the poorest sandy soil. In disturbed environment it could completely displace native worms in a short time (Miller et al. 1955). According to Bouché's ecological characterisation *Ap. caliginosa* belongs to the endogeic group, living and feeding in the mineral soil layer. It casts on the surface that sometimes could be a large quantity.

Distribution – This species is native in the Palearctis, but it has been introduced extratropically all over the world.

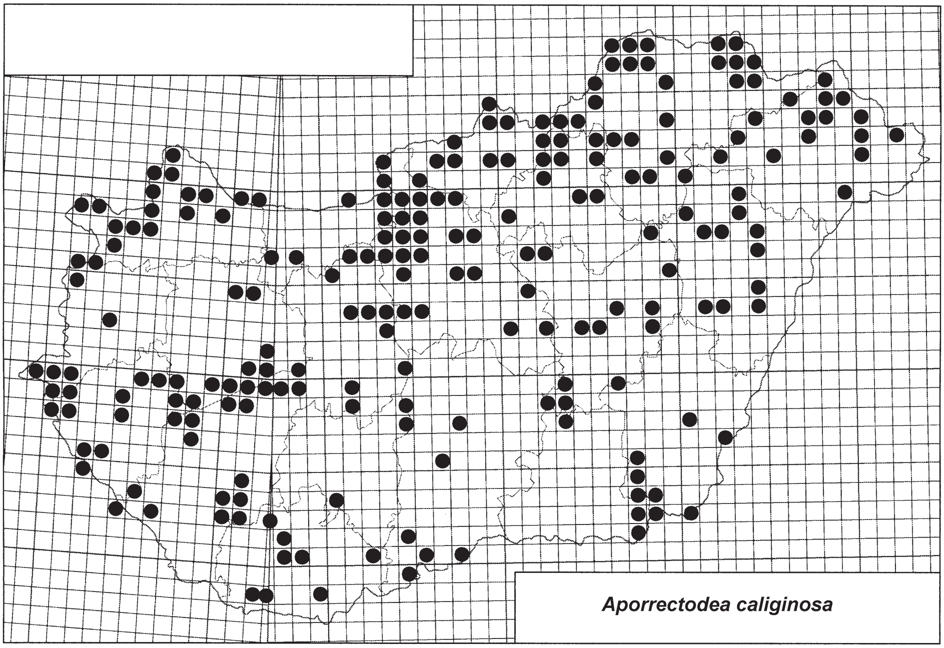

Fig. 6.9.3. Distribution of *Aporrectodea caliginosa* in Hungary.

Distribution in Hungary (fig. 6.9.3) – **BR98** *No.* 7314 Szársomlyó; **BS70** *No.* 1743 Magyarürög; *No.* 5349 Boda; **BS71** *No.* 3180 Mecsek Mts. Szuadó-völgy; **BS79** *No.* 11369, 11380, 11395 Balatonszéplak; **BS80** *No.* 1829 Pécs; *No.* 3162 Mecsek Mts. Farkas-forrás; *No.* 4734 Pécs Misina; *No.* 7163 Pécs; **BS89** *No.* 1909 Balatonszabadi-Sóstó; *No.* 11324 Balatonszabadi; **BT80** *No.* 11390, 11408 Balatonaliga; *No.* 11405 Balatonvilágos; **BT86** *No.* 5519 Vérteskéthely; **CR49** *No.* 5012, 5017 Gara; **CS03** *No.* 4790 Bonyhád; **CS12** *No.* 14448, 14455 Bátaapáti; **CS18** *No.* 3041, 3049, 3050 Cece; **CS19** *No.* 1460 Rétszilas; **CS20** *No.* 1824 Bár; **CS41** *No.* 4857 Máriakönnye; *No.* 5008 between Baja and Vaskút; **CS47** *No.* 1902 Harta; **CS48** *No.* 542, 645, 657, 2825, 2826 Dunaföldvár; **CS50** *No.* 5023 Bácsborsod; **CS65** *No.* 1639 Kecel; **CS70** *No.* 5027 Bácsalmás; **CS77** *No.* 11555 Páhi; **CT05** *No.* 2033 Vérteskozma; *No.* 5483 Csákvár; *No.* 5489, 5494 Kőhányás; *No.* 7278, 7279 Vértes Mts. Fáni-völgy; **CT13** *No.* 1645 Nadap; **CT16** *No.* 7715, 8962, 9039, 10543 Vértes Mts. Vinyabükki-völgy; **CT19** *No.* 1092, 1161 Süttő; *No.* 1094, 1163 Nyergesújfalu; *No.* 2158 Lábatlan; **CT23** *No.* 4560 Velence; **CT26** *No.* 5482 Bicske; **CT32** *No.* 1549, 1817, 1983 Adony; **CT33** *No.* 2879 Baracska; **CT36** *No.* 1843 Buda; *No.* 4413 between Zsámbék and Budakeszi; *No.* 4433 Páty; **CT37** *No.* 1746 Piliscsaba; *No.* 4398, 4400, 4408 Perbál; **CT38** *No.* 10223, 10339 Pilis Mts. Fekete-hegy; *No.* 11724 Kesztölc; **CT39** *No.* 1157, 1486 Esztergom; **CT40** *No.* 561, 677 Dunaújváros; **CT43** *No.* 551 Ercsi; *No.* 596 Sinatelep; **CT45** *No.* 708, 7371 Érd; *No.* 2937, 3248, 10203 Budaörs; *No.* 3237 Budapest, Kamaraerdő; *No.* 778, 3253, 7321

Törökbálint; **CT46** *No.* 707 Budakeszi; *No.* 6442 Buda; *No.* 3240, 3341 Budapest Ságvári-liget; *No.* 4165 Budapest, Farkas-völgy; *No.* 10427 Budapest Normafa; **CT47** *No.* 7247, 7257, 7260, 7261, 7363, 7631, 7637 Solymár; **CT48** *No.* 7282 Pilis Mts. Bölcső-hegy; *No.* 9973 Pilis Mts. Sikáros-patak; *No.* 9953, 10008, 10022 Pilis Mts. Apátkuti-völgy; *No.* 10324 Pilis Mts. between Dobogókő and Pilisszentkereszt; *No.* 10349, 10361 Pilis Mts. Király-patak; *No.* 10374 ,10379 Pilis Mts. Dobogókő; *No.* 10408 Pilis Mts. Szentlászló-völgy; *No.* 12774 Pilisszentkereszt; **CT49** *No.* 1069 Visegrád; *No.* 1088 Szob; *No.* 1137, 1151 Pilismarót; *No.* 1320 Zebegény; *No.* 10298, 10307, 10308, 10311, 10315 Pilis Mts. Hoffman-kunyhó; *No.* 10401 Dömös; **CT53** *No.* 10328 Bugyi; **CT56** *No.* 729, 780 Csepel; *No.* 1465, 1758 Margitsziget; *No.* 12768 Budapest, Engels tér; **CT57** *No.* 1542 Budakalász; **CT58** *No.* 7191, 7265 Pilis Mts. Lajosforrás; *No.* 1372, 1493, 1496 Szentendre; *No.* 2819 Alsógöd; *No.* 4179 Pilis Mts. Bükkös-patak; *No.* 4198 Pilis Mts. Vöröskő; *No.* 9980, 10237 Pilis Mts. Király-patak; **CT59** *No.* 1531 Dunabogdány; *No.* 9941, 9992 Pilis Mts. Lukács-árok; **CT69** 9027 Penc; **CT75** *No.* 4959 Maglód; **CT77** *No.* 3071, 4486, 4503, 5183, 5547, 5647, 5882 Gödöllő; **CT79** *No.* 3208, 3220, 3223, 3269 Csővár; **CT85** *No.* 4962, 5658 Mende; **CT87** *No.* 2805, 3053, 3064, 3074, 7203 Bag, Petőfi-forrás; **CU30** *No.* 2101, 2073, 3998, 4004 Letkés; **CU31** *No.* 4594 Börzsöny Mts. Csóványos; **CU50** *No.* 5235, 7339, 8040, 8069, 8219, 8422, 8438, 9003, 9045, 9067, 9626, 10293 Szendehely; **CU61** *No.* 5241 Rétság; *No.* 5246 Érsekvadkert; **CU71** *No.* 8994 Kétbodony; **CU72** *No.* 5273 Ipolyszög; **CU91** *No.* 8452, 9051 Alsótold; **CU93** *No.* 5258, 5288 Ludányhalászi; *No.* 5286 Nógrádszakál; **CU94** *No.* 5269 Litke; **DS28** *No.* 11725 between Tiszasas and Csépa; **DS37** *No.* 5193 Csongrád; **DS38** *No.* 11715 Csépa; **DS39** *No.* 3552, 3615 Tiszakécske; **DS69** *No.* 5065 Szarvas; **DS71** *No.* 960, 1011, 5629, 5632, 5633 Kövegy; **DS72** *No.* 5031 Csanádpalota; **DS73** *No.* 5036, 5037 Pitvaros; *No.* 5039 Nagyér; **DS74** *No.* 5044, 5050 Tótkomlós; **DS75** *No.* 5055 Orosháza; **DS82** *No.* 919, 926, 937, 951, 957, 966, 973, 990, 994, 1183, 1196, 1214, 1231, 1234, 1239, 1247, 1270, 1280, 1282, 5637, 9235 Mezőhegyes; **DS83** *No.* 4787 Végegyháza; **DT02** *No.* 5337 Cegléd; **DT08** *No.* 7223 Hatvan; **DT14** *No.* 3152 Farmos; **DT16** *No.* 4984 Jászberény; **DT22** *No.* 5214, 5218, 5332 Abony; **DT26** *No.* 4980 Jászjákóhalma; **DT42** *No.* 5222 Tiszapüspöki; **DT49** *No.* 9197 Kápolna; **DT52** *No.* 5206 Törökszentmiklós; **DT59** *No.* 2987, 3012 Kerecsend; **DT63** *No.* 5346, 5383 Szapárfalu; **DT82** *No.* 1017, 1022, 1027, 1850 Kisújszállás; **DT83** *No.* 8403 between Kisújszállás and Karcag; **DT87** *No.* 2990, 5211, 9619 Tiszafüred; **DT95** *No.* 8388 Nagyiván; **DU01** *No.* 9105 Sámsonháza; **DU03** *No.* 5254 Karancslapujtő; **DU20** *No.* 4236, 4252 Mátra Mts. Köszörűs-patak; **DU21** *No.* 7542, 10415 Nádújfalu; **DU22** *No.* 5895, 5899 Bárna; **DU23** *No.* 9102 Cered; **DU31** *No.* 7231 Pétervására; **DU32** *No.* 2893 Tarnalelesz; **DU33** *No.* 6941, 6944, 6946, 6954 Ivád; **DU43** *No.* 2874 Borsodnádasd; **DU51** *No.* 4428, 5177, 8279 Felsőtárkány; *No.* 4661 Bükk Mts. Szarvaskő; *No.* 8570, 8571 Bükk Mts. Teréz-forrás; **DU52** *No.* 2274 ,4667 Szilvásvárad; *No.* 9901, 9905, 9908 Bükk Mts. Tóthfalusi-völgy; **DU54** *No.* 569 Putnok; *No.* 4494 Kelemér; **DU55** *No.* 4571 Serényfalva; **DU62** *No.* 2976 Bükk Mts. Garadna-völgy; **DU66** *No.* 502, 530, 591, 673, 698, 1576, 1584, 2857, 2898, 3946, 4422 Aggtelek; **DU67** *No.* 4679 Jósvafő; **DU72** *No.* 2183, 2197, 2204 Bükk Mts. Tógazdasdág; **DU76** *No.* 2904 Szendrő; **DU77** *No.* 513 Szinpetri; *No.* 3875 Vecsem-forrás; *No.* 3926 Acskó; **DU80** *No.* 4988 Vatta; **DU86** *No.* 573 Szalonna; **DU87** *No.* 3951, 3960, 3988 Bódvaszilas; **DU91** *No.* 4718 Sajószöged; **DU93** *No.* 4991 Szikszó; **DU95** *No.* 4998 Tomor; **ES02** *No.* 942 Battonya; **ES07** *No.* 2265, 5057 Békéscsaba;

ES26 *No.* 2161 Gyula; **ET08** *No.* 7075, 7085, 7097 Újszentmargita; **ET13** *No.* 5354 Báránd; **ET17** *No.* 9607 Szálkahalom; *No.* 9610, 9614, 10499 Hortobágy; **ET23** *No.* 9006, 9007, 9021, 9062 Sáp; **ET27** *No.* 9615 Darassa; **ET38** *No.* 5374 Hajdúböszörmény; **ET39** *No.* 5310 Hajdúdorog; *No.* 5372 Hajdúvid; **ET43** *No.* 5350 Berettyóújfalu; **ET44** *No.* 5366 Derecske; **ET46** *No.* 4632, 5315 Debrecen; **ET47** *No.* 5312 Hajdúböszörmény Zelemér; *No.* 5370 Józsa; **ET99** *No.* 11194 Bátorliget; **EU00** *No.* 5302 Polgár; *No.* 5307 Tiszaszederkény; **EU21** *No.* 5295, 5380 Tiszavasvári; **EU26** *No.* 7567, 7568 Regéc; **EU27** *No.* 5475, 5478 Telkibánya; *No.* 5625 Mt. Sátor; **EU32** *No.* 14382 Tokaj; **EU35** *No.* 4269 Óhuta; *No.* 7577, 7590 Újhuta; **EU36** *No.* 5450, 11644, 11645, 11683 Kishuta; *No.* 5462 Nagyhuta; *No.* 5473 Nagybózsva; *No.* 10240 Rostalló; **EU37** *No.* 7556 Füzér; **EU43** *No.* 2108 Körtvélyes; **EU45** *No.* 3467, 3469 Sárospatak; *No.* 3474, 3481, 3482, 3492 Sárospatak, Végardó; *No.* 3477, 3478, 3479 Károlyfalva; **EU46** *No.* 3470 Sátoraljaújhely; *No.* 3487, 3488, 3489 Némahegy-Köveshegy; **EU51** *No.* 8974, 8995 Nyíregyháza; **EU64** *No.* 3554 Dombrád; **EU72** *No.* 3525, 3529, 3531, 3613, 3676 Berkesz; *No.* 3549, 3550 Nyírtass; **EU73** *No.* 3519 Rétközberencs; *No.* 3535, 3605, 3668 Ajak; *No.* 3623 Pátroha; **EU83** *No.* 3560, 3638 Gyulaháza; *No.* 3644 Szabolcsbáka; **EU84** *No.* 3500, 3502, 3503, 3558, 3575, 3576, 3577, 3582, 3585, 3597, 3617, 3619, 3627, 3647, 3650, 3664 Kisvárda; *No.* 3512, 3570, 3572 Jéke; **EU85** *No.* 3566 Tiszabezdéd; **EU94** *No.* 3543, 3662 Mezőladány; **FU01** *No.* 4075 Tunyogmatolcs; *No.* 4090, 4108 Kocsord; **FU02** *No.* 4523 Gulács; **FU03** *No.* 4902 Csaroda; **FU22** *No.* 4048, 4876 Tiszacsécse; *No.* 4082 Túristvándi; **WM99** *No.* 4712, 12086 Szakonyfalu; **XM07** *No.* 8540 Gödörháza; **XM08** *No.* 8512, 12019, 12082 Őriszentpéter; *No.* 12032 between Őriszentpéter and Kondorfa; **XM09** *No.* 12070 Kondorfa; *No.* 12237, 12262 Ispánk; **XM17** *No.* 11578 Zalabaksa; **XM18** *No.* 12073 Nagyrákos; **XM19** *No.* 12038 Viszák; **XM24** *No.* 4123, 4137, 9113 Murarátka; **XM25** *No.* 5444 Kányavár; *No.* 9146 Dobri; **XM35** *No.* 14312 Valkonya; **XM42** *No.* 5423 Őrtilos; **XM47** *No.* 8550 Bak; **XM48** *No.* 3135, 4692 Zalaegerszeg; **XM53** *No.* 9156 Somogybükkösd; **XM59** *No.* 4700 Kehida; **XM62** *No.* 9166 Csurgónagymárton; **XM69** *No.* 2868 Vidornyaszőllös; **XM77** *No.* 11358 Balatonberény; **XM78** *No.* 1389 Balaton, Szent Mihály kápolna; *No.* 1730, 1738, 2062, 2066, 2092, 2112, 2118, 2126, 2139, 4715, 7359, 11327 Keszthely; **XM79** *No.* 1839 Zalaszántó; **XM86** *No.* 7306 Marcali; **XM87** *No.* 1590, 1874, 2147, 2149 Balatonfenyves; *No.* 2836, 4649 Bélatelep; **XM88** *No.* 4529, 4537, 4545 Badacsony-tördemic; *No.* 11245 Szigliget; **XM99** *No.* 4567 Tóti-hegy; *No.* 14364 Hegyesd; **XN14** *No.* 3133 Bozsok; *No.* 11580 Velem; **XN15** *No.* 1757 Kőszeg; **XN18** *No.* 877 Sopron; *No.* 896 Sopron, Deák-forrás; *No.* 5713 Sopron, Tómalom; *No.* 5699 Brennbergbánya; **XN25** *No.* 8184 between Horvátzsidány and Kőszeg; *No.* 11424, 11433 Zsira; **XN28** *No.* 908 Fertőrákos; **XN32** *No.* 4195 Tanakajd; **XN36** *No.* 879, 902, 1202, 1295, 1333, 1343, 1349, 1355 Sopronhorpács; **XN37** *No.* 14299 Hidegség; **XN47** *No.* 864, 913 Petőháza; **XN57** *No.* 13067, 13108 Osli; **XN58** *No.* 13112 Osli, Patyi-ház; **XN59** *No.* 5611 Mosonszentjános; **XN78** *No.* 13061, 13100 Tárnokréti; *No.* 13087 Tárnokréti, Herceg-csatorna; **XN79** *No.* 13085 Lébény; **XN89** *No.* 2966 Zsejke; **XN98** *No.* 11604 Győr; **XP50** *No.* 6016 Várbalog; **XP60** *No.* 2014, 2958 Lajta; *No.* 2023 Mosonmagyaróvár; *No.* 5616, 6004, 6007, 6010 Levél; *No.* 6014 Mosonszolnok; **XP61** *No.* 1477, 1522, 1594, 1652 Rajka; *No.* 10571 Bezenye; **YL28** *No.* 4741 Csányoszró; **YL38** *No.* 4744 Vajszló; **YM02** *No.* 4781 Hencse; **YM03** *No.* 7153 Bőszénfa; *No.* 7178 Dennapuszta; **YM08** *No.* 714, 1950, 2838, 2839, 2840, 2841, 2842, 2843, 2844, 10078, 11400 Balatonboglár; *No.*

4782 Látrány; **YM09** *No.* 11257 Balatonszepezd; **YM12** *No.* 2952 Simonfa; *No.* 7296 Ropolypuszta; **YM13** *No.* 2919, 2925 Zselice; *No.* 2930 Zselicszentpál; *No.* 10432 Zselicség; **YM14** *No.* 10442 Toponár; **YM18** *No.* 1067 Balatonszemes; **YM19** *No.* 748, 3144, 3146 Tihany; **YM29** *No.* 11368 Zamárdi; *No.* 12392, 12397 Balatonendréd; **YM32** *No.* 4778 Bakóca; **YN04** *No.* 2997 Bakony Mts. Odvaskő; **YN09** *No.* 1252 Vének; **YN10** *No.* 14359 Koloska-patak; **YN14** *No.* 5515 Csesznek; *No.* 5527 Gézaháza; **YN19** *No.* 1129 Gönyű; **YN20** *No.* 11243 Palóznak; **YN21** *No.* 4202 between Veszprém and Csopak; **YN26** *No.* 5503, 5511 Bakonyszombathely.

6.10 *Aporrectodea georgii* (Michaelsen, 1890)

(Figs. 6.10.1–4.)

Allolobophora georgii Michaelsen, 1890a J. Hamb. Wiss., 7: 3.
Allolobophora georgii transylvanica Pop, 1938 Bull. Soc. Sti. Cluj, 9: 141.
***Allolobophora georgii* f. *typica*: Zicsi 1958 Opusc. Zool. Budapest, 2: 56.**
***Allolobophora georgii*: Zicsi 1968a Opusc. Zool. Budapest, 8: 157.**
Allolobophora (s. l.) *georgii*: Bouché 1972 Inst. Nat. Rech. Agron., p. 425.
Nicodrilus georgii: Perel, 1979 Range and regularities in the distr. earthworms, p. 210.
Allolobophora georgii: Zicsi, 1982a Acta zool. hung., 28: 445.
Aporrectodea georgii: Easton 1983 Earthworm Ecology, p. 476.
***Allolobophora georgii* Zicsi 1991 Opusc. Zool. Budapest, 24: 186.**
Aporrectodea (Aporrectodea) georgii: Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 315.
Koinodrilus georgii: Qiu & Bouché 1998a Doc. pedozool. integrol., 4: 187.

Description – *External* – Body length 25–80 mm, diameter 2–4 mm, 100–150 segments. Colour usually pale, pigmentation lacking. Head epilobous, first dorsal pore in the intersegmental furrow 4/5. Glandular tumescence usually on 11 *ab*. Setae closely paired, setal arrangement after the clitellum: aa:ab:bc:cd:dd = 7.6:1.2:5.2:20. Clitellum extends on segments 28, 29–35 saddle-shaped. Sucker-like tubercles on 31, 33. Male pore confined within segment 15. Nephropores irregularly alternate between setal line *b* and above *d*. *Internal* – Dissepiments 6/7–14/15 slightly thickened. Crop in 15–16, gizzards in 17–18. Two pairs of testes free in 10, 11, and four pairs of seminal vesicles in 9–12. Spermathecae two pairs in 9/10, 10/11 open in the setal line *cd*. Calciferous glands in 10–11 with lateral pouches in 10. Oesophageal hearts in 6–11 with an extraoesophageals in 12. Excretory system holonephridial. Nephridial bladders J-shaped with hook backward. Typhlosole lamelliform, the cross-section of longitudinal muscle layer is of pinnate type (fig. 6.10.1, 6.10.2).

Ecology – This is an endogeic earthworm, living in the mineral soil layer. It prefers the moist clayey soils. *Ap. georgii* casts mainly onto the soil surface (80%), the daily cast production is 54.7 mg dry mass pro 1g living weight (Zicsi 1974a).

Distribution – *Ap. georgii* is native in the Palearctis but widely distributed in the southern part of Eurasia and northern Africa (fig. 6.10.3). As an introduced species, it is recorded from South America as well (Mischis 1991).

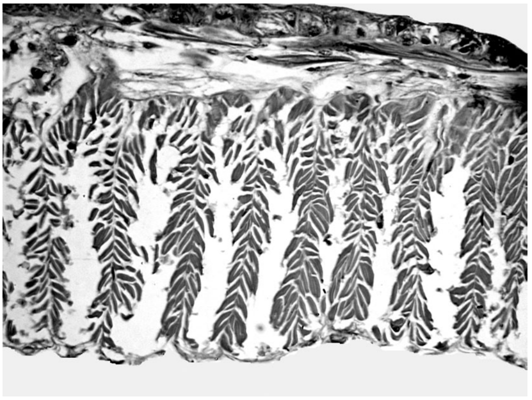

Fig. 6.10.1. Longitudinal musculature of *Aporrectodea georgii.*

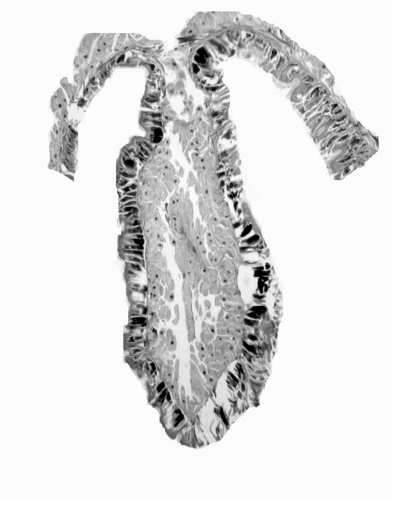

Fig. 6.10.2. Typhlosole of *Aporrectodea georgii*.

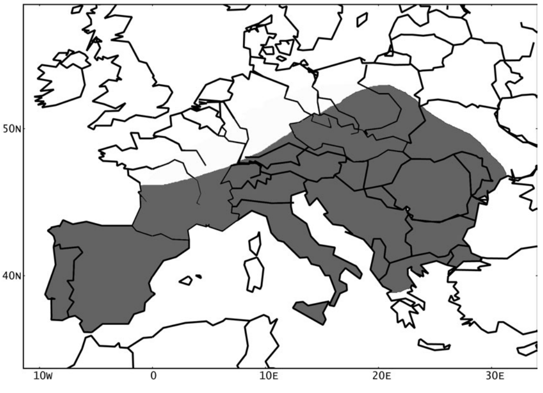

Fig. 6.10.3. Distribution of *Aporrectodea georgii*.

Distribution in Hungary (fig. 6.10.4) – **BS80** *No.* 1967 Pécs; **CS18** *No.* 3045 Cece; **CS23** *No.* 1822 Szekszárd; **CS48** *No.* 630, 798, 3023 Dunaföldvár; **CT23** *No.* 1634 Gárdony; **CT34** *No.* 1657, 2119 Martonvásár; **CT45** *No.* 3252 Törökbálint; **CT75** *No.* 4957 Maglód; **CT77** *No.* 5562 Gödöllő; **CT79** *No.* 3264 Csővár; **CT87** *No.* 2804, 3055 Bag Petőfi-forrás; **CU30** *No.* 2085, 2076 Letkés; **CU50** *No.* 2800 Nógrád; **DS28** *No.* 11726 between Tiszasas and Csépa; **DS37** *No.* 5195 Csongrád; **DS71** *No.* 961, 1007 Kövegy; **DS74** *No.* 5046 Tótkomlós; **DS82** *No.* 920, 970, 986, 1226, 1237, 1281 Mezőhegyes; **DT26** *No.* 4981 Jászjákóhalma; **DT42** *No.* 5224 Tiszapüspöki; **DT49** *No.* 4260, 5570, 9196 Kápolna; **DT52** *No.* 5207 Törökszentmiklós; **DT63** *No.* 5347, 5387 Szapárfalu; **DT83** *No.* 8405 between Kisújszállás and Karcag; **DT87** *No.* 5213 Tiszafüred; **DT94** *No.* 3359 Karcag; **DT95** *No.* 8387 Nagyiván; **DT98** *No.* 8391 Tiszacsege; **DU03** *No.* 5252 Karancslapujtő; **DU12** *No.* 5888 Mátraszele; **DU21** *No.* 1688 Nádújfalu; **DU32** *No.* 7379 Tarnalelesz; **DU40** *No.* 7412, 7428 between Sirok and Egerbakta; **DU55** *No.* 5540 Kelemér; **DU66** *No.* 506, 537, 11852 Aggtelek; **DU77** *No.* 3119 Szinpetri; **ES02** *No.* 941, 982 Battonya; **ES14** *No.* 2164 Lökösháza; **ET10** *No.* 5201 Nagylapos; **ET13** *No.* 5343, 5361 Báránd; **ET17** *No.* 9608 Szálkahalom; *No.* 9612 Hortobágy; **ET23** *No.* 9019, 9012 Sáp; **ET43** *No.* 5329 Berettyó-folyó; **ET46** *No.* 5319 Debrecen; **EU72** *No.* 3677 Berkesz; **EU73** *No.* 3665 Ajak; **EU83** *No.* 3592 Szabolcsbáka; **EU84** *No.* 3505 Kisvárda; **EU96** *No.* 3593 Zsurk; **XM78** *No.* 1429 Gyenesdiás; *No.* 2130 Keszthely; *No.* 1394 Balaton, Szent Mihály kápolna; **XM88** *No.* 4544 Badacsonytördemic; **XN37** *No.* 14298 Hidegség; **XN47** *No.* 914 Petőháza; **YM08** *No.* 1952, 3009, 11550 Balatonboglár; **YM29** *No.* 12393 Balatonendréd; *No.* 1649 Zamárdi; **YN26** *No.* 5505 Bakonyszombathely.

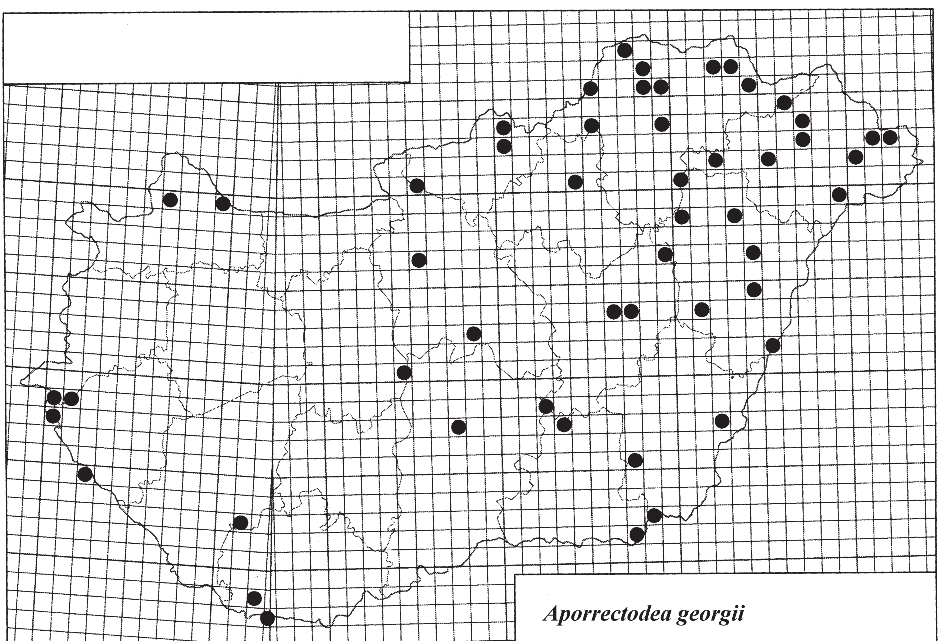

Fig. 6.10.4. Distribution of *Aporrectodea georgii* in Hungary.

6.11 *Aporrectodea handlirschi* (Rosa, 1897)

(Figs. 6.11.1–4.)

Allolobophora handlirschi Rosa, 1897 Boll. Mus. Torino, 12: 3.
Allolobophora rhenani Bretscher, 1899 Rev. suisse. Zool., 6: 417.
Allolobophora vejdovskyi Bretscher, 1899 Rev. suisse. Zool., 6: 419.
Helodrilus (Dendrobaena) rehnani: Michaelsen 1900a Das Tierreich, 10: 489.
Helodrilus (Dendrobaena) handlirschi: Michaelsen 1900a Das Tierreich, 10: 490.
***Allolobophora handlirschi*: Pop 1943a Ann. Hist.-Nat. Mus. Hung., 34: 14.**
Eiseniona handlirschi: Omodeo 1956 Arch. zool. Ital., 41: 189.
Allolobophora rosea alpina Vedovini, 1967 Bull. Soc Zool. Fr., 92: 793.
***Allolobophora handlirschi*: Zicsi 1968a Opusc. Zool. Budapest, 8: 150.**
Nicodrilus handlirschi: Perel 1979 Range and regularities in the distr. earthworms, p. 211.
Allolobophora handlirschi: Zicsi 1982c Rev. suisse Zool., 89: 559.
Allolobophora handlirschi Zicsi 1982a Acta zool. hung., 28: 429.
Aporrectodea handlirschi: Easton 1983 Earthworm Ecology, p. 476.
***Allolobophora handlirschi*: Zicsi 1991 Opusc. Zool. Budapest, 24: 184.**
Aporrectodea (Aporrectodea) handlirschi: Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 292.
Aporrectodea handlirschi: Perel 1997 Earthworms of Russia, p. 64.
Eiseniona handlirschi: Qiu & Bouché 1998a Doc. pedozool. integrol., 4: 188.

Description – *External* – Body length 35–110 mm, diameter 2–4 mm, 90–140 segments. Colour brownish, dorsal slightly red with iridescence. Head epilobous, first dorsal pore in 19/20 or after the clitellum. Glandular tumescence usually on 9, 10, 11, rarely also on 8, and 12 *ab.* Setae closely paired, setal arrangement after the clitellum: aa:ab:bc:cd:dd = 9.3:1:6.7:1:20. Clitellum extends on segments 26, 27–32, 33, saddle-shaped. Tubercles on 1/2 28, 28–1/2 32, 32. Male pore on 15, between setae *b–c*, almost as small as the female pore on 14. Nephropores alternate irregularly between setal line *b* and above *d*. *Internal* – Dissepiments 6/7–12/13 moderately thickened. Crop in 15–16, gizzards in 17–18. Two pairs of testes free or covered with sperm mass in 10, 11. Three pairs of seminal vesicles in 9, 11, 12. Spermathecae two pairs in 9/10, 10/11 open in the setal line *cd*. Calciferous glands in 10, 11 with lateral pouches in 10. Excretory system holonephridial. Nephridial bladders J-shaped with backward-oriented ental part. Typhlosole lamelliform, the cross-section of longitudinal muscle layer is of pinnate type (fig. 6.11.1, 6.11.2).

Remarks – Under the name of *Ap. handlirschi* several unrelated species have long been synonymized. After a detailed investigation Zicsi (1982c) resurrected the species *Ap. riparia* (Bretscher, 1901) and *Ap. pallida* (Bretscher, 1900) and redescribed *Ap. handlirschi* and the closely related *Ap. sineporis* (Omodeo, 1952a).

Ecology – *Ap. handlirschi* is a forest inhabiting species, where it lives in the uppermost soil layer. Its reproductive biology and feeding ecology are almost unknown. It almost evenly casts into the soil and onto the surface (59% vs. 41%). Its daily cast production is 41.93 mg dry mass pro 1 g living weight (Zicsi 1974a).

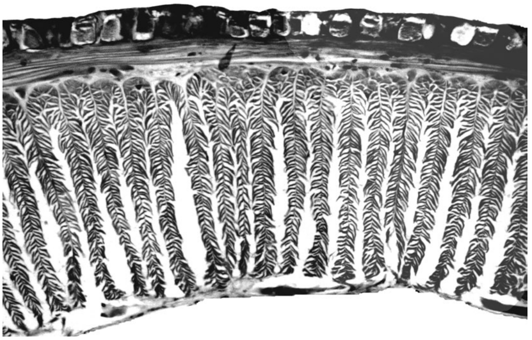

Fig. 6.11.1. Longitudinal musculature of *Aporrectodea handlirschi.*

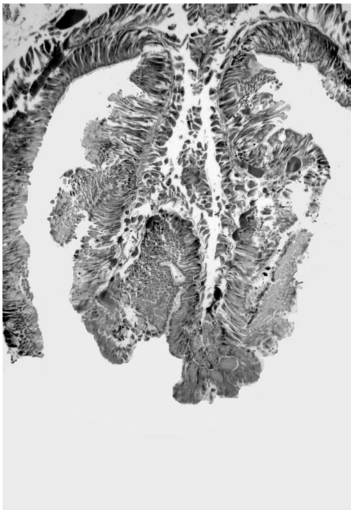

Fig. 6.11.2. Typhlosole of *Aporrectodea handlirschi*.

Distribution – *Ap. handlirschi* is native in the southern part of Eurasia, distributed from the western part of Caucasus Mts. over northern Turkey west to Italy and north to Poland (fig. 6.11.3).

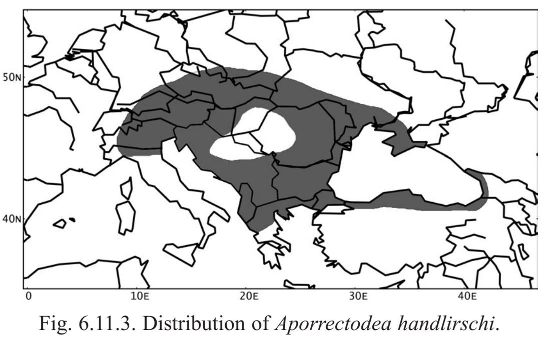

Fig. 6.11.3. Distribution of *Aporrectodea handlirschi*.

Distribution in Hungary (fig. 6.11.4) – **BS80** *No.* 849 Mecsek; Hidasi-völgy; **CT05** *No.* 2036 Vérteskozma; *No.* 5487 Vértes Mts. Kőhányás; *No.* 7270, 7277 Vértes Mts. Fáni-völgy; **CT16** *No.* 4476, 4477, 7123, 7706, 7707, 7708, 7709, 8411, 8412, 8963, 9031, 9081, 9199, 9220, 10480, 10541 Vértes Mts. Vinyabükki-völgy; **CT36** *No.* 4416 Páty; **CT38** *No.* 5577, 10341 Pilis Mts. Fekete-hegy; **CT39** *No.* 5574 Pilis Mts. Vaskapu; **CT46** *No.* 10425 Budapest, Normafa; **CT47** *No.* 7328 Budapest, Juliannamajor; **CT48** *No.* 9997, 10024, 10215, 10216, 10385 Pilis Mts. Apátkuti-völgy; *No.* 10323 Pilis Mts. between Dobogókő and Pilisszentkereszt; **CT49** *No.* 10402 Dömös; **CT58** *No.* 4184, 9963 Pilis Mts. Bükkös-patak; *No.* 4201, 4561 Pilis Mts. Vöröskő; *No.* 14267 Pilis Mts. Dömörkapu; **CT59** *No.* 9989 Pilis Mts. Lukács-árok; **CU31** *No.* 4590 Csóványos; **CU93** *No.* 4813 Endrefalva; **DT19** *No.* 4245 Mátraháza; **DU00** *No.* 7235 Mátrakeresztes; **DU10** *No.* 4251, 7219 Mátra Mts. Galyatető; *No.* 11617, 11853 Mátra Mts. Kékestető; **DU20** *No.* 4250 Mátra Mts. Nagylapát-tető; **DU51** *No.* 8283, 9229 Felsőtárkány; *No.* 9210 Bükk Mts. Szarvaskő; *No.* 4598 Bükk Mts. Peskő; *No.* 9860 Bükk Mts. Leány-völgy; *No.* 9876 Bükk Mts. Hordóhatár; *No.* 10495 Bélkő; **DU61** *No.* 5674, 7608, 7609 Cserépfalu; **DU62** *No.* 2210 Bükk Mts. Teknős-völgy; *No.* 4609 Bükk Mts. Bánkút; *No.* 4620 Bükk Mts. Belházi-víznyelő; *No.* 4643 Bükk Mts. Jávorkút; *No.* 7620 Répáshuta; *No.* 10335 Bükk Mts. Száraz-völgy; **DU63** *No.* 3334, 4388 Bükk Mts. Örvénykő; **DU72** *No.* 4168, 4513, 4811 Lillafüred; *No.* 2241 Bükk Mts. Tógazdaság; **EU36** *No.* 7113 Zempléni Mts. Kőkapu; *No.* 10249, 11658 Rostalló; **EU38** *No.* 7581 Zempléni Mts. Nagymilic; **XM88** *No.* 4449 Badacsony; **XN92** *No.* 5602 Bakonygyepes; **YM03** *No.* 7154 Bőszénfa; **YN14** *No.* 5520 Bakonyszentkirály.

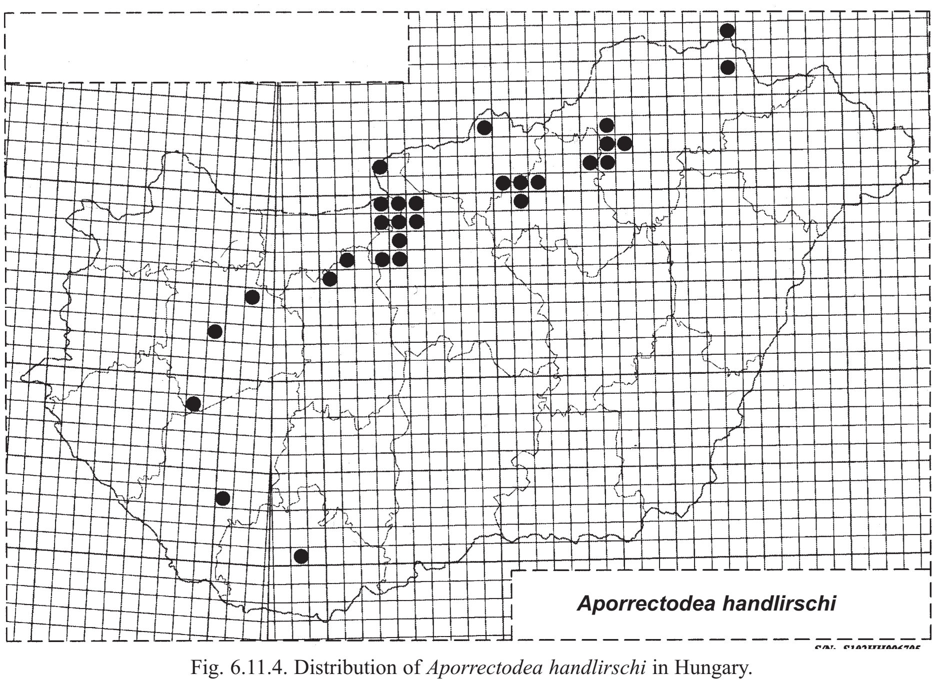

Fig. 6.11.4. Distribution of *Aporrectodea handlirschi* in Hungary.

6.12 *Aporrectodea jassyensis* (Michaelsen, 1891)

(Figs. 6.12.1–4.)

Allolobophora jassyensis Michaelsen, 1891 J. Hamb. Wiss., 8: 15.
Allolobophora jassyensis orientalis Michaelsen, 1897 Mitt. Mus. Hamb., 14: 69.
Helodrilus (Allolobophora) jassyensis: Michaelsen 1900a Das Tierreich, 10: 484.
Helodrilus cavaticus Michaelsen, 1910b Ann. Mus. St.-Petersb., 15: 57.
***Allolobophora jassyensis*: Zicsi 1959 Acta zool. hung., 5: 184.**
***Allolobophora jassyensis*: Zicsi 1968a Opusc. Zool. Budapest, 8: 156.**
Nicodrilus jassyensis: Perel 1979 Range and regularities in the distr. earthworms, p. 210.
Allolobophora jassyensis: Zicsi 1982a Acta zool. hung., 28: 445.
Aporrectodea jassyensis: Easton 1983 Earthworm Ecology, p. 476.
***Allolobophora jassyensis*: Zicsi 1991 Opusc. Zool. Budapest, 24: 186.**
Aporrectodea (Aporrectodea) jassyensis: Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 316.
Aporrectodea jassyensis: Perel 1997 Earthworms of Russia, p. 64.
Koinodrilus jasseyensis (laps.): Qiu & Bouché 1998a Doc. pedozool. integrol., 4: 187.

Description – *External* – Body length 60–100 mm, diameter 2–4 mm, 100–140 segments. Colour pale, pigmentation lacking. Head epilobous, first dorsal pore in 4/5. Glandular tumescence usually on 10, 11, 13, 27, 28 *ab.* Setae closely paired, setal arrangement after the clitellum: aa:ab:bc:cd:dd = 8:1:4.5:1:16. Clitellum saddle-shaped, extends on segments 28, 29–35. Tubercula pubertatis in the form of a band 1/n 31, 32–34, 1/n 35. Male pore on 15, great, with large glandular papillae covering partly the neighbouring segments as well. *Internal* – Dissepiments muscularized in 6/7–11/12. Crop in 15–16, and gizzards in 17–18. Two pairs of testes free in 10, 11, and four pairs of seminal vesicles in 9–12. Spermathecae two pairs in 9/10, 10/11 open in the setal line *cd*. Calciferous glands in 10–12 with lateral pouches in 10. Excretory system holonephridial. Nephridial bladders J-shaped, with caudad bent hook. Typhlosole trifid, the cross-section of longitudinal muscles is of pinnate type (fig. 6.12.1, 6.12.2).

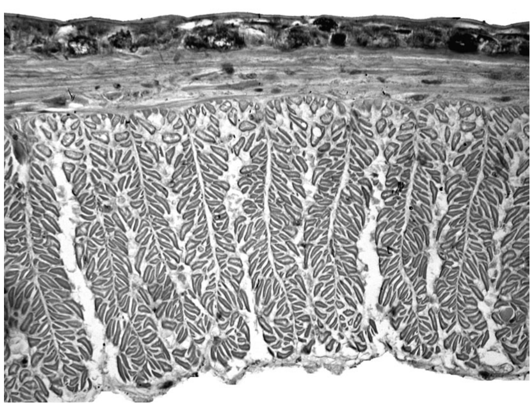

Fig. 6.12.1. Longitudinal musculature of *Aporrectodea jassyensis.*

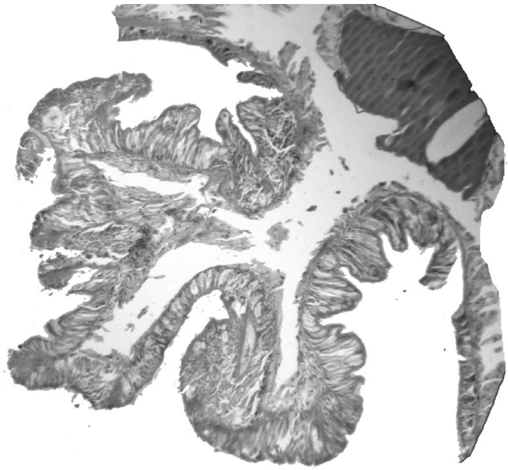

Fig. 6.12.2. Typhlosole of *Aporrectodea jassyensis*.

Remarks – *Helodrilus* (*Allolobophora*) *phoebeus* Cognetti, 1913 was regarded as a subspecies of *Ap*. *jassyensis* by Zicsi (1982a). A closer examination of the excretory system of the type material (No. OL 810) revealed that it has a sigmoid (sensu Qiu, Bouché & Soto 1998) nephridial bladder and has no affinities with *Ap. jassyensis*.

Ecology – According to Bouché's ecological characterisation *Ap. jassyensis* belongs to the endogeic group, living and feeding in the mineral soil layer.

Distribution – *Ap. jassyensis* is native in the Palearctis and widely distributed in southern Eurasia and northern Africa (fig. 6.12.3).

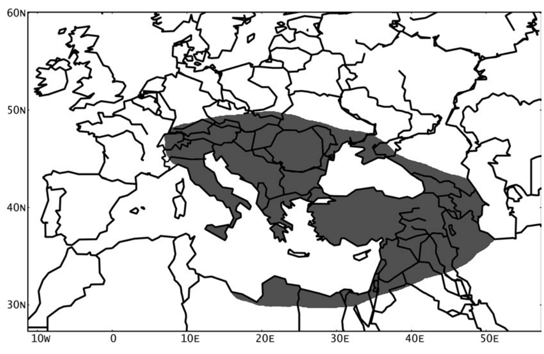

Fig. 6.12.3. Distribution of *Aporrectodea jassyensis*.

Distribution in Hungary (fig. 6.12.4) – **BS80** *No.* 1967 Pécs; **CS18** *No.* 3045 Cece, Sárrét; **CS23** *No.* 1822 Szekszárd Sió-csatorna; **CS48** *No.* 630, 798, 3023 Dunaföldvár; **CT23** *No.* 1634 Gárdony; **CT34** *No.* 1657, 2119 Martonvásár; **CT45** *No.* 3252 Törökbálint; **CT75** *No.* 4957 Maglód; **CT77** *No.* 5562 Gödöllő; **CT79** *No.* 3264 Csővár; **CT87** *No.* 2804, 3055 Bag, Petőfi-forrás; **CU30** *No.* 2085, 2076 Letkés; **CU50** *No.* 2800 Nógrád; **DS28** *No.* 11726 between Tiszasas and Csépa; **DS37** *No.* 5195 Csongrád; **DS71**

No. 961, 1007 Kövegy; **DS74** *No.* 5046 Tótkomlós; **DS82** *No.* 920, 970, 986, 1226, 1237, 1281 Mezőhegyes; **DT26** *No.* 4981 Jászjákóhalma; **DT42** *No.* 5224 Tiszapüspöki; **DT49** *No.* 4260, 5570, 9196 Kápolna; **DT52** *No.* 5207 Törökszentmiklós; **DT63** *No.* 5347, 5387 Szapárfalu; **DT83** *No.* 8405 between Kisújszállás and Karcag; **DT87** *No.* 5213 Tiszafüred; **DT94** *No.* 3359 Karcag; **DT95** *No.* 8387 Nagyiván; **DT98** *No.* 8391 Tiszacsege; **DU03** *No.* 5252 Karancslapujtő; **DU12** *No.* 5888 Mátraszele; **DU21** *No.* 1688 Nádújfalu; **DU32** *No.* 7379 Tarnalelesz; **DU40** *No.* 7412, 7428 between Sirok and Egerbakta; **DU55** *No.* 5540 Kelemér; **DU66** *No.* 506, 537, 11852 Aggtelek; **DU77** *No.* 3119 Szinpetri; **ES02** *No.* 941, 982 Battonya; **ES14** *No.* 2164 Lököshága; **ET10** *No.* 5201 Nagylapos; **ET13** *No.* 5343, 5361 Báránd; **ET17** *No.* 9608 Szálkahalom; *No.* 9612 Hortobágy; **ET23** *No.* 9019, 9012 Sáp; **ET43** *No.* 5329 Berettyó-folyó; **ET46** *No.* 5319 Debrecen; **EU72** *No.* 3677 Berkesz; **EU73** *No.* 3665 Ajak; **EU83** *No.* 3592 Szabolcsbáka; **EU84** *No.* 3505 Kisvárda; **EU96** *No.* 3593 Zsurk; **XM78** *No.* 1429 Gyenesdiás; *No.* 2130 Keszthely; *No.* 1394 Balaton, Szent Mihály kápolna; **XM88** *No.* 4544 Badacsony-tördemic; **XN37** *No.* 14298 Hidegség; **XN47** *No.* 914 Petőháza; **YM08** *No.* 1952, 3009, 11550 Balatonboglár; **YM29** *No.* 12393 Balatonendréd; *No.* 1649 Zamárdi; **YN26** *No.* 5505 Bakonyszombathely.

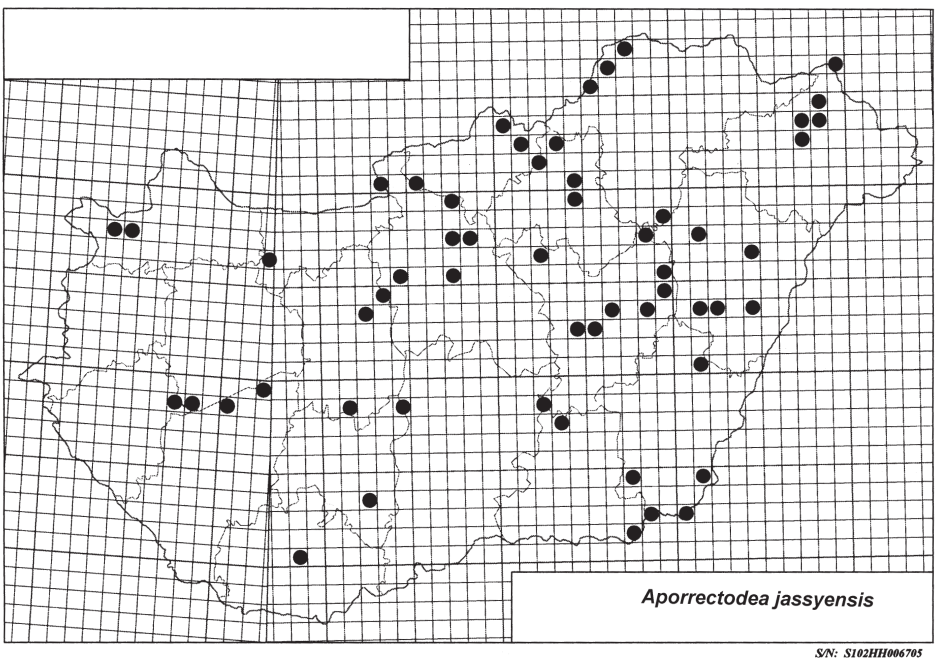

Fig. 6.12.4. Distribution of *Aporrectodea jassyensis* in Hungary.

6.13 *Aporrectodea longa* (Ude, 1885)

(Figs. 6.13.1–3., 6.15.2.)

Allolobophora longa Ude, 1885 Z. wiss. Zool., 43: 136.
Allolobophora lactea Friend, 1892c Naturalist, p. 89.

Helodrilus (Allolobophora) longus: Michaelsen 1900a Das Tierreich, 10: 483.
Octolasium intermedium Friend, 1909 Gardn. Chron., 46: 357.
***Allolobophora longa*: Zicsi 1968a Opusc. Zool. Budapest, 8: 156.**
Nicodrilus (Nicodrilus) longus longus: Bouché 1972 Inst. Nat. Rech. Agron., p. 322.
Nicodrilus (Nicodrilus) longus longus ambiguus Bouché, 1972 Inst.Nat.Rech.Agron., p. 323.
Nicodrilus (Nicodrilis) longus longus amplisellus Bouché, 1972 Inst.Nat.Rech.Agron., p. 323.
Nicodrilus (Nicodrilus) longus ripicola Bouché, 1972 Inst.Nat.Rech.Agron., p. 325.
Nicodrilus (Nicodrilus) longus ripicola viridis Bouché, 1972 Inst.Nat.Rech.Agron., p. 325.
Nicodrilus longus: Perel 1979 Range and regularities in the distr. earthworms, p. 210.
Allolobophora terrestris longa: Zicsi 1982a Acta zool. hung., 28: 432.
Aporrectodea longa: Easton 1983 Earthworm Ecology, p. 477.
Aporrectodea (Aporrectodea) longa: Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 330.
Aporrectodea longa: Perel 1997 Earthworms of Russia, p. 63.
Nicodrilus longus longus + *Nicodrilus longus ripicola*: Qiu & Bouché 1998a Doc. pedozool. integrol., 4: 188.

Description – *External* – Body length 90–160 mm, diameter 6–8 mm, 150–220 segments. Colour usually grey or brown, sometimes reddish with dorsal iridescence. Head epilobous, first dorsal pore in the intersegmental furrow 12/13. Glandular papillae usually on 9, 10, 11, 31, 33, 34 *ab*. Setae closely paired, setal arrangement after the clitellum: aa:ab:bc:cd:dd = 12:1.5:5.5:1:20. Clitellum extends on segments 27, 28–35 saddle-shaped. Tubercles as a ribbon on 32–34. Male pore on 15, great slit between setae *b–c*, surrounded with an elevated glandular crescent, protruding into the neighbouring segments. *Internal* – Dissepiments 5/6–10/11 thickened. Crop in 15–16, gizzards in 17–18. Two pairs of testes free in 10, 11, and four pairs of seminal vesicles in 9–12. Spermathecae two pairs in 9/10, 10/11 open in the setal line *cd*. Calciferous glands in 10–12 with lateral pouches in 10. Excretory system holonephridial. Nephridial bladders J-shaped with backward-oriented ental part. Typhlosole bifid, the cross-section of longitudinal muscle layer is of pinnate type (fig. 6.13.1, 6.13.2).

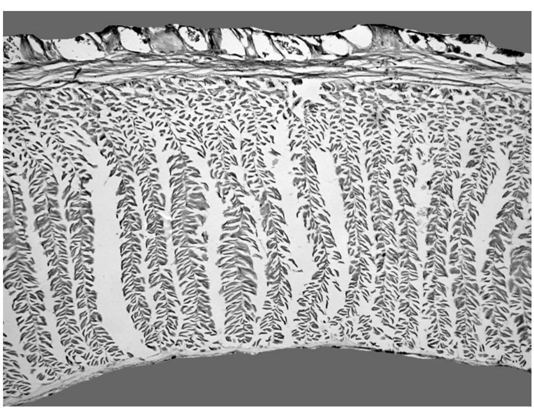

Fig. 6.13.1. Longitudinal musculature of *Aporrectodea longa.*

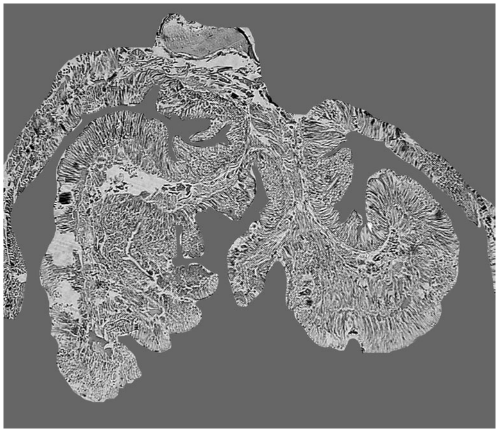

Fig. 6.13.2. Typhlosole of *Aporrectodea longa*.

Remarks – There is a taxonomic confusion regarding the species *Ap. longa* and *Ap. terrestris* (Savigny, 1826). In the earlier literature *Ap. longa* frequently appears under the name *Ap. terrestris* (e.g. Rosa 1893a).

Ecology – *Ap. longa* is a synanthropic species, common in pastures, gardens and forests as well. It is primarily geophagous, but sometimes produce litter-middens dragging leaves from the surface into the burrows (van Rhee 1963). *Ap. longa* defecates onto the surface, sometimes in great quantities.

Distribution – *Ap. longa* in its native range (Palearctis) shows an Atlantic distribution (fig. 6.13.3) but has widely been introduced extratropically by man. Its present range covers of Northern Europe, North America, South America, Africa, Asia and Australia.

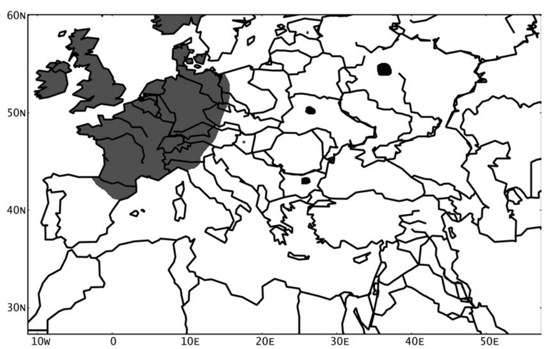

Fig. 6.13.3. Distribution of *Aporrectodea longa* in Europe.

Distribution in Hungary (fig. 6.15.2) **– XM78** *No.* 1727, 1732, 1740, 2065, 2113, Keszthely; **YM08** *No*. 11337 between Balatonlelle and Szemes.

6.14 *Aporrectodea rosea* (Savigny, 1826)

(Figs. 6.14.1–3.)

Enterion roseum Savigny, 1826 Mem. Acad. Sci. Inst. Fr., 5: 182.
Allolobophora mucosa Eisen, 1873 Öfv. Akad. Förh., 30(8): 47.
Lumbricus aquatilis Vejdovsky, 1875 SB Bőhm. Ges., p. 199.
***Allolobophora mucosa*: Örley 1881a Math. és term. tud. közlemények, 16: 593.**
Allolobophora (Notogama) rosea: Rosa 1893a Mem. Accad. Torino, 43: 427.
Allolobophora (Notogama) rosea macedonica Rosa, 1893a Mem. Accad. Torino, 43: 428.
Allolobophora danieli rosai Ribaucourt, 1896 Rev. suisse Zool., 4: 39.
Allolobophora alpestris Bretscher, 1899 Rev. suisse Zool., 6: 420.
Eisenia rosea: Michaelsen 1900a Das Tierreich, 10: 479.
Eisenia rosea bimastoides Cognetti, 1901 Boll. Mus. Torino, 16(404): 17.
Eisenia nobilii Cognetti, 1903 Boll. Mus. Torino, 18(434): 2.
Helodrilus diomedaeus Cognetti, 1906 Boll. Mus. Torino, 21(525): 1.
***Eisenia rosea* v. *budensis* Szüts, 1909 Állattani Közlemények, 8: 129.**
Eisenia rosea v. *croatica* Szüts, 1909 Állattani Közlemények, 8: 129.
Eisenia rosea glandulosa Friend, 1910a Gardn.Chron., 47: 329.
Allolobophora prashadi Stephenson, 1922 Rec. Ind. Mus., 24: 440.
Allolobophora dairenensis Kobayashi, 1940 Sci. Rept. Tohoku Univ., 15: 291.
Allolobophora harbinensis Kobayashi, 1940 Sci. Rept. Tohoku Univ., 15: 290.
Allolobophora hataii Kobayashi, 1940 Sci. Rept. Tohoku Univ., 15: 288.
Allolobophora jeholensis Kobayashi, 1940 Sci. Rept. Tohoku Univ., 15: 293.
Eisenia rosea balcanica Černosvitov, 1942 Proc. Zool. Soc. Lond., (B) 1942: 223.
***Allolobophora rosea* f. typ.: Pop 1943a Ann. Hist-Nat. Mus. Hung., 36: 15.**
Eisenia rosea pauci partita Tzelepe, 1943 Erg. z Dol. Panepis Athinan Kavig., p. 1.
Eophila kulagini Malevics, 1949 Dolk. Acad. Nauk. SSSR, 67: 399.
Eisenia rosea dendrobaenoides Omodeo, 1950 Ann. Ist. Mus. Zool. Univ. Napoli, 2(10): 1–12.
Eisenia jenensis Füller, 1953 Wiss. Zeit. Friedrich-Schiller Univ., 1952–3, p.52.
Allolobophora (Allolobophora) rosea: Omodeo 1956 Arch. Zool. Ital., 41: 183.
Eisenia moderata Chekanovskaya, 1959 Trudy Zool. Inst. Leningrad, 26: 350.
Allolobophora rosea interposita Plisko, 1965 Bull. Acad. Pol. Sci. (Biol.), 13(7): 415.
***Allolobophora rosea*: Zicsi 1968a Opusc. Zool. Budapest 8: 147.**
Allolobophora rosea troglodyta Alvarez, 1971 Bol. R. Soc. Esp. Hist. Nat. (Biol.), 69: 11.
Allolobophora rosea rosea: Bouché 1972 Inst. Nat. Rech. Agron., p. 418.
Aporrectodea rosea: Gates 1976a Megadrilogica, 2(12): 4.
Nicodrilus roseus: Perel 1979 Range and regularities in the distr. earthworms, p. 208.
Allolobophora rosea: Zicsi 1982a Acta zool. hung., 28: 445.
Aporrectodea rosea: Easton 1983 Earthworm Ecology, p. 477.
***Allolobophora rosea*: Zicsi 1991 Opusc. Zool. Budapest, 24: 183.**
Aporrectodea (Aporrectodea) rosea: Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 296.
Aporrectodea (Aporrectodea) rosea balcanica: Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 303.
Aporrectodea (Aporrectodea) rosea bimastoides: Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 304.

Aporrectodea (Aporrectodea) rosea budensis: Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 306.
Aporrectodea bowcowensis Reynolds & Clapperton 1996 Megadrilogica, 6: 77. **syn. nov**.
Aporrectodea rosea: Perel 1997 Earthworms of Russia, p. 63.
Aporrectodea rosea: Zicsi & Csuzdi 1999 Rev. suisse Zool., 106: 998.
Koinodrilus roseus roseus + *K. roseus bimastoides* + *K. roseus budensis* + *K. roseus balcanicus* + *K. roseus vedovinii*: Qiu & Bouché 1998a Doc. pedozool. integrol., 4: 188.
Nicodrilus (Nicodrilus) bowrcowensis (laps.): Qiu & Bouché 1998a Doc. pedozool. integrol., 4: 187.

Description – *External* – Body length 20–110 mm, diameter 2–4 mm, 100–150 segments. Colour usually pale, sometimes reddish. Head epilobous, first dorsal pore between 4/5–5/6. Glandular tumescence usually on 9,10,12,13,24, *ab*, 9,10,11,12 *cd.* Setae closely paired, setal arrangement after the clitellum: aa:ab:bc:cd:dd = 19:1.5:9:1:35. Clitellum extends on segments (23), 24, 25, (26)–32, 33 saddle-shaped. Tubercles usually on 29–31 sometimes on 29–30, 1/2 31. Male pore on 15, a great slit between setae *b–c*, surrounded by a glandular crescent, frequently protruding into the neighbouring segments. *Internal* – Dissepiments 5/6–9/10 slightly thickened. Crop in 15–16, gizzards in 17–18. Two pairs of testes free in 10, 11, and four pairs of seminal vesicles in 9–12, rarely two pairs in 11,12. Spermathecae two pairs in 9/10, 10/11 open in the mid-dorsal line. Calciferous glands in 10–12 with lateral pouches in 10. Excretory system holonephridial. Nephridial bladders U-shaped with backward-oriented ental part. The cross-section of longitudinal muscle layer is of pinnate type (fig. 6.14.1, 6.14.2).

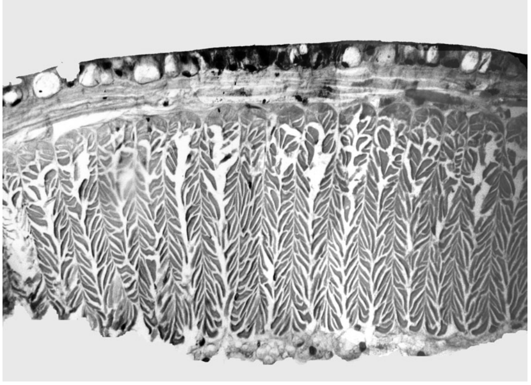

Fig. 6.14.1. Longitudinal musculature of *Aporrectodea rosea.*

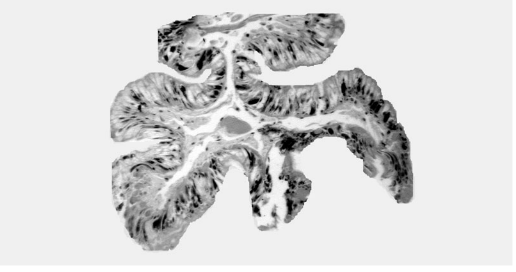

Fig. 6.14.2. Typhlosole of *Aporrectodea rosea*.

Remarks – This species is a widely distributed earthworm with different parthenogenetic morphs frequently described as separate species.

Ecology – *Ap. rosea* is a typical synanthropic species. It could be found in pastures, gardens and forests as well. It shows almost no preferences towards soil type, but is usually more abundant in moist soils. It belongs to the endogeic group, living and feeding in the mineral soil layer. *Ap. rosea* casts mainly into the soil (Zicsi 1974a) but there are some contrary statements as well (Thomson and Davies 1974). Its daily cast production in average is 71.85 mg dry mass pro 1 g living weight and 86.2 % of the total cast are put into the soil (Zicsi 1974a).

The species is frequently parthenogenetic, and according to Gates (1974) among the anthropochorous morhs the biparental reproduction is unknown.

Distribution – *Ap. rosea* is native in the Palearctis, but widely introduced extratropically by men. Its present range comprises Europe, North America, South America, Africa, Asia and Australia.

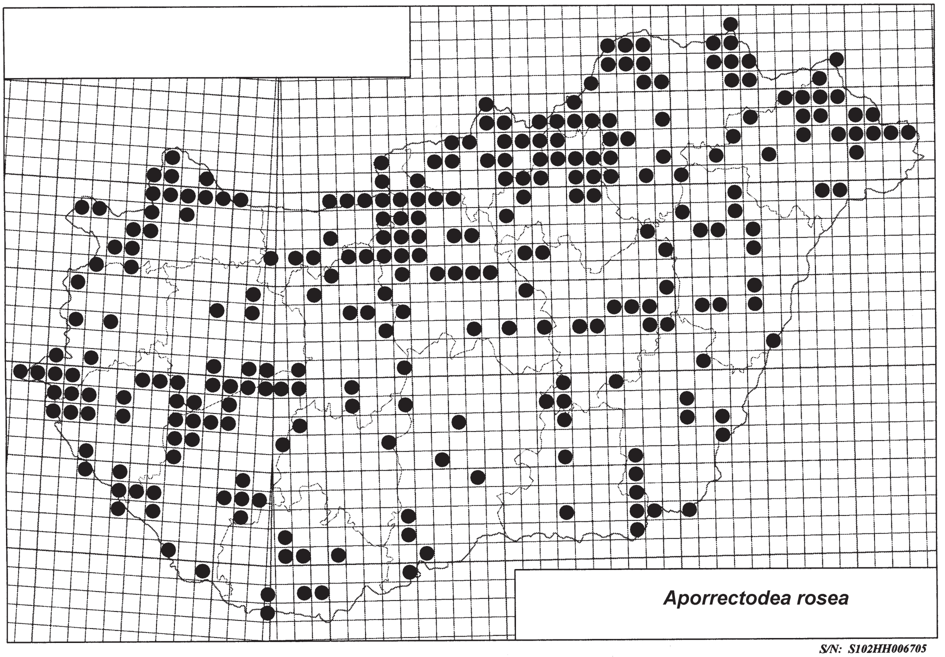

Fig. 6.14.3. Distribution of *Aporrectodea rosea* in Hungary.

Distribution in Hungary (fig. 6.14.3) – **BR88** *No.* 1959, 1963 Harkány; **BR98** *No.* 7313 Szársomlyó; *No.* 1045, 4809 Mt. Tenkes; **BS70** *No.* 1744 Magyarürög; **BS71** *No.* 3182 Mecsek Mts. Szuadó-völgy; **BS76** *No.* 12876 Somogydöröcske; **BS79** *No.* 2865, 11370, 11379 Balatonszéplak; **BS80** *No.* 820 Mecsek Mts.; *No.* 3163 Mecsek Mts. Farkas-forrás; *No.* 3170 Mecsek Mts. Hidegkút-forrás; *No.* 828, 829, 3174, 4731 Mecsek Mts. Misina; *No.* 1965, 1970, 4773, 7162 Pécs; *No.* 4793, 4798, 4860 Mecsek Mts. Tubes; **BS87** *No.* 4699, 10556 Iregszemcse; **BS89** *No.* 1910 Balatonszabadi-Sóstó; *No.* 11323, 11366

Balatonszabadi; **BT80** *No.* 11389, 11410 Balatonaliga; *No.* 11404 Balatonvilágos; **BT86** *No.* 5517 Vérteskéthely; **BT94** *No.* 1036, 1053, 4800, 4801 Csókakő; **BT96** *No.* 5500 Bokod; **CR49** *No.* 5011, 5020 Gara; **CS00** *No.* 1833 Szellő; **CS12** *No.* 14446, 14454 Bátaapáti; **CS18** *No.* 3048 Cece; *No.* 3039, 3040 Cece Sárrét; **CS19** *No.* 1458, 1459 Rétszilas; **CS36** *No.* 1892 Dunaszentbenedek; **CS41** *No.* 4854 Máriakönnye; **CS42** *No.* 1057 Érsekcsanád; **CS48** *No.* 543, 632, 641, 644, 654, 656, 801, 802, 812, 1870, 1973, 3021 Dunaföldvár; **CS50** *No.* 5025, 5022 Bácsbokod; **CS65** *No.* 1640 Kecel; **CS77** *No.* 11553, 11620 Páhi; **CS84** *No.* 4698 Kiskunhalas; **CT05** *No.* 5484 Csákvár; *No.* 7268, 7275 Vértes Mts. Fáni-völgy; *No.* 5488, 5493, 5496 Vértes Mts. Kőhányás; *No.* 2034 Vérteskozma; **CT07** *No.* 4799 Tatabánya; **CT09** *No.* 1836 Neszmély; **CT13** *No.* 1646 Nadap; **CT13** *No.* 1443 Pátka; **CT16** *No.* 4475, 4479, 7120, 7712, 7713, 8413, 8957, 8958, 9033, 9041, 9080, 10481, 10540, 10261, 14367 Vértes Mts. Vinyabükki-völgy; **CT19** *No.* 2159 Lábatlan; *No.* 10546 Pusztamarót; **CT23** *No.* 1632, 1635 Gárdony; *No.* 4558 Velence; **CT26** *No.* 5481 Bicske; **CT29** *No.* 7101 Tát; **CT32** *No.* 1550, 1557, 1558, 1982 Adony; **CT34** *No.* 2120 Martonvásár; **CT36** *No.* 1844 Buda hills; *No.* 4417, 4431 Páty; *No.* 4414 between Zsámbék and Budakeszi; **CT37** *No.* 4403, 4789 Perbál; *No.* 1747 Piliscsaba; **CT38** *No.* 11718, 11722, 11723, 11736, 11740 Kesztölc; *No.* 10222, 10340, 10345 Pilis Mts. Fekete-hegy; **CT39** *No.* 1158 Esztergom; **CT40** *No.* 564, 678 Dunaújváros; **CT43** *No.* 597 Sinatelep; **CT45** *No.* 3249, 10202 Budaörs; *No.* 2939 Sasad; *No.* 1323, 3254 Törökbálint; *No.* 709, 7370, 7374 Érd; **CT46** *No.* 3126, 3347 Buda hills; *No.* 1574 Budakeszi; *No.* 10426 Budapest, Normafa; *No.* 3342 Budapest, Ságvári-liget; **CT47** *No.* 7327 Budapest, Juliannamajor; *No.* 7250, 7255, 7256, 7364 Solymár; **CT48** *No.* 7284 Bölcső-hegy; *No.* 10373, 10378, 10326 Dobogókő; *No.* 9944 Pilis Mts. Lukács-árok; *No.* 9937 Pilis Mts. Malom-patak; *No.* 9954, 9955, 10021, 10005, 10006, 10217, 10386 Pilis Mts. Apátkuti-patak; *No.* 9974 Pilis Mts. Sikáros; *No.* 10014 Pilis Mts. Szakó-nyereg; *No.* 10229, 10368 Pilis Mts. Vörösdagonya; *No.* 10350, 10362 Pilis Mts. Király-patak; *No.* 12773 Pilisszentkereszt; *No.* 10409, 11714, 11738 Pilisszentlászló; **CT49** *No.* 10029 Pilis Mts. Lepence-patak; *No.* 9925, 10300, 10305, 10306, 10312, 10314, 10413 Pilismarót; *No.* 10400 Pilis Mts. Dömös; *No.* 1089 Szob; **CT56** *No.* 12767 Budapest; *No.* 723, 730, 781 Csepel; *No.* 4161 Budapest, Farkas-völgy; *No.* 1834 Budapest, Kelenföld; *No.* 1466, 1760 Budapest, Margitsziget; **CT57** *No.* 1543 Budakalász; **CT58** *No.* 2820 Alsógöd; *No.* 7189, 7264 Pilis Mts. Lajosforrás; *No.* 4171, 4182, 4193, 9962 Pilis Mts. Bükkös-patak; *No.* 10235, 10238 Pilis Mts. Király-patak; *No.* 9981 Pilis Mts. Királykuti-kunyhó; *No.* 1366, 1375, 1468, 1488 Szentendre; *No.* 4563 Pilis Mts. Vöröskő; **CT59** *No.* 1532 Dunabogdány; *No.* 9987 Pilis Mts. Lukács-árok; **CT65** *No.* 12776 Budapest, Pestimre; **CT69** *No.* 8986, 9025 Penc; *No.* 10479 Vác; **CT75** *No.* 4960 Maglód; **CT77** *No.* 3068, 4490, 4502, 5551, 5561, 5646 Gödöllő; **CT79** *No.* 3205, 3221, 3230, 3232, 3246, 3263 Csővár; **CT82** *No.* 4276, 4278 Hernád; **CT85** *No.* 4961 Mende; **CT87** *No.* 3056, 3066, 7201 Bag, Petőfi-forrás; **CT95** *No.* 4969 Tápiószecső; **CU30** *No.* 2071, 2079, 2086, 2098, 3999, 4008, 9185, 11746 Letkés; **CU31** *No.* 4592 Csóványos; **CU50** *No.* 5233, 7126, 7242, 7332, 7342, 7697, 7994, 8028, 8032, 8038, 8044, 8045, 8051, 8052, 8057, 8061, 8066, 8067, 8073, 8076, 8083, 8088, 8092, 8094, 8214, 8215, 8419, 8436, 8998, 9046, 9064, 9070, 9625, 10292, 10458, 10467, 10474, 10488, 11770 Szendehely; **CU61** *No.* 5244, 5245 Rétság; *No.* 5248 Érsekvadkert; **CU71** *No.* 8967 Csesztve; *No.* 8992 Kétbodony; *No.* 8979 between Szente and Magyarnándor; **CU72** *No.* 5275 Ipolyszög; **CU82** *No.* 5262 Őrhalom; **CU91** *No.* 8276, 8277, 8453, 8454, 8455, 8456, 8948, 9049 Alsótold; **CU93** *No.* 4818 Endrefalva; *No.* 5259, 5289 Ludányhalászi; **CU94** *No.* 5266 Litke; **DS28** *No.* 11727 between Tiszasas and Csépa; **DS32** *No.* 1753, 4794 Szeged; **DS35** *No.* 3154 Mindszent; **DS37** *No.* 5196 Csongrád; **DS38** *No.* 11717 Csépa; **DS39** *No.* 3551, 3614 Tiszakécske; **DS69** *No.* 5068, 5200 Szarvas; **DS71** *No.* 962, 963, 1008, 1009, 1010, 5628 Kövegy; **DS72** *No.* 5030 Csanádpalota; **DS73** *No.* 5038, 5040 Nagyér; **DS74** *No.* 5048, 5049, 5051 Tótkomlós; **DS75** *No.* 5054 Orosháza; **DS82** *No.* 921, 931, 932, 936, 950, 955, 969, 974, 987, 992, 995, 996, 997, 1015, 1186, 1187, 1198, 1199, 1207, 1208, 1211, 1217, 1218, 1225, 1232, 1233, 1241, 1242, 1245, 1248, 1268, 1269, 1273, 1279, 1283, 1284, 1288, 5634, 5640, 9234 Mezőhegyes; **DT02** *No.* 5336, 5338 Cegléd; **DT08** *No.* 7224 Hatvan; **DT14** *No.* 3153 Farmos; **DT16** *No.* 4978, 4983 Jászberény; **DT19** *No.* 4244, 5545 Mátraháza; **DT22** *No.* 5215, 5217, 5219, 5333, 5334 Abony; **DT26** *No.* 4979, 5687 Jászjákóhalma; **DT42** *No.* 5225 Tiszapüspöki; **DT49** *No.* 5568, 3970, 3971, 4259, 9198, 11760 Kápolna; **DT52** *No.* 5208 Törökszentmiklós; **DT59** *No.* 3011 Kerecsend; **DT63** *No.* 5345, 5384, 5386 Szapárfalu; **DT73** *No.* 5297 Kenderes; **DT82** *No.* 1018, 1023, 1028, 1626, 1848, 1851 Kisújszállás; **DT83** *No.* 8401 between Kisújszállás and Karcag; **DT87** *No.* 2984, 2989, 5212, 9620 Tiszafüred; **DT92** *No.* 8393, 8406 Ecsegfalva; **DT94** *No.* 5322 Karcag; **DT96** *No.* 3360, 8395, 8399 Óhat; **DU00** *No.* 4216, 7234 Mátrakeresztes; **DU01** *No.* 9107 Sámsonháza; **DU02** *No.* 5292 Kishartyán; *No.* 9097 Lucfalvai elágazás; **DU03** *No.* 5249 Karancslapujtő; **DU10** *No.* 7220 Galyatető; *No.* 11615 Kékestető; **DU12** *No.* 5887 Mátraszele; **DU20** *No.* 4238 Mátra Mts. Koszorú-patak; *No.* 4249 Mátra Mts. Nagylapát-tető; **DU21** *No.* 1687, 7543, 7217, 10417 Nádújfalu; **DU22** *No.* 5901, 5905, 5907 Bárna; **DU23** *No.* 5908, 9100 Cered; **DU31** *No.* 8261, 6935 Pétervására; **DU32** *No.* 5664 Szentdomonkos; *No.* 2892, 7376 Tarnalelesz; **DU33** *No.* 5532, 5533, 6955 Ivád; **DU33** *No.* 6938, 8975, 6943, 6947 before Ivád; **DU40** *No.* 2908 Egerbakta; **DU40** *No.* 7407, 7409, 7415, 7429 between Sirok and Egerbakta; **DU41** *No.* 3005 between Bátor and Szücs; **DU43** *No.* 2872, 2911, 7383 Borsodnádasd; **DU44** *No.* 5529 Ózd; **DU50** *No.* 5180, 5564 Eger; **DU51** *No.* 9206 Bükk Mts. Szarvaskő; *No.* 8565 Bükk Mts. Szarvaskő Teréz-forrás; *No.* 5175, 9227 Felsőtárkány; *No.* 10496 Bükk Mts. Bélkő; *No.* 4600 Bükk Mts. Peskő; *No.* 9878 Bükk Mts. Hordóhatár; *No.* 9894 Bükk Mts. Kukucsó-völgy; *No.* 9869 Bükk Mts. Leány-völgy; *No.* 9889 Bükk Mts. Szannafő; *No.* 786, 7592 Szilvásvárad; *No.* 9909, 9886, 9898 Bükk Mts. Tóthfalu-völgy; **DU53** *No.* 7628 Nekézseny; **DU55** *No.* 4495, 4838, 5537 Kelemér; *No.* 4569 Serényfalva; **DU60** *No.* 8103, 8287 Síkfőkút; **DU61** *No.* 5676, 5683, 7552 between Cserépfalu and Hollóstető; **DU62** *No.* 4603, 4610 Bükk Mts. Bánkút; *No.* 4618 Bükk Mts. Belházi-víznyelő; *No.* 10330 Bükk Mts. Jávorkút; *No.* 10334 Bükk Mts. Száraz-völgy; *No.* 2209 Bükk Mts. Teknős-völgy; *No.* 2234, 2974, 5448 Bükk Mts. Garadna-völgy; **DU63** *No.* 4385 Bükk Mts. Buzgókő; *No.* 3335, 3367, 4389, 4393 Bükk Mts. Örvénykő; **DU66** *No.* 507, 528, 533, 540, 668, 683, 686, 694, 696, 699, 713, 1578, 1585, 2855, 2901, 3942, 4443, 4459, 4576, 7368, 7653, 7654, 9072 Aggtelek; **DU66** *No.* 4819, 4835 Aggtelek, Haragistya; *No.* 3006 Aggtelek, Vörös-tó; **DU67** *No.* 795, 1720, 1939, 3101, 3279, 3296, 3304, 3315, 3317, 3321, 4678, 5914, 7210, 11664 Jósvafő; **DU72** *No.* 3366, 4167 Bükk Mts. Lillafüred; *No.* 2996 Bükk Mts. Csókás-forrás; *No.* 2174, 2179, 2192, 2194, 2199, 2263, 7230 Bükk Mts. Tógazdaság; **DU76** *No.* 2903 Szendrő; **DU77** *No.* 3922, 3955 Acskó; *No.* 4379, 4464 Alsóhegy; *No.* 3286, 3973 Szin; *No.* 512, 3120 Szinpetri; *No.* 3871 Szádvár; *No.* 3874 Vecsem-forrás; **DU80** *No.* 4272 Emőd; *No.* 4989, 4990 Vatta; **DU85** *No.* 519, 5171 Szendrőlád; **DU86**

No. 577, 583, 1032, 1935, 1938, 3947 Szalonna; **DU87** *No.* 3927, 3950, 3963, 3986 Bódvaszilas; **DU91** *No.* 4719 Sajószöged; **DU93** *No.* 4994 Szikszó; **DU95** *No.* 4999 Tomor; **ES02** *No.* 943, 977 Battonya; **ES07** *No.* 2165, 5056, 5059 Békéscsaba; **ES08** *No.* 4702, 4771 Vizesfás; **ES26** *No.* 2163 Gyula; **ES27** *No.* 5061 Sarkad; **ET08** *No.* 4724, 7074, 7078, 7080, 7083, 7089, 7093, 7094, 10564 Újszentmargita; **ET10** *No.* 5202, 5227 Nagylapos; **ET13** *No.* 5340, 5356, 5358 Báránd; **ET17** *No.* 10498, 9613 Hortobágy; **ET17** *No.* 9609 Szálkahalom; **ET23** *No.* 9063 Sáp; **ET27** *No.* 9616 Darassa; **ET38** *No.* 5375 Hajdúböszörmény; **ET39** *No.* 5309 Hajdúdorog; *No.* 5371, 5373 Hajdúvid; **ET43** *No.* 5330, 5351 Berettyóújfalu; **ET44** *No.* 5363 Derecske; **ET46** *No.* 5316 Debrecen; **ET47** *No.* 5313 Hajdúböszörmény, Zelemér; *No.* 5368, 5369 Józsa; **ET51** *No.* 5394 Ártánd; **ET89** *No.* 3355 Nyírbátor; **ET99** *No.* 11155, 11156, 11160, 11165, 11172, 11174, 11176, 11180, 11186, 11195 Bátorliget; *No.* 11171, 11193, 11199 Bátorliget, Fényi-erdő; **EU00** *No.* 5303 Polgár; **EU00** *No.* 5305 Tiszaszederkény; **EU21** *No.* 4785, 4786 Tiszalök; *No.* 5293, 5381 Tiszavasvári; **EU26** *No.* 4224, 7569, 11652 Regéc; **EU27** *No.* 3349, 5479 Telkibánya; **EU32** *No.* 14383 Tokaj; **EU35** *No.* 2769, 2770 Cifrakút; *No.* 2766 Hercegkút; *No.* 2764, 2765 Hotyka-patak; *No.* 2780 Köveskút; *No.* 4266 Óhuta; *No.* 7589, 7575 Újhuta; **EU36** *No.* 5452, 5453, 5465, 11646, 11684 Kishuta; *No.* 4938, 11691 Zemplén Mts. Kőkapu; *No.* 5472, 7560, 11631 Nagybózsva; *No.* 5463, 11670 Nagyhuta; *No.* 11657, 10239, 10250, 14324, 10246, 10538 Rostalló; **EU36** *No.* 10244 Zemplén Mts. Senyő-völgy; **EU37** *No.* 4947, 4944, 5994, 7558, 11694 Füzér; **EU38** *No.* 7579 Zemplén Mts. Nagy-Milic; **EU43** *No.* 2105 Körtvélyes; **EU45** *No.* 3471, 3493 Sárospatak, Végardó; **EU46** *No.* 3485 Némahegy-Köveshegy; **EU46** *No.* 2772, 2775, 2778 Sátoraljaújhely; **EU51** *No.* 8970, 8997 Nyíregyháza; **EU64** *No.* 3553, 3629, 3659 Dombrád; **EU72** *No.* 3523, 3528, 3530, 3675 Berkesz; *No.* 3547, 3548 Nyírtass; **EU73** *No.* 3534, 3591, 3603, 3608, 3652, 3663, 3667 Ajak; *No.* 3499, 3630 Pátroha; *No.* 3517, 3520, 3521 Rétközberencs; **EU74** *No.* 3609 Tiszakanyár; **EU83** *No.* 3559 Gyulaháza; *No.* 3586, 3637, 3639 Lövőpetri; *No.* 3611 Nyírlövő; *No.* 3563, 3645, 3646 Szabolcsbáka; **EU84** *No.* 3510, 3571, 3573, 3633 Jéke; **EU84** *No.* 3504, 3557, 3580, 3583, 3598, 3618, 3624, 3648, 3649 Kisvárda; **EU85** *No.* 3564 Tiszabezdéd; **EU92** *No.* 14379 Olcsva; **EU94** *No.* 3541, 3542 Mezőladány; *No.* 4897 Tiszakerecseny; **EU96** *No.* 3594 Zsurk; **FU01** *No.* 4091, 4111 Kocsord; *No.* 4077, 14354 Tunyogmatolcs; **FU02** *No.* 4522 Gulács; **FU03** *No.* 4885, 4893 Vámosatya, Bockerek-erdő; *No.* 4904, 8007 Csaroda; *No.* 14386, 14338 Jánd; *No.* 8013 Tákos; **FU12** *No.* 4023, 4028 Kisar; *No.* 4058, 4063, 4064, 4065, 4066, 4106, 4107, 10390 Kömörő; *No.* 4035, 4099, 8020, 8021 Tarpa; *No.* 4042, 14385 Tivadar; **FU13** *No.* 4097, 4098 Beregsurány; **FU22** *No.* 4046, 4880, 7140 Tiszacsécse; **FU22** *No.* 7132, 7146 Tiszakóród; **FU22** *No.* 4080, 4895 Túristvándi; **FU32** *No.* 10395 Tiszabecs; **WM89** *No.* 12055, 12057 Felsőszölnök; **WM99** *No.* 12075 Alsószölnök; *No.* 12076 Kétvölgy; *No.* 4706, 12047, 12060, 12087 Szakonyfalu; **XL99** *No.* 4760, 4761 Drávatamási; **XM07** *No.* 8542 Gödörháza; *No.* 8518, 8502, 8503 Velemér; **XM08** *No.* 8547 between Bajánsenye and Dávidháza; *No.* 12241 between Bajánsenye and Őriszentpéter; *No.* 8529 Kercaszomor; **XM08** *No.* 8515, 12016, 12081, 12033 Őriszentpéter; **XM09** *No.* 12256, 12263 Ispánk; *No.* 12231 Kondorfa; *No.* 12030 between Orfalu and Őriszentpéter; *No.* 8536 Szalafő; **XM17** *No.* 9149 Csesztreg; *No.* 11534, 11559 Kálócfa; *No.* 11606 Zalabaksa; **XM18** *No.* 8525 Csöde; *No.* 12028, 12074, 12079 Nagyrákos; *No.* 12044 Szatta; **XM19** *No.* 6428 Rimány; *No.* 12037 Viszák; *No.* 12240 Őrimagyarósd; **XM24** *No.* 4124, 4129, 4142, 4145, 9116, 14315 Murarátka;

XM25 *No.* 9139 Dobri; *No.* 5442 Kányavár; *No.* 9130 Szemenyecsörnye; *No.* 5437 Tormafölde; **XM27** *No.* 5398 Nova; **XM28** *No.* 12270 Zalalövő; **XM42** *No.* 5424, 5425 Őrtilos; **XM43** *No.* 14276 Molnári; **XM44** *No.* 14309 Semjénháza; **XM47** *No.* 8551, 8552 Bak; **XM48** *No.* 3134 Zalaegerszeg; **XM53** *No.* 9155 Somogybükkösd; **XM59** *No.* 4701 Kehida; **XM62** *No.* 9163 Csurgónagymárton; **XM63** *No.* 9172 Somogycsicsó; **XM69** *No.* 2867 Vidornyaszőllös; **XM70** *No.* 4766 Heresznye; **XM75** *No.* 5416 Szőkedencs; **XM76** *No.* 5412 Hollád; **XM77** *No.* 11273 Balatonberény; **XM78** *No.* 1425 Gyenesdiás; **XM78** *No.* 1409, 1731, 1739, 1993, 2060, 2061, 2068, 2095, 2114, 2115, 2116, 2117, 2123, 2125, 2129, 2141, 2142, 2143, 7355, 7356 Keszthely; **XM78** *No.* 1395, 1420 Balaton, Szent Mihály kápolna; **XM79** *No.* 1841, 1860, 10063 Zalaszántó; **XM86** *No.* 7305 Marcali; **XM87** *No.* 1866, 12382 Balatonfenyves; *No.* 10075 Balatonmáriafürdő; *No.* 2830 Bélatelep; **XM88** *No.* 4447 Badacsony; *No.* 4515, 4528, 4536, 4541 Badacsonytördemic; *No.* 11227, 11246, 11262, 11347, 14388 Szigliget; *No.* 14344 Szigliget, Eger-víz; **XM97** *No.* 4472 Fonyód; **XM99** *No.* 4566 Tóti hegy; **XN00** *No.* 8122 Vasszentmihály; **XN12** *No.* 8139 Pornóapáti; **XN14** *No.* 8135, 8168, 8188, 10637, 10644, 11562, 11579, 11584, 11588 Velem; **XN18** *No.* 5698, 5708 Brennbergbánya; **XN18** *No.* 876 Sopron; *No.* 5720 Sopron, Kecske-patak; *No.* 5714 Tómalom; **XN20** *No.* 8125, 8126, 12259 Körmend; **XN25** *No.* 8182 between Horvátzsidány and Kőszeg; *No.* 11440 Répcevis; *No.* 11425, 11426 Zsira; **XN28** *No.* 13113 Fertőrákos; **XN32** *No.* 4196 Tanakajd; **XN36** *No.* 871 Röjtökmuzsaj; *No.* 5690 between Röjtökmuzsaj and Csapod; *No.* 880, 887, 903, 904, 1205, 1291, 1293, 1326, 1331, 1337, 1340, 1350, 1354 Sopronhorpács; *No.* 873 Völcsej; **XN45** *No.* 13058, 13071 Csáfordjánosfa; **XN46** *No.* 5689 Csapod; **XN47** *No.* 865, 915 Petőháza; **XN57** *No.* 13069, 13107, 14304 Osli; **XN58** *No.* 13105 Csorna; **XN59** *No.* 5608, 5610 Mosonszentjános; **XN69** *No.* 14278, 13078 Újrónafő; *No.* 13099, 13062 Tárnokréti; **XN79** *No.* 13083, 14287 Lébény; *No.* 3001 Magyarkimle; *No.* 2008 Novákpuszta; **XN89** *No.* 2028 Lickópuszta; *No.* 2967 Zsejke; **XN90** *No.* 14334 Kapolcs; **XN93** *No.* 11758 Bakony; **XN99** *No.* 1262, 1312 Medve; **XP50** *No.* 6017 Várbalog; **XP60** *No.* 3976, 5598 Hegyeshalom; *No.* 2015, 2016 Lajta; *No.* 5618, 6005, 6008 Levél; *No.* 2019, 2020, 3982, 5615, 5998 Mosonmagyaróvár; *No.* 6012 Mosonszolnok; **XP61** *No.* 10572 Bezenye; *No.* 1478, 1523, 1561, 1592, 1602, 1609, 1614, 1653, 1659, 3881 Rajka; **XP80** *No.* 1299 Kimle; **YL37** *No.* 4751, 4759 Vejti; **YL38** *No.* 4746 Vajszló; **YM03** *No.* 11602 Bárdibükk; **YM03** *No.* 7155, 10438, 10434 Bőszénfa; *No.* 7301, 7175 Dennapuszta; **YM07** *No.* 14327 Szőlősgyörök; **YM08** *No.* 717, 1953, 2845, 11401 Balatonboglár; *No.* 11339 between Balatonlelle and Balatonszemes; *No.* 4783 Látrány; **YM09** *No.* 11256, 14328 Balatonszepezd; **YM12** *No.* 7169, 7295, 9189, 9216, 10583 Ropolya; *No.* 2948, 2949 Simonfa; **YM13** *No.* 2924, 2918 Zselice; *No.* 2931, 10446 Zselicszentpál; *No.* 10429 Zselicség; **YM14** *No.* 10443 Toponár; **YM19** *No.* 3142, 3143, 3147 Tihany; *No.* 12379, 12405 Örvényes; **YM23** *No.* 10453 Szentbalázs; **YM29** *No.* 12387, 12394, 12396 Balatonendréd; *No.* 11367 Zamárdi; **YN09** *No.* 1510, 1253 Vének; **YN10** *No.* 14341, 14358 Koloska-patak; **YN13** *No.* 14391 Pénzesgyőr; **YN14** *No.* 3378 Bakony; *No.* 5522 Bakonyszentkirály; *No.* 5514 Csesznek; *No.* 5526 Gézaháza; **YN20** *No.* 11242 Palóznak; **YN26** *No.* 5506 Bakonyszombathely.

6.15 *Aporrectodea sineporis* (Omodeo, 1952)

(Figs. 6.15.1–2.)

Eiseniella balcanica sine-poris Omodeo, 1952a Arch. Zool. Ital., 37: 31.
Eiseniona sine-poris: Omodeo 1956 Arch. Zool. Ital., 41: 189.
***Allolobophora handlirschi* (part.): Zicsi 1968a Opusc. Zool. Budapest, 8: 150.**
Allolobophora sineporis: Zicsi 1981b Opusc. Zool. Budapest, 17–18: 175.
Allolobophora balcanica sineporis: Zicsi 1982a Acta zool. hung., 28: 444.
Allolobophora cf. *sineporis*: Zicsi 1982c Rev. suisse Zool., 89: 561.
Allolobophora (s. l.) *balcanica sineporis*: Easton 1983 Earthworm Ecology, p. 476.
***Allolobophora sineporis*: Zicsi 1991 Opusc. Zool. Budapest, 24: 184.**
Aporrectodea (Aporrectodea) sineporis: Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 287.
Eiseniona balcanica sine-poris: Qiu & Bouché 1998a Doc. pedozool. integrol., 4: 188.

Description – *External* – Body length 30–40 mm, diameter 3–5 mm, 87–115 segments. Colour alive brownish, dorsally reddish with iridescence, preserved pale. Head epilobous 1/2 open, dorsal pores lacking. Glandular tumescence usually on 11, 12, rarely also on 9 *ab*. Setae closely paired, setal arrangement after the clitellum aa:ab:bc:cd:dd = 9.5:2:7.5:1:25. Clitellum extends on segments 24, 25–30, 31 saddle-shaped. Tubercles on 27–29 with two small knobs on 27 and 29. Male pore on 15, between setae *b–c*, almost as small as the female pore on 14. Nephropores alternate irregularly between setal line *b* and above *d*. *Internal* – There are no dissepiments notably thickened. Crop in 15–16, gizzards in 17–18. Two pairs of testes covered with sperm mass (or cut up testis sac?) in 10, 11. Three pairs of seminal vesicles in 9, 11, 12. Spermathecae two pairs, hanging on long stalk in 9/10, 10/11, and open in the setal line *cd*. Calciferous glands in 10–11 with lateral pouches in 10. Excretory system holonephridial. Nephridial bladders J-shaped with backward-oriented ental part. The cross-section of longitudinal muscle layer is of pinnate type (Zicsi 1982c).

Remarks – This species has long been taken for *Ap. handlirschi*, until Zicsi (1982c) redescribed it and the closely related species of the *handlirschi* group.

Ecology – *Ap. sineporis* is a forest inhabiting species, where it lives in the lower litter layer. According to the ecological groupings it belongs to the epigeic division.

Distribution – *Ap. sineporis* is a Southern-Alpine species distributed in northern Italy, Austria, Hungary and Slovenia (fig. 6.15.1).

Distribution in Hungary (fig. 6.15.2) – **CS12** *No*. 14444 Bátaapáti; **YM12** *No*. 7308 Marcado (Zselickisfalud); 7168, *No*. 7292 Ropolypuszta; **XN18** *No*. 5697 *No*. 5709 Brennbergbánya.

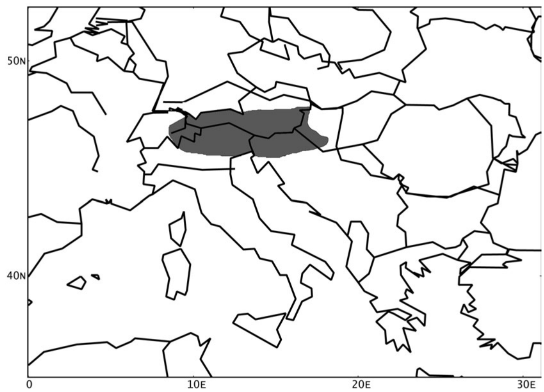

Fig. 6.15.1 Distribution of *Aporrectodea sineporis*.

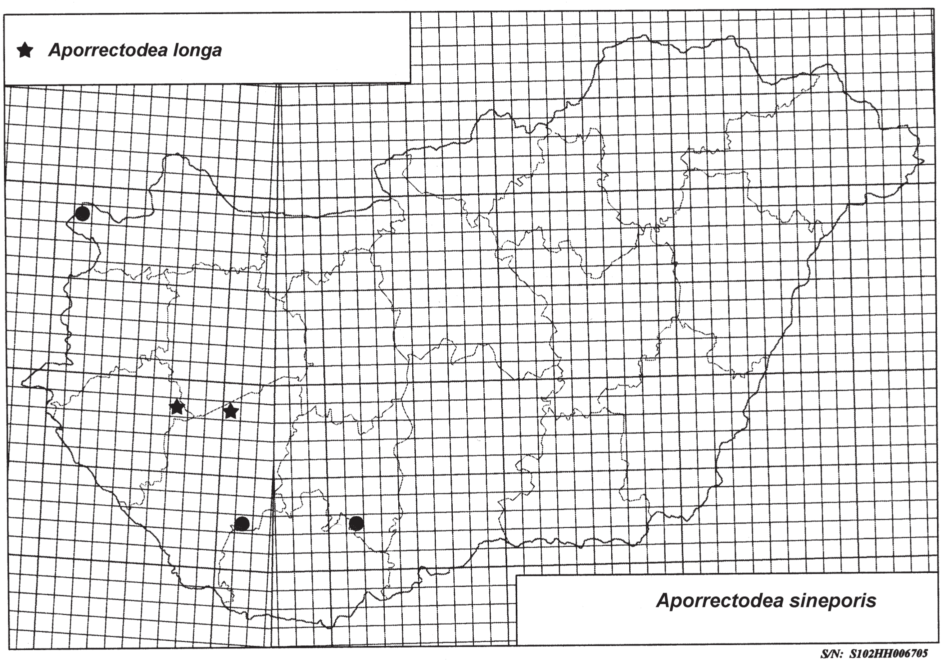

Fig. 6.15.2. Distribution of *Aporrectodea longa* and *Aporrectodea sineporis* in Hungary.

6.16 *Aporrectodea* (s. l.) *dubiosa* (Örley, 1881)

(Figs. 6.16.1–3.)

***Criodrilus dubiosus* Örley, 1881a Math. és term. tud. közlemények, 16: 603.**
***Allolobophora dubiosa*: Örley 1885 Értek. term. tud. köréből, 15: 24.**
Criodrilus dubiosus: Michaelsen 1900a Das Tierreich, 10: 515.
***Helodrilus (Allolobophora) dubiosus*: Szüts 1909 Állattani Közlemények, 8: 132.**
Archeodrilus dubiosus: Szüts 1913 Zool. Anz., 42: 346.
Allolobophora blinovi: Černosvitov, 1938 Zool. Anz., 122: 287.

Allolobophora dubiosa v. *pontica* Pop, 1938 Bul. Soc. Sti. Cluj, 9: 140.
***Allolobophora dubiosa* f. *typica* + *Allolobophora dubiosa* var. *pontica*: Pop 1943 Ann. Hist.-Nat. Mus. Hung., 36: 13.**
***Allolobophora dubiosa* f. *typica*: Zicsi 1959a Acta zool. hung., 5: 440.**
***Allolobophora dubiosa*: Zicsi 1968a Opusc. Zool. Budapest, 8: 159.**
Nicodrilus dubiosus: Perel 1979 Range and regularities in the distr. earthworms, p. 209.
Allolobophora dubiosa: Zicsi 1982a Acta zool. hung., 28: 445.
Aporrectodea dubiosa: Easton 1983 Earthworm Ecology, p. 476.
***Allolobophora dubiosa*: Zicsi 1991 Opusc. Zool. Budapest, 24: 187.**
Aporrectodea (Aporrectodea) dubiosa: Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 334.
Heraclescolex dubiosus: Qiu & Bouché 1998b Doc. pedozool. integrol., 3: 189.

Description – *External* – Body length 120–250 mm, diameter 7–10 mm, 120–303 segments. Colour dark green or greenish brown. Head epilobous, first dorsal pore between 3/4–4/5. Glandular tumescence usually on 10, 11, 13, 14, 17–19, 36–39, 43–48 *ab* and 10, 11, 36, 37, 38–46, 47, 48, 49 *cd*. Setae closely paired, setal arrangement after the clitellum: aa:ab:bc:cd:dd = 9.25:1.5:6.5:1:20. Clitellum of fully adult specimens extends on segments 36, 37–47, 48, saddle-shaped. Tubercles on 43, 44–47, 48 as a pair of slight bands, sometimes hardly seen. Male pore on 15, between setae *b–c*, surrounded by a glandular crescent, if fully developed, occupying the neighbouring segments as well. The clitellar region is frequently seen with spermatophores attached. *Internal* – Dissepiments 6/7–12/13 strongly thickened, 13/14 slightly incrassate. Crop in 15–16, gizzards in 17–18. Two pairs of testes free in 10, 11, and four pairs of seminal vesicles in 9–12. Receptacula seminis three pairs in 8/9, 9/10, 10/11 open in setal line *cd*. Calciferous glands in 10–12 with large lateral pouches in 10. Excretory system holonephridial with J-shaped nephridial bladders, hook backwards. The cross-section of longitudinal muscle layer fasciculated (fig. 6.16.1).

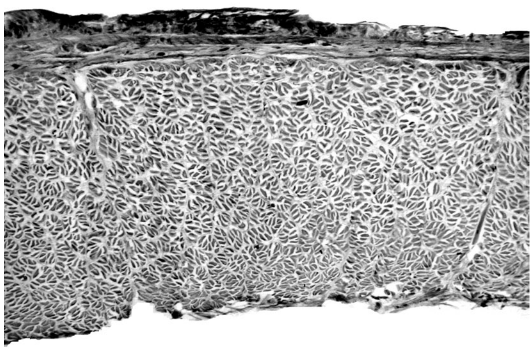

Fig. 6.16.1. Longitudinal musculature of *Aporrectodea* (s. l.) *dubiosa*

Remarks – *Criodrilus dubiosus* Örley, 1881 has been placed into *Nicodrilus* (a synonym of *Aporrectodea*) by Perel (1979) and it was later accepted by Mršić (1991), although it differs from the diagnosis of this genus in several characters such as greater size, fasciculated musculature and dark green colour, clitellum occupies more than 10 segments etc. On the basis of size and dark green colour Qiu & Bouché (1998b) placed it to their new genus *Heraclescolex* together with *Allolobophora molleri* Rosa, 1889 and *Allolobophora moebii*

Michaelsen, 1895, but it seems improbable that this Trans-Aegean species belongs to a Franco-Iberian genus that taxonomically is not robust enough.

Ap. dubiosa shows maturity only in a short period of the year. In case of unfavourable weather conditions it sets the clitellar organs back. This is the main reason for the high variability of these data found in the literature (Zicsi 1963).

Ecology – This large-bodied earthworm species lives mainly in flooded places where it burrows its head into the mud and undulates its body to secure the necessary quantity of oxygen. It feeds on mud and plant remnants and the casts are deposited on marshy tussocks as big cast-heaps. The cast production of *Ap. dubiosa* on the average is 4.15 g dry matter/day, that is one of the highest rates observed among lumbricids (Zicsi 1983b).

Distribution – This species has a Trans-Aegean distribution. It occurs from Slovakia to Ukraine and Bulgaria and there is an other area-body around the eastern shore of the Black Sea. Omodeo & Rota (1989) reported it from Northern Turkey as well (fig. 6.16.2).

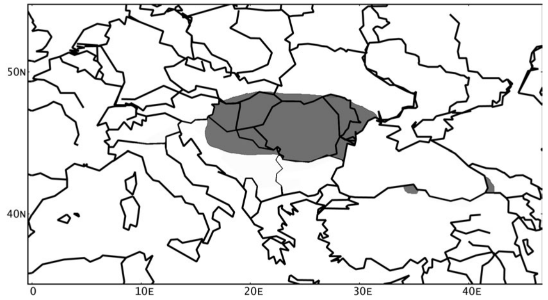

Fig. 6.16.2. Distribution of *Aporrectodea* (s. l.) *dubiosa*.

Distribution in Hungary (6.16.3) – **BR88** *No.* 1931 Harkány; **BS79** *No.* 1919 Balatonszéplak; **BT71** *No.* 1917 Balatonfűzfő; **CS21** *No.* 1064 Báta; *No.* 1821 between Bátaszék and Baja; **CS48** *No.* 595, 2045, 2046, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2883 Dunaföldvár; **CT13** *No.* 1440 Pátka; **CT77** *No.* 5554 Gödöllő; **CT79** *No.* 3235 Csővár; **CT87** *No.* 2861, 3054, 7202 Bag, Petőfi-forrás; **CT95** *No.* 4970, 4971 Tápiószecső; **CU72** *No.* 5276 Ipolyszög; **DS28** *No.* 4777 Tiszazug; *No.* 11569 Tiszaalpár; **DS32** *No.* 1717, 1718 Atka; *No.* 1734 Algyő; *No.* 1736, 1752, 2038 Szeged; *No.* 1994 Nagyfa; *No.* 1995 Vesszősi; **DS37** *No.* 1722, 1723 Csongrád; **DS72** *No.* 1696 Csanád; **DT16** *No.* 4975 Jászberény; **DT83** *No.* 8404 Kisújszállás; **DT94** *No.* 3358, 5320 Karcag; **DT95** *No.* 8382, 8383, 8386 Nagyiván, **DT98** *No.* 8389 Tiszacsege; **DU21** *No.* 1689 Nádújfalu; **ET04** *No.* 3326 Püspökladány; **ET13** *No.* 5353 Báránd; **ET17** *No.* 8379 Hortobágy; **ET23** *No.* 9014, 9020 Sáp; **ET51** *No.* 5388 Ártánd; **ET99** *No.* 11154 Bátorliget; **EU21** *No.* 5378 Tiszavasvári; **EU35** *No.* 2782, 2783 Köveskút; **EU46** *No.* 3084, 3092, 3093, 3094 Sátoraljaújhely; **EU94** *No.* 3660 Mezőladány; **FU03** *No.* 4888 Vámosatya, Bockerek-erdő; **FU12** *No.* 4026, 4027 Kisar; **XM67** *No.* 1928 Zala-folyó; **XM77** *No.* 11352 Balatonberény; **XM78** *No.* 1191 Gyenes; *No.* 1408 Keszthely; *No.* 1433 Gyenesdiás; **XM87** *No.* 11307 Balatonmária; **XM88** *No.* 1452 Badacsony; **XM98** *No.* 1447 Révfülöp; **YM08** *No.* 766, 2043, 10544 Balatonboglár; **YM09** *No.* 1434 Balatonakali.

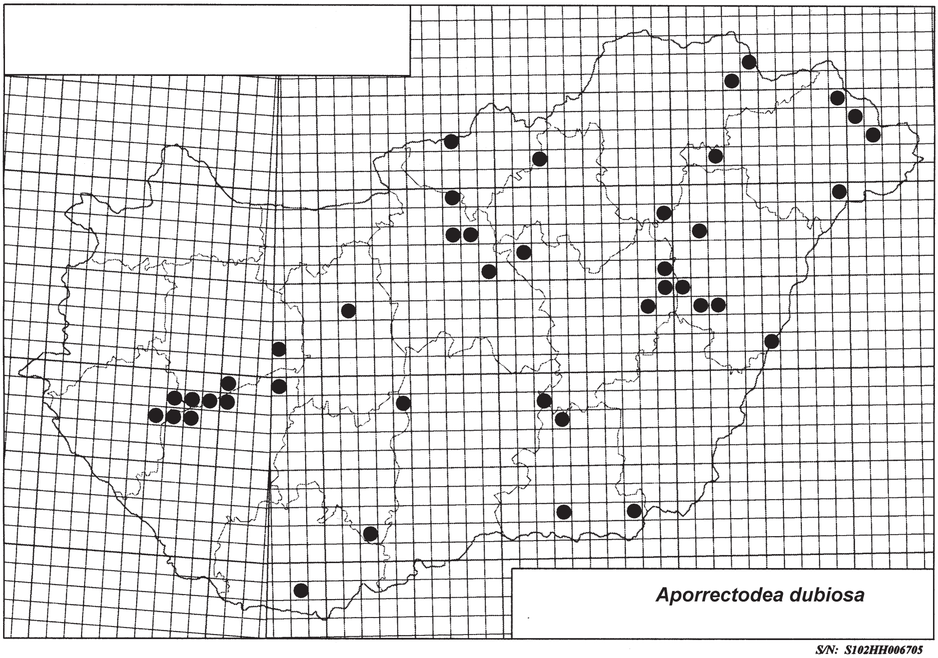

Fig. 6.16.3. Distribution of *Aporrectodea* (s. l.) *dubiosa* in Hungary.

Genus *Cernosvitovia* Omodeo, 1956 sensu Zicsi 1981a

Allolobophora (part.): Rosa 1897 Boll. Mus. Torino, 12(269): 2.
Octolasium (part.): Michaelsen 1900a Das Tierreich, 10: 504.
Allolobophora (*Cernosvitovia*) (part.) Omodeo, 1956 Arch. zool. Ital., 41: 180.
Eophila (part): Omodeo 1956 Arch. zool. Ital., 41: 184.
Cernosvitovia: Zicsi 1981a Acta zool. Hung., 27: 441.
Allolobophora (part.): Zicsi 1982a Acta Zool. Hung., 28: 444–445.
Cernosvitovia: Easton 1983 Earthworm Ecology., p. 481.
Scherotheca (*Opothedrilus*) (part.): Omodeo 1988 Boll. Zool., 55: 82.
Cernosvitovia (*Cernosvitovia*): Mršić & Šapkarev 1987 Biol. vestn., 35: 71.
Cernosvitovia (Zicsiona) (part.): Mršić & Šapkarev 1987 Biol. vestn., 35: 70.
Cernosvitovia (Cernosvitovia): Mršić & Šapkarev 1988 Acta Mus. Mac. Sci. Nat., 19: 13.
Cernosvitovia (Zicsiona) (part.): Mršić & Šapkarev 1988 Acta Mus. Mac. Sci. Nat., 19: 13.
Italobalkaniona (part.): Mršić & Šapkarev, 1988 Acta Mus. Mac. Sci. Nat., 19: 20.
Italobalkaniona (part.): Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 157.
Cernosvitovia (*Cernosvitovia*) + *Cernosvitovia (Zicsiona)* (part.): Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 140, 149.
Cernosvitovia (*Cernosvitovia*) + *Cernosvitovia (Zicsiona)*: Zicsi 1995 Ann. Naturhist. Mus. Wien, 97B: 126.
Cernosvitovia (*Cernosvitovia*) + *Cernosvitovia (Zicsiona)*: Qiu & Bouché 1998b Doc. pedozool. integrol., 3: 213.

Type species – *Allolobophora rebelii* Rosa, 1897 by original designation.

Diagnosis – *External* – Setae closely paired, pigmentation lacking, sometimes with grey or brown colour. Prostomium epilobous, dorsal pore variable. Male pore hardly visible, never on 15, shifted towards the clitellum. Spermathecae open in setal line *cd*, nephropores aligned in setal line *ab* (always?). *Internal* – Two pairs of testes in 10, 11, and two or four pairs of seminal vesicles in 11, 12 or 9–12. Receptacula seminis two pairs situated in intersegmental furrow 9/10, 10/11 or more (up to nine) situated from 9/10 backwards. Calciferous glands with lateral diverticula in 10. Excretory system holonephridial, nephridial bladders U- or J-shaped with forward-oriented ental part. The cross-section of longitudinal muscle layer is of fasciculated type.

Two subgenera: *Cernosvitovia* (*Cernosvitovia*) Omodeo, 1956
Vesicles four pairs in 9–12.
Cernosvitovia (*Zicsiona*) Mršić & Šapkarev, 1987
Vesicles two pairs in 11, 12.

Remarks – The genus *Cernosvitovia* is distributed in the Balkans and in Asia Minor. There is a Franco-Iberian genus *Postandrilus* Qiu & Bouché, 1998b showing similar generative morphology but differing in the structure of the nephridial bladders. Whether it is a convergence or there are some phylogenetic affinities between the two genera are yet to be answered.

6.17 *Cernosvitovia* (Zicsiona) *opisthocystis*? (Rosa, 1895)

(Figs. 6.17.1., 6.18.5.)

Allolobophora opisthocystis Rosa, 1895 Boll. Mus. Torino, 10: 4.
Allolobophora (Eophila) opisthocystis: Michaelsen 1900c Abh. Ver. Hamburg, 16: 10.
Helodrilus (Helodrilus) opisthocystis: Michaelsen 1900a Das Tierreich, 10: 499.
Allolobophora dugesi var. *opisthocystis*: Pop 1949 Anal. Acad. R. P. R., 1(9): 61.
***Allolobophora dugesi* var. *opisthocystis:* Zicsi 1959a Acta zool. hung., 5: 438.**
***Allolobophora dugesi* v. *opisthocystis*: Zicsi 1968a Opusc. Zool. Budapest, 8: 157.**
Allolobophora opisthocystis: Zicsi 1982a Acta zool. hung., 28: 435.
Eophila opisthocystis: Easton 1983 Earthworm Ecology, p. 481.
Cernosvitovia (Zicsiona) getica (Pop, 1947): Mršić & Šapkarev 1987 Biol. vestn., 35: 71.
Scherotheca (Opothedrilus) opisthocystis: Omodeo 1988 Boll. Zool., 55: 82.
Cernosvitovia (Zicsiona) getica: Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 152.
Italobalkaniona opisthocystis: Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 170.
Allolobophora (?) *opisthocystis*: Zicsi & Pop 1991 Mitt. hamb. zool. Mus. Inst., 88: 126.
Cernosvitovia (Zicsiona) opisthocystis: Zicsi 1995 Ann. Naturhist. Mus. Wien, 97B: 127.
Italobalkaniona opisthocystis: Qiu & Bouché 1998a Doc. pedozool. integrol., 4: 184.

Description – *External* – Body length 140–170 mm, diameter 7 mm, 290–360 segments. Colour usually grey. Head epilobous, first dorsal pore in the intersegmental furrow 11/12, 2/13, 13/14. Glandular papillae usually on 12, 14–17, 22–24, 35–37 *ab*. Setae closely paired. Clitellum extends on segments 24, 25–37, saddle-shaped. Tubercles lie alongside the clitellum's ventral margins on 25–37. Male pore in 32, 33. *Internal* – Dissepiments 5/6–9/10 strongly thickened, 4/5, and 10/11 less so. Crop in 15–16, gizzards in 17–20. Two pairs of testes free in 10, 11, and two pairs of seminal vesicles in 11, 12. Spermathecae six or seven pairs in 13/14–18/19, or 19/20, open in the setal line *cd*. Calciferous glands with lateral pouches in 10. Excretory system holonephridial. Nephridial bladders not known. There are no data on the structure of longitudinal muscle layer.

Remarks – *C. (Z.) opisthocystis* has been revised and transferred to *Cernosvitovia (Zicsiona)* by examining the type specimens (Zicsi 1995). Unfortunately this species is known only by three juvenile specimens in Hungary, and the most important character, the location of the male pore could not be traced. Until new material is collected the specific status of this material remains in question.

Ecology – It prefers chernozem soils.

Distribution – *C. (Z.). opisthocystis* seems to be a Dacian species living in the eastern part of Hungary and in the western part of Romania (fig. 6.17.1).

Distribution in Hungary (fig. 6.18.5) **– FU12** *No*. 10875 Kömörő.

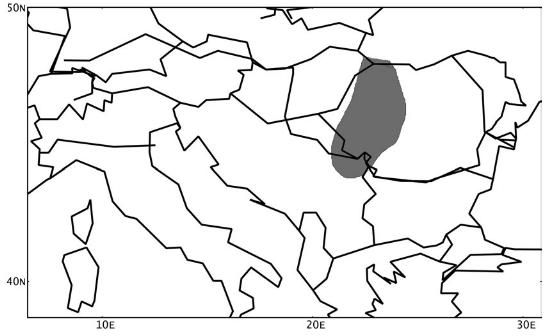

Fig. 6.17.1. Distribution of *Cernosvitovia (Zicsiona) opisthocystis*.

Genus *Dendrobaena* Eisen, 1873

Enterion (part.) Savigny, 1826 Mem. Acad. Sci. Inst. Fr., 5: 179.
Dendrobaena Eisen, 1873 Öfv. Akad. Förh., 30: 53.
Octolasion (part.) Örley 1885 Értek. term. tud. köréből, 15(18): 13.
Allolobophora (Dendrobaena) (part.): Rosa 1893a Mem. Acc. Torino, 43: 424.
Helodrilus (Dendrobaena) (part.) + *Helodrilus (Helodrilus)* (part.): Michaelsen 1900a Das Tierreich, 10: 488, 495, 501.
Dendrobaena (part.): Pop 1941 Zool. Jb. Syst., 74: 518.
Dendrobaena (Dendrobaena) (part.): Omodeo 1956 Arch. zool. Ital., 41: 173.
Dendrobaena (Dendrobaena) (part.): Bouché 1972 Inst. Nat. Rech. Agron., p. 388.
Dendrobaena (part.): Perel 1976b Zool. Zh., 55: 834.
Dendrobaena (part.): Perel 1979 Range and regularities in the distr. earthworms, p. 227.
Dendrobaena (part.): Zicsi 1982a Acta Zool. Hung., 28: 443.
Dendrobaena: Easton 1983 Earthworm Ecology, p. 478–479.
Dendrobaena + *Kritodrilus* (part.): Omodeo & Rota 1989 Boll. Zool., 56: 184.
Dendrobaena: Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 548.
Omodeoia Kvavadze, 1993 Bull. Acad. Sci. Georgia, 148: 132. **syn. nov**.
Dendrobaena (part.): Perel 1997 Earthworms of Russia, p. 77.
Dendrobaena: Csuzdi & Pavlíček 1999 Isr. J. Zool., 45: 473.
Dendrobaena: Qiu & Bouché 1998b Doc. pedozool. integrol., 3: 204.

Type species – *Enterion octaedrum* Savigny, 1826 (= *Dendronaena boeckii* Eisen, 1873) by original designation.

Diagnosis – *External* – Setae widely paired or distant, pigmentation purple-red, sometimes lacking. Prostomium from epilobous to tanylobous, dorsal pore variable. Male pore on 15, fairly visible, sometimes with glandular crescent intruding into the neighbouring segments. Spermathecae open in setal line *cd* or above up to the mid-dorsal line. Nephropores aligned in *b* or regularly or irregularly alternate between *b* and above *cd*. *Internal* – Two pairs of testes in 10, 11, and three or four (rarely two) pairs of seminal vesicles in 9–12 or 9, 11, 12 (rarely only in 11, 12). Receptacula seminis two or three pairs situated in intersegmental furrow 9/10, 10/11, (11/12). Calciferous glands without lateral diverticula in 10 but 11, 12 or in one of them. Excretory system holonephridial, nephridial bladders sausage- or biscuit-shaped sometimes alternating inside one specimen. The cross-section of longitudinal muscle layer typically is of pinnate type but in case of the *veneta*-group it is fasciculated.

Remarks – The genus *Dendrobaena* is heterogeneous very much and urgently need a revision. There are considerable differences in the shape of nephridial bladders, in the structure of longitudinal muscle layer and in the structure of calciferous glands, furthermore in the position of the last pair of hearts. Even the setal arrangement is varying from the moderately paired situation (*D. hortensis*) to distantly standing (*D. octaedra*).

Table 6.3. Distinguishing characters of *Dendrobaena* species in Hungary.

Species	Clitellum	Tubercles	Vesicles	Spermathecae	Nephridial bladders	Musculature
D. auriculata	23, 24–34	31–33	9–12	9/10, 10/11 *d*	bilobate	pinnate
D. clujensis	27, 28–33	30–32, 1/n 33	9, 11, 12	9/10, 10/11 *d*	sausage-shaped	pinnate
D. cognettii	32, 33–36, 37	—	11, 12	—	bilobate	pinnate
D. ganglbaueri	23, 24–29	25–27	9–12	9/10, 10/11 *d*	sausage-shaped	pinnate
D. hortensis	27–33	30–½ 33	9, 11, 12; 11, 12	9/10, 10/11 M	sausage-shaped	fasciculated
D. octaedra	28, 29–33, 34	31–33, 1/n 33	9, 11,12 (9–12)	9/10, 10/11, 11/12 *d*	sausage- or biscuit-shaped	pinnate
D. vejdovskyi	28, 29–33	31–32	11, 12	9/10, 10/11 *d*	sausage- or biscuit-shaped	pinnate
D. veneta	26, 27–32, 33	30–31	9–12	9/10–10/11 M	sausage-shaped	fasciculated

6.18 *Dendrobaena auriculata* (Rosa, 1897)

(Figs. 6.18.1–5.)

Allolobophora auriculata Rosa, 1897 Boll. Mus. Torino, 12: 2.
Allolobophora auriculata: Michaelsen 1900a Das Tierreich, 10: 513.
Eisenia skorikowi Michaelsen, 1902a Mitt. Mus. Hamburg, 19: 40.
Dendrobaena auriculata: Omodeo 1956 Arch. Zool. Ital., 41: 174.
Dendrobaena auriculata: Plisko 1962 Bull. Acad. Pol. Sci., 10: 62.
***Dendrobaena auriculata*: Zicsi 1964a Ann. Univ. Sci. Budapest, 7: 257.**
***Dendrobaena auriculata*: Zicsi 1968a Opusc. Zool. Budapest, 8: 135.**
Kritodrilus auriculatus: Perel 1979 Range and regularities in the distr. earthworms, p. 202.
Dendrobaena auriculata: Zicsi 1982a Acta zool. hung., 28: 443.
Kritodrilus auriculatus: Easton 1983 Earthworm Ecology, p. 482.
***Dendrobaena auriculata*: Zicsi 1991 Opusc. Zool. Budapest, 24: 176.**
Kritodrilus auriculatus: Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 489.
Dendrobaena auriculata: Zicsi & Csuzdi 1999 Rev. suisse Zool., 106: 992.
Dendrobaena auriculata: Qiu & Bouché 1998a Doc. pedozool. integrol., 4: 194

Description – *External* – Body length 25–70 mm, diameter 1.5–2.5 mm, 122–140 segments. Colour pale, pigmentation lacking. Head epilobous, dorsal pores cannot be found. Glandular tumescence usually on 9, 10 *bcd*. Setae widely paired, setal arrangement after the clitellum: aa:ab:bc:cd:dd = 1.87:1.63:1.37:1:3.1. Clitellum on segments 23, 24–34, saddle-shaped. Tubercles on 31–33 as great protuberant crescents. Male pore on 15 between setae *b–c*, confined into its own segment. Nephropores aligned in setal line *b*. *Internal* – There are no dissepiments notably thickened. Crop in 15–16, gizzards in 17–18. Two pairs of testes in 10, 11, enclosed in perioesophageal testis sacs, and four pairs of seminal vesicles in 9–12. Spermathecae two pairs in 9/10, 10/11, open near to setal line *d*. Calciferous glands in 10–12, with small but distinct diverticulum in 10. Last pair of lateral hearts in 11, extraoesophageals in segment 12 are lacking. Excretory system holonephridial. Nephridial bladders bilobate (fig. 6.18.1). Typhlosole lamelliform, the cross-section of longitudinal muscle layer is of pinnate type (fig. 6.18.2, 6.18.3).

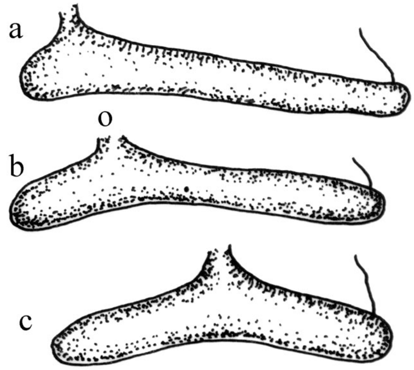

Fig. 6.18.1. Nephridial bladders of *Dendrobaena auriculata*: ***a.*** from segment 7, ***b.*** from segment 15, ***c***. from the postclitellar segments. ***o.*** = opening to the nephridiopore.

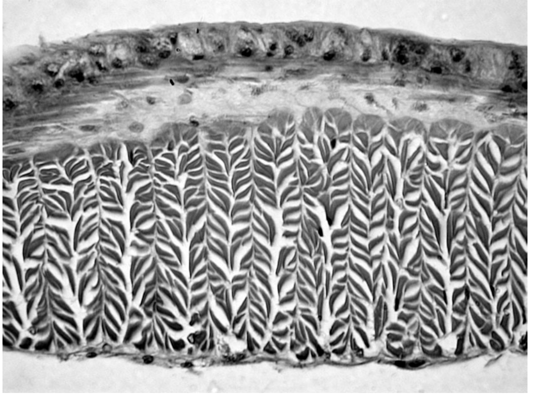

Fig. 6.18.2. Longitudinal musculature of *Dendrobaena auriculata*.

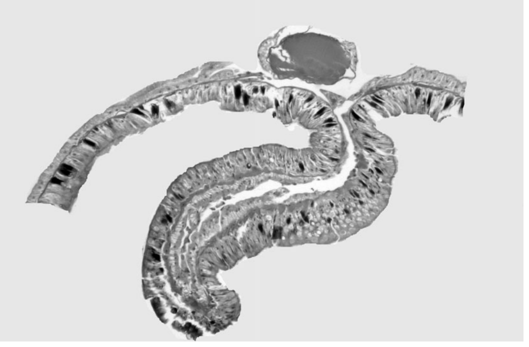

Fig. 6.18.3. Typhlosole of *Dendrobaena auriculata*.

Remarks – PEREL (1979) classifies this species into the genus *Kritodrilus* BOUCHÉ, 1972 on the basis of the shape of nephridial bladders. ZICSI & CSUZDI (1999) claim that remarkable differences exist between the species of the genus *Kritodrilus* and *D. auriculata*. These are the pinnate type of longitudinal musculature instead of being fasciculated, and the presence of calciferous diverticula in segment 10. Both of the differences alone would justify a separate genus.

Ecology – In spite of the absence of pigmentation, this species belongs into the epigeic group. It casts exclusively onto the surface. The daily cast production is 25.15 mg dry mass pro 1g living weight. The litter consumption is almost the same 24.40 mg dry mass pro 1g living weight (ZICSI 1974a). It indicates that *D. auriculata* under normal condition feeds exclusively on leaf litter.

Distribution – *D. auriculata* is an Eastern-Alpine species occurring in Austria, Hungary, Slovakia, Czech Republic, Poland and Ukraine (fig. 6.18.4).

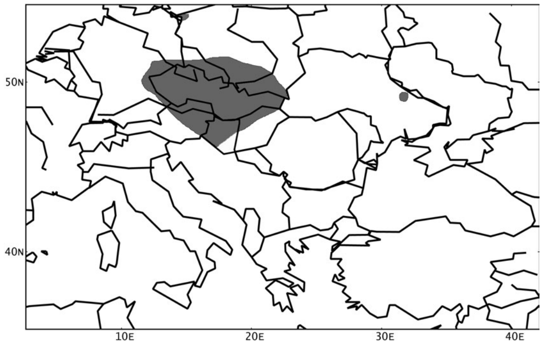

Fig. 6.18.4. Distribution of *Dendrobaena auriculata*.

Distribution in Hungary (fig. 6.18.5) – **BS80** *No.* 7316 Mecsek Mts. Lapis; **CT05** *No*. 5492 Vértes Mts. Kőhányás; **CT16** *No*. 4473, 7559, 8409, 8961, 9084, 10482 Vértes Mts. Vinyabükki-völgy; **CT38** *No*. 5573, 5576 Pilis Mts. Fekete-hegy; **CT48** *No*. 10009 Pilis Mts. Apátkuti-völgy; **CT58** *No*. 2814 Alsógöd; *No*. 7538 Pilis Mts. Lajosforrás; *No*. 9968 Pilis Mts. Bükkös-patak; **CT77** *No*. 4489 Gödöllő; **CT79** *No*. 3137, 3242, 3250 Csővár; **CU30** *No*. 4006 Letkés; **CU50** *No*. 7540 Szendehely; **DU51** *No*. 4804, 9209 Bükk Mts. Szarvaskő; **DU52** *No*. 10493 Bükk Mts Bélkő; **DU55** *No*. 4499 Kelemér; **DU63** *No*. 3337, 3368, 4392, 4648 Bükk Mts Örvénykő; **DU66** *No*. 692, 3940, 4442, 4512, 4575, 5660, 7366, 7652 Aggtelek; **DU67** *No*. 11665 Jósvafő; **DU82** *No*. 2956 Bükk Mts. Büdöspest-barlang; **EU27** *No*. 5624 Sátor Mts.; **EU36** *No*. 4642 Pálháza; **EU37** *No*. 4946 Füzér; **XN25** *No*. 8179 between Horvátzsidány and Kőszeg; **YN04** *No*. 4673 Bakony Mts. Odvaskő.

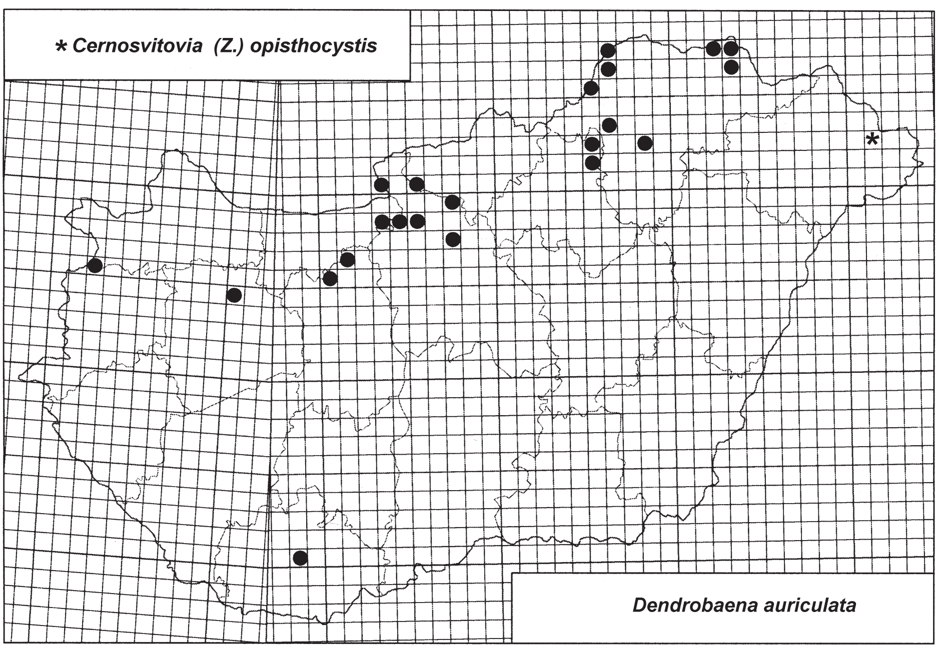

Fig. 6.18.5. Distribution of *Cernosvitovia (Zicsiona.) opisthocystis* and *Dendrobaena auriculata* in Hungary.

6.19 *Dendrobaena clujensis* Pop, 1938

(Figs. 6.19.1–4.)

Dendrobaena clujensis Pop, 1938 Bull. Soc Sti. Cluj., 9: 137.
***Dendrobaena clujensis*: Zicsi 1966a Ann. Univ. Sci. Budapest, 8: 395.**
***Dendrobaena clujensis*: Zicsi 1968a Opusc. Zool. Budapest, 8: 137.**
Dendrobaena clujensis: Zicsi 1982a Acta zool. hung., 28: 443.
Dendrobaena clujensis: Easton 1983 Earthworm Ecology, p. 478.
Kritodrilus clujensis: Omodeo & Rota 1989 Boll. Zool., 56: 184.
Dendrobaena clujensis: Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 644.
Dendrobaena clujensis: Qiu & Bouché 1998a Doc. pedozool. integrol., 4: 194.

Description – *External* – Body length 70–100 mm, diameter 4.2–4.9 mm, 110–157 segments. Colour dark red-violet. Head epilobous, first dorsal pores in 5/6. Glandular tumescences in 12 *ab*. Setae widely paired, setal arrangement after the clitellum: aa:ab:bc:cd:dd = 2:1:1.3:1:2.5. Clitellum on segments (27) 28–33, saddle-shaped, tubercles on 30–32, 1/n 33. Male pore on 15 between setae *b–c*, small, confined into own segment. Nephropores alternate irregularly between setae *b–d*. *Internal* – Dissepiments 6/7–8/9 somewhat thickened, 12/13–14/15 more strengthened. Crop in 15–16, gizzards in 17–18. Two pairs of testes in 10, 11 and three pairs of seminal vesicles in 9, 11, 12. Spermathecae two pairs in 9/10, 10/11 open close to setal line *d*. Calciferous glands with clear diverticula in 11, 12, last pair of lateral hearts in 10. Excretory system holonephridial. Nephridial bladders are sausage-shaped. Typhlosole bifid, the cross-section of longitudinal muscle layer is of pinnate type (fig. 6.19.1, 6.19.2).

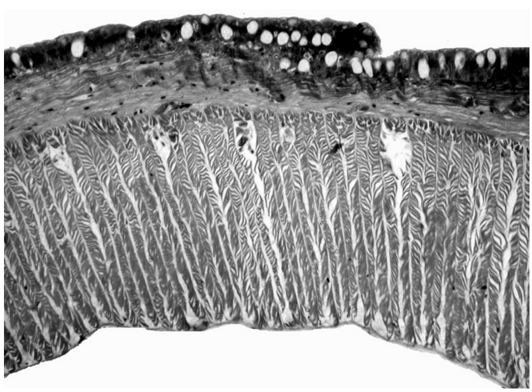

Fig. 6.19.1. Longitudinal musculature of *Dendrobaena clujensis.*

Ecology – *D. clujensis* is an anecic worm living in the soil and feeding in the litter layer. Its daily consumption rate is comparable to that of *F. platyura depressa*, it is about 25 mg dry litter pro 1 g live weight. *D. clujensis* casts mainly into the soil, its daily cast production is about 36 mg dry material pro 1 g live weight.

Distribution – *D. clujensis* is a narrowly distributed Dacian species occurring in NE Hungary and in Romania. Its present-day distribution refers to the former lowland forests converted into arable land (fig. 6.19.3).

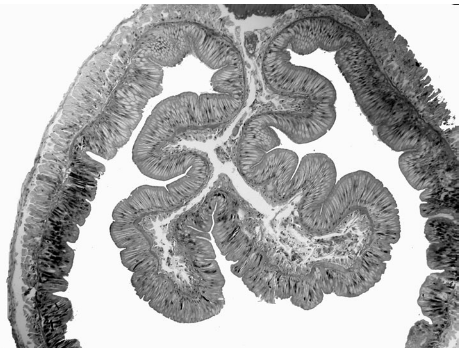

Fig. 6.19.2. Typhlosole of *Dendrobaena clujensis*.

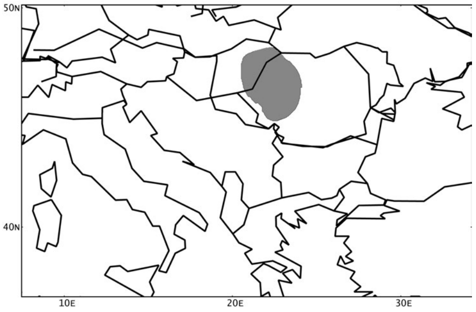

Fig. 6.19.3. Distribution of *Dendrobaena clujensis*.

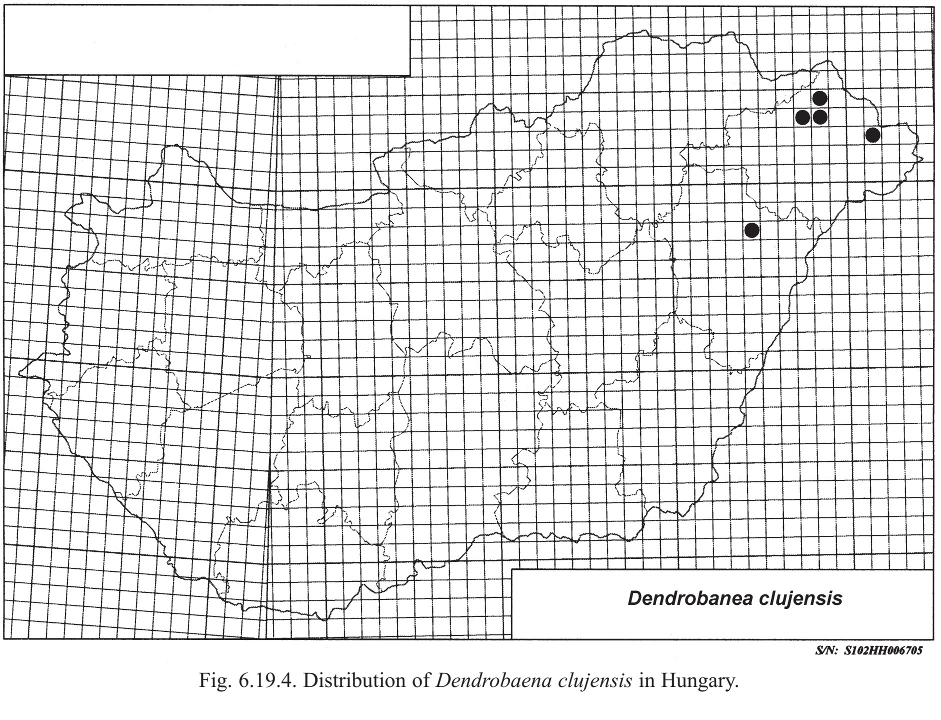

Fig. 6.19.4. Distribution of *Dendrobaena clujensis* in Hungary.

Distribution in Hungary (fig. 6.19.4) – **ET47** *No.* 5311 Hajdúböszörmény, Zelemér; *No.* 5367 Józsa; **EU73** *No.* 3588 Ajak; **EU83** *No.* 3641, 3561 Szabolcsbáka; *No.* 3635 Lövőpetri; **EU84** *No.* 3514 Jéke; *No.* 3584 Kisvárda; **FU12** *No.* 4100 Kömörő.

6.20 *Dendrobaena cognettii* (Michaelsen, 1903)

(Figs. 6.20.1–2.)

?Enterion pygmaeum (nom. nudum?) Savigny, 1826 Mem. Acad. Sci. Inst. Fr., 5: 183.
Allolobophora minima (spec. inc. sed.) Rosa, 1884 Lumbr. Pieomte, p. 39.
Octolasion minimum: Örley 1885 Értek. term. tud. köréből, 15(18): 22.
Helodrilus (Helodrilus) ribaucourti Cognetti, 1901 Boll. Mus. Torino, 16(404): 21.
Helodrilus cognettii (nom. nov. pro *H. (H.) ribaucourti*) Michaelsen, 1903 Geogr. Verbr. Olig., p. 130.
***Dendrobaena pygmaea*: Zicsi 1959c Opusc. Zool. Budapest, 3: 96.**
***Dendrobaena pygmaea*: Zicsi 1968a Opusc. Zool. Budapest, 8: 138.**
Dendrobaena pygmaea cognettii: Bouché 1972 Inst. Nat. Rech. Agron., p. 391.
Dendrobaena cognettii: Zicsi 1981b Opusc. Zool. Budapest, 17-18: 171.
Dendrobaena cognettii: Zicsi 1982a Acta zool. hung., 28: 443.
Dendrobaena pygmaea: Easton 1983 Earthworm Ecology, p. 479.
***Dendrobaena cognettii*: Zicsi 1991 Opusc. Zool. Budapest, 24: 177.**
Dendrobaena pygmaea (Michaelsen, 1903) (lapsus): Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 643.
Dendrobaena cognettii: Zicsi & Csuzdi 1999 Rev. suisse Zool., 106: 995.
Dendrobaena pygmaea cognettii: Qiu & Bouché 1998a Doc. pedozool. integrol., 4: 194.

Description – *External* – Body length 15–35 mm, diameter 0.5–1 mm, 95–111 segments. Colour pale anteriorly and reddish on dorsum. Head epilobous. Dorsal pores lacking, glandular tumescences absent. Setae unpaired, setal arrangement after the clitellum: aa:ab:bc:cd:dd = 12:10:9:8:15. Clitellum extends on segments (32) 33–36, 37 (38) saddle-shaped. There is no tubercula pubertatis. Male pore on 15 between setae *b–c*, confined into own segment. Nephropores aligned in the setal line *b*. *Internal* – There are no dissepiments notably thickened. Crop in 15–16, gizzards in 17–18. Two pairs of testes in 10, 11, and two pairs of seminal vesicles in 11, 12. Spermathecae lacking. Calciferous glands in 11–13, with diverticulua in 11, 12. Last pair of lateral hearts in 11, extraoesophageals in segment 12 are lacking. Excretory system holonephridial. Nephridial bladders after the clitellum bilobate. Cross-section of longitudinal muscle layer is of pinnate type.

Remarks – The name *Enterion pygmaeum* Savigny, 1826 was regarded as nomen nudum because of lacking of adequate description (Zicsi 1981b). The first accounts on this species refer to clitellum on 33–37, tubercles on 35–37, three pairs of vesicles in 9, 11, 12 and three pairs of receptacles opening in near to the mid-dorsal line (Michaelsen 1900a and Tétry 1937). Rosa (1884) describing the species *Allolobophora minima* gives also the same clitellar position (33–37) but there are no mention of tubercles, vesicles and spermathecae. Rosa placed *A. minima* into the group of species with spermathecae open around the mid-dorsal line. This led Zicsi (1981b) to the conclusion, that *A. minima* had possess spermathecae but it had not been mentioned and so, it is merely a synonym of *E. pygmaeum*. Based on these findings there must be a worm with characteristics of Savigny's *E.*

pygmaeum, and a separate one without tubercles and spermathecae. It is identical with the description of Cognetti's *H. ribaucourti* and now called *D. cognettii* (Michaelsen, 1903). Unfortunately there are no specimens available of *D. pygmaea* except probably a picture of Graff (1953) showing a well-marked tubercula pubertatis on segments 35–37.

Ecology – This species belongs into the epigeic group and prefers damp organic sites.

Distribution – *D. cognettii* is a species of Palearctic origin but because of its small size the real distribution is imperfectly known. In Europe it is reported from Britain, France, Spain, Italy, Austria, Hungary, Switzerland, Germany and Greece (?Atlanto-Mediterranean) (fig. 6.20.1). *D. cognettii* has been introduced to the USA and Chile as well.

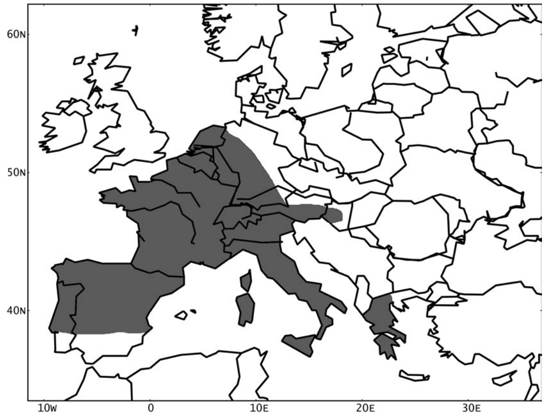

Fig. 6.20.1. Distribution of *Dendrobaena cognettii.*

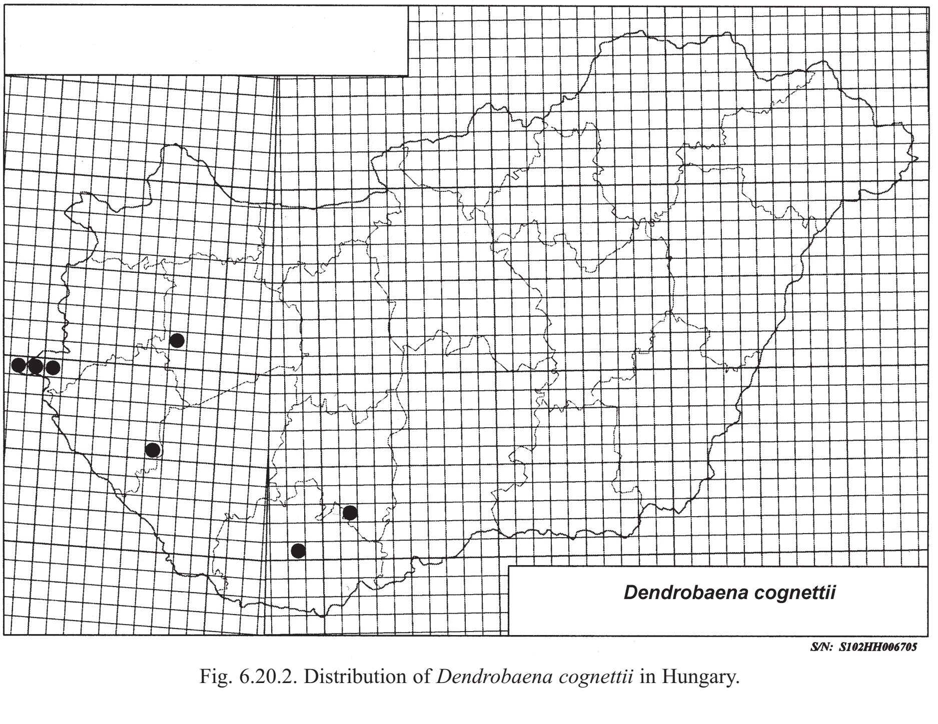

Fig. 6.20.2. Distribution of *Dendrobaena cognettii* in Hungary.

Distribution in Hungary (fig. 6.20.2) – **BS80** *No*. 4009 Pécs; **CS12** *No*. 14480 Bátaapáti; **WM89** *No*. 12052 Felsőszölnök; **WM99** *No*. 10941, 12062 Szakonyfalu; **XM09** *No*. 12065, 12252 Kondorfa; **XM65** *No*. 9008 Zalakaros; **XN71** *No*. 10196 Sárosfőpuszta.

6.21 *Dendrobaena ganglbaueri* (Rosa, 1894)

(Figs. 6.21.1–6.)

Allolobophora (Dendrobaena) ganglbaueri Rosa, 1894 Boll. Mus. Torino, 9(170): 1.
Allolobophora ganglbaueri: Rosa 1895 Boll. Mus. Torino, 10(21): 7.
Helodrilus (Dendrobaena) ganglbaueri: Michaelsen 1900a: Das Tierreich, 10: 491.
Dendrobaena byblica (Rosa, 1893): Pop 1947 Anal. Acad. R. P. R., (III)22: 107.
Dendrobaena byblica (part.): Omodeo 1956 Arch. Zool. Ital., 41: 173.
***Dendrobaena byblica*: Zicsi 1968a Opusc. Zool. Budapest, 8: 133.**
Dendrobaena byblica (part.): Perel 1979 Range and regularities in the distr. earthworms, p. 232.
Dendrobaena byblica (part.): Zicsi 1982a Acta zool. hung., 28: 443.
Dendrobaena byblica (part.): Easton 1983 Earthworm Ecology, p. 478.
***Dendrobaena ganglbaueri*: Zicsi 1991 Opusc. Zool. Budapest, 24: 176.**
Dendrobaena byblica (part.): Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 566.
Dendrobaena byblica byblica (part.): Qiu & Bouché 1998a Doc. pedozool. integrol., 4: 194.

Description – *External* – Body length 35–55 mm, diameter 2–3 mm, 55-110 segments. Colour red-violet, head epilobous, first dorsal pore in 7/8 or 8/9. Glandular tumescence usually on 9, 10, 11 *ab*, 24, 26-28 *a* with well developped genital setae (figs. 6.21.3-4.). Setae distantly standing, setal arrangement after the clitellum: aa:ab:bc:cd:dd = 1:1:1:1:1.6. Clitellum extends on segments 23, 24–29 almost ring-shaped. Tubercles on 25–27. Male pore small on 15, between setae *b–c*. Nephropores aligned in setal line *b*. *Internal* – There are no dissepiments notably thickened. Crop in 15–16, gizzards in 17–18. Two pairs of testes in 10, 11, enclosed in perioesophageal testis sac (always?). Four pairs of seminal vesicles in 9–12. Spermathecae two pairs in 9/10, 10/11, open in the setal line *d*. Calciferous glands in 11 with hardly recognizable diverticula. Last pair of lateral hearts in 11, and a pair of extraoesophageals in 12. Excretory system holonephridial. Nephridial bladders are of biscuit-shape (octaedra-type). Typhlosole anchor-shaped, the cross-section of longitudinal muscle layer is of pinnate type (figs. 6.21.1-2.).
Remarks – This species has long been synonymized with *D. byblica* (Rosa, 1893) a Holo-Mediterranean catch-all species (Csuzdi & Pavlíček, 1999) until Zicsi (1991) resurrected the name *D. ganglbaueri* (Rosa, 1894) for the specimens occurring in Central Europe.

Ecology – In Hungary it lives exclusively in humid forests near to stream banks.

Distribution – *D. ganglbaueri* seems to be an Illyric species distributed in Austria, Hungary, Slovenia, Croatia, Yugoslavia and Bosnia-Herzegovina (fig. 6.21.5).

Distribution in Hungary (fig. 6.21.6) – **WM99** *No*. 1681 Szakonyfalu; **XM25** *No*. 14504 Szentmargitfalva; **XN14** *No*. 5583, 8164, 8187, 10628, 11704, 11781 Velem.

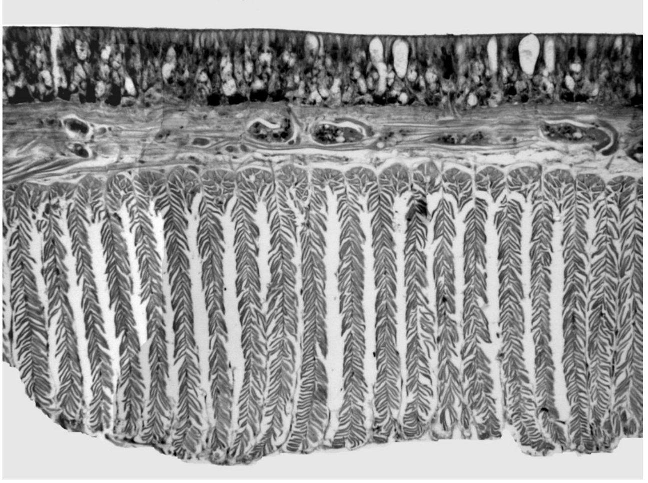

Fig. 6.21.1. Longitudinal musculature of *Dendrobaena ganglbaueri*.

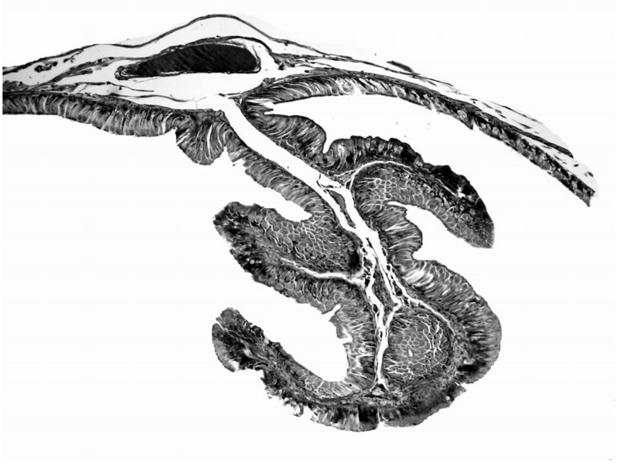

Fig. 6.21.2. Typhlosole of *Dendrobaena ganglbaueri*.

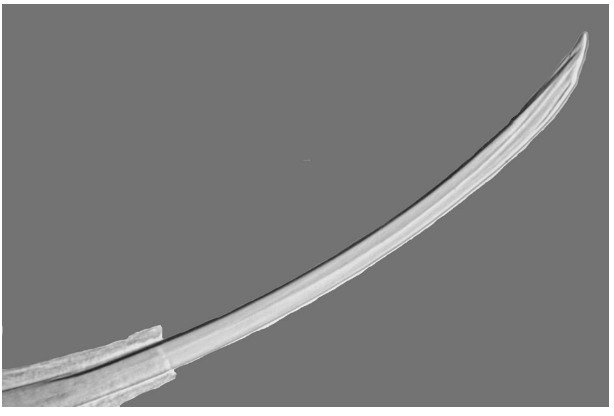

Fig. 6.21.3. Penial seta from segment 11 of *Dendrobaena ganglbaueri*.

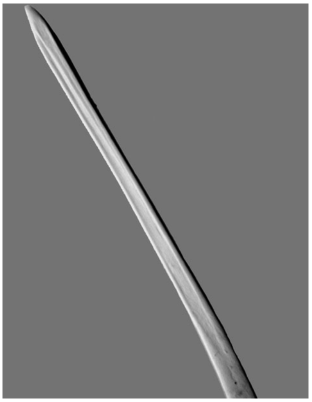

Fig. 6.21.4. Penial seta from the clitellum of *Dendrobaena ganglbaueri*.

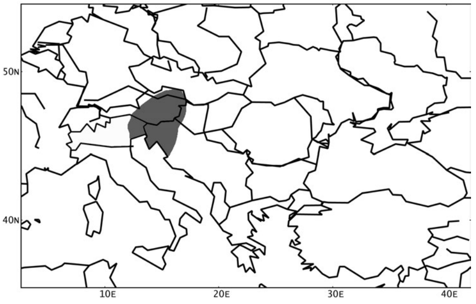

Fig. 6.21.5. Distribution of *Dendrobaena ganglbaueri*.

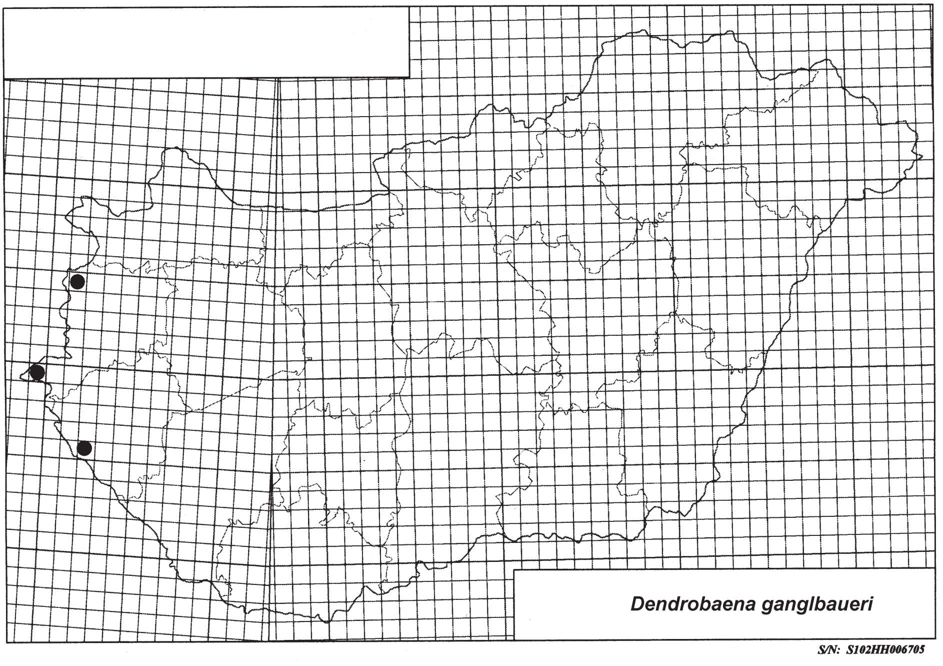

Fig. 6.21.6. Distribution of *Dendrobaena ganglbaueri* in Hungary.

6.22 *Dendrobaena hortensis* (Michaelsen, 1890)
(Figs. 6.22.1–3.)

Allolobophora veneta var.: Rosa 1889 Boll. Mus. Torino, 4(63): 2.
Allolobophora subrubicunda var. *hortensis* Michaelsen, 1890a J. Hamb. Wiss., 7: 15.
Allolobophora hibernica Friend, 1892d Proc. Irish. Acad., (3)2: 402.
Eisenia veneta var. *hortensis*: Michaelsen 1900a Das Tierreich, 10: 477.
Allolobophora veneta tepidaria Friend, 1904 Gard. Chron., 35: 161.
Allolobophora veneta dendroidea Friend, 1909 Gard Chron., 46: 243.
Allolobophora veneta robusta Friend, 1909 Gard. Chron., 46: 203. **syn. nov.**
Eisenia birsteini Malevics, 1947 Bull. Soc. Mosc. (Biol.), 52(4): 19.
***Dendrobaena hortensis*: Zicsi 1968a Opusc. Zool. Budapest, 8: 135.**
Dendrobaena nicaensis Vedovini, 1971 Bull. Soc. Zool. Fr., 96: 45. **syn. nov**.
Dendrobaena venata hortensis (laps.): Bouché 1972 Inst. Nat. Rech. Agron., p. 398.
Dendrobaena pseudohortensis Šapkarev, 1977 Ann. Fac. Biol. Univ. Skopje, 30: 37. **syn. nov**.
Dendrobaena hortensis: Zicsi 1982a Acta zool. hung., 28: 443.
Dendrobaena hortensis: Easton 1983 Earthworm Ecology, p. 478.
***Dendrobaena hortensis:* Zicsi 1991 Opusc. Zool. Budapest, 24: 176.**
Dendrobaena hortensis: Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 622.
Dendrobaena venata hortensis Michaelsen, 1889 (laps.) + *Dendrobaena hortensis* + *Dendrobaena nicaensis* + *Dendrobaena pseudohortensis*: Qiu & Bouché 1998a Doc. pedozool. integrol., 4: 194.

Description – *External* – Body length 15–50 mm, diameter 2–3 mm, 50–120 segments. Colour reddish. Head epilobous, first dorsal pore in 5/6. Glandular tumescence usually on 11 *cd*, 9–12 *ab.* Setae moderately paired, setal arrangement after the clitellum: aa:ab:bc:cd:dd = 2.8:1:2.4:1.1:4.4. Clitellum usually on segments 27–33, saddle-shaped. Tubercles on 30–½ 32. Male pore on 15 between setae *b–c*, frequently protruding into the neighbouring segments. Nephropores irregularly alternate between setal lines *b–d*. *Internal* – Dissepiments 7/8–9/10 thickened. Crop in 15–16, gizzards in 17–18. Two pairs of testes in 10, 11, enclosed in perioesophageal testis sacs. Three (rarely two) pairs of seminal vesicles in 9, 11, 12 (or 11, 12). Spermathecae two pairs in 9/10, 10/11, open near to the mid-dorsal line. Calciferous lamellae in 11–13, diverticulum lacking. Last pair of lateral hearts in 11 accompanied by a pair of extraoesophageals in segment 12. Excretory system holonephridial. Nephridial bladders are of sausage-shape. Typhlosole lamelliform, the cross-section of longitudinal muscle layer is of intermediate type showing almost fasciculated characters (fig. 6.22.1, 6.22.2).

Remarks – *Allolobophora veneta robusta* Friend, 1909 has been regarded as a synonym of *D. veneta veneta* (Zicsi 1982). Investigating syntypes housed in The Natural History Museum, London under Reg. No. 1923.12.31.106–116. we concluded that it is a synonym of *D. hortensis*.

Ecology – *D. hortensis* is one of the worms suitable for vermicomposting (Zicsi 1985b). Its cocoons contain 1–4 juveniles and the net reproduction rate is comparable with that of *E. fetida*, 4.7 juv./week. The incubation time is 19.4 ± 4.5 days (Csuzdi & Zicsi 1988) and to reach maturity takes 48.8 ± 3.5 days (Csuzdi 1987).

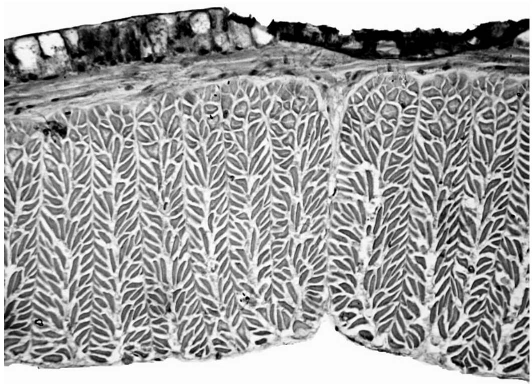

Fig. 6.22.1. Longitudinal musculature of *Dendrobaena hortensis*.

Fig. 6.22.2. Typhlosole of *Dendrobaena hortensis*.

Distribution – Origin unknown, in Central and Western Europe it could mostly be found in composts and dung heaps. It has extensively been introduced all over Europe in connection with the vermicomposting industry.

Distribution in Hungary (fig. 6.22.3) **– BS79** *No.* 11378 Balatonszéplak; **BT80** *No.* 11406, 11375 Balatonaliga; **CT45** *No.* 10059, 10255 Budatétény; **CT56** *No.* 4424, 12099 Budapest, Botanical Garden; **CT68** *No.* 12096 Vácrátót; **CT77** *No.* 12782 Gödöllő; **XM78** *No.* 1396 Vonyarcvashegy, Szent Mihály kápolna; **XN36** *No.* 862, 883, 889, 911 Sopronhorpács; **XN47** *No.* 866 Petőháza; **YM13** *No.* 10606 Kaposvár; **YN20** *No.* 11320 Palóznak. (The Hungarian occurrences of this species must be more frequent because the typical localities have not usually been sampled.)

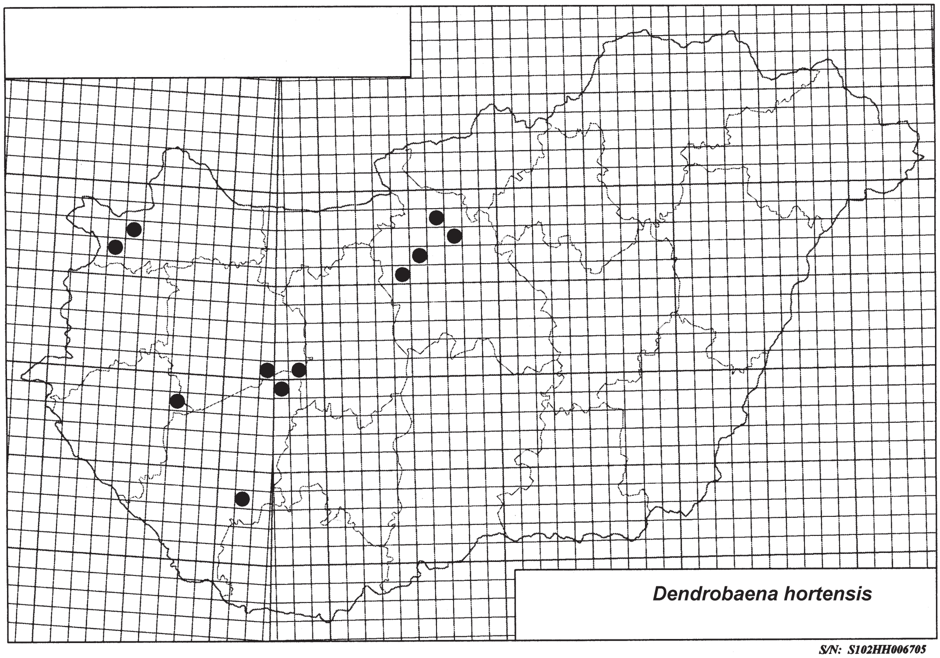

Fig. 6.22.3. Distribution of *Dendrobaena hortensis* in Hungary.

6.23 *Dendrobaena octaedra* (Savigny, 1826)

(Figs. 6.23.1–3.)

Enterion octaedrum Savigny, 1826 Mem. Acad. Sci. Inst. Fr., 5: 183.
Lumbricus flaviventris Leuckart, 1849 Arch. Naturg., 15: 159.
Dendrobaena boeckii Eisen, 1873 Öfv. Akad. Förh., 30: 53.
Dendrobaena camerani Rosa, 1882 Atti. Acad. Torino, 18: 172.
***Octolasion boeckii*: Örley 1885 Értek. term. tud. köréből, 15(18): 20.**
Allolobophora octaedra alpinula Ribaucourt, 1896 Rev. suisse Zool., 4: 37.
Allolobophora octaedra liliputiana Ribaucourt, 1896 Rev. suisse. Zool., 4: 32.
Helodrilus (Dendrobaena) octaedrus: Michaelsen 1900a Das Tierreich, 10: 494.
Helodrilus (Dendrobaena) octaedrus casterinensis Chinaglia, 1911 Boll. Mus. Torino, 26(635): 4.
***Dendrobaena octaedra* f. *typica*: Pop 1943 Ann. Hist.–Nat. Mus. Hung., 36: 20.**
***Dendrobaena octaedra*: Zicsi 1968a Opusc. Zool. Budapest, 8: 137.**
Dendrobaena (Dendrobaena) octaedra: Bouché 1972 Inst. Nat. Rech. Agron., p. 388.
Dendrobaena (Dendrobaena) octaedra brevisella Bouché, 1972 Inst. Nat. Rech. Agron., p. 389.
Dendrobaena octaedra: Perel 1979 Range and regularities in the distr. earthworms, p. 229.
Dendrobaena octaedra: Zicsi 1982a Acta Zool. Hung., 28: 443.
Dendrobaena octaedra: Easton 1983 Earthworm Ecology, p. 479.
***Dendrobaena octaedra*: Zicsi 1991 Opusc. Zool. Budapest, 24: 176.**
Dendrobaena octaedra: Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 607.
Dendrobaena octaedra octaedra: Qiu & Bouché 1998a Doc. pedozool. integrol., 4: 193.

Description – *External* – Body length 20–60 mm, diameter 2–4 mm, 80–100 segments. Colour red-violet, head epilobous, first dorsal pore in 4/5. Glandular tumescence usually on 10, 15, 16, 31–33 *b*. Setae distantly standing, setal arrangement after the clitellum: aa:ab:bc:cd:dd = 1.5:1:1.25:1:2. Clitellum extends on segments 28, 29, (30)–33, 1/n 34, saddle-shaped. Tubercles on 31–33. Male pore on 15 between setae *b–c*, size variable. Nephropores aligned in setal line *b*. *Internal* – There are no dissepiments notably thickened. Crop in 15–16, gizzards in 17–18. Two pairs of testes in 10, 11, enclosed in perioesophageal testis sac. Three pairs of seminal vesicles in 9, 11, 12. Spermathecae three pairs in 9/10, 10/11, 11/12, open in the setal line *d*. Well developed calciferous glands in 11–12, last pair of lateral hearts in 9 or 10. Excretory system holonephridial. Nephridial bladders are of biscuit-shape (octaedra-type). Typhlosole lamelliform, the cross-section of longitudinal muscle layer is of pinnate type (fig. 6.23.1, 6.23.2).

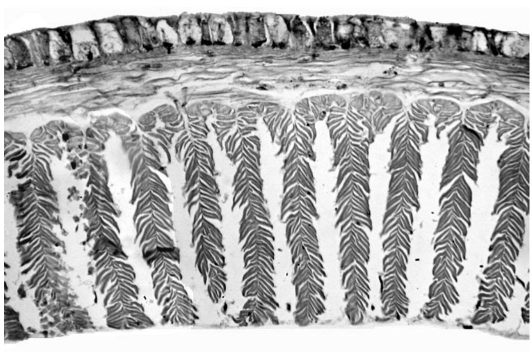

Fig. 6.23.1. Longitudinal musculature of *Dendrobaena octaedra*.

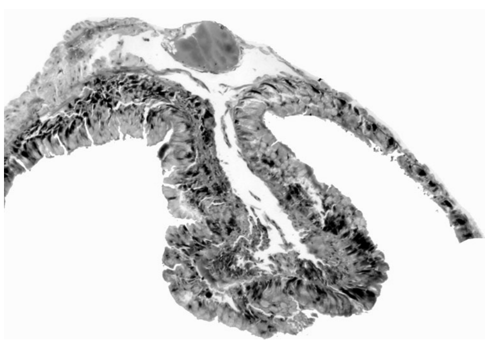

Fig. 6.23.2. Typhlosole of *Dendrobaena octaedra*.

Remarks – This is a widely distributed peregrine species with different polyploid and parthenogenetic races that bring forth high morphological variation. This could mainly be manifested in the reduction of the reproductive organs as spermathecae, vesicles and the tubercula pubertatis. This is the main reason for the high number of synonyms described.

Ecology – *D. octaedra* is an epigeic worm living in the upper litter layer and under bark and stone. Its litter consumption is 1.07 g dry weight pro animal pro year. It defecates exclusively onto the soil surface; the cast production is 1.17 g dry weight pro animal pro year. Extrapolating these data to a hectare of forest the yearly consumption of this small species proved to be 32 kg litter pro hectare and the cast production was 35 kg pro hectare (Zicsi 1974a).

Distribution – This is a widespread Palearctic species, distributed north as far as Greenland and Novaya Zemlya, and has been introduced world-wide.

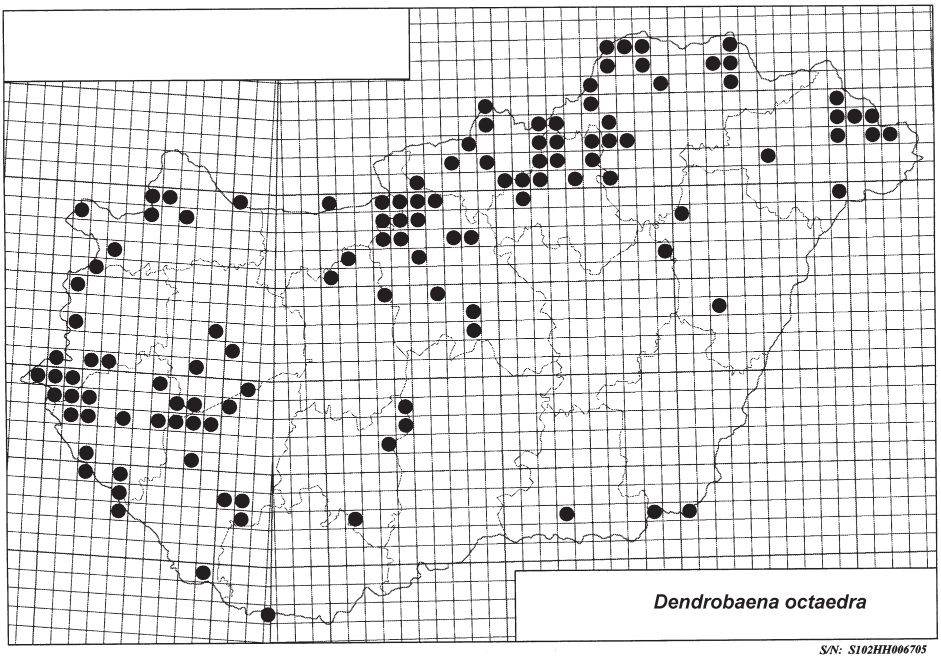

Fig. 6.23.3. Distribution of *Dendrobaena octaedra* in Hungary.

Distribution in Hungary (fig. 6.23.3) – **CS12** *No.* 14456 Bátaapáti; **CS36** *No.* 760 Paks; **CS47** *No.* 1020 Bölcske; **CS48** *No.* 607, 807 Dunaföldvár; **CT05** *No.* 5498 Kőhányás; **CT09** *No.* 1179 Dunaalmás; **CT16** *No.* 7122, 7711, 8410, 8960, 9032, 9042, 9083, 10262, 10542 Vértes Mts. Vinyabükki-völgy; **CT34** *No.* 612 Martonvásár; **CT37** *No.* 10033 Piliscsaba Iluska-forrás; **CT38** *No.* 14464 Pilisszentlélek; **CT39** *No.* 3915 between Esztergom and Visegrád; **CT47** *No.* 7252 Solymár; **CT48** *No.* 9926 Pilis Mts. Hoffmann-kunyhó; *No.* 9931 Pilis Mts. Szőke-forrás; *No.* 9943, 9991 Pilis Mts. Lukács-árok *No.* 9975 Pilis Mts. Sikáros; *No.* 9952, 10001, 10020 Pilis Mts. Apátkuti-völgy; *No.* 10226, 10366 Pilis Mts. Vörösdagonya; *No.* 10363 Pilis, Király-patak; **CT49** *No.* 9948, 10027 Lepence-patak; **CT56** *No.* 721 Csepel; **CT58** *No.* 1813 Pilis Mts. Dömörkapu; *No.* 2815 Alsógöd; *No.* 4173, 4185, 9965 Pilis Mts. Bükkös-patak; *No.* 9982 Pilis Mts. Királykuti-kunyhó; **CT59** *No.* 7104, 8116 Magyarkút; **CT64** *No.* 4805, 11709 Ócsa; **CT69** *No.* 8987, 9028 Penc; **CT77** *No.* 2812, 4504, 5548, 5884 Gödöllő; **CT82** *No.* 4277 Hernád; **CT83** *No.* 7289 Csévharaszt; **CT87** *No.* 7200 Bag, Petőfi-forrás; **CU50** *No.* 5237, 7118, 7127, 7239, 7333, 7598, 7992, 8055, 8090, 8218, 8435, 9002, 9066, 9627, 10466 Szendehely; **CU71** *No.* 8980 between Szente and Magyarnándor; **CU82** *No.* 5263 Őrhalom; **CU91** *No.* 8450, 8459, 8460, 8954, 8955, 8956, 9050 Alsótold; *No*. 9879 Hollókő; **CU93** *No*. 4816 Endrefalva; **CU94** *No*. 5270 Litke; **DS32** *No*. 1647, 3035 Tápé; **DS82** *No*. 929, 945, 984, 1228, 9232 Mezőhegyes; **DT19** *No*. 4243 Mátraháza; **DT96** *No*. 8397 Óhat; **DU00** *No*. 4212, 7233 Mátrakeresztes; **DU10** *No*. 854, 11618 Mátra Mts. Kékestető; **DU20** *No*. 4239 Mátra Mts. Koszorú-patak; *No*. 4247 Mátra Mts. Nagylapát-tető; **DU21** *No*. 7216, 7544 Nádújfalu; **DU22** *No*. 5898, 5904 Bárna; **DU23** *No*. 9104 Cered; **DU31** *No*. 6934, 8264 Pétervására; **DU32** *No*. 5667 Szentdomonkos; **DU33** *No*. 6949 Ivád; **DU40** *No*. 7413, 7419, 7424, 7427 between Sirok and Egerbakt; **DU51** *No*. 1041, 1052, 4641, 4659, 8561, 9208 Bükk Mts. Szarvaskő; *No*. 8282, 9222 Felsőtárkány; **DU52** *No*. 9863 Bükk Mts. Leány-völgy; *No*. 9872 Bükk Mts. Határhordó; *No*. 9881, 9888, 9899, 9916 Bükk Mts. Tóthfalusi-völgy; *No*. 9893 Bükk Mts. Ivánka-lápa; *No*. 9890 Szannafő; **DU54** *No*. 4836, 4841 Putnok; **DU55** *No*. 4496, 4840, 8115 Kelemér; **DU60** *No*. 8102 Síkfőkút; **DU62** *No*. 2215, 2222, 2227, 2246 Bükk Mts. Teknős-völgy; *No*. 2978 Bükk Mts. Garadna-völgy; *No*. 4608 Bükk Mts. Bánkút; *No*. 4621 Bükk Mts. Belházi-víznyelő; *No*. 7618 Répáshuta; **DU63** *No*. 4386 Bükk Mts. Buzgókő; *No*. 4423 Bükk Mts. Örvénykő; **DU66** *No*. 526, 589, 670, 689, 691, 1025, 1579, 1586, 4446, 4511 Aggtelek; *No*. 4829, 4845 Aggtelek, Haragistya; *No*. 9075 Aggtelek, Vöröstó; **DU67** *No*. 3281, 3306, 3322, 4677, 5544, 7209 Jósvafő; **DU72** *No*. 2173, 2178, 2206, 2239, 7227 Bükk Mts. Garadna-völgy; *No*. 3015 Bükk Mts. Felső-forrás; **DU77** *No*. 1571, 3287, 3974 Szin; *No*. 3122 Szinpetri; *No*. 3956 Acskó; **DU86** *No*. 581 Szalonna; **DU87** *No*. 3967 Bódvaszilas; **DU95** *No*. 4997 Tomor; **ES02** *No*. 944 Battonya; **ET08** *No*. 7079, 7082, 7090, 7098, 10563, 10565 Újszentmargita; **ET23** *No*. 9061 Sáp; **ET99** *No*. 11162, 11181, 11197, 11735 Bátorliget; *No*. 11170, 11191 Bátorliget, Fényi-erdő; **EU26** *No*. 4230, 4257, 11653 Regéc; **EU35** *No*. 4267, 11666 Óhuta; *No*. 11677 Újhuta; *No*. 4952, 7114, 11689 Zemplén Mts. Kőkapu; *No*. 5460, 11674 Nagyhuta; *No*. 5466 Nagybózsva; **EU36** *No*. 10247, 10251, 11549, 11638, 11648, 11659, 11680, 14326 Rostalló; *No*. 11626, 11629 Zemplén Mts. Senyő-völgy; *No*. 11642, 11682Kishuta; **EU37** *No*. 4942 Füzér; **EU51** *No*. 8972 Nyíregyháza; **EU92** *No*. 14378 Olcsva; **EU93** *No*. 1684 Vásárosnamény; **EU94** *No*. 4899 Tiszakerecseny; **FU03** *No*. 4887, 4890, 10590 Vámosatya, Bockerek-erdő; *No*. 8008, 10503, 11609 Csaroda; **FU12** *No*. 4017 Kisar; *No*. 4034, 8024 Tarpa; *No*. 4056, 4105, 10391 Kömörő; **FU13** *No*. 4096 Beregsurány; **FU22** *No*. 4051 Tiszacsécse; **WM99** *No*. 3157, 4713 Szakonyfalu; *No*. 12077 Kétvölgy; **XL99** *No*. 10264, 10506 Barcs; **XM08** *No*. 12022 Őriszentpéter; *No*. 12243 between Bajánsenye and Őriszentpéter; **XM09** *No*. 8532 Orfalu; *No*. 12264 Ispánk; **XM17** *No*. 9150 Csesztreg; *No*. 11538 Kálócfa; *No*. 11607 Zalabaksa; **XM18** *No*. 12026 Nagyrákos; *No*. 12045 Szatta; **XM19** *No*. 12238 Őrimagyarósd; **XM24** *No*. 4119, 4131, 9114 Murarátka; **XM25** *No*. 5441 Kányavár; *No*. 9140 Dobri; **XM27** *No*. 5409 Nova; **XM28** *No*. 12272 Zalalövő; **XM42** *No*. 5421 Őrtilos; **XM43** *No*. 14271 Molnári; **XM44** *No*. 14310 Semjénháza; **XM47** *No*. 8554 Bak; **XM67** *No*. Zala-folyó; **XM69** *No*. 2870 Vidornyaszőllös; **XM77** *No*. 11279, 11291 Balatonberény; **XM78** *No*. 1391 Balaton, Szt Mihály kápolna; *No*. 1991, 2128 Keszthely; **XM85** *No*. 2153 Cserfekvés; **XM87** *No*. 2835, 4636 Bélatelep; *No*. 10071 Balatonmária-fürdő; *No*. 12384 Balatonfenyves; **XM88** *No*. 14350 Szigliget; **XM97** *No*. 4471 Fonyód; **XN00** *No*. 12232 Csörötnek; **XN12** *No*. 8136 Pornóapáti; **XN14** *No*. 5588, 8167, 8186, 10634, 10647, 11564, 11699, 14320 Velem; *No*. 10514, 10516 Kőszegi Mts.; **XN18** *No.* 5701 Brennbergbánya; *No.* 5724 Sopron, Kecske-patak; **XN20** *No.* 12260 Körmend; **XN25** *No.* 1648 Szakonyfalu; *No.* 8177 between Horvátzsidány and Kőszeg; **XN30** *No.* 3130 Győrvár; **XN36** *No.* 870 Sopronhorpács; **XN58** *No.* 13074, 13094, 14293 Csorna, Csíkos-éger; **XN59** *No.* 5609 Mosonszentjános; **XN69** *No.* 13080, 14279 Újrónafő; **XN78** *No.* 14288 Lébényi nyíres; **XN80** *No.* 10198, 10592 Felsőnyirád; **XN92** *No.* 3132 Bakonygyepes; **YL37** *No.* 4754 Vejti; **YM03** *No.* 10440 Bőszénfa; **YM08** *No.* 661 Balatonboglár; **YM12** *No.* 7171, 9191 Ropolyapuszta; **YM13** *No.* 834 Zselicség; **YM19** *No.* 12376 Örvényes; **YN01** *No.* 775 Úrkút; **YN09** *No.* 1512 Gönyü.

6.24 *Dendrobaena vejdovskyi* (ČERNOSVITOV, 1935)

(Figs. 6.24.1–4.)

Bimastus vejdovskyi ČERNOSVITOV, 1935 Arch. Prirod. Cech., 19: 66.
Dendrobaena octaedra filiformis POP, 1947 Anal. Acad. R. P. R, (III) 22(3): 31.
***Dendrobaena octaedra filiformis*: ZICSI 1959c Opusc. Zool. Budapest, 3: 96.**
Dendrobaena vejdovskyi: ZICSI 1965b Opusc. Zool. Budapest, 5: 254.
***Dendrobaena vejdovskyi*: ZICSI 1968a Opusc. Zool. Budapest, 8: 138.**
Dendrobaena vejdovskyi: ZICSI 1982a Acta Zool. Hung., 28: 443.
Dendrobaena octaedra: EASTON 1983 Earthworm Ecology, p. 479.
***Dendrobaena vejdovskyi*: ZICSI 1991 Opusc. Zool. Budapest, 24: 177.**
Dendrobaena vejdovskyi: MRŠIĆ 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 592.
Dendrobaena vejdovskyi: CSUZDI 1995 Savaria, 22(2): 39.
Dendrobaena vejdovskyi: QIU & BOUCHÉ 1998a Doc. pedozool. integrol., 4: 194.

Description – *External* – Body length 20–50 mm, diameter 1–1.5 mm, 54–110 segments. Colour red-violet, head epilobous, first dorsal pore in 5/6. Glandular tumescence usually on 16, 17 *ab*. Setae distantly standing, setal arrangement after the clitellum: aa:ab:bc:cd:dd = 11:10:11:9:15. Clitellum extends on segments ½ 28, 29,–33, saddle-shaped. Tubercles disciform on 31–32. Male pore on 15 between setae *b–c*, great, usually intruding into the neighbouring segments. Nephropores aligned in setal line *b*. *Internal* – There are no dissepiments notably thickened. Crop in 15–16, gizzards in 17–18. Two pairs of testes in 10, 11, and two pairs of seminal vesicles in 11, 12. Spermathecae two pairs in 9/10, 10/11, open through inner glandular swellings, in the setal line *d*. Well-developed calciferous diverticula in 11–12. Last pair of lateral hearts in 11, extraoesophageals lacking. Excretory system holonephridial, nephridial bladders are of biscuit-shape (octaedra-type). Typhlosole lamelliform, the cross-section of longitudinal muscle layer is of pinnate type (fig. 6.24.1, 6.24.2).

Remarks – *D. vejdovskyi* is one of the smallest earthworms known only in few localities in the westernmost part of the country (ZICSI 1968a, 1991, CSUZDI 1995). It could effectively be collected only by the formol method.

Ecology – This is a poorly known epigeic worm living in the uppermost litter layer.

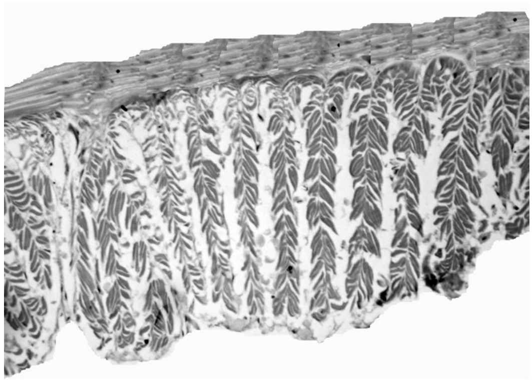

Fig. 6.24.1. Longitudinal musculature of *Dendrobaena vejdovskyi*.

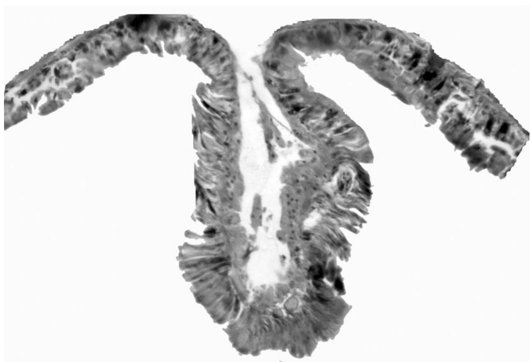

Fig. 6.24.2. Typhlosole of *Dendrobaena vejdovskyi*.

Distribution – *D. vejdovskyi* is a narrowly distributed Eastern-Alpine species, occurring in Austria, Southern Germany, Slovakia and Hungary (fig. 6.24.3).

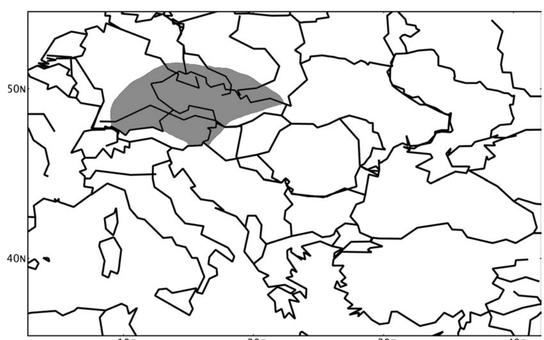

Fig. 6.24.3. Distribution of *Dendrobaena vejdovskyi*.

Distribution in Hungary (fig. 6.24.4) **– WM99** *No*. 10942, 4802, 4806, 4709 Szakonyfalu; **XM09** *No*. 12067, 12251 Kondorfa; **XM19** *No*. 12234 Szőce; **XN00** *No*. 12233 Csörötnek; **XN14** *No*. 10513 Kőszegi Mts.

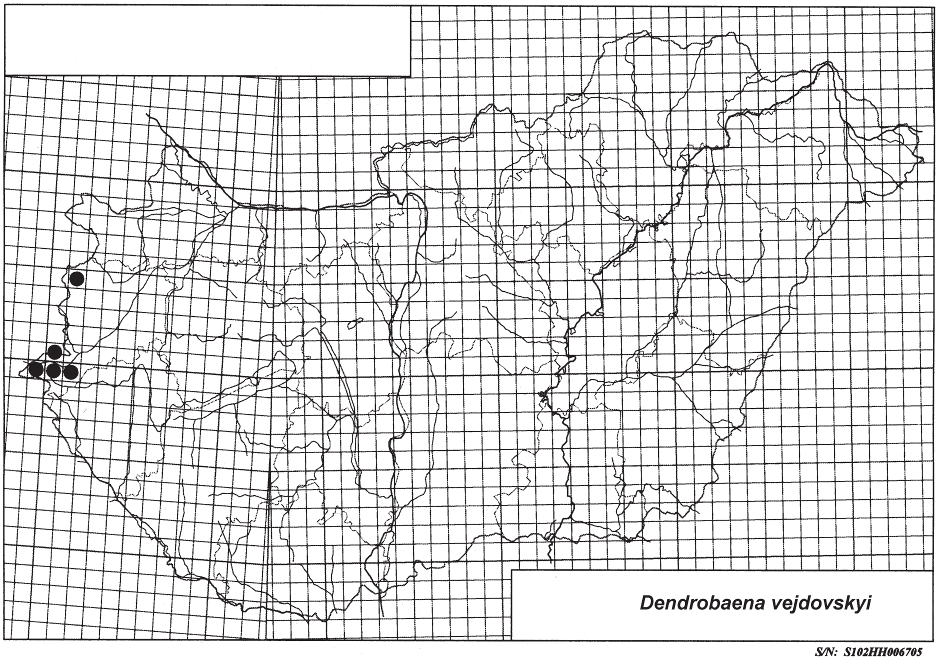

Fig. 6.24.4. Distribution of *Dendrobaena vejdovskyi* in Hungary.

6.25 *Dendrobaena veneta veneta* (Rosa, 1886)

(Figs. 6.25.1–5.)

Allolobophora veneta Rosa, 1886 Atti. Ist. Veneto, (6) 4: 674.
Dendrobaena caucasica Kulagin, 1889 Izv. Obshch. Moskov., 58(2): 13.
Dendrobaena bogdanowi Kulagin, 1889 Izv. Obshch. Moskov., 58(2): 14.
Allolobophora (Notogama) veneta: Rosa 1893b Boll. Mus. Torino, 8(160): 2.
Eisenia veneta: Michaelsen 1900a Das Tierreich, 10: 477.
Eisenia veneta zebra Michaelsen, 1902a Mitt. Mus. Hamb., 19: 39.
Allolobophora (Notogama) veneta succinta Rosa, 1905 Ann. Mus. Wien, 20: 104.
Eisenia veneta concolor Michaelsen, 1909 Süsswasserf. Deutsch., p. 35.
Helodrilus venetus picta Michaelsen, 1910b Ann. Mus. St.–Petersb., 15: 30.
Eisenia austriaca Michaelsen, 1936 Festsch. E. Strand Riga, 1: 35.
Eisenia veneta crassa Malevics, 1947 Bull. Soc. Mosc. (Biol.), 52(4): 17.
Eisenia veneta minuta Malevics, 1947 Bull. Soc. Mosc. (Biol.), 52(4): 18.
***Dendrobaena veneta* f. *typica*: Zicsi 1959c Opusc. Zool. Budapest, 3: 98.**
***Dendrobaena veneta* f. *typica*: Zicsi 1968a Opusc. Zool. Budapest, 8: 135.**
Dendrobaena veneta: Zicsi 1973 Acta zool. hung., 19: 225.
Dendrobaena veneta: Perel 1979 Range and regularities in the distr. earthworms, p. 231.
Dendrobaena veneta veneta: Zicsi 1982a Acta Zool. Hung., 28: 443.
Dendrobaena veneta veneta: Easton 1983 Earthworm Ecology, p. 479.
***Dendrobaena veneta veneta*: Zicsi 1991 Opusc. Zool. Budapest, 24: 176.**
Dendrobaena veneta veneta: Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 613.

Dendrobaena veneta veneta: Csuzdi & Pavlíček 1999 Isr. J. Zool., 45: 478.
Dendrobaena venata venata (laps.) + *Dendrobaena zebra* + *Dendrobaena concolor*: Qiu & Bouché 1998a Doc. pedozool. integrol., 4: 194.
Dendrobaena veneta: Csuzdi & Pavlíček 2002 Zool. Middle East, 25: 111.

Description – *External* – Body length 30–110 mm, diameter 4–8 mm, 54–150 segments. Colour striped red-violet dorsally and paler ventrally. Head epilobous, first dorsal pore in 5/6. Glandular tumescence usually on 10, 11, 28–32 *ab* with well developped genital setae (figs. 6.25.3-4.). Setae distant, setal arrangement after the clitellum: aa:ab:bc:cd:dd = 3:1.5:2:1.7:7. Clitellum usually on segments 26, 27, (28)–32, 33, saddle-shaped. Tubercles on 30–31. Male pore on 15 between setae *b–c*, great, frequently protruding into neighbouring segments. Nephropores irregularly alternate between setal lines *b–d*. *Internal* – Dissepiments 10/11–12/13 thickened. Crop in 15–16, gizzards in 17–18. Two pairs of testes in 10, 11, enclosed in perioesophageal testis sac (always?). Four (rarely three or two) pairs of seminal vesicles in 9–12 (or 9, 11, 12 or 11, 12). Spermathecae two pairs in 9/10, 10/11, open near to the mid-dorsal line. Calciferous lamellae in ½ 10–11, diverticulum lacking. Last pair of lateral hearts in 11 with a pair of small extraoesophageals in segment 12. Excretory system holonephridial. Nephridial bladders are of sausage-shape. Typhlosole lamelliform, the cross-section of longitudinal muscle layer is of fasciculated type (figs. 6.25.1-2.).

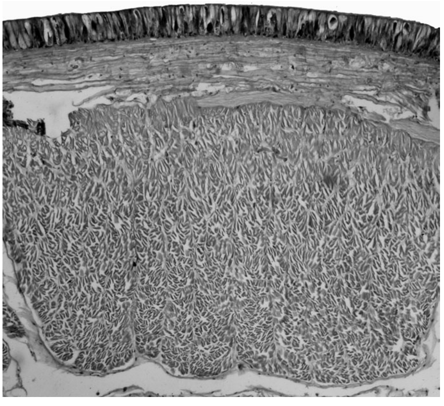

Fig. 6.25.1. Longitudinal musculature of *Dendrobaena veneta veneta*.

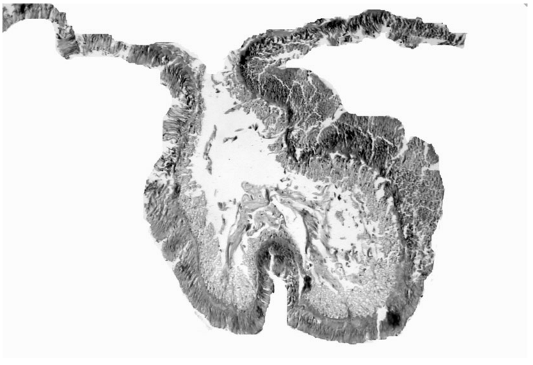

Fig. 6.25.2. Typhlosole of *Dendrobaena veneta veneta*.

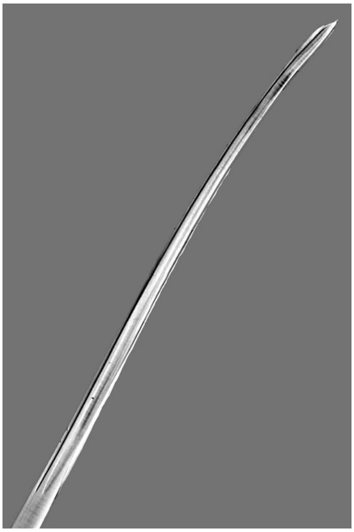

Fig. 6.25.3. Penial seta from segment 11 of *Dendrobaena veneta veneta*.

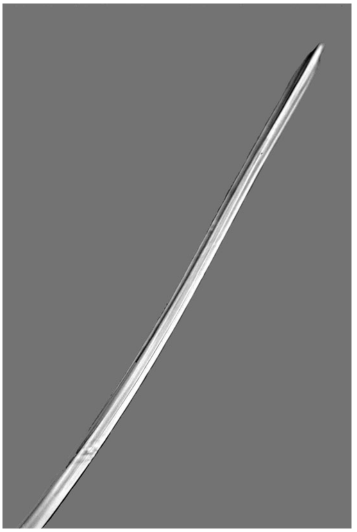

Fig. 6.25.4. Penial seta from the clitellum of *Dendrobaena veneta veneta*.

Remarks – *D. v. veneta* is a widely distributed peregrine species with high morphological variability. It is probably of East-Mediterranean origin (Perel 1979), in Central and Western Europe it could mostly be found in composts and dung heaps.

Ecology – *D. v. veneta* is one of the worms suitable for vermicomposting, but its cocoons contain only 1–2 juveniles and the net reproduction rate is rather low, 1.4 juv./week (Edwards 1998). The incubation time is between 21 and 31 days and the maturity takes 82–99 days (Zicsi 1985b). Life expectancy of this species is about 3.2 years (Zicsi 1974a). The daily consumption rate and cast production proved to be 45.5 mg dry matter pro 1g living weight (Zicsi 1974a).

Distribution – *D. v. veneta* has extensively been introduced all over in Europe, especially in the last two decades in connection with the vermicomposting industry.

Distribution in Hungary (fig. 6.25.5) **– CT45** *No.* 772, 768 Budapest, Budaörsi út.; *No.* 10256 Budatétény; *No.* 7373, 9179, 9180, 11532, 11533 Érd; *No.* 2936 Sasad; **CT46** *No.* 1831 Budapest Szemlőhegyi-barlang; *No.* 10940 Buda hills; *No.* 7058, 8966 Budapest, Juliannamajor; **CT56** *No.* 8965 Budapest, Népliget; *No.* 4152 Budapest, Farkas-völgy; *No.* 3866, 3868 Budapest, Botanical Garden; **CT77** *No.* 12779 Gödöllő. (The Hungarian occurrences of this species must be more frequent because the typical localities have not usually been sampled.)

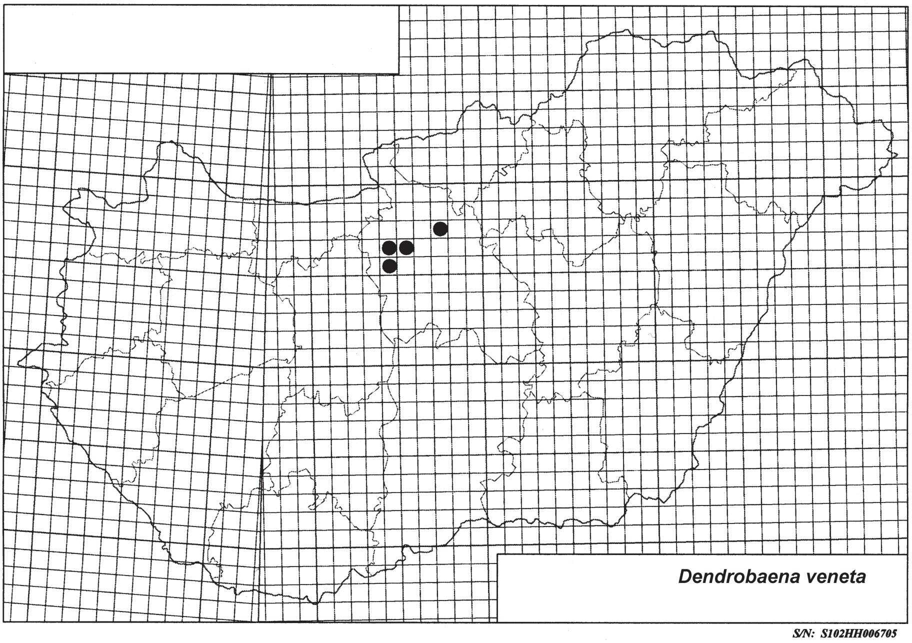

Fig. 6.25.5. Distribution of *Dendrobaena veneta veneta* in Hungary.

Genus *Dendrodrilus* Omodeo, 1956

Enterion (part.) Savigny, 1826 Mem. Acad. Sci. Inst. Fr., 5: 179.
Dendrobaena (part.): Örley 1881a Math. és term. tud. közlemények, 16: 585.
Octolasion (part.): Örley 1885 Értek. term. tud. köréből, 15(18): 13.
Allolobophora (part.): Örley 1885 Értek. term. tud. köréből, 15(18): 23.
Helodrilus (Dendrobaena) (part.) + *Helodrilus* (*Bimastus*) (part.): Michaelsen 1900a Das Tierreich, 10: 488, 501.
Dendrobaena (part.): Pop 1941 Zool. Jb. Syst., 74: 518.
Dendrobaena (Dendrodrilus) Omodeo, 1956 Arch. zool. Ital., 41: 175.
Dendrobaena (Dendrodrilus): Bouché 1972 Inst. Nat. Rech. Agron., p. 388.
Dendrodrilus: Perel 1976b Zool. Zh., 55: 834.
Dendrodrilus: Perel 1979 Range and regularities in the distr. earthworms, p. 200.
Dendrobaena (part.): Zicsi 1982a Acta Zool. Hung., 28: 443.
Dendrodrilus: Easton 1983 Earthworm Ecology, p. 479.
Dendrodrilus: Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 260.
Dendrodrilus: Perel 1997 Earthworms of Russia, p. 59.
Dendrodrilus: Qiu & Bouché 1998b Doc. pedozool. integrol., 3: 205.

Type species – *Enterion rubidum* Savigny, 1826 by original designation.

Diagnosis – *External* – Setae moderately paired, pigmentation purple-red. Prostomium epilobous, first dorsal pore around 5/6. Male pore on 15, fairly visible, sometimes with small glandular crescent slightly intruding into the neighbouring segments. Spermathecae, if present, two pairs, open near to setal line *c.* Nephropores irregularly alternate between *b* and above *d*. *Internal* – Two pairs of testes in 10, 11, and three or two pairs of seminal vesicles in 9 ,11, 12 (11, 12). Receptacula seminis, if present, two pairs situated in intersegmental furrow 9/10, 10/11. Calciferous glands with lateral diverticula in 10. Excretory system holonephridial, nephridial bladders U-shaped with ahead bent ental part. The cross-section of longitudinal muscle layer is of pinnate type with slight intermediate characters.

Table 6.4. Distinguishing characters of *Dendrodrilus* species in Hungary.

Species	Clitellum	Tubercles	Vesicles	Spermathecae	Nephridial bladders	Musculature
Dd. r. rubidus	26, (27)–31, 32	29–30	9, 11, 12	9/10, 10/11 *c*	U; forward	intermediate
(parthenogenetic form)	26–31	—	11, 12	—		
Dd. r. subrubicundus	26, (27)–31, 32	28–30	9, 11, 12	9/10, 10/11 *c*	U; forward	intermediate

6.26 *Dendrodrilus rubidus rubidus* (Savigny, 1826)

(Figs. 6.26.1–4.)

Enterion rubidum Savigny, 1826 Mem. Acad. Sci. Inst. Fr, 5: 182.
Lumbricus xanthurus Templeton, 1836 Ann. Mag. Nat. Hist., 9: 235.
Lumbricus puter Hoffmeister, 1845 Regenwürmer, p. 33.
Lumbricus pieter d'Udekem, 1865 Mem. Acad. Belg., 35: 41.
Hypogeon havaicus Kinberg, 1867 Öfv. Akad. Förh., 23: 101.
Allolobophora arborea Eisen, 1873 Öfv. Akad. Förh., 30: 49.
Allolobophora tenuis Eisen, 1874 Öfv. Akad. Förh., 31: 44.
***Dendrobaena puter* (part.): Örley, 1881a Math. és term. tud. közlemények, 16: 586.**
Allolobophora constricta Rosa, 1884 Lumbric. Piemonte, p. 38.
Octolasion constrictum: Örley 1885 Értek. term. tud. köréből, 15: 21.
Allolobophora darwini Ribaucourt, 1896 Rev. suisse Zool., 4: 18.
Allolobophora putris subrubicunda helvetica Ribaucourt, 1896 Rev. suisse Zool., 4: 18.
Helodrilus (Dendrobaena) rubidus: Michaelsen 1900a Das Tierreich, 10: 490.
Helodrilus (Bimastus) constrictus: Michaelsen 1900a Das Tierreich, 10: 503.
***Helodrilus (Bimastus) constrictus* (part.): Szüts 1909 Állattani Közlemények, 8: 139.**
non *Helodrilus (Dendronaena) rubidus*: Szüts 1909 Állattani Közlemények, 8: 137.
***Dendrobaena rubida* var. *tenuis*: Pop 1943a Ann. Hist.-Nat. Mus. Hung., 36: 21.**
Dendrobaena subrubicunda v. papillosa (part.): Pop 1943a Ann. Hist.-Nat. Mus. Hung., 36: 21.
Dendrobaena magnesa Tzelepe, 1943 Erg. z. Dol. Panepis Athinan Kavig., p. 38.
Dendrobaena (Dendrodrilus) rubida: Omodeo 1956 Arch. Zool. Ital., 41: 175.
Dendrobaena (Dendrodrilus) rubida f. *tenuis*: Omodeo 1956 Arch. Zool. Ital., 41: 175
Dendrobaena rubida (part.): Zicsi 1959 Acta zool. hung., 5: 435.
***Dendrobaena rubida* (part.): Zicsi, 1968a Opusc. Zool. Budapest, 8: 135.**
Dendrodrilus rubidus f. *tenuis* + *Dendrodrilus rubidus* f. *subrubicundus* (part): Perel 1979 Range and regularities in the distr. earthworms, p. 200–201.
Dendrobaena rubida rubida: Zicsi 1982a Acta zool. hung., 28: 443.
Dendrobaena rubida tenuis: Zicsi 1982a Acta zool. hung., 28: 443.
Dendrodrilus rubidus rubidus: Easton 1983 Earthworm Ecology, p. 477.
Dendrodrilus rubidus tenuis: Easton 1983 Earthworm Ecology, p. 480.
***Dendrodrilus rubidus rubidus*: Zicsi 1991 Opusc. Zool. Budapest, 24: 174.**
***Dendrodrilus rubidus tenuis*: Zicsi 1991 Opusc. Zool. Budapest, 24: 175.**
Dendrodrilus rubidus rubidus: Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 263.
Dendrodrilus rubidus tenuis: Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 270.
Dendrodrilus rubidus tenuis: Perel 1997 Earthworms of Russia, p. 60.
Dendrodrilus rubidus: Qiu & Bouché 1998a Doc. pedozool. integrol., 4: 195.
Dendrodrilus tenuis: Qiu & Bouché 1998a Doc. pedozool. integrol., 4: 195.

Description – *External* – Body length 30–60 mm, diameter 2–3 mm, 50–110 segments. Colour red-violet, darker dorsally. Head epilobous, first dorsal pore in 5/6. Glandular tumescence usually on 16 *ab*. Setae moderately paired, closer laterally and wider ventrally. Setal arrangement after the clitellum: aa:ab:bc:cd:dd = 2:1:2:1.4:6. Clitellum extends on segments 26, (27)–31, (32), saddle-shaped. Tubercles on 29–30, sometimes hardly seen. Male pore on 15 between setae *b*–*c*, incrassate, confined within its own segment. Nephropores irregularly alternate between setal lines *b–d*. *Internal* – Dissepiments 5/6–10/11 slightly thickened. Crop in 15–16, gizzards in 17–18. Two pairs of testes in 10, 11, and three pairs of seminal vesicles in 9, 11, 12. Spermathecae two pairs in 9/10, 10/11 open in the setal line *c*. Calciferous glands in 10–12 with lateral diverticula in 10. Excretory system holonephridial. Nephridial bladders U-shaped with ahead bent ental part. Typhlosole lamelliform, the cross-section of longitudinal muscle layer is of pinnate type, showing slight intermediate characters (fig. 6.26.1, 6.26.2).

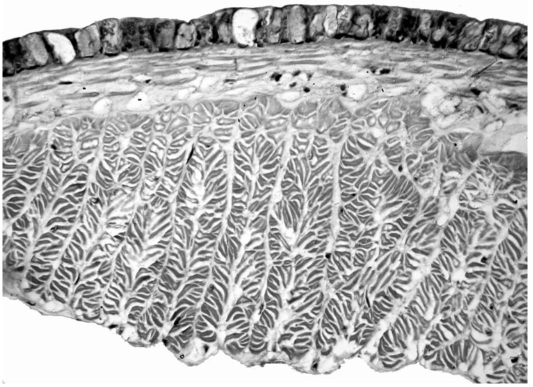

Fig. 6.26.1. Longitudinal musculature of *Dendrodrilus rubidus rubidus*.

Fig. 6.26.2. Typhlosole of *Dendrodrilus rubidus rubidus*.

Remarks – The validity of the three subspecies of *Dd. rubidus* is in question. All the subspecies are widely distributed peregrine worms with different state of polyploidy and parthenogenesis. Certain authors regard them as subspecies (Zicsi 1982a, Mršić 1991), others as forms (Perel 1979) or independent species (Qiu & Bouché 1998a). We treat *Dd. r. subrubicundus* here as subspecies, but *Dd. r. tenuis* is only a parthenogenetic form of the nominal subspecies.

Ecology – *Dd. r. rubidus* is an epigeic worm frequently found under bark of fallen logs, under stones and in dung. Its yearly litter consumption is 1.15 g dry weight pro animal. *Dd. r. rubidus* defecates almost exclusively onto the soil surface. The yearly cast production is 1.99 g dry weight pro animal. Extrapolating these data to a hectare of forest the yearly consumption of this small species proved to be 53.7 kg litter pro hectare and the cast production was 93.2 kg pro hectare (Zicsi 1974a).

Distribution – It is native in the Palearctis but introduced extratropically all over the world.

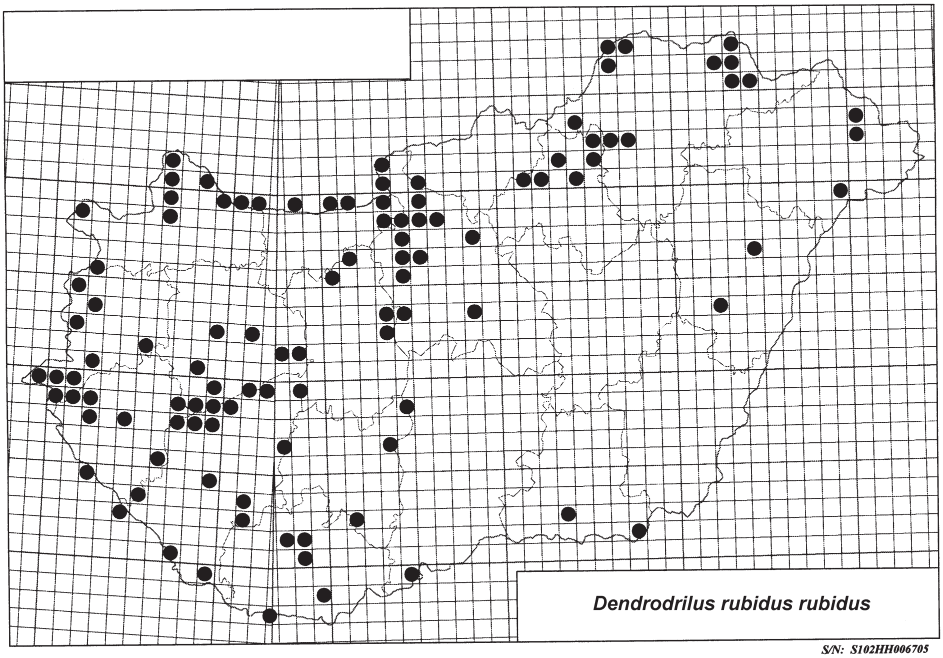

Fig. 6.26.3. Distribution of *Dendrodrilus rubidus rubidus* in Hungary.

Distribution in Hungary (*Dd. r. rubidus***)** (fig. 6.26.3) **– BR98** *No.* 7309 Szársomlyó; **BS71** *No.* 3191 Mecsek Mts. Abaliget; *No.* 3200 Mecsek Mts. Szuado-völgy; *No.* 14317 Mecsek Mts. Orfü; **BS76** *No.* 12879 Somogydöröcske; *No.* 738 Siófok; *No.* 11377, 11398 Balatonszéplak; **BS80** *No.* 821, 831 Mecsek Mts.; *No.* 825, 1783, 1788, 1801, 1802, 4732 Mecsek Mts. Misina; *No.* 1792, 1796, 1798, 1804 Mecsek Mts. Tubes; *No.* 3166 Mecsek Mts. Fehérkút; *No.* 3186 Mecsekszabolcs; *No.* 4775 Pécs; **BS81** *No.* 837 Mecsek Mts. Mánfai-barlang; **BS89** *No.* 735 Balatonszabadi; **BT71** *No.* 1918 Balatonfűzfő; **BT81** *No.* 11248 Balatonkenese; **BT89** *No.* 1117 Komárom; **CR49** *No.* 5019 Gara; **CS12** *No.* 14445 Bátaapáti; **CS36** *No.* 1893 Dunaszentbenedek; **CS48** *No.* 602 Dunaföldvár; **CT05** *No.* 5485 Csákvár; *No.* 5499 Vértes Mts. Kőhányás; **CT09** *No.* 1107, 1174 Süttő; *No.* 1178 Dunaalmás; **CT16** *No.* 8407 Vértes Mts. Vinnyabükki-völgy; **CT19** *No.* 1518 Nyergesújfalu; **CT32** *No.* 675 Adony; **CT33** *No.* 2877 Baracska; **CT38** *No.* 14471 Pilis Mts. Kétbükkfa-nyereg; **CT39** *No.* 3914 between Esztergom and Visegrád; **CT43** *No.* 554 Ercsi; **CT45** *No.* 771 Budapest, Budaörsi út; **CT46** *No.* 7638 Budapest, Farkasréti temető; **CT47** *No.* 7249, 7253 Solymár; **CT48** *No.* 9935 Pilis Mts. Szőke-forrás völgye; *No.* 10012 Pilis Mts. Szakó-nyereg; *No.* 10023 Pilis Mts. Apátkuti-patak; *No.* 10407 Pilis Mts. Szentlászló-völgy; **CT49** *No.* 9927 Pilis Mts. Hoffmann-kunyhó; **CT56** *No.* 779 Csepel; *No.* 4162 Budapest, Farkas-völgy; *No.* 4425, 12100 Budapest, Botanical Garden; **CT58** *No.* 2816 Alsógöd; *No.* 4176, 4183 Pilis Mts. Bükkös-patak; *No.* 7187, 7263, 7271 Pilis Mts. Lajosforrás; **CT59** *No.* 7105 Magyarkút; **CT68** *No.* 12095

Vácrátót; **CT83** *No.* 7288 Csévharaszt; **CT87** *No.* 7199 Bag, Petőfi-forrás; **CU30** *No.* 2074 Letkés; **CU31** *No.* 4593 Csóványos; **CU50** *No.* 8420, 11772 Szendehely; **DS32** *No.* 1683 Tápé; **DS71** *No.* 5627 Kövegy; **DU10** *No.* 842 Mátra Mts. Galyatető; *No.* 11616 Mátra Mts. Kékestető; **DU20** *No.* 4253 Mátra Mts. Köszörűs-patak; **DU31** *No.* 8265 Pétervására; **DU40** *No.* 7418 between Sirok and Egerbakta; **DU43** *No.* 7387 Borsodnádasd; **DU51** *No.* 4637, 8563 Bükk Mts. Szarvaskő; *No.* 5176, 8284 Felsőtárkány; **DU52** *No.* 790 Szilvásvárad; *No.* 9868 Bükk Mts. Leány-völgy; *No.* 9873 Bükk Mts. Határhordó *No.* 9882, 9887, 9900 Bükk Mts. Tóthfalusi-völgy; **DU62** *No.* 2979 Bükk Mts. Garadna-völgy; *No.* 4605 Bükk Mts. Bánkút; *No.* 4634 Bükk Mts. Meteor-forrás; *No.* 6430 Ómassa; *No.* 7619 Répáshuta, Csúnya-völgy; **DU66** *No.* 588, 1787, 2856, 3159, 3944, 4456, 4510 Aggtelek; *No.* 4839 Aggtelek, Haragistya; **DU67** *No.* 1940, 3313, 4646 Jósvafő; **DU72** *No.* 2994 Bükk Mts. Csókás-forrás; *No.* 4815, 7381 Lillafüred; **DU77** *No.* 510 Szinpetri; *No.* 4461 Őz; *No.* 4463 Alsóhegy; **ET23** *No.* 9056 Sáp; **ET46** *No.* 4631 Debrecen; **ET99** *No.* 11734 Bátorliget; *No.* 11190 Bátorliget, Fényi-erdő; **EU26** *No.* 4256 Regéc; **EU35** *No.* 4264 Óhuta; **EU36** *No.* 4467 Pálháza; *No.* 4935, 4951 Zemplén Mts. Kőkapu; *No.* 4937 Zemplén Mts. Kemence-patak; *No.* 10253, 14323 Zemplén Mts. Rostalló; *No.* 11640 Kishuta; **EU37** *No.* 4943, 5993 Füzér; **EU45** *No.* 4939 Zemplén Mts. Királyhegy; **FU02** *No.* 4524, 4564, 7287 Gulács; **FU03** *No.* 4891, 10591 Vámosatya, Bockerek-erdő; **WM99** *No.* 4708, 12061 Szakonyfalu; **XL99** *No.* 10263 Barcs; **XM08** *No.* 8530 Kercaszomor; *No.* 12021 Őriszentpéter; **XM09** *No.* 8534 Orfalu; *No.* 12069 Kondorfa; **XM18** *No.* 12024 Nagyrákos; **XM19** *No.* 12235 Szőce; **XM24** *No.* 4118 Murarátka; **XM27** *No.* 5401, 5408 Nova; **XM28** *No.* 6439 Zalalövő; **XM42** *No.* 5426 Őrtilos; **XM47** *No.* 8553 Bak; **XM53** *No.* 9152 Surd; **XM65** *No.* 9011 Zalakaros; **XM70** *No.* 4767 Heresznye; **XM77** *No.* 10289, 11229, 11268, 11272, 11281, 11294, 11312, 11357, 12755 Balatonberény; **XM78** *No.* 752, 1990 Keszthely; *No.* 1392, 1422 Balaton, Szt Mihály kápolna; **XM87** *No.* 2150 Balatonfenyves; *No.* 2832, 4635, 4652, 4653 Bélatelep; *No.* 11236 Balatonmária; **XM88** *No.* 4399, 4448 Badacsony; *No.* 4531 Badacsonytördemic; **XM94** *No.* 4468 between Nagybajom and Böhönye; **XM97** *No.* 4655 Fonyódliget; **XM98** *No.* 1450 Révfülöp; **XM99** *No.* 4565 Tóti hegy; **XN12** *No.* 8137 Pornóapáti; **XN14** *No.* 5586, 8114, 8130, 8169, 8185, 10636 Velem; *No.* 5595 Kőszeg, Szabó-hegy; *No.* 10517 Kőszeg; *No.* 8199 Cák; **XN18** *No.* 5702 Brennbergbánya; *No.* 5715 Tómalom; *No.* 5723 Sopron, Kecske-patak; **XN20** *No.* 12250 Nádasd; **XN23** *No.* 12093 Szombathely; **XN25** *No.* 8178 between Horvátzsidány and Kőszeg; **XN51** *No.* 8129 Bögöte; **XN68** *No.* 13095, 13075 Csorna, Csíkos-éger; **XN69** *No.* 14277 Újrónafő; **XN80** *No.* 10197 Felsőnyirád; **XN92** *No.* 5603 Bakonygyepes; **XN99** *No.* 1265, 1315 Medve; **XP60** *No.* 3933 Hegyeshalom; **XP61** *No.* 1597, 1618, 3882, 3979, 6022 Rajka; **XP80** *No.* 1507 Dunasziget; **YL37** *No.* 4753 Vejti; **YM08** *No.* 665, 767, 1945, 11364 Balatonboglár; **YM12** *No.* 7307 Marcado; **YM13** *No.* 852, 2921, 2929 Zselice; **YM19** *No.* 12373 Örvényes; *No.* 12759 Balatonszárszó; **YM29** *No.* 743, 11386 Zamárdi; **YN09** *No.* 1511 Nagybajcs; **YN12** *No.* 4852 Márkó; **YN19** *No.* 1127, 1130 Gönyü.

Distribution in Hungary (*Dd. r. rubidus* morph tenuis**)** (fig. 6.26.4) – **CT37** *No.* 10034 Piliscsaba, Iluska-forrás; **CT48** *No.* 10266 Pilis Mts. Kétbükkfa-nyereg; *No.* 9976 Pilis Mts. Sikáros; **CT49** *No.* 9951, 10000 Pilis Mts. Apátkuti-völgy; **CT59** *No.* 9994 Pilis Mts. Lukács-árok; **CT68** *No.* 12098 Vácrátót; **DU66** *No.* 671 Aggtelek; **EU36** *No.* 11673 Nagyhuta; **XL99** *No.* 10508 Barcs; **XM77** *No.* 10279 Balatonberény; **XM87** *No.* 10074 Balatonmária-fürdő; **XN14** *No.* 11703 Velem; **XN23** *No.* 12094 Szombathely; **XN93** *No.* 11759 Bakony; **XN98** *No.* 11603 Győr.

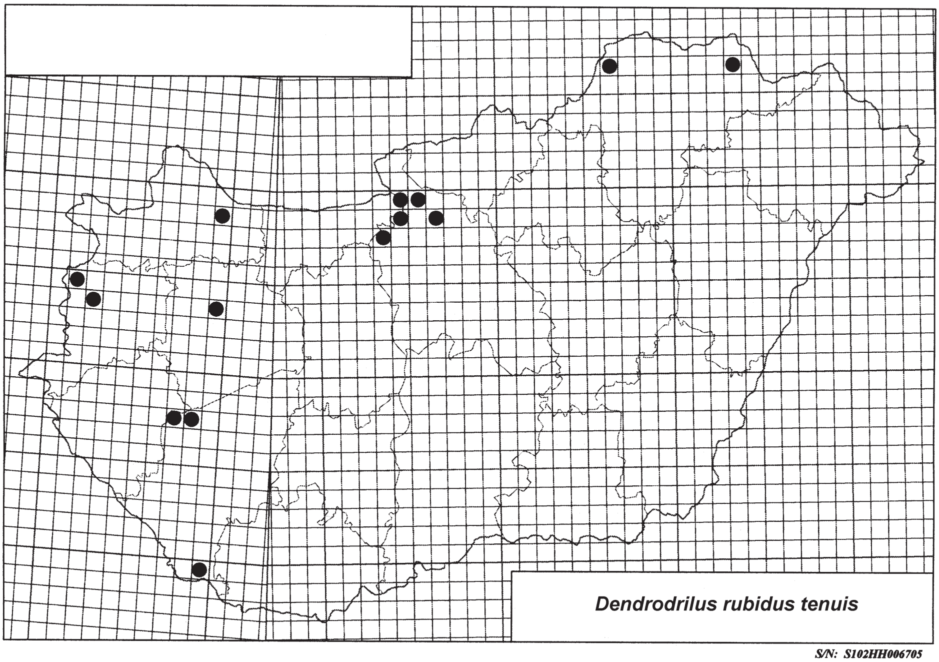

Fig. 6.26.4. Distribution of *Dendrodrilus rubidus rubidus* (morph tenuis) in Hungary.

6.27 *Dendrodrilus rubidus subrubicundus* (Eisen, 1873)

(Figs. 6.27.1–3.)

?*Lumbricus valdiviensis* Blanchard, 1849 Gay. Hist. Chile, 3: 43.
Allolobophora subrubicunda Eisen, 1873 Öfv. Akad. Förh., 30: 51.
Allolobophora fraissei Örley, 1881b Zool. Anz., 4: 285. **syn. nov**.
***Dendrobaena puter* (part.): Örley 1881a Math. és term. tud. közlemények, 16: 586.**
Octolasion subrubicundum: Örley 1885 Értek. term. tud. köréből, 15: 20.
Helodrilus (Dendrobaena) rubidus var *subrubicundus*: Michaelsen 1900a Das Tierreich, 10: 490.
Dendrobaena putris dieppi Ribaucourt, 1901 Bull. Sci. Fr. Belg., 35: 226.
***Helodrilus (Bimastus) constrictus* (part.): Szüts 1909 Állattani Közlemények, 8: 139.**
Dendrobaena subrubicunda var. *papillosa* Pop, 1938 Bull. Soc. Sti. Cluj, 9. 139. **syn. nov.**
***Dendrobaena rubida* var. *subrubicunda:* Pop 1943a Ann. Hist.-Nat. Mus. Hung., 36: 21.**
Dendrobaena (Dendrodrilus) rubida f. *subrubicunda*: Omodeo 1956 Arch. Zool. Ital., 41: 175.
Dendrobaena rivulicola Chandebois, 1958 Bull. Soc. Zool. Fr., 83: 159.
***Dendrobaena rubida* (part.): Zicsi 1968a Opusc. Zool. Budapest 8: 135.**
Dendrodrilus rubidus f. *subrubicundus* (part): Perel 1979 Range and regularities in the distr. earthworms, p. 201.
Dendrobaena rubida subrubicunda: Zicsi 1982a Acta zool. hung., 28: 443.
Dendrodrilus rubidus subrubicundus: Easton 1983 Earthworm Ecology, p. 479.
Dendrodrilus rubidus subrubicundus: **Zicsi 1991 Opusc. Zool. Budapest, 24: 175.**
Dendrodrilus rubidus subrubicundus: Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 267.

Dendrodrilus rubidus subrubicundus: PEREL 1997 Earthworms of Russia, p. 60.
Dendrodrilus subrubicundus: QIU & BOUCHÉ 1998a Doc. pedozool. integrol., 4: 195.

Description – *External* – Body length 50–90 mm, diameter 3–4 mm, 60–125 segments. Colour red-violet, dorsally darker. Head epilobous, first dorsal pore in 5/6. Glandular tumescence usually on 9, 16, 22–25 *ab.* Setae moderately paired, closer laterally and wider ventrally. Setal arrangement after the clitellum: aa:ab:bc:cd:dd = 2.2:1:1.6:1.6:8. Clitellum extends on segments 25, 26–31, (32) saddle-shaped. Tubercles on 28–30. Male pore on 15 between setae *b–c*, incrassate, confined within its own segment. Nephropores irregularly alternate between setal lines *b–d*. *Internal* – Dissepiments 5/6–10/11 slightly thickened. Crop in 15–16, gizzards in 17–18. Two pairs of testes in 10, 11, and three pairs of seminal vesicles in 9, 11, 12. Spermathecae two pairs in 9/10, 10/11 open in the setal line *c*. Calciferous glands in 10–12 with lateral diverticula in 10. Excretory system holonephridial. Nephridial bladders "U" shaped with forward oriented ental part. Typhlosole lamelliform, the cross-section of longitudinal muscle layer is of intermediate type (fig. 6.27.1, 6.27.2).

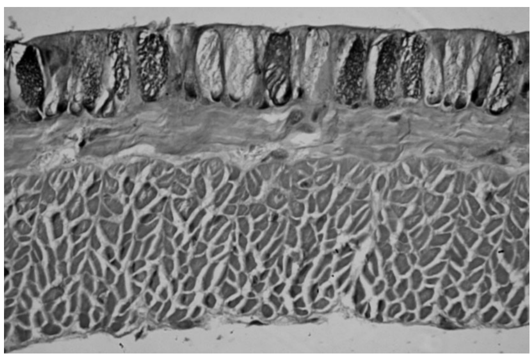

Fig. 6.27.1. Longitudinal musculature of *Dendrodrilus rubidus subrubicundus*.

Fig. 6.27.2. Typhlosole of *Dendrodrilus rubidus subrubicundus*.

Remarks – MICHAELSEN (1900a) placed *A. fraissei* ÖRLEY, 1881 in synonymy with *Dd. rubidus rubidus*. Examining the syntypes housed in The Natural History Museum, London under Reg. No. 1881.7.8.3–4. revealed, that it is a synonym of *Dd. r. subrubicundus* and not of the nominal subspecies. We found the same situation in case of

D. subrubicunda v. *papillosa* Pop, 1938. The syntypus housed in The Natural History Museum, London Reg. No. 1949.3.1.634. proved to be identical with *Dd. r. subrubicundus*.

Ecology – *Dd. r. subrubicundus* is an epigeic worm frequently found in dung and compost heaps. GERARD (1964) reports its presence near sewage works.

Distribution – This species is native in the Palearctis but introduced extratropically all over the world.

Distribution in Hungary (fig. 6.27.3) **– BT80** *No.* 11391 Balatonaliga; *No.* 11402 Balatonvilágos; **BT81** *No.* 11283 Balatonkenese; **CS97** *No.* 10504 Bugac; **CT49** *No.* 10030 Lepence-patak; **CT56** *No.* 3865 Budapest, Botanical Garden; **XL99** *No.* 10507 Barcs; **XM77** *No.* 12750 Balatonberény.

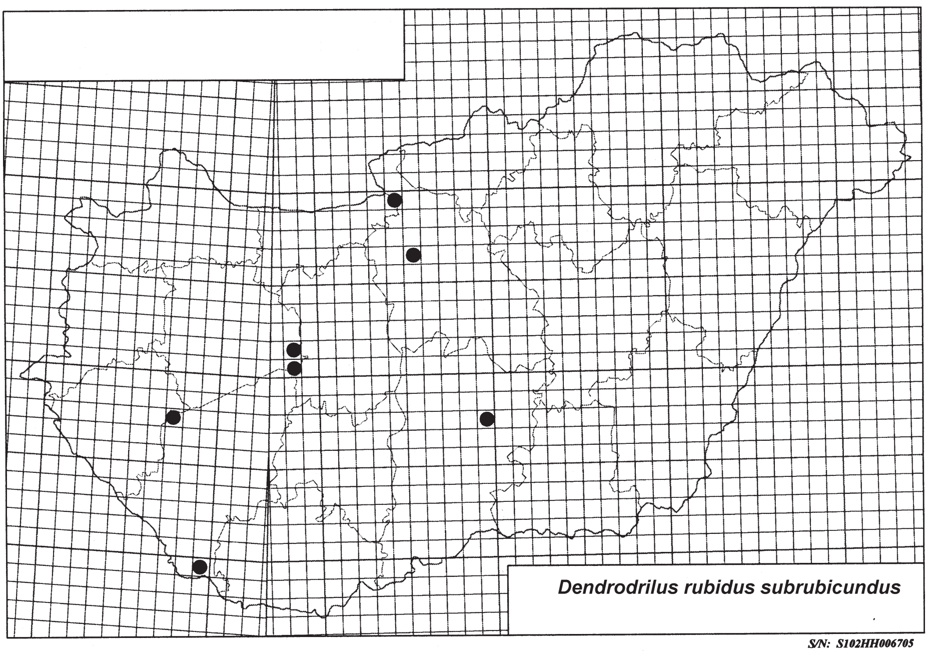

Fig. 6.27.3. Distribution of *Dendrodrilus rubidus subrubicundus* in Hungary.

Genus *Eisenia* MALM, 1877

Enterion (part.) SAVIGNY, 1826 Mem. Acad. Sci. Inst. Fr., 5: 182.
Allolobophora (part.) EISEN, 1873 Öfv. Acad. Förh., 30: 45.
Eisenia MALM, 1877 Öfv. Salsk. Hort. Förh. Göteborg, 1: 45.
Allolobophora (part.): ÖRLEY, 1881a Math. és term. tud. közlemények, 16: 591.
Allolobophora (part): ÖRLEY 1885 Értek. term. tud. köréből, 15: 23.
Allurus (part.): ÖRLEY 1885 Értek. term. tud. köréből, 15: 12.
Allolobophora (Notogama) (part.) ROSA, 1893a Mem. Acc. Torino, 43: 424.
Eisenia (part.): MICHAELSEN 1900a Das Tierreich, 10: 474.
Eisenia (part.): SZÜTS 1909 Állattani Közlemények, 8: 126.
Eisenia (part.): POP 1941 Zool. Jb. Syst., 74: 518.
Eisenia (part): OMODEO 1956 Arch. zool. Ital., 41: 170.
Eisenia + *Eisenia* (sensu lato): BOUCHÉ 1972 Inst. Nat. Rech. Agron., p. 381.
Eisenia: PEREL 1976b Zool. Zh., 55: 835.
Eisenia: PEREL 1979 Range and regularities in the distr. earthworms, p. 214.
Eisenia (part.): ZICSI 1982a Acta zool. hung., 28: 443.
Eisenia: EASTON 1983 Earthworm Ecology, p. 480.
Eisenia: MRŠIĆ 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 491.
Eisenia: PEREL 1997 Earthworms of Russia, p. 66.
Eisenia: QIU & BOUCHÉ 1998b Doc. pedozool. integrol., 3: 199.

Type species – *Enterion fetidum* Savigny, 1826 by subsequent designation (GATES 1969).

Diagnosis – *External* – Setae closely paired, pigmentation dark red or reddish-brown sometimes lacking. Prostomium epilobous, first dorsal pore around 5/6. Male pore on 15, usually medium-sized. Spermathecae open in setal line *cd* or above up to the mid-dorsal line. Nephridial pores alternate irregularly between *b* and above *cd*. *Internal* – Two pairs of testes free in 10, 11. Four or two pairs of vesicles in 9–12 or 11, 12 and two pairs of spermathecae in 9/10, 10/11. Calciferous glands usually with diverticula in 11, 12 or only in one of them. Excretory system holonephridial, nephridial bladders simple, sausage-shaped. The cross-section of longitudinal muscle layer is of pinnate, intermediate or fasciculated type.

Remarks – The genus *Eisenia* is heterogeneous to such an extent that it requires urgent revision. Unfortunately most of the species attributed to it are of Caucasian or Far East origin and had not been studied during the last revisions (MRŠIĆ 1991, QIU & BOUCHÉ 1998b). We had the opportunity to examine a part of these species and concluded that *E. grandis* (MICHAELSEN, 1907) and the closely related species from the Caucasus and Asia Minor should not be classified with *E. fetida*. Leaving out of consideration the setal arrangement, this group of species shows remarkable similarity with the "*veneta*" group of the genus *Dendrobaena*. Looking over the literature data (especially Kvavadze 1985), a continuous transition could be observed from the closely paired setae to the distantly standing ones (see also ZICSI 1981a). It sometimes makes difficult to determine the generic affiliation of certain species. For example *Helodrilus (Eisenia) venetus ebneri* MICHAELSEN, 1914 is referred to different genera by different authors, such as *Allolobophora grandis ebneri* (ZICSI 1982a), *Eisenia* *ebneri* (Zicsi & Michalis 1981), *Eisenia* (?*Dendrobaena*) *ebneri* (Zicsi et Csuzdi 1986) and *Eophila grandis ebneri* (Omodeo 1988) *Eisenia grandis ebneri* (Mršić 1991, Qiu & Bouché 1998a).

Table 6.5. Distinguishing characters of the *Eisenia* species in Hungary.

Species	**Clitellum**	**Tubercles**	**Vesicles**	**Spermathecae**	**Nephridial bladders**	**Musculature**
E. balatonica	24, 25–30	26–29	9–12	9/10, 10/11 M	sac-shaped	pinnate
E. fetida	25, 26, 27–31, 32, 33	½ 28, 28–30, 31	9–12	9/10, 10/11 M	sausage-shaped	pinnate
E. lucens	25, 26, 27–33, 34	½ 28, 29–31, 32	9–12	9/10, 10/11 *d*–M	sausage-shaped	fasciculated
E. spelaea	25, 26, 27–33, 34	28, 29–31, 32	9–12	9/10, 10/11 M–*d*	sausage-shaped	fasciculated

6.28 *Eisenia balatonica* (Pop, 1943)

(Figs. 6.28.1–3.)

***Eiseniella balatonica* Pop, 1943 Ann. Hist.-Nat. Mus. Hung., 36: 15.**
Eisenia ukrainae Malevics, 1950 Dokl. Akad. Nauk SSSR, 70: 1083.
***Eiseniella balatonica*: Zicsi 1968a Opusc. Zool. Budapest, 8: 140.**
Eisenia balatonica: Perel 1979 Range and regularities in the distr. earthworms, p. 221.
Eiseniella balatonica: Zicsi 1982a Acta zool. hung., 28: 444.
Eisenia balatonica: Easton 1983 Earthworm Ecology, p. 480.
***Eiseniella balatonica*: Zicsi 1991 Opusc. Zool. Budapest, 24:178.**
Eisenia balatonica: Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 506.
Eisenia balatonica: Perel 1997 Earthworms of Russia, p. 72.
Eisenia balatonica: Qiu & Bouché 1998a Doc. pedozool. integrol., 4: 189.

Description – *External* – Body length 40–100 mm, diameter 1.5–2.5 mm, 80–132 segments. Colour brown or yellowish–brown. Head epilobous, first dorsal pore in 4/5. Glandular tumescence usually on 10, 11, 22, 23 and along the clitellum *ab*. Setae closely paired, setal arrangement after the clitellum: aa:ab:bc:cd:dd = 4:1:4:1:5. Clitellum saddle–shaped, extends on segments 24, 25–30. Tubercles on 26–29. Male pores moderately sized, on 15. Nephropores alternate irregularly between *b* and above *d*. The body has a characteristic quadrangular shape behind the clitellum, with setae on the edges. *Internal* – There are no dissepiments notably thickened. Crop in 15–16, gizzards 17–18. Two pairs of testes free in 10, 11, and four pairs of seminal vesicles in 9–12. Receptacula seminis two pairs in 9/10–10/11 open in the mid–dorsal line. Calciferous glands with diverticula in 11, 12. Excretory system holonephridial with saccular nephridial bladders. The cross-section of longitudinal muscle layer is of pinnate type (fig. 6.28.1).

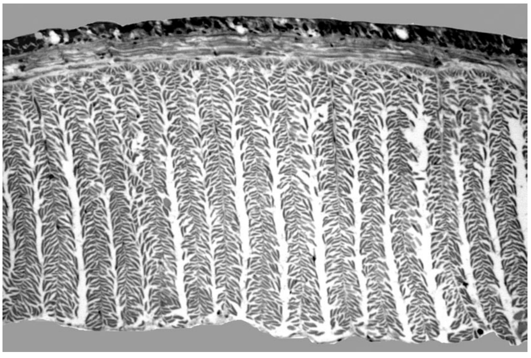

Fig. 6.28.1. Longitudinal musculature of *Eisenia balatonica*.

Remarks – Several authors (Perel 1979, Mršić 1991, Qiu & Bouché 1998a) attribute this species to the genus *Eisenia* on the basis that it has no calciferous diverticula in 10 and the muscular gizzard occupies two segments. Our observation corroborates these findings so contrary to the marked external similarity with the *Eiseniella* species we also place *E. balatonica* into *Eisenia*.

Ecology – *Eisenia balatonica* is a limicolous species showing an overwhelming preference for damp habitats.

Distribution – *E. balatonica* is a Central-European species occurring in Hungary, Romania and Ukraine (fig. 6.28.2). Perel (1997) reported also several isolated Siberian occurrences that must be corroborated.

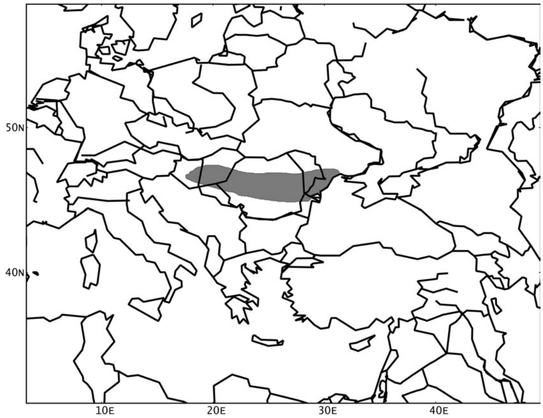

Fig. 6.28.2. Distribution of *Eisenia balatonica* in Europe.

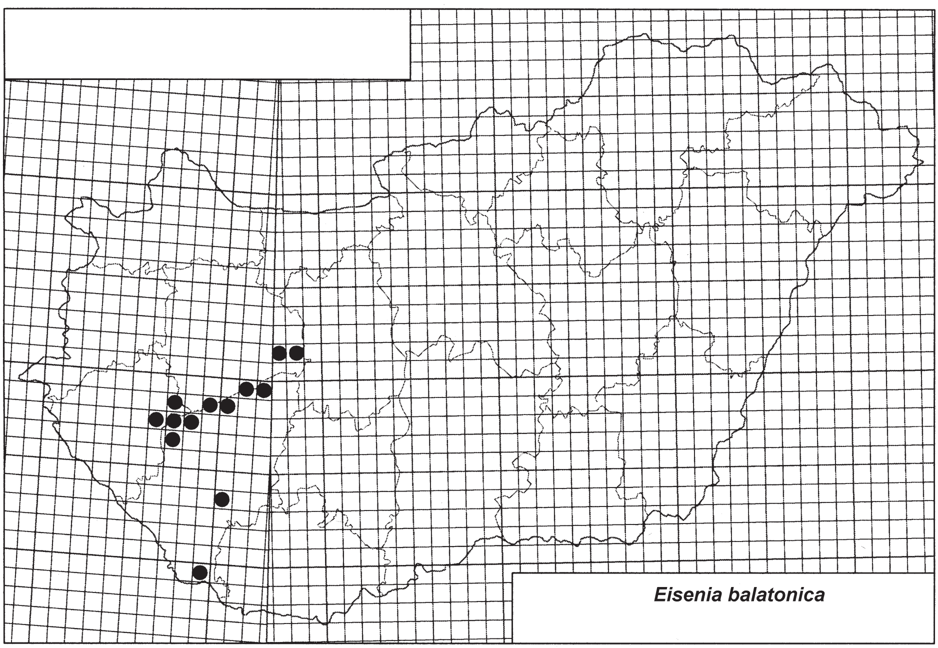

Fig. 6.28.3. Distribution of *Eisenia balatonica* in Hungary.

Distribution in Hungary (fig. 6.28.3) – **BT71** *No.* 1915 Balatonfűzfő; **BT81** *No.* 11287 between Balatonkenese and Fűzfő; **XL99** *No.* 10510 Barcs; **XM67** *No.* 1924, 11259 Fenékpuszta; **XM76** *No.* 11319 between Tikos and Sajkod; **XM77** *No.* 11231, 11270, 11342, 11350, 11351, 12748, 12756 Balatonberény; **XM78** *No.* 1190, 1424 Gyenesdiás; *No.* 1407, 11252, 11328 Keszthely; *No.* 1386 Balaton, Szt. Mihály kápolna; **XM87** *No.* 11309, 11332, 11340, 11306 Balatonfenyves; *No.* 10070 Balatonmária-fürdő; **XM98** *No.* 1448 Révfülöp; **YM03** *No.* 11541, 11542, 11543, 11598, 11599, 11600 Bárdibükk; **YM08** *No.* 2044 Balatonboglár; **YM19** *No.* 11372, 12751, 12757 Balatonszárszó; **YM29** *No.* 11384 Zamárdi.

6.29 *Eisenia fetida* (Savigny, 1826)

(Figs. 6.29.1–3.)

Enterion fetidum Savigny, 1826 Mem. Acad. Sci. Inst. Fr., 5: 182.
Lumbricus semifasciatus Burmeister, 1835 Zool. Hand-Atl., 33: 3.
Lumbricus annularis Templeton, 1836 Mag. Nat. Hist., 9: 234.
Lumbricus olidus Hoffmeister, 1842 Verm. Lumbric., p. 25.
Lumbricus luteus Blanchard, 1849 Gay. Hist. Chile, 3: 42.
Lumbricus rubro-fasciatus Baird, 1873 J. Linn. Soc., 11: 97.
Allolobophora foetida: Eisen 1873 Öfv. Acad. Förh., 30: 50.
Lumbricus annulatus Hutton, 1877 Trans. N. Z. Inst., 9: 52.
Eisenia foetida: Malm 1877 Öfv. Salsk. Hort. Förh. Göteborg, 1: 45.
***Allolobophora foetida fimetora* Örley, 1881a Math. és term. tud. közlemények, 16: 598.**
***Allolobophora foetida*: Örley 1885 Értek. term. tud. köréből, 15: 27.**
Allolobophora (Notogama) foetida: Rosa 1893a Mem. Acc. Torino, 43: 424.
Eisenia foetida: Michaelsen 1900a Das Tierreich, 10: 475.
Eisenia nordenskiöldi caucasica Michaelsen, 1902a Mitt. Nat. Mus. Hamb., 19: 28.
?*Eisenia foetida*: Szüts 1909 Állattani Közlemények, 8: 127.
Helodrilus (Eisenia) foetidus: Michaelsen 1913 Zool. Jb. Syst., 34: 551.
Eisenia foetida attica Tzelepe, 1943 Erg.z. Dol. Panepis Athinan Kavig., p. 1.
Eisenia fasciata Backlund 1948 Kungl. Fysiogr. Sällsk. Handl., 18(6): 1.
***Eisenia foetida*: Zicsi 1959a Acta zool. hung., 5: 434.**
Eisenia foetida unicolor Andre, 1963 Bull. Biol. Fr. Belg. 81(1): 24.
***Eisenia foetida*: Zicsi 1968a Opusc. Zool. Budapest 8:132.**
Eisenia fetida andrei Bouché, 1972 Inst. Nat. Rech. Agron., p. 381.
Eisenia fetida fetida: Bouché 1972 Inst. Nat. Rech. Agron., p. 381.
Eisenia foetida: Perel 1979 Range and regularities in the distr. earthworms, p. 217.
Eisenia foetida: Zicsi 1982a Acta zool. hung., 28: 443.
Eisenia fetida: Easton 1983 Earthworm Ecology, p. 480.
***Eisenia foetida*: Zicsi 1991 Opusc. Zool. Budapest, 24:174.**
Eisenia fetida: Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 497.
Eisenia fetida: Perel 1997 Earthworms of Russia, p. 69.
Eisenia fetida fetida+*Eisenia andrei andrei*: Qiu & Bouché 1998a Doc. pedozool. integrol., 4: 189.

Description – *External* – Body length 26–130 mm, diameter 2–4 mm, 60–120 segments. Colour dark violet sometimes alternating stripes of darker segmental with paler intersegmental areas. Head epilobous, first dorsal pore in (3/4), 5/6. Glandular tumescence usually on 9, 10, 11 *abcd.* Setae closely paired, setal arrangement after the clitellum: aa:ab:bc:cd:dd = 5:1.3:4:1:16.7. Clitellum extends on segments (24), 25, 26, 27–31, 32, (33) saddle-shaped. Tubercles usually on 1/2 28, 28–30, 31. Male pore on 15 between setae *b–c*, surrounded by a glandular crescent, frequently protruding into the neighbouring segments. Nephropores alternate irregularly between setae *b* and above *d*. *Internal* – Dissepiments 6/7–8/9 slightly thickened. Crop in 15–16, gizzards in 17–18. Two pairs of testes free in 10, 11, and four pairs of seminal vesicles in 9–12. Spermathecae two pairs in 9/10, 10/11 open in the mid-dorsal line. Calciferous glands in 10–12 without distinct diverticula. Excretory system holonephridial. Nephridial bladders simple, sausage-shaped. Typhlosole lamelliform, the cross-section of longitudinal muscle layer is of pinnate type (fig. 6.29.1, 6.29.2).

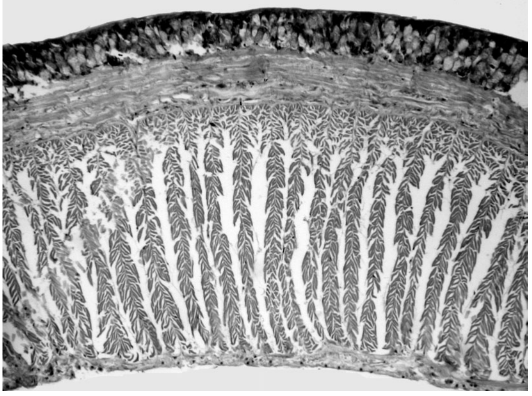

Fig. 6.29.1. Longitudinal musculature of *Eisenia fetida*.

Fig. 6.29.2. Typhlosole of *Eisenia fetida*.

Remarks – This species is introduced by man all over the world and hence shows high character variability.

Ecology – *E. foetida* is the well-known manure worm. Usually it is found in compost heaps or in manure and reared on earthworm farms in Europe and North America. Its high proliferation rate makes this species especially suitable for vermicomposting. The reproduction rate is 0.644 juvenile pro adult pro day (CSUZDI & ZICSI 1988) and the maturity takes 70–98 days (ZICSI 1985b). It means that under favourable condition an *E. foetida* population could progenerate three-four generations yearly. Life expectancy of this species is about 2.25 years (ZICSI 1974a) but a maximum of 4.5 years is also reported (LEE 1985). The daily consumption rate and cast production proved to be 71.51 ± 6.29 and 84.51 ± 14.14 mg dry mass pro 1g living weight respectively (CSUZDI 1988).

Distribution – The original range of this species supposed to be from the Caucasus to the forest-steppe zone of Russia (PEREL 1997) where it is en epigeic species occurring under bark of fallen trunks and in organic rich decaying material. Its present range comprises Europe, North America, South America, Africa, Asia and Australia.

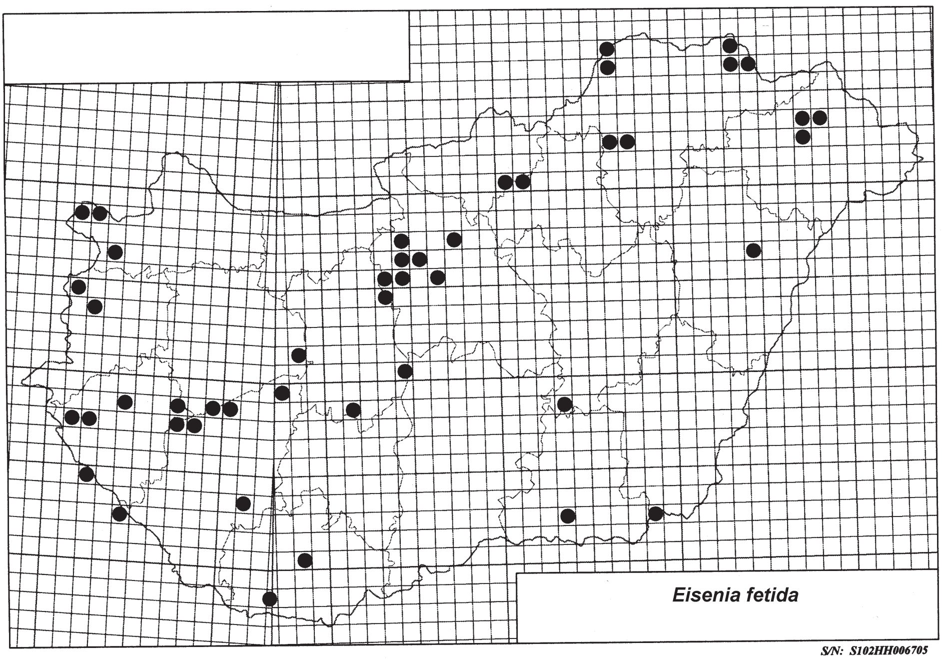

Fig. 6.29.3. Distribution of *Eisenia fetida* in Hungary.

Distribution in Hungary (fig. 6.29.3) – **BS79** No. 11376 Balatonszéplak; **BS80** *No*. 3190 Mecsek Mts. Alsómohár; **BT81** *No*. 11285 Balatonkenese; **CS18** *No*. 3051 Cece; **CT34** *No*. 613 Martonvásár; **CT35** *No*. 4440, 4484 Budapest; **CT40** *No*. 12778 Dunaújváros; **CT45** *No*. 676 Törökbálint; *No*. 769 Budapest, Budaörsi Str.; *No*. 2941 Budapest, Sasad; *No*. 7369 Érd; *No*. 10257 Budatétény; **CT46** *No*. 2266 Budakeszi; **CT47** *No*. 7258 Solymár; **CT56** *No*. 3864, 12102 Budapest, Botanical Garden; **CT65** *No*. 12777 Budapest X. kerület; **CT77** *No*. 12781 Gödöllő; **DS32** *No*. 2041 Szeged; **DS38** *No*. 11716 Csépa; **DS82** *No*. 998, 1236 Mezőhegyes; **DU00** *No*. 4220 Mátrakeresztes; **DU10** *No*. 2272 Mátraszentistván; **DU62** *No*. 4601, 4602 Bükk Mts. Bánkút; **DU66** *No*. 586, 687, 4420 Aggtelek; **DU67** *No*. 792, 3300 Jósvafő; **DU72** *No*. 2185, 2189, 2200 Bükk Mts. Garadna-völgy; **ET46** *No*. 4633 Debrecen; **EU36** *No*. 5451 Zempléni Mts. Kishuta; **EU37** *No*. 5996 Zempléni Mts. Füzér; **EU46** *No*. 3089 Sátoraljaújhely; **EU72** *No*. 3524 Berkesz; **EU73** *No*. 3590 Ajak; **EU83** *No*.

3587 Lövőpetri; **XM17** *No*. 11577 Zalabaksa; **XM24** *No*. 4116 Murarátka; **XM27** *No*. 5407 Nova; **XM42** *No*. 5427 Őrtilos; **XM48** *No*. 4694 Zalaegerszeg; **XM77** *No*. 10286 Balatonberény; **XM78** *No*. 1388 Balaton, Szt Mihály kápolna; No. 4716 Keszthely; **XM87** *No*. 2833, 2837, 4650 Bélatelep; **XM98** *No*. 1451 Révfülöp; **XN14** *No*. 11568 Velem; **XN18** *No*. 5696 Brennbergbánya; **XN23** *No*. 12092 Szombathely; **XN28** *No*. 909 Fertőrákos; **XN36** *No*. 860, 884, 910 Sopronhorpács; **YL38** *No*. 4742 Vajszló; **YM08** *No*. 663 Balatonboglár; **YM13** *No*. 10603, 10604, 10605, 11624 Kaposvár.

6.30 *Eisenia lucens* (Waga, 1857)

(Figs. 6.30.1–4.)

Lumbricus lucens Waga, 1857 Bibl. Warsz., 2: 161.
Lumbricus submontanus Vejdovsky, 1875 SB Böhm. Ges., 1875: 199.
Allolobophora foetida hungarica Örley, 1881a Math. és term. tud. közlemények,16: 598.
Allurus submontanus: Örley 1885 Értek. term. tud. köréből, 15: 13.
Allolobophora (*Notogama*) *tigrina* Rosa, 1896 Boll. Mus. Torino, 11(246): 1.
Eisenia tigrina + *Lumbricus submontanus*: Michaelsen 1900a Das Tierreich, 10: 476, 516.
Helodrilus (Allolobophora) latens Cognetti, 1902 Atti. Soc. Modena, 5(36): 7.
Eisenia rosea var. *croatica* Szüts, 1909 Állattani Közlemények, 8: 129.
Eisenia croatica: Szüts 1919 Zool. Anz., 50: 297.
Allolobophora gavrilovi Černosvitov 1942 Proc. Zool. Soc. London, (B) 111: 226.
Eisenia submontana: Černosvitov 1935 Arch. Prir. Vyzk. Cech., 19: 35.
***Eisenia submontana*: Pop 194a Ann. Hist.-Nat. Mus. Hung., 34: 18.**
***Eisenia submontana*: Zicsi 1959a Acta zool. hung., 5: 434.**
Eisenia lucens: Plisko 1961 Bull. Acad. Pol. Sci., 9: 101.
***Eisenia lucens*: Zicsi 1968a Opusc. Zool. Budapest, 8: 132.**
Eisenia submontana Bouché, 1972 Inst. Nat. Rech. Agron., p. 383.
Eisenia submontana: Perel 1979 Range and regularities in the distr. earthworms, p. 217.
***Eisenia lucens*: Zicsi** 1982a **Acta zool. hung., 28: 443.**
Eisenia lucens: Easton 1983 Earthworm Ecology, p. 480.
Eisenia lucens + ?*Eisenia submontana*: Omodeo 1984 Hidrobiologia, 115: 188.
***Eisenia lucens*: Zicsi 1991 Opusc. Zool. Budapest, 24: 174.**
Eisenia lucens: Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 500.
Eisenia submontana: Qiu & Bouché 1998a Doc. pedozool. integrol., 4: 189.

Description – *External* – Body length 45–180 mm, diameter 4–6 mm, 60–130 segments. Colour dark violet with alternating stripes of darker segmental with yellowish intersegmental areas. Head epilobous, first dorsal pore in (3/4), 4/5. Glandular tumescence usually on 9–13 *cd* and 16, 17, 23–34 *ab*. Setae closely paired, setal arrangement after the clitellum: aa:ab:bc:cd:dd = 4.5:1:3.5:1:10 Clitellum extends on segments (24), 25, 26, 27–33, 34 saddle-shaped. Tubercles usually on 1/2 28, 29–31, 1/2 32, 1/n 33. Male pore on 15 between setae *b–c*, surrounded by a glandular crescent, frequently protruding into the neighbouring segments. Nephropores irregularly alternate between *b* and above *d*. *Internal* – Dissepiments 5/6–9/10 slightly thickened. Crop in 15–16, gizzards in 17–18. Two pairs of testes free in 10, 11, and four pairs of seminal vesicles in 9–12. Spermathecae two pairs in 9/10, 10/11 open somewhat above setal line *d*. Calciferous glands 11–13 without distinct diverticula. Excretory system holonephridial. Nephridial bladders simple, sausage-shaped. Typhlosole long, lamelliform, the cross-section of longitudinal muscle layer is of fasciculated type (fig. 6.30.1, 6.30.2).

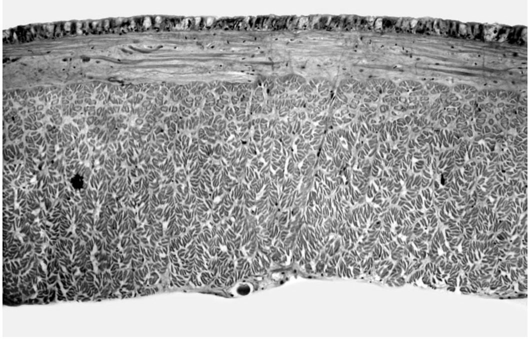

Fig. 6.30.1. Longitudinal musculature of *Eisenia lucens*.

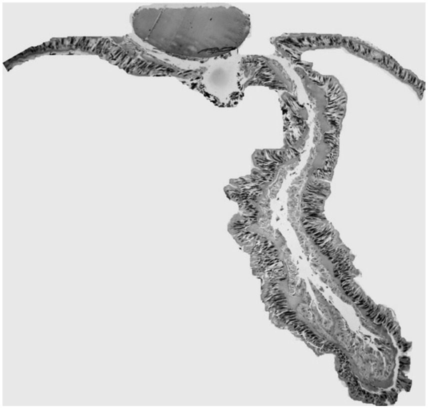

Fig. 6.30.2. Typhlosole of *Eisenia lucens*.

Remarks – This species was known as *E. submontana* for a long time when PLISKO (1961) synonymized it with *E. lucens*. Some authors (PEREL 1979, QIU & BOUCHÉ 1998a) keep the name *E. submontana* because they regard *E. lucens* as nomen nudum. OMODEO (1984) claims for the distinctness of the two species regarding *E. submontana* as a Charpatho–Balkanic species and *E. lucens* as a more northern species with luminescence. In our opinion the specimens without luminescence that OMODEO (1984) attributes to *E. submontana* might be *E. spelaea* (ROSA, 1901) as well.

E. lucens is very close to *E. spelaea* and they are supposedly synonymous (PEREL 1979). The only remarkably difference is in the bioluminescence that is not recorded for *E. spelaea*.

Ecology – *E. lucens* lives in fallen logs under bark. It is common in higher elevations from the Pyrenean to the Balkan. It is one of the species suitable for vermicomposting. Its cocoons contain 1–6 embryos and the incubation period varies between 22 and 30 days, but the maturity is extremely long, 130–150 days (ZICSI 1985b). Its periodic reproduction takes place in spring and in autumn. Supplying organic rich food such as rabbit manure a continuous cocoon production could be generated but the sterility of the cocoons laid increased dramatically (Csuzdi & Zicsi 1991).

In natural condition *E. lucens* contributes in the decomposition of woody debris. Its daily consume is about 28 mg dry material pro 1 g live weight regardless of tree species. It supports the view of Márialigeti (1977, 1979), that the main nourishment of *E. lucens* comprises different bacteria species.

Distribution – The exact range of this species is ambiguous because of the mistaken records for *E. spelaea*, but it seems to be an expanded type of Central European distribution. It occurs in the Pyrenean Mts. and in Central Europe from the Alps to the Balkan Peninsula (fig. 6.30.3).

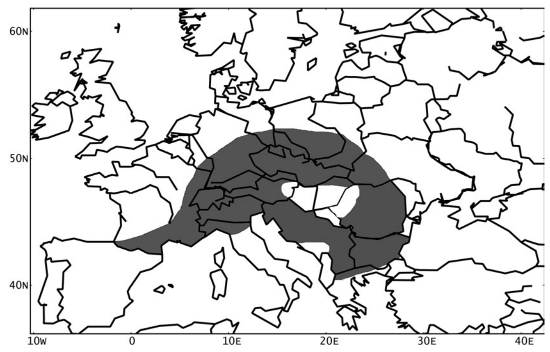

Fig. 6.30.3. Distribution of *Eisenia lucens*.

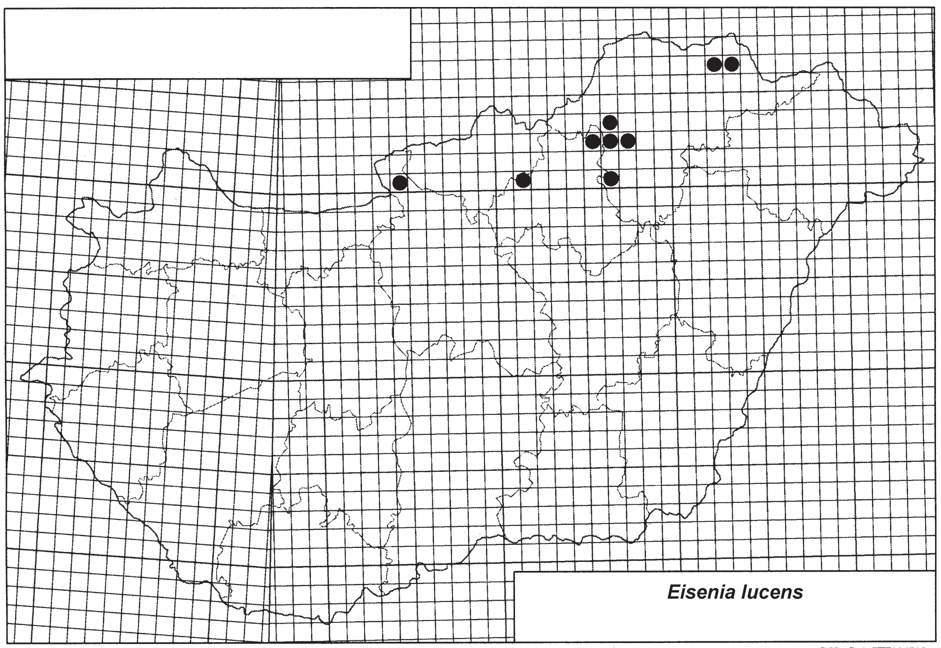

Fig. 6.30.4. Distribution of *Eisenia lucens* in Hungary.

Distribution in Hungary (fig. 6.30.4) **– CU40** *No.* 5192 Börzsöny Mts. Csóványos; **DU10** *No.* 840 Galyatető; *No.* 11613 Kékestető; **DU52** *No.* 9861, 9864, 9867 Bükk Mts. Leányka-völgy; *No.* 9912 Bükk Mts. Hármaskút; **DU60** *No.* 8018 Bükk Mts. Istvánkút; **DU62** *No.* 2221, 2245 Bükk Mts. Teknős-völgy; *No.* 2230 Bükk Mts. Garadna-völgy; **DU63** *No.* 2981 Bükk Mts. Örvénykő; **DU72** *No.* 2167, 2175, 2201, 2238, 2242, 2247 Bükk Mts. Garadna-völgy Tógazdaság; *No.* 7207, 7380 Lillafüred; **EU26** *No.* 4255 Regéc; **EU36** *No.* 4934, 4936 Zempléni Mts. Kőkapu; *No.* 5474 Nagybózsva; *No.* 10242, 11668, 11669 Zempléni Mts. Senyő-völgy; *No.* 10537, 11660 Zempléni Mts. Rostalló.

6.31 *Eisenia spelaea* (Rosa, 1901)

(Figs. 6.31.1–4.)

Allolobophora spelaea Rosa, 1901 Atti. Soc. Nat. Modena, 4:3 6.
Eisenia triglavensis Pop, 1943a Ann. Hist.- Nat. Mus. Hung., 36: 17.
Eisenia spelaea: Omodeo 1956 Arch. Zool. Ital., 41: 171.
***Eisenia spelaea*: Zicsi 1966b Opusc. Zool. Budapest, 6: 190.**
***Eisenia spelaea*: Zicsi 1968a Opusc. Zool. Budapest, 8: 133.**
Eisenia spelaea: Perel 1979 Range and regularities in the distr. earthworms, p. 219.
Eisenia spelaea: Zicsi 1982a Acta zool. hung., 28: 444.
Eisenia spelaea: Easton 1983 Earthworm Ecology, p. 480.
Eisenia spelaea + ?*Eisenia submontana*: Omodeo 1984 Hidrobiologia, 115: 188.
***Eisenia spelaea*: Zicsi 1991 Opusc. Zool. Budapest, 24: 174.**
Eisenia spelaea: Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 503.
Eisenia spelaea: Qiu & Bouché 1998a Doc. pedozool. integrol., 4: 189.

Description – *External* – Body length 55–110 mm, diameter 3–6 mm, 80–120 segments. Colour yellowish-violet with paler ventral side. Head epilobous, first dorsal pore in 4/5. Glandular tumescence usually on 9–11 *cd* and 16, 17, 23–25, 32, 33, 34 *ab*. Setae closely paired, setal arrangement after the clitellum: aa:ab:bc:cd:dd = 5.75:1:4:1:15. Clitellum extends on segments (24), 25, 26, 27–33, 34 saddle-shaped. Tubercles usually on 28, 29–31, 32. Male pore on 15 between setae *b–c*, surrounded by a glandular crescent, protruding into the neighbouring segments. Nephropores irregularly alternate. *Internal* – Dissepiments 12/13–13/14 thickened. Crop in 15–16, gizzards in 17–18. Two pairs of testes free in 10, 11, and four pairs of seminal vesicles in 9–12. Spermathecae two pairs in 9/10, 10/11 open between setal line *d* and the mid-dorsal line. Calciferous glands in 11–13 without distinct diverticula. Excretory system holonephridial. Nephridial bladders simple, sausage-shaped. Typhlosole lamelliform, the cross-section of longitudinal muscle layer is of fasciculated type (fig. 6.31.1, 6.31.2).

Remarks – *E. spelaea* is very close to *E. lucens*. Besides lacking of bioluminescence the only somatic difference is in the position of the receptacle openings that is closer to the mid-dorsal line in the case of *E. spelaea*. However this is a very scanty difference, so the preserved specimens could hardly be discerned. The reason why they have not been synonymized yet is the markedly different biotope and the bioluminescence of *E. lucens*.

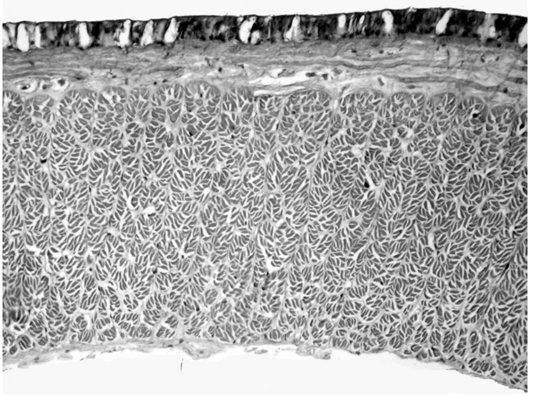

Fig. 6.31.1. Longitudinal musculature of *Eisenia spelaea*.

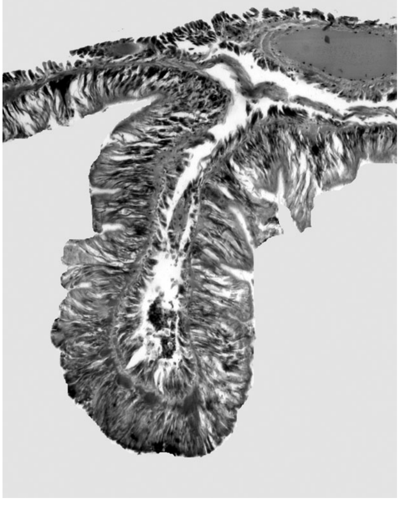

Fig. 6.31.2. Typhlosole of *Eisenia spelaea*.

Ecology – *E. spelaea* lives in submerged litter in streams, and more rarely in wet clayey soils. *E. spelaea* is one of the few species suitable for vermicomposting (Zicsi 1985b) but we have almost no data on the biology of this species. Its cocoon contains 1–4 embryos and the incubation takes 23–27 days, the maturity is fairly long, 110–130 days (Zicsi 1985b).

Distribution – The exact range of this species is ambiguous because of the mistaken records for *E. lucens*, but it seems to be Central European. It occurs from the Alps to the northern part of the Balkan Peninsula (Slovenia, Croatia and Montenegro) (fig. 6.31.3).

Distribution in Hungary (fig. 6.31.4) **– XM24** *No.* 4148, 4149 Murarátka; **XM25** *No.* 9144 Dobri; **XM28** *No.* 12271 Zalalövő; **XM35** *No.* 5404 Lasztonya; **XM53** *No.* 9160 Somogybükkösd; **XM62** *No.* 9167 Csurgónagymárton; **XN14** *No.* 5578, 5579, 5580, 5581, 5582, 8131, 8175, 8176, 10629, 10648, 11547, 11779 Velem; **XN18** *No.* 5719 Sopron, Kecske-patak.

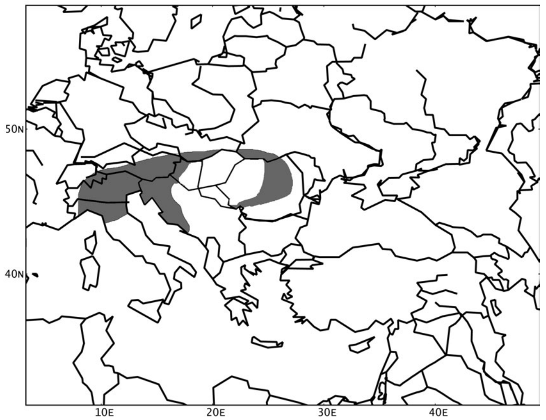

Fig. 6.31.3. Distribution of *Eisenia spelaea*.

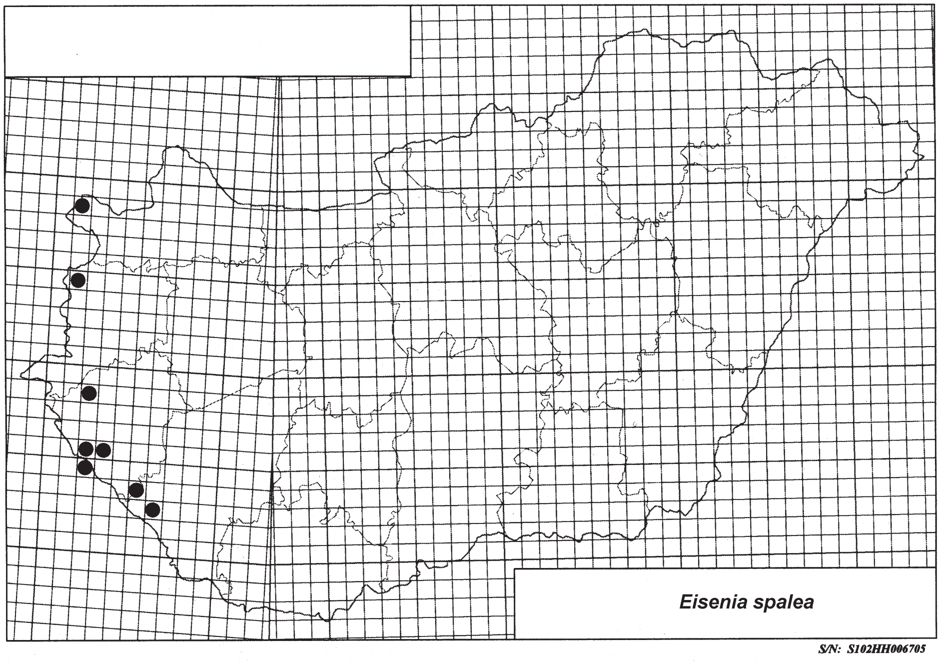

Fig. 6.31.4. Distribution of *Eisenia spelaea* in Hungary.

Genus *Eiseniella* Michaelsen, 1900

Enterion (part.) Savigny, 1826 Mem. Acad. Sci. Inst. Fr., 5: 184.
Lumbricus (part.): Eisen 1871 Öfv. Akad. Förh., 27: 967.
Allurus Eisen, 1873 Öfv. Akad. Förh. 30: 45.
Tetragonorus Eisen, 1874 Öfv. Akad. Förh. 31: 47.
Allurus: Michaelsen 1890a Mitt. Mus. Hamb., 7: 7.
Allurus: Örley 1881a Math. és term. tud. közlemények,. 16: 599
Allurus: Örley 1885 Értek. term. tud. köréből, 15: 13.
Eiseniella Michaelsen, 1900a: Das Tierreich, 10: 471.
Eiseniella: Szüts 1909 Állattani Közlemények, 8: 125–126.
Allurus: Friend 1911a Nott. Nat. Soc., 60: 63.
Eiseniella: Pop 1941 Zool. Jb. Syst., 74: 518.
Eiseniella: Omodeo 1956 Arch. zool. Ital., 41: 187.
Eiseniella: Bouché 1972 Inst. Nat. Rech. Agron., p. 214.
Eiseniella: Perel 1976b Zool. Zh., 55: 835.
Eiseniella: Perel 1979 Range and regularities in the distr. earthworms, p. 226.
Eiseniella: Zicsi 1982a Acta zool. hung., 28: 444.
Eiseniella: Easton 1983 Earthworm Ecology, p. 480.
Eiseniella: Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 514–523.
Eiseniella: Qiu & Bouché, 1998b Doc. pedozool. integrol., 3: 206.

Type species – *Enterion tetraedrum* Savigny, 1826 by original designation.

Diagnosis – *External* – Setae closely paired pigmentation brown or lacking. Prostomium epilobous, first dorsal pore around 5/6. Male pore on 13, 14, 15 or before, medium to great. Female pores in or just medial to setal line *a*. Spermathecae open in setal line *cd*. Clitellum annular with somewhat less developed ventral part. Nephropores alternate irregularly between *b* and above *cd*. *Internal* – Two pairs of testes free in 10, 11. Four pairs of vesicles in 9–12 and two pairs of spermathecae in 9/10, 10/11 sometimes lacking. Calciferous glands wit lateral diverticula in 10 opening posterio-ventrally into the gut in 10/11. Gizzard weak in 17, usually occupying only one segment. Excretory system holonephridial, nephridial bladders simple, saccular. The cross-section of longitudinal musculature pinnate.

Remarks – The members of the genus *Eiseniella* are limicolous and have a characteristic quadrangular tail end. The male pore is variable in position and this led several authors to describe different species or subspecies. In most cases this variation is connected with parthenogenesis and in our opinion it is of less taxonomic value.

6.32 *Eiseniella tetraedra* (SAVIGNY, 1826)

(Figs. 6.32.1–4.)

Enterion tetraedrum SAVIGNY, 1826 Mem. Acad. Sci. Inst. Fr., 5: 184.
Lumbricus quadrangularis RISSO, 1826 Hist. Nat. Eur. Merid., 4: 426.
Lumbricus amphisbaena DUGÉS, 1828 Ann. Sci. Nat., 15: 289.
Lumbricus agilis HOFFMEISTER, 1843 Arch. Naturg., 9: 191.
Lumbricus tetraedrus luteus EISEN, 1871 Öfv. Akad. Förh., 27: 966.
Lumbricus tetraedrus obscurus EISEN, 1871 Öfv. Akad. Förh., 27: 967.
Tetragonorus pupa EISEN, 1874 Öfv. Akad. Förh. 31: 47.
Allurus dubius MICHAELSEN, 1890a J. Hamb. Wiss., 7: 7.
Allurus hercynius MICHAELSEN, 1890a J. Hamb. Wiss., 7:7.
***Allurus tetraedrus*: ÖRLEY 1881a Math. és term. tud. közlemények,. 16: 599**
Allurus tetragonurus FRIEND, 1892e Sci. Gossip., 28: 194.
Allurus flavus FRIEND, 1893 Proc. R. Irish. Ac., (3)2: 402.
Allurus macrurus FRIEND, 1893 Proc. R. Irish. Ac., (3)2: 402.
***Allurus tetraedrus*: ÖRLEY 1885 Értek. term. tud. köréből, 15: 13.**
Allolobophora tetraedrus novis RIBAUCOURT, 1896 Rev. suisse Zool., 4: 69.
Allurus tetraedrus bernensis RIBAUCOURT, 1896 Rev. suisse Zool., 4: 73.
Allurus tetraedrus infinitesimalis RIBAUCOURT, 1896 Rev. suisse Zool., 4: 73.
Eiseniella tetraedra typica + *Eis. t. hercynia* + *Eis. t. bernensis* + *Eis. t. pupa* + *Eis. t. tetragonura* + *Eis. macrura*: MICHAELSEN 1900a Das Tierreich, 10: 473–474.
Eiseniella tetraedra hammoniensis MICHAELSEN, 1909 Süss. Deut., 13: 63.
***Eiseniella tetraedra* var. *typica* + *Eiseniella tetraedra* var. *hercynia*: SZÜTS 1909 Állattani Közlemények, 8: 125–126.**
Allurus mollis FRIEND, 1911a Nott. Nat. Soc., 60: 63.
Eisenia tetraedra intermedia JACKSON, 1931, Proc. Roy. Soc. W. Aust., 17: 123.
Eiseniella tetraedra intermedia ČERNOSVITOV, 1934 Sborn. Zool. Odd. Narod. Mus., 1: 17.
Eiseniella tetraedra quadripora ČERNOSVITOV, 1942 Proc. Zool. Soc. Lond., 1942: 220.
***Eiseniella tetraëdra* f. *typica* + *Eiseniella tetraëdra* v. *hercynia*: ZICSI 1959a Acta zool. hung., 5: 183.**
***Eiseniella tetraedra popi* ZICSI, 1960 Ann. Univ. Sci. Budapest, 3: 435.**
***Eiseniella tetraedra* f. *typica* + *Eis. t.* f. *hercynia* + *Eis. t.* f. *intermedia*: ZICSI 1968a Opusc. Zool. Budapest, 8: 139-140**.
Eiseniella tetraedra: PEREL 1979 Range and regularities in the distr. earthworms, p. 226.
Eiseniella tetraedra tetraedra + *Eis. t. intermedia* + *Eis. t. hercynia*: ZICSI 1982a Acta zool. hung., 28: 444.
Eiseniella tetraedra tetraedra + *Eis. t. intermedia* + *Eis. t. pupa*: EASTON 1983 Earthworm Ecology, p. 480.
***Eiseniella tetraedra tetraedra* + *Eis. t. intermedia* + *Eis. t. hercynia*: ZICSI 1991 Opusc. Zool. Budapest, 24: 177–178.**
Eiseniella tetraedra tetraedra + *Eis. t. intermedia* + *Eis. t. pupa*: MRŠIĆ 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 514–523.
Eiseniella tetraedra tetraedra + *Eis. t. pupa* + *Eis. t. intermedia* + *Eis. t. bernensis*: QIU & BOUCHÉ 1998a Doc. pedozool. integrol., 4: 196.
Eiseniella tetraedra phorogenesa QIU & BOUCHÉ, 1998c Doc. pedozool. integrol., 4: 104. **syn. nov**.
Eiseniella tetraedra proporandra QIU & BOUCHÉ, 1998c Doc. pedozool. integrol., 4: 105. **syn. nov**.

Description – *External* – Body length 20–80 mm, diameter 1.5–2.5 mm, 65–100 segments. Colour brown or yellowish-brown. Head epilobous, first dorsal pore in 4/5 or 5/6. Setae closely paired, setal arrangement after the clitellum: aa:ab:bc:cd:dd = 4.8:1:4.8:1:10. Clitellum extends on segments 22, 23–26, 27, annular with less developed ventral side (fig. 6.32.1). Tubercles on 23, 24–25, 26. Male pores great, usually on 13 but sometimes they are on 11, 12, 14 or 15 and often asymmetrically arranged. Nephropores alternate irregularly between *b* and above *d*. The body has a characteristic quadrangular tail end, with setae on the edges. *Internal* – Dissepiments 7/8–11/12 thickened. Crop in 15–16. Gizzard small, confined into one segment in 17. Two pairs of testes free in 10, 11 and four pairs of seminal vesicles in 9–12. Receptacula seminis two pairs in 9/10–10/11 open above setal line *cd*, rarely lacking. Calciferous glands with diverticula in 10. Excretory system holonephridial with saccular nephridial bladders. The cross-section of longitudinal muscle layer is of pinnate type.

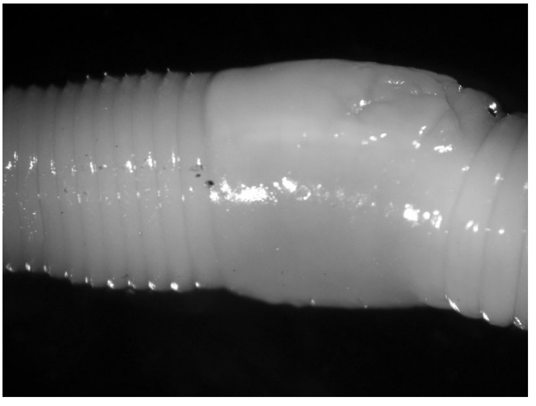

Fig. 6.32.1. Ventral view of the clitellum of *Eiseniella tetraedra tetraeda*.

Remarks – *Eis. tetraedra* is a widely introduced peregrine species with different parthenogenetic morphs. A number of different forms and varieties have been described, and some of them subsequently have been regarded as subspecies (Zicsi 1982a) differing only in the position of male pores. The three subspecies usually distinguished – *Eis. t. tetraedra*, *Eis. t. intermedia* and *Eis. t. hercynia* – possess male pore on 13, 14, and 15 respectively and no other differences could be observed.

Ecology – *Eiseniella tetraedra* is a limicolous species showing an overwhelming preference for damp habitats. It occurs in ponds, lakes, streams, rivers, springs etc.

Distribution – It is of Palearctic origin but has been widely introduced all over the world.

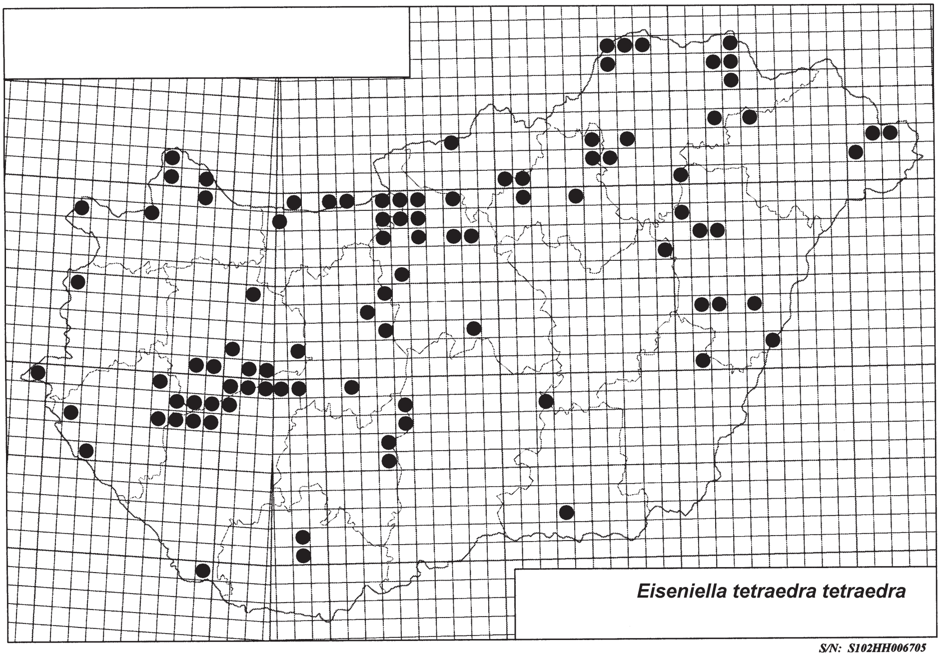

Fig. 6.32.2. Distribution of *Eiseniella tetraedra tetraedra* in Hungary.

Distribution in Hungary (*Eis. t. tetraedra*) (fig. 6.32.2) – **BS79** *No.* 2862, 11381 Balatonszéplak; *No.* 739 Siófok; **BS80** *No.* 847, 851 Mecsek Mts.; *No.* 3184 Mecsek Mts. Hidasi-völgy; *No.* 4772 Pécs; **BS81** *No.* 836 Mecsek Mts. Mánfai-barlang; **BS89** *No.* 736 Balatonszabadi; **BT78** *No.* 1118 Ács; **BT81** *No.* 11286 between Balatonkenese and Fűzfő; **BT89** *No.* 1112 Komárom; **CS19** *No.* 1457, 1463 Rétszilas; **CS35** *No.* 1882 Gerjen; **CS36** *No.* 1894 Dunaszentbenedek; **CS47** *No.* 1899 Harta; **CS48** *No.* 604, 609, 625, 650, 3036 Dunaföldvár; **CT09** *No.* 1169, 1513 Süttő; **CT19** *No.* 1097, 1863 Lábatlan; **CT23** *No.* 3330, 4556 Velence; **CT32** *No.* 1819 Adony; **CT34** *No.* 614 Martonvásár; **CT37** *No.* 10036 Piliscsaba, Iluska-forrás; **CT38** *No.* 14458 Pilisszentlélek; **CT39** *No.* 3917 Pilis Mts. Szőke-forrás; **CT45** *No.* 3258 Törökbálint; **CT48** *No.* 9928, 9936 Pilis Mts. Malom-patak; *No.* 10002 Pilis Mts. Apátkuti-patak; **CT49** *No.* 1141 Dömös; *No.* 1308 Nagymaros; *No.* 1146 Pilismarót; *No.* 1068 Visegrád; **CT57** *No.* 1539 Budakalász; **CT58** *No.* 1815 Pilis Mts. Dömörkapu; *No.* 4175, 4192 Pilis Mts. Bükkös-patak; *No.* 11753 Szentendre; **CT59** *No.* 9993 Pilis Mts. Lukács-árok; **CT77** *No.* 2811, 5549, 5648, 5886 Gödöllő; **CT79** *No.* 3206, 3266 Csővár; **CT82** *No.* 4273 Hernád; **CT87** *No.* 3061, 3073 Bag, Petőfi-forrás; **CU72** *No.* 5280 Ipolyszög; **DS28** *No.* 11728 between Tiszasas and Csépa; **DS32** *No.* 2001 Atka; *No.* 1627, 1754 Szeged; **DT19** *No.* 845 Mátraháza; **DT49** *No.* 3110, 10210, 11761 Kápolna; **DT96** *No.* 3361 Óhat; **DU00** *No.* 4219 Mátrakeresztes; **DU10** *No.* 841, 843, 855 Galyatető; *No.* 2270 Mátraszentistván; **DU51** *No.* 4430, 4842 Felsőtárkány; *No.* 4640, 4664 Bükk Mts Szarvaskő; **DU52** *No.* 9914 Bükk Mts. Hármaskút; *No.* 9903, 9884 Bükk Mts Tóthfalusi-völgy; **DU61** *No.* 5682 between Cserépfalu and Hollóstető; **DU66** *No.* 585, 590, 669, 1026, 1785, 2134, 2136, 4457 Aggtelek; *No.* 4830 Aggtelek, Haragistya; **DU67** *No.* 4205, 5913 Jósvafő; **DU72** *No.* 3017

Bükk Mts Felső-forrás; *No.* 4873 Bükk Mts Hámori-tó; *No.* 4676 Bükk Mts Kecskelyuk; *No.* 1988 Lillafüred; **DU77** *No.* 3924, 3957 Acskó; *No.* 5730 Meteor-barlang; *No.* 1570, 3288 Szin; **DU87** *No.* 3965 Bódvaszilas; **ET08** *No.* 4727 Újszentmagita; **ET10** *No.* 5204 Nagylapos; **ET13** *No.* 5342, 5355 Báránd; **ET17** *No.* 3353, 9611 Hortobágy; *No.* 9605 Hortobágy, Szálkahalom; **ET23** *No.* 9018 Sáp; **ET27** *No.* 9618 Darassa; **ET43** *No.* 5331 Berettyó-csatorna; **ET51** *No.* 5390 Ártánd; **EU00** *No.* 5300 Polgár; **EU23** *No.* 4940 Zempléni Mts. Király-hegy; **EU26** *No.* 11654 Regéc; **EU35** *No.* 4263 Óhuta; **EU36** *No.* 5467 between Nagybózsva and Telkibánya; **EU37** *No.* 5995 Füzér; **EU43** *No.* 2110 Körtvélyes, **FU01** *No.* 4072 Tunyogmatolcs; **FU12** *No.* 4019, 4029 Kisar; **FU22** *No.* 4084 Túristvándi; **WM99** *No.* 1855, 4710 Szakonyfalu; **XL99** *No.* 10509 Barcs; **XM17** *No.* 11556 Kálócfa; *No.* 11572 Zalabaksa; **XM25** *No.* 5435 Tormafölde; **XM67** *No.* 12403 Kisbalaton Diás-sziget; *No.* 1930 Zala-folyó; **XM69** *No.* 1832 Vindornyaszőlős; **XM77** *No.* 11230, 11266, 11274, 11295 Balatonberény; **XM78** *No.* 1194 Gyenesdiás; *No.* 751, 1862, 1948, 1992, 2094, 2132 Keszthely; **XM87** *No.* 2148, 11331 Balatonfenyves; *No.* 11237 between Balatonmária and Balatonberény; *No.* 1455 Balatonmária-fürdő; *No.* 5410 Bélatelep; **XM88** *No.* 1454 Badacsony; *No.* 4534, 4549 Badacsonytördemic; *No.* 11235, 11265 Szigliget; **XM97** *No.* 4654 Fonyód; **XM98** *No.* 1449 Révfülöp; **XN14** *No.* 8200 Cák; *No.* 5585, 10635, 11702, 11783, 14319 Velem; **XN18** *No.* 5703, 5705 Brennbergbánya; *No.* 5721 Sopron, Kecske-patak; **XN58** *No.* 13096, 14294 Csorna; **XN80** *No.* 10200 Felsőnyirád; **XN89** *No.* 2025, 2963 Lickópuszta; **XN90** *No.* 14332 Kapolcs; **XP60** *No.* 2961 Lajta-csatorna; **XP61** *No.* 3980 Rajka; **XP80** *No.* 1515, 3938 Derenk; **YM08** *No.* 662, 765, 1946 Balatonboglár; **YM09** *No.* 1436 Balatonakali; **YM19** *No.* 733 Balatonszántód; *No.* 12752, 12758 Balatonszárszó; *No.* 12378, 12406 Örvényes; **YM29** *No.* 741, 1527, 11385 Zamárdi; **YN01** *No.* 776 Úrkút; **YN10** *No.* 14361, 14371 Koloska-patak; *No.* 3381 Bakony Mts.; **YN14** *No.* 5516 Csesznek; **YN20** *No.* 11241 Palóznak.

(*Eis. t. intermedia*) (fig. 6.32.3) – **CT09** *No*. 1109 Dunaalmás; *No*. 10916 Neszmély; **CT38** *No*. 14459 Pilisszentlélek; **CT48** *No*. 10010, 10387 Pilis Mts. Apátkuti-völgy; **CT58** *No*. 4177 Pilis Mts. Bükkös-patak; **CT64** *No*. 11531 Ócsa; **CT82** *No*. 4274 Hernád; **XM52** *No*. 9178 Porrogszentpál; **XM88** *No*. 1415 Szigliget; **YL37** *No*. 4755 Vejti.

(*Eis. t. hercynia*) (fig. 6.32.4) – **BS79** *No.* 2863, 11382 Balatonszéplak; **BT78** *No.* 1119 Ács; **BT81** *No.* 1913 Balatonkenese; **BT89** *No.* 1113 Komárom; **CS00** *No.* 1630 Szellő; **CS35** *No.* 1883 Gerjen; **CS42** *No.* 1058 Érsekcsanád; **CS48** *No.* 605, 627, 646, 651, 797, 3024, 10917 Dunaföldvár; **CT09** *No.* 1104, 1170 Süttő; **CT19** *No.* 1098 Lábatlan; **CT23** *No.* 3331, 4557 Velence; **CT33** *No.* 2878 Baracska; **CT45** *No.* 3259 Törökbálint; **CT49** *No.* 1147 Pilismarót; **CT55** *No.* 1847 Budapest; **CT58** *No.* 11754 Szentendre; **CT79** *No.* 3267 Csővár; **DS28** *No.* 11729 between Tiszasas and Csépa; **DS32** *No.* 1629 Szeged; **DT14** *No.* 3151 Farmos; **DT49** *No.* 10211 Kápolna **DT83** *No.* 8402 Kisújszállás; **DT94** *No.* 5321 Karcag; **DT96** *No.* 3362 Óhat; **DU23** *No.* 9103 Cered; **DU40** *No.* 7411, 7426 between Sirok and Egerbakta; **DU66** *No.* 1024 Aggtelek; **DU90** *No.* 1628 Bába; **ET08** *No.* 4728, 7092 Újszentmargita; **ET10** *No.* 5205 Nagylapos; **ET17** *No.* 3354, 9606 Hortobágy; **ET23** *No.* 9004, 9017, 9059 Sáp; **ET27** *No.* 9617 Darassa; **ET51** *No.* 5389 Ártánd; **EU26** *No.* 4232 Regéc; **EU35** *No.* 4262 Óhuta; **EU36** *No.* 4953 Zempléni Mts. Kőkapu; **FU01** *No.* 4073 Tunyogmatolcs; **FU12** *No.* 4020, 4030 Kisar; **WM99** *No.* 3158 Szakonyfalu; **XM77** *No.* 11267 Balatonberény; **XM88** *No.* 4530, 4533, 4547 Badacsonytördemic; **XN14** *No.* 11784 Velem; **YM29** *No.* 742 Zamárdi; **YN19** *No.* 1123 Gönyű.

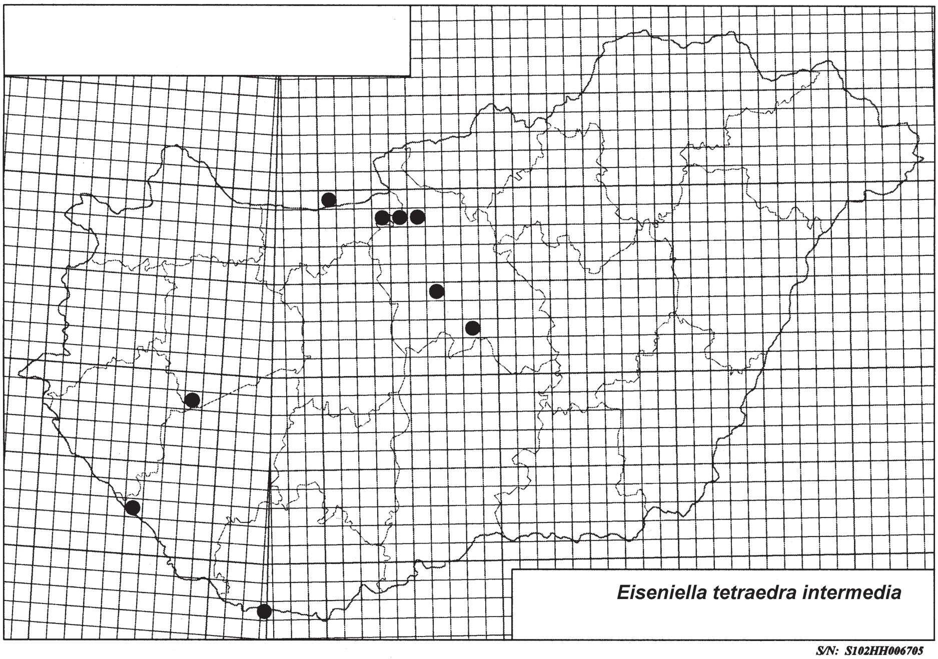

Fig. 6.32.3. Distribution of *Eiseniella tetraedra tetraedra* (morph intermedia) in Hungary.

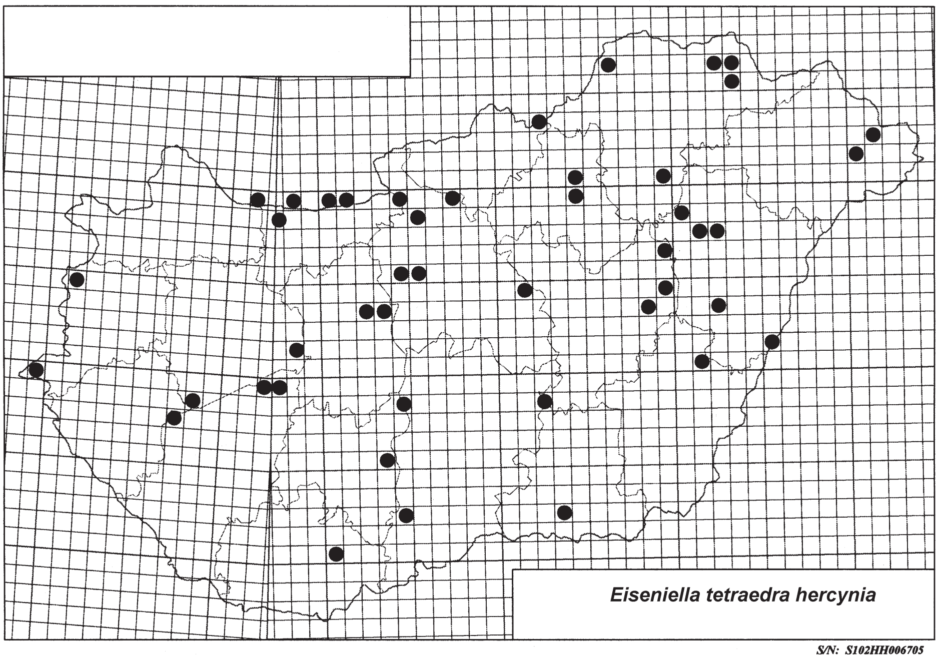

Fig. 6.32.4. Distribution of *Eiseniella tetraedra tetraedra* (morph hercynia) in Hungary.

Genus *Fitzingeria* ZICSI, 1978

Enterion (part.): FITZINGER 1833 Isis, p. 553.
Lumbricus (part.): ÖRLEY 1881a Math. és term. tud. közlemények,. 16: 583.
Octolasion (part.) ÖRLEY, 1885 Értek. term. tud. köréből, 15: 18.
Allolobophora (Dendrobaena) (part.): ROSA 1893a Mem. Acc. Torino, 43: 424.
Helodrilus (Dendrobaena) (part.): MICHAELSEN 1900a Das Tierreich, 10: 488.
Helodrilus (Dendrobaena) (part.): SZÜTS 1909 Állattani Közlemények, 8: 138.
Dendrobaena (part.): POP 1941 Zool. Jb. Syst., 74: 518.
Dendrobaena (Dendrobaena) (part.): BOUCHÉ 1972 Inst. Nat. Rech. Agron., p. 407.
Dendrobaena (part.): PEREL 1976b Zool. Zh., 55: 835.
Fitzingeria ZICSI, 1978 Acta. zool. hung., 24: 441.
Dendrobaena (part.): PEREL 1979 Range and regularities in the distr. earthworms, p. 227.
Dendrobaena (part.): ZICSI 1982a Acta zool. hung., 28: 443.
Fitzingeria: EASTON 1983 Earthworm Ecology, p. 481.
Fitzingeria: MRŠIĆ 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 537.
Fitzingeria: QIU & BOUCHÉ 1998b Doc. pedozool. integrol., 3: 213.

Type species – *Enterion platyurum* FITZINGER, 1833 by original designation.

Diagnosis – *External* – Setae distant, pigmentation usually purple-red, sometimes brown. Prostomium epilobous, dorsal pore variable. Male pore hardly seen, shifted far back to the clitellum. Spermathecae open in setal line *d*. Nephropores irregularly alternate (always?) between *b* and above *cd*. *Internal* – Two pairs of testes in 10, 11 enclosed in perioesophageal testis sac, and three or two (rarely four) pairs of seminal vesicles in or 9, 11, 12 or 11, 12 (rarely 9–12). Receptacula seminis two to four pairs situated in intersegmental furrow 7/8, 8/9, 9/10, 10/11. Calciferous glands with lateral diverticula in 11, (12). Last pairs of hearts are in 11 and a pair of extraoesophageals in 12. Excretory system holonephridial, nephridial bladders sausage- or biscuit-shaped (fig. 3.15A) sometimes alternating inside one specimen. The cross-section of longitudinal muscle layer is of pinnate type.

Remarks – The backwards shifting of the male pore not unusual among the lumbricids. This phenomenon occurs among the more primitive "*Allolobophora* s. lato" like earthworms as well (e.g. gen. *Cernosvitovia*), that suggests a homoplasy. To unite these evolutionary apart standing groups into a common subfamily: Postandrilinae QIU & BOUCHÉ, 1998b is misleading and unacceptable.

Table 6.6. Distinguishing characters of the *Fitzingeria* subspecies in Hungary.

Subspecies	Clitellum	Tubercles	Vesicles	Spermathecae	Nephridial bladders	Musculature
F. pl. platyura	½ 24, 25–30	25, 26–29	9, 11, 12	9/10, 10/11 *d*	biscuit-shaped	pinnate
F. pl. depressa	½ 24, 25–30	25, 26–29	9, 11, 12	(7/8), 8/9, 9/10, 10/11 *d*	biscuit-shaped	pinnate
F. pl. montana	½ 24, 25–30	25, 26–29	11, 12	(7/8), 8/9, 9/10, 10/11 *d*	biscuit-shaped	pinnate

6.33 *Fitzingeria platyura platyura* (Fitzinger, 1833)

(Figs. 6.33.1–3.)

Enterion platyurum Fitzinger, 1833 Isis, p. 553.
***Lumbricus terrestris* var. *platyurus* (part.) Örley, 1881a Math. és term. tud. közlemények, 16: 583.**
***Octolasion platyurum* (part.): Örley 1885 Értek. term. tud. köréből, 15: 18.**
Allolobophora fitzingeri Beddard, 1895 Monogr. Olig., p. 721.
Allolobophora oerleyi (part.) Horst, 1887 Notes Leyden Mus., 9: 294.
Allolobophora (Dendrobaena) platyura ssp. *typica*: Rosa 1893a Mem. Acc. Torino, 43: 439.
Helodrilus (Dendrobaena) platyurus (*typicus*): Michaelsen 1900a Das Tierreich, 10: 494.
***Helodrilus (Dendrobaena) platyurus* (part.): Szüts 1909 Állattani Közlemények, 8: 138.**
Dendrobaena platyura f. *typica*: Černosvitov 1935 Arch. Prir. Vyzk. Cech., 19: 42.
***Dendrobaena platyura* f. *typica*: Pop 1943a Ann. Hist.-Nat. Mus. Hung., 34: 21.**
Dendrobaena platyura f. *typica:* Pop 1943b Zool. Jb. Syst., 76: 399.
Dendrobaena platyura f. *typica*: **Zicsi 1968a Opusc. Zool. Budapest, 8: 133.**
***Fitzingeria platyura platyura*: Zicsi 1978 Acta zool. hung., 24: 442.**
Dendrobaena platyura platyura: Perel 1979 Range and regularities in the distr. earthworms, p. 230.
Dendrobaena platyura platyura: Zicsi, 1982a Acta zool. hung., 28: 443.
Fitzingeria platyura platyura: Easton 1983 Earthworm Ecology, p. 481.
***Fitzingeria platyura platyura*: Zicsi 1991 Opusc. Zool. Budapest, 24: 190.**
Fitzingeria platyura platyura: Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 542.
Fitzingeria platyura platyura: Qiu & Bouché 1998a Doc. pedozool. integrol., 4: 198.

Description – *External* – Body length 65–170 mm, diameter 4–8 mm, 90–170 segments. Colour red-violet, head epilobous, first dorsal pore between intersegmental furrows 5/6–8/9, usually in 6/7. Glandular tumescence usually lacking. Setae distantly standing, setal arrangement after the clitellum: aa:ab:bc:cd:dd = 1.9:1.6:1.25:1:3.8 Clitellum circular, extends on segments ½ 24, 25–30. Tubercles on 25, 26–29. Male pore externally invisible, located on segment 26 or 27. Nephridiopores alternate irregularly between *b* and above *d*. *Internal* – Dissepiments 5/6–12/13 thickened, 13/14–14/15 markedly strengthened. Crop in 15–16, gizzards in 17–18. Two pairs of testes in 10, 11, enclosed in perioesophageal testis sac. Three (rarely four) pairs of seminal vesicles in 9, 11, 12 (9–12). Spermathecae two pairs in 9/10, 10/11, open in the setal line *d*. Calciferous glands in ½10–12 with diverticula in 11. Last pair of lateral hearts in 11, and a pair of extraoesophageals in 12. Excretory system holonephridial. Nephridial bladders are of biscuit-shape (octaedra-type). Cross-section of longitudinal muscle layer is pinnate (fig. 6.33.1).

Ecology – *F. pl. platyura* belongs to the anecic group of earthworms. Because of its large size this species has a profound effect on the decomposition of leaf litter and on the structure of soil. Its daily litter consumption is 31 mg dry mass pro 1 g living weight and the cast production is 47.1 mg dry mass pro 1 g living weight. *F. pl. platyura* defecates nearly equally onto the surface and into the soil (51.8% and 48.2% respectively) (Zicsi 1977). Taking into account the average abundance, biomass and seasonal activity of this species the corrected yearly consumption and cast production are between 857–983 kg/ha and 1443–1656 kg/ha respectively (Zicsi 1974a).

The natural life cycle of this species is unknown. Laboratory data show a maximum of 3 years and 8 months longevity, a 100–130 days cocoon incubation period and 12–14 months maturity (Zicsi 1982b).

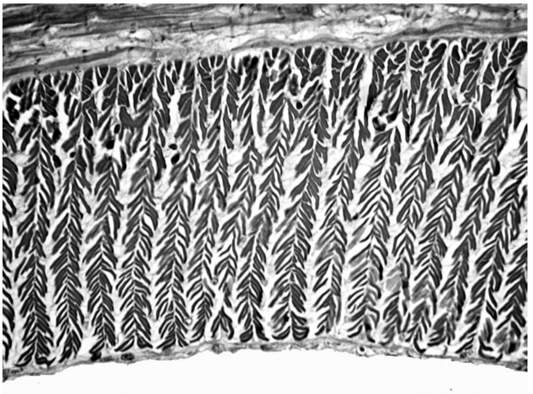

Fig. 6.33.1. Longitudinal musculature of *Fitzingeria platyura platyura*.

Distribution – *F. platyura platyura* shows a typical Central-European arboreal distribution (fig. 6.33.2).

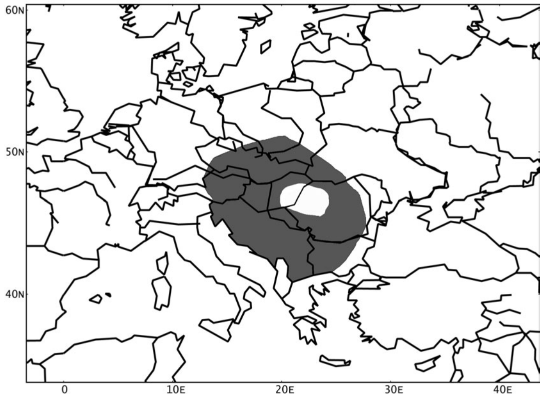

Fig. 6.33.2. Distribution of *Fitzingeria platyura platyura*.

Distribution in Hungary (fig. 6.33.3) – **CT19** *No.* 10547 Pusztamarót; **CT59** *No.* 7107 Magyarkút; **CU50** *No.* 5230, 5654, 7597, 7700, 7892, 7990, 8030, 8037, 8041, 8049, 8053, 8058, 8060, 8071, 8075, 8098, 8089, 8216, 8439, 8079, 10457, 10472, 10486, 10577, 11773, 10291 Szendehely; **DU33** *No.* 6942, 6948, 6953 Ivád; **DU40** *No.* 7422 between Sirok and Egerbakta; **DU51** *No.* 4429, 5173 Felsőtárkány; **EU81** *No.* 2982 Baktalórántháza; **XM88** *No.* 4516, 4517, 4518, 4519 Badacsonytördemic; **XN14** *No.* 8201, 8202, 8203, 8204, 8205 Cák; *No.* 5591, 5593, 5594, 8192, 8193, 8194, 8170, 10630, 11586, 11591, 11705 Velem; **XN18** *No.* 894, 5718 Sopron; **XN20** *No.* 12246 Nádasd; **XN25** *No.* 11438 Répcevis; *No.* 11430 Zsira; **XN28** *No.* 13091, 14285 Fertőrákos; **XN36** *No.* 1296 Sopronhorpács; **XN66** *No.* 5606 between Páli and Répcelak;

XN79 *No.* 2970, 2972, 2998 Magyarkimle; **XN89** *No.* 2965 Zsejke; **XP60** *No.* 2957 Lajta-csatorna; **XP61** *No.* 10573 Bezenye; *No.* 1479, 1565, 1595, 1596, 1610, 1615, 1654, Rajka; **XP80** *No.* 1506 Dunasziget; **YM08** *No.* 1655, 1699, 1700, 1954, 2847, 2848, 2849 Balatonboglár; **YM19** *No.* 12371 Örvényes; **YN12** *No.* 4850 Márkó; **YN14** *No.* 3383 Bakony Mts.; **YN14** *No.* 3377 Bakony Mts. Cuha-völgy.

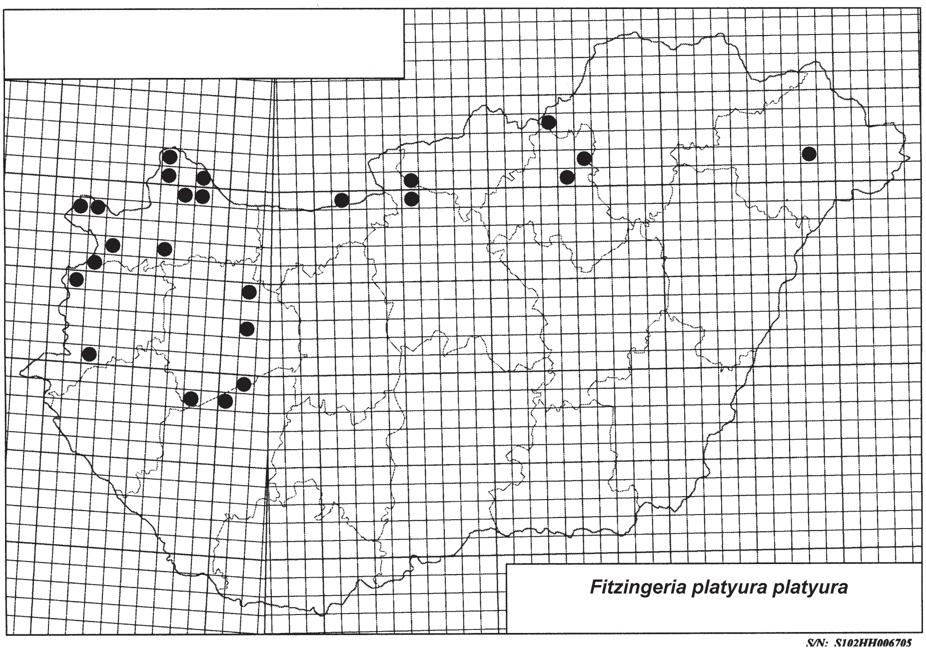

Fig. 6.33.3. Distribution of *Fitzingeria platyura platyura* in Hungary.

6.34 *Fitzingeria platyura depressa* (Rosa, 1893)

(Figs. 6.34.1–4.)

Enterion platyurum (part.) Fitzinger, 1833 Isis, p. 553.
***Lumbricus terrestris* var. *platyurus* (part.) Örley, 1881a Math. és term. tud. közlemények, 16: 583.**
***Octolasion platyurum* (part): Örley 1885 Értek. term. tud. köréből, 15: 18.**
Allolobophora oerleyi (part.) Horst, 1887 Notes Leyden Mus., 9: 294.
Allolobophora platyura depressa Rosa, 1893a Mem.Acad.Torino 43: 439.
Helodrilus (Dendrobaena) platyurus depressus: Michaelsen 1900a Das Tierreich, 10: 494.
***Helodrilus (Dendrobaena) platyurus* (part.): Szüts 1909 Állattani Közlemények, 8: 138.**
Dendrobaena platyura var. *depressa*: Černosvitov 1935 Arch. Prir. Vyzk. Cech., 19: 43.
Dendrobaena platyura var. *depressa*: Pop 1943a Ann. Hist.-Nat. Mus. Hung., 34: 21.
Dendrobaena platyura var. *depressa:* Pop 1943b Zool. Jb. Syst., 76: 401.
Dendrobaena platyura moravica Proksova, 1955 Prir. Sborn. Ostrav., 15: 523.
Dendrobaena platyura pannonica Proksova, 1955 Prir. Sborn. Ostrav., 15: 523.
***Dendrobaena platyura* v. *depressa*: Zicsi 1968a Opusc. Zool. Budapest, 8: 133.**

Dendrobaena (Dendrobaena) platyura depressa: Bouché, 1972 Inst. Nat. Rech. Agron., p. 407.
***Fitzingeria platyura depressa*: Zicsi 1978 Acta zool. hung., 24: 444.**
Dendrobaena platyura depressa: Zicsi 1982a Acta zool. hung., 28: 443.
Fitzingeria platyura depressa: Easton 1983 Earthworm Ecology, p. 481.
?*Fitzingeria viminiana* Mršić, 1986 Biosistematika Beograd, 12: 111. **? syn. nov**.
***Fitzingeria platyura depressa*: Zicsi 1991 Opusc. Zool. Budapest, 24:189.**
Fitzingeria platyura depressa: Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 543.
Fitzingeria platyura quadrivesiculata: Qiu & Bouché 1998c Doc. pedozool. integrol., 4: 99. **Syn. nov**.
Fitzingeria platyura depressa + *Fitzingeria platyura quadrivesiculata*: Qiu & Bouché 1998a Doc. pedozool. integrol., 4: 198.

Description – *External* – Body length 80–190 mm, diameter 4–9 mm, 80–230 segments. Colour dark grey with reddish iridescence. Head epilobous, first dorsal pore between intersegmental furrows 5/6–7/8. Glandular tumescence usually on 9, 11, 25, 29 *ab*. Setae distantly standing, setal arrangement after the clitellum: aa:ab:bc:cd:dd = 1.8:1.5:1:1.1:4.4 Clitellum circular, extends on segments ½ 24, 25–30. Tubercles on 25, 26–29, 30. Male pore externally invisible, located usually on segment 26. Nephropores irregularly alternate between *b* and above *d*. *Internal* – Dissepiments 5/6–12/13 thickened, 13/14–14/15 markedly strengthened. Crop in 15–16, gizzards in 17–18. Two pairs of testes in 10, 11, enclosed in perioesophageal testis sac. Three (rarely four) pairs of seminal vesicles in 9, 11, 12 (9–12). Spermathecae three to five pairs in (6/7, 7/8), 8/9, 9/10, 10/11, open in the setal line *d*. Calciferous glands in ½10–12 with diverticula in 11. Last pair of lateral hearts in 11, and a pair of extraoesophageals in 12. Excretory system holonephridial. Nephridial bladders are of biscuit-shape (octaedra-type). Typhlosole great unilobate, the cross-section of longitudinal muscle layer is of pinnate type (fig. 6.34.1, 6.34.2).

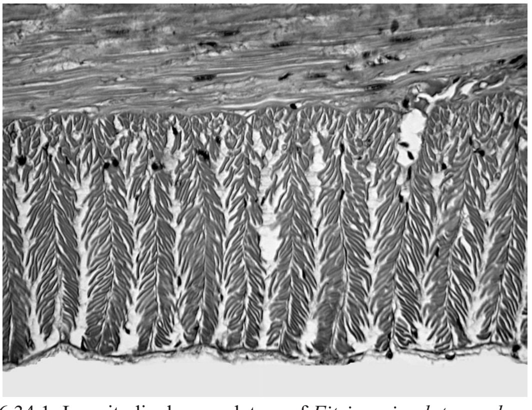
Fig. 6.34.1. Longitudinal musculature of *Fitzingeria platyura depressa*.

Fig. 6.34.2. Typhlosole of *Fitzingeria platyura depressa*.

Remarks – Mršić (1986) described a new species *F. viminiana*, markedly similar to *F. pl. depressa*. The only slight difference distinguishing the two species is the somewhat longer clitellum of *viminiana* (½ 24–31). Examining our material of *F. pl. depressa* we have frequently found specimens with clitellum beginning on 24 and covering partly the 31st segment. This indicates the possible synonymy of the two names. The subspecies of Qiu & Bouché (1998c): *Fitzingeria platyura quadrivesiculata* differs from *F. pl. depressa* only in the number of seminal vesicles. This variation could even be observed inside a population and has no taxonomic value (Pop 1943b).

Ecology – *F. pl. depressa* belongs to the anecic group (Bouché 1977) of earthworms. Because of its large size this species as well as subspecies *platyura* has a profound effect on the decomposition of leaf litter and on the structure of soil. Its daily litter consumption is 25.02 mg dry mass pro 1 g living weight and the cast production is 35.29 mg dry mass pro 1 g living weight. *F. pl. depressa* defecates mainly into the soil (89% vs. 11%) (Zicsi 1975). Taking into account the average abundance, biomass and seasonal activity of this species the corrected yearly consumption and cast production are between 1171–1342 kg/ha and 1526–1749 kg/ha respectively (Zicsi 1974a).

The natural life cycle of this species is unknown. Laboratory data show a maximum of 4 years and 5 months longevity, a 120–150 days cocoon incubation period and 15–16 months maturity (Zicsi 1982b).

Distribution – *F. platyura depressa* shows a Central-European arboreal distribution (fig. 6.34.3).

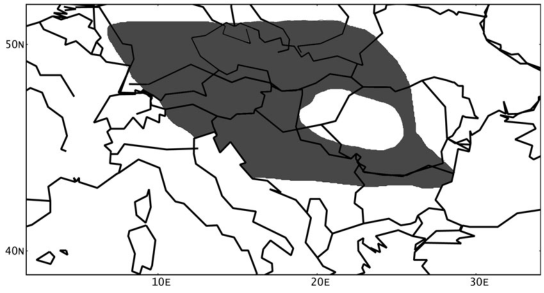

Fig. 6.34.3. Distribution of *Fitzingeria platyura depressa*.

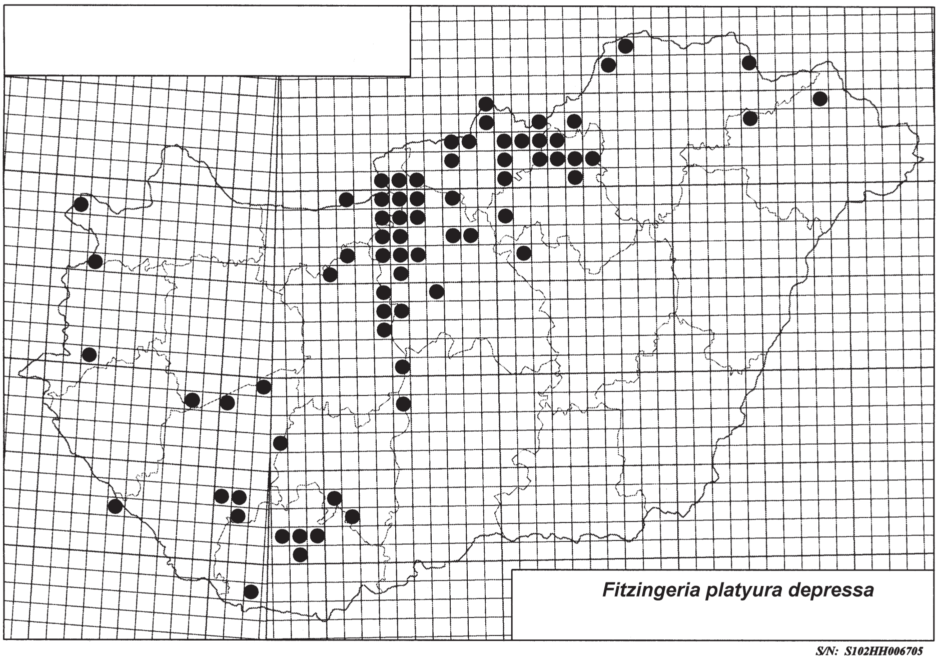

Fig. 6.34.4. Distribution of *Fitzingeria platyura depressa* in Hungary.

Distribution in Hungary (fig. 6.34.4) – **BS71** *No.* 3178 Mecsek Mts. Szuadó-völgy; **BS76** *No.* 12878 Somogydöröcske; **BS80** *No.* 7180 Mecsek Mts. Lapis; *No.* 3168, 3172 Mecsek Mts. Hidegkút-forrás; *No.* 824, 1807, 3177, 4735, 4736 Mecsek Mts. Misina; *No.* 819 Mecsek Mts. Tubes; *No.* 1972, 4776, 7164 Pécs; **BS81** *No.* 3198 Mecsek Mts. Mély-völgy; **BS91** *No.* 1702 Mecsek, Hidasi-völgy; **CS03** *No.* 1643 Bonyhád; **CS12** *No.* 14452 Bátaapáti; **CS48** *No.* 547, 621, 640, 643, 649, 800, 805, 1871, 1974, 2829, 3028 Dunaföldvár; **CT05** *No.* 5491 Kőhányás; **CT16** *No.* 9034, 14366 Vértes Mts. Vinyabükki-völgy; **CT19** *No.* 1103 Lábatlan; **CT32** *No.* 1554, 1981 Adony; **CT33** *No.* 2881 Baracska; **CT34** *No.* 616, 1707 Martonvásár; **CT36** *No.* 1698 Buda hills; *No.* 4436 Páty; **CT37** *No.* 1708, 4396, 4406, 4409, 4453 Perbál; *No.* 1748 Piliscsaba; **CT38** *No.* 10343 Pilis Mts. Fekete-hegy; *No.* 14466 Pilis Mts. Kétbükkfa-nyereg; **CT39** *No.* 3916, 3918 Pilis Mts.; *No.* 3919 Pilis Mts. Szőke-forrás; **CT40** *No.* 562 Dunaújváros; **CT43** *No.*

555, 1705 Ercsi; *No.* 600 Sinatelep; **CT45** *No.* 2935 Sasad; **CT46** *No.* 10423 Budapest, Normafa; *No.* 3340 Budapest, Ságvári-liget; **CT47** *No.* 7254 Solymár; **CT48** *No.* 7243, 7285 Pilis Mts. Bölcsőhegy; *No.* 9960 Pilis Mts. Bükkös-patak; *No.* 10371, 10377, 10322 Pilis Mts. Dobogókő; *No.* 9923 Pilis Mts. Malompatak völgy; *No.* 9940 Pilis Mts. Lukács-árok; *No.* 9929 Pilis Mts. Szőke-forrás völgye; *No.* 10017, 9950, 9996 Pilis Apátkuti-patak; *No.* 9971 Pilis Mts. Sikáros; *No.* 10405 Pilis Mts. Szentlászló-völgy; *No.* 10367 Pilis Mts. Vörösdagonya; *No.* 4191 Pilis Mts. Bükki-puszta; *No.* 10303, 10317, 10411 Pilis, Hoffman-kunyhó; *No.* 10218, 10351, 10359 Pilis, Király-patak; **CT49** *No.* 1138, 1701, 1709, 10299, 11708, 11742 Pilismarót; *No.* 9946, 9958, 10026 Lepence; *No.* 10398 Dömös; **CT56** *No.* 725, 726 Csepel; *No.* 4154, 4155 Farkasvölgy; *No.* 3238 Budapest, Kamaraerdő; *No.* 1697 Budapest, Kelenföld; **CT58** *No.* 10224, 10233 Pilis Mts. Király-patak völgye; *No.* 4170, 4178, 4181, 4187 Pilis Mts. Bükkös-patak; *No.* 7184, 7185, 7186, 7352, 7399, 7400, 7890, 7891 Pilis Mts. Lajosforrás; *No.* 1374, 1472, 1487, 1498, 1501 Szentendre; *No.* 4200 Pilis Mts. Vöröskő; **CT59** *No.* 1537 Dunabogdány; *No.* 7108 Magyarkút; *No.* 9986 Pilis Mts. Lukács-árok; **CT64** *No.* 11561, 11776 Ócsa; **CT77** *No.* 2809, 3072, 5182, 5558, 5645, 5881 Gödöllő; **CT79** *No.* 3209, 3211, 3215, 3216, 3217, 3227, 3262, 3274, 3275 Csővár; **CT87** *No.* 2801, 3063, 3075, 7206 Bag, Petőfi-forrás; **CU30** *No.* 2075, 2087, 2099, 4002, 9183, 11744 Letkés; **CU40** *No.* 4587 Börzsöny Mts. Oltár-patak; **CU50** *No.* 5231, 5653, 7116, 7125, 7240, 7323, 7324, 7325, 7329, 7336, 7341, 7345, 7348, 7396, 7397, 7602, 7699, 8031, 8042, 8048, 8063, 8074, 8080, 8093, 8097, 8217, 8417, 8440, 8441, 8442, 9068, 9628, 10463, 10471, 11774 Szendehely; **CU71** *No.* 8993 Kétbodony; **CU72** *No.* 5282 Ipolyszög; **CU82** *No.* 5265 Őrhalom; **CU93** *No.* 5287 Ludányhalászi; *No.* 5285 Nógrádszakál; **CU94** *No.* 5272 Litke; **DT08** *No.* 7225 Hatvan; *No.* 2160 Nagygombos; **DT16** *No.* 4972 Jászberény; **DU00** *No.* 4207, 4208, 4209, 4210, 4211, 4233, 4234, 4235 Mátrakeresztes; **DU01** *No.* 9106 Sámsonháza; **DU02** *No.* 5290 Kishartyán; *No.* 9087 Lucfalvai elágazás; **DU12** *No.* 5891 Mátraszele; **DU21** *No.* 1691, 2797, 3283, 3993, 7218, 10414 Nádújfalu; **DU22** *No.* 5894, 5902 Bárna; *No.* 9093, 9094, 9095, 9096 Istenmezeje; **DU23** *No.* 9099 Cered; **DU31** *No.* 8266, 8271, 8272, 8273, 8274 Pétervására; **DU32** *No.* 5661, 5662 Szentdomonkos; *No.* 2895, 7378 Tarnalelesz; **DU40** *No.* 7421, 7430 between Sirok and Egerbakta; **DU41** *No.* 3004 between Bátor and Szücs; **DU43** *No.* 7388 Borsodnádasd; **DU51** *No.* 4657 Bükk Mts. Szarvaskő; *No.* 8568 Bükk Mts. Teréz-forrás; **DU66** *No.* 534 Aggtelek; **DU77** *No.* 556, 1706 Szin; **EU43** *No.* 2104 Körtvélyes; **EU46** *No.* 3486 Némahegy-Köveshegy; **EU84** *No.* 3515, 3632 Jéke; *No.* 3501, 3578 Kisvárda; **XM42** *No.* 5431 Őrtilos; **XM88** *No.* 14343 Szigliget; **XN18** *No.* 5717 Sopron; **XN20** *No.* 12247 Nádasd; **XN25** *No.* 11439 Répcevis; *No.* 11431 Zsira; **YL28** *No.* 4739 Csányoszró; **YM03** *No.* 7158, 7159 Bőszénfa; *No.* 7299 Dennapuszta; **YM08** *No.* 658, 10079 Balatonboglár; **YM12** *No.* 2916, 7174, 9193, 10568 Ropolyapuszta; *No.* 2954 Simonfa; **YM13** *No.* 1859, 2923, 2927 Zselice; *No.* 2934 Zselicszentpál; **YM29** *No.* 12385, 12389, 12398 Balatonendréd.

6.35 *Fitzingeria platyura montana* (Černosvitov, 1932)

(Figs. 6.35.1–4.)

Octolasium montanum Černosvitov, 1932 Zool. Jb. Syst., 62: 535.
Octolasium montanum: Černosvitov 1935 Arch. Prir. Vyzk. Cech., 19: 68.
Dendrobaena platyura var. *montana*: Pop 1943a Ann. Hist.-Nat. Mus. Hung., 34: 21.
Dendrobaena platyura var. *montana*: Pop 1943b Zool. Jb. Syst., 76: 402.
***Dendrobaena platyura* var. *montana*: Zicsi 1958 Opusc. Zool. Budapest, 2: 58.**
***Dendrobaena platyura* v. *montana*: Zicsi 1968a Opusc. Zool. Budapest, 8: 134.**
Dendrobaena (*Dendrobaena*) *platyura montana*: Plisko 1973 Fauna Poloniae, p. 77.
***Fitzingeria platyura montana*: Zicsi 1978 Acta zool. hung., 24: 446.**
Dendrobaena platyura f. *montana*: Perel 1979 Range and regularities in the distr. earthworms, p. 230.
Dendrobaena platyura montana: Zicsi 1982a Acta zool. hung., 28: 443.
Fitzingeria platyura montana: Easton 1983 Earthworm Ecology, p. 481.
***Fitzingeria platyura montana*: Zicsi 1991 Opusc. Zool. Budapest, 24: 190.**
Fitzingeria platyura montana: Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 546.
Fitzingeria platyura montana: Qiu & Bouché 1998a Doc. pedozool. integrol., 4: 198.

Description – *External* – Body length 110–380 mm, diameter 8–15 mm, 130–196 segments. Colour dark grey with reddish iridescence. Head epilobous, first dorsal pore in intersegmental furrow 8/9 or 9/10. Glandular tumescence usually on 25, 30, 33, 34, 36 *ab*. Setae distantly standing, setal arrangement after the clitellum: aa:ab:bc:cd:dd = 2.1:1.6:1:1.2:4.7 Clitellum circular, extends on segments ½ 24, 25–½ 30, 30. Tubercles on ½ 25,–½ 30. Male pore externally invisible, located usually on segment 25. Nephropores irregularly alternate between *b* and above *d*. *Internal* – Dissepiments 6/7–8/9 thickened, 12/13–14/15 markedly strengthened. Crop in 15–16, gizzards in 17–18. Two pairs of testes in 10, 11, enclosed in perioesophageal testis sacs. Two pairs of seminal vesicles in 11, 12. Spermathecae three to five pairs in (6/7, 7/8), 8/9, 9/10, 10/11, open in the setal line *d*. Calciferous glands in 11–12 with diverticula in 11. Last pair of lateral hearts in 11, and a pair of extraoesophageals in 12. Excretory system holonephridial. Nephridial bladders are of biscuit-shape (octaedra-type). Typhlosole great, multilobate, the cross-section of longitudinal muscle layer is of pinnate type (fig. 6.35.1, 6.35.2).

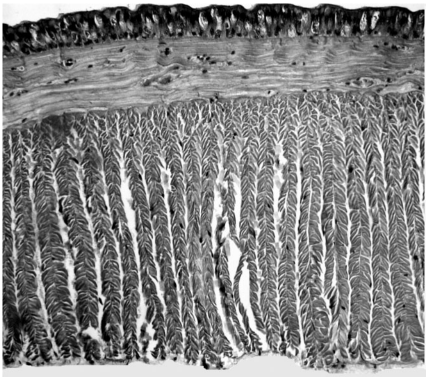

Fig. 6.35.1. Longitudinal musculature of *Fitzingeria platyura montana*.

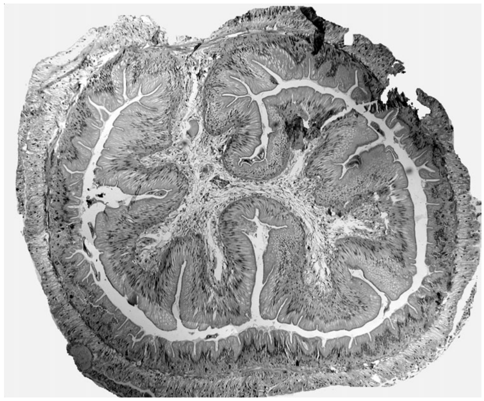

Fig. 6.35.2. Typhlosole of *Fitzingeria platyura montana*.

Ecology – *F. pl. montana* is an anecic earthworm. Because of its large size this species plays a significant role in the decomposition of leaf litter and in the soil formation. Its daily litter consumption is 16.7 mg dry mass pro 1 g living weight and the cast production is 78.27 mg dry mass pro 1 g living weight. *F. pl. montana* defecates mainly into the soil (97.3% vs. 2.7%) (Zicsi 1975). Taking into account the average abundance, biomass and seasonal activity of this species the corrected yearly consumption and cast production are between 2310–2540 kg/ha and 10821–11895 kg/ha respectively (Zicsi 1974a).

The natural life cycle of this species is unknown. Laboratory data show a maximum of 6 years and 5 months longevity, a 180–210 days cocoon incubation period and 17–19 months maturity (Zicsi, 1982b).

Distribution – *F. platyura montana* shows a Central-European montane distribution (fig. 6.35.3).

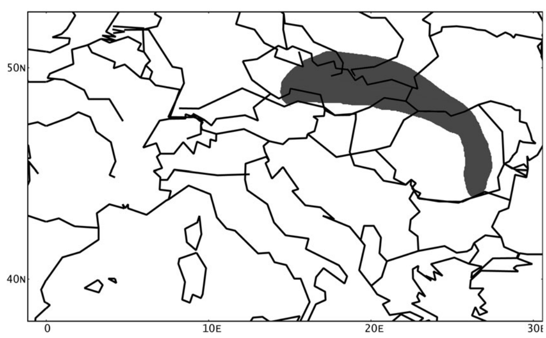

Fig. 6.35.3. Distribution of *Fitzingeria platyura montana*.

Distribution in Hungary (fig. 6.35.4) – **DU51** *No.* 4658 Bükk Mts. Szarvaskő; *No.* 8569 Bükk Mts. Teréz-forrás; **DU52** *No.* 1750 Bélapátfalva; *No.* 9891 Bükk Mts. Ivánkalápa; *No.* 9895 Bükk *No.* 4500, 4501 Kelemér; *No.* 4572 Serényfalva; **DU61** *No.* 5669, 5680 Cserépfalu; **DU62** *No.* 4607 Bükk Mts. Bánkút; **DU63** *No.* 4383 Bükk Mts. Buzgókő; *No.* 4387 Bükk Mts. Örvénykő; **DU66** *No.* 527, 535, 536, 570, 1936, 2899, 7744, 7745, 7746 Aggtelek; **DU67** *No.* 791, 1721, 1943, 3103, 3276, 3299, 3302, 3308, 3309, 3310, 3319, 3324, 4241, 4462, 4682, 4683, 4684, 5541, 5912, 7208, 11663 Jósvafő; **DU72** *No.* 2251 Bükk Mts Garadna-völgy; *No.* 2991 Bükk Mts. Csókás-forrás; **DU76** *No.* 2907 Szendrő; **DU77** *No.* 4380 Alsóhegy; *No.* 3873 Szádvár; **DU80** *No.* 4271 Emőd; **DU85** *No.* 1693, 2853, 3018, 5169 Szendrőlád; **DU86** *No.* 574, 584, 1034, 1724, 1932, 3030, 3466, 7110 Szalonna; **DU87** *No.* 3961, 3984, 3985 Bódvaszilas; **DU95** *No.* 4996 Tomor; **EU26** *No.* 4222, 11635 Regéc; **EU27** *No.* 5477 Telkibánya; **EU35** *No.* 11656 Óhuta; **EU36** *No.* 5455, 11681 Kishuta; *No.* 5471, 7563, 7572, 11633 Nagybózsva; *No.* 11672 Nagyhuta; *No.* 11636, 14322 Rostalló; **EU37** *No.* 5990, 5997, 7557, 11695 Füzér; **EU38** *No.* 7578 Nagymilic; **FU12** *No.* 8019 Tarpa; **FU22** *No.* 4050, 7138 Tiszacsécse; *No.* 7133, 7143, 7144, 7145 Tiszakóród.

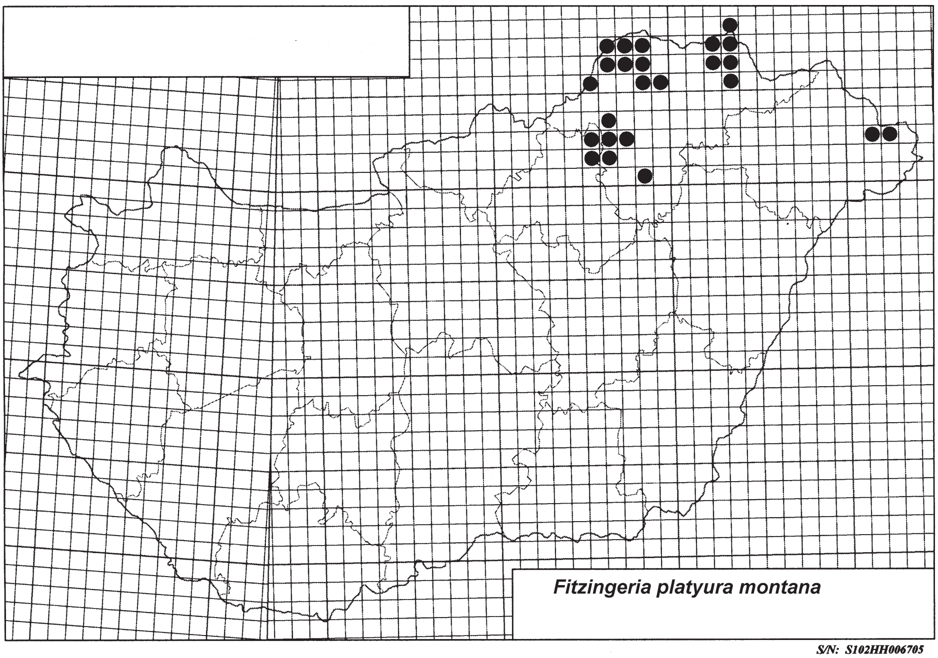

Fig. 6.35.4. Distribution of *Fitzingeria platyura montana* in Hungary.

Genus *Helodrilus* Hoffmeister, 1845

Helodrilus Hoffmeister, 1845 Regenwürmer, p. 38.
Helodrylus (laps.): D'Udekem 1855 Bull. Acad. Belg., 22: 541.
Helodrilus (part.): Rosa 1893a Mem. Acc. Torino, 43: 424.
Helodrilus (*Helodrilus*) (part.): Michaelsen 1900a Das Tierreich, 10: 495.
Helodrilus (*Allolobophora*) (part.): Michaelsen 1900a Das Tierreich, 10: 486.
Allolobophora (part.): Pop 1941 Zool. Jb. Syst., 74: 518.
Helodrilus (part.): Omodeo 1953 Mem. Mus. Civ. St. Nat. Verona, 4: 75.
Helodrilus (part.): Omodeo 1956 Arch. zool. Ital., 41: 171.
Eiseniella (part.): Omodeo 1956 Arch. zool. Ital., 41: 188.
Allolobophora (sensu lato) (part): Bouché, 1972 Inst. Nat. Rech. Agron., p. 417.
Helodrilus (part.): Perel 1976b Zool. Zh., 55: 833.
Helodrilus (part.): Perel 1979 Range and regularities in the distr. earthworms, p. 179.
Allolobophora (part.): Zicsi 1982a Acta Zool. Hung., 28: 444.
Helodrilus: Easton 1983 Earthworm Ecology, p. 481.
Helodrilus: Zicsi 1985a Acta zool. hung., 31: 277.
Helodrilus: Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 101.
Helodrilus (part.): Perel 1997 Earthworms of Russia, p. 53.
Helodrilus: Zicsi & Csuzdi 1999 Rev. suisse Zool., 106: 990.
Helodrilus: Qiu & Bouché 1998b Doc. pedozool. integrol., 3: 209.

Type species – *Helodrilus oculatus* Hoffmeister, 1845 by original designation.

Diagnosis – *External* – Setae extremely closely paired, pigmentation lacking. Prostomium epilobous, first dorsal pore around 5/6. Male pore on 15, great, with glandular crescent intruding into the neighbouring segments. Spermathecae open in setal line *cd*, or near to the mid-dorsal line. Nephridial pores segmental hardly visible. *Internal* – Two pairs of testes free in 10, 11, and two to four (rarely three) pairs of seminal vesicles in 9–12; 11, 12 (9, 11, 12). Receptacula seminis two to five pairs. Calciferous glands with lateral diverticula in 10, sometimes hardly recognisable. Excretory system holonephridial and exonephric, nephridial bladders lacking (fig. 3.14A). The cross-section of longitudinal muscle layer is of fasciculated type.

Table 6.7. Distinguishing characters of the *Helodrilus* species in Hungary.

Species	Clitellum	Tubercles	Vesicles	Spermathecae	Nephridial bladders	Musculature
H. cernosvitovianus	21, 22–28, 29	½ 26–½ 28	11, 12	9/10, 10/11 M	—	fasciculated
H. deficiens	26–33	30, 31	11, 12	9/10, 10/11 *d*	—	fasciculated
H. mozsaryorum	25–35	31–½ 34	11, 12	9/10, 10/11 *cd*	—	fasciculated

6.36 *Helodrilus cernosvitovianus* (Zicsi, 1967)

(Figs. 6.36.1–3.)

***Allolobophora cernosvitoviana* Zicsi, 1967 Acta zool. hung., 13: 248.**
***Allolobophora cernosvitoviana*: Zicsi 1968a Opusc. Zool. Budaspest, 8: 147.**
Helodrilus cernosvitovianus: Perel 1976b Zool. Zh., 55: 833.
Helodrilus cernosvitovianus: Perel 1979 Range and regularities in the distr. earthworms, p. 181.
Helodrilus cernosvitovianus: Zicsi & Michalis 1981 Acta zool. hung., 27: 247.
Allolobophora cernosvitoviana: Zicsi 1982a Acta zool. hung., 28: 444.
Helodrilus cernosvitovianus: Easton 1983 Earthworm Ecology, p. 482.
Helodrilus cernosvitovianus: Zicsi 1985a Acta zool. hung., 31: 282.
Allolobophora cernosvitoviana: Rosen & Kostecka 1988 Przeglad Zoologiczny, 32: 199.
***Helodrilus cernosvitovianus*: Zicsi 1991 Opusc. Zool. Budapest, 24: 188.**
Helodrilus cernosvitovianus: Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 115.
Helodrilus cernosvitoviana: Qiu & Bouché 1998a Doc. pedozool. integrol., 4: 196.

Description – *External* – Body length 60–85 mm, diameter 3–4 mm, 87–149 segments. Colour alive reddish, conserved white. Head epilobous, first dorsal pore in 4/5. Glandular tumescence usually on 12 *abcd*, 26–28 *ab.* Setae closely paired, setal arrangement after the clitellum: aa:ab:bc:cd:dd = 5.75:1:4.25:1:10. Clitellum saddle-shaped, extends on segments 21, 22–28, 29. Tubercula pubertatis in the form of a band on ½ 26–½ 28. Male pore on 15, great, covering partly the neighbouring segments as well. *Internal* – Dissepiments 5/6–9/10 strongly thickened. Crop in 15–16, gizzards in 17–18. Two pairs of testes in 10, 11 free, and two pairs of seminal vesicles in 11, 12. Spermathecae two pairs in 9/10, 10/11, open above setal line *cd*, close to the mid-dorsal line. Calciferous glands in 10–12 with small lateral pouches in 10. Last pair of lateral hearts in 11 and a pair of extraoesophageals in 12. Excretory system exonephric and holonephridial. Nephridial bladders lacking. The cross-section of longitudinal muscles layer is of fasciculated type (fig. 6.36.1).

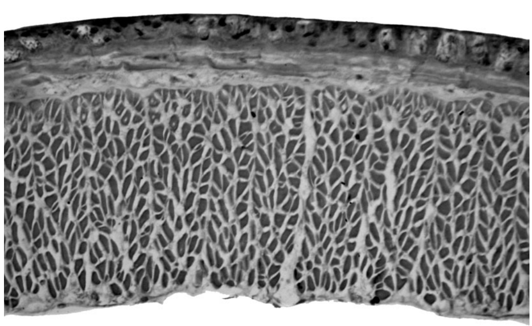

Fig. 6.36.1. Longitudinal musculature of *Helodrilus cernosvitovianus*.

Ecology – *H. cernosvitovianus* belongs to the endogeic group, living and feeding in the mineral soil layer. It prefers moist clayey soils.

Distribution – This species has been described from Hungary (Zicsi 1967) and it has later been recorded for Ukraine, Serbia, Greece and Poland (fig. 6.36.2).

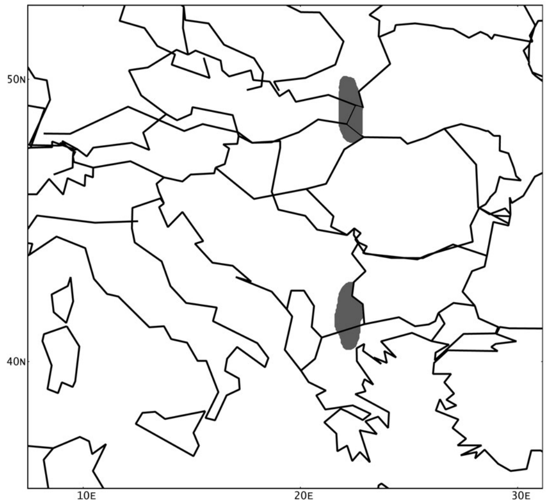

Fig. 6.36.2. Distribution of *Helodrilus cernosvitovianus*.

Distribution in Hungary (fig. 6.36.3) – **FU12** *No*. 4022 Kisar; *No*. 4067, 4068, 10388, 10872 Kömörő.

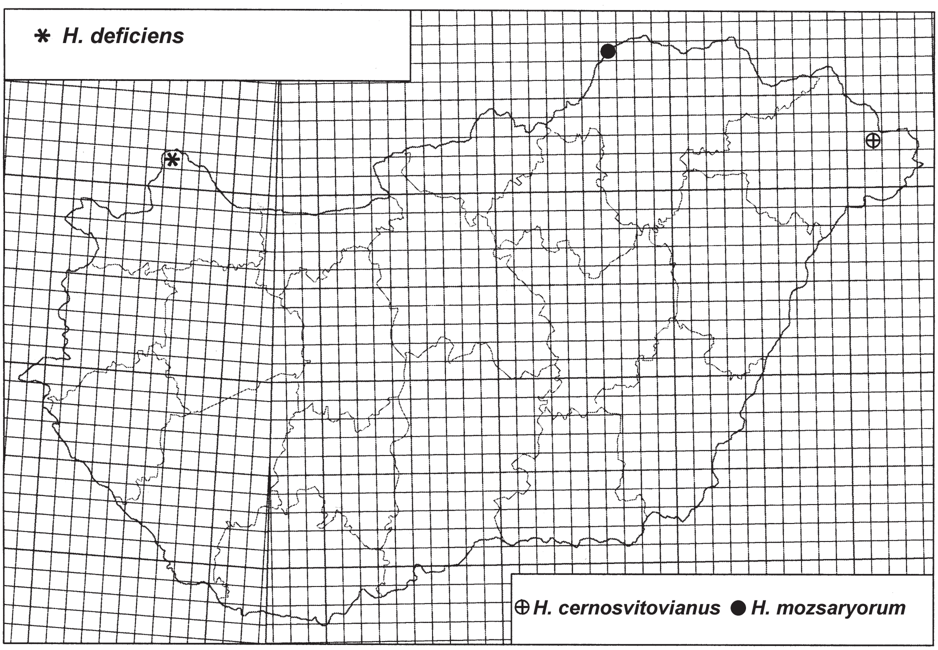

Fig. 6.36.3. Distribution of *Helodrilus cernosvitovianus, Helodrilus deficiens* and *Helodrilus mozsaryorum* in Hungary.

6.37 *Helodrilus deficiens* Zicsi, 1985

(Figs. 6.36.3, 6.37.1.)

***Helodrilus deficiens* Zicsi, 1985a Acta zool. hung., 31: 282.**
Helodrilus deficiens: Mršić & Šapkarev 1988 Acta Mus. Mac. Sci. Nat., 19: 11.
Helodrilus deficiens: Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 126.
***Helodrilus deficiens*: Zicsi 1991 Opusc. Zool. Budapest, 24: 188.**
Helodrilus deficiens: Zicsi 1994 Verh. Zool.-Bot. Ges. Wien, 131: 43.
Helodrilus deficiens: Qiu & Bouché 1998a Doc. pedozool. integrol., 4: 197.

Description – *External* – Body length 35–70 mm, diameter 3–5.5 mm, 78–125 segments. Colour without any pigment. Head epilobous, first dorsal pore in 4/5. Glandular tumescence usually on 8 *cd*, 29–32 *ab*. Setae closely paired, setal arrangement after the clitellum: aa:ab:bc:cd:dd =12.7:1.3:9.3:1:33. Clitellum saddle-shaped extends on segments 26–33. Scale-like tubercles on 30, 31. Male pore on 15, great, covering partly the neighbouring segments as well. *Internal* – Dissepiments 6/7–9/10 strongly thickened. Crop in 15–16, gizzards in 17–18. Two pairs of testes in 10, 11 free, and two pairs of seminal vesicles in 11, 12. Spermathecae two pairs in 9/10, 10/11, open somewhat above setal line *cd*. Calciferous glands in 10–12 with lateral diverticles in 10. Excretory system exonephric and holonephridial. Nephridial bladders lacking. The cross-section of longitudinal muscles layer is of fasciculated type.

Ecology – *H. deficiens* belongs to the endogeic group, living and feeding in the mineral soil layer. It prefers extremely moist clayey soils.

Distribution – This species occurs in Hungary and Austria. All the localities are from the bank of Danube River (fig. 6.37.1).

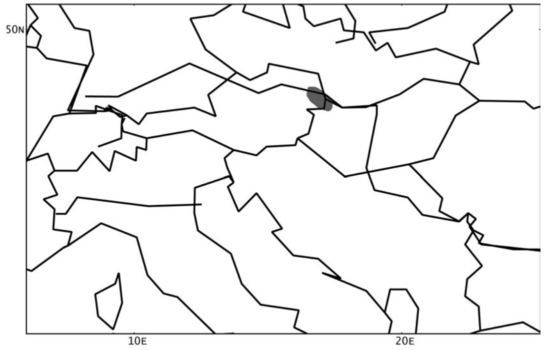

Fig. 6.37.1. Distribution of *Helodrilus deficiens*.

Distribution in Hungary (fig. 6.36.3) – **XP61** *No*. 1481, 1591, 1593, 1605, 1608, 10065 Rajka, Duna-part.

6.38 *Helodrilus mozsaryorum* (Zicsi, 1974)

(Figs. 6.36.3., 6.38.1–2.)

***Allolobophora mozsaryorum* Zicsi, 1974b Acta zool. hung., 20: 230.**
Allolobophora mozsaryorum: Easton 1983 Earthworm Ecology, p. 476.
***Helodrilus mozsariorum* (lapsus): Zicsi 1985a Acta zool. hung., 31: 282.**
Helodrilus mozsariorum (lapsus): Mršić & Šapkarev 1988 Acta Mus. Mac. Sci. Nat., 19: 11.
***Helodrilus mozsaryorum*: Zicsi 1991 Opusc. Zool. Budapest, 24: 188.**
Helodrilus mozsaryorum: Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 115.
***Helodrilus mozsaryorum*: Zicsi, Dózsa-Farkas & Csuzdi 1999 Fauna of the Aggtelek Nat. Park, p. 42.**
Helodrilus mozsaryorum: Qiu & Bouché 1998a Doc. pedozool. integrol., 4: 196.

Description – *External* – Body length 65–95 mm, diameter 4.5–6.5 mm, 108–126 segments. Colour white. Head epilobous, first dorsal pore in 4/5. Glandular tumescence usually on 8–11, 31–34 *ab.* Setae closely paired, setal arrangement after the clitellum: aa:ab:bc:cd:dd = 6:1.25:5.25:1:17.5. Clitellum saddle-shaped extends on segments 25–35, tubercula pubertatis on 31–½ 34. Male pore on 15, great, covering partly the neighbouring segments as well. *Internal* – Dissepiments 6/7–10/11 slightly thickened. Crop in 15–16, gizzards in 17–18. Two pairs of testes in 10, 11 free, and two pairs of seminal vesicles in 11, 12. Spermathecae two pairs in 9/10, 10/11, open in setal line *c*. Calciferous glands in 10–12 with almost indistinguishable diverticles in 10. Excretory system exonephric and holonephridial. Nephridial bladders lacking. Typhlosole simple, lamelliform, the cross-section of longitudinal muscles layer is of fasciculated type (fig. 6.38.1, 6.38.2).

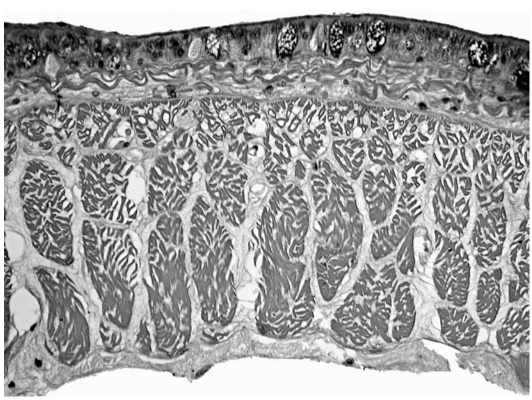

Fig. 6.38.1. Longitudinal musculature of *Helodrilus mozsaryorum*.

Remark – This species seems to be the only real Hungarian endemism. Its special way of life and extremely restricted distribution makes it endangered. Although the Baradla cave belongs to the Aggtelek National Park *H. mozsaryorum* deserves species-wide protection (see Zicsi, Dózsa-Farkas & Csuzdi 1999).

Fig. 6.38.2. Typhlosole of *Helodrilus mozsaryorum*.

Ecology – *H. mozsaryorum* is one of the rare troglobiont earthworms. It lives under water upside down in the bottom mud of deep siphons and secures its oxygen demand by circular motion of tail end.

Distribution – This species occurs in the Baradla cave Hungary.

Distribution in Hungary (fig. 6.36.3) – **DU67** *No*. 7717, 10558, 10580, 12741
Jósvafő, Baradla-barlang.

Genus *Lumbricus* Linnaeus, 1758

Lumbricus (part.) Linnaeus, 1758 Systema Naturae, p. 647.
Lumbricus (part.): Müller 1774 Verm. Terr. Fluv., 1(2): 24.
Enterion (part.): Savigny 1826 Mem Ac. Fr., 5: 179.
Lumbricus (part.): Hoffmeister 1845 Regenwürmer, p. 4.
Lumbricus: Eisen 1873 Öfv. Akad. Förh., 30(8): 45.
Lumbricus (part.): Örley 1881a Math. és term. tud. közlemények, 16: 580.
Lumbricus (part.): Örley 1885 Értek. term. tud. köréből, 15(18): 28.
Lumbricus: Rosa 1893a Mem. Acc. Torino, 43: 417.
Lumbricus (part.): Michaelsen 1900a: Das Tierreich, 10: 508.
Lumbricus: Szüts 1909 Állattani Közlemények, 8: 141.
Lumbricus: Omodeo 1956 Arch. zool. Ital., 41: 190.
Lumbricus: Bouché 1972 Inst. Nat. Rech. Agron., p. 352.
Lumbricus: Perel 1976b Zool. Zh., 55: 834.
Lumbricus: Gates 1978 Megadrilogica, 3: 81.
Lumbricus: Perel 1979 Range and regularities in the distr. earthworms, p. 211.
Lumbricus: Zicsi 1982a Acta zool. hung., 28: 443.
Lumbricus: Easton 1983 Earthworm Ecology, p. 482.
Lumbricus: Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 463.
Lumbricus: Perel 1997 Earthworms of Russia, p. 65.
Lumbricus: Qiu & Bouché 1998b Doc. pedozool. integrol., 3: 203.

Type species – *Lumbricus terrestris* Linnaeus, 1758 by subsequent designation (Sims 1973).

Diagnosis – *External* – Setae closely paired, pigmentation purple-violet. Prostomium tanylobous, first dorsal pore variable. Male pore on 15, sometimes hardly visible. Spermathecae open in setal line *cd*, nephridial pores irregularly alternate between *b* and above *cd*. *Internal* – Two pairs of testes in 10 and 11 enclosed in suboesophageal testis sac. Three pairs of seminal vesicles in 9, 11, 12 and two pairs of receptacula seminis situated in 9/10, 10/11. Calciferous glands with diverticula in 10 opening posteriorly and ventrally into the gut. Excretory system holonephridial, nephridial bladders J-shaped with backward-oriented ental part (fig. 3.15D). The cross-section of longitudinal muscle layer is of pinnate type.

Remarks – This is almost the only genus accepted as monophyletic for a long time by earthworm taxonomists.

Table 6.8. Distinguishing characters of the *Lumbricus* species in Hungary.

Species	Clitellum	Tubercles	Vesicles	Spermathecae	Nephridial bladders	Musculature
L. baicalensis	28–32	29–31	9, 11, 12	9/10, 10/11 *cd*	J backward	pinnate
L. castaneus	28–33	29–32	9, 11, 12	9/10, 10/11 *cd*	J backward	pinnate
L. polyphemus	37, 38, 39–43, 44, 45, 47	37, 38, 39, 40–43, 44, 45	9, 11, 12	9/10, 10/11 *cd*	J backward	pinnate
L. rubellus	26, 27–32	28–31	9, 11, 12	9/10, 10/11 *cd*	J backward	pinnate
L. terrestris	31, 32–37	33–36	9, 11, 12	9/10, 10/11 *cd*	J backward	pinnate

6.39 *Lumbricus baicalensis* Michaelsen, 1900

(Figs. 6.39.1–2.)

Lumbricus baicalensis Michaelsen, 1900b Ann. Mus. St.-Petersb., 5: 215.
Lumbricus baicalensis: Michaelsen, 1900a Das Tierreich, 10: 509.
Allolobophora düggelii Bretscher, 1903 Rev. suisse. Zool., 11: 20.
Lumbricus pusillus Wessely, 1905 Jahrb. Verh. Nat. Linz, 34: 7.
Lumbricus baicalensis: Michaelsen 1910b Ann. Mus. St.-Petersb., 15: 73.
Lumbricus baicalensis: Zicsi 1965a Naturk. Jahrb. Linz, 11: 180.
***Lumbricus baicalensis*: Zicsi 1966a Ann. Univ. Sci. Budapest, 8: 394.**
***Lumbricus baicalensis*: Zicsi 1968a Opusc. Zool. Budapest, 8: 130.**
Lumbricus baicalensis: Perel 1979 Range and regularities in the distr. earthworms, p. 213.
Lumbricus baicalensis: Zicsi 1982a Acta zool. hung., 28: 443.
Lumbricus baicalensis: Easton 1983 Earthworm Ecology, p. 482.
Lumbricus baicalensis: Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 484.
Lumbricus baicalensis: Qiu & Bouché 1998a Doc. pedozool. integrol., 4: 192.

Description – *External* – Body length 40–70 mm, diameter 5 mm, 65–105 segments. Colour red-violet. Head tanylobous, first dorsal pore between 5/6. Glandular tumescence usually on 8, 9, 10 or 11 *ab*. Setae closely paired, setal arrangement after the clitellum: aa:ab:bc:cd:dd = 7:1.7:8:1:30. Clitellum extends on segments 28–32 saddle-shaped. Tubercles on 29–31. Male pore on 15, with large glandular crescent. Post-mating specimens frequently with spermatophores on 24/25–26/27. Nephropores irregularly alternate between *b* and above *d*. *Internal* – Dissepiments 9/10–11/12 thickened. Crop in 15–16, gizzards in 17–18. Two pairs of testes in 10, 11, enclosed in suboesophageal testis sacs. Three pairs of seminal vesicles in 9, 11, 12. Receptacula seminis two pairs in 9/10, 10/11 open in setal line *cd*. Calciferous glands in 10–12 with lateral pouches in 10. Excretory system holonephridial with J-shaped nephridial bladders, hook backwards. The cross-section of longitudinal muscle layer is of pinnate type.

Ecology – This is an epigeic species, living in the lower litter layer and preferring humid environment. It could be found frequently on river and stream banks and other limnic habitats.

Remarks – The epithet of this species erroneously refers to the Baikal Sea, because of the mistaken labels of the original material (Michaelsen 1910b)

Distribution – *L. baicalensis* has a Eastern-Alpine distribution, occurring from Austria to Ukraine (fig. 6.39.1).

Distribution in Hungary (fig. 6.39.2) – **DU77** *No*. 3293 Szin; **XN14** *No*. 5592 Velem.

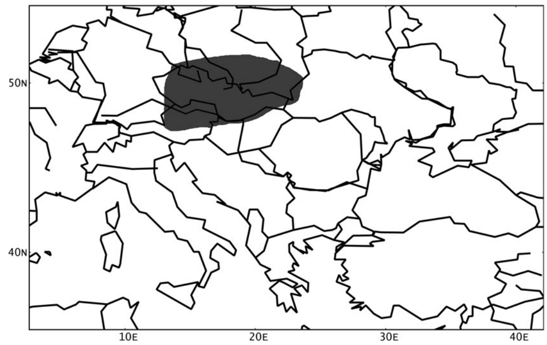

Fig. 6.39.1. Distribution of *Lumbricus baicalensis*.

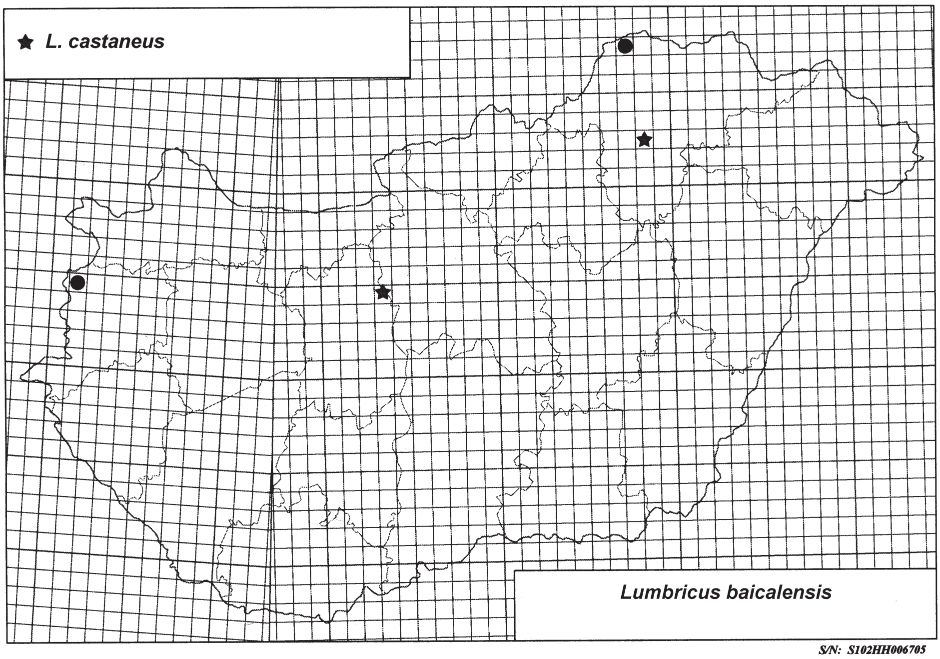

Fig. 6.39.2. Distribution of *Lumbricus baicalensis* and *Lumbricus castaneus* in Hungary.

6.40 *Lumbricus castaneus* (Savigny, 1826)

(Figs. 6.39.2., 6.40.1–3.)

Enterion castaneum Savigny, 1826 Mem. Acad. Sci. Inst. Fr., 5: 180.
Enterion pupilum Savigny, 1826 Mem. Acad. Sci. Inst. Fr., 5: 181.
Lumbricus trinnularis Grube, 1851 Reise Sibirien, 2(1): 18.
Lumbricus minor Johnston, 1865 Cat. Brit. nonparas Worms, p. 59.
Lumbricus josephinae Kinberg, 1867 Öfv. Akad. Förh., 23: 98.
Lumbricus purpureus Eisen, 1871 Öfv. Akad. Förh., 27: 956.

Enterion purpureum + *Lumbricus purpureus*: Örley 1881a Math. Term. Közlem. Magyar Akad. 16: 588, 590.
Lumbricus triannularis + *Lumbricus castaneus*: Örley 1885 Értek. Term. Tud. Köréből, 15: 29–30.
Lumbricus pumilosum (lapsus): Beddard 1895 Monogr. Oligochaeta, p. 722.
Lumbricus castaneus morelli Ribaucourt, 1896 Rev. suisse Zool., 4: 10.
Lumbricus castaneus perrieri Ribaucourt, 1896 Rev. suisse Zool., 4: 10.
Allolobophora brunescens Bretscher, 1900 Rev. suisse. Zool., 8: 42.
Lumbricus castaneus: Michaelsen 1900a Das Tierreich, 10: 510.
Lumbricus castaneus disjunctus Tétry, 1936 Bull. Soc. Sci. Nancy, 9: 196.
Lumbricus castaneus: Pop 1943a Ann. Hist. Nat. Mus. Hung., 36: 19.
Lumbricus castaneus pictus Chandebois, 1957b Bull. Soc. Zool. Fr., 82: 417.
***Lumbricus castaneus*: Zicsi 1959a Acta zool. hung., 5: 433.**
***Lumbricus castaneus*: Zicsi 1968a Opusc. Zool. Budapest, 8: 130.**
Lumbricus castaneus: Zicsi 1982a Acta zool. hung., 28: 443.
Lumbricus castaneus: Easton 1983 Earthworm Ecology, p. 482.
Lumbricus castaneus rubelloides Hidvegi & Josens, 1990 Rev. Ecol. Biol. Sol., 27(2): 248. **syn. nov**.
Lumbricus castaneus: Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 474.
Lumbricus castaneus castaneus: Qiu & Bouché 1998a Doc. pedozool. integrol., 4: 192.

Description – *External* – Body length 30–85 mm, diameter 3–5 mm, 595–120 segments. Colour dark red-violet. Head tanylobous, first dorsal pore between 5/6 or 6/7. Glandular tumescence usually on 9, 10 or on 10, 11 *ab*. Setae closely paired, setal arrangement after the clitellum: aa:ab:bc:cd:dd = 7:1.5:5:1:20. Clitellum extends on segments 28–33, saddle-shaped. Tubercles on 29–32 two bands on the ventral edge of the clitellum. Male pore on 15, small, without glandular crescent. Nephropores irregularly alternate between *b* and above *d*. *Internal* – No dissepiments notably thickened. Crop in 15–16, gizzards in 17–18. Two pairs of testes 10, 11, enclosed in oesophageal testis sacs. Three pairs of seminal vesicles in 9, 11, 12. Receptacula seminis two pairs in 9/10, 10/11 open in setal line *cd*. Calciferous glands in 10–12 with lateral pouches in 10. Excretory system holonephridial with J-shaped nephridial bladders, hook backwards. Typhlosole lamelliform but multilobate, the cross-section of longitudinal muscle layer is of pinnate type (fig. 6.40.1, 6.40.2).

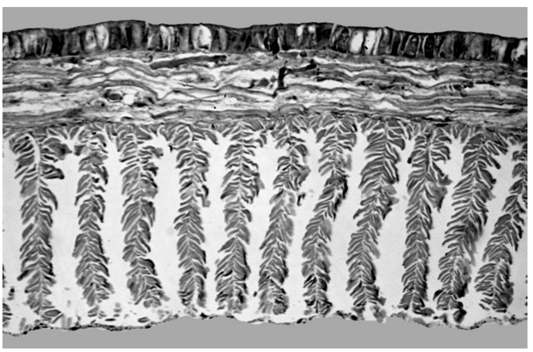

Fig. 6.40.1. Longitudinal musculature of *Lumbricus castaneus*.

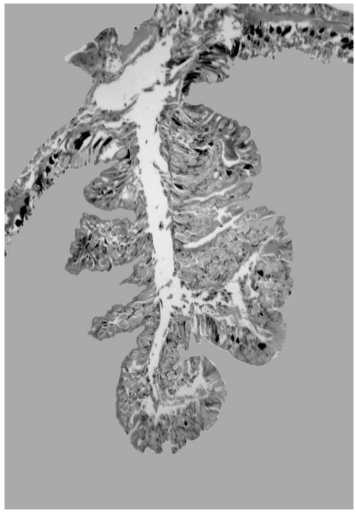

Fig. 6.40.2. Typhlosole of *Lumbricus castaneus*.

Ecology – *L. castaneus* occurs in humid soils rich in organic material. In forests it lives in the litter that serves as its food as well. Its consumption rate is about 22.9 mg dry mass pro 1 g living weight and the cast production is about 28.3 mg dry mass pro 1 g living weight. Casts are deposited mostly onto the soil surface, and a lower quantity (about 19%) are put into the soil (Zicsi 1974a)

Distribution – This species is native in the Palearctis, but it has been introduced extratropically all over the world (fig. 6.40.3).

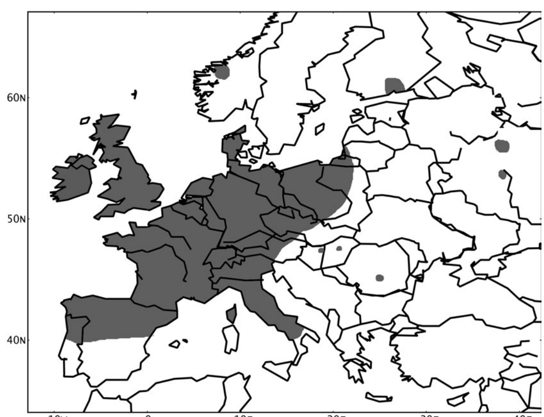

Fig. 6.40.3. Distribution of *Lumbricus castaneus* in Europe.

Distribution in Hungary (fig. 6.39.2) – **CT34** *No*. 611, 10922 Martonvásár; **EU32** *No*. 14380 Tokaj, Tisza-holtág.

6.41 *Lumbricus polyphemus* (Fitzinger, 1833)

(Figs. 6.41.1–4.)

Enterion polyphemum Fitzinger, 1833 Isis, p. 552
Lumbricus polyphemus: Michaelsen 1900a Das Tierreich, 10: 512.
***Lumbricus polyphemus*: Szüts 1909 Állattani Közlemények, 8: 142.**
Lumbricus polyphemus: Pop 1949 Anal. Acad. R.P.R., 1(9): 477.
***Lumbricus polyphemus*: Zicsi 1959a Acta zool. hung., 5: 434.**
***Lumbricus polyphemus*: Zicsi 1968a Opusc. Zool. Budapest, 8: 131.**
Lumbricus annulatus Perel, 1975 Zool. Zh., 54(7): 995.
Lumbricus polyphemus: Perel 1979 Range and regularities in the distr. earthworms, p. 213.
Lumbricus polyphemus: Zicsi 1982a Acta zool. hung., 28: 443.
Lumbricus polyphemus + *Lumbricus annulatus*: Easton 1983 Earthworm Ecology, p. 482.
***Lumbricus polyphemus*: Zicsi 1991 Opusc. Zool. Budapest, 24: 173.**
Lumbricus polyphemus: Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 473.
Lumbricus polyphemus: Qiu & Bouché 1998a Doc. pedozool. integrol, 4: 192.

Description – *External* – Body length 150–450 mm, diameter 6–10 mm, 90–182 segments. Colour dark red-violet, with dorsal stripes. Head tanylobous, dorsal pore absent. Glandular tumescence usually on 11, 17, 28, 29, 30 *ab*. Setae closely paired, setal arrangement after the clitellum: aa:ab:bc:cd:dd = 11.4:1.7:8.6:1:30. Clitellum extends on segments 37, 38, 39–43, 44, 45, 46, 47 saddle-shaped. Tubercles on 38, 39, 40–43, 44, 45 leaving free at least one anterior and two posterior segments of the clitellum. Male pore on 15, small, hardly visible. Nephropores irregularly alternate between *b* and above *d*. *Internal* – Dissepiments 6/7–8/9 slightly thickened. Crop in 15–16, gizzards in 17–18. Two pairs of testes in 10, 11, enclosed in oesophageal testis sacs. Three pairs of seminal vesicles in 9, 11, 12. Receptacula seminis two pairs in 9/10, 10/11 open in setal line *cd*. Calciferous glands in 10–12 with lateral pouches in 10. Excretory system holonephridial with J-shaped nephridial bladders, hook backwards. Typhlosole great, bifid, the cross-section of longitudinal muscle layer is of pinnate type (fig. 6.41.1, 6.41.2).

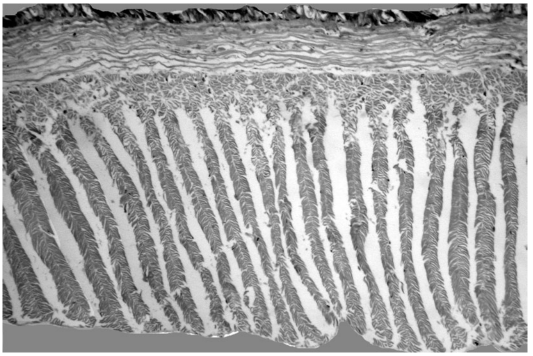

Fig. 6.41.1. Longitudinal musculature of *Lumbricus polyphemus*.

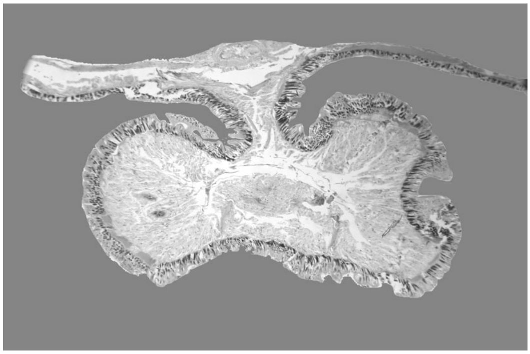

Fig. 6.41.2. Typhlosole of *Lumbricus polyphemus*.

Remarks – The variability of the clitellar organs in *L. polyphemus* is remarkable and quite unusual in the genus *Lumbricus*. The main underlying reason for this might be the backward shifted clitellum that prevents interbreeding with other species, therefore the position of the clitellum and tubercles are not under selection pressure.

Ecology – *L. polyphemus* belongs to the anecic group (Bouché 1977) of earthworms. Because of its large size this species has a profound effect on the decomposition of leaf litter and on the structure of soil. In an average this species alone, at a density of 4 m^{-2} would transport 8125 kg dry weight of soil/ha annually (Zicsi 1983a) and the litter consumption would reach 3323 kg dry weight/ha. As the annual litter production in a hornbeam-oak forest in Hungary is 2550–3300 kg/ha it means that *L. polyphemus* would consume alone the yearly litter amount. Taking into account that the activity of the earthworms in the driest months of summer is ceased, the consumption values corrected accordingly would between 2659–2753 kg dry weight/ha (Zicsi 1977).

The natural life cycle of this species is unknown. Laboratory data show a maximum of 9 years and 5 months longevity, a 120–180 days cocoon incubation period and 18–20 months maturity (Zicsi 1982b).

Distribution – *L. polyphemus* shows a typical Central-European arboreal distribution (fig. 6.41.3).

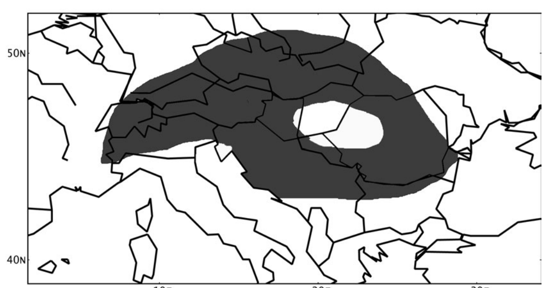

Fig. 6.41.3. Distribution of *Lumbricus polyphemus*.

Distribution in Hungary (fig. 6.41.4) – **BS70** No. 3199 Mecsek Mts. Jakab-hegy; **BS71** No. 3179 Mecsek Mts. Szuadó-völgy; **BS80** No. 818, 830, 835 Mecsek Mts.; No. 1703, 1704, 1713, 7165, 7166, 7167 Pécs; No. 1794, 4862 Mecsek Mts. Tubes; No. 823, 1799, 4733 Mecsek Mts. Misina; No. 3165 Mecsek Mts. Farkas-forrás; No. 3185 Mecsekszabolcs; No. 7181, 7318 Mecsek Mts. Lapis; **BS81** No. 1810, 3194 Mecsek Mts. Mély-völgy; No. 3192 Mecsek Mts. Melegmány; **BS91** No. 1809 Mecsek Mts. Síngödör-völgy; **CR49** No. 5014 Gara; **CS12** No. 14481 Bátaapáti; **CT16** No. 9036, 9037, 10258 Vértes Mts. Vinyabükki-völgy (**introduced**); **CT19** No. 10548 Pusztamarót; **CT38** No. 10337, 10342 Pilis Mts. Fekete-hegy; No. 11741 Kesztölc; No. 14460 Pilisszentlélek; **CT39** No. 3907, 3908, 3910, 3911 Pilis Mts. Szőke-forrás völgye; **CT45** No. 777 Törökbálint; **CT46** No. 1715, 3346 Buda hills; **CT46** No. 10420 Budapest, Normafa; **CT47** No. 7061, 7382 Budapest, Juliannamajor; **CT48** No. 4826 Pilis Mts. Prédikálószék; No. 7245, 7246 Pilis Mts. Bölcsőhegy; No. 9920, 9933 Pilis Mts. Malom-patak völgye; No. 9970 Pilis Mts. Sikáros; No. 9995 Pilis Mts. Apátkuti-völgy; No. 10011, 10016 Pilis Szakó-nyereg; No. 10230, 10365 Pilis Mts. Vörösdagonya; No. 14465, 10265 Pilis Kétbükkfa-nyereg; No. 10320 Pilis Mts. between Dobogókő and Pilisszentkereszti; No. 9978, 10347, 10355 Pilis Mts. Király-patak; No. 10369, 10375 Pilis Mts. Dobogókő; No. 10403 Szentlászló-völgy; **CT49** No. 9945, 9957, 10025 Pilis Mts. Lepence-patak; No. 9949 Pilis Mts. Apátkuti-völgy; No. 10296 Pilis Mts. Pilismarót; No. 10301, 10309, 11706, 11719 Pilismarót, Hoffman-kunyhó; No. 10396 Pilis Mts. Dömös; **CT56** No. 4153, 4156, 4157, 4158 Budapest, Farkas-völgy; **CT57** No. 703 Pomáz; No. 1546 Budakalász; **CT58** No. 1812 Pilis Mts. Dömörkapu; No. 7183, 7344, 7349, 7350, 7401, 7635 Pilis Mts. Lajosforrás; No. 4197 Pilis Mts. Vöröskő; No. 9969 Pilis Mts. Bükkös-patak; **CT59** No. 9938, 9939, 9985 Pilis Mts. Lukács-árok; No. 7103 Pilis Mts. Magyarkút; **CT69** No. 9029 Penc; No. 10476 Vác; **CT77** No. 5555 Gödöllő; CT87 No. 3060 Bag, Petőfi-forrás; **CU40** No. 12780 Börzsöny Mts. Királyrét; **CU50** No. 5229, 5655, 5656, 5657, 7238, 7334, 7337, 7343, 7346, 7347, 7398, 7595, 7596, 7694, 7695, 8029, 8035, 8043, 8056, 8059, 8065, 8070, 8084, 8085, 8443, 8444, 8445, 8446, 8447, 9621, 10290, 10456, 10462, 10468, 10485, 10490, 10576, 11767 Szendehely; **CU61** No. 5238 Rétság; **CU91** No. 8275, 8462, 8463, 8464, 8465, 8466, 8467, 8951, 9052, 9053 Alsótold; **DU20** No. 4246 Mátra Mts. Nagylapát-tető; No. 5623 Mátra Mts. Saskő; **DU66** No. 10561 Aggtelek; **DU72** No. 2252, 2255 Bükk Mts. Garadna-völgy; **WM89** No. 12054 Felsőszölnök; **XM08** No. 7604 Őriszentpéter; **XM09** No. 12266 Ispánk; **XM19** No. 12043 Vadása-tó; **XM25** No. 9132 Szemenyecsörnye; **XM28** No. 12268 Zalalövő; **XM35** No. 14313 Valkonya; **XM42** No. 5429 Őrtilos; **XM53** No. 9157, 9158 Somogybükkösd; **XM63** No. 9171 Somogycsicsó; **XM78** No. 2057, 7351, 7353, 7361 Keszthely; **XN14** No. 5589, 8132, 8171, 8172, 8173, 8174, 8195, 8196, 8197, 8198, 10638, 10646, 11565, 11590, 11698 Velem; **XN14** No. 8208, 8209, 8210, 8211 Cák; No. 9048, 10515 Kőszeg; **XN18** No. 892 Sopron; **XN20** No. 12257 Körmend; **XN25** No. 8183 Horvátzsidány; No. 11436 Zsira; **XN28** No. 14283 Soproni Mts. Szárhalmi-erdő; **YM02** No. 1714 Hencse; **YM03** No. 7150 Bőszénfa; **YN12** No. 4848 Márkó; **YN26** No. 5509 Bakonyszombathely.

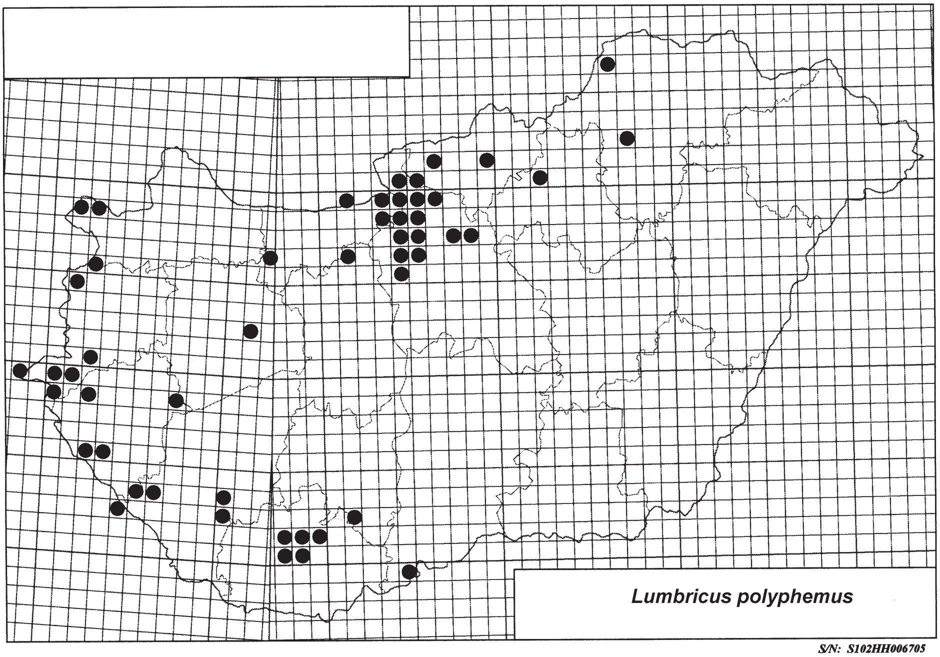

Fig. 6.41.4. Distribution of *Lumbricus polyphemus* in Hungary.

6.42 *Lumbricus rubellus* HOFFMEISTER 1843

(Figs. 3.3a, 6.42.1–3.)

Lumbricus rubellus HOFFMEISTER, 1843 Arch. Naturg., 9(1): 187.
Lumbricus campestris HUTTON, 1877 Trans. N .Z .Inst., 9: 351.
***Enterion rubellum* var *parvum* + *Enterion rubellum* var. *magnum*: ÖRLEY 1881a Math. és term. tud. közlemények, 16: 588–589.**
***Lumbricus rubellus*: ÖRLEY 1885 Értek. term. tud. köréből, 15: 29.**
Lumbricus rubellus curticaudatus FRIEND, 1892b J. Linn. Soc. London, 24: 312.
Lumbricus rubellus tatrensis NUSBAUM, 1895 Spraw. Korn. Fiz. Krakow, 30: 42.
Allolobophora herculeana BRETSCHER, 1899 Rev. suisse. Zool., 6: 419.
Lumbricus rubellus: MICHAELSEN 1900a Das Tierreich, 10: 509.
Allolobophora ribaucourti BRETSCHER, 1901 Rev. suisse. Zool. 9: 220.
Helodrilus (Allolobophora) relictus SOUTHERN, 1909 Proc. Roy. Irish. Acad., 27B: 169.
***Lumbricus rubellus*: SZÜTS 1909 Állattani Közlemények, 8: 141.**
Lumbricus rubellus tristani PICKFORD, 1932 Disc. Rept., 4: 289.
Lumbricus rubellus: **POP 1943a Ann. Hist.-Nat. Mus. Hung., 36: 20.**
***Lumbricus rubellus*: ZICSI 1959a Acta zool. hung., 5: 433.**
***Lumbricus rubellus*: ZICSI 1968a Opusc. Zool. Budapest, 8: 128.**
Lumbricus rubellus castaneoides BOUCHÉ, 1972 Inst. Nat. Rech. Agron., p. 371.
Lumbricus rubellus friendoides BOUCHÉ, 1972 Inst. Nat. Rech. Agron., p. 372.
Lumbricus rubellus: ZICSI 1982a Acta zool. hung., 28: 443.
Lumbricus rubellus: EASTON 1983 Earthworm Ecology, p. 482.

***Lumbricus rubellus*: Zicsi 1991 Opusc. Zool. Budapest, 24: 171.**
Lumbricus rubellus: Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 474.
Lumbricus rubellus rubellus + *Lumbricus rubellus castanoides* + *Lumbricus rubellus friendoides*: Qiu & Bouché 1998a Doc. pedozool. integrol., 4: 192.

Description – *External* – Body length 33–150 mm, diameter 4–6 mm, 95–145 segments. Colour dark red-violet. Head tanylobous, first dorsal pore between 5/6–7/8. Glandular tumescence usually on 10 *ab*. Setae closely paired, setal arrangement after the clitellum: aa:ab:bc:cd:dd = 13.3:1.3:7:1:23.3. Clitellum extends on segments 26, 27–32 saddle-shaped. Tubercles on 28–31. Male pore on 15, small, without glandular crescent (fig. 3.3a). Nephropores irregularly alternate between *b* and above *d*. *Internal* – Dissepiments 6/7–14/15 slightly thickened. Crop in 15–16, gizzards in 17–18. Two pairs of testes in 10, 11, enclosed in oesophageal testis sacs. Three pairs of seminal vesicles in 9, 11, 12. Receptacula seminis two pairs in 9/10, 10/11 open in setal line *cd*. Calciferous glands in 10–12 with lateral pouches in 10. Excretory system holonephridial with J-shaped nephridial bladders, hook backwards. Typhlosole lamelliform but multilobate, the cross-section of longitudinal muscle layer is of pinnate type (fig. 6.42.1, 6.42.2).

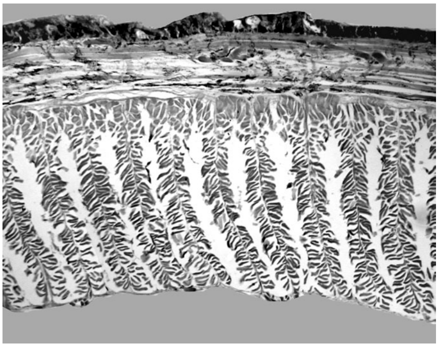

Fig. 6.42.1. Longitudinal musculature of *Lumbricus rubellus*.

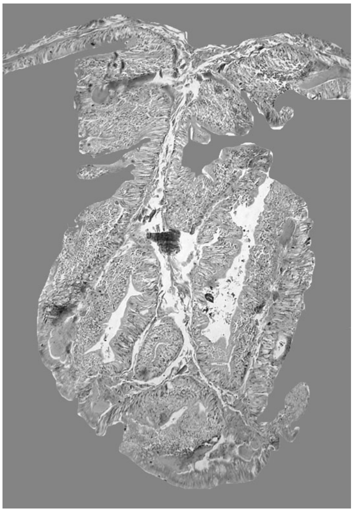

Fig. 6.42.2. Typhlosole of *Lumbricus rubellus*.

Ecology – *L. rubellus* prefers the moist habitats rich in organic material. In gardens it could frequently be found under compost or fallen litter. In forests it lives in the uppermost soil layer (A_o) and also under bark of decaying logs, and feeds on litter. Litter consumption in average is 5.62 g dry mass/year by an animal and the cast production is about 8.5 g dry mass/year. Defecation takes place mainly in the surface, only 19.5 % of the cast is put into the soil (Zicsi 1974a)

Distribution – This species is native in the Palearctis, but it has been introduced extratropically all over the world.

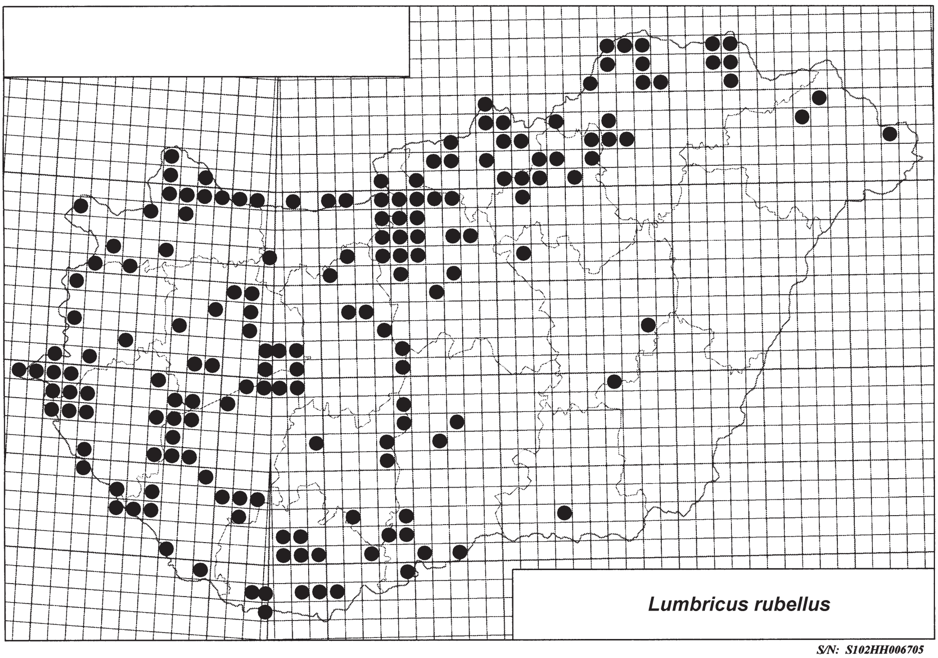

Fig. 6.42.3. Distribution of *Lumbricus rubellus* in Hungary.

Distribution in Hungary (fig. 6.42.3) – **BR88** *No.* 1962 Harkány; **BR98** *No.* 1037, 1042, 4797 Tenkes Mt.; *No.* 7312 Szársomlyó; **BS70** *No.* 1745 Magyarürög; **BS71** *No.* 3181, 3193 Mecsek Mts. Szuadó-völgy; *No.* 14318 Mecsek Mts. Orfü; **BS79** *No.* 11371, 11397 Balatonszéplak; **BS80** *No.* 815, 822, 850, 853, 1784, 1790, 1800, 1835, 3175, 3202, 4729 Mecsek Mts. Misina; *No.* 1770, 1968, 2122, 7161 Pécs; *No.* 1797, 1805, 1806, 4861 Mecsek Mts. Tubes; *No.* 3164 Mecsek Mts. Farkas-forrás; *No.* 3171 Mecsek Mts. Hidegkút-forrás; *No.* 3188 Mecsekszabolcs; *No.* 7179, 7317 Mecsek Mts. Lapis; **BS81** *No.* 3173 Mecsek Mts. Kantavári-forrás; *No.* 3189, 3197 Mecsek Mts. Mély-völgy; **BS89** *No.* 734 Balatonszabadi; **BS90** *No.* 1782 Vermeskozári; **BS96** *No.* 1768 Tamási; **BT71** *No.* 1914 Balatonfűzfő; **BT80** *No.* 746, 11393, 11407 Balatonaliga; **BT81** *No.* 1911 Balatonkenese; **BT89** *No.* 1116 Komárom; **CR08** *No.* 838 Villányi Mts. Fekete-hegy; **CR49** *No.* 5010, 5018 Gara; **CS12** *No.* 14457 Bátaapáti; **CS20** *No.* 1827 Bár; **CS31** *No.* 5002 Pörböly; **CS35** *No.* 1884 Gerjen; **CS36** *No.* 754, 761, 762 Paks; *No.* 1895

Dunaszentbenedek; **CS41** *No.* 5007 between Baja and Vaskút; **CS42** *No.* 1059 Érsekcsanád; **CS47** *No.* 1898 Harta; **CS48** *No.* 545, 548, 594, 603, 608, 619, 624, 634, 637, 653, 813, 2827, 3027 Dunaföldvár; **CS50** *No.* 5024 Bácsborsod; **CS66** *No.* 10593 Kiskőrős; **CS70** *No.* 5028 Bácsalmás; **CS77** *No.* 11551, 11619 Páhi; **CT05** *No.* 2035 Vérteskozma; *No.* 5497 Vértes Mts. Kőhányás; *No.* 7276 Vértes Mts. Fáni-völgy; **CT09** *No.* 1108, 1176 Süttő; *No.* 1110, 1180 Dunaalmás; *No.* 1837 Neszmély; **CT13** *No.* 1444 Pátka; **CT16** *No.* 4480, 7714, 8416, 8964, 9030, 9038, 9082, 10484, 10539 Vértes Mts. Vinnyabükki-völgy; **CT19** *No.* 1091, 1162, 1519 Nyergesújfalu; *No.* 1101, 1167 Lábatlan; **CT23** *No.* 3332 Velence; **CT32** *No.* 1555, 1977 Adony; **CT36** *No.* 1845 Buda hills; *No.* 4435 Páty; **CT37** *No.* 10032 Piliscsaba; **CT38** *No.* 5575, 10344 Pilis Mts, Fekete-hegy; *No.* 11720 Kesztölc; *No.* 14463 Pilisszentlélek; *No.* 14469 Pilis Mts. Kétbükkfa-nyereg; **CT39** *No.* 1159, 1923 Esztergom; *No.* 3913 Visegrádi Mts.; **CT40** *No.* 563 Dunaújváros; **CT41** *No.* 679 Kulcs; **CT45** *No.* 3256 Törökbálint; **CT46** *No.* 3345 Buda hills; *No.* 10421 Budapest, Normafa; **CT47** *No.* 7060 Budapest, Juliannamajor; *No.* 7365 Solymár; **CT48** *No.* 7281 Pilis Mts. Bölcső-hegy; *No.* 9924, 9932 Pilis Mts. Malompatak-völgy; *No.* 9972 Pilis Mts. Sikáros; *No.* 9998, 10018, 10384, 9956 Pilis Mts. Apátkuti-völgy; *No.* 10013 Pilis Mts. Szakó-nyereg; *No.* 10319, 10321, 10370, 10376 Pilis Mts. Dobogókő; *No.* 10348, 10356 Pilis Mts. Király-patak; *No.* 10404 Pilis Mts. Szentlászló-völgy; *No.* 10412, 10302 Pilis Mts. Hoffman-kunyhó; **CT49** *No.* 1072, 1076 Visegrád; *No.* 1080, 1145, 10397 Dömös; *No.* 1082, 1153, 11707 Pilismarót; *No.* 1087, 1135 Szob; **CT56** *No.* 720, 783 Csepel; *No.* 4164 Farkas-völgy; *No.* 14268 Budapest, Óbudai-sziget; **CT57** *No.* 704 Pomáz; *No.* 1541 Budakalász; *No.* 14265 Budapest, Palotai-sziget; **CT58** *No.* 1369, 1379, 1471, 1476, 1492, 1502, 11752 Szentendre; *No.* 1814 Pilis Mts. Dömörkapu; *No.* 7190, 7193, 7194, 7195, 7894 Pilis Mts. Lajosforrás; *No.* 4174, 4180, 9961 Pilis Mts. Bükkös-patak; *No.* 4562 Pilis Mts. Vöröskő; *No.* 7262, 7273, 7634 Pilis Mts. Lajosforrás; *No.* 9979 Pilis Mts. Királykúti-kunyhó; *No.* 10232 Pilis Mts. Király-völgy; **CT59** *No.* 1530, 1538 Dunabogdány; *No.* 7109 Magyarkút; *No.* 9988 Pilis Mts. Lukács-völgy; **CT64** *No.* 11560, 11712 Ócsa; **CT69** *No.* 8984, 9024 Penc; *No.* 10477 Vác; **CT75** *No.* 4954 Maglód; **CT77** *No.* 2810, 3069, 4505, 5185, 5560, 5883 Gödöllő; **CT79** *No.* 3207, 3212, 3226, 3231, 3245, 3265 Csővár; **CT87** *No.* 3059, 3078, 7198 Bag, Petőfi-forrás; *No.* 3116 Aszód; **CU30** *No.* 2072 Letkés; **CU50** *No.* 5236, 7115, 7124, 7331, 7340, 7599, 7698, 7991, 8027, 8033, 8050, 8068, 8077, 8081, 8095, 8423, 8437, 9001, 9047, 9065, 9622, 10294, 10460, 10464, 10473, 10575, 11768 Szendehely; **CU61** *No.* 5239 Rétság; **CU71** *No.* 8969 Csesztve; *No.* 8982 between Szente and Magyarnándor; *No.* 8990 Kétbodony; **CU72** *No.* 5277 Ipolyszög; **CU91** *No.* 8451, 8457, 8952, 8953 Alsótold; **CU93** *No.* 4812 Endrefalva; *No.* 5284 Nógrádszakál; **CU94** *No.* 5268 Litke; **DS32** *No.* 1762, 1767, 2004, 2006, 2039 Szeged; *No.* 1769 Nagyfa; *No.* 2000 Atka; **DS69** *No.* 5064 Szarvas; **DT16** *No.* 4976 Jászberény; **DT19** *No.* 844, 4242 Mátraháza; **DT82** *No.* 1035 Kisújszállás; **DU00** *No.* 4215, 4221 Mátrakeresztes; **DU02** *No.* 9090 Lucfalva; **DU03** *No.* 5256 Karancslapujtő; **DU10** *No.* 11612 Kékestető; **DU12** *No.* 5890 Mátraszele; **DU20** *No.* 4248 Mátra Mts. Nagylapát-tető; **DU21** *No.* 2796, 7214 Nádújfalu; **DU31** *No.* 8263 Pétervására; **DU33** *No.* 6951, 8976 Ivád; **DU40** *No.* 2909 Egerbakta; *No.* 7423 between Sirok and Egerbakta; **DU51** *No.* 4638, 4660, 8566, 8567, 9207 Bükk Mts. Szarvaskő; *No.* 8280, 8281, 9221 Felsőtárkány; **DU52** *No.* 789, 4669, 7593 Szilvásvárad; *No.* 9866 Bükk Mts. Leányka-völgy; *No.* 9871 Bükk Mts. Határhordó; *No.* 9880 Bükk Mts. Tóthfalusi-völgy; *No.* 9892

Bükk Mts. Gerenna-vár; *No.* 9911 Bükk Mts. Hármaskút; *No.* 10494 Bükk Mts. Bélkő; **DU55** *No.* 4492 Kelemér; **DU62** *No.* 2213, 2229, 2264 Bükk Mts. Ómassa; *No.* 2216, 2219, 2244 Bükk Mts. Teknős-völgy; *No.* 2231, 2977, 5446 Bükk Mts. Garadna-völgy; *No.* 4606, 4611, 4612, 4613, 4614, 4615 Bükk Mts. Bánkút; *No.* 4616 Bükk Belházi-víznyelő; *No.* 4644 Bükk Mts. Jávorkút; *No.* 7617 Répáshuta; *No.* 10332 Bükk Mts. Száraz-völgy; **DU63** *No.* 2888 Bükk Mts. Örvénykő; *No.* 4384 Bükk Mts. Buzgókő; **DU66** *No.* 531, 690, 710, 3945 Aggtelek; *No.* 4828, 4834, 4844 Aggtelek, Haragistya; *No.* 3034, 9073 Aggtelek, Vöröstó; **DU67** *No.* 793, 3312, 4685 Jósvafő; **DU72** *No.* 2166, 2168, 2176, 2177, 2184, 2188, 2190, 2196, 2198, 2202, 2203, 2212, 2240, 2248, 2249, 2254, 2262, 2993, 7226 Bükk Mts. Garadna-völgy; *No.* 3016 Bükk Mts. Felső-forrás; *No.* 7624 Bükkszentkereszt; **DU77** *No.* 560, 1569, 3285 Szin; *No.* 3123 Szinpetri; *No.* 3870 Szádvár; *No.* 4378 Alsóhegy; *No.* 5187, 5189, 5729 Meteor-barlang; *No.* 11748 Szelce-puszta; **DU85** *No.* 516, 2851, 5170 Szendrőlád; **DU86** *No.* 580, 3032, 3930, 3949 Szalonna; **DU87** *No.* 3964, 3991 Bódvaszilas; **DU95** *No.* 5000 Tomor; **EU26** *No.* 4226 Regéc; **EU27** *No.* 3351 Telkibánya; **EU35** *No.* 4268, 11655 Óhuta; *No.* 7576, 7591 Újhuta; **EU36** *No.* 4948, 7111, 11688 Zempléni Mts. Kőkapu; *No.* 5449, 11643, 11685 Kishuta; *No.* 5461, 11671 Nagyhuta; *No.* 5468, 7566, 11632 Nagybózsva; *No.* 10248 Telkibánya; *No.* 10254, 11637, 11649, 11678, 14325 Rostalló; *No.* 11628 Zemplén Mts. Senyő-völgy; **EU37** *No.* 4941, 5992 Zempléni Mts. Füzér; **EU73** *No.* 3607 Ajak; **EU84** *No.* 3507, 3581 Kisvárda; **FU22** *No.* 4878 Tiszacsécse; **WM89** *No.* 12053 Felsőszölnök; **WM99** *No.* 1766, 1856, 4704, 4807, 12046, 12064, 12085 Szakonyfalu; **XL99** *No.* 4762 Drávatamási; **XL99** *No.* 10505 Barcs; **XM07** *No.* 8505, 8517 Velemér; *No.* 8541 Gödörháza; **XM08** *No.* 8514 Őriszentpéter; *No.* 8546 between Bajánsenye and Dávidháza; *No.* 12018 between Őriszentpéter and Kondorfa; *No.* 12244 between Bajánsenye and Őriszentpéter; **XM09** *No.* 8535 Orfalu; *No.* 12068 Kondorfa; *No.* 12265 Ispánk; **XM17** *No.* 9147 Csesztreg; *No.* 11535, 11558 Kálócfa; *No.* 11576 Zalabaksa; **XM18** *No.* 8524 Csöde; *No.* 12027 Nagyrákos; **XM19** *No.* 12036 Viszák; *No.* 12239 Őrimagyarósd; **XM24** *No.* 4114, 4126, 4139, 4146, 9111 Murarátka; **XM25** *No.* 5439 Tormafölde; *No.* 5443 Kányavár; *No.* 9126 Szemenyecsörnye; *No.* 9136 Kerka-szentkirály; *No.* 9138 Dobri; **XM27** *No.* 5399, 5405, 5406 Nova; *No.* 5727 between Nagycenk and Kópháza; **XM28** *No.* 6429 Irsapuszta; *No.* 12269 Zalalövő; **XM42** *No.* 5420 Őrtilos; **XM43** *No.* 14272 Molnári; **XM52** *No.* 9176 Porrogszentpál; **XM62** *No.* 9162 Csurgónagymárton; **XM63** *No.* 9174 Somogycsicső; **XM65** *No.* 9010 Zalakaros; **XM67** *No.* 1925 Zala-folyó; **XM69** *No.* 2871 Vidornyaszőllös; **XM70** *No.* 4765 Heresznye; **XM75** *No.* 5417 Szőkedencs; **XM76** *No.* 5413 Hollád; **XM77** *No.* 10272, 11282, 11293, 11343, 11361 Balatonberény; **XM78** *No.* 1390, 1404 Balaton, Szt Mihály kápolna; *No.* 1406, 2091, 7360 Keszthely; *No.* 1432 Gyenesdiás; *No.* 4791 Petőhegy; **XM85** *No.* 2152 Cserfekvés; **XM87** *No.* 1876 Balatonfenyves; *No.* 2831 Bélatelep; *No.* 10076 Balatonmária-fürdő; *No.* 11308, 11335, 12380 Balatonfenyves; **XM88** *No.* 4532, 4539, 4543 Badacsonytördemic; *No.* 11228, 11264 Szigliget; **XM94** *No.* 3969 Nagybajom; **XN00** *No.* 8123 Vasszentmihály; **XN12** *No.* 8140 Pornóapáti; **XN14** *No.* 3129, 10518 Kőszeg; **XN14** *No.* 5584, 8133, 8134, 8166, 8189, 8190, 10631, 10645, 11546, 11566, 11585, 11589, 11701, 11780, 14321 Velem; **XN14** *No.* 8206 Cák; **XN18** *No.* 5704, 5706 Brennbergbánya; *No.* 5725 Sopron, Kecske-patak; *No.* 10491 Sopron; **XN20** *No.* 12249 Nádasd; *No.* 12258 Körmend; **XN25** *No.* 8180 Horvátzsidány; *No.* 11432 Zsira; **XN36** *No.* 858, 867, 901, 906, 1294, 1324, 1344 Sopronhorpács; *No.* 5693

Röjtökmuzsaj; **XN41** *No.* 5599 Kám; **XN45** *No.* 13054 Csáfordjánosfa; **XN58** *No.* 13089 Csorna; *No.* 14292 Csorna, Csíkos-éger; **XN66** *No.* 5604 between Páli and Répcelak; **XN69** *No.* 14280 Újrónafő, Öregerdő; **XN72** *No.* 1858 Somló; **XN78** *No.* 13059, 13101 Tárnokréti; **XN79** *No.* 2011 Novákpuszta; *No.* 2971, 2999 Magyarkimle; **XN80** *No.* 10193 Bakony Mts. Agártető; *No.* 10195 Felsőnyirád; **XN89** *No.* 2027 Lickópuszta; *No.* 2968 Zsejke; **XN90** *No.* 14333 Kapolcs; **XN93** *No.* 11756 Bakony Mts.; **XN99** *No.* 1266, 1316, 3013 Medve; **XP60** *No.* 2017 Lajta Mts.; *No.* 2021, 5613, 6002 Mosonmagyaróvár; *No.* 2960 Mosonmagyaróvár, Lajta-csatorna; **XP61** *No.* 1480, 1525, 1566, 1600, 1601, 1611, 1622, 3880, 3978, 6021 Rajka; **XP80** *No.* 1508 Dunaremete; **YL28** *No.* 4737 Csányoszró; **YL37** *No.* 4750 Vejti; **YL38** *No.* 4743 Vajszló; **YM03** *No.* 7152 Bőszénfa; **YM08** *No.* 659 1944 Balatonboglár; **YM12** *No.* 2913, 7293, 9190, 10582 Ropolypuszta; *No.* 2955 Simonfa; *No.* 7303 Zselickisfalud; **YM13** *No.* 2922 Zselice; *No.* 2933, 10447 Zselicszentpál; **YM19** *No.* 749 Tihany; *No.* 1065, 12374 Balatonföldvár; **YM23** *No.* 10455 Szentbalázs; **YM29** *No.* 12390, 12399 Balatonendréd; **YN04** *No.* 4674, 4808 Bakony Mts. Odvaskő; **YN09** *No.* 1257, 1307 Vének; **YN12** *No.* 4849 Márkó; **YN13** *No.* 4672 Bakony Mts. Köves-hegy; *No.* 14390 Pénzesgyőr; **YN14** *No.* 3382 Bakony Mts.; *No.* 5513 Csesznek; *No.* 5521 Bakonyszentkirály; *No.* 5528 Gézaháza; **YN19** *No.* 1128 Gönyü; **YN20** *No.* 11239 Palóznak; **YN21** *No.* 4204 between Veszprém and Csopak; **YN26** *No.* 5508 Bakonyszombathely.

6.43 *Lumbricus terrestris* Linneaus, 1758

(Figs. 6.43.1–2.)

Lumbricus terrestris (part.) Linneaus, 1758 Systema Naturae, 10: 647.
Enterion herculeum Savigny, 1826 Mem. Acad. Sci. Inst. Fr., 5: 180.
Lumbricus agricola Hoffmeister, 1842 Verm. Lumbric., p. 24.
Lumbricus infelix Kinberg, 1867 Öfv. Akad. Förh., 23: 98.
Lumbricus americanus Perrier, 1872 N. Arch. Mus. Paris, 8: 44.
***Lumbricus terrestris*: Örley 1885 Értek. term. tud. köréből, 15: 30.**
Lumbricus studeri Ribaucourt, 1896 Rev. suisse Zool., 4: 5.
Lumbricus terrestris: Michaelsen 1900a Das Tierreich, 10: 511.
***Lumbricus terrestris*: Szüts 1909 Állattani Közlemények, 8: 142.**
***Lumbricus herculeus*: Pop 1943a Ann. Hist.-Nat. Mus. Hung., 36: 19.**
***Lumbricus terrestris*: Zicsi 1959a Acta zool. hung., 5: 433.**
***Lumbricus terrestris*: Zicsi 1968a Opusc. Zool. Budapest, 8: 130.**
Lumbricus herculeus: Bouché 1972 Inst. Nat. Rech. Agron., p. 352.
Lumbricus terrestris Zicsi 1982a Acta zool. hung., 28: 443.
Lumbricus terrestris: Easton 1983 Earthworm Ecology, p. 482.
***Lumbricus terrestris*: Zicsi 1991 Opusc. Zool. Budapest, 24: 173.**
Lumbricus terrestris: Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 481.
Lumbricus terrestris terrestris: Qiu & Bouché 1998a Doc. pedozool. integrol., 4: 192.

Description – *External* – Body length 90–300 mm, diameter 6–8 mm, 110–180 segments. Colour dark red or violet dorsally, yellowish ventrally. Head tanylobous, first dorsal pore between 7/8, 8/9. Glandular tumescence usually on 25, 26, 27 *ab*. Setae closely paired, setal arrangement after the clitellum: aa:ab:bc:cd:dd = 6.6: 1.:5.4:1:18. Clitellum extends on segments 31, 32–37 saddle-shaped. Tubercles on 33–36 canoe-shaped bands. Male pore on 15, large, with glandular crescent protruding into the neighbouring segments. Nephropores irregularly alternate between *b* and above *d*. *Internal* – Dissepiments 6/7–9/10 slightly thickened. Crop in 15–16, gizzards in 17–18. Two pairs of testes in 10, 11, enclosed in oesophageal testis sacs. Three pairs of seminal vesicles in 9, 11, 12. Receptacula seminis two pairs in 9/10, 10/11 open in setal line *cd*. Calciferous glands in 10–12 with lateral pouches in 10. Excretory system holonephridial with J-shaped nephridial bladders, hook backwards. The longitudinal muscle layer is of pinnate type (fig. 6.43.1).

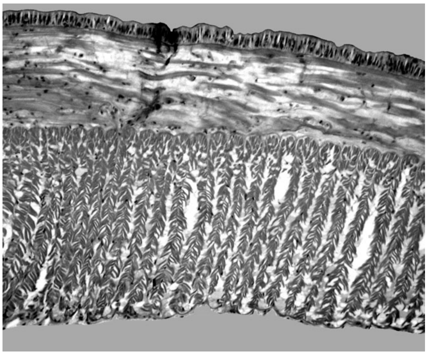

Fig. 6.43.1. Longitudinal musculature of *Lumbricus terrestris*.

Remarks – The name *Lumbricus terrestris* is frequently used even in scientific papers synonymously with "earthworm" and refers completely to unrelated species.

Ecology – *L. terrestris* is the only anecic species that became peregrine. Because of its large body-size it has remarkable effect in the biological breakdown of leaf litter where it occurs. According to the investigation of Zicsi (1982b) the litter consumption of an animal could reaches 69.9 g dry mass pro year and the cast production 131.9 g dry mass pro year. *L. terrestris* defecates mainly onto the surface, only 26.9 % of the total excrements are put into the soil.

In arable fields where dead plant materials are missing *L. terrestris* could become a pest by pulling the seedlings into the burrows (Prenner & Nagy 1966).

Distribution – This species is native in the Palearctis, but it has been introduced extra tropically all over the world. In Hungary it might be introduced, and shows a synanthropic distribution. Occasionally it is spread into nearby forests where other large-bodied species are missing.

Distribution in Hungary (fig. 6.43.2) – **BS89** *No.* 11322 Balatonszabadi; **CT23** *No.* 1636 Gárdony; **CT45** *No.* 7322 Törökbálint; *No.* 10201 Budaörs; *No.* 3236 Budapest, Kamaraerdő; **CT46** *No.* 1694 Budakeszi; *No.* 3239 Budapest, Ságvári-liget; *No.* 10422 Budapest, Normafa; **CT47** *No.* 7389, 7630, 7685, 7718, 7719, 11529 Solymár; **CT48** *No.* 12772 Pilisszentkereszt; **CT56** *No.* 1761 Budapest, Margitsziget; *No.* 6441 Buda; *No.* 12769 Budapest, Engels tér; **CU91** *No.* 8461 Alsótold; **DS32** *No.* 1710, 1711, 1712, 1719 Szeged; **DS73** *No.* 5033 Pitvaros; **DS82** *No.* 952, 1276 Mezőhegyes; **DT52** *No.* 5210

Törökszentmiklós; **DT94** *No.* 8400 Karcag; **DU10** *No.* 11611 Mátra Mts. Kékestető; **DU20** *No.* 4240 Mátra Mts. Koszorú-patak; **DU31** *No.* 7232 Pétervására; **DU52** *No.* 9906 Bükk Mts. Tóthfalusi-völgy; **DU54** *No.* 567 Putnok; **DU61** *No.* 5672 between Cserépfalu and Hollóstető; **ET46** *No.* 5314 Debrecen; **ET58** *No.* 1716 Bökönye; **EU32** *No.* 14381 Tokaj; **EU35** *No.* 11676 Újhuta; **EU45** *No.* 3468 Sárospatak; *No.* 3483 Sárospatak, Végardó; **XM08** *No.* 8513, 8516 Őriszentpéter; **XM18** *No.* 12023, 12072 Nagyrákos; **XM19** *No.* 12050 Vadása-tó; **XM25** *No.* 9134, 9135 Kerkaszentkirály; **XM28** *No.* 12267 Zalalövő; **XM42** *No.* 5430 Őrtilos; **XM48** *No.* 4695, 4696 Zalaegerszeg; **XM78** *No.* 1403 Balaton, Szt. Mihály kápolna; *No.* 1431 Gyenesdiás; *No.* 1728, 1741, 2064, 2093, 2127, 2137 Keszthely; **XM88** *No.* 14351, 14352 Szigliget; **XN14** *No.* 11581 Velem; **XN18** *No.* 878, 10492 Sopron; *No.* 5695 Brennbergbánya; **XN28** *No.* 14284 Sopron, Szárhalmi-erdő; **XN32** *No.* 4194 Tanakajd; **XN36** *No.* 859, 868, 885, 907, 1201, 1289, 1336, 1353 Sopronhorpács; **XN45** *No.* 13070 Csáfordjánosfa; **XN47** *No.* 863, 912 Petőháza; **XN57** *No.* 13066, 13106 Osli, Tölösi-erdő; **XN57** *No.* 14296 Öntésmajor; **XN58** *No.* 13103 Csorna; *No.* 13110 Osli, Patyi-ház; **XN68** *No.* 13064 Öntésmajor, Boldogasszonyi-erdő; **XN78** *No.* 13060, 13102 Tárnokréti; *No.* 14291 Maglóca; **XN79** *No.* 13081 Lébény; **XN98** *No.* 5612 Győr; **XP60** *No.* 6009 Levél; **XP80** *No.* 11713 Cikola-sziget; **YM06** *No.* 10570 Somogyvár; **YM08** *No.* 11399 Balatonboglár; **YM09** *No.* 11255, 14330 Balatonszepezd; **YM19** *No.* 3145, 3148 Tihany; **YM19** *No.* 11766 Sajkod; **YN00** *No.* 14337 Pula; **YN10** *No.* 14360, 14373 Koloska-patak; **YN13** *No.* 14389 Pénzesgyőr.

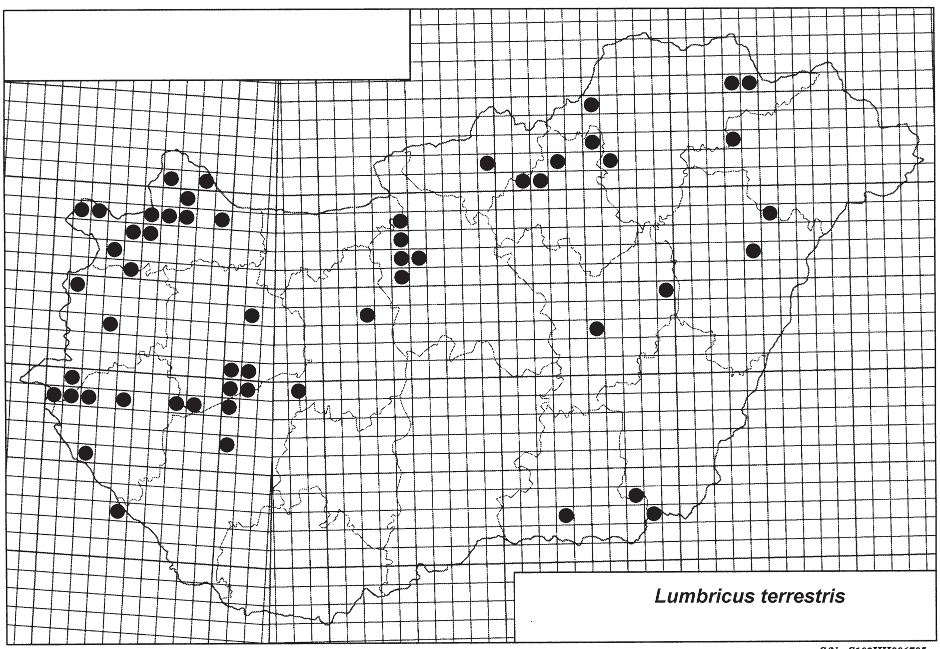

Fig. 6.43.2. Distribution of *Lumbricus terrestris* in Hungary.

Genus *Octolasion* Örley, 1885

Enterion (part.) Savigny, 1826 Mem Ac. Fr., 5: 179.
Alyattes Kinberg, 1867 Öfv. Akad. Förh., 23: 97. (non Thomson, 1864 Coleoptera)
Lumbricus (part.): Örley 1881a Math. és term. tud. közlemények, 16: 584.
Octolasion (part.): Örley 1885 Értek. term. tud. köréből, 15(18): 13.
Allolobophora (*Octolasion*) (part.): Rosa 1893a Mem. Acc. Torino, 43: 424.
Octolasia: Rosa 1896 Boll. Mus. Torino, 11: 3.
Octolasium (part.): Michaelsen 1900a Das Tierreich, 10: 504.
Octolasium (*Incolore*) Omodeo, 1952a Arch. zool. Ital., 37: 47.
Octolasium (*Octolasium*): Omodeo 1956 Arch. zool. Ital., 41: 175.
Octolasium: Bouché 1972 Inst. Nat. Rech. Agron., p. 253.
Octolasion: Gates 1975 Megadrilogica 2: 4.
Octolasium (part.): Perel 1976b Zool. Zh., 55: 834.
Octolasium (part.): Perel 1979 Range and regularities in the distr. earthworms, p. 202.
Octolasium: Zicsi 1982a Acta zool. hung., 28: 443.
Octolasion: Easton 1983 Earthworm Ecology, p. 482.
Octolasion: Sims 1984 Boll. Zool. Nom., 41(4): 254.
Octolasion: Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 463.
Octolasion (part.): Perel 1997 Earthworms of Russia, p. 60.
Octolasion: Zicsi & Csuzdi 1999 Rev. suisse Zool., 106: 999.
Octolasion: Qiu & Bouché 1998b Doc. pedozool. integrol., 3: 203.

Type species – *Lumbricus terrestris* var. *lacteus* Örley, 1881a (subsequent designation Int. Com. Zool. Nom. Op. 1403).

Diagnosis – *External*. Colour usually whitish, sometimes with dark pigmentation. Head epilobous, first dorsal pore around intersegmental groove 10/11. Setae in closer pairs laterally and more wider ventrally (*ab* >> *cd*). Male pore on 15 between setae *b–c*, great, usually intruding into the neighbouring segments. Nephropores aligned in setal line *b*. *Internal* – Two pairs of testes in 10 and 11, sometimes in perioesophageal testis sacs. Four pairs of seminal vesicles in 9–12. Spermathecae two pairs in 9/10, 10/11, open around setal lines *c*. Calciferous glands in 10–12, with lateral diverticula in 10. Last pair of lateral hearts in 11 and a pair of extraoesophageals in 12. Excretory system holonephridial. Nephridial bladders are of ocarina-shape (fig. 3.15D). Longitudinal musculature is of pinnate type.

Remarks – Michaelsen (1900) changed the Greek endings of the genus to Latin ones. According to the Zoological Nomenclature the original spelling is to be maintained, therefore the correct name is *Octolasion*. Omodeo (1952a) divided the genus into two subgenera; *Octolasium (Incolore)* and *Octolasium (Purpureum)* that subsequently changed to *Octolasium (Octolasium)* and *Octolasium (Octodrilus)* Omodeo, 1956. According to the rules of the Zoological Nomenclature the name *Octolasium (Incolore)* is a junior synonym of *Octolasion (Octolasion)*, but the name *Octolasion* (*Purpureum*) had precedence over *Octolasion (Octodrilus)* although earthworm taxonomists widely used the latter one. Sims (1984) applied this case to the Commission of Zoological Nomenclature, and the Commission using its plenary power suppressed the senior synonym *Octolasion (Purpureum)* in favour of *Octolasion (Octodrilus)* with opinion No. 1403.

Table 6.9. Distinguishing characters of the *Octolasion* species in Hungary.

Species	Clitellum	Tubercles	Vesicles	Spermathecae	Nephridial bladders	Musculature
O. cyaneum	29–34	30–33	9–12	9/10, 10/11 *c–d*	ocarina-shaped	pinnate
O. lacteum	30–35	31–34	9–12	9/10, 10/11 *c–d*	ocarina-shaped	pinnate
O. lacteovicinum	29–35	½ 29–½ 35	9–12	9/10, 10/11 *c–d*	ocarina-shaped	pinnate
O. montanum	32–36	½ 32–½ 36	9–12	9/10, 10/11 *c–d*	ocarina-shaped	pinnate

6.44 *Octolasion cyaneum* (Savigny, 1826)

(Figs. 6.44.1–4.)

Enterion cyaneum Savigny, 1826 Mem. Acad. Sci. Inst. Fr., 5: 181.
Lumbricus cyaneus: Dugés 1837 Ann. Sci. Nat., (2)8: 17.
Lumbricus stagnilis (part.) Hoffmeister, 1845 Regenwürmer, p. 35.
Lumbricus alyattes Kinberg, 1867 Öfv. Akad. Förh., 23(4): 99.
Allolobophora studiosa Michaelsen, 1890b Arch.Ver. Mecklenb., 44: 50.
Allolobophora (*Octolasion*) *cyanea*: Rosa 1893a Mem. Acc. Torino, 43: 424.
Octolasium cyaneum: Michaelsen 1900a Das Tierreich, 10: 506.
Helodrilus (Dendrobaena) kempi Stephenson, 1922 Rec. Ind. Mus., 24: 441.
***Octolasium cyaneum*: Zicsi 1968a Opusc. Zool. Budapest, 8: 141.**
Octolasium cyaneum var. armoricum Bouché, 1972 Inst. Nat. Rech. Agron., p. 260.
Octolasium cyaneum: Perel 1979 Range and regularities in the distr. earthworms, p. 204.
Octolasion cyaneum: Gates 1982 Megadrilogica, 4(1–2): 28.
Octolasium cyaneum: Zicsi 1982a Acta zool. hung., 28: 444.
Octolasion cyaneum: Easton 1983 Earthworm Ecology, p. 483.
Octolasion cyaneum: Fender 1985 Megadrilogica, 4(5): 125.
Octolasion cyaneum: Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 227.
Octolasion cyaneum: Reynolds 1995 Earthworm Ecology and Biogeography, p. 12.
Octolasdion cyaneum: Zicsi and Csuzdi 1999 Rev. suisse Zool., 106: 999.
Octolasion cyaneum cyaneum: Qiu & Bouché 1998a Doc. pedozool. integrol., 4: 192.

Description – *External* – Body length 65–140 mm, diameter 6–8 mm, 100–160 segments. Colour usually whitish, pigmentation lacking. Head epilobous, first dorsal pore around intersegmental groove 10/11. Glandular tumescence usually on 10, 18, 19–22 *ab* or *abcd.* Setae in closer pairs anteriorly and somewhat wider posteriorly; setal arrangement on segment 10: aa:ab:bc:cd:dd = 4.5:1.25:3:1:17.5 and after the clitellum: aa:ab:bc:cd:dd = 4:1.5:1.7:1:10. Clitellum extends on segments 29–34, saddle-shaped. Tubercles as white bands on 30–33. Male pore on 15 between setae *b–c*, great usually intruding into the neighbouring segments. Nephropores aligned in *b*. *Internal* – Dissepiments 6/7–8/9 slightly, 9/10–14/15 strongly thickened. Crop in 15–16, gizzards in 17–18. Two pairs of testes in 10, 11, and four pairs of seminal vesicles in 9–12. Spermathecae two pairs in 9/10, 10/11, open between setal lines c*–d*. Calciferous glands in 10–12, with lateral diverticula in 10. Last pair of lateral hearts in 11 and a pair of extraoesophageals in 12. Excretory system holonephridial. Nephridial bladders are ocarina-shaped. Typhlosole anchor-shaped, the cross-section of longitudinal muscle layer is of pinnate type (fig. 6.44.1, 6.44.2).

Remarks – This species is a widely distributed earthworm with different parthenogenetic morphs. Its occurrences are usually associated with human activity.

Ecology – *O. cyaneum* is an endogeic worm living in the mineral soil layer. It has no special preferences towards soil type and shows a wide range of *p*H tolerance (5.2–8.0) (Reynolds 1977).

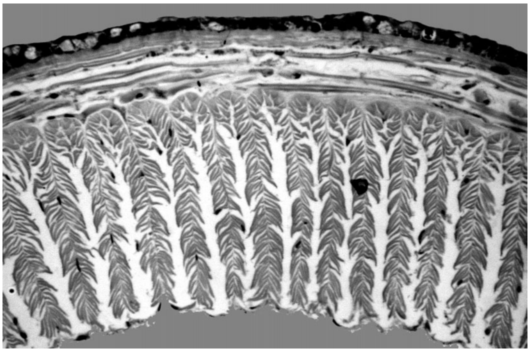

Fig. 6.44.1. Longitudinal musculature of *Octolasion cyaneum*.

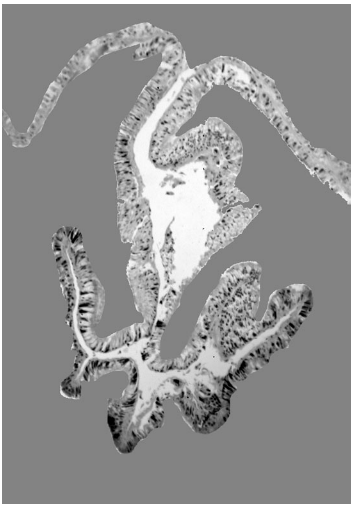

Fig. 6.44.2. Typhlosole of *Octolasion cyaneum*.

Distribution – *O. cyaneum* is native in the Palearctis and may have had an Atlantic distribution (fig. 6.44.3), but it has been widely introduced by man and its present range comprises Europe, North America, South America, India and Australasia (Gates 1972).

Distribution in Hungary (fig. 6.44.4) **– CT56** *No*. 3863 Budapest, Botanical Garden, *No*. 10896 Budapest, Margitsziget; **DS82** *No*. 1278 Mezőhegyes.

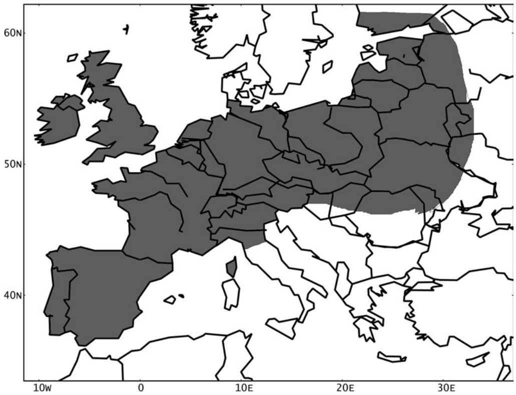

Fig. 6.44.3. Distribution of *Octolasion cyaneum* in Europe.

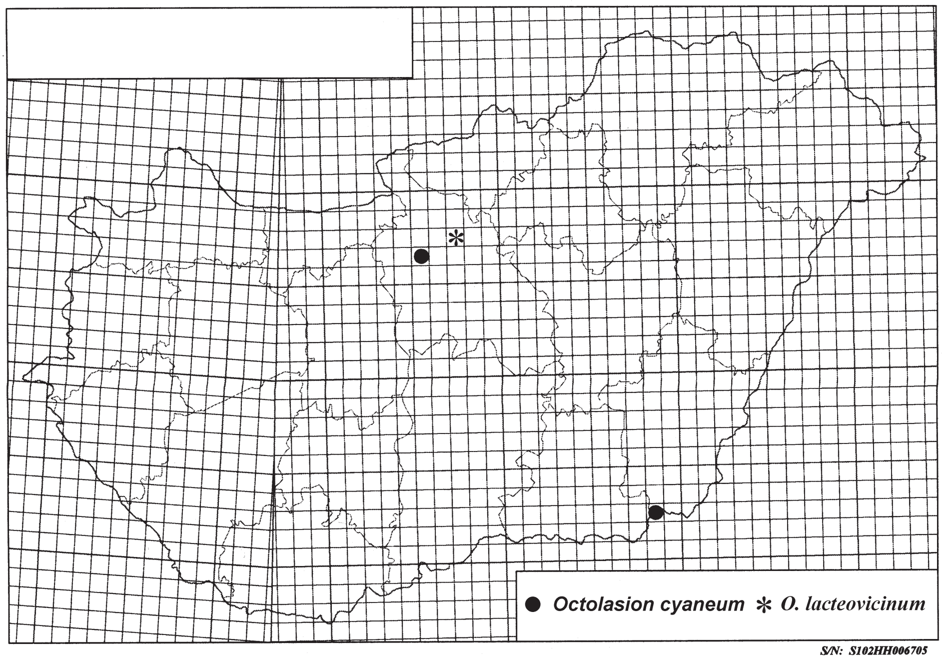

Fig. 6.44.4. Distribution of *Octolasion cyaneum* and *Octolasion lacteovicinum* in Hungary.

6.45 *Octolasion lacteovicinum* Zicsi, 1968

(Figs. 6.44.4., 6.45.1–2.)

Octolasium lacteovicinum **Zicsi, 1968b Acta zool. hung., 14: 236.**
Octolasium lacteovicinum**: Zicsi 1968a Opusc. Zool. Budapest, 8: 141.**
Octolasium lacteovicinum: Zicsi 1982a Acta zool. hung., 28: 444.
Octolasion lacteovicinum: Easton 1983 Earthworm Ecology, p. 483.
Octolasium lacteovicinum**: Zicsi 1991 Opusc. Zool. Budapest, 24: 180.**
Octolasion lacteovicinum: Qiu & Bouché 1998a Doc. pedozool. integrol., 4: 192.

Description – *External* – Body length 35–54 mm, diameter 3–4 mm, 68–129 segments. Colour usually grey. Head epilobous, first dorsal pore in 10/11. Glandular tumescence usually lacking. Setae in closer pairs anteriorly and somewhat wider posteriorly; setal arrangement on segment 10: aa:ab:bc:cd:dd = 8.3:1.3:2.7:1:13.3 and after the clitellum: aa:ab:bc:cd:dd = 2.3:1.1:1.3:1:4.3. Clitellum extends on segments 29–35, saddle-shaped. Tubercles as white bands on ½ 29–35. Male pore on 15 between setae *b–c*, great, intruding into the neighbouring segments. Nephropores aligned in setal line b. *Internal* – Dissepiments 6/7–8/9 slightly, 9/10–14/15 considerably thickened. Crop in 15–16, gizzards in 17–18. Two pairs of testes in 10, 11, and four pairs of seminal vesicles in 9–12. Spermathecae two pairs in 9/10, 10/11, open between setal lines *c–d*. Calciferous glands in 10–12, with lateral diverticula in 10. Last pair of lateral hearts in 11 and a pair of extraoesophageals in 12. Excretory system holonephridial. Nephridial bladders are of ocarina-shape. Typhlosole anchor-shaped, the cross-section of longitudinal muscle layer is of pinnate type (fig. 6.45.1, 6.45.2).

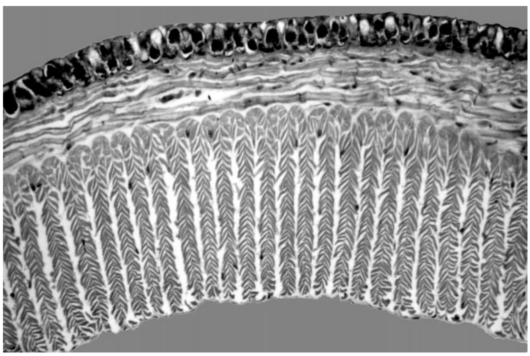

Fig. 6.45.1. Longitudinal musculature of *Octolasion lacteovicinum*.

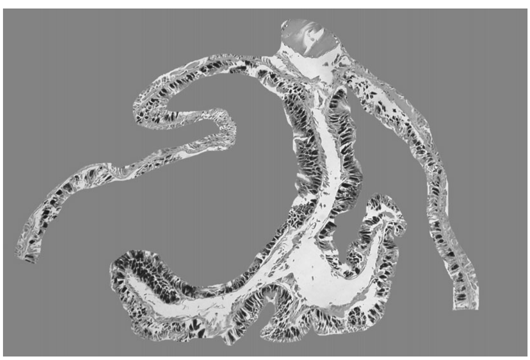

Fig. 6.45.2. Typhlosole of *Octolasion lacteovicinum*.

Remarks – This species is known only from the environs of Gödöllő, Hungary.

Ecology – *O. lacteovicinum* is an endogeic worm living in the mineral soil layer. It occurs on moist black sandy soil.

Distribution – Hungary.

Distribution in Hungary (fig. 6.44.4) – **CT77** *No.* 5184, 5553, 5649, 5650, 5652, 5880, 10895 Gödöllő.

6.46 *Octolasion lacteum* (Örley, 1881)

(Figs. 6.46.1–3.)

***Lumbricus terrestris* var. *lacteus* Örley, 1881a Math. és term. tud. közlemények, 16: 584.**
***Lumbricus terrestris* var. *rubidus* Örley, 1881a Math. és term. tud.közlemények, 16: 584.**
Allolobophora profuga Rosa, 1884 Lumbric. Piemonte, p. 47.
***Octolasion lacteum*: Örley 1885 Értek. term. tud. köréből, 15(18): 21.**
***Octolasion gracile* Örley 1885 Értek. term. tud. köréből, 15(18): 18.**
***Octolasion rubidum*: Örley 1885 Értek. term. tud. köréből, 15(18): 16.**
***Octolasion profugum*: Örley 1885 Értek. term. tud. köréből, 15(18): 17.**
Allolobophora cyanea profuga var. *sylvestris* Ribaucourt, 1896 Rev. suisse Zool, 4: 95.
Allolobophora (*Octolasion*) *profuga*: Michaelsen 1900c Abh. ver. Hamburg, 16: 16.
Octolasium lacteum: Michaelsen 1900a Das Tierreich, 10: 506.
***Octolasium lacteum*: Szüts 1909 Állattani Közlemények, 8: 139.**
***Octolasium lacteum*: Pop 1943a Ann. Hist.-Nat. Mus. Hung., 36: 17.**
Eophila himalayana Černosvitov, 1937 Rec. Ind. Mus., 39: 109.
***Octolasium lacteum*: Zicsi 1968a Opusc. Zool. Budapest, 8: 141.**
Octolasium lacteum lacteum: Bouché 1972 Inst. Nat. Rech. Agron., p. 253.
Octolasium lacteum gracile: Bouché 1972 Inst. Nat. Rech. Agron., p. 257.
Octolasion tyrtaeum (Savigny, 1826): Gates 1973 Bull. Tall Timbers Res. Station, 14: 35.
Octolasium lacteum: Perel 1979 Range and regularities in the distr. earthworms, p. 204.
Octolasion tyrtaeum: Gates 1982 Megadrilogica, 4(1–2): 28.
Octolasium lacteum: Zicsi 1982a Acta zool. hung., 28: 444.
Octolasion lacteum + *Octolasion tyrtaeum*: Easton 1983 Earthworm Ecology, p. 483.
Octolasium lacteum gigantheum Mršić, 1983 Biol. Vestn., 31(2): 56.
Octolasion tyrtaeum: Fender 1985 Megadrilogica 4(5): 126.
***Octolasium lacteum*: Zicsi 1991 Opusc. Zool. Budapest, 24: 180.**
Octolasion tyrtaeum (Örley, 1881) (laps.): Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 347.
Octolasion tyrtaeum: Reynolds 1995 Earthworm Ecology and Biogeography, p. 12.
Octolasion lacteum: Zicsi & Csuzdi 1999 Rev. Suisse Zool., 106: 1000.
Octolasion tyrtaeum tyrtaeum + *Octolasion tyrtaeum gracile*: Qiu & Bouché 1998a Doc. pedozool. integrol., 4: 192.

Description – *External* – Body length 30–180 mm, diameter 2–8 mm, 50–230 segments. Colour usually whitish, sometimes with dark pigmentation. Head epilobous, first dorsal pore around intersegmental groove 10/11. Glandular tumescence usually on 9–12, 20–22 *ab.* Setae in closer pairs anteriorly and somewhat wider posteriorly; setal arrangement on segment 11 aa:ab:bc:cd:dd = 5:1.3:3.3:1:12.5 and after the clitellum: aa:ab:bc:cd:dd = 2.6:1.3:1.5:1:6.3. Clitellum extends on segments 30–35, saddle-shaped. Tubercles as white bands on 31–34. Male pore on 15 between setae *b–c*, great, usually intruding into the neighbouring segments. Nephropores aligned in setal line *b*. *Internal* – Dissepiments

6/7–8/9 slightly, 9/10–14/15 strongly thickened. Crop in 15–16, gizzards in 17–18. Two pairs of testes in 10, 11, and four pairs of seminal vesicles in 9–12. Spermathecae two pairs in 9/10, 10/11, open between setal lines *c–d*. Calciferous glands in 10–12, with lateral diverticula in 10. Last pair of lateral hearts in 11 and a pair of extraoesophageals in 12. Excretory system holonephridial. Nephridial bladders are of ocarina-shape. Typhlosole anchor-shaped, the cross-section of longitudinal muscle layer is of pinnate type (fig. 6.46.1, 6.46.2).

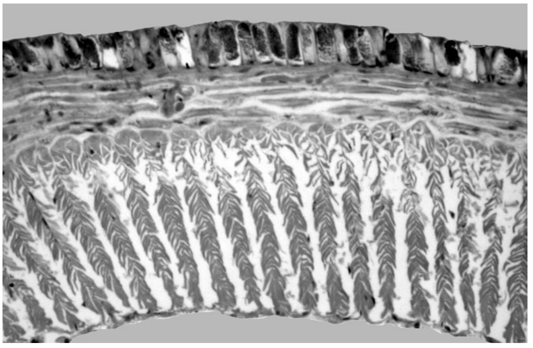

Fig. 6.46.1. Longitudinal musculature of *Octolasion lacteum*.

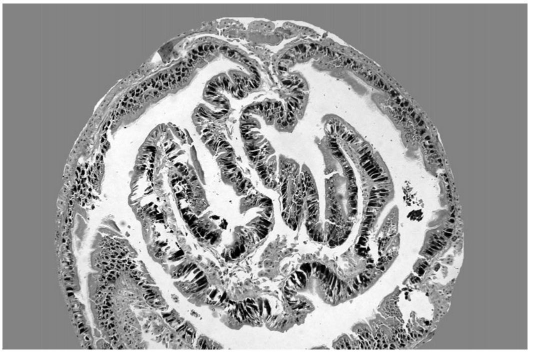

Fig. 6.46.2. Typhlosole of *Octolasion lacteum*.

Remarks–This species is a widely distributed earthworm with different parthenogenetic morphs. This might be the reason of the great size variability observed.

There is some nomenclatural confusion regarding this species. For seventy years all over the world the epithet *lacteum* was used, when GATES (1973) proposed its synonymy with *tyrtaeum*. This point of view slowly penetrated all the English based literature and by now it is widely used. Unfortunately the description of *Enterion tyrtaeum* SAVIGNY, 1826 inadequate to such an extent that even its generic affiliations could be questioned. This is the reason why MICHAELSEN (1900a) regarded *Enterion tyrtaeum* as *species incertae sedis* in the genus *Lumbricus*. We do believe that the stability of the nomenclature has precedence over a dubious synonymy, and the name *Octolasion lacteum* should be regarded as valid.

Ecology – *O. lacteum* is an endogeic worm living in the mineral soil layer. It has almost no preferences towards the soil type, but Zicsi (1968a) reported a higher frequency on calcareous soils. Defecation takes places mainly within the soil, and the daily cast production is about 113 mg dry matter pro 1g living weight (Zicsi 1974a)

Distribution – *O. lacteum* is native in the Palearctis but it has been widely introduced by man and its present range comprises Europe, North America, South America, Africa and Australia (Gates 1972).

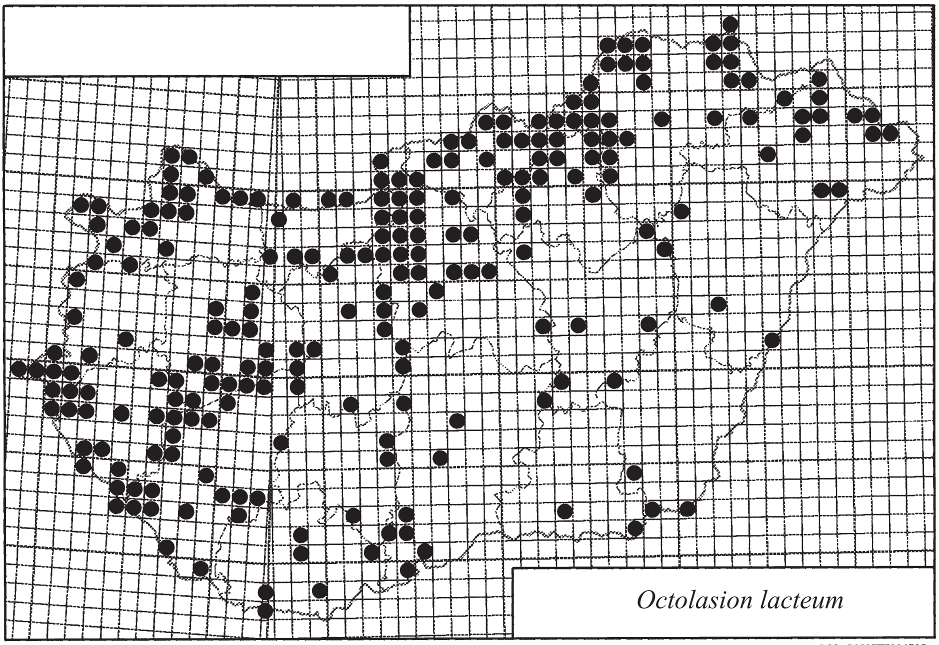

Fig. 6.46.3. Distribution of *Octolasion lacteum* in Hungary.

Distribution in Hungary (fig. 6.46.3) **– BR98** *No.* 3128 Villányi Mts.; *No.* 7315 Szársomlyó; **BS76** *No.* 12877 Somogydöröcske; **BS80** *No.* 816, 846 Mecsek Mts.; *No.* 827, 3176, 4730 Mecsek Mts. Misina; *No.* 3169 Mecsek Mts. Hidegkút-forrás; *No.* 4859 Mecsek Mts. Tubes; *No.* 1966, 4774, 7160 Pécs; **BS81** *No.* 3196 Mecsek Mts. Mély-völgy; **BS89** *No.* 11325 Balatonszabadi; **BT78** *No.* 1120 Ács; **BT80** *No.* 744, 11374, 11392 Balatonaliga; **BT81** *No.* 11288, 11317 Between Balatonkenese and Fűzfő; **BT86** *No.* 5518 Vérteskéthely; **BT89** *No.* 1115 Komárom; **BT91** *No.* 4206 Polgárdi; **BT96** *No.* 5501 Bokod; **CR49** *No.* 5009, 5015 Gara; **CS12** *No.* 14449, 14453 Bátaapáti; **CS18** *No.* 3044, 3052 Cece; **CS20** *No.* 1826 Bár; **CS31** *No.* 4847 Szeremle; *No.* 5004 Pörböly; **CS35** *No.* 1885 Gerjen; **CS36** *No.* 756, 764 Paks; **CS41** *No.* 4853 Máriakönnye; *No.* 5006 Between Baja and Vaskút; **CS42** *No.* 1054 Érsekcsanád; **CS48** *No.* 550, 617, 622, 639, 642, 803, 810, 1438, 1872, 2824, 3026, 4521 Dunaföldvár; **CS50** *No.* 5026 Bácsbokod; **CS65** *No.* 1641 Kecel; **CS77** *No.* 11621 Páhi; **CT05** *No.* 2032 Vérteskozma; *No.* 5490, 5495 Vértes Mts. Kőhányás; **CT09** *No.* 1105, 1175 Süttő; *No.* 1838 Neszmély; **CT13** *No.* 1441 Pátka; **CT16** *No.* 4478 Szár; *No.* 4474, 7121, 7710, 8415, 8959, 9035, 9040, 9086, 10260, 10483, 14369 Vértes Mts. Vinyabükki-völgy; **CT19** *No.* 1517 Nyergesújfalu; *No.* 10545 Pusztamarót; **CT26** *No.* 5480 Bicske; **CT32** *No.* 1553, 1985 Adony; **CT33** *No.* 2876 Baracska; **CT34** *No.* 615 Martonvásár; **CT36** *No.* 3338 Budajenő; *No.* 4412 Between Zsámbék and Budakeszi; *No.* 4419 Páty; **CT37** *No.* 4401 Perbál; *No.* 10037 Piliscsaba; **CT38** *No.* 10220, 10338, 10346 Pilis Mts. Fekete-hegy; *No.* 14462 Pilisszentlélek; *No.* 14468 Pilis Mts. Kétbükkfa-nyereg; **CT39** *No.* 1155 Pilismarót; *No.* 3912 between Esztergom and Visegrád; **CT40** *No.* 566 Dunaújváros; **CT41** *No.* 681 Kulcs; **CT45** *No.* 4441, 4485 Budapest; *No.* 2940 Budapest, Sasad; *No.* 7320 Törökbálint; **CT46** *No.* 4159 Budapest, Farkas-völgy; *No.* 6443 Budapest, Buda; *No.* 1846 Budapest, Hársbokor-hegy; *No.* 2269 Budakeszi; *No.* 3339, 3344 Budapest, Ságvári-liget; *No.* 10419 Budapest, Normafa; *No.* 14269 Budapest, Virányos; **CT47** *No.* 7059 Juliannamajor; *No.* 7248, 7251, 7259, 7362, 7390, 7632, 7633, 7636, 11530 Solymár; **CT48** *No.* 4189 Pilis Mts. Bükki-puszta; *No.* 7283 Pilis Mts. Bölcső-hegy; *No.* 9921, 9922 Pilis Mts. Hoffmann-kunyhó; *No.* 9930, 9934 Pilis Mts. Szőke-forrás völgye; *No.* 9942 Pilis Mts. Rám-szakadék; *No.* 9977 Pilis Mts. Sikáros; *No.* 10003, 10004, 10019 Pilis Mts. Apátkuti-völgy; *No.* 10015 Pilis Mts. Szakó-nyereg; *No.* 10227 Pilis Mts. Vörösdagonya; *No.* 10325, 10372, 10380 Pilis Mts. Dobogókő; *No.* 10353, 10357 Pilis Mts. Király-patak; *No.* 10406 Pilis Mts. Szentlászló-völgy; *No.* 12771 Pilisszentkereszt; **CT49** *No.* 1085 Szob; *No.* 1081, 1152, 10304, 10310, 10318, 11732, 11743, 10297 Pilismarót; *No.* 9947, 9959, 10031 Pilis Mts. Lepence-patak; **CT53** *No.* 10327 Bugyi; **CT55** *No.* 724, 731 Csepel; **CT56** *No.* 3867 Budapest, Botanical Garden; *No.* 1467 Budapest, Margitsziget; **CT57** *No.* 701 Pomáz; *No.* 14266 Budapest, Palotai-sziget; **CT58** *No.* 1368, 1377 Szentendrei-sziget *No.* 11751 Szentendre; *No.* 2817 Alsógöd; *No.* 3038 Leányfalu; *No.* 7192, 7196, 7266, 7274, 7893 Pilis Mts. Lajosforrás; *No.* 4172, 4186, 9964, 9967 Pilis Mts. Bükkös-patak; *No.* 4199 Pilis Mts. Vöröskő; *No.* 9983 Pilis Mts.Királykuti-kunyhó; **CT59** *No.* 1535 Dunabogdány; *No.* 7106, 8117 Magyarkút; *No.* 9990 Pilis Mts. Lukács-árok; **CT64** *No.* 11710, 11777 Ócsa; *No.* 10478 Vác; **CT75** *No.* 4958 Maglód; **CT77** *No.* 2808, 4491, 4506, 5552, 5556, 5651 Gödöllő; **CT79** *No.* 3218, 3225, 3233, 3244, 3271 Csővár; **CT85** *No.* 4964 Mende; **CT87** *No.* 2802, 3058, 7204 Bag, Petőfi-forrás; **CT95** *No.* 4968 Tápiószecső; **CU30** *No.* 2069, 2080, 2084, 9184 Letkés; **CU31** *No.* 4591 Börzsöny Mts. Csóványos; **CU40** *No.* 4597 Börzsöny Mts. Sajkút-domb; **CU50** *No.* 5232, 7117, 7128, 7241, 7335, 7338, 7600, 7701, 7702, 7703, 7704, 7705, 7996, 8025, 8026, 8034, 8039, 8046, 8054, 8062, 8064, 8072, 8078, 8082, 8087, 8091, 8096, 8212, 8213, 8418, 8430, 843, 8432, 8433, 8434, 8999, 9000, 9043, 9071, 9623, 9624, 10295 10459, 10465, 10470, 10489, 10578, 11771 Szendehely; **CU61** *No.* 5240 Rétság; *No.* 5247 Érsekvadkert; **CU71** *No.* 8968 Csesztve; *No.* 8983 between Szente and Magyarnándor; *No.* 8991 Kétbodony; **CU72** *No.* 5274 Ipolyszög; **CU82** *No.* 5261 Őrhalom; **CU91** *No.* 8448, 8449, 8458, 8949, 9054, 9055 Alsótold; **CU93** *No.* 4814 Ludányhalászi; *No.* 5283 Nógrádszakál; **DS28** *No.* 11571 Tiszaalpár; **DS32** *No.* 1735 Szeged Algyő; *No.* 1755 Szeged; *No.* 1765 Nagyfa; **DS39** *No.* 3616 Kécske; **DS69** *No.* 5066 Szarvas; **DS71** *No.* 978, 5626 Kövegy; **DS74** *No.* 5047 Tótkomlós; **DS82** *No.* 930, 946, 958, 968, 972, 985, 991, 1185, 1212, 1215, 1221, 1227, 1238, 1277, 5638, 5643, 9233 Mezőhegyes; **DT16** *No.* 4973 Jászberény; **DT18** *No.* 1764 Gyöngyöshalász; **DT19** *No.* 5546 Mátraháza; **DT22** *No.* 5220 Abony; **DT42** *No.* 5226 Tiszapüspöki; **DT59** *No.* 2986 Kerecsend; **DT82** *No.* 1852 Kisújszállás; **DT87** *No.* 2985 Tiszafüred; **DT96** *No.* 8396 Óhat; **DU00** *No.* 4218, 7236 Mátrakeresztes; **DU02** *No.* 5291

Kishartyán; *No.* 9089 Lucfalvai elágazás; **DU03** *No.* 5255 Karancslapujtő; **DU10** *No.* 2271 Mátraszentistván; *No.* 7221 Galyatető; *No.* 7237 Mátraszentimre; *No.* 11614 Kékestető; **DU12** *No.* 5893 Mátraszele; **DU20** *No.* 4237 Mátra Mts. Koszorú-patak; *No.* 4254 Mátra Mts. Köszörűs-patak; *No.* 5622 Mátra Mts. Saskő; **DU21** *No.* 3284, 7213, 7545, 10416 Nádújfalu; **DU22** *No.* 5896, 5900, 5906 Bárna; **DU23** *No.* 5909 Cered; **DU31** *No.* 8267, 8268, 8269, 8270 Pétervására; **DU32** *No.* 2890, 7377 Tarnalelesz; *No.* 5663 Szentdomonkos; **DU33** *No.* 5534, 6937, 6950, 8978 Ivád; **DU40** *No.* 7408, 7416, 7420 between Sirok and Egerbakta; **DU43** *No.* 7386 Borsodnádasd; **DU44** *No.* 5530 Ózd; **DU51** *No.* 4427, 5174, 8278, 9225 Felsőtárkány; *No.* 4639, 4663, 8564, 9205 Szarvaskő; **DU52** *No.* 787, 4666 Szilvásvárad; *No.* 5620 Bükk Mts. Bélkő; *No.* 9862, 9865, 9870 Bükk Mts. Leányka-völgy; *No.* 9874, 9877 Bükk Mts. Határhordó; *No.* 9883, 9885, 9897, 9902, 9910, 9919 Bükk Mts. Tóthfalusi-völgy; *No.* 9915 Bükk Mts. Hármaskút; **DU53** *No.* 7627 Nekézseny; **DU54** *No.* 4831 Putnok; **DU55** *No.* 4493, 4837, 5539 Kelemér; **DU60** *No.* 7650, 7651, 8099, 8100, 8286 Síkfőkút; *No.* 8016 Istvánkút; **DU61** *No.* 5670, 5673, 5679, 5684 Cserépfalu; **DU62** *No.* 2208, 2218 Bükk Mts. Teknős-völgy; *No.* 2233, 2973, 5447 Bükk Mts. Garadna-völgy; *No.* 4604 Bükk Mts. Bánkút; *No.* 4619 Bükk Mts. Belházi-víznyelő; *No.* 10329 Bükk Mts. Jávorkút; *No.* 10333 Bükk Mts. Száraz-völgy; **DU63** *No.* 4382 Bükk Mts. Buzgókő; *No.* 4390, 4394 Bükk Mts. Örvénykő; **DU66** *No.* 501, 523, 532, 538, 667, 684, 688, 695, 700, 712, 1575, 1587, 2135, 2897, 3941, 4444, 4454, 9074, 5659 Aggtelek; *No.* 4827, 4833, 4843 Aggtelek, Haragistya; **DU67** *No.* 794, 1941, 3100, 3277, 3297, 3305, 3311, 3318, 3323, 5543, 5911, 7211 Jósvafő; **DU72** *No.* 2181, 2187, 2195, 2205, 2243, 2253, 2261, 7229 Bükk Mts. Tógazdaság; *No.* 2992, 3125 Bükk Mts. Csókás-forrás; *No.* 3014 Bükk Mts. Felső-forrás; *No.* 3365, 4169 Lillafüred; *No.* 7623 Bükkszentkereszt; **DU76** *No.* 2906 Szendrő; **DU77** *No.* 511, 3118 Szinpetri; *No.* 558, 3291 Szin; *No.* 3869 Szádvár; *No.* 3923, 3953 Acskó; *No.* 4465 Alsó-hegy; *No.* 5186, 5188 Meteor-barlang; **DU85** *No.* 522 Szendrőlád; **DU86** *No.* 576, 582, 1030, 1726, 1934, 3031, 3929, 3948, 4003 Szalonna; **DU87** *No.* 3928, 3952, 3962, 3989 Bódvaszilas; **DU93** *No.* 4992 Szikszó; **ES02** *No.* 983 Battonya; **ET08** *No.* 7081 Újszentmargita; **ET23** *No.* 9058 Sáp; **ET51** *No.* 5392 Ártánd; **ET89** *No.* 3356 Nyírbátor; **ET99** *No.* 11158, 11163, 11164, 11175, 11182, 11189, 11196 Bátorliget; *No.* 11169, 11192, 11200 Bátorliget Fényi-erdő; **EU23** *No.* 5731 Zemplén Mts. Várhegy-forrás; **EU26** *No.* 4223, 4228, 4229, 7570, 11634, 11651 Regéc; **EU27** *No.* 3350, 5476 Telkibánya; **EU35** *No.* 2767 Zemplén Mts. Hercegkút; *No.* 2768 Zemplén Mts. Cifrakút; *No.* 4265, 11667 Óhuta; *No.* 7574, 11675 Újhuta; **EU36** *No.* 2988, 10241, 10243, 10252, 11627, 11647, 11662, 11679 Rostalló; *No.* 4950, 11690 Zemplén Mts. Kőkapu; *No.* 5458, 11641, 11687 Kishuta; *No.* 5469, 7561, 7562, 7564, 7565, 7573 Nagybózsva; **EU37** *No.* 5991, 7555, 11693 Füzér; **EU38** *No.* 7580 Zemplén Mts. Nagymilic; **EU43** *No.* 2106 Körtvélyes; **EU45** *No.* 3475 Sárospatak, Végardó; **EU51** *No.* 8973, 8996 Nyíregyháza; **EU64** *No.* 3555 Dombrád; **EU72** *No.* 3527, 3532, 3612 Berkesz; *No.* 3544, 3545, 3546 Nyírtass; **EU73** *No.* 3518 Rétközberencs; *No.* 3536, 3589, 3604, 3651, 3670 Ajak; *No.* 3622, 3631 Pátroha; **EU83** *No.* 3562, 3642 Szabolcsbáka; *No.* 3636 Lövőpetri; **EU84** *No.* 3506, 3579, 3599, 3620 Kisvárda; *No.* 3513, 3634 Jéke; **EU85** *No.* 3565 Tiszabezdéd; **FU03** *No.* 14375 Jánd; **FU12** *No.* 4103 Kömörő; **FU13** *No.* 4094 Beregsurány; **FU22** *No.* 4047, 4874 Tiszacsécse; **WM89** *No.* 12056 Felsőszölnök; **WM99** *No.* 1857, 4705, 12048, 12063, 12088 Szakonyfalu; **XL99** *No.* 4763 Drávatamási; **XM07** *No.* 8504, 8519 Velemér; *No.* 8539 Gödörháza; **XM08** *No.* 8510, 8511, 12015, 12020, 12034

Őriszentpéter; *No.* 8545 between Bajánsenye and Dávidháza; *No.* 12245 between Bajánsenye and Őriszentpéter; **XM09** *No.* 8537, 12029 Orfalu; *No.* 12066, 12253 Kondorfa; *No.* 12236, 12255 Ispánk; **XM17** *No.* 9148 Csesztreg; *No.* 11536, 11557 Kálócfa; *No.* 11575, 11608 Zalabaksa; **XM18** *No.* 8526 Csöde; *No.* 12025, 12071 Nagyrákos; *No.* 12080 between Nagyrákos and Őriszentpéter; **XM19** *No.* 12035 Viszák; *No.* 12042, 12051 Vadása-tó; **XM24** *No.* 4115, 4128, 4138, 9119, 14314 Murarátka; *No.* 14306 Muraszemenye; **XM25** *No.* 5438 Tormafölde; *No.* 5445, 14776 Kányavár; *No.* 9131 Szemenyecsörnye; *No.* 9137 Kerkaszentkirály; *No.* 9142 Dobri; **XM27** *No.* 5400, 6437 Nova; **XM28** *No.* 6438 Zalalövő; **XM35** *No.* 14472 Lasztonya; *No.* 14478 Lispeszentadorján; **XM42** *No.* 5422 Őrtilos; **XM43** *No.* 14273 Molnári; **XM44** *No.* 14311 Semjénháza; **XM47** *No.* 8549 Bak; **XM52** *No.* 9177 Porrogszentpál; **XM53** *No.* 9154 Surd; *No.* 9159 Somogybükkösd; **XM62** *No.* 9164 Csurgónagymárton; **XM63** *No.* 9170 Somogycsicsó; **XM65** *No.* 9009 Zalakaros; **XM67** *No.* 1927 Zala-folyó; *No.* 11258, 11362 Fenékpuszta; **XM69** *No.* 2869 Vidornyaszöllős; **XM70** *No.* 4769 Heresznye; **XM75** *No.* 5418 Szőkedencs; **XM76** *No.* 5411 Hollád; **XM77** *No.* 10285, 11233, 11271, 11275, 11280, 11292, 11311, 11314, 11344, 11353, 11359, 12749, 12754 Balatonberény; **XM78** *No.* 1387, 1405, 1419 Balaton, Szt. Mihály kápolna; *No.* 1427 Gyenesdiás; *No.* 1729, 1733, 1742, 2067, 2090, 2131, 2138, 4714, 7354, 7358, 11253, 11329 Keszthely; **XM79** *No.* 1842 Zalaszántó; **XM82** *No.* 4749 Kivadár; **XM87** *No.* 1877, 2146 Balatonfenyves; *No.* 2834, 4651 Bélatelep; *No.* 10072, 11305 Balatonmária; *No.* 11333, 12383 Balatonfenyves; **XM88** *No.* 4514, 4527, 4546 Badacsonytördemic; *No.* 11234, 11247, 11263, 11346, 14345, 14387 Szigliget; **XM94** *No.* 4469 between Nagybajom and Böhönye; **XM97** *No.* 4470 Fonyód; **XM99** *No.* 4568 Tóti-hegy; *No.* 14297, 14365 Hegyesd; **XN00** *No.* 8124 Vasszentmihály; **XN12** *No.* 8138 Pornóapáti; **XN14** *No.* 8207 Cák; *No.* 5590, 8165, 8191, 10632, 10633, 10649, 11545, 11563, 11582, 11583, 11587, 11700, 11782 Velem; **XN18** *No.* 875, 891, 5710, 5716 Sopron; *No.* 895 Sopron, Deák-forrás; *No.* 5722 Sopron, Kecske-forrás; *No.* 5726 between Balf and Sopron; *No.* 5700 Brennbergbánya; *No.* 5711 Tómalom; **XN20** *No.* 8127, 12261 Körmend; *No.* 12248 Nádasd; **XN25** *No.* 8181 Horvátzsidány; *No.* 11429, 11435 Zsira; *No.* 11441 Répcevis; **XN27** *No.* 5728 between Nagycenk and Kópháza; **XN28** *No.* 13092, 13115, 14286 Fertőrákos; **XN36** *No.* 869, 888, 899, 1204, 1290, 1292, 1325, 1330, 1335, 1342, 1347, 1356 Sopronhorpács; *No.* 872 Völcsej; *No.* 5694 Röjtökmuzsaj; *No.* 5691 between Röjtökmuzsaj and Csapod; **XN41** *No.* 5600 Kám; **XN45** *No.* 13056, 13072 Csáfordjánosfa; **XN47** *No.* 917 Petőháza; **XN57** *No.* 13068, 13109, 14305 Osli, Tölösi-erdő; **XN58** *No.* 13111 Osli, Patyi-ház; *No.* 13090, 13104 Csorna, Királytói-erdészlak; *No.* 13076, 14295 Csorna, Csíkos-éger; **XN66** *No.* 5605 between Pál and Répcelak; **XN68** *No.* 13065 Öntésmajor, Boldogasszonyi-erdő; **XN69** *No.* 13077 Újrónafő; **XN78** *No.* 13063, 13088, 13098 Tárnokréti; *No.* 14289 Lébényi nyíres; **XN79** *No.* 2012 Novákpuszta; *No.* 13082 Lébény; **XN80** *No.* 10192 Bakony Mts. Agártető; *No.* 10199 Felsőnyirád; **XN90** *No.* 14335, 14336 Kapolcs; **XN92** *No.* 5601 Bakonygyepes; **XN93** *No.* 11757 Bakony Mts.; **XN99** *No.* 1263 Medve; **XP60** *No.* 5614, 6001 Mosonmagyaróvár; *No.* 6006 Levél; *No.* 6013 Mosonszolnok; **XP61** *No.* 1524, 1563, 1598, 1599, 1612, 1623, 3883, 6023, 10898 Rajka; **XP71** *No.* 1504 Dunasziget; **XP80** *No.* 3937 Derenk; **YL37** *No.* 4757 Vejti; **YL38** *No.* 4745 Vajszló; **YM03** *No.* 11544, 11601 Bárdibükk; *No.* 7157, 10439 Bőszénfa; *No.* 7176, 7300 Dennapuszta; **YM08** *No.* 666, 715, 1951, 2846 Balatonboglár; **YM09** *No.* 14329 Balatonszepezd; **YM12** *No.* 2915, 7173, 7294, 9188, 9218, 10581 Ropolyapuszta; *No.* 2953 Simonfa; *No.* 7304 Zselickisfalud; **YM13** *No.* 2920, 2926, 10431 Zselicei-erdő; *No.* 10445 Zselicszentpál; **YM19** *No.* 750 Tihany; *No.* 12372, 12375, 12377, 12402, 12404, 12409 Örvényes; **YM23** *No.* 10454 Szentbalázs; **YM29** *No.* 12386, 12400 Balatonendréd; **YN02** *No.* 4466 Miklóspálhegy; **YN09** *No.* 1259 Nagybajcs; *No.* 1306 Vének; **YN10** *No.* 14342, 14362, 14363, 14372 Koloska-patak; **YN12** *No.* 4851 Márkó; **YN13** *No.* 14392 Pénzesgyőr; **YN14** *No.* 3380, 3384 Bakony Mts.; *No.* 5512 Csesznek; *No.* 5524 Bakonyszentkirály; *No.* 5525 Gézaháza; **YN19** *No.* 1125 Gönyű; **YN20** *No.* 11240,11345 Palóznak; **YN21** *No.* 4203 between Veszprém and Csopak; **YN26** *No* 5510 Bakonyszombathely.

6.47 *Octolasion montanum* (Wessely, 1905)

(Figs. 6.47.1–4.)

Allolobophora montana Wessely, 1905 Jahrb. Verh. Nat. Linz., 34: 16.
non *Octolasium montanum* (= *Fitzingeria platyura montana*) Černosvitov, 1932 Zool. Jb. Syst., 62: 535.
Octolasium montanum: Pop 1947 Anal. Acad. R.P.R., 22: 101.
***Octolasium montanum*: Zicsi 1961 Ann. Univ. Sci. Budapest, 4: 224.**
Octolasium montanum: Zicsi 1965b Opusc. Zool. Budapest, 5: 257.
***Octolasium montanum*: Zicsi 1968a Opusc. Zool. Budapest, 8: 144.**
Octolasium montanum: Zicsi 1982a Acta zool. hung., 28: 444.
Octolasion montanum: Easton 1983 Earthworm Ecology, p. 483.
Octolasion montanum: Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 221.
***Octolasium montanum*: Zicsi 1991 Opusc. Zool. Budapest, 24: 182.**
Octolasion montanum: Qiu & Bouché 1998a Doc. pedozool. integrol., 4: 192.

Description – *External* – Body length 70–140 mm, diameter 5–7 mm, 129–183 segments. Colour whitish or grey. Head epilobous, first dorsal pore in intersegmental groove 12/13. Glandular tumescence usually on 10, 11 *ab*. Setae in closer pairs anteriorly and somewhat wider posteriorly; setal arrangement on segment 10 aa:ab:bc:cd:dd = 8.25:4.5:5.25:1:30, and after the clitellum: aa:ab:bc:cd:dd = 6:2:3:1:12. Clitellum extends on segments 32–36, saddle-shaped. Tubercles as white bands on ½ 32–½ 36. Male pore on 15 between setae *b–c*, great, usually intruding into the neighbouring segments. Nephropores aligned in setal line *b*. *Internal* – Dissepiments from 5/6–13/14 becoming more and more thickened. Crop in 15–16, gizzards in 17–18. Two pairs of testes in 10, 11, and four pairs of seminal vesicles in 9–12. Spermathecae two pairs in 9/10, 10/11, open between setal lines *c–d*. Calciferous glands in 10–12, with lateral diverticula in 10. Last pair of lateral hearts in 11 and a pair small extraoesophageals in 12. Excretory system holonephridial. Nephridial bladders are of ocarina-shape. Typhlosole multilobate, the cross-section of longitudinal muscle layer is of pinnate type (fig. 6.47.1, 6.47.2).

Remarks – *Allolobophora montana* Wessely, 1905 has inadequately been described in a little known journal until Pop (1947) redescribed it and clarified its taxonomic status. In the meantime Černosvitov (1932) described a different species under the name *Octolasium montanum* that has been transferred by Pop (1943b) to *Dendrobaena platyura montana* (Černosvitov, 1932) and now called *Fitzingeria platyura montana*.

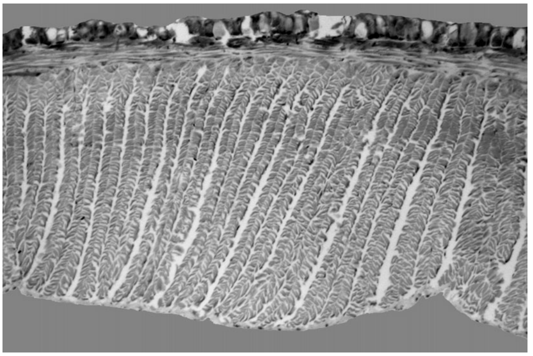

Fig. 6.47.1. Longitudinal musculature of *Octolasion montanum*.

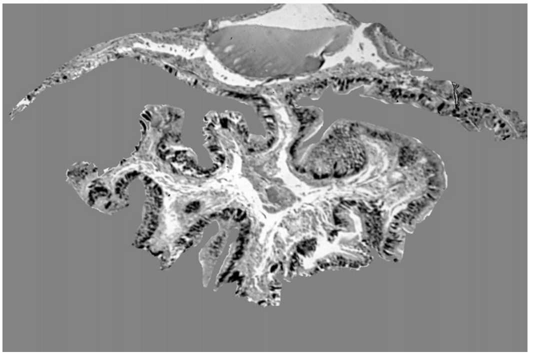

Fig. 6.47.2. Typhlosole of *Octolasion montanum*.

Ecology – *O. montanum* is an endogeic worm living in the mineral soil layer. Its distribution highly corresponds with that of the forest soils (Zicsi 1968a). *O. montanum* defecates predominantly inside the soil, in the depth of 0–50 cm. The daily cast production is about 113 mg dry matter pro 1 g living weight (Zicsi 1974a).

Distribution – This is a restricted Eastern-Alpine species occurring in Austria, Slovakia and Hungary (fig. 6.47.3).

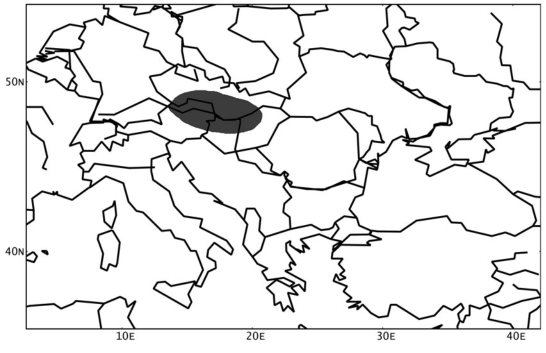

Fig. 6.47.3. Distribution of *Octolasion montanum*.

Distribution in Hungary (fig. 6.47.4) – **CT05** *No.* 7267 Vértes Mts. Fáni-völgy; **CT16** *No.* 7716, 7119, 8414, 9200, 9078, 9079, 10259, 14368 Vértes Mts. Vinyabükki-völgy; **CT37** *No.* 10191 Piliscsaba; **CT46** *No.* 10424 Budapest, Normafa; **CT48** *No.* 7244, 7280 Pilis Mts. Bölcső-hegy; *No.* 4190 Pilis Mts. Bükki-puszta; *No.* 10228 Pilis Mts. Vörösdagonya; *No.* 10219, 10352, 10358, 10225 Pilis Mts., Király-patak; **CT49** *No.* 10399 Dömös; **CT58** *No.* 7182 Pilis Mts. Lajosforrás; *No.* 9966 Pilis Mts. Bükkös-patak; *No.* 10234, 10236 Pilis Mts. Király-patak völgye; **CT77** *No.* 3067 Gödöllő; **CU30** *No.* 2097, 3996 Letkés; **CU50** *No.* 8036, 8047, 8086, 8220, 8421, 9044, 9069, 10469 Szendehely; **DU51** *No.* 8285 Felsőtárkány; **XN79** *No.* 2007 Novákpuszta; **XN89** *No.* 2030 Lickópuszta; **XP61** *No.* 1564, 3878, 10900 Rajka.

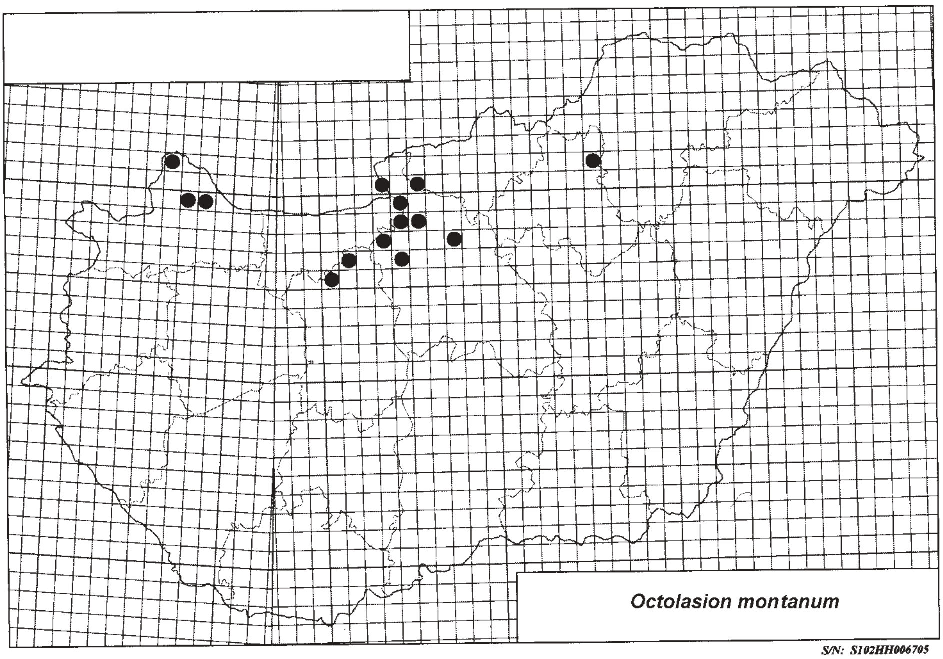

Fig. 6.47.4. Distribution of *Octolasion montanum* in Hungary.

Genus *Octodrilus* Omodeo, 1956

Octolasion (part.): Örley 1885 Értek. term. tud. köréből, 15(18): 13.
Allolobophora (Octolasion) (part.): Rosa 1893a Mem. Acc. Torino, 43: 424.
Octolasium (part.): Michaelsen 1900a Das Tierreich, 10: 504.
Octolasium (Purpureum) (part.) Omodeo, 1952a Arch. zool. Ital., 37: 47.
Octolasium (Octodrilus) (part): Omodeo 1956 Arch. zool. Ital., 41: 175.
Octodrilus: Bouché 1972 Inst. Nat. Rech. Agron., p. 311.
Octolasium (part.): Perel 1976b Zool. Zh., 55: 834.
Octolasium (part.): Perel 1979 Range and regularities in the distr. earthworms, p. 202.
Octodrilus: Zicsi 1982a Acta zool. hung., 28: 444.
Octodrilus (part.): Easton 1983 Earthworm Ecology, p. 483.
Octodrilus: Sims 1984 Boll. Zool. Nom., 41(4): 254.
Octodrilus: Zicsi 1986 Opusc. Zool. Budapest, 22: 108.
Octodrilus: Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 356.
Octolasion (part.): Perel 1997 Earthworms of Russia, p. 60.
Octodrilus: Qiu & Bouché 1998b Doc. pedozool. integrol., 3: 203.

Type species – *Lumbricus complanatus* Dugés, 1828 (original designation but see Sims 1984 and opinion No. 1403 of the Int. Comm. Zool. Nom. 1986).

Diagnosis – *External*. Colour usually brown or red-violet. Head epilobous, first dorsal pore variable. Setae distantly standing. Male pore on 15 between setae *b–c*, usually small, without genital crescent. *Internal* – Two or one pairs of testes in 10 and 11, or only in 11 sometimes enclosed in testis sacs. Seminal vesicles four, three or two pairs in 9–12, or 9, 10, 12 or 10, 12. Spermathecae five to eight pairs open around setal lines *c*. Calciferous glands in 10–12, with lateral diverticula in 10. Last pair of lateral hearts in 11 and a pair of extraoesophageals in 12. Excretory system holonephridial. Nephridial bladders are ocarina-shaped. Longitudinal musculature is of pinnate type.

Remarks – Omodeo (1952a) designated *Lumbricus complanatus* as type species for the genus *Octolasium* Örley, 1885 and *Allolobophora lissaensis* Michaelsen, 1891 for the subgenus *Octolasium (Purpureum)* Omodeo, 1952. The International Commission on Zoological Nomenclature in Opinion No. 1403 with the suppression of the genus-group name *Purpureum* suppressed all the previously designated type species and accepted as valid the designation of *Lumbricus complanatus* as the type species of subgenus *Octolasium (Octodrilus)* by Omodeo (1956).

Table 6.10. Distinguishing characters of the *Octodrilus* species in Hungary.

Species	Clitellum	Tubercles	Vesicles	Spermathecae	Nephridial bladders	Musculature
Oc. compromissus	29–36	29–37	9–12	5/6–10/11 *c*	ocarina-shaped	pinnate
Oc. gradinescui	1/2 29, 30–38	30–38	9–12	6/7–10/11 *c*	ocarina-shaped	pinnate
Oc. lissaensioides	29–36	29–37	9, 11, 12	5/6–10/11 *c*	ocarina-shaped	pinnate
Oc.pseudolissaensioides	29–36	29–36	10, 12	5/6–9/10 *c*	ocarina-shaped	pinnate
Oc. pseudotranspadanus	29–37	29–37	10, 12	5/6–9/10 *c*	ocarina-shaped	pinnate
Oc. transpadanus	29, 30–37	29, 30–37	9–12	6/7–10/11 *c*	ocarina-shaped	pinnate

6.48 *Octodrilus compromissus* Zicsi & Pop, 1984

(Figs. 6.48.1–2.)

***Octolasium* (*Octodrilus*) *lissaense* (Michaelsen, 1891): Zicsi 1968a (part.) Opusc. Zool. Budapest, 8: 144.**
Octodrilus compromissus Zicsi & Pop, 1984 Acta zool. hung., 30: 245
Octodrilus compromissus: Zicsi 1986 Opusc. Zool. Budapest, 22: 108.
***Octodrilus compromissus*: Zicsi, Dózsa-Farkas & Csuzdi 1990 Bátorliget Nat. Res., p. 219.**
***Octodrilus lissaensis* (part.): Zicsi 1991 Opusc. Zool. Budapest, 24: 179.**
Octodrilus compromissus: Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 389.

Description – *External* – Body length 66–193 mm, diameter 3–6 mm, 91–206 segments. Colour grey. Head epilobous, first dorsal pore in intersegmental furrow 11/12 or in 12/13. Glandular tumescence usually lacking. Setae widely paired, setal arrangement after the clitellum: aa:ab:bc:cd:dd = 3.5:2.3:1.5:0.9:4. Clitellum extends on segments 29–36, saddle-shaped. Tubercles as thin bands extend at the margin of the clitellum on 29–37. Male pore on 15 between setae *b–c*, small, hardly visible. Nephropores in setal line *b*. *Internal* – Dissepiments from 5/6–9/10 thickened, 13/14–14/15 strongly muscular. Crop in 15–16, gizzards in 17–18. Two pairs of testes in 10, 11 enclosed in perioesophageal testis sacs and four pairs of vesicles in 9–12. Spermathecae six pairs in 5/6–10/11, open in setal line *c*. Calciferous glands in 10–12, with lateral diverticula in 10. Last pair of lateral hearts in 11 and a pair of extraoesophageals in 12. Excretory system holonephridial. Nephridial bladders are of ocarina-shape. The cross-section of longitudinal muscle layer is of pinnate type.

Remarks – This species was described from Romania. The Hungarian population does not differ from the typical one except the size, that is somewhat smaller, being on the lower region of population variability.

Distribution – *Oc. compromissus* is known from NE Hungary and Romania (fig. 6.48.1).

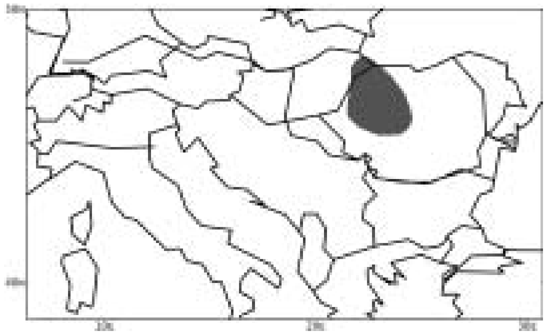

Fig. 6.48.1. Distribution of *Octodrilus compromissus*.

Distribution in Hungary (fig. 6.48.2) **– ET99** *No*. 11152, 11167, 11184, 11187, 11733 Bátorliget; *No*. 4949, 11692 Zemplén Mts. Kőkapu; *No*. 5457, 11686 Zemplén Mts. Kishuta; *No*. 11548, 11639 Zemplén Mts. Rostalló; *No*. 11625 Zemplén Mts. Senyő-völgy; **EU37** *No*. 4945 Zemplén Mts. Füzér; **EU92** *No*. 14377 Olcsva; **FU01** *No*. 4093 Kocsord; *No*. 14356 Tunyogmatolcs; **FU03** *No*. 10589 Vámosatya, Bockerek-erdő; **FU13** *No*. 8011 Daróc.

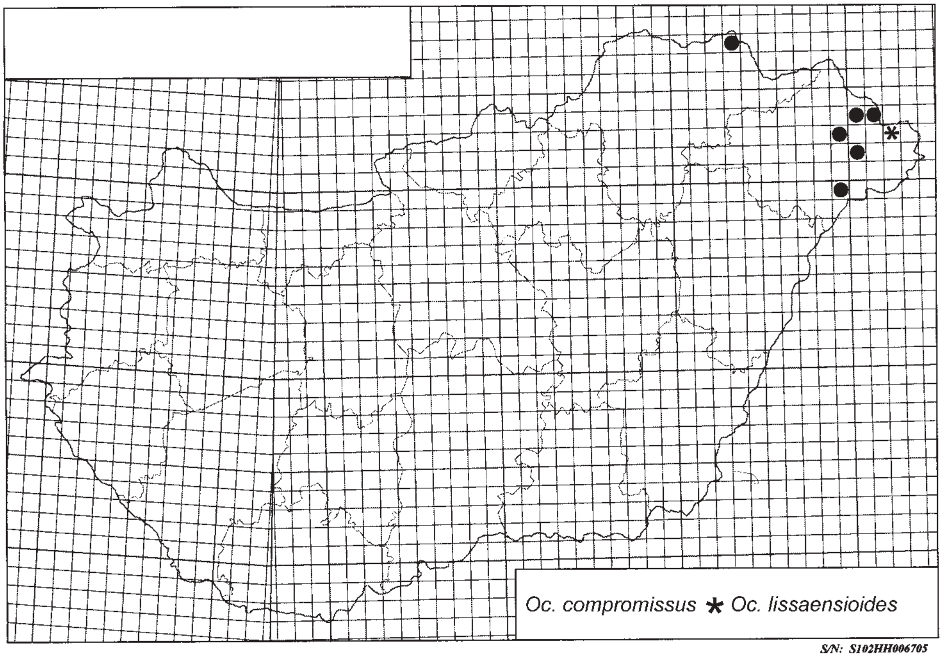

Fig. 6.48.2. Distribution of *Octodrilus compromissus* and *Octodrilus lissaensioides* in Hungary.

6.49 *Octodrilus gradinescui* (Pop, 1938)

(Figs. 6.49.1–4.)

Octolasium gradinescui Pop, 1938 Bull. Soc. Sti. Cluj, 9: 151.
Octolasium gradinescui: Pop 194a3: Pop 1943 Ann. Hist. Nat. Mus. Hung., 36: 17.
***Octolasium gradinescui*: Zicsi 1966a Ann. Univ. Sci. Budapest, 8: 396.**
***Octolasium exacystis* (Rosa, 1896): Zicsi 1967 Acta zool. hung., 13: 252.**
***Octolasium (Octodrilus) exacystis*: Zicsi 1968a Opusc. Zool. Budapest, 8: 146.**
***Octolasium (Octodrilus) gradinescui*: Zicsi 1968a Opusc. Zool. Budapest, 8: 146.**
Octodrilus gradinescui: Zicsi 1982a Acta zool. hung., 28: 444.
Octodrilus gradinescui: Easton 1983 Earthworm Ecology, p. 483.
Octodrilus gradinescui: Zicsi 1986 Opusc. Zool. Budapest, 22: 108.
***Octodrilus gradinescui*: Zicsi 1991 Opusc. Zool. Budapest, 24:180.**
Octodrilus gradinescui: Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 429.
Octodrilus gradinescui: Qiu & Bouché 1998a Doc. pedozool. integrol., 4: 193.

Description – *External* – Body length 250–300 mm, diameter 8–10 mm, 150–220 segments. Colour dark grey or brownish. Head epilobous, first dorsal pore between intersegmental furrow 9/10–12/13. Glandular tumescence usually on 22, 23, 30 *ab*. Setae widely paired, setal arrangement after the clitellum: aa:ab:bc:cd:dd = 3.4:1.7:1.7:1:8. Clitellum extends on segments 29, 30–38, ½ 39 saddle-shaped. Tubercles as thin bands extend at the margin of the clitellum on 30–38. Male pore on 15 between setae *b–c*, small. Nephropores irregularly alternate between setal line *b* and above *d*. *Internal* –

Dissepiments from 5/6–8/9 slightly thickened, 13/14–14/15 strongly muscular. Crop in 15–16, gizzards in 17–18. Two pairs of testes in 10, 11 segment enclosed in perioesophageal testis sacs. Four pairs of vesicles in 9–12 and five pairs of spermathecae in 6/7–10/11, open in the setal line *c*. Calciferous glands in 10–12, with posterio-lateral diverticula in 10. Last pair of lateral hearts in 11 and a pair of extraoesophageals in 12. Excretory system holonephridial. Nephridial bladders are of ocarina-shape. Typhlosole simple, lamelliform, the cross-section of longitudinal muscle layer is of pinnate type (fig. 6.49.1, 6.49.2).

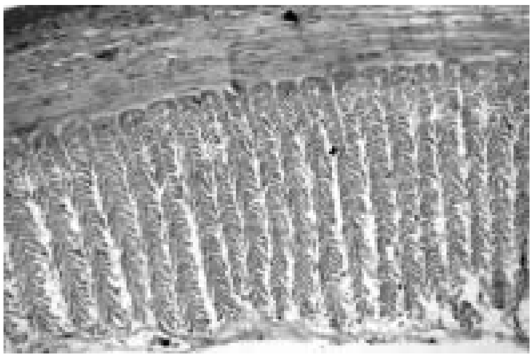

Fig. 6.49.1. Longitudinal musculature of *Octodrilus gradinescui*.

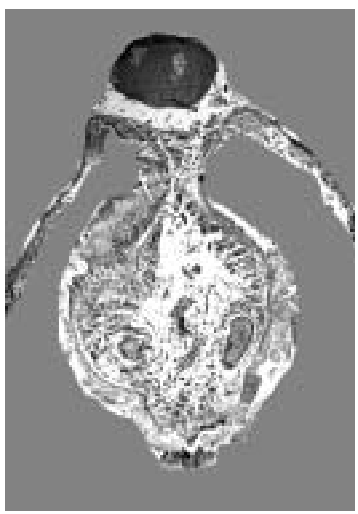

Fig. 6.49.2. Typhlosole of *Octodrilus gradinescui*.

Remarks – *Oc. gradinescui* is very close to *Oc. transpadanus*, but there are some somatic differences. The clitellar organs are longer; always fully cover the 38th segment. The setal arrangement also somewhat different. While at *Oc. transpadanus ab* ~ *cd,* at *Oc*. *gradinescui ab* ~ 1.5 *cd*.

A revision of the material from NE Hungary (Zicsi 1967, 1968a) revealed, that it had been erroneously referred as *Oc. exacystis*, but it should be included into *Oc. gradinescui*. This eliminates *Oc. exacystis* from the list of Hungarian earthworms.

Ecology – *Oc. gradinescui* is a large-bodied endogeic species, occurring always in hard clayey soils. Its daily cast production is one of the highest among the endogeic species, it is 124 mg dry matter pro 1 g living weight in average. 96% of the total casts are deposited into the soil largely between 0–50 cm depth (Zicsi 1974a).

Distribution – *Oc. gradinescui* is a species of Dacian origin occurring in Romania, Slovakia, Ukraine and Hungary (fig. 6.49.3).

Distribution in Hungary (fig. 6.49.4) – **CT68** *No.* 2854 Sződliget; **DS71** *No.* 964, 5631 Kövegy; **DS74** *No.* 5052 Tótkomlós; **DS82** *No.* 935, 971 Mezőhegyes; **DT49** *No.* 3106, 4261, 4450, 5572, 7130, 9195 Kálkápolna; **DU77** *No.* 3872 Szádvár; **DU87** *No.* 3966 Bódvaszilas; **ES02** *No.* 980 Battonya; **ES07** *No.* 5058 Békéscsaba; **FU12** *No.* 4044 Tivadar; **FU22** *No.* 4070, 4071, 7136, 7137 Tiszacsécse; *No.* 7134, 7135, 7149 Tiszakóród.

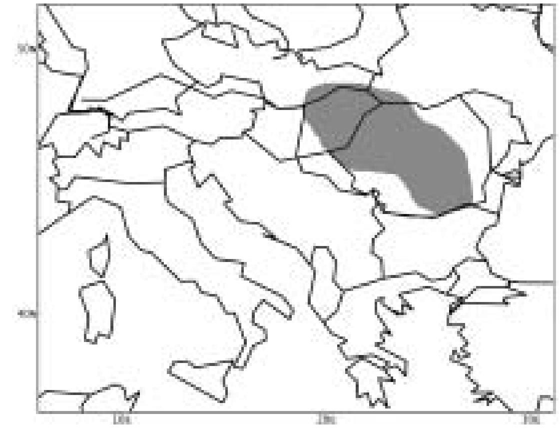

Fig. 6.49.3. Distribution of *Octodrilus gradinescui*.

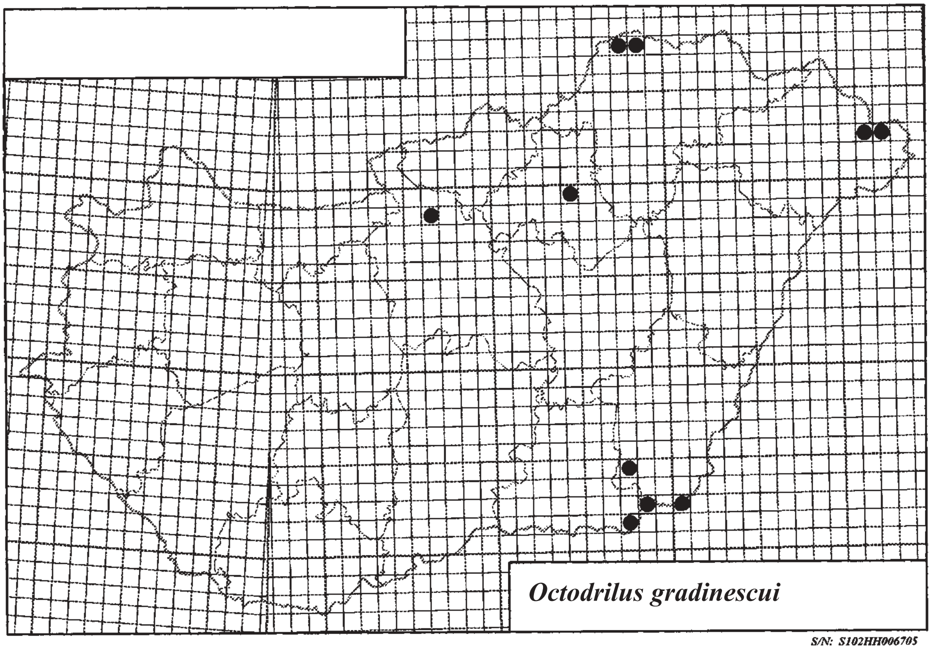

Fig. 6.49.4. Distribution of *Octodrilus gradinescui* in Hungary.

6.50 *Octodrilus lissaensioides* (Zicsi, 1971)

(Figs. 6.48.2., 6.50.1.)

***Octolasium lissaense* (Michaelsen, 1891): Zicsi 1967 (part) Acta zool. hung., 13: 251.**
***Octolasium (Octodrilus) lissaense*: Zicsi 1968a (part.) Opusc. Zool. Budapest, 8: 144.**
***Octolasium (Octodrilus) lissaensioides* Zicsi, 1971a Acta zool. hung., 17: 226.**
Octodrilus lissaensioides: Zicsi 1982a Acta zool. hung., 28: 444
Octodrilus lissaensioides: Easton 1983 Earthworm Ecology, p. 483.
***Octodrilus lissaensioides*: Zicsi 1986 Opusc. Zool. Budapest, 22: 108.**
***Octolasium lissaensis* (part.): Zicsi 1991 Opusc. Zool. Budapest, 24: 179**
Octodrilus lissaensioides: Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 386.
Octodrilus lissaensioides: Qiu & Bouché 1998a Doc. pedozool. integrol., 4: 193.

Description – *External* – Body length 57–115 mm, diameter 4–8 mm, 132–196 segments. Colour reddish-grey. Head epilobous, first dorsal pore in intersegmental furrow 9/10. Glandular tumescence usually lacking. Setae widely paired, setal arrangement after the clitellum: aa:ab:bc:cd:dd = 2.6:1.9:1.4:1:5.5. Clitellum extends on segments 29–36, saddle-shaped. Tubercles as thin bands extend at the margin of the clitellum on 29–37. Male pore on 15 between setae *b–c*, small, but visible. Nephropores aligned in setal line *b*. *Internal* – Dissepiments from 6/7–9/10 and 12/13–14/15 somewhat thickened. Crop in 15–16, gizzards in 17–18. Two pairs of testes in 10, 11 segment. That of 10 enclosed in oesophageal testis sacs and that of 11 enclosed in perioesophageal testis sac. Three pairs of vesicles in 9, 11, 12. Six pairs of spermathecae in 5/6–10/11, open somewhat below the setal line *c*. Calciferous glands in 10–12, with posterio-lateral diverticula in 10. Last pair of lateral hearts in 11 and a pair of extraoesophageals in 12. Excretory system holonephridial. Nephridial bladders are of ocarina-shape. The cross-section of longitudinal muscle layer is of pinnate type (fig. 6.50.1).

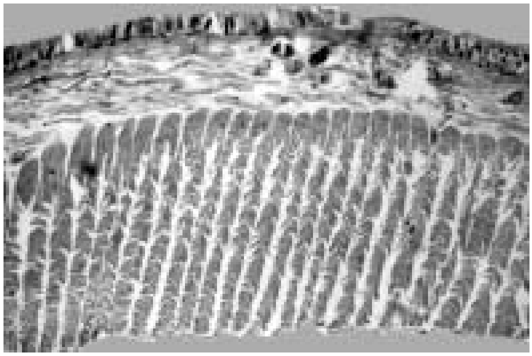

Fig. 6.50.1. Longitudinal musculature of *Octodrilus lissaensioides.*

Remarks – This species is similar to *Oc. compromissus*, but differs from it in the number of vesicles.

Distribution – *Oc. lissaensioides* is known from NE Hungary.

Distribution in Hungary (fig. 6.48.2) **– FU22** *No*. 4069, 4881, 7142, 12738 Tiszacsécse.

6.51 *Octodrilus pseudolissaensioides* Zicsi, 1994

(Figs. 6.51.1, 6.52.2.)

***Octolasium hemiandrum* Cognetti, 1901: Zicsi 1961 Ann. Univ. Sci. Budapest, 4: 225.**
Octolasium hemiandrum: Zicsi 1965a Naturk. Jahrb. Linz, 11: 192.
Octolasium hemiandrum: Zicsi 1965b Opusc. Zool. Budapest, 5: 259.
Octolasium hemiandrum: Zicsi 1965c Opusc. Zool. Budapest, 5: 270.
***Octolasium (Octodrilus) hemiandrum*: Zicsi 1968a (part.) Opusc. Zool. Budapest, 8: 144.**
***Octolasium (Octodrilus) pseudotranspadanum* Zicsi, 1971a (part.) Acta zool. hung., 17: 227.**
Octodrilus pseudotranspadanus (part.): Zicsi 1986 Opusc. Zool. Budapest, 22: 108.
***Octodrilus pseudotranspadanus* (part.): Zicsi 1991 Opusc. Zool. Budapest, 24: 179.**
***Octodrilus pseudolissaensioides* Zicsi, 1994 Verh. Zool.-Bot. Ges. Wien, 131: 45.**

Description – *External* – Body length 60–115 mm, diameter 4–6 mm, 125–142 segments. Colour grey. Head epilobous, first dorsal pore in intersegmental groove 11/12. Glandular tumescence usually on 29 *a.* Setae widely paired, setal arrangement after the clitellum: aa:ab:bc:cd:dd = 2.5:1.5:1:1:4.5. Clitellum extends on segments 29–36, saddle-shaped. Tubercles thin bands, extend all over the margin of the clitellum on 29–36. Male pore small, on 15 between setae *b–c*. Nephropores constantly in setal line *b*. *Internal* – Dissepiments from 5/6–9/10 slightly thickened, 12/13–14/15 muscular. Crop in 15–16, gizzards in 17–18. One pair of testes in 11, enclosed into oesophageal testis sac and two pairs of vesicles in 10 and 12. Spermathecae five pairs in 5/6–9/10, open in setal lines *c*. Calciferous glands in 10–12, with posterio-lateral diverticula in 10. Last pair of lateral hearts in 11 and a pair of extraoesophageals in 12. Excretory system holonephridial. Nephridial bladders are of ocarina-shape. The cross-section of longitudinal muscle layer is of pinnate type.

Remarks – Zicsi (1971a) describing *Oc. pseudotranspadanus* remarked that specimens from Northern Hungary and Austria differ from the type selected in the position of the clitellum and the length of tubercula pubertatis (cl and tb: 29–36 vs. 29–37). These specimens were subsequently described as a new species: *Oc. pseudolissaensioides* Zicsi, 1994.

Distribution – Upper and Lower Austria and NW Hungary (fig. 6.51.1).

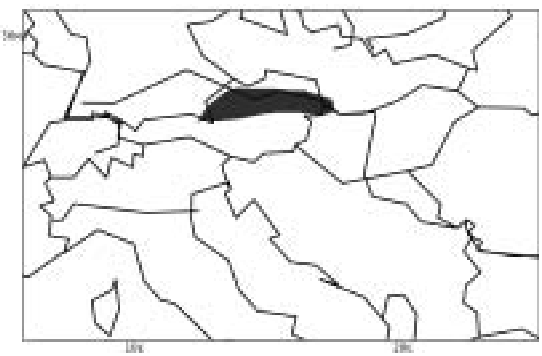

Fig. 6.51.1. Distribution of *Octodrilus pseudolissaensioides*.

Distribution in Hungary (fig. 6.52.2) – **XP61** *No*. 3884, 6024, 12010 Rajka; **XP71** *No*. 14545 Dunasziget, Denkpál.

6.52 *Octodrilus pseudotranspadanus* (Zicsi, 1971)

(Figs. 6.52.1–2.)

***Octolasium hemiandrum* Cognetti, 1901: Zicsi 1968a (part.) Opusc. Zool. Budapest, 8: 144.**
***Octolasium (Octodrilus) pseudotranspadanum* Zicsi, 1971a (part.) Acta zool. hung., 17: 227.**
Octodrilus pseudotranspadanus (part.): Zicsi 1982a Acta zool. hung., 28: 444.
Octodrilus pseudotranspadanus (part.): Easton 1983 Earthworm Ecology, p. 483.
Octodrilus pseudotranspadanus: Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.) 31: 377.
***Octodrilus pseudotranspadanus* (part): Zicsi 1991 Opusc. Zool. Budapest, 24: 179.**
Octodrilus pseudotranspadanus: Qiu & Bouché 1998a Doc. pedozool. integrol, 4: 193.

Description – *External* – Body length 62–105 mm, diameter 4–6 mm, 133–145 segments. Colour grey. Head epilobous, first dorsal pore in intersegmental groove 11/12. Glandular tumescence usually lacking. Setae widely paired, setal arrangement after the clitellum: aa:ab:bc:cd:dd = 2.2:1.6:1:1:5.7. Clitellum extends on segments

29–37, saddle-shaped. Tubercles as thin bands extend all over the margin of the clitellum on 29–37. Male pore on 15 between setae *b–c*, small, hardly visible. Nephropores aligned in setal line *b*. *Internal* – Dissepiments from 6/7–8/9 and 12/13–14/15 slightly thickened. Crop in 15–16, gizzards in 17–18. One pairs of testes in 11, enclosed into oesophageal testis sac and two pairs of vesicles in 10 and 12. Spermathecae five pairs in 5/6–9/10, open around setal lines *c*. Calciferous glands in 10–12, with posterio-lateral diverticula in 10. Last pair of lateral hearts in 11 and a pair of small extraoesophageals in 12. Excretory system holonephridial. Nephridial bladders are of ocarina-shape. The cross-section of longitudinal muscle layer is of pinnate type.

Distribution – This species is known from Southwest Hungary and Bosnia, that indicate a restricted Illyric distribution (fig. 6.52.1).

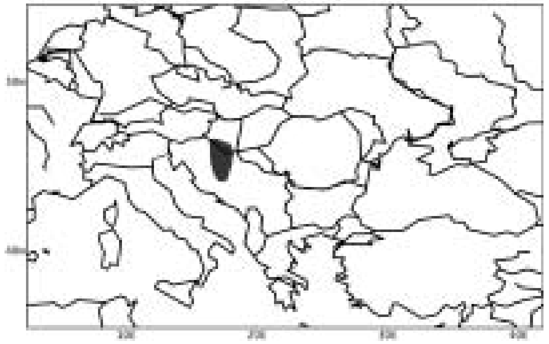

Fig. 6.52.1. Distribution of *Octodrilus pseudotranspadanus*.

Distribution in Hungary (fig. 6.52.2) **– XM24** *No*. 4120, 4121, 4133, 9121, 9122 Murarátka; **XM25** *No*. 9151 Csörnyeföld; *No*. 9145 Dobri; *No*. 9129 Szemenyecsörnye; **XM43** *No*. 14270 Molnári; **XM44** *No*. 14307 Semjénháza; **XM52** *No*. 9175 Porrogszentpál; **XM53** *No*. 9161 Somogybükkösd; **XM62** *No*. 9168, 9169 Csurgó-nagymárton.

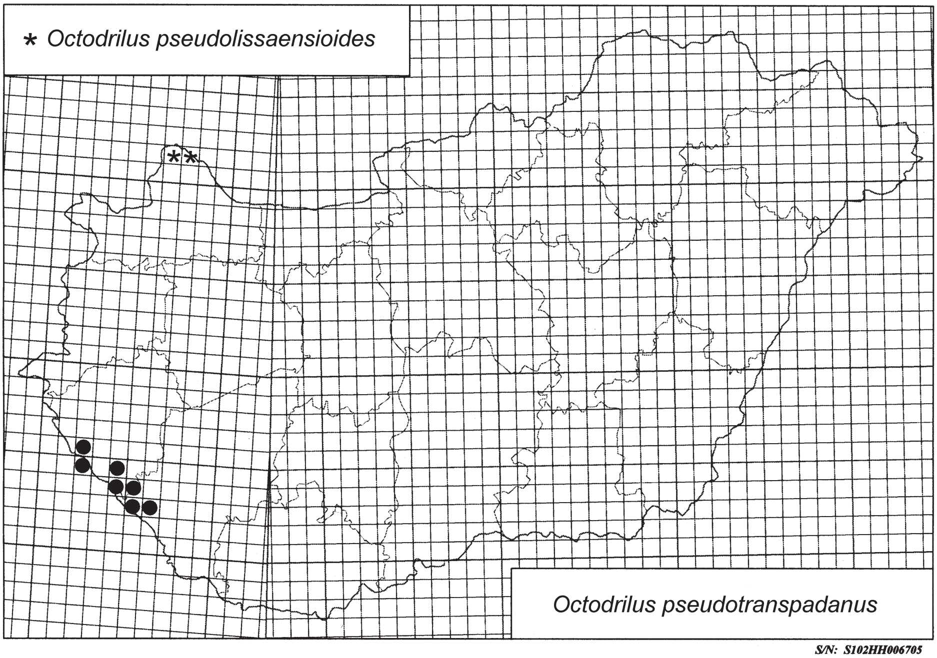

Fig. 6.52.2. Distribution of *Octodrilus pseudolissaensioides* and *Octodrilus pseudotranspadanus* in Hungary.

6.53 *Octodrilus transpadanus* (Rosa, 1884)

(Figs. 6.53.1–4.)

Enterion opimum Savigny, 1826 (part.) Mem. Acad. Sci. Inst. Fr, .5: 183.
Allolobophora transpadana Rosa, 1884 Lumbric. Piemonte, p .45.
Octolasion transpadanum: Örley 1885 Értek. Term. Tud. Köréből, 15: 19.
Allolobophora transpadana cinerea Rosa, 1886 Atti. Ist. Veneto, 4: 679.
Allolobophora cyanea recta Ribaucourt, 1896 Rev. suisse. Zool., 4: 67.
Allolobophora nivalis Bretscher, 1899 Rev. suisse. Zool., 6: 420.
Octolasium transpadanum: Michaelsen 1900a Das Tierreich, 10: 507.
Octolasium transpadana alpina Bretscher, 1905 Rev. suisse Zool., 11: 1.
Octolasium transpadanum: Szüts 1909 Állattani Közlemények, 8: 140.
***Octolasium transpadanum*: Pop 1943a Ann. Hist. Nat. Mus. Hung., 36: 17.**
Octolasium (Octodrilus) transpadanum: Omodeo 1956 Arch. Zool. Ital., 41: 177.
***Octolasium (Octodrilus) transpadanum*: Zicsi 1968a Opusc. Zool. Budapest, 8: 144.**
Octolasium transpadanum: Perel 1979 Range and regularities in the distr. earthworms, p. 205.
Octodrilus transpadanus: Zicsi 1982a Acta zool. hung., 28: 444.
Octodrilus transpadanus: Easton 1983 Earthworm Ecology, p. 483.
Octodrilus transpadanus: Zicsi 1986 Opusc. Zool. Budapest, 22: 108.
***Octodrilus transpadanus*: Zicsi 1991 Opusc. Zool. Budapest, 24: 179.**
Octodrilus transpadanus: Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 371.
Octodrilus transpadanus: Qiu & Bouché 1998a Doc. pedozool. integrol., 4: 192.

Description – *External* – Body length 40–450 mm, diameter 4–10 mm, 100–252 segments. Colour dark grey or brownish. Head epilobous, first dorsal pore around intersegmental furrow 12/13. Glandular tumescence usually on 21, 39 *ab.* Setae widely paired, setal arrangement after the clitellum: aa:ab:bc:cd:dd = 2.15:1:1.4:1:4.6. Clitellum extends on segments ½ 29, 30–37, saddle-shaped. Tubercles as thin bands extend at the margin of the clitellum on 30–37. Male pore on 15 between setae *b–c*, small. Nephropores irregularly alternate between setal line *b* and above *d*. *Internal* – Dissepiments from 5/6–13/14 thickened. Crop in 15–16, gizzards in 17–18. Two pairs of testes in 10, 11 segment sometimes in perioesophageal testis sacs. Four pairs of vesicles in 9–12 and five pairs of spermathecae in 6/7–10/11, open in the setal line *c*. Calciferous glands in 10–12, with posterio-lateral diverticula in 10. Last pair of lateral hearts in 11 and a pair of small extraoesophageals in 12. Excretory system holonephridial. Nephridial bladders are of ocarina-shape. Typhlosole anchor-shaped, the cross-section of longitudinal muscle layer is of pinnate type (fig. 6.53.1, 6.53.2).

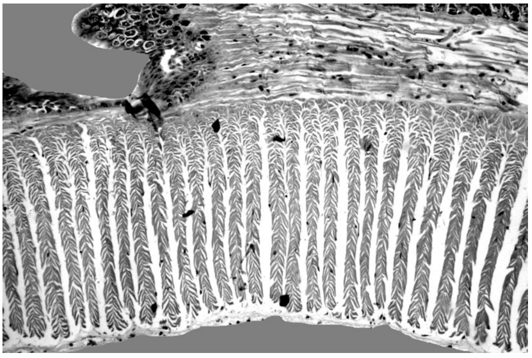

Fig. 6.53.1. Longitudinal musculature of *Octodrilus transpadanus*.

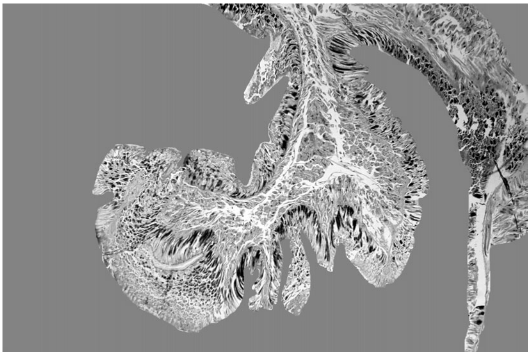

Fig. 6.53.2. Typhlosole of *Octodrilus transpadanus*.

Remarks – An extremely great size variation could be observed in this species. Specimens living in stream or riverbanks are between 40–100 mm, but specimens living in closed forest could reach 300 mm or more. The largest earthworm specimen collected in Hungary is put also with this species. Its length exceeds 400 mm.

Ecology – *Oc. transpadanus* is a large-bodied endogeic species, occurring in almost all types of soils. Its density is especially high in moist soils such as in swamps and riverbanks. Its daily cast production in average is 107.8 mg dry matter pro 1 g living weight. 80% of the total casts are deposited into the soil up to 1 m deep (Zicsi 1974a). Taking into account that the activity of the earthworms in winter and in the driest months of summer is ceased the yearly cast production corrected accordingly would be 2.23 kg/m[2] (Loksa & Zicsi 1972).

Distribution – *Oc. transpadanus* shows a typical Trans-Aegean distribution (fig. 6.53.3).

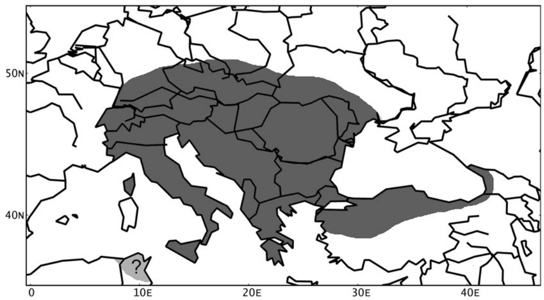

Fig. 6.53.3. Distribution of *Octodrilus transpadanus*.

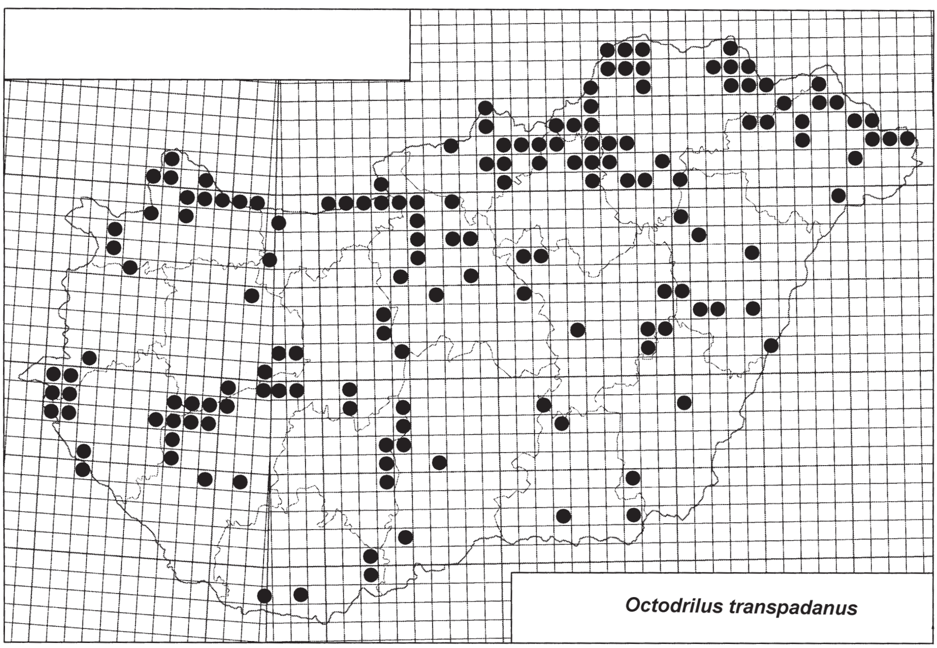

Fig. 6.53.4. Distribution of *Octodrilus transpadanus* in Hungary.

Distribution in Hungary (fig. 6.53.4) – **BR88** *No.* 1957 Harkány; **BS79** *No.* 1920, 2864 Balatonszéplak; **BS89** *No.* 11365 Balatonszabadi; **BT71** *No.* 1916 Balatonfűzfő; **BT78** *No.* 1121 Ács; **BT81** *No.* 1912, 11250 Balatonkenese; **BT81** *No.* 11289, 11316 between Balatonkenese and Fűzfő; **CR29** *No.* 1682, 1779 Mohács; **CS18** *No.* 3046 Cece; **CS19**

No. 1461 Rétszilas; **CS20** *No.* 1828 Bár; **CS34** *No.* 1865 Fadd; **CS35** *No.* 1886, 1887 Gerjen; **CS36** *No.* 755, 763 Paks; *No.* 1897 Dunaszentbenedek; **CS41** *No.* 5005 between Baja and Vaskút; *No.* 4858 Máriakönnye; **CS46** *No.* 1906 Ordas; **CS47** *No.* 1667 Bölcske; *No.* 1900 Harta; **CS48** *No.* 546, 549, 593, 601, 606, 618, 620, 633, 638, 648, 811, 1437, 1873, 1975, 2823, 3025 Dunaföldvár; **CS65** *No.* 1642 Kecel; **CT09** *No.* 1111, 1177 Dunaalmás; *No.* 1106, 1173 Süttő; **CT19** *No.* 1100, 1166 Lábatlan; *No.* 1096 Nyergesújfalu; **CT29** *No.* 7100 Tát; **CT32** *No.* 674, 1820, 1980 Adony; **CT33** *No.* 2875 Baracska; **CT39** *No.* 1156, 1483 Esztergom; **CT41** *No.* 680 Kulcs; **CT45** *No.* 3255 Törökbálint; **CT49** *No.* 1075, 1136, 1139 Visegrád; *No.* 1079, 1144 Dömös; *No.* 1150 Pilismarót; *No.* 1086 Szob; **CT56** *No.* 722 Csepel; **CT57** *No.* 1545 Budakalász; **CT58** *No.* 2818 Alsógöd; *No.* 1613 Surány; **CT58** *No.* 1373, 1378, 1491, 1475 Szentendre; **CT59** *No.* 1536, 1529 Dunabogdány; **CT64** *No.* 11711 Ócsa; **CT77** *No.* 3070, 5559 Gödöllő; **CT79** *No.* 3272 Csővár; **CT85** *No.* 4965, 4966, 4967 Mende; **CT87** *No.* 2806, 2860, 3062, 3076, 7197 Bag, Petőfi-forrás; **CU30** *No.* 2100, 3997, 4000, 4001, 9182 Letkés; **CU72** *No.* 5279 Ipolyszög; **CU91** *No.* 8950 Alsótold; **CU93** *No.* 4817 Endrefalva; *No.* 5257 Ludányhalászi; **CU94** *No.* 5271 Litke; **DS28** *No.* 11570 Tiszaalpár; *No.* 11731 between Tiszasas and Csépa; **DS32** *No.* 1661 Algyő; *No.* 1999 Atka; **DS32** *No.* 1663, 2003, 2005, 1756, 2040, 1668 Szeged; **DS37** *No.* 1664 Csongrád; **DS72** *No.* 5032 Csanádpalota; **DS74** *No.* 5045 Tótkomlós; **DT14** *No.* 10599 Farmos; **DT16** *No.* 4974 Jászberény; **DT26** *No.* 5686 Jászjákóhalma; **DT42** *No.* 5221 Tiszapüspöki; **DT81** *No.* 1660 Túrkeve; **DT82** *No.* 1853 Kisújszállás; **DT92** *No.* 8392 Ecsegfalva; **DT94** *No.* 5324 Karcag; **DU00** *No.* 4213 Mátrakeresztes; **DU01** *No.* 9109, 9110 Sámsonháza; **DU02** *No.* 9091 Lucfalvai elágazás; **DU12** *No.* 5892 Mátraszele; **DU21** *No.* 1692, 2795, 3992, 3994, 3995 Nádújfalu; **DU22** *No.* 5903 Bárna; **DU32** *No.* 2894 Tarnalelesz; **DU33** *No.* 5531, 6940 Ivád; **DU41** *No.* 3003 Bátor; **DU43** *No.* 2910 Borsodnádasd; **DU50** *No.* 5563 between Eger and Lillafüred; **DU51** *No.* 8572, 9213, 9214, 9215 Bükk Mts. Szarvaskő; *No.* 9228 Felsőtárkány; **DU52** *No.* 2273, 4670 Szilvásvárad; **DU52** *No.* 9896 Bükk Mts. Tóthfalusi-völgy; **DU53** *No.* 7629 Nekézseny; **DU54** *No.* 568 Putnok; **DU55** *No.* 5536 Kelemér; **DU55** *No.* 4573 Serényfalva; **DU61** *No.* 5668, 5678, 7553 Cserépfalu; **DU62** *No.* 7622 Répáshuta; **DU66** *No.* 504, 524, 539, 571, 693, 705, 706, 711, 1582, 1583, 1588, 2858, 2900, 4445, 4509, 4574, 7367 Aggtelek; No 4832 Aggtelek, Haragistya; **DU66** *No.* 3007, 3033, 9076, 9077 Aggtelek, Vöröstó; **DU67** *No.* 1942, 3102, 3280, 4681, 5910 Jósvafő; **DU70** *No.* 3108 Bükkábrány; **DU72** *No.* 3364 Lillafüred; *No.* 2259 Bükk Mts. Csókásforrás; *No.* 2250 Bükk Mts. Tógazdaság; **DU76** *No.* 2905 Szendrő; **DU77** *No.* 3925 Acskó; *No.* 4381 Alsóhegy; *No.* 557, 1572, 3289, 3294 Szin; **DU77** *No.* 508, 3117 Szinpetri; **DU80** *No.* 4987 Vatta; **DU85** *No.* 515, 521, 2850, 3020, 5172 Szendrőlád; **DU86** *No.* 575, 579, 1933, 1937, 3931, 3932 Szalonna; **DU87** *No.* 3958, 3959, 3987 Bódvaszilas; **DU91** *No.* 4717, 4722, 4723 Sajószöged; **ES08** *No.* 4703 Vizesfás; **ET04** *No.* 3327, 3329 Püspökladány; **ET08** *No.* 4725, 7087, 7088, 7096 Új-szentmargita; **ET13** *No.* 5357 Báránd; **ET17** *No.* 3352 Hortobágy; *No.* 8380 Hortobágy, Gyökérkúti-halastó; **ET23** *No.* 9060, 9022, 9023, 9015, 9016 Sáp; **ET43** *No.* 5327 Berettyó; **ET46** *No.* 5317 Debrecen; **ET51** *No.* 5396 Ártánd; **ET99** *No.* 11153, 11159, 11183, 11188 Bátorliget; *No.* 11168 Bátorliget, Fényi-erdő; **EU00** *No.* 5301 Polgár; *No.* 5308 Tiszaszederkény; **EU26** *No.* 4231, 7571, 11650 Regéc; **EU35** *No.* 4270 Óhuta; **EU36** *No.* 5456 Kishuta; *No.* 5470, 11630 Nagybózsva; *No.* 11661, 10245 Rostalló; *No.* 4933 Zempléni Mts. Kőkapu; *No.* 7112 Zempléni Mts. Nagygereben; **EU37** *No.* 5989

Füzér; **EU43** *No.* 2103, 2107 Körtvélyes; **EU45** *No.* 3473, 3494 Sárospatak, Végardó; **EU46** *No.* 3083, 3085, 3087, 3088, 3096, 3098 Sátoraljaújhely; **EU53** *No.* 6440 Tiszakarád; **EU55** *No.* 5619 Alsóberecki; **EU64** *No.* 3628 Dombrád; **EU72** *No.* 3526, 3672, 3674 Berkesz; **EU73** *No.* 3606, 3653, 3654, 3655, 3656, 3657, 3669, 3673 Ajak; *No.* 3498 Pátroha; *No.* 3516 Rétközberencs; **EU84** *No.* 3574 Jéke; *No.* 3556, 3595, 3600, 3601, 3602, 3621, 3626 Kisvárda; **EU85** *No.* 3567, 3568, 3569 Tiszabezdéd; **EU94** *No.* 3540 Mezőladány; **FU01** *No.* 4092, 4109 Kocsord; *No.* 14355 Tunyogmatolcs; **FU03** *No.* 4883, 4886, 4889 Vámosatya, Bockerek-erdő; *No.* 4903, 8006, 11610 Csaroda; *No.* 14376 Jánd; *No.* 8014 Tákos; **FU12** *No.* 4015, 4016 Kisar; *No.* 4054, 4061, 4062, 4101, 10392 Kömörő; *No.* 4032, 4036, 4037, 4038, 4039, 8022 Tarpa; *No.* 4043, 10598 Tivadar; **FU13** *No.* 4095 Beregsurány; *No.* 8010 Daróc; **FU22** *No.* 7147, 7148 Tiszakóród; *No.* 4083, 4087, 4088 Túristvándi; **FU32** *No.* 10393 Tiszabecs; **XM07** *No.* 8506 Velemér; **XM08** *No.* 8548 between Bajánsenye and Dávidháza; *No.* 12014, 12084 Őriszentpéter; **XM09** *No.* 8538 Orfalu; **XM17** *No.* 11537 Kálócfa; *No.* 11574 Zalabaksa; **XM18** *No.* 8527 Csöde; **XM19** *No.* 12041 Viszák; **XM24** *No.* 4117, 4140, 9123, 9124, 9125 Murarátka; **XM25** *No.* 5434 Tormafölde; **XM67** *No.* 11363 Fenékpuszta; *No.* 1926 Zala-folyó; **XM75** *No.* 5419 Szőkedencs; **XM76** *No.* 11318 Tikos; **XM77** *No.* 1442, 10271, 10273, 10275, 10277, 10282, 10283, 10287, 10288, 11232, 11269, 11276, 11278, 11290, 11310, 11315, 11349, 11360, 12747, 12753 Balatonberény; **XM78** *No.* 2089, 11251, 11326 Keszthely; *No.* 1393 Balaton, Szt Mihály kápolna; **XM87** *No.* 1867, 1878, 2145, 11334, 11341 Balatonfenyves; *No.* 11304 Balatonmária; *No.* 11238, 11336 between Balatonmária and Balatonberény; *No.* 1921, 10077, 11330 Balatonmária-fürdő; **XM88** *No.* 1453 Badacsony; *No.* 4550 Badacsonytördemic; **XM94** *No.* 3968 Nagybajom; **XM97** *No.* 4656 Fonyódliget; **XM98** *No.* 1446 Révfülöp; **XN20** *No.* 8128 Körmend; **XN36** *No.* 5692 between Röjtökmuzsaj and Csapod; *No.* 1298 Sopronhorpács; **XN37** *No.* 14300 Hidegség; **XN45** *No.* 13053 Csáfordjánosfa; **XN58** *No.* 13093 Földsziget; **XN78** *No.* 14290 Lébényi nyíres; *No.* 13086, 13097 Tárnokréti; **XN79** *No.* 3000 Magyarkimle; *No.* 2010 Novákpuszta; **XN89** *No.* 2026 Lickópuszta; **XN99** *No.* 1264 Medve; **XP50** *No.* 6019 Várbalog; **XP60** *No.* 3935, 5596 Hegyeshalom; *No.* 2959 Lajta-csatorna; **XP60** *No.* 2022, 6003 Mosonmagyaróvár; **XP61** *No.* 1624, 1625, 3877, 3977 Rajka; **XP80** *No.* 1505, 1509, 1302 Dunaremete; **YL38** *No.* 4747 Vajszló; **YM08** *No.* 660, 718, 3008 Balatonboglár; **YM09** *No.* 1435 Balatonakali; *No.* 11254, 11348 Balatonszepezd; **YM14** *No.* 10441 Toponár; **YM29** *No.* 740, 11387 Zamárdi; **YN09** *No.* 1260 Nagybajcs; *No.* 1256 Vének; **YN14** *No.* 5523 Bakonyszentkirály; **YN19** *No.* 1126, 1251 Gönyű; **YN20** *No.* 11321 Palóznak; **YN26** *No.* 5502 Bakonyszombathely.

Genus *Octodriloides* Zicsi, 1986

Octolasium (*Purpureum*) (part.) Omodeo, 1952a Arch. zool. Ital., 37: 47.
Octolasium (*Octodrilus*) (part.): Omodeo 1956 Arch. zool. Ital., 41: 175.
Octodrilus (part.): Bouché 1972 Inst. Nat. Rech. Agron., p. 311.
Octolasium (part.): Perel 1976b Zool. Zh., 55: 834.
Octolasium (part.): Perel 1979 Range and regularities in the distr. earthworms, p. 202.
Octodrilus (part.): Zicsi 1982a Acta zool. hung., 28: 444.
Octodrilus (part.): Easton 1983 Earthworm Ecology, p. 483.
Octodriloides: Zicsi 1986 Opusc. Zool. Budapest, 22: 110.
Octodriloides: Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 436.
Octolasion (part.): Perel 1997 Earthworms of Russia, p. 60.
Octodriloides: Qiu & Bouché 1998b Doc. pedozool. integrol., 3: 203.

Type species – *Octolasium (Octodrilus) kovacevici* Zicsi, 1970 by original designation.

Diagnosis – *External*. Colour usually brown or red-violet. Head epilobous, first dorsal pore variable. Setae distantly standing. Male pore minute, shifted backwards from the segment 15, variable in position. Nephropores aligned in setal line *b*. *Internal* – Two or one pairs of testes in 10 and 11, or only in 11 enclosed in testis sacs. Seminal vesicles four, three or two pairs in 9–12, or 9, 10, 12 or 10, 12 . Spermathecae five to nine pairs open around setal lines *c*. Calciferous glands in 10–12, with lateral diverticula in 10. Last pair of lateral hearts in 11 and a pair of extraoesophageals in 12. Excretory system holonephridial. Nephridial bladders are of ocarina-shape. Longitudinal musculature is of pinnate type.

Remarks – The position of the male pore is extremely variable even within the same species. It is always minute, and could mostly be recognized only in dissected animals tracing the male duct backwards.

6.54 *Octodriloides karawankensis* (Zicsi, 1969)

(Figs. 6.54.1–2.)

***Octolasium kamnense* Baldasseroni, 1919: Zicsi 1966b Opusc. Zool. Budapest, 6: 189.**
***Octolasium (Octodrilus) kamnense*: Zicsi 1968a Opusc. Zool. Budapest, 8: 146.**
Octolasium (*Octodrilus*) *karawankense* Zicsi, 1969 Opusc. Zool. Budapest, 9: 382.
Octodrilus karawankensis: Zicsi 1982a Acta zool. hung., 28: 444.
Octodrilus karawankensis: Easton 1983 Earthworm Ecology, p. 483.
Octodriloides karavankensis (laps.): Zicsi 1986 Opusc. Zool. Budapest, 22: 107.
***Octodriloides karawankensis*: Zicsi 1991 Opusc. Zool. Budapest, 24: 179.**
Octodriloides kamnensis (part.): Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 458.
Octodriloides kamnensis (part.): Qiu & Bouché 1998a Doc. pedozool. integrol., 4: 193.

Description – *External* – Body length 58–82 mm, diameter 4–6 mm, 102–154 segments. Colour light-grey. Head epilobous, first dorsal pore in intersegmental furrow 13/14. Glandular tumescence usually on 33, 40 *a* but sometimes on 11, 22, 31, 34 *a* as well. Setae widely paired, setal arrangement after the clitellum: aa:ab:bc:cd:dd = 3.2:1.4:1.85:1:5.7. Clitellum extends on segments 30–37, saddle-shaped. Tubercles as thin bands extend at the margin of the clitellum on 30–40. Male pore hardly visible, in the region of segment 19–22 or backwards, between setae *b–c*. Nephropores constantly in setal line *b*. *Internal* – Dissepiments from 5/6–9/10 slightly thickened. Crop in 15–16, gizzards in 17–18. Two pairs of testes in 10, 11 enclosed in perioesophageal testis sacs and four pairs of vesicles in 9–12. Spermathecae seven pairs in 6/7–12/13, open inferior to setal line *c*. Calciferous glands in 10–12, with lateral diverticula in 10. Last pair of lateral hearts in 11 a pair of extraoesophageals in 12. Excretory system holonephridial. Nephridial bladders are of ocarina-shape. The cross-section of longitudinal muscle layer is of pinnate type.

Remarks – This species was described from Austria and has subsequently been reported from Yugoslavia and Hungary (Zicsi 1986). Mršić (1991) regards it as a synonym of *Oi. kamnensis* that seems to be very close to *Oi. karawankensis*. The only difference is the position of tubercles that is on 30–39 in the case of *Oi. kamnensis* and 30–40 in the case of *Oi. karawankensis*. It is to be decided whether this slight difference is enough to justify a specific status but according to Pop (1947, 1949) the tubercula pubertatis is one of the most important taxonomic character because its stability exceeds that of the clitellum. This is why we regard *Oi. karawankensis* to be a distinct species.

Distribution – *Oi. karawankensis* has a Southern-Alpine distribution occurring in SE Austria, N Italy, SW Hungary, Slovenia and Croatia (fig. 6.54.1).

Distribution in Hungary (fig. 6.54.2) **– XM24** *No.* 4150 Murarátka; **YM03** *No.* 10641 Bőszénfa; **YM12** *No.* 7297 Ropolyapuszta; **YM13** *No.* 4779, 10899 Zselicei-erdő.

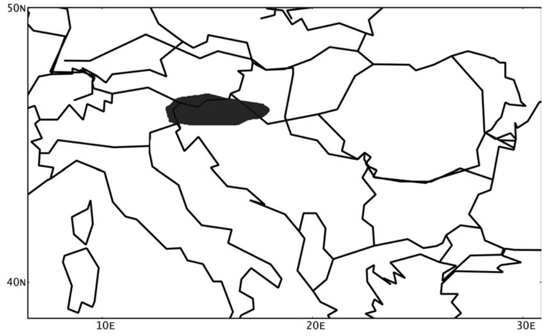

Fig. 6.54.1. Distribution of *Octodriloides karawankensis*.

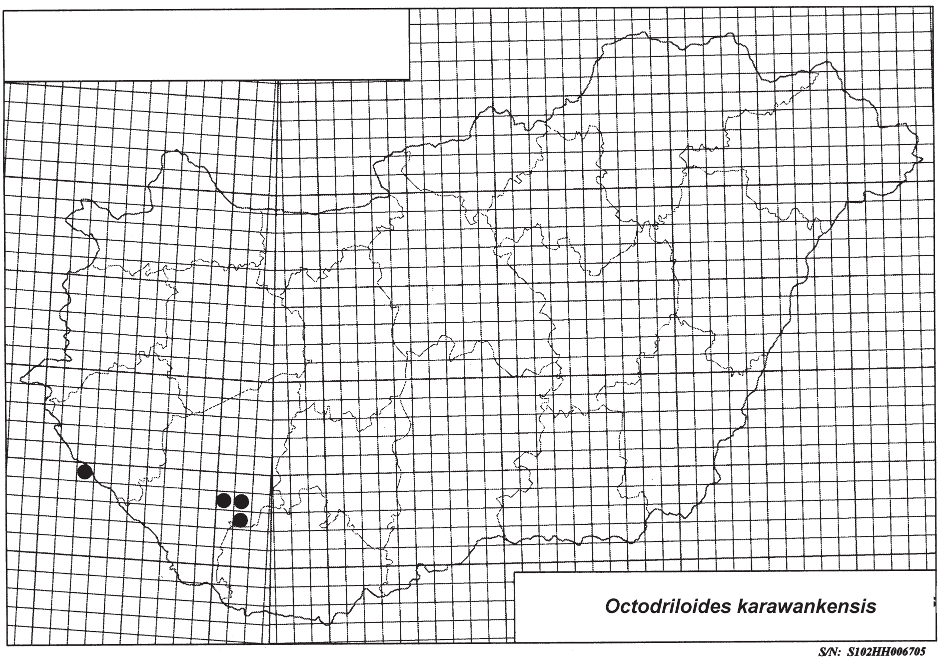

Fig. 6.54.2. Distribution of *Octodriloides karawankensis* in Hungary.

Genus *Proctodrilus* ZICSI, 1985

Helodrilus (Helodrilus) (part.): MICHAELSEN 1900a Das Tierreich, 10: 496.
Allolobophora (part.): POP 1941 Zool. Jb. Syst., 74: 518.
Allolobophora (Microeophila) (part.): OMODEO 1956 Arch. zool. Ital., 41: 184.
Allolobophora (sensu lato) (part.): BOUCHÉ 1972 Inst. Nat. Rech. Agron., p. 417.
Helodrilus (part.): PEREL 1976b Zool. Zh., 55: 833.
Helodrilus (part.): PEREL 1979 Range and regularities in the distr. earthworms, p. 179.
Allolobophora (part.): ZICSI 1982a Acta Zool. Hung., 28: 444–445.
Helodrilus (part.): EASTON 1983 Earthworm Ecology, p. 482.
Proctodrilus ZICSI, 1985 Acta zool. hung., 31: 285.
Proctodrilus: MRŠIĆ 1991 Acad. Sci. Art. Slov. (Hist. Nat.) 31: 128.
Helodrilus (part.): PEREL 1997 Earthworms of Russia, p. 53.
Proctodrilus: QIU & BOUCHÉ 1998b Doc. pedozool. integrol., 3: 209.

Type species – *Allolobophora antipae* Michaelsen, 1891 by original designation.

Diagnosis – *External* – Setae closely paired, pigmentation lacking. Prostomium epilobous, first dorsal pore around 5/6. Male pore on 15 with glandular crescent, intruding into the neighbouring segments. Spermathecae open in setal line *cd* or above close to the mid-dorsal line. Nephropores are lacking. *Internal* – Two pairs of testes free in 10, 11, and two pairs of seminal vesicles in 11, 12. Receptacula seminis two pairs situated in 9/10, 10/11. Calciferous glands with lateral diverticula in 10. Last pair of lateral hearts in 11 and a pair of extraoesophageals in 12. Excretory system holonephridial and enteronephric, nephridial bladders lacking. Nephridia behind the clitellum discharge into a common collecting canal on each side of the body (fig. 3.14B) that communicate with the intestine just before the anus. The cross-section of longitudinal muscle layer is of fasciculated type.

Remarks – Enteronephry is a well-known phenomenon among earthworms occurring in almost all families (CSUZDI 1996). In the family Lumbricidae besides *Proctodrilus* it could be observed only in *Diporodrilus* BOUCHÉ, 1970.

Table 6.11. Distinguishing characters of the *Proctodrilus* species in Hungary.

Species	Clitellum	Tubercles	Vesicles	Spermathecae	Nephridial bladders	Musculature
P. antipai	25–33	30, 31	11, 12	9/10, 10/11 *cd*	—	fasciculated
P. opisthoductus	25–33	30–31	11, 12	9/10, 10/11 M	—	fasciculated
P. tuberculatus	26–33	30/31–31/32	11, 12	9/10, 10/11 *cd*	—	fasciculated

6.55 *Proctodrilus antipai* (Michaelsen, 1891)

(Figs. 6.55.1–4.)

Allolobophora antipae Michaelsen, 1891 J. Hamb. Wiss., 8: 16.
Helodrilus (Helodrilus) antipae: Michaelsen 1900a Das Tierreich, 10: 498.
Allolobophora (Microeophila) antipai: Omodeo 1956 Arch. Zool. Ital., 41: 184.
Allolobophora cuginii helodriloides Chandebois, 1957a Bull. Soc. Zool. Fr., 82: 410.
***Allolobophora antipai* forma *typica*: Zicsi 1959b Ann. Univ. Sci. Budapest, 2: 283.**
***Allolobophora antipai* f. *typica*: Zicsi 1968a Opusc. Zool. Budapest, 8: 151.**
Allolobophora antipai antipai: Zicsi 1982a Acta zool. hung., 28: 444.
Helodrilus antipae antipae: Easton 1983 Earthworm Ecology, p. 482.
Proctodrilus antipai: Zicsi 1985a Acta zool. hung., 31: 285.
***Proctodrilus antipai*: Zicsi 1991 Opusc. Zool. Budapest, 24: 188**
Proctodrilus antipai antipai: Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 131.
Proctodrilus antipai antipai: Qiu & Bouché 1998a Doc. pedozool. integrol., 4: 197.

Description – *External* – Body length 30–50 mm, diameter 1–2.5 mm, 84–116 segments. Colour pale without any pigment. Head epilobous, first dorsal pore in 4/5. Glandular tumescence usually on 10 *cd*, 30–32 *ab.* Setae closely paired, setal arrangement after the clitellum: aa:ab:bc:cd:dd = 10.5:1.5:9:1:25. Clitellum saddle-shaped extends on segments 25 (26)–33. Squamiform tubercula pubertatis on 30, 31. Male pore on 15, great, covering the neighbouring segments as well. *Internal* – Dissepiments 6/7–9/10 thickened. Crop in 15–16, gizzards in 17–18. Two pairs of testes in 10, 11 and two pairs of seminal vesicles in 11, 12. Spermathecae two pairs in 9/10, 10/11 open in setal line *cd*. Calciferous glands in 10–12 with lateral diverticula in 10. Excretory system holonephridial and in the posterior end of the body enteronephric. Nephridial bladders lacking. Typhlosole lamelliform, longitudinal muscles are of fasciculated type (fig. 6.55.1, 6.55.2).

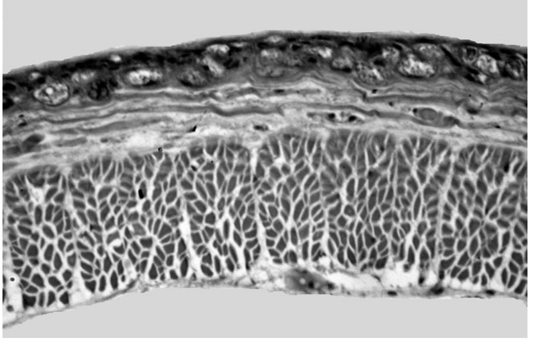

Fig. 6.55.1. Longitudinal musculature of *Proctodrilus antipai*.

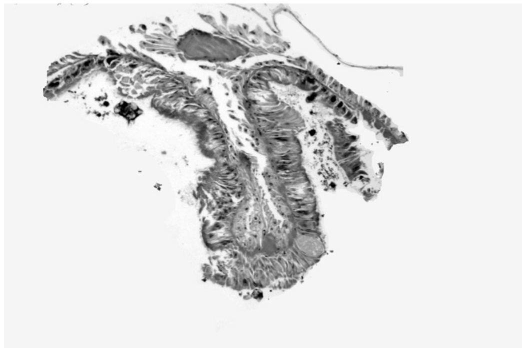

Fig. 6.55.2. Typhlosole of *Proctodrilus antipai*.

Ecology – *P. antipai* belongs to the endogeic group, living and feeding in the mineral soil layer. It occurs in extremely moist and hard clayey soil and gives preferences to calcareous substrate (Zicsi 1959b). This species defecates mainly (85 %) onto the soil. Its daily cast production 50 mg dry matter pro 1 g living weight (Zicsi 1974a).

Distribution – *P. antipai* has an expansive Central-European area (fig. 6.55.3).

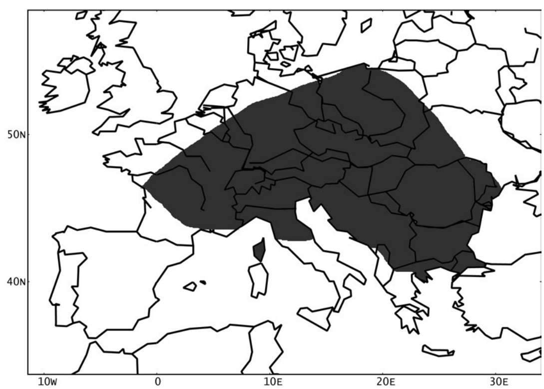

Fig. 6.55.3. Distribution of *Proctodrilus antipai*.

Distribution in Hungary (fig. 6.55.4) – **BR88** *No.* 1960 Harkány; **CS20** *No.* 1823 Bár; **CS21** *No.* 1061 Báta; **CS35** *No.* 1879 Gerjen; **CS36** *No.* 758 Duna, Paks; *No.* 1889 Dunaszentbenedek; **CS48** *No.* 808 Dunaföldvár; **CS65** *No.* 1638 Kecel; **CS84** *No.* 1680 Kiskunhalas; **CT19** *No.* 2157 Lábatlan; **CT29** *No.* 7102 Tát; **CT32** *No.* 1816 Adony; **CT39** *No.* 1154, 1484 Pilismarót; **CT56** *No.* 728 Csepel; **CT58** *No.* 1370 Szentendre; **CT77** *No.* 4488, 4507 Gödöllő; **CT79** *No.* 3268 Csővár; **CU30** *No.* 9186 Letkés; **DS28** *No.* 11730 between Tiszasas and Csépa; **DS32** *No.* 1669, 1777 Algyő; *No.* 1778, 2268 Szeged; **DT16** *No.* 4985 Jászberény; **DT22** *No.* 5335 Abony; **DT87** *No.* 2983 Tiszafüred; **DT92** *No.* 8394 Ecsegfalva; **DT94** *No.* 5323 Karcag; **DT98** *No.* 8385, 8390 Tiszacsege; **DU21** *No.* 1690, 2798 Nádújfalu; **DU55** *No.* 5538 Kelemér; **DU66** *No.* 592, 1786 Aggtelek; **DU77** *No.* 3290

Szin; *No.* 509, 3121 Szinpetri; **DU85** *No.* 520 Szendrőlád; **DU91** *No.* 4721 Sajószöged; **ES08** *No.* 1679 Vizesfás; **ET04** *No.* 3328 Püspökladány; **ET10** *No.* 5203, 5228 Nagylapos; **ET13** *No.* 5341, 5362 Báránd; **ET43** *No.* 5328 Berettyó-folyó; **ET46** *No.* 5325 Debrecen; **ET89** *No.* 3357 Nyírbátor; **EU00** *No.* 5304 Polgár; **EU43** *No.* 2109 Körtvélyes; **EU45** *No.* 3081, 3095, 3097 Sárospatak; *No.* 3509 Végardó; **EU46** *No.* 2773, 3086, 3091 Sátoraljaújhely; **EU94** *No.* 4900 Tiszakerecseny; **FU12** *No.* 4018, 4031 Kisar; *No.* 4057 Kömörő; **FU22** *No.* 4085 Túristvándi; **WM89** *No.* 12058 Felsőszölnök; **WM99** *No.* 12078 Kétvölgy; *No.* 12049 Szakonyfalu; **XM07** *No.* 8508 Velemér; **XM08** *No.* 12242 between Bajánsenye and Őriszentpéter; *No.* 12017 Őriszentpéter; *No.* 8531 Kercaszomor; **XM09** *No.* 12254 Ispánk; **XM47** *No.* 8556 Bak; **XM75** *No.* 5415 Szőkedencs; **XN25** *No.* 11437 Zsira; **XP80** *No.* 1300 Dunasziget; **YN09** *No.* 1305 Vének.

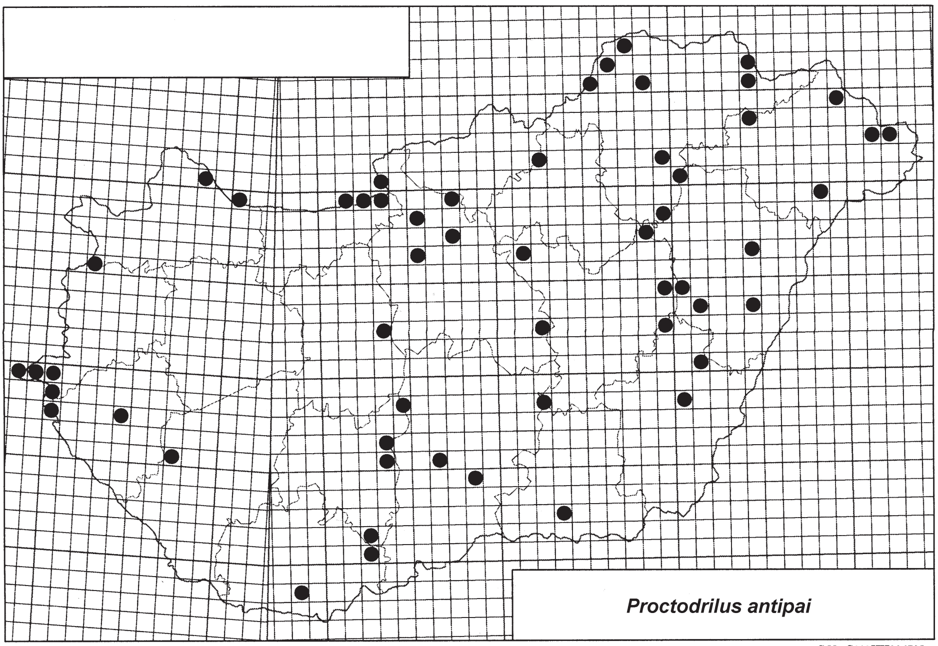

Fig. 6.55.4. Distribution of *Proctodrilus antipai* in Hungary.

6.56 *Proctodrilus opisthoductus* Zicsi, 1985

(Figs. 6.56.1–3.)

Allolobophora rosea **(part.): Zicsi 1968a Opusc. Zool. Budapest, 8: 147.**
Proctodrilus opisthoductus **Zicsi, 1985a Acta zool. hung., 31: 285.**
Proctodrilus opisthoductus: Mršić & Šapkarev 1988 Acta Mus. Mac. Sci. Nat., 19(1/154): 11.
Proctodrilus opisthoductus**: Zicsi 1991 Opusc. Zool. Budapest, 24: 188**
Proctodrilus opisthoductus: Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 130.
Proctodrilus opisthoductus: Zicsi & Michalis 1993 Acta zool. hung., 39: 303.
Proctodrilus opisthoductus: Qiu & Bouché 1998a Doc. pedozool. integrol., 4: 197.

Description – *External* – Body length 25–75 mm, diameter 2.5–3.5 mm, 60–135 segments. Colour pale without any pigment. Head epilobous, first dorsal pore in 4/5. Glandular tumescence usually on 8, 14–16 and along the clitellum *ab*, 11 *cd*. Setae closely paired, setal arrangement after the clitellum: aa:ab:bc:cd:dd = 11:1:8:1:25. Clitellum saddle-shaped extends on segments 25–33. Tubercula pubertatis strongly protuberant, on 30–31. Male pore on 15, great, covering the neighbouring segments as well. *Internal* – Dissepiments 6/7–9/10 thickened. Crop in 15–16, gizzards in 17–18. Two pairs of testes in 10, 11 covered with free sperms, and two pairs of seminal vesicles in 11, 12. Spermathecae two pairs in 9/10, 10/11 open in the mid-dorsal line. Calciferous glands in 10–12 with lateral pouches in 10. Excretory system holonephridial and in the posterior end of the body enteronephric. Nephridial bladders lacking. Longitudinal musclulature is of fasciculated type (fig. 6.56.1).

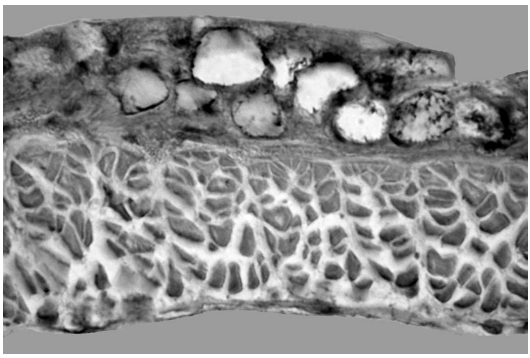

Fig. 6.56.1. Longitudinal musculature of *Proctodrilus opisthoductus.*

Ecology – *P. opisthoductus* belongs to the endogeic group, living and feeding in the mineral soil layer.

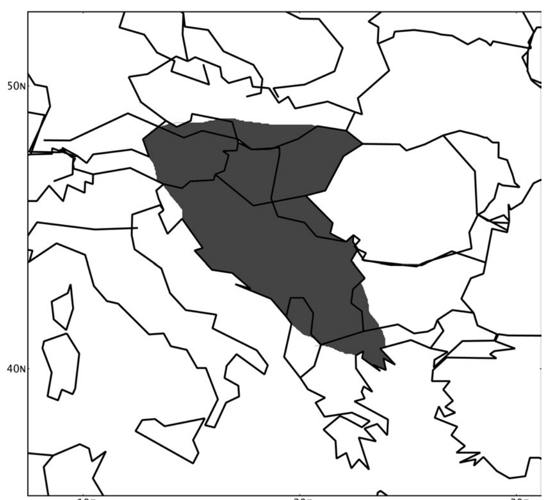

Fig. 6.56.2. Distribution of *Proctodrilus opisthoductus*.

Distribution – The exact area of this species is unknown. It is recorded for Hungary, Austria, Slovenia, Serbia and Greece (fig. 6.56.2).

Distribution in Hungary (fig. 6.56.3) – **BR98** *No.* 7310 Szársomlyó; **BS80** *No.* 10060 Pécs; **CS12** *No.* 14447 Bátaapáti; **CT05** *No.* 7269 Vértes Mts. Fáni-völgy; **CT16** *No.* 8408, 9085 Vértes Mts. Vinyabükki-völgy; **CT23** *No.* 1631 Gárdony; **CT32** *No.* 1559 Adony; **CT36** *No.* 4432 Páty; **CT37** *No.* 4395, 4405, 4410 Perbál; **CT38** *No.* 10267, 14470 Pilis Mts. Kétbükkfa-nyereg; **CT48** *No.* 4188 Pilis Mts. Bükki-puszta; *No.* 10354, 10360 Pilis Mts. Király-patak; *No.* 12775 Pilisszentkereszt; **CT49** *No.* 10313, 10316 Pilismarót, Hoffman-kunyhó; **CT58** *No.* 9984 Pilis Mts. Királykuti-kunyhó; **CU30** *No.* 2070, 2078 Letkés; **CU50** *No.* 5234, 7601, 7995, 10461, 10475, 10487, 10574 Szendehely; **CU61** *No.* 5242 Rétság; **CU72** *No.* 5281 Ipolyszög; **CU93** *No.* 5260 Ludányhalászi; **CU94** *No.* 5267 Litke; **DS37** *No.* 5194 Csongrád; **DS38** *No.* 10560 Csépa; **DS71** *No.* 979 Kövegy; **DS82** *No.* 927, 933, 956, 1188, 5641 Mezőhegyes; **DT16** *No.* 4986 Jászberény; **DT26** *No.* 4982 Jászjákóhalma; **DT49** *No.* 4258, 4452, 5569, 10209 Kápolna; **DT63** *No.* 5348 Szapárfalu; **DU01** *No.* 9108 Sámsonháza; **DU02** *No.* 9092 Lucfalvai elágazás; **DU03** *No.* 5250 Karancslapujtő; **DU22** *No.* 5897 Bárna; **DU23** *No.* 9101 Cered; **DU55** *No.* 4570 Serényfalva; **DU93** *No.* 4995 Szikszó; **ET13** *No.* 5360 Báránd; **ET43** *No.* 5352 Berettyóújfalu; **ET44** *No.* 5365 Derecske; **WM99** *No.* 4707 Szakonyfalu; **XM17** *No.* 11540 Kálócfa; **XM18** *No.* 8528 Csöde; **XM19** *No.* 12040 Viszák; **XM43** *No.* 14274 Molnári; **XM78** *No.* 2059, 2124, 4795, 7357 Keszthely; **XM79** *No.* 1840 Zalaszántó; **XM88** *No.* 4538 Badacsonytördemic; *No.* 14347 Szigliget; **XN45** *No.* 13055 Csáfordjánosfa; **XN79** *No* 2009 Novákpuszta; **XN89** *No.* 2029 Lickópuszta; **XP61** *No.* 1603, 1616, 1619 Rajka; **YN26** *No.* 5507 Bakonyszombathely.

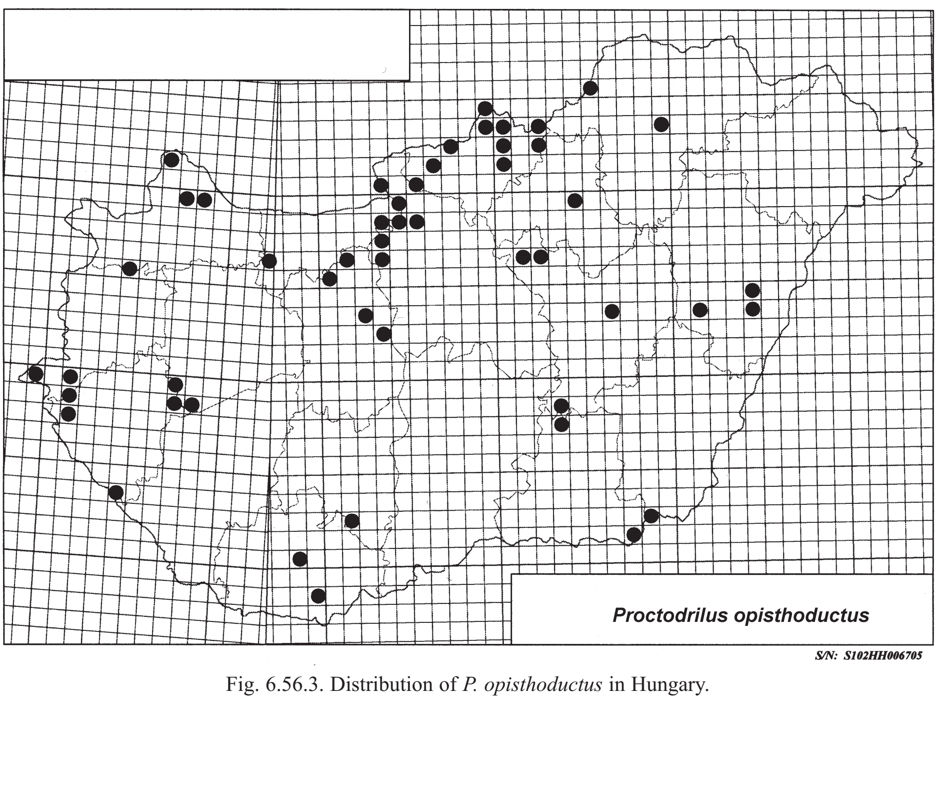

Fig. 6.56.3. Distribution of *P. opisthoductus* in Hungary.

6.57 *Proctodrilus tuberculatus* (Černosvitov, 1935)

(Figs. 6.57.1–4.)

Eophila antipae var. *tuberculata* Černosvitov, 1935 Arch. Prirod. Cech., 19: 58.
Allolobophora Antipai f. *typica*: (part.) Pop 1949 Anal. Acad. R.P.R., 1(9): 434.
***Allolobophora antipai* v. *tuberculata*: Zicsi 1959a Acta zool. hung., 5: 438.**
***Allolobophora antipai* var. *tuberculata*: Zicsi 1959b Ann. Univ. Sci. Budapest, 2: 285.**
***Allolobophora antipai* v. *tuberculata*: Zicsi 1968a Opusc. Zool. Budapest, 8: 151.**
Helodrilus antipai var. *tuberculatus*: Perel 1976b Zool. Zh., 55: 833.
Helodrilus antipae f. *tuberculata*: Perel 1979 Range and regularities in the distr. earthworms, p. 180.
Allolobophora antipai tuberculata: Zicsi 1982a Acta zool. hung., 28: 444.
Helodrilus antipae tuberculatus: Easton 1983 Earthworm Ecology, p. 482.
Proctodrilus tuberculatus: Zicsi 1985a Acta zool. hung., 31: 285.
***Proctodrilus tuberculatus*: Zicsi 1991 Opusc. Zool. Budapest, 24: 188**
Proctodrilus antipai tuberculatus: Mršić 1991 Acad. Sci. Art. Slov. (Hist. Nat.), 31: 134.
Proctodrilus antipai tuberculata: Qiu & Bouché 1998a Doc. pedozool. integrol., 4: 197.

Description – *External* – Body length 45–60 mm, diameter 2–2.5 mm, 89–130 segments. Colour pale without any pigment. Head epilobous, first dorsal pore in 4/5–8/9. Glandular tumescence usually on 12, 26–32 *ab*. Setae closely paired, setal arrangement after the clitellum: aa:ab:bc:cd:dd = 10.4:1.2:7.2:1:24. Clitellum saddle-shaped extends on segments 25, (26)–33. Two pairs of squamiform tubercula pubertatis in 30/31 and 31/32. Male pore on 15, great, covering the neighbouring segments as well. *Internal* – Dissepiments 5/6–8/9 thickened. Crop in 15–16, and gizzards in 17–18. Two pairs of testes in 10, 11 and two pairs of seminal vesicles in 11, 12. Spermathecae two pairs in 9/10, 10/11 open in setal line *cd*. Calciferous glands in 10–12 with minute lateral pouches in 10. Excretory system holonephridial and in the posterior end of the body enteronephric. Nephridial bladders lacking. Typhlosole bilobate, longitudinal muscles are of fasciculated type (fig. 6.57.1, 6.57.2).

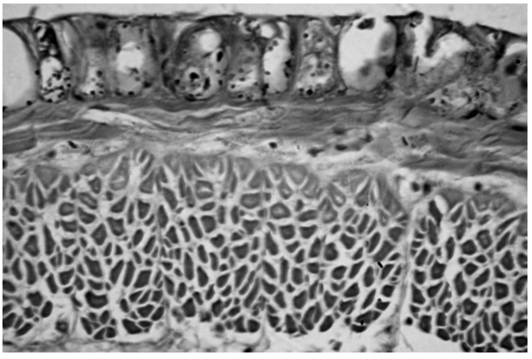

Fig. 6.57.1 Longitudinal musculature of *Proctodrilus tuberculatus.*

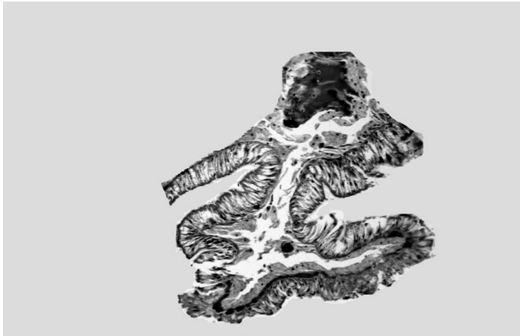

Fig. 6.57.2. Typhlosole of *Proctodrilus tuberculatus*.

Ecology – *P. tuberculatus* belongs to the endogeic group, living and feeding in the mineral soil layer. It prefers moist soils, but its drought tolerance is somewhat higher than that of *P. antipai* (Zicsi 1959b). This species defecates largely (95 %) onto the soil. Its daily cast production 56 mg dry matter pro 1 g living weight (Zicsi 1974a).

Distribution – *P. tuberculatus* has an expansive Trans-Aegean distribution occurring from the West Caucasus to France in east and Germany to north (fig. 6.57.3).

Fig. 6.57.3. Distribution of *Proctodrilus tuberculatus*.

Distribution in Hungary (fig. 6.57.4) – **BS80** *No.* 1969 Pécs; **BS87** *No.* 1674 Iregszemcse; **BS89** *No.* 11394 Balatonszabadi; **BS96** *No.* 1671 Tamási; **CR29** *No.* 1780 Mohács; **CS09** *No.* 1672 Dég; **CS18** *No.* 3043 Cece; **CS34** *No.* 1904 Fajsz; **CS35** *No.* 1880 Gerjen; **CS36** *No.* 759 Paks; *No.* 1890 Dunaszentbenedek; **CS41** *No.* 4855 Máriakönnye; **CS42** *No.* 1055 Érsekcsanád; **CS46** *No.* 1907 Ordas; **CS47** *No.* 1021 Bölcske; *No.* 1901 Harta; **CS48** *No.* 541, 635, 804, 1868, 3022 Dunaföldvár; **CS50** *No.* 5021 Bácsborsod; **CS77** *No.* 11554, 11622, Páhi; **CS84** *No.* 1676 Kiskunhalas; **CT09** *No.* 1171 Süttő; **CT19** *No.* 1090, 1160 Nyergesújfalu; **CT23** *No.* 1633 Gárdony; **CT32** *No.* 1551, 1979 Adony; **CT34** *No.* 1673 Martonvásár; **CT39** *No.* 1485 Pilismarót; *No.* 1922 Esztergom; **CT41** *No.* 682 Kulcs; **CT43** *No.* 2155 Ercsi; *No.* 599 Sinatelep; **CT49** *No.* 1077, 1133, 1142 Dömös; *No.* 1148 Pilismarót; *No.* 1084 Szob; *No.* 1070, 1073 Visegrád; *No.* 1317, 1318, 1322 Zebegény; **CT56** *No.* 782 Csepel; **CT57** *No.* 1544 Budakalász;

CT58 *No*. 2821 Alsógöd; *No*. 1367, 1469, 1473, 1489, 1499, 11755 Szentendre; **CT59** *No*. 1528, 1533 Dunabogdány; *No*. 1665 Tahi **CT75** *No*. 4955 Maglód; **CT77** *No*. 4487, 4508, 5550, 5644, 5885 Gödöllő; **CT79** *No*. 3247 Csővár; **CT85** *No*. 4963 Mende; **CT87** *No*. 3065 Bag, Petőfi-forrás; **CU30** *No*. 2077 Letkés; **CU71** *No*. 8981 between Szente and Magyarnándor; **CU82** *No*. 5264 Őrhalom; **DS32** *No*. 1675, 2037, 3155 Szeged; **DT02** *No*. 5339 Cegléd; **DT16** *No*. 4977 Jászberény; **DT22** *No*. 5216 Abony; **DT49** *No*. 5571, 7129, 10208 Kápolna; **DU02** *No*. 9088 Lucfalvai elágazás; **DU12** *No*. 5889 Mátraszele; **DU21** *No*. 7215 Nádújfalu; **DU32** *No*. 5665 Szentdomonkos; *No*. 2896 Tarnalelesz; **DU43** *No*. 2873, 7384 Borsodnádasd; **DU50** *No*. 5179 Eger; **DU51** *No*. 8562 Szarvaskő, Teréz-forrás; **DU77** *No*. 3876 Vecsem-forrás; **DU86** *No*. 1725 Szalonna; **ET51** *No*. 5397 Ártánd; **EU26** *No*. 4227 Regéc; **EU46** *No*. 3484 Köveshegy; **EU83** *No*. 3640 Lövőpetri; *No*. 3643 Szabolcsbáka; **FU01** *No*. 4074, 14353 Tunyogmatolcs; **FU03** *No*. 14374, 14339 Jánd; **FU12** *No*. 4104 Kömörő; *No*. 4040, 14384 Tivadar; **FU22** *No*. 4879 Tiszacsécse; **WM89** *No*. 12059 Felsőszölnök; **WM99** *No*. 3156 Szakonyfalu; **XL99** *No*. 4764 Drávatamási; **XM07** *No*. 8543 Gödörháza; *No*. 8520, 8507 Velemér; **XM08** *No*. 12083 Őriszentpéter; **XM09** *No*. 8533 Orfalu; **XM17** *No*. 11539 Kálócfa; **XM18** *No*. 8522 Csöde; **XM19** *No*. 12039 Viszák; **XM24** *No*. 4113, 4127, 4143, 4147, 9115 Murarátka; **XM25** *No*. 9143 Dobri; *No*. 9127, 9133 Szemenyecsörnye; *No*. 5436 Tormafölde; **XM35** *No*. 14479 Lispeszentadorján; **XM43** *No*. 14275 Molnári; **XM44** *No*. 14308 Semjénháza; **XM47** *No*. 8555 Bak; **XM53** *No*. 9153 Surd; **XM59** *No*. 1670, 1678 Kehida; **XM62** *No*. 9165 Csurgónagymárton; **XM63** *No*. 9173 Somogycsicső; **XM69** *No*. 2866 Vidornyaszőllös; **XM70** *No*. 4770 Heresznye; **XM78** *No*. 1677, 2058, 2140 Keszthely; **XM88** *No*. 4548 Badacsonytördemic; *No*. 14348 Szigliget; **XN18** *No*. 5712 Tómalom; **XN25** *No*. 11428, 11434 Zsira; **XN36** *No*. 900, 1332, 1339, 1341, 1348 Sopronhorpács; **XN46** *No*. 5688 Csapod; **XN47** *No*. 916 Petőháza; **XN98** *No*. 11605 Győr; **XN99** *No*. 1261, 1311 Medve; **XP60** *No*. 2018 Lajta; *No*. 6000 Mosonmagyaróvár; **XP61** *No*. 1617, 1620, 1621, 3981 Rajka; **XP71** *No*. 1503 Dunasziget; **XP80** *No*. 12783 Cikolasziget; *No*. 1301 Dunaremete; **YL37** *No*. 4752 Vejti; **YM03** *No*. 7156, 10436 Bőszénfa; *No*. 7177 Dennapuszta; **YM12** *No*. 7302 Zselickisfalud; *No*. 9217, 7170, 7291, 10569 Ropolyapuszta; *No*. 2950 Simonfa; **YM13** *No*. 10448 Zselicszentpál; *No*. 2928, 2917, 10430 Zselice; **YM14** *No*. 10444 Toponár; **YM29** *No*. 12401 Balatonendréd; **YN09** *No*. 1258, 1309 Nagybajcs; *No*. 1254, 1304, 11848 Vének; **YN19** *No*. 1131, 1250 Gönyü.

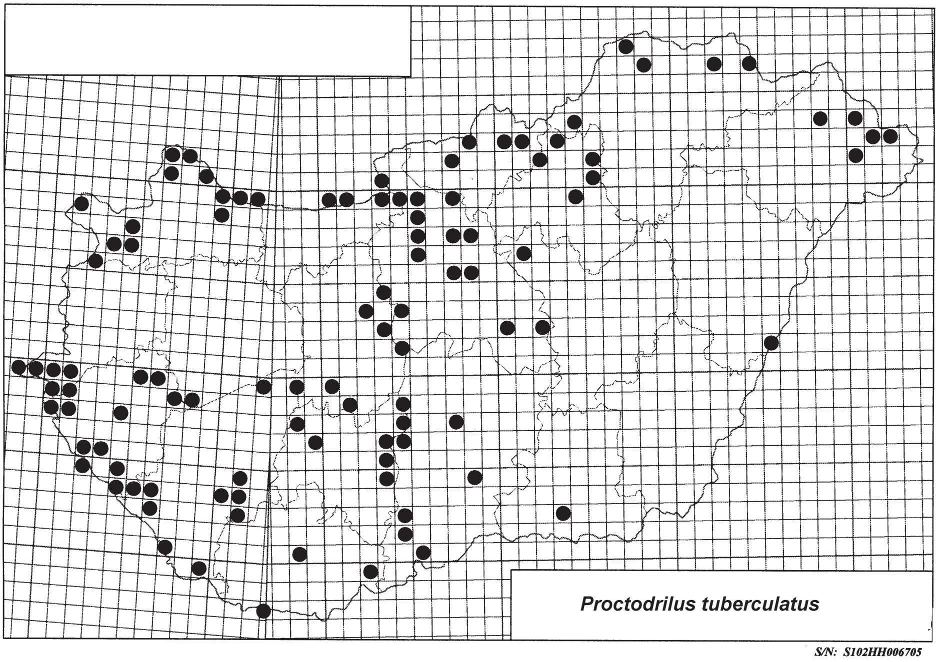

Fig. 6.57.4. Distribution of *Proctodrilus tuberculatus* in Hungary.

7. BIOGEOGRAPHIC ANALYSIS OF THE HUNGARIAN EARTHWORM FAUNA

The large disjunctions in the distribution of different earthworm families were yet observed in the last century (MICHAELSEN 1903, 1911), and MICHAELSEN (1921) was one of the first supporters of WEGENER's theory of the continental drift. The scattered distributions of these sedentary animals could hardly be explained but passively moving with the drifting continental fragments (OMODEO 1963, 2000, SIMS 1980) because natural spreading is limited to a great extent. The anemochor or biochore dispersal (UDVARDY 1969) is also impossible owing to susceptibility to desiccation (SIMS 1980).

It follows from the foregoing that earthworms would have to be one of the most important groups to reconstruct the biogeographic history of different regions (BROWN & GIBSON 1983, JAMES 1998). In spite of this fact, relatively few work deal with the biogeography of earthworms (MICHAELSEN 1903, 1911, 1921, 1933, OMODEO 1952b, 1963, 2000, SIMS 1980) and especially little work has been done to understand the distribution of lumbricids (GATES 1966, 1976b, MRŠIĆ 1991, OMODEO 1952b, 1961, OMODEO & ROTA 1999, POP 1949, ZAJONC 1965).

It was MICHAELSEN (1902b, 1903) who first recognized that the distribution area of endemic species is localized apart from the southern border of the Quaternary ice sheet (fig. 7.1). To the north of this line only peregrine species are found suggesting that the ice cover completely destroyed the indigenous earthworm fauna, and the repopulation has taken place by inadvertent introduction by man. This introduction might have begun even in the prehistoric period (MICHAELSEN 1903, PEREL 1979). Supporting this view JAMES (1998) using the experimental data of MARINISSEN & VAN DEN BOSCH (1992) predicted a 100–200 km natural range expansion capability of earthworm species since the time of the last glacial maximum. Therefore the characteristic distribution types of the endemic earthworm species should not be inerpreted by the range regression-expansion dynamism caused by the ice age that is more plausible for vagile animals such as for example the butterflies (DE LATTIN 1967, VARGA 1977).

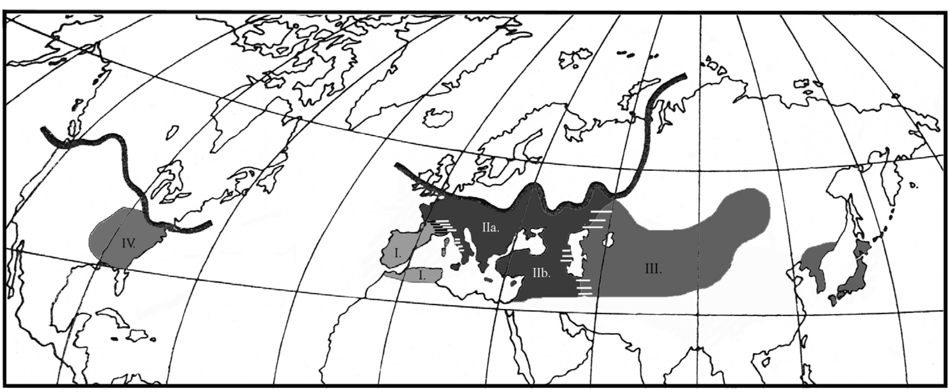

Fig. 7.1. Distribution of the endemic species of Lumbricidae in the Holarctis. The solid lines represent the southern border of the ice sheet during the last glaciation (Wisconsin, Würm). ***I.*** Franco-Iberian domain, ***IIa***. North-Aegean subdomain, ***IIb***. South-Aegean subdomain, ***III.*** Turanian–Far-Eastern domain, ***IV.*** North-American domain.

Omodeo (1952b, 1961) pointed out that the distribution patterns of the endemic species could be connected to the tertiary land masses as distribution centres and on the basis of these four main distribution types (faunal elements) may be distinguished. An Alpine-Illyric-Carpathian type connected to the former North-Aegean land masses, a Syrian-Anatolian-Aegean type proper to the former South Aegean land masses, a Caucasian-Alpine-Syrian-Aegean type with a mixed north-south-Aegean distribution and a North-South-Western European type covering Europe west of the Alpine arc. This division has later been complemented with the Central-European distribution type by Zajonc (1965), and the mixed north-south Aegean was renamed to Trans-Aegean type (Perel 1979).

Mršić (1991) by taking into account the up-to-date paleogeographic scenarios critically analysed the biogeographic patterns of lumbricid earthworms and connected the development of different genera to the proposed isolated tertiary land masses. According to him the genera *Healyella*, *Spermophorodrilus* and *Dendrobaena* appeared on the Southern Aegean land masses, the genera *Karpatodinariona*, *Alpodinaridella*, *Microeophila*, *Octodrilus* and *Octodriloides* evolved on the Nothern Aegeids, the genus *Eisenia* on the Asian plate, the genera *Aporrectodea*, *Lumbricus* in Western Europe and the genus *Bimastos* in North America. Mršić (1991) severely criticized Omodeo (1952b, 1988) who placed phylogenetically divergent species into the genus *Eophila* and *Scheroteca* that led to a misleading zoogeographical conclusion. We have to agree with Mršić in this respect and also with Omodeo (2000) citing Sluys (1992) that “historical biogeographic analysis depends on good taxonomy”. Therefore, without a thorough taxonomic and phylogenetic revision of lumbricid genera (cf. Chapter 4) a biogeographic conclusion based on the distribution of different genera might easily be misleading.

Bearing this in mind herewith we try to summarize the biogeographic patterns of earthworms with special interest to the Hungarian fauna.

In the distribution area of endemic earthworms four great domains may be recognized (fig. 7.1).

I. Franco–Iberian domain (Iberian Peninsula, France west from the alps, Sardinia, Corsica, South-West Italy, Atlas Mts.) is characterised by a number of unique earthworm groups such as Hormogastridae, Ailoscolecidae, *Diporodrilus*, *Prosellodrilus* (sensu Qiu & Bouché 1998a), *Kritodrilus* (sensu Zicsi & Csuzdi 1999), *Allolobophora* (s.l.) *molleri-moebii* gr. ect.

II. Aegean domain (Europe from the Alps to the Ural Mts., Anatolia, Levant and Mesopotamia) is characterised by the genera of *Octodrilus, Octodriloides*, *Cernosvitovia Fitzingeria* and *Dendrobaena*.

III. Turanian–Far-Eastern domain (from the Turanic Basin to the Sajan Mts., Korean Peninsula and Japan) is characterised by the species of the genera *Eisenia* (s. str., excluding the species with fasciculated musculature) and *Perelia.*

IV. North-American domain is characterised by the genera *Eisenoides* and *Bimastos* (s. str.).

It is remarkable, that the *Franco–Iberian* domain is quite homogeneous and rather separate from the others accommodating especial families of Lumbricoidea such as Hormogastridae and Ailoscolecidae. It might be explained by the early separation (from the Middle Cretaceous to the Early Tertiary) of the Iberian Peninsula from the rest of Europe (fig. 7.2).

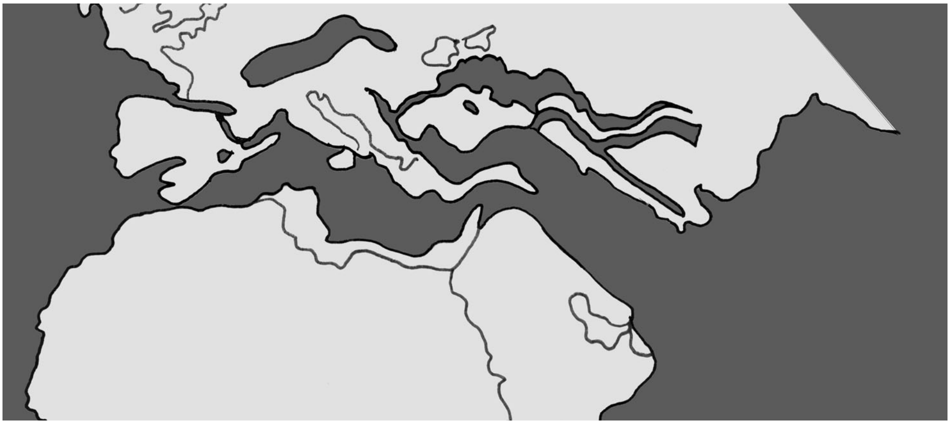

Fig. 7.2. Paleogeographic reconstruction of the early Paleogene (ca. 65 Ma) (after HAY et al. 1999).

On the contrary, the *Aegean domain* is rather heterogeneous but a number of Trans-Aegean species (distribution type No. 3 by Omodeo 1952b (fig. 7.3) attest to the close paleogeographical and biogeographical relationships of the Northern and Southern Aegeids (OMODEO & ROTA 1999). Nevertheless, remarkable differences do exist so the distinction of a North- and South-Aegean sub-domain is reasonable. The North-Aegean sub-domain consists of Central- and Eastern-Europe, and characterised by the high diversity of *Octodrilus* and *Octodriloides* species. The South-Aegean sub-domain covers Anatolia, the Caucasus Mts. The Levant, Mesopotamia and characterised by the *Healyella* (*Bimastos* sensu lato) genus and the *Eisenia* (s.l.) *grandis* species group (OMODEO and ROTA 1999).

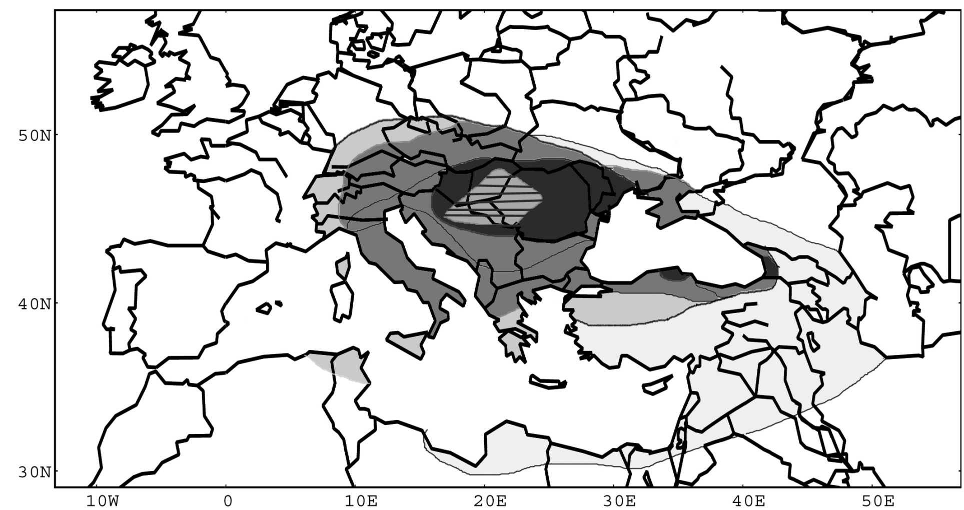

Fig. 7.3. Distribution of Trans-Aegean species.

The *Turanian–Far-Eastern domain* is quite distinct and relatively poor in species. Most of the Aegean genera are missing and the dominance of the *Perelia* and *Eisenia* species is obvious. This relative poorness in species might be interpreted by the disappearance of the arcto-tertiary forest belt due to the global cooling and the increasing aridity as a consequence of the uplift of the Tibetan plateau (Guthrie 2001).

The origin of the Lumbricid fauna of the *North American domain* has widely been debated (Omodeo 1963, Gates 1966, 1976a). According to contemporary views (Reynolds 1995, James 1998) the majority of Lumbricid species in North America is introduced by man. These introductions might have begun in the 17th century (Gates 1966) and persist even today (Csuzdi & Szlávecz 2003). The only exceptions are the representatives of the genera *Bimastos* (s. str.) and *Eisenoides* that are thought to be endemic in North America. Unfortunately the phylogenetic affinities of these genera have not yet been assessed but according to the shape and orientation of the nephridial bladders both genera belong to the so-called eastern group (Mršić 1991), e.g. possessing ahead bent nephridial bladders, suggesting affinities with the groups of the Aegean domain.

In analysing the Hungarian earthworm fauna, among the autochtonous species we have found almost exclusively Aegean species (Table 7.1). The only exceptions are *Ap. georgii* and *D. cognetii* showing a typical Atlanto-Mediterranean distribution (fig. 6.10.3, 6.20.1) covering partly the Franco-Iberian and the Aegean domains, but in the case of *D. cognettii* some taxonomic uncertainties exist. First, similarly to *Murchieona minuscula* (Rosa, 1905) the populations in Greece and Italy possess somewhat different clitellar position from that of the northern populations. Second, the generic affiliation of this species is ambiguous because its nephridial bladders are J-shaped oriented caudad in the first several segment and bilobous after the clitellum that is completely different from that of *Dendrobaena octaedra*, the type species of genus *Dendrobaena*.

The true Aegean species according to their area may be assorted into several well-demarcated distributional groups (faunal elements). The Trans-Aegean distribution (No. 3 acc. Omodeo 1952b), a rather characteristic area-type of the Hungarian earthworms, are represented by the species *A.* (s. l.) *leoni*, *Ap. dubiosa*, *Ap. handlirschi*, *Ap. jassyensis*, *Oc. transpadanus* and *P. tuberculatus*. It is noteworthy that most of these species are hygrophilous and frequently found on the banks of streams, rivers and lakes (fig. 7.4), so in this case the passive hydrochore distribution could not be excluded. If this is the case, this type of distribution may be connected with the pluvial periods of the Quaternary ice age and is rather novel. The other interesting phenomenon of the Trans-Aegean distribution is the strong similarity (by the shape of the area) with the Ponto-Mediterranean distribution of the vagile animals, like butterflies (Varga 1977). However, this is only an apparent similarity because the underlying processes leading to this area form are completely different. In the first case the origin of the distribution is connected to the Quaternary either by hydrochore dispersal or by a regression from a wider distribution in connection with the global shrinking of forests. In the second case the area-type originated after the ice age by dispersal from the Ponto-Mediterranean refuge (dispersal centre).

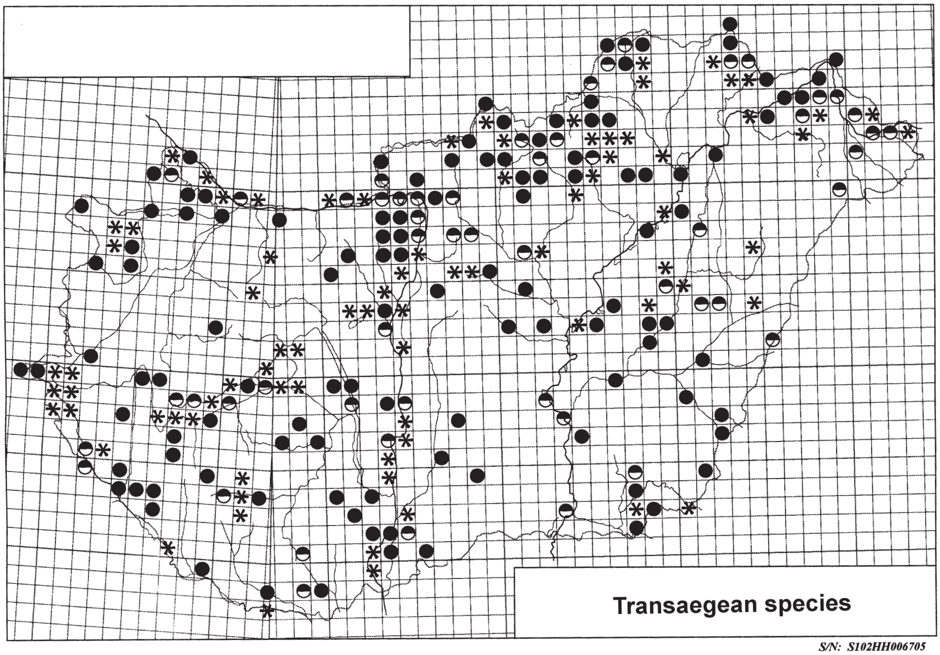

Fig. 7.4. Distribution of Trans-Aegean species in Hungary. The solid circle represents one, the asterisk two and the half circle three or more species present in the UTM quadrate.

An other major distribution type of the Hungarian earthworms is the Central-European. It roughly agrees with the Alpine-Illyric-Carpathian type of OMODEO (1952b) but contains only species distributed almost evenly in the central part of Europe. *P. opisthoductus* and *P. antipai* are attributed to this group with question because the first one has recently been described and its true distribution is not exactly known, while the second one is distributed far beyond the glaciation border that indicates a possible introduction. Apart from these two species all the others represent forest elements (*L. polyphemus F. platyura platyura, F. platyura depressa, F. platyura montana* are anecic; *E. lucens* and *E. spelaea* are epigeic). Although primary forests do (or in most cases did) occur in the Hungarian Plain, these species are missing from this region (fig. 7.5). In case of the epigeic species it is probably due to the unfavorable climatic conditions while in the case of anecic species this might be in connection with the lack of hornbeam in the lowland-forests (fig. 7.6), being essential for these large-bodied earthworms (ZICSI 1983a).

The Eastern-Alpine species have a much more restricted range than that of the Central-European ones. They are distributed from Tirol to the Eastern-Carpathians in the mountainous area of North-Central-Europe (fig. 7.7). These species (table 7.1) are forest elements, in Hungary found only besides the Hungarian Plane (fig. 7.8).

The Southern-Alpine distribution differs from the Eastern-Alpine one in its center of distribution situated on the south-eastern edge of the Alps, and these species are missing from Upper- and Lower Austria (Ober and Nieder-Österreich) (fig. 7.9). In Hungary these species (table 7.1) are living in the western and south-western part of the country where the yearly precipitation exceeds 700 mm (fig. 7.10).

Table 7.1. Distribution types of the Hungarian earthworm fauna

Distribution type	Species
Peregrine	*Allolobophora chlorotica* (Savigny, 1826)
	Aporrectodea caliginosa (Savigny, 1826)
	Aporrectodea longa (Ude, 1885)
	Aporrectodea rosea (Savigny, 1826)
	Dendrobaena hortensis (Michaelsen, 1890)
	Dendrobaena octaedra (Savigny, 1826)
	Dendrobaena veneta veneta (Rosa, 1886)
	Dendrodrilus rubidus rubidus (Savigny, 1826)
	Dendrodrilus rubidus subrubicundus (Eisen, 1874)
	Eisenia fetida (Savigny, 1826)
	Eiseniella tetraedra (Savigny, 1826)
	Lumbricus castaneus (Savigny, 1826)
	Lumbricus rubellus Hoffmeister, 1843
	Lumbricus terrestris Linneaus, 1758
	Octolasion lacteum (Örley, 1881)
Peregrine / Atlantic origin	*Allolobophoridella eiseni* (Levinsen, 1884)
	Aporrectodea longa (Ude, 1885)
	Lumbricus castaneus (Savigny, 1826)
	Octolasion cyaneum (Savigny, 1826)
Atlanto-Mediterranean	*Aporrectodea georgii* (Michaelsen, 1890)
	Dendrobaena cognettii (Michaelsen, 1903)
Trans-Aegean	*Allolobophora (s.l.) leoni* Michaelsen, 1891
	Aporrectodea (s.l.) dubiosa (Örley, 1881)
	Aporrectodea handlirschi (Rosa, 1897)
	Aporrectodea jassyensis (Michaelsen, 1891)
	Octodrilus transpadanus (Rosa, 1884)
	Proctodrilus tuberculatus (Černosvitov, 1935)
Central-European	*Fitzingeria platyura platyura* (Fitzinger, 1833)
	Fitzingeria platyura depressa (Rosa, 1893)
	Fitzingeria platyura montana (Černosvitov, 1932)
	Eisenia lucens (Waga, 1857)
	Eisenia spelaea (Rosa, 1901)
	Lumbricus polyphemus (Fitzinger, 1833)
	?Proctodrilus antipai (Michaelsen, 1891)
	?Proctodrilus opisthoductus Zicsi, 1985
Eastern-Alpine	*Dendrobaena auriculata* (Rosa, 1897)
	Dendrobaena vejdovskyi (Černosvitov, 1935)
	Lumbricus baicalensis Michaelsen, 1900
	Octolasion montanum (Wessely, 1905)
	Octodrilus pseudolissaensioides Zicsi, 1994
Southern-Alpine	*Allolobophora (s.l.) nematogena* Rosa, 1903
	Aporrectodea sineporis (Omodeo, 1952)
	Octodriloides karawankensis (Zicsi, 1969)
Illyric	*Dendrobaena ganglbaueri* (Rosa, 1894)
	Octodrilus pseudotranspadanus (Zicsi, 1971)
Vindobonic	*Allolobophora (s.l.) hrabei* (Černosvitov, 1935)
	Helodrilus deficiens Zicsi, 1985
Dacian	*Allolobophora (s.l.) dacica* (Pop, 1938)
	Allolobophora (s.l.) mehadiensis mehadiensis Rosa, 1895
	Cernosvitovia (Zicsiona) opisthocystis? (Rosa, 1895)
	Dendrobaena clujensis Pop, 1938
	Octodrilus compromissus Zicsi & Pop, 1984
	Octodrilus gradinescui (Pop, 1938)
Endemics	*?Allolobophora (s.l.) gestroides* Zicsi, 1970
	Octodrilus lissaensioides (Zicsi, 1971)
	Octolasion lacteovicinum Zicsi, 1968
	Helodrilus mozsaryorum (Zicsi, 1974)
Unclear type	*Eisenia balatonica* Pop, 1943
	Helodrilus cernosvitovianus (Zicsi, 1967)

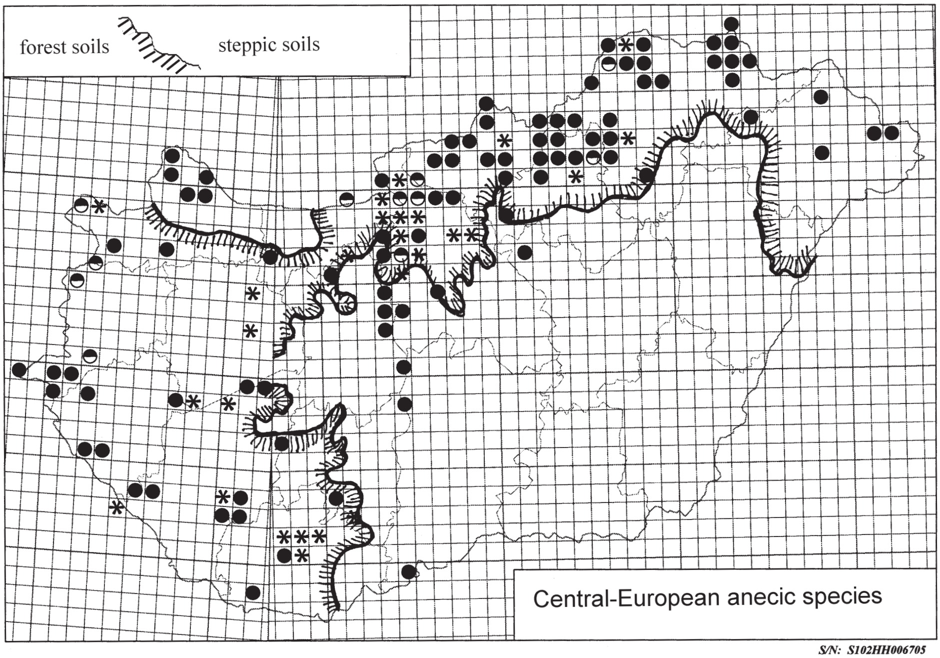

Fig. 7.5. Distribution of the Central-European anecic species in Hungary. The solid circle represents one, the asterisk two and the half circle three or more species present in the UTM quadrate in question.

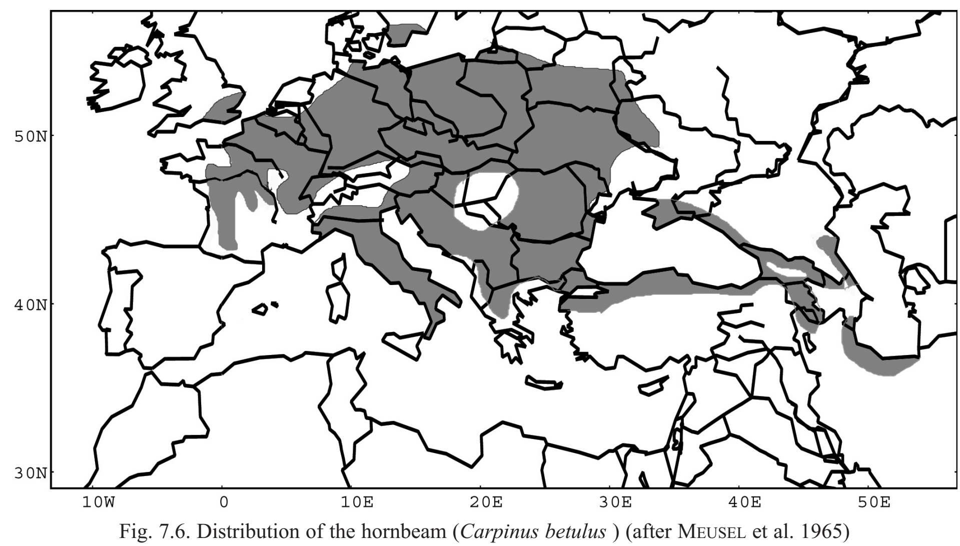

Fig. 7.6. Distribution of the hornbeam (*Carpinus betulus*) (after MEUSEL et al. 1965)

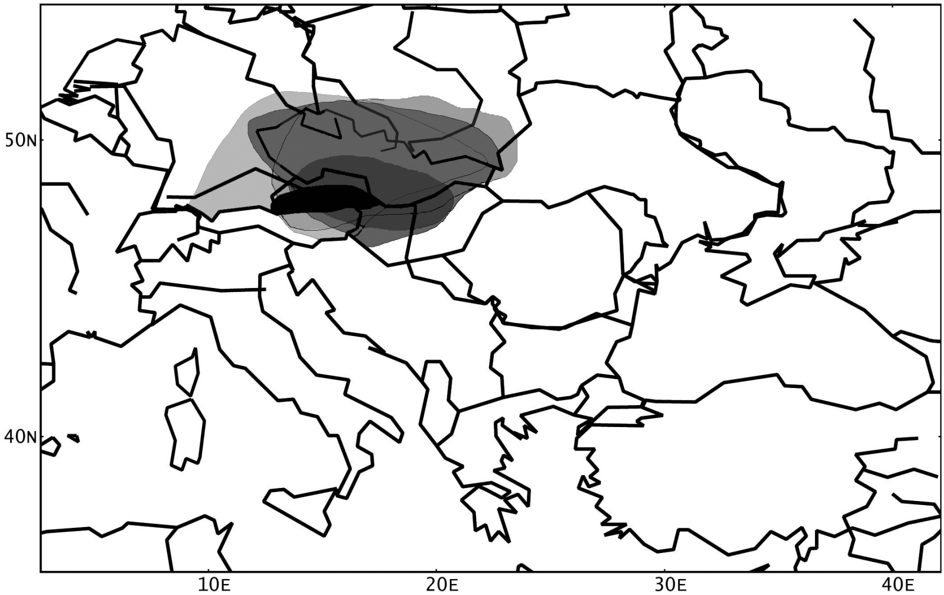

Fig. 7.7. Distribution of the Eastern-Alpine species.

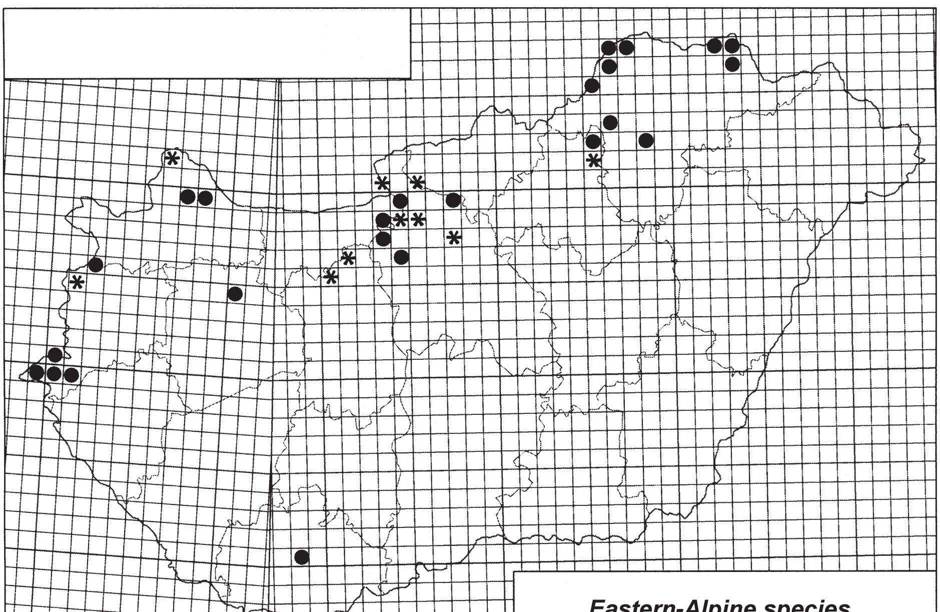

Fig. 7.8. Distribution of the Eastern-Alpine species in Hungary. The solid circle represents one, the asterisk two species present in the UTM quadrate.

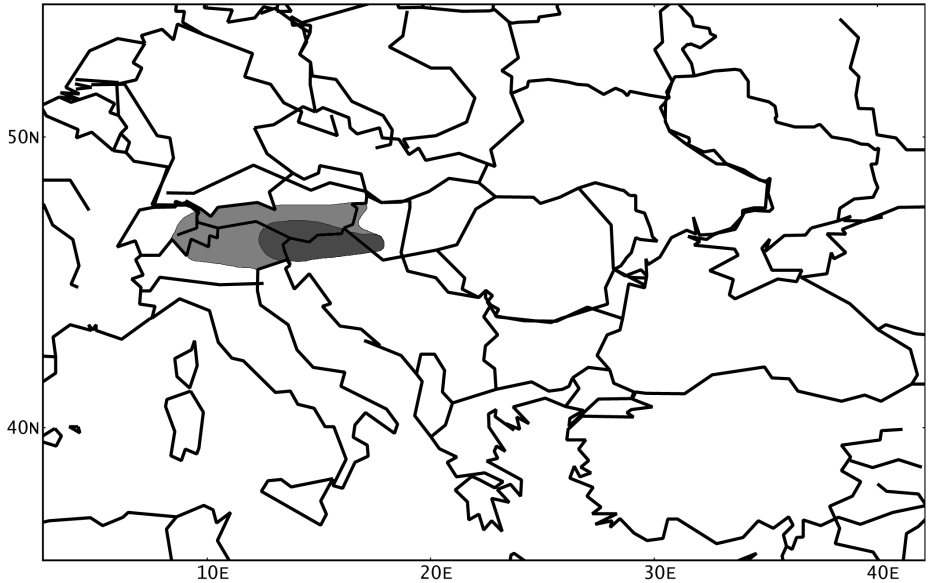

Fig. 7.9. Distribution of the Southern-Alpine species.

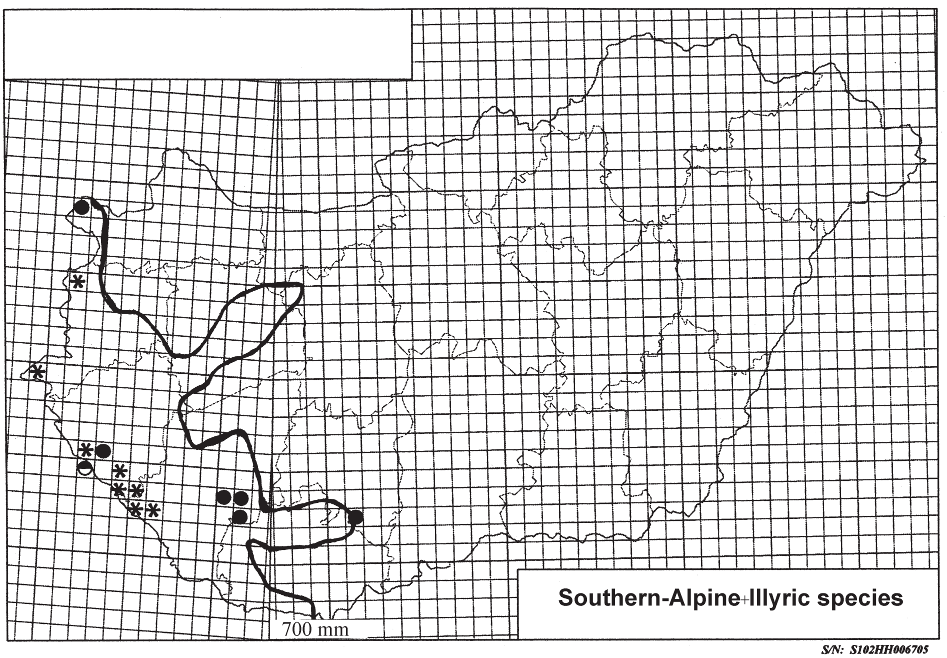

Fig. 7.10. Distribution of the Southern-Alpine and the Illyric species in Hungary. The solid circle represents one, the asterisk two and the half circle three or more species present in the UTM quadrate.

Two species are referred here to the Illyric type of distribution but with some doubts. *Dendrobaena ganglbaueri* has been in synonymy for a long time with *Dendrobaena byblica* – a Circum-Mediterranean species conglomerate – until Zicsi (1991) resurrected it. Unfortunately the literature data are ambiguous because the species affiliation frequently could not be decided; therefore the distribution pattern is based only on our data (fig. 6.21.5). *Oc. pseudotranspadanus* has been described just from the Croatian border of Hungary and subsequently has been reported from Bosnia-Herzegovina (Mršić 1991). It is curious that this species has not yet been reported from Croatia, which suggests that our knowledge on the distribution of *Oc. pseudotranspadanus* is far from being complete.

A very restricted distribution could be observed in the case of *A.* (s.l.) *hrabei* and *H. deficiens*. Both species live in a small area around the Hungarian-Austrian-Slovakian border, and thought to be endemic in that region, so we propose to call them Vindobonic elements. It is noteworthy that *A.* (s. l.) *hrabei* has a quite peculiar systematic position might be representing the easternmost occurrence of the Franco-Iberian genus *Zophoscolex* Qiu & Bouché, 1998.

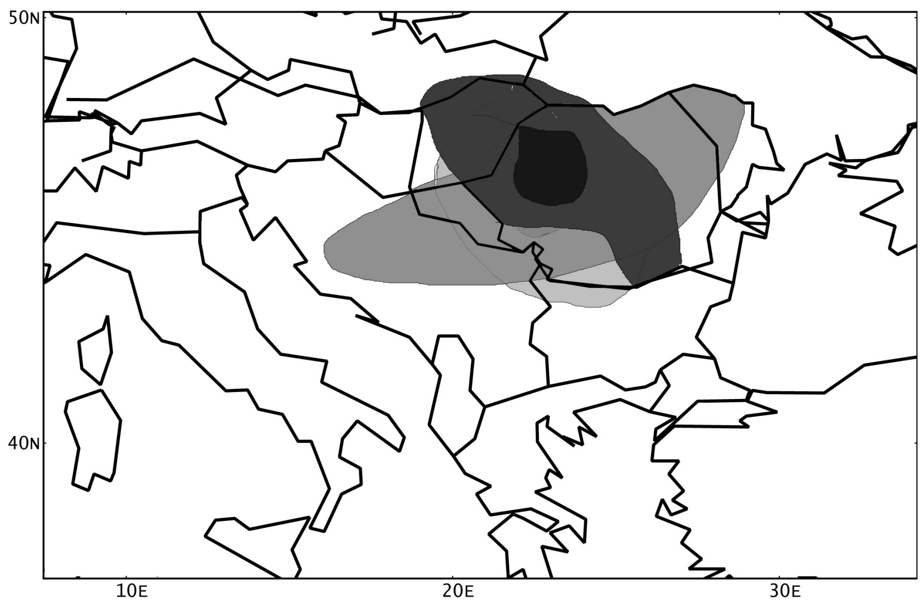

Fig. 7.11. Distribution of the Dacian species.

Besides the Trans-Aegean species the Dacian elements represent the second largest group of the autochthonous earthworms of Hungary. Their distribution centre proper to the Apuseni (Bihar) Mts. in Transylvania (fig. 7.11). This region had a very dynamic tectonic history (summarized by Pop 1994) and in the Quaternary ice age has not been covered by continuous ice sheets, therefore it might have served as refuge for a number of forest plants and trees such as hornbeam (*Carpinus betulus*), beech (*Fagus sylvatica*) and oak (*Quercus*) species (Bodnariuc et al. 2002). The importance of this region as one of the most significant centre of endemism for the genus *Octordilus* has yet been stressed by Pop (1994, 1998), and the high species diversity observed has been attributed to the repeated insularity of the region, occurred last time in the Quaternary. Most of the narrow endemic *Octodrilus* species of the Bihar Mts. thought to have been evolved during the last glaciations in connection with the selection pressure represented by the environmental stress and habitat segregation (Pop 1994). This view contradicts the hypotheses of Omodeo (1952b) who dated back the origin of earthworm species to the Tertiary. The few molecular studies on Lumbricoidea accomplished (Cobolli et al. 1987, Cobolli et al. 1992) corroborate this view, and the speciation in this group may take about 20 million years to become detectable on morphological level (Omodeo & Rota 1999). Therefore, it is feasible that the speciation events led to the high diversity of *Octodrilus* species in the Bihar Mts. may be connected with some earlier events. One of these events might rather be the transgression-regression cycles of Lake Pannon from the Middle Miocene to the Early Pliocene (Magyar et al. 1999). During the transgression phases of Lake Pannon the territory of the Bihar Mts. has been fragmented while in case of regression the region had been connected with the Carpathians and Dinarides (fig. 7.12).

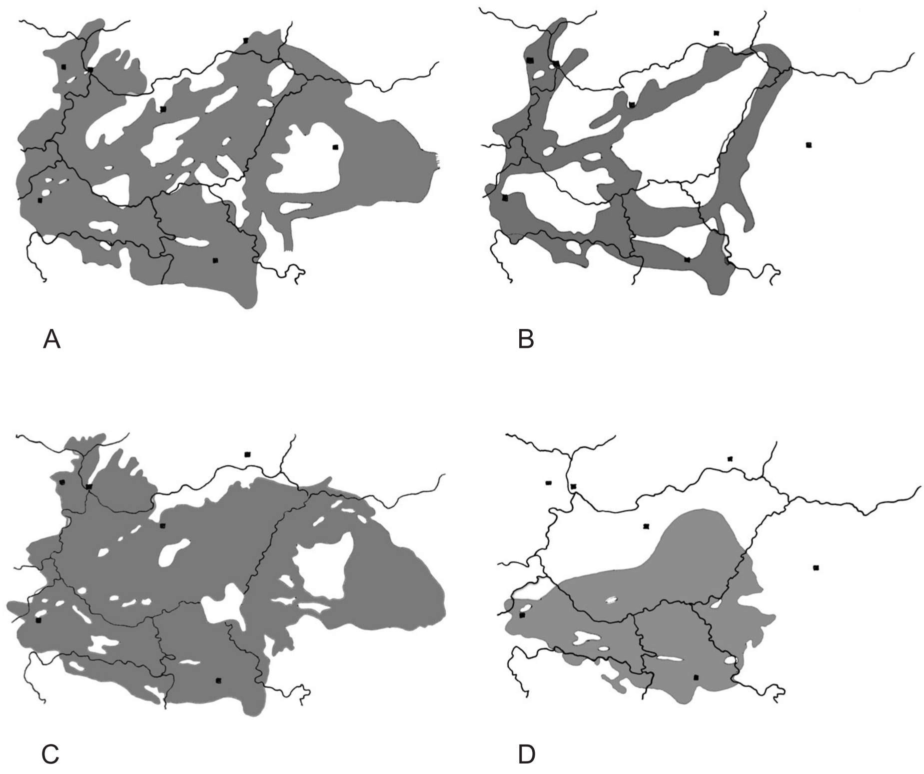

Fig. 7.12. Paleogeographic reconstructions of the Lake Pannon (shaded) in the Miocene. ***A.*** in the Sarmatian (ca. 13.5 million years ago (Ma)), ***B.*** in the Mecsekia ultima (ca. 12 Ma), ***C.*** ca. 9.5 Ma, ***D***. ca. 8 Ma (after Magyar et al. 1999).

The Dacian elements in Hungary are confined to the eastern part of the country (fig. 7.13). It is interesting, that species (*A*. (s. l.) *dacica*, *A*. (s. l.) *mehadiensis*, *D. clujensis* etc.) occur in mountainous habitats in Romania (Pop 1998), in Hungary have almost

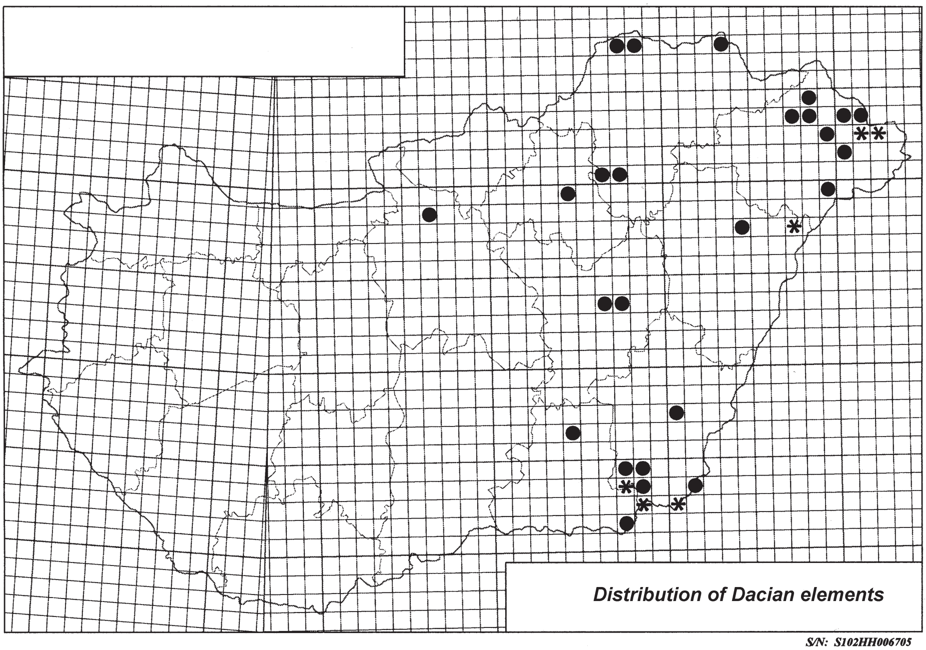

Fig. 7.13. Distribution of the Dacian species in Hungary. The solid circle represents one, the asterisk two species present in the UTM quadrate.

exclusively been found in the Trans-Tisza region. This corroborates Pop (1949) conception of mountain origin of earthworm species and a subsequent invasion of lowland habitats. It is even more plausible if we take into account, that the Pannon Lake in the Miocene has repeatedly covered the territory of the Hungarian Plain.

Four species are known only from Hungary up till now, but only the peculiar *H. mozsaryorum* is thought to be a true endemism living in the Baradla Cave (NE Hungary). *A* (s. l.) *gestroides* has a wider distribution in the northern mountainous part of the country, so its occurrence in the neighboring countries (Slovakia and perhaps Ukraine) is highly probable. *O. lacteovicinum* and *Oc. lissaensioides* are only known from the first descriptions, therefore their zoogeographic significances could not be evaluated. This is true for the species *E. balatonica* and *H. cernosvitovianus* as well. *E. balatonica* was described from the Lake Balaton (SW Hungary) and has subsequently been reported from Ukraine and Siberia (Perel 1979). The European distribution forms a more or less continuous belt ranging from SW Hungary through Romania to S Ukraine (fig. 6.28.2) and after several thousand km of interruption there is an other area body in S Siberia. This strange area suggests either an introduction or that the Siberian population represents an other species. The other problematic species – *H. cernosvitovianus* – has recently been described from NE Hungary and subsequently it was reported from Ukraine (Perel 1977), Poland (Rozen & Kostecka 1988), Serbia (Šapkarev 1980, Karaman & Stojanovic 1996) and Greece (Zicsi & Michalis 1981). The disruption of its area (fig. 6.36.2) might denote our inaccurate knowledge on the distribution of this species.

8. REFERENCES

ALVAREZ, S. J. (1971): Biolspeleologia de la cueva de Ojo Guarena. Oligoquetos terrícolas. – *Boletín de la Real Sociedad Española de Historia Natural, Sección Biológica*, **69:** 11–18.

ANDRÁSSY, I. (1955): *Gyűrűsférgek I. Annelida I.* Magyarország Állatvilága **3(10):** 1–59.

ANDRÉ, F. (1963): Contribution à l'analyse expérimentale de la reproduction des Lombriciens. – *Bulletin Biologique de la France et de la Belgique,* **81:** 1–101.

APÁTHY, I. (1920): *IV. Vermes*. – Fauna Regni Hungariae, Budapest, pp. 50.

BACKLUND, H.O. (1948): Eisenia fasciata n. sp. a new Lumbricid from Sweden. – *Kungliga Fysiografiska Sällskapets Handlingar,* **18(6):** 1–5.

BAIRD, W. (1873): Description of some new species of Annelida and Gephyrea in the Collection of British Museum. – *The Journal of the Linnean Society of London*, **11:** 94–97.

BEDDARD, F.E. (1895): *A monograph of the order of Oligochaeta*. – Oxford, pp. 721.

BLANCHARD, E. (1849): Escoleideanos. – C. *Gay. Historia, fisica y politica de Chile (Zoologia)*, 3: 37–52.

BODNARIUC, A., BOUCHETTE, A., DEDOUBAT, J.J., OTTO, T., FONTUGNE, M. & JALUT, G. (2002): Holocene vegetational history of the Apuseni mountains, central Romania. – *Quaternary Science Reviews* **21:** 1465–1488.

BOUCHÉ, M. B. (1972): *Lombriciens de France. Écologie et Sysématique*. Institut National de la Recherche Agronomique, Articles de Zoologie-Écologie animale (Numéro hors-série). pp. 671.

BOUCHÉ, M. B. (1977): Strategies lombriciennes. – *Ecological Bulletin Stockholm*, **25:** 122–132.

BRETSCHER, K. (1899): Beitrag zur Kenntnis der Oligochaeten-Fauna der Schweiz – *Revue suisse de Zoologie,* **6:** 369–426.

BRETSCHER, K. (1900): Südschweizerische Oligochaeten.. – *Revue suisse de Zoologie,* **8:** 435–459.

BRETSCHER, K. (1901): Beobachtungen über Oligochaeten der Schweiz. – *Revue suisse de Zoologie,* **9:** 189–223.

BRETSCHER, K. (1903): Beobachtungen über die Oligochaeten der Schweiz. – *Revue suisse de Zoologie,* **11:** 1–22.

BRETSCHER, K. (1905): Beobachtungen über die Oligochaeten der Schweiz. – *Revue suisse de Zoologie,* **13:** 663–667.

BROWN, J. H. & GIBSON, A. C. (1983): *Biogeography*. – The C.V. Mosby Company St. Louis, Toronto, London pp. 643.

BURMEISTER, H. (1835): *Zoologischer Hand-Atlas zum Schulgebrauch und Selbst-unterricht*. – Berlin, pp. 42.

ČERNOSVITOV, L. (1929): Communication préliminaire sur les Oligochetes récoltés par M.P. Remy pendant la croisiere arctique effectuée par le "Pourquoi-Pas?" en 1926 sous la direction du Dr J.-B. Charcot. – *Bulletin du Muséum National d'Histoire Naturelle Paris,* **21:** 144–149.

ČERNOSVITOV, L. (1932): Die Oligochaetenfauna der Karpathen. II. - Die Lumbriciden und ihre Verbreitung. – *Zoologische Jahrbücher Abteilung für Systematik, Ökologie und Geographie der Tiere,* **62:** 525–546.

Černosvitov, L. (1934): Sur les Oligochétes terricoles de Créte. – *Sbornik Zoologického Oddeleni Narodniho Musea v Praze*, **1:** 17–20.

Černosvitov, L. (1935): Monographie des tschechoslovakischen Lumbriciden. – *Archiv pro Prirodovedecky Vyzkum Cech*, **19:** 1–86.

Černosvitov, L. (1936): Oligochetes des grottes artificielles du Nord-Est de la France. – *Archives de Zoologie Expérimentale et Générale*, **78:** 1–7.

Černosvitov, L. (1937): On a collection of Indian earthworms of the family Lumbricidae. – *Records of the Indian Museum*, **39:** 105–111.

Černosvitov, L. (1938): Zur Kenntnis der Oligochätenfauna des Balkans. V. Oligochäten aus Jugoslawien und Albanien. – *Zoologischer Anzeiger,* **122:** 285–289.

Černosvitov, L. (1942): Oligochaeta from various parts of the world. – *Proceedings of the Zoological Society of London*, **B111:** 197–236.

Chandebois, R. (1957a): Sur la présence en Corse d'une forme nouvelle *d'Allolobophora cuginii* Rosa et sur une mode d'evolution des Lumbricides. – *Bulletin de la Société Zoologique de France*, **82:** 410–412.

Chandebois, R. (1957b): Une nouvelle forme, provançale et corse, de Lumbricus castaneus (Sav.). – *Bulletin de la Société Zoologique de France*, **82:** 417–419.

Chandebois, R. (1958): Dendrobaena rivulicola n. sp., nouveau lumbricide amphibie de la région méditerranéenne. – *Bulletin de la Société Zoologique de France*, **83:** 159–162.

Chekanovskaya, O.V. (1959): On the Oligochaeta fauna of the Northern Caucasus. – *Trudy Zoologicheskaya Instituta Akademia Nauk Leningrad,* **26:** 347–354. (in Russian)

Chinaglia, L. (1911): Materiali per la fauna Alpina del Piemonte. II. Lombrichi della Valle del Roja. – *Bollettino dei Musei di Zoologia ed Anatomia comparata della R. Università di Torino,* **26(635):** 1–7.

Cobolli Sbordoni, M., De Matthaeis E., Omodeo, P., Bidoli, R. & Rodino, E. (1987): *Allozyme variation and divergence between diploid and triploid population of Allolobophora caliginosa (Lumbricidae: Oligochaeta)*. – In: A.M. Bonvicini Pagliani, P. Omodeo (eds.), On Earthworms. Selected synposia and monographs. Mucci Modena, p. 57–74.

Cobolli Sbordoni, M., De Matthaeis E., Alonzi, A., Mattoccia, M., Omodeo, P. & Rota, E. (1992): Speciation, genetic divergence and palaeogeography in the Hormogastridae. – *Soil Biology and Biochemistry*, **24:** 1213–1221.

Cognetti, L. (1901): Gli Oligocheti della Sardegna. – *Bollettino dei Musei di Zoologia ed Anatomia comparata della R. Università di Torino,* **16(404):** 1–26.

Cognetti, L. (1902): Contributo alla conoscenza degli Oligocheti cavernicoli. – *Atti della Società dei Naturalisti e Matematici di Modena*, **5(36):** 1–10.

Cognetti, L. (1903): Lumbricidi del Cadore e del Tirolo. – *Bollettino dei Musei di Zoologia ed Anatomia comparata della R. Università di Torino*, **18(434):** 1–4.

Cognetti, L. (1904): Lombricidi dei Pirenei. – *Bollettino dei Musei di Zoologia ed Anatomia comparata della R. Università di Torino,* **19(476):** 1–14.

Cognetti, L. (1906): Contributo alla conoscenza della drilofauna delle isole Canarie. – *Bollettino dei Musei di Zoologia ed Anatomia comparata della R. Università di Torino,* **21(525):** 1–4.

Csuzdi, Cs. (1987): *Data to the reproductive biology of Dendrobaena hortensis /Michaelsen 1890/ /Oligochaeta: Lumbricidae/*. - In: Soil Fauna and Soil Fertility. Proceedings of the 9th. International Colloquium on Soil Zoology. Moscow Nauka, p. 300–304.

CSUZDI, CS. (1988): Über die Bestimmung der Konsummenge von Eisenia foetida /Sav. 1826/ /Oligichaeta: Lumbricidae/. – *Opuscula Zoologica Budapest*, **23:** 137–139.

CSUZDI, CS. (1995): The earthworm fauna of the Őrség Landscape Conservation Area (Oligochaeta, Lumbricidae). – *Savaria*, **22(2):** 37–42.

CSUZDI, CS. (1996): Revision der Unterfamilie Benhamiinae Michaelsen, 1897 (Oligochaeta: Acanthodrilidae). – *Mitteilungen aus dem Zoologischen Museum in Berlin*, **72:** 347–367.

CSUZDI, CS. & 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:** 467–486.

CSUZDI, CS. & PAVLÍČEK, 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, CS. & SZLÁVECZ, K. (2003): Lumbricus friendi Cognetti, 1904 a new exotic earthworm in North America. – Northeastern Naturalist, **10(1):** 77–82.

CSUZDI, CS. & ZICSI, A. (1988): Weitere Angaben zur Lebensweise von Dendrobaena hortensis /Michaelsen, 1890/ /Oligochaeta: Lumbricidae/. – *Opuscula Zoologica Budapest*, **23:** 141–147.

CSUZDI, CS. & ZICSI, A. (1991): *Die Bedeutung der Regenwurmart Eisenia lucens (Waga 1857) bei der Zersetzung von Holz-abfällen*. - In: Advances in Management and Conservation of Soil Fauna, Ed: G.K.Veeresh, D. Rajagopal, C.A.Viraktamath, Oxford IBH Publ. New Delhi p. 547–552.

DÉVAI, GY., MISKOLCZI, M. & TÓTH, S. (1997): Proposal for the unification of geographic names and UTM coding applied to the locality component of biotic data. – *Acta Biologica Debrecina supplementum Oecologica Hungarica*, **8:** 13–42.

DUGÉS, A. (1828): Recherche sur la circulation, la respiration, et la reproduction des Annélides sétigéres abranches. – *Annales des Sciences Naturelles Paris*, **15:** 284–336.

DUGÈS, A. (1837): Nouvelles observations sur la zoologie et l'anatomie des Annales des Annélides sétigéres abranches. – *Annales des Sciences Naturelles Paris* ser. 2 *Zoologie,* **8:** 15–35..

EASTON, E.G. (1983): *A guide to the valid names of Lumbricidae (Oligochaeta)*. In: J.E. Satchell (ed.) Earthworm ecology from Darwin to vermiculture. Chapman and Hall, London. p. 475–485.

EDWARDS, C.E. (1998): *The use of earthworms in the breakdown and management of organic wastes*. – In: C.A. Edwards (ed.), Earthworm Ecology. St.Lucie Press, Boca Raton, p. 327–354.

EISEN, G. (1871): Bidrag till Skandinaviens Oligochaet-fauna. – *Öfversigt af Kongliga Vetenskaps-Akademiens Förhandligar*, **27:** 953–971.

EISEN, G. (1873): Om Skandinaviens Lumbricider. – *Öfversigt af Kongliga Vetenskaps-Akademiens Förhandligar,* **30(8):** 43–56.

EISEN, G. (1874): New Englands och Canadas Lumbricider. – *Öfversigt af Kongliga Vetenskaps-Akademiens Förhandligar,* **31(2):** 41–49.

EVANS, A.C. (1946): A new earthworms of the genus *Allolobophora*. – *The Annals and Magazine of Natural History London,* **13:** 98–101.

EVANS, A.C. (1948): On some earthworms from Iowa, including a description of a new species. – *The Annals and Magazine of Natural History London,* **14:** 514–516.

FARRIS, J.S. (1988): *HENNIG86 version 1.5*. – Distributed by the author, Port Jefferson Station, NY.

FELSENSTEIN, J. (1989): PHYLIP – Phylogeny Inference Package (Version 3.2). – *Cladistics*, **5:** 164–166.

FELSENSTEIN, J. (2002): *PHYLIP (Phylogeny Inference Package) version 3.6a3*. – Distributed by the author. Department of Genome Sciences, University of Washington, Seattle.

FENDER, W.M. (1982): *Dendrobaena attemsi* in an American greenhouse, with notes on its morphology and systematic position. – *Megadrilogica*, **4:** 8–11.

FENDER, W.M. (1985): Earthworms of the Western United States. Part I. Lumbricidae. – *Megadrilogica*, **4:** 93–129.

FITZINGER, L. (1833): Beobachtungen über die Lumbrici – *Isis,* **4:** 549–553.

FLETSCHER, J.J. (1886): Notes on Australian earthworms – Part I. – *Proceedings of the Linnean Society New South Wales*, **1:** 523–574.

FOREY, P.L., HUMPHRIES, C.J., KITCHING, I.J., SCOTLAND, R.W., SIEBERT, D.J. & WILLIAMS, D.M. (1992): *Cladistics. A practical course in systematics*. – The Systematics Association Publications. No. 10. Calderon press, Oxford. pp. 191.

FRIEND, H. (1892a): British Annelids. With especial reference to the Earthworms of Essex. – *The Essex Naturalist*, **6:** 30–33.

FRIEND, H. (1892b): Studies of British tree- and earthworms. – *The Journal of the Linnean Society of London*, **24:** 292–312.

FRIEND, H. (1892c): New Yorkshire earthworms, with an emended list of North British species. – *The Naturalist*, **17:** 87– 90.

FRIEND, H. (1892d): On a new species of earthworm. – *Proceedings of the Royal Irish Academy,* **(3)2:** 402–410.

FRIEND, H. (1892e): The earthworms of Middlesex. – *Science Gossip*, **28:** 194–196.

FRIEND, H. (1893): On some new Irish earthworms. – *Proceedings of the Royal Irish Academy,* **(3)2:** 402–453.

FRIEND, H. (1904): New garden worms. – *Gardener's Chronicles*, **35:** 161.

FRIEND, H. (1909): New garden worms. – *Gardener's Chronicles*, **46**: 243, 274, 357.

FRIEND, H. (1910a): New garden worms. – *Gardener's Chronicles*, **47:** 329–330., 381.

FRIEND, H. (1910b): New garden worms. – *Gardener's Chronicles*, **48:** 98–99.

FRIEND, H. (1911a): Annelid Hunting in Notts. – *Reports of the Nottingham Nature Society,* **60:** 50–64.

FRIEND, H. (1911b): The distribution of British annelids. – *Zoologist*, **(4)15:** 143–146, 184–191, 367–374.

FRIEND, H. (1911c): A New Earthworm. – *Zoologist*, **(4)15:** 192–193.

FÜLLER, H. (1953): Tiergeographisch-ökologische Untersuchungen über die Lumbriciden des mittleren Saaletales – *Wissenschaftliche Zeitschrift der Friedrich-Schiller-Universität Jena,* **53:** 51–60.

GATES, G.E. (1952): New species of earthworms from the Arnold Arboretrum, Boston. – *Breviora*, **9:** 3.

GATES, G.E. (1966): Requiem for Megadrile Utopias. A Contribution toward the Understanding of the Earthworm Fauna of North America. – *Proceedings of the Biological Society of Washington*, **79:** 239–254.

GATES, G.E. (1969): On two American genera of the earthworm family Lumbricidae. – *Journal of Natural History*, **9:** 305–307.
GATES, G.E. (1972): Burmese earthworms. An introduction to the systematics of megadrile oligochaetes with special references to southeast Asia. – *Transactions of the American Philosophical Society,* **62(7):** 1–326.
GATES, G.E. (1973): Contributions to North American Earthworms (Annelidae). No. 8. The Earthworm Genus *Octolasion* in America. – *Bulletin of Tall Timbers Research Station*, **14:** 29–50.
GATES, G.E. (1974): Contributions to a revision of the earthworm family Lumbricidae. XI. *Eisenia rosea* (SAVIGNY, 1826). – *Bulletin of Tall Timbers Research Station*, **16:** 9–30.
GATES, G.E. (1975): Contributions to a revision of the earthworm family Lumbricidae XII. Enterion mammale Savigny, 1826 and its position in the family. – *Megadrilogica*, **2(1):** 1–5.
GATES, G.E. (1976a): Contributions to a revision of the earthworm family Lumbricidae XIX. On the genus of the earthworm Enterion roseum Savigny, 1826. – *Megadrilogica*, **2(12):** 4.
GATES, G.E. (1976b): More on Earthworm Distribution in North America. – *Proceedings of the Biological Society of Washington*, **89:** 467–476.
GATES, G.E. (1978): The earthworm genus *Lumbricus* in North America. – *Megadrilogica,* **3(6):** 81–116.
GATES, G.E. (1982): Farewell to North American Megadriles. – *Megadrilogica,* **4(1–2):** 12–77.
GERARD, B.M. (1964): *Lumbricidae (Annelida) with keys and descriptions*. – In: Synopses of the British Fauna No. 6. The Linnean Society of London, pp. 58.
GRAFF, O. (1953): *Die Regenwürmer Deutschlands*. – Braunschweig pp. 81.
GRUBE, A.E. (1851): Annulaten. In. Middendorff, A.T. *Reise in den äussersten Norden und Osten Sibiriens*, **2(1):** 1–24.
GUTHRIE, R.D. (2001): Origin and causes of the mammoth steppe: a story of cloud cover, woolly mammal tooth pits, buckles, and inside-out Beringia. – *Quaternary Science Reviews*, **20:** 549–574.
HAY, W.W., DECONTO, R., WOLD, C.N., WILSON, K.M., VOIGT, S., SCHULZ, M., WOLD-ROSSBY, A., DULLO, W-C., RONOV, A.B., BALUKHOVSKY, A.N. & SOEDING, E. (1999): *Alternative Global Creatceous Paleogeography*. – In: BARRERA, E. & JOHNSON, C. (eds.), The Evolution of Cretaceous Ocean/Climate Systems, Geological Society of America Special Paper No. 332, pp. 1–47.
HENNIG, W. (1966): *Phylogenetic Systematics*. – University of Illinois Press, Urbana.
HIDVEGI, F. & JOSENS, G. (1990): Affinités écologiques de Lumbricus castaneus rubelloides, sous-espèce nouvelle; comparaison avec L. castaneus et L. rubellus rubellus (Lumbricidae). – *Revue d'Écologie et de Biologie du Sol*, **27(2):** 247–252.
HOFFMEISTER, W. (1842): *De vermibus quibusdam ad genus Lumbricorum pertinentibus*. – Berlin, pp. 28.
HOFFMEISTER, W. (1843): Beitrag zur Kenntnis deutcher Landanneliden. – *Archiv für Naturgeschichte*, **91:** 183–198.
HOFFMEISTER, W. (1845): *Übersicht aller bis jetzt bekannten Arten aus der Familie der Regenwürmer*. – Friedrich Vieweg & Sohn, Braunschweig, pp. 43.
HORST, R. (1887): Descriptions of earthworms III. – *Notes from the Leiden Museum*, **9:** 291–299.

HUTTON, F.W. (1877): On New Zealand earthworms in the Otago Museum. – *Transactions and Proceedings of the New Zealand Institute*, **9:** 350–353.

International Commission on Zoological Nomenclature (1986): Opinion 1403. *Lumbricus lacteus* Örley, 1881 designated as type species of *Octolasion* Örley, 1885 (Annelida, Oligochaeta). – *Bulletin of Zoological Nomenclature*, **43:** 235–236.

JACKSON, A. (1931): The Oligochaeta of South-Western Australia. – *The Journal of The Royal Society of Western Australia,* **17:** 71–137.

JAMES, S.W. (1998): *Earthworms and earth history*. – In. Earthworm Ecology ed. C.A. Edwards, St.Lucie Press, Boca Raton, pp. 3–14.

JAMIESON, B.G.M. (1988): On the Phylogeny and Higher Classification of the Oligochaeta. – *Cladistics*, **4:** 367–410.

JANIS, C.M. (1993): Tertiary mammal evolution in the context of changing climates, vegetation and tectonic events. – *Annual Review of Ecology and Systematics*, **24:** 467–500.

JOHNSTON, G. (1865): *A catalogue of British non –parasitical worms in the collection of the British Museum*. –Taylor & Francis London, pp. 365.

KARAMAN, S. & STOJANOVIC, M. (1996): New earthworm (Oligochaeta: Lumbricidae) records from Serbia (Yugoslavia). – *Bios (Macedonia, Greece)*, **4:** 7–13.

KINBERG, J.G. (1867): Annulata nova (Continuatio). – *Öfversigt af Kongliga Vetenskaps-Akademiens Förhandligar*, **23:** 97–103.

KOBAYASHI, S. (1928): The spectroscopic observations on Porphyrin found in the integument of the Earthworm *Allolobophora foetida* (Sav.). – *The Science Reports of the Tohoku Imperial University*, **3:** 467–479.

KOBAYASHI, S. (1940): Terrestrial Oligochaeta from Manchoukou. – *The Science Reports of the Tohoku Imperial University*, **15:** 261–316.

KULAGIN, N.M. (1889): Materiali po estestvennoy istorii dozdevych chervei (sem. Lumbricidae). – *Izvestija obshchestva ljubitelei estestvoznaniya, antropologii i ethnografii Moscow*, **58(2):** 1–65.

KVAVADZE, E.S. (1985): *The earthworms (Lumbricidae) of the Caucasus.* – Metsniereba, Tbilisi pp. 237.

KVAVADZE, E.S. (1993): A new genus of eartworms *Omodeoia* gen. nov. (Oligochaeta: Lumbricidae). – *Bulletin of the Academy of Sciences of Georgia*, **148:** 129–134.

LATTIN, G. DE (1967): *Grundriss der Zoogeographie*. – Fischer Verlag, Jena pp. 602.

LEE, K.E. (1985): *Earthworms, their ecology and relationships with soils and land use*. – Academic Press, Sydney, London, pp. 411.

LEUCKART, R. (1849): Zur Kenntnis der Fauna von Island. – *Archív für Naturgeschichte*, **15(1):** 159-163.

LEVINSEN, G.M.R. (1884): Systematisk-geografisk oversigt over de nordiske Annulata, Gephyrea, Chaetognathi og Balanoglossi. – *Videnskabelige Meddelelser fra den naturhistoriske Forening i Kjöbenhavn*, **45:** 241.

LINNAEUS, C. (1758): *Systema Naturae*. – Laurentii Salvii Holmiea, pp. 824.

LOKSA, I. & ZICSI, A. (1972): A zooedaphon szerepének vizsgálata terepen és modell-kísérletekben. – *Az MTA Biológiai Osztályának Közleményei*, **15:** 45–50.

MALEVICS, I.I. (1947): Oligochaeta proper to caves of the Caucasus. – *Bulletin of the Naturalists Society Moscow, Series Biology*, **52(4):** 11–24. (in Russian)

MALEVICS, I.I. (1949): Materiali k poznanyiju dozsgyevüh cservej orehovo-plodovüh leszov juzsnoj Kirgizii. *Dokladi Akademii Nauk SSSR*, **67:** 397–400. (in Russian)

MALEVICS, I. (1950): New and little known earthworm species in the fauna of the European part of SSSR. – *Dokladi Akademii Nauk SSSR*, **70:** 1083–1086. (in Russian)

MALM A.W. (1877): Om Daggmaskar, Lumbricina. – *Öfversigt af Sallskapet Hortikulturens Vänners i Göteborg Förhandligar*, **1:** 34–47.

MAGYAR, I., GEARY, D.H. & MÜLLER, P. (1999): Paleogeographic evolution of the late Miocene Lake Pannon in Central Europe. – *Palaeogeography, Palaeoclimatology, Palaeoecology,* **147:** 151–167.

MARINISSEN, J.C. & VAN DEN BOSCH, F. (1992): Colonisation of new habitats by earthworms. – *Oecologia* Berlin, **91:** 371–376.

MÁRIALIGETI, K. (1977): Adatok a földigiliszták bakteriológiájához. I. Vizsgálatok az Eisenia lucens (Waga, 1857) bélflóráján. – *Állattani Közlemények*, **64:** 129–141.

MÁRIALIGETI, K. (1979): On the community-structure of the gut-microbiota of Eisenia lucens (Annelida, Oligochaeta). – *Pedobiologia*, **19:** 213–220.

MAYR, E. & ASCHLOCK, P.D. (1991): *Principles of systematic zoology*. – McGraw-Hill, New York, pp. 473.

MEUSEL, H., JÄGER, E. & WEINERT, E. (1965): *Vergleichende Chorologie der Zenztraleuropäischen Flore. Karten.* – Gustav Fischer, Jena, pp.258

MICHAELSEN, W. (1890a): Die Lumbriciden Norddeutschlands. – *Jahrbuch der Hamburgischen Wissenschaftlichen Anstalten*, **7:** 1–19.

MICHAELSEN, W. (1890b): Die Lumbriciden Mecklenburg's. – *Archiv des Vereins der Freunde der Naturgeschichte in Mecklenburg*, **44:** 48–54.

MICHAELSEN, W. (1891): Oligochaeten des Naturhistorischen Museums in Hamburg IV. – *Jahrbuch der Hamburgischen Wissenschaftlichen Anstalten*, **8:** 1–42.

MICHAELSEN, W. (1897): Neue und wenig bekannte afrikanische Terricolen – *Mitteilungen aus dem Naturhistorischen Museum in Hamburg*, **14:** 1–72.

MICHAELSEN, W. (1899): Beiträge zur Kenntnis der Oligochäten – *Zoologische Jahrbücher Abteilung für Systematik, Ökologie und Geographie der Tiere,* **12:** 105–144.

MICHAELSEN, W. (1900a): *Oligochaeta* – In: Das Tierreich X. Friedländer & Sohn, Berlin, pp. 575.

MICHAELSEN, W. (1900b): Die Lumbriciden-Fauna Eurasiens. – *Annuaire du Musée Zoologique de l'Académie Impériale des Sciences de St.-Pétersbourg*, **5:** 213–225.

MICHAELSEN, W. (1900c): Die Lumbriciden-Fauna Nordamerikas. – *Abhandlungen aus dem Gebiete der Naturwissenschaften, Herausgegeben vom Naturwissenschaftlichen Verein, Hamburg,* **16:** 1–22.

MICHAELSEN, W. (1902a): Neue Oligochaeten und neue Fundorte alt-bekannter. – *Mitteilungen aus dem Naturhistorischen Museum in Hamburg,* **19:** 3–53.

MICHAELSEN, W. (1902b): Der Einfluss der Eiszeit auf die Verbreitung der Regenwürmer. – *Verhandlungen des Naturwissentschaftlichen Vereins in Hamburg*, **11:** 1–3.

MICHAELSEN, W. (1903): *Die geographische Verbreitung der Oligochaeten*. – Friedländer & Sohn, Berlin pp. 186.

MICHAELSEN, W. (1907): Die Lumbriciden des Kaukasischen Museums in Tiflis. – *Mitteilungen des Kaukasischen Museums,* **3:** 81–93.

MICHAELSEN, W. (1908): Die zoologische Reise des naturwissenschaftlichen Vereines nach Dalmatien im April 1906. VIII. Lumbricidae. – *Mitteilungen des Naturwissenschaftlichen Vereines an der Universität Wien,* **6:** 117–119.

MICHAELSEN, W. (1909): Oligochaeta. – *Die Süsswasserfauna Deutschlands*, **13:** 1–66.

Michaelsen, W. (1910a): Oligochäten von verschiedenen Gebieten. – *Mitteilungen aus dem Naturhistorischen Museum in Hamburg*, **27:** 47–169.

Michaelsen, W. (1910b): Zur Kenntnis der Lumbriciden und ihrer Verbreitung. – *Annuaire du Musée Zoologique de l'Académie Impériale des Sciences de St.-Pétersbourg,* **15:** 1–74.

Michaelsen, W. (1911): Zur Kenntnis der Eodrilaceen und ihrer Verbreitungsverhältnisse. – *Zoologische Jahrbücher Abteilung für Systematik, Ökologie und Geographie der Tiere,* **30:** 527–572

Michaelsen, W. (1913): Die Oligochäten des Kaplandes. – *Zoologische Jahrbücher Abteilung für Systematik, Ökologie und Geographie der Tiere,* **34:** 473–556.

Michaelsen, W. (1921): Die Verbreitung der Oligochäten im Lichte der Wegener'schen Theorie der Kontinentenverschiebung und andere Fragen zur Stammesgeschichte und Verbreitung dieser Tiergruppe. – *Verhandlungen des Naturwissentschaftlichen Vereins in Hamburg*, **29:** 45–79.

Michaelsen, W. (1928): Oligochaeten. – *Handbuch der Zoologie*, **2(8):** 1–118.

Michaelsen, W. (1933): Die Oligochätenfauna Surinames. Mit Erörterung der verwandschaftlichen und geographischen Beziehungen der Octocätinen. – *Tijdschrift der Nederelandsche Dierkundige Vereeniging,* **3:** 112–130.

Michaelsen, W. (1936): Zwei neue opisthopore Oligochäten. – *Festschrift zum 60. Geburtstage von Prof. Dr. Embrik Strand,* **1:** 31–36.

Mihailova, P. (1965): Five species of Lumbricidae (Oligochaeta) new to the fauna of Bulgaria. – *Annuaire de l'Université de Sofia, Faculté de Biologie*, **58:** 257–266. (in bulgarian)

Miller, R.B., Stout, J.D. & Lee, K.E. (1955): Biological and chemical changes following scrub burning on a New Zealand hill soil. – *The New Zealand journal of science and technology*, **37:** 290–313.

Mischis, K. (1991): Las lombrices de tierra (Annelida, Oligochaeta) de la Provincia de Córdoba (Argentina). – *Boletín de la Academia Nacional de Ciencias Córdoba*, **59:** 187–237.

Miskolczi, M., Dévai, Gy., Kertész, Gy. & Bajza, Á. (1997): Coding list of Hungarian settlements according to a 10x10 km scale grid map of UTM system. – *Acta Biologica Debrecina supplementum Oecologica Hungarica,* **8:** 43–194.

Moore, H.J. (1893): Preliminary account of a new genus of Oligochaeta. – *Zoologischer Anzeiger*, **16:** 333–334.

Mršić, N. (1983): Research on fauna and associations of earthworms (Lumbricidae) in Durmitor Crna Gora (Montenegro). – *Bioloski vestnik Lubljana*, **31:** 53–66.

Mršić, N. (1986): *Fitzingeria viminiana* sp. n. and the earthworm fauna (Lumbricidae) of North-Eastern Serbia. – *Biosistematika Beograd*, **12:** 111–117.

Mršić, N. (1990): Description of a new subgenus, three new species and taxonomic problems of the genus *Allolobophora* sensu Mršić & Šapkarev 1988 (Lumbricidae, Oligochaeta). – *Bioloski vestnik Lubljana*, **38:** 49–68.

Mršic, 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.

Mršić, N. & Šapkarev, J. (1987): Survey of the earthworms (Lumbricidae) of Serbia in a restricted sense and description of new taxa. – *Bioloski vestnik Lubljana*, **35:** 67–86

MRŠIĆ, N. & ŠAPKAREV, J. (1988): Revision of the genus Allolobophora Eisen, 1874 (sensu Pop 1941) (Lumbricidae, Oligochaeta). – *Acta Musei Macedonici Scientiarum Naturalium*, **19:** 1–38

MÜLLER, O.F. (1774): *Vermium Terrestrium et Fluviatilium*. – Heinech & Faber, Havinae et Lipsiae, pp. 80.

NUSBAUM, J. (1895): Sprawozdanie z poszukiwan nad fauna robaków dokonanych w lecier. 1893. – *Sprawozdania Komisji Fizjograficznej Krakow*, **30:** 41–44.

OMODEO, P. (1950): Napoli Richerce zoologische sul massiccio del pollino (Lucania-Calabria) I. Oligocheti. – *Annuario dell'Istituto e Museo di Zoologia della Università di Napoli*, **2(10):** 1–12.

OMODEO, P. (1952a): Materiali zoologici raccolti dal Dr. Marcuzzi sulle Alpi Dolomitiche. – *Archivio Zoologico Italiano*, **37:** 29–59.

OMODEO, P. (1952b): Particolarita della Zoogeografia dei lombrichi. – *Bolletino di Zoologia*, **19:** 349–369.

OMODEO, P. (1953): Nota su alcuni lombrichi delle Alpi e considerationi sul. gen. *Helodrilus* di Hoffmeister. – *Memorie del Museo Civico di Storia Naturale di Verona*, **4:** 75–85.

OMODEO, P. (1956): Contributo alla revisione dei Lumbricidae. – *Archivio Zoologico Italiano* **41:** 129–212.

OMODEO, P. (1961): Le Peuplement des Iles Méditerranéennes et le Problème de L'Insularite. – *Colloques Internationaux du Centre National de la Recherche Scientifique*, **94:** 128–133.

OMODEO, P. (1963): *Distribution of the terricolous Oligochaetes on the two shores of the Atlantic.* – In: A. Love & D. Love (eds.), North Atlantic Biota and their History. Pergamon Press London, p. 127–151.

OMODEO, P. (1984): On aquatic Oligochaeta Lumbricomorpha in Europe. – *Hidrobiologia*, **115:** 187–190.

OMODEO, P. (1988): The genus *Eophila* (Lumbricidae, Oligochaeta). – *Bolletino di Zoologia*, **55:** 73–88.

OMODEO, P. (2000): Evolution and biogeography of megadriles (Annelida, Clitellata). – *Italian Journal of Zoology*, **67:** 179–201.

OMODEO, P. & MARTINUCCI, G. (1987): *Earthworms of Maghreb*. – In: A.M. Bonvicini Pagliani & P. Omodeo (eds.), On Earthworms. Selected synposia and monographs. Mucci Modena, p. 235–250.

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). – *Biogeografia*, **20:** 62–79.

ÖRLEY, L. (1881a): A magyarországi Oligochaeták faunája. I. Terricolae. – *Mathematikai és Természettudományi Közlemények*, **16:** 562–611.

ÖRLEY, L. (1881b): Beiträge zur Lumbricinen-Fauna der Balearen. – *Zoologischer Anzeiger,* **4:** 284–287.

ÖRLEY, L. (1885): A palaearktikus övben élő Terrikoláknak revíziója és elterjedése. – *Értekezések a Természettudományok Köréből*, **15:** 1–34.

PEREL, T.S. (1968): The structure of muscle bundles in earthworms as systematic and phylogenetic character. – *Zoologicheski Zhurnal*, **47:** 200–211. (in Russian)

Perel, T.S. (1975): The genus Lumbricus Linné (Oligochaeta: Lumbricidae) in the fauna of USSR. – *Zoologicheski Zhurnal*, **54:** 994–997. (in Russian)

Perel, T.S. (1976a): A critical analysis of the Lumbricidae genera system (with key to the USSR fauna genera). – *Révue d'Écologie et Biologie du Sol*, **13(4):** 635–643.

Perel, T.S. (1976b): A critical analysis of the system of family Lumbricidae. – *Zoologicheski Zhurnal*, **55:** 823–836. (in Russian)

Perel, T.S. (1977): Species of the genera *Helodrilus*, *Allolobophora*, *Nicodrilus* (Oligochaeta, Lumbricidae) in the fauna of the USSR. – *Zoologicheski Zhurnal*, **56:** 1775–1780. (in Russian)

Perel, T.S. (1979): *Range and regularities in the distribution of earthworms of the USSR fauna*. – Nauka, Moscow pp. 272. (in Russian)

Perel, T.S. (1997): *The Earthworms of the Fauna of Russia*. – Nauka Moscow, pp. 97.

Pérez Onteniente, A. & Rodríguez Babio, C. (2002): Three new species of earthworms (Annelida: Oligochaeta: Lumbricidae), from the Valencian Community, Spain. – *Journal of Natural History*, **36:** 515–530.

Perrier, E. (1872): Recherches pour servir a l'histoire des Lombriciens terrestres. – *Nouvelles Archives du Muséum d'Histoire Naturelle de Paris*, **8:** 5–198

Pickford, G.E. (1932): Oligochaeta. Part 2. Earthworms. – *Discovery Reports Cambridge*, **4:** 265–292.

Pickford, G.E. (1937): *A Monograph of the Acanthodrilinae earthworms of South Africa*. – Heffer & Sons Cambridge, pp. 612.

Plisko, J.D. (1961): Lumbricus submontanus Vejdovsky, 1876 – ein jüngeres Synonym des Namens Lumbricus lucens Waga, 1857 (Oligochaeta, Lumbricidae) – *Bulletin de l'Academie Polonaise des Sciences*, **9:** 101–104

Plisko, J.D. (1962): Dendrobaena auriculata (Rosa, 1897) eine für die Fauna Polens neue Art von Regerwürmern (Oligochaeta, Lumbricidae). – *Bulletin de l'Academie Polonaise des Sciences,* **10:** 61–63

Plisko, J.D. (1965): Die in Polen auftretenden morphologischen Formen der Art Allolobophora rosea (Savigny, 1826) (Oligochaeta, Lumbricidae). – *Bulletin de l'Academie Polonaise des Sciences,* **13:** 409–416

Plisko J.D. (1973): *Lumbricidae (Annelida, Oligochaeta)*. – Fauna Poloniae, Warsawa pp. 156.

Pool, G. (1937): Eiseniella tetraedra (Sav.). Ein Beitrag zur vergleichenden Anatomie und Systematik der Lumbriciden. – *Acta Zoologica Stockholm*, **18:** 1–110.

Pop, V. (1938): Neue Lumbriciden aus Rumänien. – *Buletinul Societatii de Stiinte din Cluj*, **9:** 134–152.

Pop, V. (1941): Zur phylogenie und Systematik der Lumbriciden. – *Zoologische Jahrbücher Abteilung für Systematik, Ökologie und Geographie der Tiere*, **74:** 487–522.

Pop, V. (1943a): Hazai és külföldi Lumbricidák a Magyar Nemzeti Múzeumban. – *Annales Historico-Naturales Musei Nationalis Hungarici*, **34:** 12–24.

Pop, V. (1943b): Das Verwandtschaftsverhältnis zwischen Dendrobaena platyura (Fitzinger) und Octolasium montanum Černosvitov (Oligochaeta). – *Zoologische Jahrbücher Abteilung für Systematik, Ökologie und Geographie der Tiere,* **76:** 397–412.

POP, V. (1947): Die Lumbriciden der Ostalpen. – *Analele Academiei Române Memoriile Sectiunii Ştiintific*, seria III, **22(3):** 85–133.

Pop, V. (1949): Lumbricidele din România. – *Analele Academiei Republicii Populare Române*, **1(9):** 383–505.

Pop, V.V. (1978): Allolobophora mehadiensis Rosa, 1895 and its subspecies (Oligochaeta, Lumbricidae). – *Travaux du Muséum d'Histoire naturelle Grigore Antipa,* **19:** 255–258.

Pop, V.V. (1994): On the speciation in the Genus Octodrilus Omodeo, 1956 (Oligochaeta, Lumbricidae). – *Mitteilungen aus dem Hamburgischen zoologischen Museum und Institut*, **89(2):** 37–46.

Pop V.V. (1998): *Earthworm biology and ecology – A case study: The genus Octodrilus Omodeo, 1956 (Oligochaeta, Lumbricidae), from the Carpathians*. – In. Earthworm Ecology ed. C.A. Edwards, St.Lucie Press, Boca Raton, pp. 65–97.

Prenner, J. & Nagy, J. (1966): A földigiliszta károsítása termesztett növényeinken. – *Növényvédelmi tudományos értesítő Budapest*, **73:** 1–5.

Proksova, M. (1955): Rainworms in Silesian forest soils. – *Prírodovedecky Sbornik Ostravského kraje*, **15:** 522–530.

Qiu, J-P. & Bouché, M.B. (1998a): Liste classée des taxons valides de Lombriciens (Oligochaeta: Lumbricoidea) après l'étude des trios cinquième d'entre-eux. – *Documents pedozoologiques & integrologiques*, **4:** 181–200.

Qiu, J-P. & Bouché, M.B. (1998b): Révision des taxons supraspécifiques de Lumbricoidea. – *Documents pedozoologiques & integrologiques*, **3:** 179–216.

Qiu, J-P. & Bouché, M.B. (1998c): Contribution à la révision des Lumbricoidea (Annelida: Oligochaeta). Une nouvelle sous-espèce du genere *Fitzingeria* Zicsi, 1978. – *Documents pedozoologiques & integrologiques*, **4:** 98–101.

Qiu, J-P. & Bouché, M.B. (1998d): L'interpretation des caractéristiques lombriciennes. – *Documents pedozoologiques & integrologiques*, **3:** 119–178.

Qiu, J-P., Bouché, M.B. & Soto, P. (1998): L'acquisition, la rationalisation et la gestion des connaissances: application à la biodiversité lombricienne. *Documents pedozoologiques & integrologiques*, **3:** 57–118.

Reynolds, J.W. (1977): *The Earthworms (Lumbricidae and Sparganophilidae) of Ontario*. – Royal Ontario Museum, Life Sciences Miscellaneous Publications, Toronto pp. 141.

Reynolds J.W. (1995): *Status of Exotic Earthworm Systematic and Biogeography in North America*. In. P.F. Hendrix (ed.) Earthworm Ecology and Biogeography in North America. Lewis publishers Boca Raton. p. 1–27.

Reynolds, J.W. (1998): *The Status of Earthworm Biogeography, Diversity, and Taxonomy in North America revisited with Glimpses into the Future*. – In. C.A. Edwards (ed.), Earthworm Ecology. St. Lucie Press, Boca Raton, pp. 15–34.

Reynolds, J.W. & Clapperton, M.J. (1996): New earthworm records for Alberta (Oligochaeta: Lumbricidae) including the description of a new Canadian species. – *Megadrilogica,* **6:** 73–82.

Rhee, J.A. (1963): *Earthworm activities and the breakdown of organic matter in agricultural soils.* – In: Doecksen, J. & van der Drift, J. (eds.), Soil Organisms, Amsterdam, p. 55–59.

Ribaucourt, E. (1896): Étude sur la faune Lombricide de la Suisse. – *Revue suisse de Zoologie,* **4:** 1–110

Ribaucourt, E. (1901): Étude sur l'anatomie comparée des Lombricides. – *Bulletin scientifuique de la France et de la Belgique,* **35:** 211–311

Risso, A. (1826): *Les Lombrics*. – In: Histoire naturelle des principales productions de l'Europe méridionale el particuliérement de celles des environs de Nice et des Alpes maritimes. Paris, Levrault, p. 426–427

Rosa, D. (1882): Descrizione de due nuovi Lumbrici. – *Atti della Reale Accademia delle Scienze di Torino*, **18:** 169–173.

Rosa, D. (1884): *Lumbricidi del Pieomte*. – Torino, pp. 54.

Rosa, D. (1886): Note sui lombrici del Veneto. – *Atti del Reale Istituto Veneto di Scienze*, **4:** 673–687.

Rosa, D. (1889): Note sui Lombrichi iberici. – *Bollettino dei Musei di Zoologia ed Anatomia comparata della R. Università di Torino,* **4(63):** 1–5.

Rosa, D. (1893a): Revisione dei lumbricidi. – *Memoire della Reale Academia delle Scienze di Torino (Serie 2),* **43:** 399–477.

Rosa, D. (1893b): Viaggio del Dr. E. Festa in Palestina, nel Libano e regioni vicine. – II. Lumbricidi. – *Bollettino dei Musei di Zoologia ed Anatomia comparata della R. Università di Torino,* **8(160):** 1–14.

Rosa, D. (1894): *Allolobophora Ganglbaueri* ed *A. Oliveirae* nuove specie di Lumbricidi europei. – *Bollettino dei Musei di Zoologia ed Anatomia comparata della R. Università di Torino,* **9(170):** 1–3.

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.

Rosa, D. (1896): *Allobophora tigrina* ed A. *exacystis* n. sp. – *Bollettino dei Musei di Zoologia ed Anatomia comparata della R. Università di Torino,* **11(246):** 1–4.

Rosa, D. (1897): Nuovi lombrichi dell'Europa orientale. (Seconda serie.) – *Bollettino dei Musei di Zoologia ed Anatomia comparata della R. Università di Torino,* **12(269):** 1–5.

Rosa, D. (1901): Un lombrico cavernicolo. – *Atti della Società dei Naturalisti e Matematici di Modena*, **4:** 36–39.

Rosa, D. (1903): L'*Allolobophora* (*Eophila*) *nematogena* n. sp. ed i suoi speciali linfociti. – *Atti della Società dei Naturalisti e Matematici di Modena*, **5:** 11–13.

Rosa, D. (1905): Ergebnisse einer naturwissenschaftlichen Reise zum Erdschias-Dagh. Terricolen. – *Annalen des K. K. Naturhistorischen Hofmuseums Wien*, **20:** 104–106.

Rozen, A. & Kostecka, J. (1988): *Allolobophora cernosvitoviana* (Zicsi, 1967) (Oligochaeta, Lumbricidae), a new species of earthworm on Poland. – *Przeglad Zoologiczny*, **32:** 199–202.

Rota, E. & Erseus, C. (1997): First record of *Dendrobaena attemsi* (Michaelsen) (Oligochaeta, Lumbricidae) in Scandinavia, with a critical review of its morphological variations, taxonomic relathionships and geographical range. – *Annales Zoologica Fennica*, **34:** 89–104.

Rota, E. (1993): Contribution to the taxonomy of the Hormogastridae (Annelida: Oligochaeta) with description of two new species from southern France. – *Journal of Natural History*, **28:** 27–36.

Šapkarev, J. (1971): Neue Regenwürmer (Oligochaeta: Lumbricidae) aus Mazedonien – *Fragmenta Balcanica Skopje*, **8:** 149–164.

Šapkarev, J. (1972): The fauna of earthworms of Macedonia. The earthworms of the valley of Pelagonia. – *Fragmenta Balcanica Skopje*, **9:** 125–135.

Šapkarev, J. (1975): Contribution to the knowledge of the earthworms (Lumbricidae) and leeches (Hirudinea) of Kosovo, Yugoslavia – *Annuaire de la Faculté des Sciences de l'Université de Skopje,* **27–28:** 39–54.

ŠAPKAREV, J. (1977): The fauna of earthworms of Macedonia 7. The earthworms (Oligochaeta: Lumbricidae) of Ohrid-Struga valley. – *Annuaire de la Faculté de Biologie de l'Université "Kiril et Metodij" de Skopje*, **30:** 27–45.

ŠAPKAREV, J. (1980): Prilog poznavanju kiśnih glista (Lumbricidae) SR Srbije. – *Zbornik Radova faune Srbije*, **1:** 165–179.

SAVIGNY, J.C. (1826): In G. Cuvier: Analyse des Travaux de l'Académie royale des Sciences, pendant l'année 1821, partie physique. – *Mémoires de l'Académie des Sciences de l'Institut de France Paris,* **5:** 176–184.

SCIACCHITANO, I. (1931): Oligocheti. – *Annali del Museo Civico di Storia Naturale di Genova,* **3(55):** 302–304.

SIMS, R.W. (1973): *Lumbricus terrestris* Linneaus, 1758 (Annelida, Oligochaeta): designation of a neotype in accordance with accustomed usage. Problems arising from the misidentification of the species by Savigny (1822 and 1826). – *Bulletin of Zoological Nomenclature*, **30:** 27–33.

SIMS, R.W. (1980): A classification and the distribution of earthworms, suborder Lumbricina (Haplotaxida: Oligochaeta). – *Bulletin of the British Museum (Natural History) Zoology series*, **39:** 103–124.

SIMS, R.W. (1984): Octolasion Örley, 1885 (Annelida, Oligochaeta, Lumbricidae): Ratification of the designation of the type species and the introduction of Octolasion (Octodrilus) by Omodeo, 1956 in accordance with usage, with the suppression of the designation of the type species and of names Octolasion (Incolore) and Octolasion (Purpureum) by Omodeo, 1952. – *Bulletin of Zoological Nomenclature*, **41:** 254–258.

SLUYS, R. (1992): Synopsis of the freshwater triclads of the Caribbean. – *Studies on the natural history of the Caribbean Region,* **71:** 1–23.

SOUTHERN, R. (1909): Contributions towards a monograph of the British and Irish Oligochaeta. – *Proceedings of the Royal Irish Academy,* **27B:** 119–186.

STEPHENSON, J. (1917): On a collection of Oligochaeta from various parts of India and Further India. – *Records of the Indian Museum*, **13:** 353–416.

STEPHENSON, J. (1922): Some earthworms from Kashmir, Bombay and other parts of India. – *Records of the Indian Museum*, **24:** 427–444.

SVETLOV P.G. (1924): Beobachtungen über Oligochaeten des gouv. Perm. I. Zur Systematik, Fauna und Oekologie der Regenwürmer. – *Bulletin Institut Res. Biol. Perm*, **2(8):** 313–328.

SWOFFORD, D.L. (1990): *PAUP: Phylogenetic Analysis Using Parsimony. Ver. 3.0* – Illinois Natural History Survay, Champaign, Illinois.

SZŰTS, A. (1909): Magyarország Lumbricidái. – *Állattani Közlemények*, **8:** 120–142.

SZŰTS, A. (1913): Die Archaeo- und Neolumbricinen. – *Zoologischer Anzeiger,* **42:** 337–351.

SZŰTS, A. (1919): Beiträge zus Kenntnis der Lumbricidenfauna Kroatien und Bosnien. – *Zoologischer Anzeiger,* **50:** 294–298.

TEMPLETON, R. (1836): A catalogue of the species of annulose animals. – *The Annals and Magazine of Natural History London,* **9:** 233–240.

TÉTRY, A. (1936): Une variété nouvelle de Lumbricus castaneus Savigny, sa valeur systématique. – *Bulletin de la Société Sciences de Nancy*, **9:** 196–201.

TÉTRY, A. (1937): *Contribution à l'étude de la faune de l'est de la France*. Nancy, Georges Thomas, pp. 453.

Thomson, A.J. & Davies, D.M. (1974): Production of surface casts by the earthworm Eisenia rosea. – *Canadian Journal of Zoology,* **52:** 659.

Tzelepé, N.D. (1943): *Symbolé eis tén melethén ton Oligochaeton tés Hellados*. – University dissertation Athens, pp. 60.

Ude, H. (1885): Über die Rückenporen der terricolen Oligochaeten, nebst Beiträge zur Histologie des Leibesschlauches und zur Sytematik der Lumbriciden. – *Zeitschrift für Wissenschaftliche Zoologie*, **43:** 87–143.

Ude, H.(1922): Regenwürmer aus Mazedonien. – *Archiv für Naturgeschichte*, **88(7):** 155–162.

d'Udekem, J. (1855): Nouvelle Classification des Annélides sétigéres Abranches. – *Bulletin de l'Academie Royale des Sciences des Lettres et des Beau-Arts de Belgique*, **22:** 533–555.

d'Udekem, J. (1865): Memoire sur les lombricins. – *Mémoires de l'Academie Royal des Sciences des Lettres et des Beau-Arts de Belgique*, **36:** 41.

Udvardi, M. (1969): *Dynamic Zoogeography With Special Reference to Land Animals*. – Van Nostrand Reinhold Company New York, Melbourne pp. 445.

Varga, Z. (1977): Das Prinzip der areal-analitischen Methode in der Zoogeographie und die Faunaelemente-Einleitung der europäischen Tagschmetterlinge /Lepidoptera: Diurna/. – *Acta Biologica Debrecina*, **14:** 223–285.

Vedovini, A. (1967): Une nouvelle forme provencale d'Allolobophora rosea (Savigny) – *Bulletin de la Société Zoologique de France*, **92:** 793–796.

Vedovini, A. (1971): Lombricides nouveaux de la région provencale. – *Bulletin de la Société Zoologique de France,* **96:** 45–48.

Vejdovsky, F. (1875): Beiträge zur Oligochaetenfauna Böhmens. – *Sitzungsberichte der Königlichen Böhmischen Gesellschaft der Wissenschaften in Prag*, **1875:** 191–201.

Vejdovsky, F. (1884): *System und Morphologie der Oligochaeten*. – Franz Rivnac, Prag pp. 166.

Waga, A. (1857): Sprawozdanie z podrozy naturalistov odbytej w r. 1854 do Ojcowa. – *Bibliotheca Warszawie,* **2:** 161–227.

Wessely, K.(1905): Die Lumbriciden Oberösterreichs. – *Jahresbericht des Vereins für Naturkunde Linz,* **34:** 1–19.

Wiley, E.O. (1981): *Phylogenetics: The Theory and Practice of Phylogenetic Systematics*. – Wiley-Liss, New York.

Wiley, E.O., Siegel-Causey, D., Brooks, D., Funk, V.A. (1991): *The compleat cladist*. – University of Kansas special publication No. 19.

Zajonc, I. (1958): Beitrag zur Kenntnis der Regenwürmer des Kreisgebietes Brünn (Oligochaeta, Lumbricidae). – *Acta Societatis Zoologicae Bohemoslovacae*, **22:** 59–70.

Zajonc, I. (1965): Beitrag zur Frage der endemischen Arten von Regenwürmern (Oligochaeta, Lumbricidae) in Karpatengebiet. – *Informationsbericht der Landwirtschaftlichen Hochschule Nitra. Serie: Biologische Grundlagen der Landwirtschaft*, **1(1–4):** 73–87.

Zicsi, A. (1958): Beiträge zur Kenntnis der ungarischen Lumbriciden Fauna I. – *Opuscula Zoologica Budapest,* **2:** 55–60.

Zicsi, A. (1959a): Faunistisch-systematische und ökologische Studien über die Regenwürmer Ungarns. I–II. – *Acta Zoologica Academiae Scientarum Hungaricae*, **5:** 165–189, 401–447.

Zicsi, A. (1959b): Beitrag zur geographischen Verbreitung und ökologie von Allolobophora antipai (Michaelsen) 1891. – *Annales Universitatis Scientarium Budapestiensis de Rolando Eötvös Nominatae, Sectio Biologica,* **2:** 283–292.

Zicsi, A. (1959c): Beiträge zur Kenntnis der ungarischen Lumbriciden-Fauna, II. – *Opuscula Zoologica Budapest,* **3:** 95–100.

Zicsi, A. (1960): Die Regenwurmfauna des oberen ungarischen Donau-Ufergebietes.– *Annales Universitatis Scientarium Budapestiensis de Rolando Eötvös Nominatae, Sectio Biologica,* **3:** 427–440.

Zicsi, A. (1961):): Die Regenwurmfauna Ufergebietes und Inseln der ungarischen Donau – Danubialia Hungarica, XII. – *Annales Universitatis Scientarium Budapestiensis de Rolando Eötvös Nominatae, Sectio Biologica,* **4:** 221–231.

Zicsi, A. (1963): Beobachtungen über die Lebensweise des Regenwurmes Allolobophora dubiosa (Örley 1880). – *Acta Zoologica Academiae Scientarum Hungaricae,* **9:** 219–236.

Zicsi, A. (1964a): Neue Fundorte des Lumbriciden Dendrobaena auriculata (Rosa 1897) in Ungarn. – *Annales Universitatis Scientarium Budapestiensis de Rolando Eötvös Nominatae, Sectio Biologica,* **7:** 255–258.

Zicsi, A. (1964b): Neubeschreibung des Lumbriciden Allolobophora hrabei (Cernosvitov, 1935). – *Opuscula Zoologica Budapest,* **5:** 119–123.

Zicsi, A. (1965a): Die Lumbriciden Oberösterreichs und Österreichs unter Zugrundlegung der Sammlung Karl Wesselys mit besonderer Berücksichtigung des Linzer Raumes. – *Naturkundliches Jahrbericht der Stadt Linz*, **11:** 125–201.

Zicsi, A. (1965b): Beiträge zur Kenntnis der Lumbricidenfauna Österreichs. – *Opuscula Zoologica Budapest,* **5:** 247–265.

Zicsi, A. (1965c): Bearbeitung der Lumbriciden-Sammlung des Naturhistorischen Museums von Wien. – *Opuscula Zoologica Budapest,* **5:** 267–272.

Zicsi, A. (1966a): Beiträge zur Kenntnis der ungarischen Lumbricidenfauna, III. – *Annales Universitatis Scientarium Budapestiensis de Rolando Eötvös Nominatae, Sectio Biologica,* **8:** 389–400.

Zicsi, A. (1966b): Beiträge zur Kenntnis der ungarischen Lumbricidenfauna, IV. – *Opuscula Zoologica Budapest,* **6:** 187–190.

Zicsi, A. (1967): Beiträge zur Kenntnis der ungarischen Lumbricidenfauna, V. – *Acta Zoologica Academiae Scientarum Hungaricae*, **13:** 245–252.

Zicsi, A. (1968a): Ein zusammenfassendes Verbreitungsbild der Regenwürmer auf Grund der Boden- und Vegetationsverhältnisse Ungarns. – *Opuscula Zoologica Budapest*, **8:** 99–164.

Zicsi, A. (1968b): Eine neue Octalasium-Art (Oligochaeta: Lumbricidae) aus Ungarn. – *Acta Zoologica Academiae Scientarum Hungaricae*, **14:** 233–238.

Zicsi, A. (1969): Neue Regenwurm-Arten (Lumbricidae) aus den österreichischen Karawanken. – *Opuscula Zoologica Budapest,* **9:** 379–384.

Zicsi, A. (1970): Allolobophora gestroides sp. nov., ein neuer Regenwurm (Oligochaeta: Lumbricidae) aus Ungarn. – *Opuscula Zoologica Budapest,* **10:** 359–370.

Zicsi, A. (1971a): Regenwürmer aus dem Tessin sowie Bemerkungen über die meroandrischen Formen der Untergattung Octodrilus (Oligochaeta: Lumbricidae). – *Acta Zoologica Academiae Scientarum Hungaricae*, **17:** 219–231.

Zicsi, A. (1971b): Bemerkungen über Allolobophora nematogena Rosa, 1903 (Oligochaeta: Lumbricidae) und ihre Synonyme. – *Annales Universitatis Scientarium Budapestiensis de Rolando Eötvös Nominatae, Sectio Biologica,* **13:** 339–347.

Zicsi, A. (1974a). *A struktúra és funkció kapcsolata terresztrikus ökoszisztémák földigilisztáinak tevékenysége tükrében*. – Doktori értekezés, Budapest pp. 303.

Zicsi, A. (1974b): Ein neuer Höhlen-Regenwurm (Oligochaeta: Lumbricidae) aus Ungarn. – *Acta Zoologica Academiae Scientarum Hungaricae*, **20:** 227–232.

Zicsi, A. (1975): Zootische Einflüsse auf die Streuzersetzung in Hainbuchen-Eichenwäldern Ungarns. – *Pedobiologia*, **15:** 432–438.

Zicsi, A. (1977): A zoogén faktor szerepe gyertyános-tölgyes ökoszisztémák avarlebomlási folyamatában. – *Az MTA Biológiai Osztályának Közleményei*, **20:** 195–197.

Zicsi, A. (1978): Revision der Art *Dendrobaena platyura* (Fitzinger, 1833) (Oligochaeta: Lumbricidae). – *Acta Zoologica Academiae Scientarum Hungaricae*, **24:** 439–449.

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

Zicsi, A. (1981b): Weitere Angaben zur Lumbricidenfauna Italiens (Oligochaeta: Lumbricidae). – *Opuscula Zoologica Budapest,* **17–18:** 157–180.

Zicsi, A. (1982a): Verzeichnis der bis 1971 beschriebenen und revidierten Taxa der Familie Lumbricidae (Oligochaeta). – *Acta Zoologica Academiae Scientarum Hungaricae*, **28:** 421–454.

Zicsi, A. (1982b): Új állatökológiai kutatások lehetősége az aggteleki Baradla-barlang biológiai laboratóriumában. – *Állattani Közlemények*, **69:** 13–27.

Zicsi, A. (1982c): Revision zweier Bretscherischen Regenwurm-Arten (Oligochaeta: Lumbricidae). – *Revue suisse de Zoologie*, **89:** 553–565.

Zicsi, A. (1983a): *Earthworm ecology in deciduous forests in central and southeast Europe*. In: Satchell, J. E. (ed.), Earthworm ecology from Darwin to vermiculture. Chapter **14:** 171–177.

Zicsi, A. (1983b): *The earthworm fauna of the Hortobágy National Park (Oligochaeta, Luimbricidae)*. – In: Mahunka S. (ed.): The Fauna of the Hortobágy National Park. Hungarian Natural History Museum Budapest, p. 47–49.

Zicsi, A. (1985a): Über die Gattungen Helodrilus Hoffmeister, 1845 und Proctodrilus gen. n. (Oligochaeta: Lumbricidae). – *Acta Zoologica Academiae Scientarum Hungaricae*, **31:** 275–289.

Zicsi, A. (1985b): Welche Lumbriciden-Arten eignen sich noch in Europa zum Anlagen von Wurmkulturen zweks Kompostirungsversuche? – *Opuscula Zoologica Budapest*, **21**: 137–139.

Zicsi, A. (1986): Über die taxonomischen Probleme der Gattung *Octodrilus* Omodeo, 1956 und *Octodriloides* gen. n. (Oligochaeta: Lumbricidae). – *Opuscula Zoologica Budapest,* **22:** 103–112.

Zicsi, A. (1991): Über die Regenwürmer Ungarns (Oligochaeta: Lumbricidae) mit Bestimmungstabellen der Arten. – *Opuscula Zoologica Budapest,* **24:** 167–191.

Zicsi, A. (1994): Die Regenwürmer Österreichs (Oligochaeta: Lumbricidae) mit Bestimmungstabellen der Arten. – *Verhandlungen der Zoologisch-Botanischen Gesellschaft in Österreich,* **131:** 47–74.

Zicsi, A. (1995): Über die systematische Stellung von Allolobophora opisthocystis Rosa, 1895 (Oligochaeta: Lumbricidae). – *Annalen des Naturhistorischen Museums in Wien*, **97B:** 125–129.

Zicsi, A. & Csuzdi, Cs (1986): Regenwürmer aus Bulgarien (Oligochaeta: Lumbricidae). – *Opuscula Zoologica Budapest*, **22:** 121.

Zicsi, A. & Csuzdi, Cs. (1999): Weitere Angaben zur Regenwurmfauna Frankreichs mit Beschreibung fünf neuer Arten (Oligochaeta: Lumbricidae). – *Revue suisse de Zoologie*, **106:** 983–1003.

Zicsi, A., Dózsa-Farkas, K. & Csuzdi, Cs. (1990): *Terrestrial Oligochaeta from the nature conservation areas of Bátorliget (NE Hungary).* – In: Mahunka S. (ed.), The Bátorliget Nature Reserves – after forty years. Hungarian Natural History Museum Budapest, p. 215–220.

Zicsi, A., Dózsa-Farkas, K. & Csuzdi, Cs. (1999): *Terrestrial Oligochaetes of the Aggtelek National Park.* In. Mahunka S. (ed.), The Fauna of the Aggtelek National Park. Hungarian Natural History Museum Budapest, p. 39–43.

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

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

Zicsi, A. & Pop, V.V. (1984): Neue Regenwürmer aus Rumänien (Oligochaeta: Lumbricidae). – *Acta Zoologica Academiae Scientarum Hungaricae*, **30:** 241–248.

Zicsi, A. & Pop, V.V. (1991): Cernosvitovia munteniana sp. n. ein neuer Regenwurm aus Rumänien (Oligochaeta: Lumbricidae). – *Mitteilungen aus dem Hamburgischen zoologischen Museum und Institut*, **88:** 125–127.

9. INDEX OF GENERA AND SPECIES