

## New earthworm records from Austria (Megadrili: Lumbricidae)

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**Abstract.** Earthworm collecting trips to different parts of Austria – the Karawanks, Carinthia, Lower and Western Austria – resulted in recording altogether 17 species. Based on the morphological data, *Dendrobaena velkovrhia* Mršić, 1988 is found to be a synonym of *Dendrobaena auriculifera* Zicsi, 1969. The problems with the previously published *Eisenia lucens* (Waga, 1857) records and these specimens' supposed identity with *E. spelaea* (Rosa, 1901) are also discussed.

**Keywords.** Clitellata, Oligochaeta, Austria, species, synonymy.

### INTRODUCTION

The beginning of the researches on the Austrian earthworm fauna goes back to the turn of the 19<sup>th</sup>–20<sup>th</sup> century, when Rosa (1895, 1897) and Wessely (1905, 1920) published the first data from the country. Their work was followed by Pop (1947) and Franz (1961), who presented new records from the North and Northeastern Alps.

Zicsi (1965a, 1965b) summarized all the information about the Austrian earthworm fauna, described two new species from the Karawanks (Zicsi 1969a) and revised the earthworm collection of Karl Wessely (Zicsi 1969b).

After a longer break in the researches, Zicsi (1994) published another comprehensive paper with identification keys and the description of two new species, and listed altogether 60 species of the Austrian earthworm fauna.

Since then, the exotic earthworm species *Amyntas corticis* (Kinberg, 1867) was reported from a greenhouse in Lower Austria (Zicsi *et al.* 1999), the earthworms of Carinthia were summarized by Zicsi & Holzinger (1999) and a synoptic key to the earthworms of Austria was published by Christian & Zicsi (1999).

The aim of this study is to present the new earthworm records collected primarily in the Karawanks and Carinthia by the staff of the Hungarian Natural History Museum in the last decade.

### MATERIAL AND METHODS

Earthworms were collected by digging and searching under stones and the bark of fallen logs. The specimens were killed, fixed and preserved in 75% or 96% ethanol, and deposited in the earthworm collections of the Hungarian Natural History Museum (HNHM) and the Natural History Museum Vienna (NHMW).

### RESULTS

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

*Enterion caliginosum* Savigny, 1826: 180.

*Allolobophora caliginosa*: Zicsi 1965a: 261; 1969a: 384; 1994: 63. Zicsi & Holzinger 1999: 628.

*Allolobophora caliginosa caliginosa*: Christian & Zicsi 1999: 129.

*Aporrectodea caliginosa caliginosa*: Csuzdi 2012.

*Material examined.* HNHM/16461 3 ex., Viktorsberg, 28.03.2003, leg. S. Mahunka. HNHM/

16682, 2 ex., Karawanks, near Rada, alder marsh and pasture, 06.10.2005, leg. L. Dányi, J. Kontschán. HNHM/16684, 1 ex., Karawanks, after Schlatten, meadow and a small beech forest, 07.10.2005, leg. L. Dányi, J. Kontschán. HNHM/16687, 1 ex., Karawanks, after Schlatten, meadow and a small beech forest, 07.10.2005, leg. L. Dányi, J. Kontschán.

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

*Enterion roseum* Savigny, 1826: 182.

*Allolobophora rosea*: Zicsi 1965a: 260; 1969a: 383; 1994: 67. Zicsi & Holzinger 1999: 628.

*Allolobophora rosea rosea*: Christian & Zicsi 1999: 128.

*Aporrectodea rosea*: Csuzdi 2012.

*Material examined.* HNMH/16683, 1 ex., Karawanks, near Rada, alder marsh and pasture, 06.10.2005, leg. L. Dányi, J. Kontschán.

***Aporrectodea smaragdina* (Rosa, 1892)**

*Allolobophora smaragdina* Rosa, 1892: 1.

*Allolobophora smaragdina*: Zicsi 1965a: 261; 1969a: 383; 1994: 68. Zicsi & Holzinger 1999: 628. Christian & Zicsi 1999: 128.

*Aporrectodea smaragdina*: Csuzdi 2012.

*Material examined.* HNHM/16679, 1 ex., Karawanks, above Bad Vellach, Vellach-Ursprung, stream valley, 06.10.2005, leg. L. Dányi, J. Kontschán. HNHM/17269, 4 ex., NHMW 4 ex. Carinthia, Villach-Land, Wurzenpass, 46.526487° N, 13.752188° E, 1004 m, beech and spruce forest; under moss, logs, stones and leaf litter, 24.06.2017, leg. N. Akkari, A-S. Ganske, L. Dányi. HNHM/17278, 4 ex., Carinthia, Spittal an der Drau, Silbergraben, 46.72993° N, 12.96741° E, 871 m, mixed beech and spruce forest; under stones, logs and from leaf litter, 21.06.2017, leg. N. Akkari, A-S. Ganske, L. Dányi. HNHM/17281, 4 ex., NHMW 4 ex. Carinthia, Hermagor, Plöcken, Grünsee, 46.61240° N, 12.96641° E, 1269 m, spruce and beech forest; under stones, logs and from leaf litter, 22.06.2017, leg. N. Akkari, A-S. Ganske, L. Dányi. HNHM/17282, 1 ex., Carinthia, Völkermarkt, Trögern, 46.45931° N,

14.50225° E, 746 m, from rock wall in the gorge, 25.06.2017, leg. N. Akkari, A-S. Ganske, L. Dányi. HNHM/17283, 2 ex., Carinthia, Hermagor, Gailberg, 46.70897° N, 12.97030° E, 950 m, spruce forest; under stones, logs and from leaf litter and moss, 22.06.2017, leg. N. Akkari, A-S. Ganske, L. Dányi. HNHM/17286, 2 ex., Carinthia, Klagenfurt-Land, Loibltal, 46.448055° N, 14.256039° E, 1000 m, beech and spruce forest; under stones, moss and from leaf litter, 25.06.2017, leg. N. Akkari, A-S. Ganske, L. Dányi. HNHM/17290, 1 ex., Carinthia, Hermagor, Poludniggipfel, 46.57201° N, 13.40984° E, 1999 m, alpine meadow; under stones, 23.06.2017, leg. N. Akkari, A-S. Ganske, L. Dányi. HNHM/17291, 1 ex., Carinthia, Villach-Land, Boden, 46.67437° N, 13.51811° E, 1054 m, spruce and beech forest; under stones, logs and from leaf litter, 24.06.2017, leg. N. Akkari, A-S. Ganske, L. Dányi. HNHM/17293, 2 ex., Carinthia, Hermagor, Plöcken, 46.62292° N, 12.94744° E, 1060 m, beech forest; under stones, logs and from leaf litter, 22.06.2017, leg. N. Akkari, A-S. Ganske, L. Dányi.

***Bimastos rubidus* (Savigny, 1826)**

*Enterion rubidum* Savigny, 1826: 182.

*Dendrobaena rubida*: Zicsi 1965a: 252; 1969a: 380.

*Dendrodrilus rubidus*: Zicsi 1994: 52. Zicsi & Holzinger 1999: 628.

*Dendrodrilus rubidus subrubicundus*: Zicsi 1994: 54. Christian & Zicsi 1999: 124.

*Dendrodrilus rubidus rubidus*: Christian & Zicsi 1999: 124.

*Dendrodrilus rubidus tenuis*: Christian & Zicsi 1999: 124.

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

*Material examined.* HNMH/16676, 1 ex., Karawanks, above Bad Vellach, near Seeburgsattel, mixed beech-pine forest, 06.10.2005., leg. L. Dányi, J. Kontschán. HNHM/17279, 1 ex., Carinthia, Spittal an der Drau, Silbergraben, 46.72993° N, 12.96741° E, 871 m, mixed beech and spruce forest; under stones, logs and from leaf litter, 21.06.2017, leg. N. Akkari, A-S. Ganske, L. Dányi.

***Dendrobaena alpina alpina* (Rosa, 1884)**

*Allolobophora alpina* Rosa, 1884: 28.

*Dendrobaena alpina*: Zicsi 1965a: 252; 1969a: 381; 1994: 48. Zicsi & Holzinger 1999: 628. Christian & Zicsi 1999: 125.

*Material examined.* HNHM/16689, 3 ex., NHMW 1 ex. Karawanks, 06.10.2005, leg. L. Dányi, J. Kontschán. HNHM/17275 1 ex., Carinthia, Spittal an der Drau, St. Wolfgang, 46.80741°N, 13.51704°E, 665 m, disturbed spruce forest; under logs and stones, 20.06.2017, leg. N. Akkari, A-S. Ganske, L. Dányi. HNHM/17292, 1 ex., Carinthia, Villach-Land, Boden, 46.67437°N, 13.51811°E, 1054 m, spruce and beech forest; under stones, logs and from leaf litter, 24.06.2017, leg. N. Akkari, A-S. Ganske, L. Dányi. HNHM/17294, 1 ex., Carinthia, Villach-Land, Jeserz, 46.56565°N, 13.69508°E, 557 m, beech and spruce forest; under moss, logs, stones and leaf litter, 24.06.2017, leg. N. Akkari, A-S. Ganske, L. Dányi.

***Dendrobaena attemsi* (Michaelsen, 1902)**

*Helodrilus (Dendrobaena) attemsi* Michaelsen, 1902: 47.

*Dendrobaena attemsi*: Zicsi 1965a: 253; 1994: 51. Christian & Zicsi 1999: 125.

*Material examined.* HNHM/17284, 4 ex., NHMW 2 ex. Carinthia, Spittal an der Drau, Seebachtal Alm, 47.01581°N, 13.18667°E, 1288 m, spruce forest with a stream and meadow; under logs and stones, 21.06.2017, leg. N. Akkari, A-S. Ganske, L. Dányi. HNHM/17287, 2 ex., Carinthia, Spittal an der Drau, Angermann, 47.00932°N, 13.17739°E, 1253 m, spruce forest, close to stream; under stones, moss, logs and from leaf litter, 21.06.2017, leg. N. Akkari, A-S. Ganske, L. Dányi.

***Dendrobaena auriculifera* Zicsi, 1969**

*Dendrobaena auriculifera* Zicsi, 1969a: 381; 1994: 49. Zicsi & Holzinger 1999: 628. Christian & Zicsi 1999: 124.

*Dendrobaena velkovrhia* Mršić, 1988: 17. **syn. nov.**

*Dendrobaena velkovrhi*: Mršić 1991: 575.

*Material examined.* HNHM/16675, 2 ex., Karawanks, above Bad Vellach, near Seebergsattel, mixed beech-pine forest, 06.10.2005, leg. L. Dányi, J. Kontschán. HNHM/16677, 1 ex., Karawanks, above Bad Vellach, Vellach-Ursprung, stream valley, 06.10.2005, leg. L. Dányi, J. Kontschán.

*Remarks.* Mršić (1988) described *Dendrobaena velkovrhia* from Krnica, Slovenia, close to the type locality of *D. auriculifera* (Wurzen Pass, Austria). Based on the original description and the Monograph of Mršić (1991: 575.), the main characters of the two species are similar: clitellum on 2/3 25, 1/2 25–1/2 33, 33 in case of *D. velkovrhia* and 1/4 25–33 in *D. auriculifera*, tubercles on 2/3 30, 1/2 30–32 vs. 30–32, four pairs of seminal vesicles, two pairs of spermathecae opening near setal line *c*, calciferous glands with diverticula in segment 11 and 12. Taking all these similarities into account *D. velkovrhia* is regarded as a synonym of *D. auriculifera*.

*D. auriculifera* is a narrowly distributed species found in Austria and Slovenia. Its range stretches from the Karawanks through the Julian Alps to the northern projection of the Dinaric Alps (Mršić 1991).

***Dendrobaena ganglbaueri* (Rosa, 1894)**

*Allolobophora ganglbaueri* Rosa, 1894: 1.

*Dendrobaena ganglbaueri*: Zicsi 1994: 49. Zicsi & Holzinger 1999: 628. Christian & Zicsi 1999: 124.

*Dendrobaena byblica*: Zicsi 1965a: 251; 1969a: 380.

*Material examined.* HNHM/16673, 1 ex., NHMW 1 ex. Karawanks, above Bad Vellach, near Seebergsattel, mixed beech-pine forest, 06.10.2005, leg. L. Dányi, J. Kontschán. HNHM/16686, 2 ex., Karawanks, near Ebriach Obirsko, Ebriach bach, streambank, mixed pine forest, 06.10.2005, leg. L. Dányi, J. Kontschán. HNHM/17288, 1 ex., Carinthia, Völkermarkt, Trögern, 46.45931°N, 14.50225°E, 746 m, from rock wall in the gorge, 25.06.2017, leg. N. Akkari, A-S. Ganske, L. Dányi.

***Dendrobaena octaedra* (Savigny, 1826)**

*Enterion octaedrum* Savigny, 1826: 183.

*Dendrobaena octaedra*: Zicsi 1965a: 253; 1969a: 382; 1994: 50. Zicsi & Holzinger 1999: 628. Christian & Zicsi 1999: 125.

*Material examined.* HNHM/16674, 4 ex., NHMW 2 ex. Karawanks, above Bad Vellach, near Seebergsattel, mixed beech-pine forest, 06.10.2005, leg. L. Dányi, J. Kontschán. HNHM/16688, 1 ex., Karawanks, Rosenbach, srteambank near the bridge, 07.10.2005, leg. L. Dányi, J. Kontschán. HNHM/16690, 5 ex., Karawanks, 10.2005, leg. L. Dányi, J. Kontschán. HNHM/17272, 1 ex., Carinthia, Wolfsberg, Twimberg, 46.928807°N, 14.843355°E, 811 m, slope with acer; from leaf litter, 26.06.2017, leg. N. Akkari, A-S. Ganske, L. Dányi. HNHM/17274, 2 ex., Carinthia, Spittal an der Drau, St. Wolfgang, 46.80741°N, 13.51704°E, 665 m, disturbed spruce forest; under logs and stones, 20.06.2017, leg. N. Akkari, A-S. Ganske, L. Dányi. HNHM/17285, 1 ex., Carinthia, Spittal an der Drau, Seebachtal Alm, 47.01581°N, 13.18667°E, 1288 m, spruce forest with a stream and meadow; under logs and stones, 21.06.2017, leg. N. Akkari, A-S. Ganske, L. Dányi.

***Eisenia spelaea* (Rosa, 1901)**

*Allolobophora spelaea* Rosa, 1901: 36.

*Eisenia spelaea*: Christian & Zicsi 1999: 129.

*Eisenia lucens*: Zicsi 1965a: 251; 1969a: 380.

*Material examined.* HNHM/7831, 1 ex., Lower Austria, Höfl near Purgstall an der Erlauf, 16.07.1971, leg. F. Ressler. HNHM/7840, 1 ex., Lower Austria, Göstling an der Ybbs, Hochmoor, 23.06.1969, leg. Rausch. HNHM/12784, 1 ex., Wurzen Pass, 18.09.1980., leg. A. Zicsi. HNHM/17271, 1 ex., Carinthia, Klagenfurt-Land, Waidisch, 46.49146°N, 14.34890°E, 602 m, rocky beech forest with spruce; under stones, logs and from leaf litter, 25.06.2017, leg. N. Akkari, A-S. Ganske, L. Dányi.

*Remarks.* Regarding its morphological characteristics, *E. spelaea* is very similar to *E. lucens*

(Waga, 1857). The only remarkable difference which can successfully be used to distinguish the two species in preserved state is the position of the openings of the spermathecae, which is near setal line *d* in *E. spelaea* and between *d* and the mid-dorsal line in *E. lucens*. The main reason why they are regarded as separate species is the ability of bioluminescence in case of *E. lucens* (Pes *et al.* 2016). Besides, their habitat preference is also different; *E. lucens* is usually found under the bark of fallen logs, while *E. spelaea* prefers the submerged leaf litter in streams (Csuzdi & Zicsi 2003).

The Austrian data for these two species are rather controversial and questionable. The species name *Eisenia spelaea* first appears as member of the Austrian earthworm fauna in the paper of Christian & Zicsi (1999), but without any locality data. The previous literature contains only *E. lucens* records, often from wet habitats, *e.g.* stream banks (Zicsi 1969a). Furthermore, a part of the published records were originally identified as *E. spelaea* by Prof. Zicsi, but then published as *E. lucens*.

As a result of the revision of all published and non-published Austrian *E. lucens* / *E. spelaea* specimens, it can be stated that morphologically all of them are more similar to *E. spelaea*.

***Lumbricus castaneus* (Savigny, 1826)**

*Enterion castaneum* Savigny, 1826: 180.

*Lumbricus castaneus*: Zicsi 1965a: 249; 1994: 58.

Zicsi & Holzinger 1999: 628. Christian & Zicsi 1999: 127.

*Material examined.* HNHM/16681, 1 ex., Karawanks, near Rada, alder marsh and pasture, 06.10.2005, leg. L. Dányi, J. Kontschán. HNHM/17270, 1 ex., Carinthia, Klagenfurt-Land, Waidisch, 46.49146°N, 14.34890°E, 602 m, rocky beech forest with spruce; under stones, logs and from leaf litter, 25.06.2017, leg. N. Akkari, A-S. Ganske, L. Dányi. HNHM/17289, 1 ex., Carinthia, Völkermarkt, Trögern, 46.45931°N, 14.50225°E, 746 m, from rock wall in the gorge, 25.06.2017, leg. N. Akkari, A-S. Ganske, L. Dányi.

***Lumbricus rubellus* Hoffmeister, 1843**

*Lumbricus rubellus* Hoffmeister, 1843: 187. Zicsi 1965a: 248; 1969a: 379; 1994: 59. Zicsi & Holzinger 1999: 628. Christian & Zicsi 1999: 127.

*Material examined.* HNHM/17267, 1 ex., Carinthia, Hermagor, Poludniger Alm, 46.57418°N, 13.41469°E, 1735 m, alpine pasture edge and Larix forest; under logs and stones, 23.06.2017, leg. N. Akkari, A-S. Ganske, L. Dányi. HNHM/17273, 3 ex., Carinthia, Spittal an der Drau, St. Wolfgang, 46.80741°N, 13.51704°E, 665 m, disturbed spruce forest; under logs and stones, 20.06.2017, leg. N. Akkari, A-S. Ganske, L. Dányi. HNHM/17277, 1 ex., Carinthia, Spittal an der Drau, Lassach Sonnseite, 46.96720°N, 13.18118°E, 1167 m, beech and maple forest; under stones, logs and from leaf litter, 21.06.2017., leg. N. Akkari, A-S. Ganske, L. Dányi.

***Lumbricus terrestris* Linneaus, 1758**

*Lumbricus terrestris* Linneaus, 1758: 647. Zicsi 1965a: 250; 1994: 62. Christian & Zicsi 1999: 127.

*Material examined.* HNHM/16680, 1 ex., Karawanks, near Rada, alder marsh and pasture, 06.10.2005, leg. L. Dányi, J. Kontschán.

***Octodriloides karawankensis* (Zicsi, 1969)**

*Octolasion (Octodrilus) karawankense* Zicsi, 1969a: 382.

*Octodriloides karawankensis* Zicsi 1994: 39. Zicsi & Holzinger 1999: 628. Christian & Zicsi 1999: 126.

*Material examined.* HNHM/16678, 1 ex., Karawanks, above Bad Vellach, Vellach-Ursprung, stream valley, 06.10.2005, leg. L. Dányi, J. Kontschán.

***Octodrilus argoviensis* (Bretscher, 1899)**

*Allolobophora argoviense* Bretscher, 1899: 418.

*Octolasion croaticum* v. *argoviensis*: Zicsi 1965a: 258.

*Octolasion (Octodrilus) croaticum* v. *argoviense*: Zicsi 1969a: 382.

*Octodrilus argoviensis*: Zicsi 1994: 44. Zicsi & Holzinger 1999: 628. Christian & Zicsi 1999: 125.

*Material examined.* HNHM/17266, 2 ex., NHMW 1 ex. Carinthia, Hermagor, Poludniger Alm, 46.57418°N, 13.41469°E, 1735 m, alpine pasture edge and Larix forest; under logs and stones, 23.06.2017., leg. N. Akkari, A-S. Ganske, L. Dányi. HNHM/17280, 1 ex., Carinthia, Hermagor, Plöcken, Grünsee, 46.61240°N, 12.96641°E, 1269 m, spruce and beech forest; under stones, logs and from leaf litter, 22.06.2017, leg. N. Akkari, A-S. Ganske, L. Dányi.

***Octodrilus croaticus* (Rosa, 1895)**

*Allolobophora lissaensis* v. *croatica* Rosa, 1895: 5.

*Octolasion croaticum* f. *typica*: Zicsi 1965a: 257.

*Octodrilus croaticus*: Zicsi 1994: 39. Christian & Zicsi 1999: 125.

*Material examined.* HNHM/16462, 1 ex., Viktorsberg, 28.03.2003, leg. S. Mahunka.

***Octolasion lacteum* (Örley, 1881)**

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

*Octolasion lacteum*: Zicsi 1965a: 257; 1969a: 382.

*Octolasion lacteum*: Zicsi 1994: 55. Zicsi & Holzinger 1999: 628. Christian & Zicsi 1999: 126.

*Material examined.* HNHM/16685, 1 ex., Karawanks, after Schlatten, meadow and a small beech forest, 07.10.2005, leg. L. Dányi, J. Kontschán. HNHM/17268, 2 ex., Carinthia, Hermagor, Poludniger Alm, 46.57418°N, 13.41469°E, 1735 m, alpine pasture edge and Larix forest; under logs and stones, 23.06.2017, leg. N. Akkari, A-S. Ganske, L. Dányi. HNHM/17276, 2 ex., Carinthia, Spittal an der Drau, Lassach Sonnseite, 46.96720°N, 13.18118°E, 1167 m, beech and maple forest; under stones, logs and from leaf litter, 21.06.2017, leg. N. Akkari, A-S. Ganske, L. Dányi.

**DISCUSSION**

The present study resulted in reporting altogether 17 species mostly from the Karawanks and

Carinthia, with a few records from Lower and Western Austria.

Based on the morphological characters in the literature, *Dendrobaena velkovrhia* Mršić, 1988 was found to be a synonym of *Dendrobaena auriculifera* Zicsi, 1969, a narrowly distributed species occurring in Southeastern Austria and Slovenia (Mršić 1991).

The revision of the *E. lucens* specimens published by Zicsi (1965a, 1969a, 1994) revealed that morphologically they are more similar to *E. spelaea*. Although not all specimens are from wet habitats preferred by the latter species, a recent study revealed that *E. spelaea* can be found not just in the leaf litter of streams, but even in soil (Szederjesi *et al.* 2011). As the only useful morphological character is not stable and can often be hardly observed in preserved state, fresh material is needed for clarification of the exact distribution of these species in Austria on one hand to test the presence of bioluminescence, and also to apply molecular methods, *e.g.* DNA barcoding for the species delimitation.

**Acknowledgements** – My thanks are due to the collectors of the material examined.

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