FOLIA HISTORICO NATURALIA MUSEI MATRAENSIS
2006 30: 105–113

On the occurrence of *Lithobius erythrocephalus* C. L. Koch, 1847, and *Lithobius schuleri* Verhoeff, 1925 (Myriapoda: Chilopoda) in Hungary

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Abstract: As *L. schuleri* has been considered earlier as a subspecies of *L. erythrocephalus,* there are several records which mention its occurrence under the name of this latter species. Besides a critical review of earlier published Hungarian data of these two species numerous new occurrences from Hungary as well as some from outside the country (Slovakia, Romania, Bulgaria, Croatia, Austria) are given. In contrast to the widespread and euriecious *L. erythrocephalus,* the presence of *L. schuleri* with its distinctly montane character, is of greater faunistical importance (e.g. in the Mecsek Mts., the Börzsöny Mts., the Bükk Mts., the Aggtelek Karst and the Zemplén Mts.). A description of the characters of both species along with drawings and pictures made by scanning electron microscope are given.

Introduction

In Europe, the most species-rich genus within the chilopods is *Lithobius* (261 species according to Zapparoli (2003)), which also represents a considerable part of Hungary´s chilopod species. At present, there are 30 *Lithobius* species known from Hungary, which is nearly half of the whole Hungarian chilopod fauna.

We can state in general about this large group that the distribution patterns of the species are not known satisfactorily enough (Eason 1992, Zapparoli 2003). This is due, on the one hand, to some areas being poorly known in international terms, such as the whole of Hungary, where since the paper of Loksa in 1955 no other publication has appeared which considered all the Hungarian occurrences of this genus in a summarizing manner suitable for zoogeographical analysis on a European scale. On the other hand, in the case of some species, their earlier uncertain taxonomical status is to blame.

The reason for the taxonomical confusion with the two species discussed here has been their close relatedness. These two taxons have only been considered as subspecies for a long time (Dobroruka 1962, Koren 1992, Verhoeff 1925) and numerous works have been published (also by the author) which gave no information on the level of subspecies (Korsós 1987, 1991; Dányi & Korsós 2002, Korsós & Dányi 2002, Dányi & Korsós 2003, Dányi 2005). Special interest is to be taken in the area around Bátorliget, where Loksa (1953) found examples showing characters of both subspecies mixed, though being closer to the *erythrocephalus* form.

The importance of clarifying the distributional pattern of these two taxa, which are nowadays generally regarded as two separate species (Zapparoli 2002, 2003; Stoev 2002; and suggested as a possibility already in Eason 1982), is emphasized by the (seemingly) rather differing ecological conditions, according to our present knowledge: while *L. erythrocephalus* is wide-spread throughout the whole of Europe and euriecious, *L. schuleri* has a more Middle and Southeast European chorotype and occurres typically in mountainous

regions (Stoev 2002, Zapparoli 2002). This difference can be of great importance also in the faunistic evaluation of Hungarian areas.

Materials and methods

Individuals of *L. erythrocephalus* and *L. schuleri* from numerous different places mainly within and some from outside of Hungary were examined and compared. Apart from the individuals determined by myself, I also included material from the Myriapoda Collection of the Hungarian Natural History Museum determined or revised by Imre Loksa or Zoltán Korsós. Further material was studied in the Museum of Natural History Vienna determined by Robert Latzel or Carl Graf Attems (marked with "MNHV" in the records. The newly determined material has been placed at the same Collection conserved in 70% ethanol.

The drawings were made with *camera lucida*. For electron microscopy, specimens were air-dried and photographed on a HITACHI SN 2600 in the Hungarian Natural History Museum, Budapest.

In the cases of new records the names of the collectors are given in brackets behind the dates, their abbreviations are the following: DL: László Dányi; HG: Gábor Hegyessy; KZ: Zoltán Korsós; KJ: Jenő Kontschán; SzGy: Győző Szél; MD: Dávid Murányi; MO: Ottó Merkl

Lithobius erythrocephalus C. L. Koch, 1847

Lithobius eximius Meinert: Daday 1889: p. 96.; Daday 1918: p. 10.; Szilády 1925: p. 156. *Lithobius erythrocephalus* C. Koch: Tömösváry 1879b: p. 247.; Latzel 1880: p. 110., t. 4., fig. 29.; Chyzer 1886: p. 75., Daday 1889: p. 97., fig. 22. on tab. III; Szalay 1942: p. 49.; Loksa 1953: p. 144.; Loksa 1956: p. 390; Szalai 1974: p. 67.; Matic & Ceuca 1970: p. 107. fig4. on p. 108. *Lithobius erythrocephalus* Koch: Szabó 1932: p. 16.; Loksa 1961: p. 72.; Loksa 1966: p. 35.; Loksa 1971: p. 308. *Lithobius erythrocephalus erythrocephalus* C. Koch: Loksa 1955: p. 342. *Lithobius erythrocephalus*: Loksa 1959: p. 390.; Loksa 1969: p. 157.; Kondás & Teglovics 1982: p. 106.; Czvitkovics 1988: p. 28.; Szlávecz & Loksa 1991: p. 804. *Lithobius erythrocephalus* C.L. Koch: Loksa 1973: p. 86.; Loksa 1981: p. 49.; Loksa 1983: p. 69.; Kálnay 1984: p. 12.; Korsós 1987: p. 76.; Korsós 1991: p. 260.; Loksa 1991: p. 137.; Sallai 1992a: p. 81.; Sallai, Á. 1992b: p. 98.; Sallai 1993: p. 204.; Dányi & Korsós 2002: p. 138.; Korsós & Dányi 2002: p. 187. *Lithobius erythrocephalus* (Koch): Ilosvay 1983: p. 71. *Lithobius erythrocephalus* (C.L. Koch): Dányi & Korsós 2003: p. 354.

Short description

Body: 10 to 18 mm (fig. 1a). Colour of tergites usually simply rusty brown, they become only darker posteriorly. Sometimes posterior border of tergites darker, in some cases a streak along the middle of the animal's back can be feebly seen.

Head: Usually with a typical, striking pattern: posterior corners rather light, yellowish-rusty, whereas median and anterior part with a more or less abrupt dark-brown transition.

Antennae: Rather short, 28 to 35 articles; stroken back they reach till about the end of the 3rd or 4th tergit (fig. 1a). Colour of basal articles corresponds to dark colour of forehead, distal articles becoming more and more lighter.

Ocelli: 10 to 14 on each side (fig. 1b).

Forcipular coxosternite: Colour often fairly vivid yellow, anterior border with 2 teeth on either side (fig. 1d).

Tergites: Posterior corner of tergites without or only with minute triangular projections only on the 13th, posterior corners rectangular or blunt (fig. 1a).

Legs: Legs and ventral side of trunk pale, last pair of legs somewhat darker brown, 15th tibiae of males usually lighter at the base. The 15th tibiae of male dorsoventrally flattened (fig. 2b)

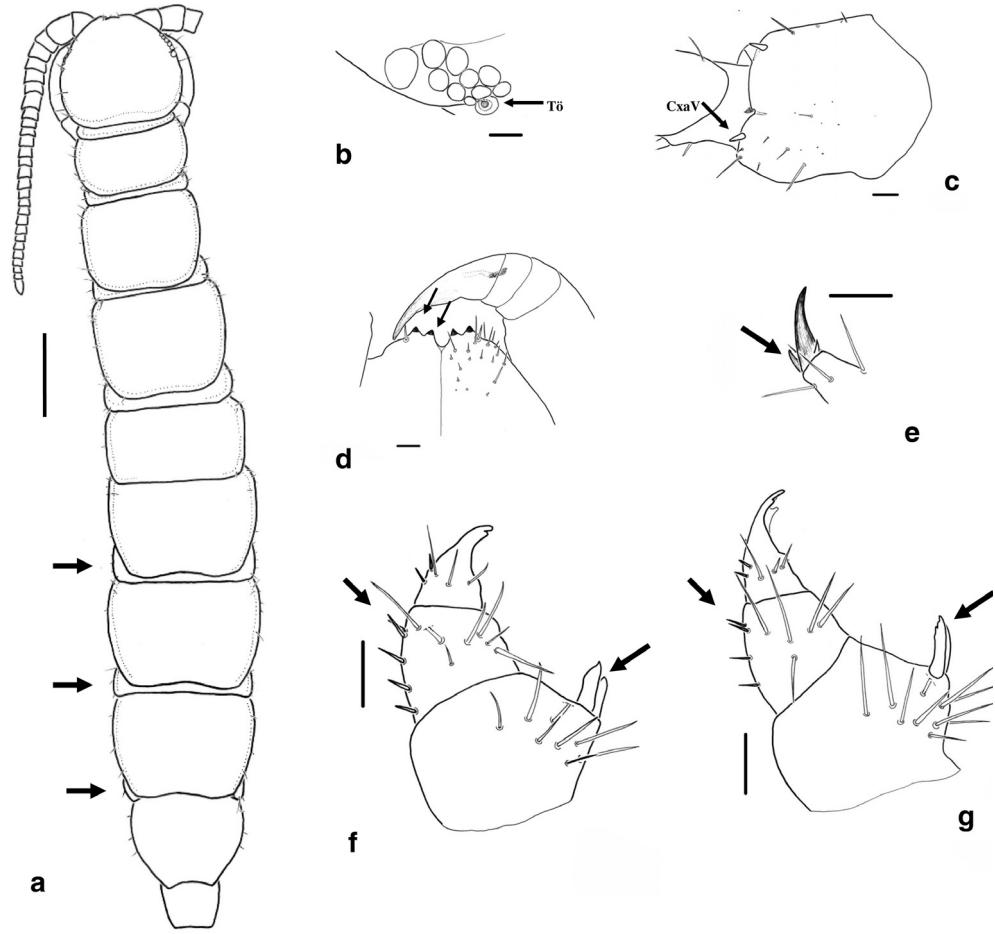
Accessory apical claw: Present (fig. 1e)

Spinulation: Spine (CxaV) present on posteriolateral border of coxa (fig. 1c).

14th: 103p p 15th: 103 p^0 0
0133am 0133$^{am}a^0$

Coxal pores: Round.

Gonopods: With 2+2 spurs, about three times longer than broad (fig. 1f, 2a). Gonopod claw ends in 3 broad and blunt tips (fig 1f, 2a).



Figs 1a–1f: *Lithobius erythrocephalus* C.L. Koch, 1847 (scales 1a: 1mm, 1b-1f: 0.1 mm) – a = habitus with tergite 9,11,13th, dorsal site; b = group of ocelli, lateral view (Tö: organ of Tömösváry); c = coxa of 15th leg with the CxaV spine, lateral view; d = forcipular coxosternite with teeth, ventral view; e = proximal end of 15th leg with apical claw and the accessory apical claw, lateral view; f = female gonopod with spurs and dorsolateral setae, lateral view.

Fig. 1g: *Lithobius schuleri* Verhoeff, 1925 (scale 0.1 mm) – female gonopod with spurs and dorsolateral setae, lateral view.

New records

Hungary: Baskó, ruin of the castle 07.07.1999(KZ); Bajót, Öreg-kő 15.10.2005(DL); Baktalórántháza, Baktai-erdő 22.03.1989(KZ); Balatonfenyves, Nagyberek 08.10.1985(KZ), 26.06.1986(KZ); Balatonfenyves 05.06.1988(KZ); Balatonfüred, Koloska-völgy 21.05.2003(KJ); Balinka-Mécstelep, Gaja brook 19.02.2002(DL); Bodajk, „Falutábor" 18.05.2005(DL); Boglárlelle/Balatonlelle, kilátó 10.06.1990(KZ); Budapest, Csillebérc 08.04.1991(Fürjes I.); Csévharaszt 18-19.04.2002(SzGy), 01-02.10.2001(SzGy), 07.05.2002 (MD,KJ); Csókakő, Arany-hegy

23.03.1989(Róka Sz.); Dénesfa 03.06.2001(MO); Devecser, Széki-erdő 25.09.1999(KZ); Devecser, Széki-erdő 05.06.1991(KZ); Doboz, Sarkad-Dobozi-erdő 23.06.2004(DL); Dunasziget, Hajós 05.09.1999(SZGY); Egyek Ohati-erdő 20.03.1989(KZ); Fehérvárcsurgó, Gaja brook 19.02.2002(DL); Fenékpuszta 20.05.2003(KJ); Gödöllő/Babat, Kacsa-tó 12.04.1989(Kiss I.); Gödöllő/Babat 23.03.1989(KZ); Győrzámoly, Patkányospuszta 13.10.1998(KZ); Gyula, Városerdő(Bánom) 22.06.2004(DL); Halmaj, Nyilas 18.07.2001(HG); Hegyesd 11.06.2004(DL); Hernádkércs, Hernád 25.06.2003(HG); Hollóháza 14.04.1984(Gór A.); Járdánháza, Cseterna-völgy 09.03.2002(MD); Kállósemjén Mohos-tó 22.03.1989(KZ); Kászon Salutaris, 800m 18-29.06.1943(Fodor J., Kaszab J.); Kisgyón, Burok-völgy 31.10.2004(DL); Kistarcsa, behind the hospital 2002.09.(DL), 22.04.2002(DL); Komló, Szöge-hegy 11.05.2003(DL); Körmöcbánya, shore of the lake 24.05.1933(Dudich E.); Leányfalu, Álló-rét 30.04.1989(MO); Litér, Mogyorós-hegy 28. 05.1997(KCS); Lovasberény, holiday centre of the ministry 11.09.2002 (KJ,DL); Majk, Majk-puszta 14.12.2000(KJ); Majk 15.02.2001(KJ); Mátraszentistván, Vörös-kő 13.07.2003(DL); Mecsértelep, Gaja brook 22.01.2002(KJ,MD); Nagykovácsi, Kutya-hegy 14.04.1989(KZ); Nagyrécse 04.10.2004(MO, Grabant A.); Nagyvisnyó, Leányvásár ? (MO); Nyíri, Vörös-víz brook 11.05.2000(HG); Ócsa, Mádencia-erdő 28.04.1989(KZ); Öcs 17.07.1997(KZ), 14.03.2002(DL), 14.03.2002(DL); Paks, southern access road 15.10.2003(KJ); Paks, northern access road 15.10.2003(KJ); Pilisszentlászló, Öreg-Papp-hegy/Spartacus-ösvény 09.10.2005(DL); Pusztavám 24.04.2001(KJ); Regéc, Nagy-patak 29.03.2003(MD); Regéc, Ördög-völgy 22.06.2005 (MD); Salgóbánya, beside Hotel Medves 20.09.2002(DL); Simontornya, (Pillich)(MNHV-No.5215); Siófok, ?(?)(MNHV-No.5323); Somlóvásárhely, Holló-forrás 02.10.1999(KZ); Somoskő 20.09.2002(DL); Szár, Zuppa-hegy 19.04.1989(MO); Szigetbecse 12.02.1989 (MO); Telekgerendás 04.07.2001(KZ); Telkibánya; Cserenkő-patak 27.04.2002(MD); Telkibánya, Osva-völgy/Ork-hegy 16.09.1999(KZ); Tengelic 10.10.1970(Babos M.); Tótszentgyörgy 27.04.2004(MO,Grabant A.); Tömörd 30.04.-17.05.1999(Gyurácz J.); Vérteskozma, Fáni-völgy 27.04.1991(KZ); Villány 27.05.-02.06.2000(MS); Vizsoly, Hernád-holtág 23.08.2002(HG), 29.07.2002(HG); Zalaszántó, Kovácsi-hegy/bazalt-folyosó 03.12.1994(KZ); Zalavár 09.05.1985(KZ); Zirc-Akli, Szarvaskút 19.02.2002(DL).

Bulgaria: Mts Slivenska, Sinite Kamáni NP, Karandila 05.09.2005(KJ); Struma basin, Tiha Rila, outlet stream of Lake Smradlivo, 2250m 06.09.2005(KJ).

Slovakia: Slovensk? Raj, Geravy 02.08.2002(DL); Smolenice 19.03.2004(DL,KZ).

Lithobius schuleri Verhoeff, 1925

Lithobius erythrocephalus Schuleri Verhoeff: Loksa 1955: p. 343. *Lithobius erythrocephalus* C.L. Koch: Dányi 2005: p. 19.

Short description

Most of the features are the same as at *L. erythrocephalus* (see above).

The most important differences between the two species are the following:

Spurs of the female´s gonopods four or five times longer than broad (fig. 1g, 2c); at *L. erythrocephalus* about three times longer than broad.

Dorsolateral setae more slender than general setae (fig. 1g, 2c); at *L. erythrocephalus* as stout as or stouter than general setae.

According to Loksa (1955), the inner gonopods at *L. schuleri* are arched, but this character can´t be used with certainty since Eason´s drawing of the type of *L. erythrocephalus* (Eason 1972) also show it.

The 15th tibiae of male *L. schuleri* are almost perfectly cylindrical (fig. 2d), whereas that of *L. erythrocephalus* are dorsoventrally flattened (fig. 2b).

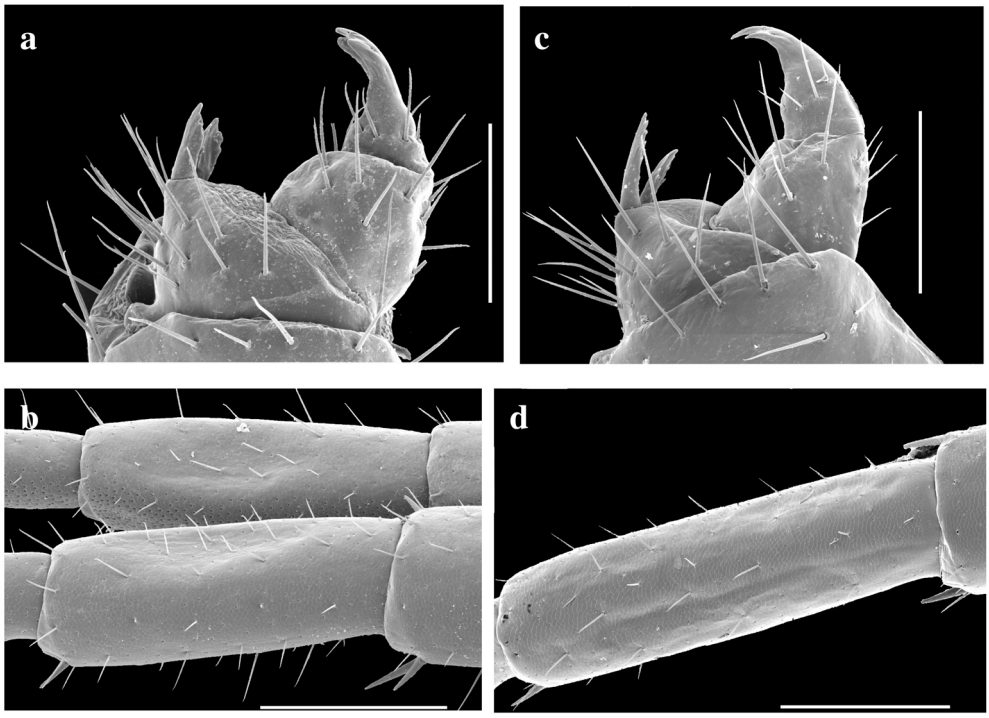
New records

Hungary: Bátaapáti 27.04.2004(KZ); Háromhuta, István-kút 24.07.1986(KZ); Háromhuta, Márika-forrás 11.07.2002(HG), 05.06.2002(HG); Regéc, Vajda-völgy 06.04.2002(MD); Rostalló 13.04.1985(Gór A.); Szuhafő, Szuha-völgy 20.05.2003(HG).

Croatia: Kokočak 20.04.2004(DL); Kutjevo, pass abowe Kutjevo 20.04.2004(DL); Zvecevo 22.04.2004(DL);

Romania: Băile Herculane (Herkulesfürdő) 28.04.2004.(KJ); Sighetu Marmaţiei (Máramarossziget), Vf. Ţiganului, 1200m 21.09.2005(KJ,MD);

Slovakia: Javorie, Blyskovica, 650m 20.10.2005(DL,KJ,MD)



Figs 2a–2b: *Lithobius erythrocephalus* C.L. Koch, 1847 – a = female gonopod, lateral view (scale: 250 ìm); b = 15th tibiae of male, dorsolateral view (scale: 500 ìm).

Figs 2c–2d: *Lithobius schuleri* Verhoeff, 1925 – c = female gonopod, lateral view (scale: 250 ìm); d = 15th tibiae of male, dorsolateral view (scale: 500 ìm).

Discussion

Overviewing the distribution of these two species in Hungary, we can see *L. erythrocephalus* occurring all over the country (fig. 3), being not at all selective with regards the habitat, so we may expect to find this species in any other place within Hungary, where it has not yet been detected. In contrast, *L. schuleri* has a much more specialized distributional pattern. About this species, there is only occurrences from some of the Hungarian low mountain ranges (fig. 4). As it has been found in several other European countries as preferring definitely higher, mountainous regions (Matic 1966, Zapparoli 2002), one can regard its occurrence in Hungarian low mountain ranges as an interesting alpine-mountainous influence. These Hungarian regions are the Mecsek Mts., the Zemplén Mts., the Bükk Mts., the Aggtelek Karst and the Börzsöny Mts., in all of which the presence of alpine elements was also known from other animal groups (Csuzdi & Zicsi 2003, Kárpáthegyi & Kontschán 2005, Kontschán 2003, Kontschán & al 2003, Korsós 1994, Lengyel & al 2004).

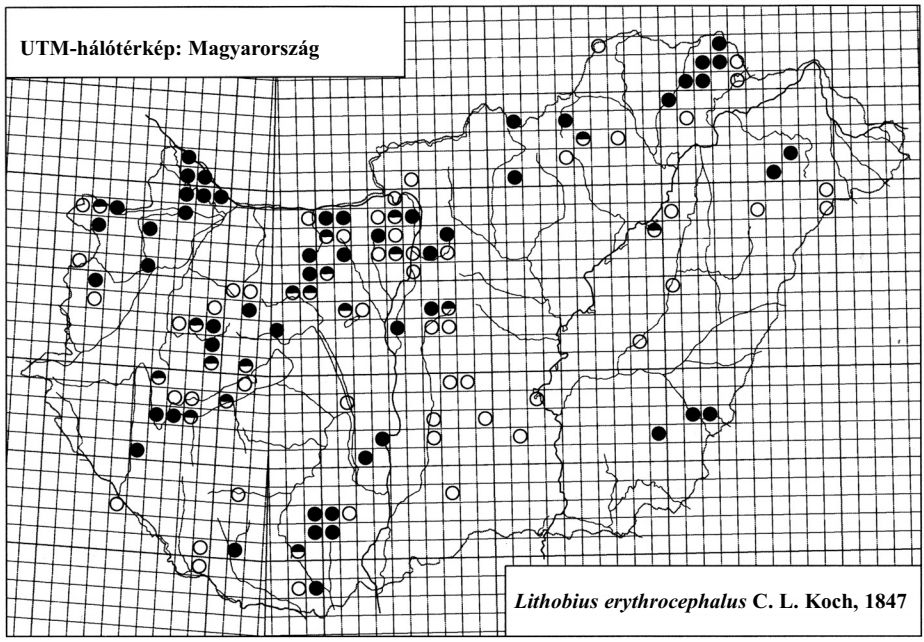


Fig. 3: Distribution of *L. erythrocephalus* in Hungary. (Empty circles: earlier data, filled circles: data of the author, half-filled circles: data with both earlier and recent recordings by the author.)

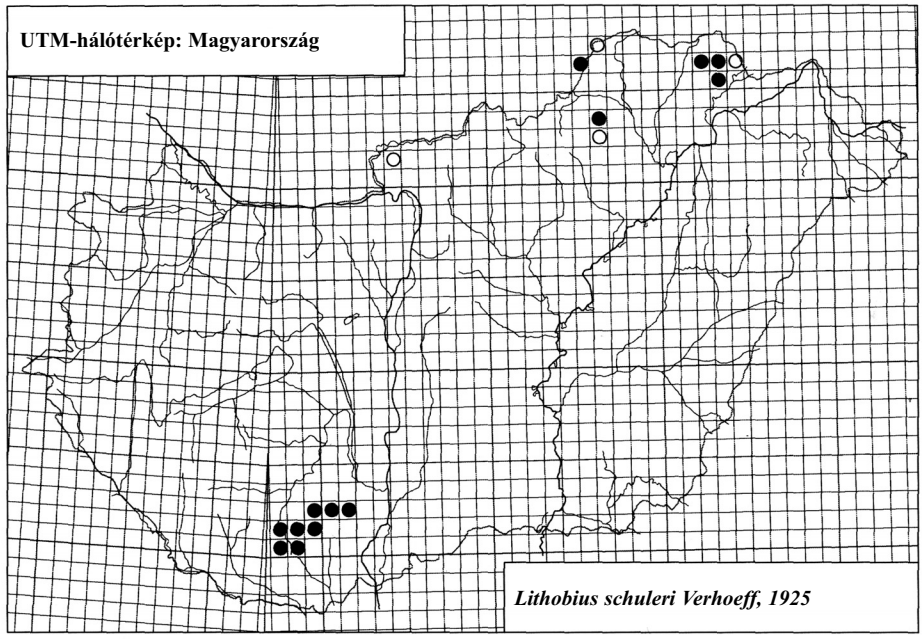


Fig. 4: Distribution of *L. schuleri* in Hungary. (Empty circles: earlier data, filled circles: data of the author, half-filled circles: data with both earlier and recent recordings by the author.)

We have to pay special attention to the population of *L. erythrocephalus* at Bátorliget, because as Loksa (1953) described, there are animals showing transitional characters between the two species. There was no possibility of re-examining the examples studied by Loksa, but among the animals collected from the same place forty years after and determined by Korsós (Korsós 1991), I could not find any forms with such intermediate characters, all individuals proved to be *L. erythrocephalus*.

Because *L. schuleri* occurs in Hungary almost everywhere sympatrically with *L. erythrocephalus* (fig. 3-4), this supoorts their nowadays widely accepted statuses as species. However, in the Zemplén Mts. the two species show an interesting pattern: whereas *L. schuleri* is typical for the central parts of the Mountains, *L. erythrocephalus* has rather been found towards the edge.

Regarding the Central to SE European distribution of *L. schuleri* stated by many authors (Stoev 2002, Zapparoli 2003), I have to mention that Eason (1972) described W European individuals of *L. erythrocephalus* depicting characters fitting more to *L. schuleri*. Thus, for clarifying the real distribution of *L. schuleri* a re-examination of the W European material of *L. erythrocephalus* might be needed.

Acknowledgements: I have to thank all people who had collected animals for me. Special thanks to Kriszta Buckó (HNHM) for her help with the SEM photographs, and to Jenő Kontschán and Zoltán Korsós (HNHM) for their useful advices on the manuscript. I am most grateful to Ágnes Vári for her help with the English translation. I am very grateful for the opportunity to study the specimens deposited in the Museum of Natural History Vienna. My work in Vienna was supported by a grant from the European Commission's (FP 6) Integrated Infrastructure Initiative programme SYNTHESYS (ATTAF).

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