

## Millipedes (Diplopoda) from the Zemplén Mountains, Northeast Hungary, with two julid species new to the Hungarian fauna

D. BOGYÓ<sup>1</sup>, Z. KORSÓS<sup>2</sup>, E. LAZÁNYI<sup>3</sup> and G. HEGYESSY<sup>4</sup>

**Abstract.** New data of millipedes from 92 sites in Northeastern Hungary are presented, based on the examination of more than 1300 individuals. The studied regions were the Zemplén Mountains and its surrounding plains, the Hernád valley and the Bodrogek area. Altogether 25 millipede species were found, two Carpathian species are new to the fauna of Hungary: *Leptoiulus liptauensis* (Verhoeff, 1899) and *Cylindroiulus burzenlandicus* (Verhoeff, 1907). Remarkable and rare species for the Hungarian fauna are *Trachysphaera costata* (Waga, 1858) and *Brachydesmus dadayi* Verhoeff, 1895.

**Keywords.** Diplopoda, fauna, Transdanubian Mountains, Hernád Valley, Bodrogek.

### INTRODUCTION

Faunistic knowledge of the Hungarian millipedes (Diplopoda) is still incomplete and novelties can turn up, despite the surveys in the past decades (see e.g. Korsós 2005). Exact distributional records of millipedes are only known from 21.2% of the country area (based on the UTM mapping system of Hungary (Korsós 2005)). Especially the eastern and northeastern parts of the country are represented by only a few data (e.g. Korsós 1994, 1998). This study presents new faunistic records from the almost entirely unknown region of Northeast Hungary: the Zemplén Mountains, (“Zempléni-hegység”) and its surrounding plains, the Hernád valley (“Hernád-völgy”) and the Bodrogek area (Fig. 1).

The Zemplén Mountains are volcanic parts of the Hungarian Northern Middle Range. The highest peak of the mountains is the Nagy-Milic (895 m a.s.l.). Dominant base rock types are andesite, rhyolite and tuff, and the soil is mainly acidic (Kiss 2007). Vegetation of the Zemplén Mountains is usually considered intermediate between the plant associations of the Hungarian Middle Ranges and that of the Carpathians, with presence both Pannonian and Carpathian floral elements. The lower parts of the Zemplén Mountains (up to 600 m a.s.l.) are dominated by

forest-steppes (such as *Aceri tatarici-Quercetum roboris*) and various oak (*Quercetum*) forests, whereas the native forests in the higher parts (600–840 m a.s.l.) are oak-hornbeam (*Quercus-Carpinetum*) and beech (*Fagetum*) forests (Simon 2006). Since 1984 a 26,500 ha area of the Zemplén Mountains has been designated for protection (as a landscape protection area, called “Zempléni Tájvédelmi Körzet”). The Zemplén Mountains are surrounded by lower sandy floodplains of the rivers Hernád and Bodrog. These are covered mainly by floodplain (*Populetum*, *Salicetum*, *Alnetum*) and oak forests (*Convallario-Quercetum roboris*) together with marshes, grasslands and agricultural fields (Tuba & Szirmai 2008).

Our goal was to survey the poorly known diplopod fauna of the area, and to improve our knowledge of the Hungarian millipedes.

### MATERIALS AND METHODS

Millipedes were collected by the fourth author (GH) with pitfall trapping (with ethylene-glycol as preservative), singling and litter sifting, altogether in 91 sampling localities. Collecting period was between May 1999 and July 2006. An additional singling (Hejce, Solyomkö) was made in July 2008 by the first author (DB), so the total number of sampling localities is 92. All materials collected were preserved in 70% ethanol and

<sup>1</sup>Dávid Bogyó, Department of Ecology, University of Debrecen, H-4010 Debrecen, PO Box 71, Hungary. E-mail: davidbogyo@yahoo.co.uk

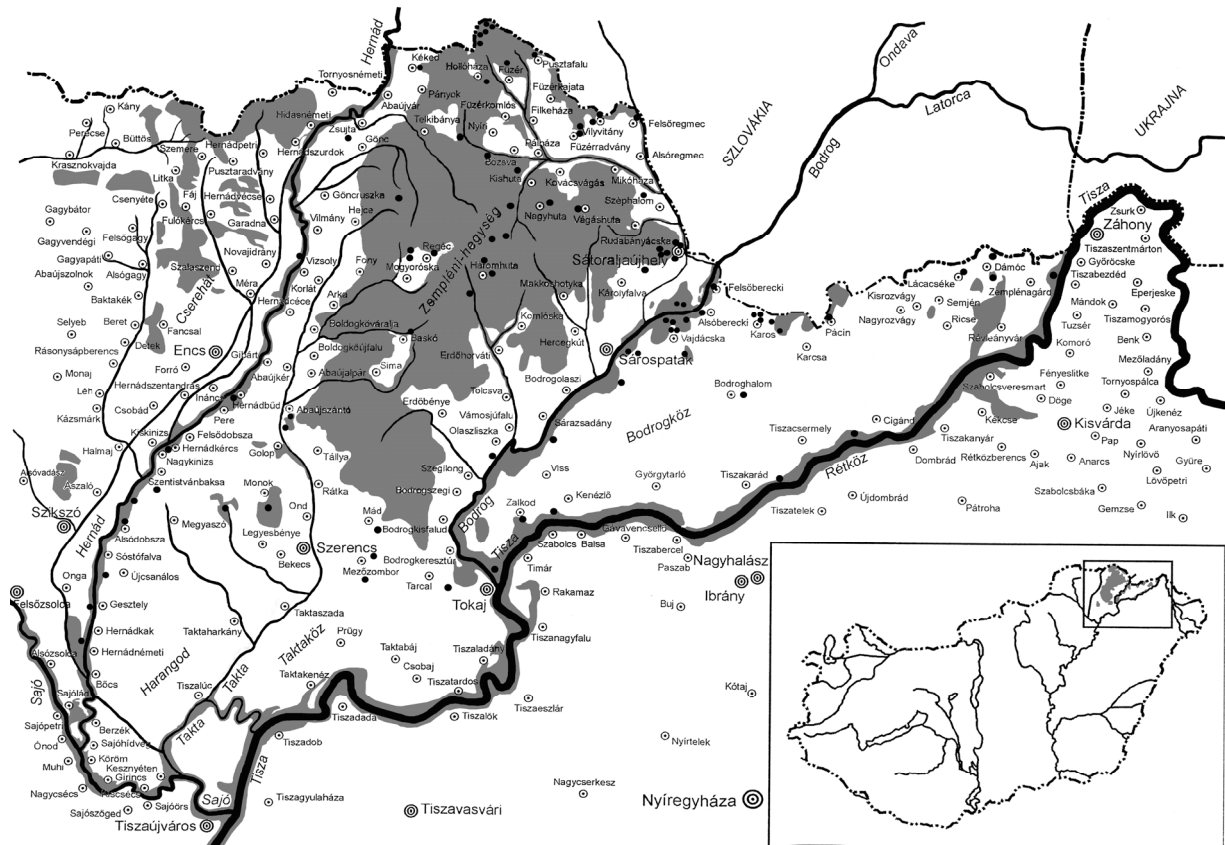
<sup>2</sup>Dr. Zoltán Korsós, Department of Zoology, Hungarian Natural History Museum, Baross str. 13, H-1088 Budapest, Hungary

<sup>3</sup>Dr. Eszter Lazányi, Department of Zoology, Hungarian Natural History Museum, Baross str. 13, H-1088 Budapest, Hungary

<sup>4</sup>Dr. Gábor Hegyessy, Kazinczy Ferenc Museum, Dózsa Gy. str. 11, H-3980 Sátoraljaújhely, Hungary

deposited in the Myriapoda Collection of the Hungarian Natural History Museum, Budapest. For identification we used a Nikon SM-800 and a Motic SMZ-168 stereo microscope, and the works by Bielak-Oleksy & Stojalowska (1968), Blower (1985), Schubart (1934) and Verhoeff (1895, 1899). Line drawings were made with Leica M125 stereo microscope and Leica DM-1000 light microscope.

Valid nomenclature was applied according to Fauna Europaea (Enghoff & Kime 2009, 2011). At each species we give a general synonymy list, with the important Hungarian citations of the species; the list of localities (settlement names separated by comma and followed by the local geographical names, all in Hungarian to facilitate localization on a regional map) and additional biogeographical or ecological remarks.



**Figure 1.** Map of the studied region: Zemplén Mountains, Hernád valley and Bodrogek area. Black dots: collecting sites; white circles with small black dots: settlements in the area; dark grey area: forested area; light grey area: natural habitats except forests (grasslands, meadows, scrubland...etc.); white area: agricultural and urbanised areas.

## RESULTS

### POLYXENIDA

#### Polyxenidae

##### *Polyxenus lagurus* (Linnaeus, 1758)

*Scopendora lagura* Linnaeus, 1758: 637.

*Pollyxenus lagurus*: Latreille 1802–1804: 45.

*Polyxenus lagurus*: Latzel 1884: 70, Loxsa 1953: 178.

*Localities.* Háromhuta, Flóríka-forrás; Háromhuta, Huta-völgyi kút; Pácin, Mágócsi-kastély.

*Remarks.* The species was found only in three, mostly native forest localities with nine specimens altogether. It is a holarctic species though easily overlooked (Enghoff & Kime 2011), relatively common also in Hungary (Korsós 1994). The scarce presence in the samples may be due to the collecting method by pitfall traps.

## GLOMERIDA

### Glomeridae

#### *Glomeris hexasticha* Brandt, 1833

*Glomeris hexasticha* Brandt, 1833: 197.

*Glomeris hexasticha*: Jermy 1942: 21–24, Loksa 1968a: 266–272.

*Localities.* Felsőregmec, Mátyásháza; Fony, Fekete-patak; Fony, Tekenös; Füzér, Drahos; Füzér, Halyagos-rét; Füzér, Kerékgyártó-bükk; Füzér, Torok; Füzér, Vár-forrás; Füzérradvány, Arborétum; Háromhuta, Flóríka-forrás; Hejce, Solyomkő; Hernádbüd, Gaz; Pusztafalu, Kertek alja; Regéc, Ördög-völgy; Regéc, Bálint-hegy; Sátoraljaújhely, Boda-dülő; Sátoraljaújhely, Gejzír-domb; Sátoraljaújhely, Gyalmos; Sátoraljaújhely, Kecske-hát; Sátoraljaújhely, Májuskút, szőlő; Telkibánya, Kecske-hát; Vilyvitány, Magócsa-patak; Vilyvitány, Vilyi-legelő.

*Remarks.* An abundant species in the studied regions. It occurred together with *Glomeris tetrasticha* in 6 localities. The species is one of the most abundant species in Hungary and in Central and Southeast Europe as well, widespread mostly in natural woodlands (Korsós 1994, Enghoff & Kime 2011, Voigtländer 2011).

#### *Glomeris tetrasticha* Brandt, 1833

*Glomeris tetrasticha* Brandt, 1833

*Glomeris connexa* C. L. Koch, 1847: 97.

*Glomeris connexa*: Schubart 1934: 41–43, Jermy 1942: 37–42, Loksa 1953: 178.

*Glomeris tetrasticha*: Hoess 2000: 13, Hoess & Scholl 2001: 18, Lazányi & Korsós 2009: 36–37.

*Localities.* Baskó, Tekerés-patak; Bózsva, Farkas-völgy; Dámóc, Órhegy; Füzér, Bodó-rét; Füzér, Halyagos-rét; Füzér, Kerékgyártó-bükk; Füzér, Oláh-rét; Füzér, Vár-forrás; Pusztafalu, Kertek alja; Sátoraljaújhely, Gyalmos; Sátoraljaújhely, Kacsató; Sátoraljaújhely, Long-erdő (Háromhónvéd-fa); Telkibánya, Kecske-hát.

*Remarks.* The species occurred altogether in 13 localities, mainly in the forests of the mountainous Zemplén, but in some cases in the lower floodplains, too. It is a principally montane species, widespread in Eastern Europe (Korsós 1994, Enghoff & Kime 2011, Wytwer *et al.* 2009).

## Dideriidae

#### *Trachysphaera costata* (Waga, 1857)

*Gervasia costata* Waga, 1858: 829.

*Gervasia costata*: Jermy 1942: 54–59.

*Trachysphaera schmidtii* Heller, 1858: 317.

*Trachysphaera hyrtlui* Wankel, 1861: 253–254.

*Trachysphaera costata*: Strasser 1966: 334, Korsós 1994: 33.

*Localities.* Füzér, Vár-forrás.

*Remarks.* Three specimens (2 males, 1 female) were found in August 2005 near the castle ruins of Füzér (Northeast Zemplén) next to a spring located in a closed hornbeam forest (at about 480m a.s.l.). Previously the species was only reported from Budapest (Jermy 1942, Loksa 1959) and Szentdomonkos (Upponyi Hills, Northeast Hungary) (Korsós 1994).

## POLYZONIIDA

### Polyzoniidae

#### *Polyzonium germanicum* Brandt, 1837

*Polyzonium germanicum* Brandt, 1837: 179.

*Polyzonium germanicum*: Loksa 1968a: 266.

*Localities.* Dámóc, Órhegy; Füzér, Torok; Karcsa, Becskedi-erdő; Pusztafalu, Kertek alja; Sátoraljaújhely, Gyalmos; Sátoraljaújhely, Long-erdő (Háromhónvéd-fa); Sátoraljaújhely, Mocsolya; Telkibánya, Kecske-hát.

*Remarks.* Thirty-eight specimens were found in 8 localities, almost all in oak-hornbeam forests of the Zemplén Mountains. The species was previously recorded from several other Hungarian localities, especially from old, undisturbed forests (Korsós 1994, Lazányi & Korsós 2009).

## CHORDEUMATIDA

### Mastigophorophyllidae

#### *Mastigona bosniensis* (Verhoeff, 1897)

*Heteroparatia bosniense* Verhoeff, 1897a: 193–195, Loksa 1968a: 272–276.

*Mastigona bosniensis*: Jeekel 1971: 67, Loksa 1988: 164.

*Heteroparatia bosniense hungaricum* Loksa, 1953: 179.

*Localities.* Abaujszántó, Kassi-szőlő; Kovácsvágás-Somoska; Pácin, Mágocsi-kastély; Sárospatak, Keleti-Bodrog-holtág; Sátoraljaújhely, Boda-dűlő; Sátoraljaújhely, Gyalmos; Sátoraljaújhely, Kecske-hát; Sátoraljaújhely, Long-erdő (Háromhónvéd-fa); Telkibánya, Kecske-hát.

*Remarks.* The species occurred in 9 localities in all of the three regions, but only with 22 specimens. These sites represent forests under different disturbance levels: oak-hornbeam forests, floodplain forests and in forest edges of former vineyards. The widespread species occurs in various habitats of Eastern Europe (e.g. Jędryczkowski 1992, Korsós 1994, Wytwer *et al.* 2009).

## JULIDA

### Nemasomatidae

#### *Nemasoma varicorne* C. L. Koch, 1847

*Nemasoma varicorne* C. L. Koch, 1847: 116.  
*Isobates varicornis*: Latzel 1884: 240–243, Loksa 1957: 194.  
*Nemasoma varicorne*: Enghoff 1985: 41.

*Localities.* Megyaszó, Hernád-part (Tátorjános TVT); Regéc, Rostalló.

*Remarks.* The species had only two occurrences with 6 specimens, probably due to the use of pitfall traps. It was found in softwood inundation forests (*Salicetum* and *Alnetum*). *N. varicorne* is a bark-dwelling species (Blower 1985), in Hungary moderately common (Korsós 1994).

### Blaniulidae

#### *Proteroiulus fuscus* (Am Stein, 1857)

*Blaniulus fuscus* Am Stein, 1857: 139.  
*Blaniulus pulchellus* Porat, 1889: 82.  
*Amsteinia fuscum*: Verhoeff 1911: 539–540.  
*Proteroiulus fuscus*: Korsós 1994: 37.

*Localities.* Sátoraljaújhely, Ungvári pincék.

*Remarks.* We found two specimens (one female and one juvenile) in a cellar in Sátoraljaújhely. The species often occurs around human

settlements in Hungary (Korsós 1992, 1994), and favors synanthropic localities elsewhere, too (e.g. Riedel *et al.* 2009). However, it can be widespread in natural and seminatural forests in Europe (Schubart 1934, Blower 1985, Kime 1990, 2004). Some authors (e.g. Voigtländer 2011) classify the species as eurytopic, woodland species without obvious preferences.

## Julidae

#### *Brachyiulus bagnalli* (Brolemann, 1924)

*Iulus pusillus* Leach, 1815: 379 *sensu* Latzel 1884: 281–283.  
*Brachyiulus (Microbrachyiulus) pusillus*: Verhoeff 1898: 152–153.  
*Microbrachyiulus bagnalli*: Brolemann, 1924: 108.  
*Brachyiulus bagnalli*: Dziadosz 1964: 207–209, Korsós 1994: 37–38, Bogyó & Korsós 2009: 414, 416.  
*Brachyiulus pusillus kaszabi* Loksa, 1956: 389.

*Localities.* Bodroghalom, Medvetanya; Mezőzombor, Szarkatanya; Szentistvánbaksa, Bakshalom; Tarcal, Ördög-bánya, Vizsoly, Hernád-holtág; Zalkod, Palocsa.

*Remarks.* The species was found in a few localities at low altitudes in the regions of Bodroghalom and the Hernád valley. The localities are mostly on the floodplains of the rivers Hernád, Tisza and Bodrog with more or less open vegetation (floodplain forests, grasslands, vineyards). *Brachyiulus bagnalli* was characterized by Dziadosz (1964) as a Southeast European steppe species. The species was previously recorded from Hungary (Loksa 1956, Korsós 1994, Korsós *et al.* 2002, Bogyó & Korsós 2009). It seems that *B. bagnalli* has a wide habitat preference, occurring in xerothermic grasslands, floodplain forests, and anthropogenic habitats like city parks as well.

#### *Cylindroiulus burzenlandicus* Verhoeff, 1907

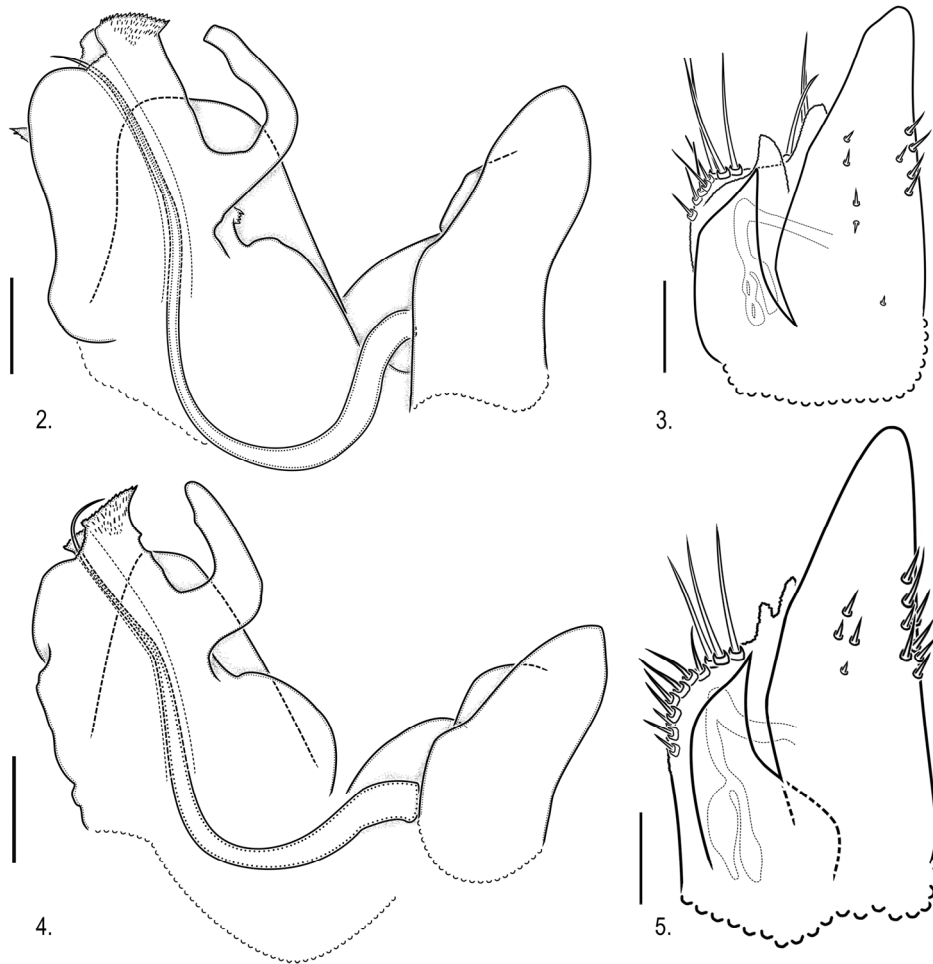
(Figures 2–5)

*Cylindroiulus burzenlandicus* Verhoeff, 1907: 310–311.  
*Cylindroiulus luridus burzenlandicus*: Ložek & Gulička 1962: 63–66, 68, 78.  
*Cylindroiulus burzenlandicus*: Schubart 1934: 214, Bielak-Oleksy & Stojałowska 1968: 20–21.

*Localities.* Bózsza, Szuha-völgy, Füzér, Bodórét; Füzér, Halyagos-rét; Füzér, Oláh-rét; Hejce, Sóllyom-kő, Nagyhuta, Kávaskúti-völgy.

*Remarks.* This species is new to the Hungarian fauna! Altogether 13 specimens were found from 7 localities in the northern Zemplén Mountains. These sites are situated in natural beech forests and in a mountain hay meadow (Füzér, Bodó-rét). *C. burzenlandicus* was described from montane forests around Braşov (formerly Kronstadt), Romania (Verhoeff 1907). It is a Carpathian element, with relatively narrow range: adjoining parts of Poland, Slovakia, Ukraine and Romania (e.g., Jędrzykowski 1992, Mock 2001, Kosyanenko 2003, Kosyanenko & Chumak 2008, Enghoff & Kime 2009). In the neighboring Slovakia and Ukraine the species is typical for old montane beech forests, with a maximum abundance at a-

about 600m a.s.l. in the Ukrainian Carpathians (Kosyanenko & Chumak 2008, Mock 2011 pers. comm.). Reexamination of specimens formerly identified as *C. luridus* from the Zemplén Mountains (2♂, 3♀ Rostalló, 1986. July 23., sifting; 3♂, 2♀, 2 juv., Rostalló, 1986. July 21–25., soil trap; 2♂ Komlóska valley, 1986. July 22., all leg. and det. by Z. Korsós, see Korsós (1994) proved that they are in fact *C. burzenlandicus*. Here we present new illustration of the male gonopods (Fig. 2), illustration for the first time of the female vulvae (Fig. 3), to compare it to the very similar *C. luridus* (Figs. 4–5, gonopods and vulvae, respectively.)



**Figures 2–3.** *Cylindroiulus burzenlandicus* Verhoeff, 1907 from Nagyhuta, Kávás-völgyi kút (Hungary). 2 = male right gonopods, mesal view. 3 = female right vulva, anterior view.

**Figures 4–5.** *Cylindroiulus luridus* (C. L. Koch, 1847) from Tardosbánya, Bánya-hegy (Hungary). 4 = male right gonopods, mesal view. 5 = female right vulva, anterior view (scale bars: 0.2 mm).

***Enantiulus nanus* (Latzel, 1884)**

*Julus nanus* Latzel, 1884: 264–267.

*Leptophyllum nanum*: Verhoeff 1910: 56, Loksa 1968b: 266–288, 1979: 88, 91.

*Enantiulus nanus*: Hoffman 1980: 110, Korsós 1994: 43.

*Localities.* Háromhuta, Flóríka-forrás; Pusztafalu, Kertek alja.

*Remarks.* In spite of the species' relatively high abundance in other northeastern Hungarian mountainous regions (Loksa 1968a, Lazányi & Korsós 2009) we have found only three specimens in the northern part of the Zemplén Mountains, in hornbeam forests. Since it is a small soil- and rock-dwelling species, this can be the result of the pitfall collecting method.

***Julus terrestris* Linnaeus, 1758**

*Julus terrestris* Linnaeus, 1758: 639.

*Julus terrestris* Loksa 1973: 81, 1988: 170.

*Julus (L.) terrestris*: Szabó 1931: 15, 18, 25–26, 28.

*Localities.* Alsóberecki, Berecki híd; Bodroghalom, Medvetanya; Felsőberecki, Bodrog-ártér; Fony, Tekenős; Hernádkércs, Hernád (füzes); Hernádnémeti, Török-jussa; Karcsa, Tekerületi-dűlők; Karos, Móka-domb; Karos, Szőlő-máj homok; Kenézlő, Görbe-ér; Kovácsvágás, Somoska; Megyaszó, Hernád-part (Tátorjános TVT); Mezőzombor, Kamara-rét; Olaszliszka, Fenyér; Regéc, Rostalló; Regéc, Bálint-hegy; Sáradsadány, Törökér; Sárospatak, Déli-Bodrog-holtág; Sárospatak, Kapronca; Sátoraljaújhely, Mocsolya; Sátoraljaújhely, Long-erdő (Háromhónvéd-fa); Telkibánya, Kecse-hát; Vajdácaska, Diófás-dűlő; Zalkod, Palocsa; Zemplénagárd, Vér-tó.

*Remarks.* This is an abundant species in localities with open vegetation at low altitudes. It was found mainly on the floodplains and agricultural fields of Bodroghalom and the Hernád valley, sometimes in mass occurrence. In the Zemplén Mountains only a few records were found. *J. terrestris* is a typical millipede species of the Great Hungarian Plain (Korsós 1994) and other Eastern European open lowland areas (e.g. Jedryczkowski 1992).

***Kryphioiulus occultus* (C. L. Koch, 1847)**

*Allajulus occultus* C. L. Koch, 1847: 117–118.

*Cylindroiulus occultus*: Verhoeff 1907: 284, Loksa 1953: 179.

*Kryphioiulus occultus*: Read 1990: 107, Korsós 1994: 41.

*Localities.* Dámóc, Darvasi-legelő; Karos, Sétahomoki dűlő; Lácacséke, Ereszvény-dűlő.

*Remarks.* This generally xerothermic and somewhat synanthropic species (Schubart 1934, Korsós 1992, Bogyó & Korsós 2009, Riedel *et al.* 2009, Voigtländer 2011) was found at three sampling sites with only a few specimens. The localities belong to the low altitude landscape type of the Bodroghalom on sandy soil.

***Leptoiulus cibdellus* (Chamberlain, 1921)**

*Julus minutus* Porat, 1889: 130–132.

*Julus (Leptoiulus) minutus*: Verhoeff 1898: 136.

*Leptoiulus minutus*: Verhoeff 1908: 436.

*Julus cibdellus* Chamberlain, 1921: 83.

*Leptoiulus cibdellus*: Enghoff 1974: 31, Korsós 1994: 40.

*Localities.* Cigánd, Póherei-dűlő; Olaszliszka, Fenyér; Sátoraljaújhely, Gyalmos; Sátoraljaújhely, Long-erdő (Háromhónvéd-fa); Sátoraljaújhely, Mocsolya; Telkibánya, Kecse-hát; Vajdácaska, Diófás-dűlő; Vajdácaska, Holt-Bodrog; Zalkod, Palocsa.

*Remarks.* We have found the species in 9 localities with 15 specimens. The localities are mostly in diverse wetland habitats of the Bodroghalom. The species occurred in the Zemplén Mountains in several places, too. Our findings correspond to the results of previous works which stated that the species occurs mostly in wet woodlands across Central and North Europe, and has the ability to survive submersion during flood (Zulka 1991, Jedryczkowski 1992, Sallai 1993, Enghoff & Kime 2009).

***Leptoiulus liptauensis* (Verhoeff, 1899)**

(Figure 6)

*Julus (Leptoiulus) ciliatus liptauensis* Verhoeff, 1899: 201.

*Leptoiulus liptauensis*: Verhoeff 1908: 440, Bielak-Oleksy & Stojalowska 1968: 21–23, Tajovský 1997: 229, Mock 2001: 31.

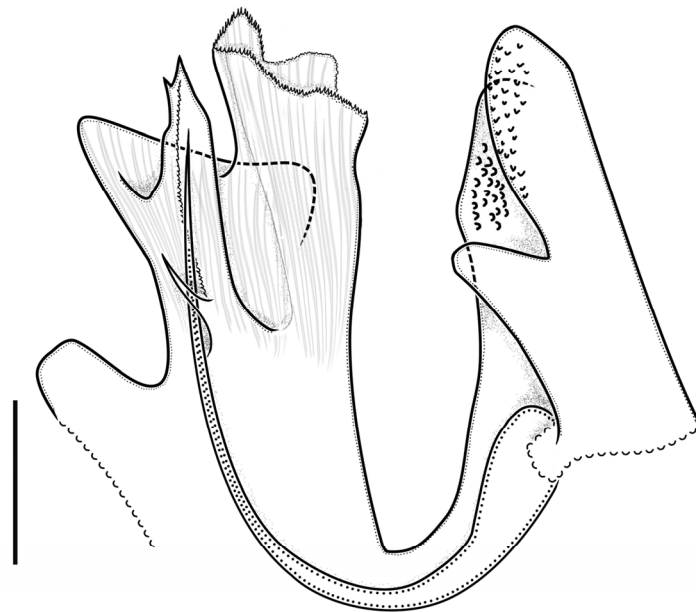
*Localities.* Bózsva, Farkas-völgy; Füzér, Vár-

forrás; Háromhuta, Flórika-forrás; Pusztafalu, Kertek alja; Sátoraljaújhely, Kecse-hát.

*Remarks.* This species is new to the Hungarian fauna! Altogether 13 specimens were found in five localities. All the sites are situated in closed deciduous woodlands in the Zemplén Mountains, between 320 and 480m a.s.l. *L. liptauensis* was described from alpine ranges (1350–2000m a.s.l.) of the Nízke Tatry, Vysoké Tatry and Západné Tatry Mountains, Slovakia (Verhoeff 1899). Later Gulička (1975) found the species in a collapsed cave (Duča) in the Slovak Paradise (about 950m a.s.l.) in Slovakia. It was mentioned from Poland as well; Krkonoše/Karkonosze Mts, Western Sudets (e.g. Stojalowska & Starega 1974). *L. liptauensis* was formerly described as a western Carpathian species, occurring exclusively in alpine and subalpine ecosystems, typical mainly to alpine coniferous woodlands and dwarf shrub heaths (Jawlowsky 1938, Gulička 1956, Tajovský 1997). In spite of these statements Mock (1999) recorded its occurrence in eastern Slovakia from

lower altitudes (440–500m a.s.l.) and from deciduous forests (Slanské vrchy Mountains: localities Zámutovská jelšina and Dolina obrov). Zemplén Mts may represent the southernmost occurrence of this Carpathian endemism. In agreement with Mock (1999) we found that the species usually occurs together with *Cylindroiulus burzenlandicus*, *Megaphyllum projectum*, *Unciger foetidus*, *Strongylosoma stigmatosum* and *Polydesmus complanatus* at this altitude and vegetation type. However, in the Zemplén Mountains it was found in four sampling sites together with *Leptoiulus proximus* as well. The ecological background of these co-occurrences has not yet been clarified.

Here we present a new gonopod figure of the species (Fig. 6). Unfortunately those samples which contained females were from regions where other *Leptoiulus* species occurred too, thus we are not able to give the details of female vulvae. The outer morphology of female vulva was already described by Bielak-Oleksy & Stojalowska (1968).



**Figure 6.** *Leptoiulus liptauensis* (Verhoeff, 1899) from Háromhuta, Flórika-forrás (Hungary). Male right gonopod, mesal view (scale bar: 0.2 mm).

***Leptoiulus proximus* (Nemec, 1896)**

*Julus (Leptoiulus) proximus* Nemec, 1896: 3–4.  
*Julus (Leptoiulus) ciliatus buekkensis*: Verhoeff 1899: 201.  
*Leptoiulus trilobatus buekkensis*: Verhoeff 1908: 441.  
*Leptoiulus proximus*: Attems 1927: 137, Loksa 1979: 88, 91.

**Localities.** Alsóregmec, Debrai-forrás; Fony, Fekete-patak; Fony, Tekenős; Füzér, Drahos; Füzér, Kerégyártó bükk; Füzér, Torok; Füzér, Vár-forrás; Háromhuta, Flórika-forrás; Hejce, Sóllyom-kő; Pusztafalu, Kertek alja; Sáros-patak, Veres-haraszt; Sátoraljaújhely, Gyalmos; Sátoraljaújhely, Kecse-hát; Sátoraljaújhely, Long-erdő; Sátoraljaújhely, Lóteri-forrás; Telkibánya, Kecse-hát; Zsujta, Haraszka.

**Remarks.** *L. proximus* was found in 17 localities of the Zemplén Mountains, with 58 specimens. It was found in different types of undisturbed forests (mainly alderwood, beech, oak-hornbeam) and mountain meadows, in some sites together with *L. cibdellus*, *L. liptauensis* and *L. trilobatus*. *L. proximus* is a widespread forest species in Hungary (Korsós 1994) and in Central and East Europe as well (Enghoff & Kime 2009). It prefers different forest types, mainly with multi-level tree and/or shrub layers (e.g. Schubart 1934, Jedryczkowsky 1992, Wytwer *et al.* 2009, Voigtländer 2011).

***Leptoiulus trilobatus* (Verhoeff, 1894)**

*Julus trilobatus* Verhoeff, 1894a: 12.  
*Julus (Leptoiulus) ciliatus* Verhoeff, 1897b: 115–116.  
*Leptoiulus trilobatus*: Verhoeff 1908: 440, Korsós 1994: 40.

**Localities.** Füzér, Halyagos-rét; Hejce, Sóllyom-kő; Sátoraljaújhely, Gyalmos.

**Remarks.** *L. trilobatus* was found in three localities of the Zemplén Mountains, with 37 specimens. In the 110 years old alderwood grove (*Alnetum*) of Gyalmos (Sátoraljaújhely) it occurred together with *L. cibdellus* and *L. proximus*. *L. trilobatus* has a Central European distribution (Enghoff & Kime 2009). In Hungary it prefers mostly the closed, undisturbed forests (Lazányi & Korsós 2009). However, other studies described it as an „adaptable” species (Tuf & Tufová 2008).

***Megaphyllum projectum projectum* Verhoeff, 1894**

*Megaphyllum projectum* Verhoeff, 1894b: 323–324.  
*Brachyiulus projectus*: Verhoeff 1897b: 111–112.  
*Chromatoiulus projectus*: Schubart 1934: 278–280, Loksa 1979: 88.  
*Brachyiulus projectus dioritanus* Verhoeff, 1907: 303, 305, Figs 5–8.  
*Chromatoiulus projectus dioritanus*: Loksa 1968a: 268.  
*Megaphyllum projectum dioritanum*: Loksa 1988: 164, 1991: 131–132.  
*Megaphyllum projectum*: Hoffman 1980: 104.  
*Megaphyllum projectum projectum*: Lazányi & Korsós 2011: 45–49, 51–53.

**Localities.** Dámóc, Órhegy; Dámóc, Darvasilegelő; Füzér, Drahos; Füzér, Vár-forrás; Füzér, Torok; Füzér, Kerégyártó-bükk; Füzéradvány, Arborétum; Háromhuta, Flórika-forrás; Monok, Csörgő-domb; Pusztafalu, Kertek alja; Regéc, Rostalló; Sátoraljaújhely, Kecse-hát; Sátoraljaújhely, Májuskút, szőlő; Sátoraljaújhely, Boda-dűlő; Telkibánya, Kecse-hát; Vilyvitány, Magócsapatak.

**Remarks.** This is an abundant julid species in the research area. It lives in the deciduous forests of the Zemplén Mountains, and it was also found in an oak woodland of the Hernád valley (Monok). It is widespread in Hungary as well as in Central and Eastern Europe (Korsós 1994, Enghoff & Kime 2009). In the Eastern European Plain the species is closely associated to the oak woodlands (Wytwer *et al.* 2009), but seems to be more eurytopic in Western Europe (Voigtländer 2011).

***Megaphyllum unilineatum* (C. L. Koch, 1838)**

*Julus unilineatus* C. L. Koch, 1838: 22.  
*Brachyiulus (Chromatoiulus) unilineatus*: Verhoeff 1897b: 114–115.  
*Brachyiulus unilineatus*: Szabó 1931: 15, 18, 22–24, 26–28, 30.  
*Chromatoiulus unilineatus*: Attems 1927: 220.  
*Chromatoiulus unilineatus*: Loksa 1953: 179; 1983: 68.  
*Megaphyllum unilineatum*: Hoffman 1980: 104, 113, Loksa 1988: 162–164, 170.

**Localities.** Abaújszántó, Sátor-hegy; Abaújszántó, Kassi-szőlő; Baskó, Tekeres-patak; Bodroghalom, Medvetanya; Dámóc, Darvasilegelő; Füzér, Drahos; Gesztely, Ürmös-hát; Hernád-



németi, Török-jussa; Karos, Móka-domb; Mád, Becsek; Mezőzombor, Szarkatanya; Pusztafalu, Kertek alja; Tarcal, Ördög-bánya; Újcsanáros, Ócsanárosi part; Vilmány, Középső-mező; Vizsoly, Hernád-holtág.

*Remarks.* The species was relatively abundant in the lower altitude habitats of the study area. *M. unilineatum* occurred mainly in the Hernád valley, but it could be found in the Zemplén Mountains and in Bodrogek, too. It was also abundant in disturbed, anthropogenic habitats. In Europe and in Hungary it is a generally widespread, xerothermic open land species (e. g. Korsós 1994, Tuf & Tufová 2008, Enghoff & Kime 2009, Voigtländer 2011).

#### ***Ommatoiulus sabulosus* (Linnaeus, 1758)**

*Iulus sabulosus* Linnaeus, 1758: 640.

*Iulus (Ommatoiulus) sabulosus*: Haase 1887: 27–29.

*Schizophyllum sabulosum*: Verhoeff 1900: 466–473.

*Archulus sabulosus*: Attems 1927: 240, 279–282.

*Ommatoiulus sabulosus*: Jeekel 1968, Korsós 1994: 43.

*Localities.* Bózsva, Farkas-völgy; Füzér, Drahos; Háromhuta, Márka-forrás; Pusztafalu, Kertek alja.

*Remarks.* The species had four occurrences with 28 specimens altogether. All localities were in natural forest habitats of the northeastern part of the Zemplén Mountains. It occurs in a wide range of habitats (from open grasslands to different forest types) across Europe (e.g. Blower 1985, Jędrzykowski 1992, Kime 1992, 1996, Wytwer *et al.* 2009, Voigtländer 2011). In Eastern Hungary it is less abundant. Nevertheless, former studies (Korsós 1994, Mock 1999) showed that it was already found close to our present localities.

#### ***Unciger foetidus* (C. L. Koch, 1838)**

*Iulus foetidus* C. L. Koch, 1838: 22.

*Oncoiulus foetidus*: Verhoeff 1899: 190–191.

*Unciger foetidus*: Lohmander 1925: 60–61, Loksa 1953: 179.

*Localities.* Füzér, Bodó-rét; Füzér, Drahos; Füzér, Halyagos; Füzér, Kerékgyártó-bükk; Füzér, Vár-forrás; Háromhuta, Flórka-forrás; Hejce, Solyom-kő, Nagyhuta, Kávaskúti-völgy.

*Remarks.* This species was recorded from 8 localities in the central part of the Zemplén Mountains in undisturbed natural forest habitats. In northwestern areas of Europe it tends to be eurytopic (Voigtländer 2011) and sometimes synanthropic (Lindner *et al.* 2010), but in Hungary it is more confined to natural forests (e.g. Korsós 1994, Lazányi & Korsós 2009).

### **POLYDESMIDA**

#### **Paradoxosomatidae**

#### ***Strongylosoma stigmatosum* (Eichwald, 1830)**

*Iulus stigmatosus* Eichwald, 1830: 124.

*Strongylosoma pallipes* (Olivier, 1792): Latzel 1884: 168–170, Loksa 1953: 179.

*Strongylosoma stigmatosum*: Jeekel 1967: 166, Szlávecz & Loksa 1991: 804.

*Localities.* Füzér, Vár-forrás; Füzér, Oláh-rét; Füzér, Halyagos-rét; Füzéradvány, Arborétum; Háromhuta, Huta-völgyi-kút; Hejce, Solyom-kő.

*Remarks.* The species was found in six localities which represent undisturbed woodland habitats in the Zemplén Mountains. This species is widespread in hilly and montane forests in Hungary and in East Central and East Europe as well (e.g. Jędrzykowski 1992, Korsós 1994, Enghoff & Kime 2011, Lazányi & Korsós 2009).

#### **Polydesmidae**

#### ***Brachydesmus dadayi* Verhoeff, 1895**

*Brachydesmus dadayi* Verhoeff, 1895: 287–288.

*Brachydesmus dadayi*: Korsós, 1994: 44.

*Localities.* Tarcal, Ördög-bánya.

*Remarks.* A single male specimen was found in the mixture of a former vineyard and natural grassland area near an abandoned quarry. The species was described by Verhoeff (1895) from Slovakia (Zlaté Moravce). It is endemic to the Carpathian Basin (Korsós 1998) with relatively few occurrences, but was also found in synanthropic habitats (Korsós 1992).

***Polydesmus complanatus* (Linnaeus, 1761)**

*Julus complanatus* Linnaeus, 1761: 502.

*Polydesmus illyricus* Verhoeff, 1893: 273–275.

*Polydesmus complanatus*: Porat 1870: 820, Lohmander 1925: 16–17, Szabó 1931: 15, 17–18, 21–22, 25–29, Loksa 1954: 217–218.

**Localities.** Abaújszántó, Kassi-szőlő; Abaújszántó, Sátor-hegy; Alsóberecki, Berecki híd; Alsóregmec, Köblös és Szompoly; Cigánd, Póhereidűlő; Felsőberecki, Bodrog-ártér; Füzér, Drahos; Füzér, Halyagos-rét; Füzér, Vár-forrás; Füzér-radvány, Arborétum; Füzérradvány, Fülemlévölgy; Háromhuta, Flórika-forrás; Hernádkércs, Hernád (füzes); Kéked, Kékedfürdő; Mád, Becsek; Megyaszó, Hernád-part (Tátorjános TVT); Monok, Csörgő-domb; Pácin, Mágócsikastély; Pusztafalu, Kertek alja; Regéc, Rostalló; Sárazsadány, Törökér; Sárospatak, Keleti-Bodrogholtág, Sárospatak, Veresharasz; Sátoraljaújhely, Boda-dűlő; Sátoraljaújhely, Gyalmos; Sátoraljaújhely, Kacsató; Sátoraljaújhely, Kecské-hát; Sátoraljaújhely, Long-erdő (Háromhonvéd-fa); Sátoraljaújhely, Májuskút, szőlő; Sátoraljaújhely, Mocsolya; Sátoraljaújhely, Ungvári pincék; Tarcál, Ördög-bánya; Telkibánya, Kecské-hát; Tiszakarád, Szárnya-szög; Tokaj, Rákóczi-vár; Vágáshuta, Nagypart; Vajdácaska, Kopaszló-sarok; Vilyvitány, Magócsa-patak; Vilyvitány, Vilyilegelő; Vizsoly, Hernád-holtág; Zalkod, Palocsa; Zemplénagárd, Vér-tó; Zsujta, Haraszka.

**Remarks.** Common and widespread millipede species in the region, found altogether in 42 localities. It occurs in almost every kind of habitats, and is common in Central–Eastern Europe and in Hungary, too (Tadler & Thaler 1993, Korsós 1994, 1998, Tuf & Tufová 2008, Enghoff & Kime 2011).

***Polydesmus denticulatus* C. L. Koch, 1847**

*Polydesmus denticulatus* C. L. Koch, 1847: 135.

*Polydesmus denticulatus*: Szabó 1931: 15, 17–18, 26–27, 30, Loksa 1954: 217, 220.

**Localities.** Alsódobsza, Erős-domb; Bodroghalom, Medvetanya; Dámóc, Darvasi-legelő; Fony, Fekete-patak; Füzér, Drahos; Gesztely, Ürmöshát; Hernádbúd, Gaz; Hernádnémeti, Török-jussa;

Mád, Becsek; Mezőzombor, Szarkatanya; Monok, Ingvár; Monok, Csörgő-domb; Olaszliszka, Fenyér; Sárazsadány, Törökér; Sárospatak, Fűzes-ér; Sátoraljaújhely, Mocsolya; Sátoraljaújhely, Kacsató; Szentistvánbaksa, Baksa-halom; Telkibánya, Kecské-hát; Tiszakarád, Szárnya-szög; Vágáshuta, Nagypart; Vajdácaska, Kopaszló-sarok; Vizsoly, Hernád-holtág; Zalkod, Palocsa.

**Remarks.** This is the most abundant millipede species in the research area, found in 22 localities. In many cases the species was found at low altitudes under human disturbance. In 12 localities it was found together with *P. complanatus*. *P. denticulatus* is an eurytopic species, widespread in Hungary and in Europe, sometimes in synanthropic habitats, too (Tadler & Thaler 1993, Korsós 1994, Enghoff & Kime 2011).

**DISCUSSION**

The present study lists 25 species with 1370 individuals from the Zemplén Mountains and its surroundings, i.e. 24,3% of the Hungarian millipede fauna (Korsós 2005). The regular use of pitfall trapping may explain this relatively low number of species. Although we worked with 92 sampling sites, some interesting localities were particularly missing from the research area, like the central and southwestern parts of the Zemplén Mountains, and the southeastern, more or less isolated point of the mountains (the Tokaj Hill). All these are protected under the Hungarian nature conservation law.

With the two new species, recorded for the first time, the actual number of Hungarian millipede species increases to 103 (Korsós 2005, Korsós unpublished).

Most of the recorded species (64%) can be characterized as (undisturbed) forest species. The number of eurytopic species (found sometimes also in synanthropic habitats) like *Proteroiulus fuscus* and *Polydesmus denticulatus* was low (8%), *P. denticulatus* was, however, one of the most abundant species in disturbed lowland areas. The (xerothermic) open land species, like *Brachyiulus*

*bagnalli*, *Julus terrestris*, *Kryphioiulus occultus* and *Megaphyllum unilineatum* occurred mainly on the plains around the Zemplén Mountains. The most abundant five species were as it follows: *Polydesmus denticulatus*, *Polydesmus complanatus*, *Glomeris hexasticha*, *Julus terrestris*, *Megaphyllum projectum*.

In biogeographic relations, most of the recorded species (80%) are widespread; e.g. in Central and/or Eastern Europe. Three Carpathian species were found, two of them were new to the Hungarian fauna: *Cylindroiulus burzenlandicus* and *Leptoiulus liptauensis*; the third was *Brachydesmus daday*, endemic to the Carpathian Basin. *Glomeris tetrasticha* was the fourth montane species in our list.

In agreement with faunistic information based on other invertebrate taxa here we present new evidence that the forested habitats of the Zemplén Mountains are suitable for Carpathian faunal elements in Hungary. The forests of the Zemplén Mountains do have a biogeographic connection both with the Slovakian and Ukrainian part of the Carpathians as it was proven by other invertebrate taxa as well (e. g. Nagy *et al.* 1998, Dányi & Korsós 2002, Kontschán *et al.* 2006, Jordán *et al.* 2007, Sólymos 2008). As discussed by Mock (1999) and Lazányi & Korsós (2009) there is still a chance to find new species to the Hungarian millipede fauna in this region. Species occurring in the broader region of Eastern Slovakia, like the Carpathian *Trachysphaera acutula* (Latzel, 1884) and *Xestoiulus carpathicus* (Verhoeff, 1907) can also be expected in the territory of Hungary.

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