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Original paper

# New data on the poorly-known Dinaric cave-dwelling species *Lithobius remyi* Jawłowski, 1933 (Chilopoda: Lithobiomorpha: Lithobiidae)

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**Summary.** The endemic Dinaric centipede *Lithobius remyi* Jawłowski, 1933, one of the rarest cave-dwelling centipedes in the Balkan Peninsula, is recorded for the first time in Serbia. An adult male from Karamakaz Cave in the Serbian Autonomous Province of Kosovo and Metohija was discovered in a private collection. The specimen is briefly described and illustrated with all taxonomically important morphological features. The currently known geographical distribution of the species is shown on the map.

**Keywords:** Balkan Peninsula, centipedes, Dinarides, Serbia, troglobionts.

## INTRODUCTION

As a globally recognized hotspot of biodiversity, the Dinarides are home to many rare and endemic species of various groups of organisms. Different animal groups have undergone intense speciation related to the ecological characteristics of the region, mainly thanks to the geographical position, climatic conditions and specific karst systems. A remarkable part of this diversity, with an extremely high degree of endemism, is linked to underground habitats. In fact, the Dinaric karst region can rightly be considered a global center of subterranean biodiversity for many reasons (Sket 1999; Sket et al. 2004). According to Deharveng et al. (2024), the two most species-rich subterranean sites in the world (including troglobionts and stygobionts) originate from the Dinarides: the Postojna Planina Cave System with 105 recorded species (Slovenia) and the Vjetrenica Cave System with 93 species (Bosnia and Hercegovina). In addition, Križna Jama (59 species) from Slovenia is the fourth most species-rich cave in the world. These three sites are the only known sites in the world with both 25 or more troglobionts and 25 or more stygobionts (Deharveng et al. 2024).

One of the important components of this biodiversity are centipedes (Chilopoda), which are among the largest terrestrial predators in cave habitats. A large part of the species diversity of the Dinaric cave centipedes belong mainly to the order Lithobiomorpha (e.g. Verhoeff 1899, 1900; Folkmanová 1935, 1940; Attems 1959; Matic and Dărăbanțu 1968; Matic and Stentzer 1977; Stoev 1996; Stoev et al. 2013; Stojanović et al. 2016, 2019, 2021; Akkari et al. 2017; Dányi et al. 2019; Kos et al. 2023a, 2023b).

In the present study, one of the rarest Dinaric troglobitic

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centipedes, *Lithobius remyi* Jawłowski, 1933 is recorded in Serbia for the first time. The brief description of a discovered specimen is provided, illustrated by photographs of the taxonomically most important morphological structures. Finally, the geographic distribution of the species is presented on a distribution map.

## MATERIALS AND METHODS

A male of *Lithobius remyi* from the Karamakaz Cave near Peć (Autonomous Province of Kosovo and Metohija, Serbia) is discovered in the private collection of Dragan Pavićević, a famous Serbian entomologist and biospeleologist. Currently, the specimen is preserved in 70% ethanol and deposited in the collection of the Institute of Zoology, University of Belgrade – Faculty of Biology (IZB collection).

Identification, measuring and imaging of the relevant morphological characters were made with a stereomicroscope Carl Zeiss Stemi 2000-C with an AxioCam MRc camera and Nikon SMZ 1270 binocular stereomicroscope with Nikon DS-Fi2 camera. The images were stacked with a Zerene Stacker and finally processed with Adobe Photoshop CS6. The distribution map was created with Google Earth Pro (ver. 7.3.6.9345) and Adobe Photoshop CS6.

The terminology follows Bonato et al. (2010). The species identification is based on the original description of the species (Jawłowski 1933). The specimen is morphologically compared with data from the types collected in Montenegro (presented by Jawłowski 1933) and additionally with a male from a cave in Albania, described by Stoev (1996) and housed in the National Museum of Natural History in Sofia (NMNHS collection, Bulgaria).

Abbreviations: a – anterior; C – coxa; D – dorsal; F – femur; m – median; p – posterior; P – prefemur; t – trochanter; T – tergite; Ti – tibia; V – ventral.

## RESULTS

**Taxonomy**

Class Chilopoda Latreille, 1817
Ordo Lithobiomorpha Pocock, 1895
Family Lithobiidae Newport, 1844
Genus *Lithobius* Leach, 1814
***Lithobius remyi*** Jawlowski, 1933

**Material examined**

Male (IZB ChL084) – Serbia, Karamakaz Cave (syn. pećina Crne makaze = Black Scissors Cave), Rugovska Gorge, near Peć, Kosovo and Metohija, September 1995, leg. P. Jakšić.

Male (NMNHS collection) – Albania, Merkurth Cave (syn. Spela Mërkurth), near to village of Mërkurth, District Rrëshen, 11-06-1993, leg. P. Beron and B. Petrov.

**Description**. Body ca. 12.8 mm long and 1.3 mm wide at tergite 8 (T8); pale yellow color (Fig. 1A). Cephalic plate as long as wide. Antennae ca. 7 mm long, composed of 65 and 66 antennomeres, the terminal one twice as long as wide. Forcipular coxosternite subrectangular; forcipules slender, moderately elongated; dental margin with 2+3 small blunt teeth; medial diastema shallow; laterally very stout porodonts; no shoulders of forcipular coxosternite lateral to teeth (Fig. 1B–C). Ocelli absent. Tömösváry's organ large, oval (Fig. 1D). Coxal pores small, rounded; 3443 in number. All tergites without posterior triangular projections; posterior margin of T14 elongate and rounded, posteriorly with the most recognizable feature of the species – a field of fine setae (Fig. 1E). Sternite of ultimate leg-bearing segment trapeziform; first genital sternite as wide as long; gonopods short, bulge-like, distally with a few long setae (Fig. 1F). Walking legs slightly elongated, with clearly divided tarsi on legs 1–13 (Fig. 1G). Penultimate and ultimate legs more elongate, with small and numerous glandular pores on the inner side; pretarsi without accessory claws (Fig. 1H). Last two pairs of legs without any modifications. Plectrotaxy as in Table 1.

## DISCUSSION

In general, the troglomorphic appearance of centipedes is reflected in various morphological adaptations that have evolved as a consequence of the continual darkness of subterranean life, such as the reduction of ocelli and pigmentation, and the elongation of the body and appendages, viz. antennae, legs and claws (e.g. Stoev et al. 2015; Bonato and Ferreira 2023). Among cave-dwelling centipedes, the largest number is recorded within the genus *Lithobius* Leach, 1814. The most common features associated with troglomorphism in these centipedes are related to the complete reduction of the ocelli. According to Stojanović et al. (2019), there are about 10 eyeless species within this genus from caves in southeastern Europe, to which six more "blind" species outside of caves (endogean species) are added. In addition to *L. remyi*, four other eyeless cave-dwelling species, namely *L. matulicii* Verhoeff, 1899, *L. sketi* Matic & Darabanţu, 1968, *L. troglomontanus* (Folkmanová, 1940) and *L. zveri* (Matic & Stenzer, 1977), as well as two endogean species, namely *L. apfelbecki* Verhoeff, 1900 and *L. reiseri* Verhoeff, 1900, were originally described from the Dinarides (see Stojanović et al. 2016). Almost all of these species, with the exception of *L. matulicii*, can be considered as quite rare.

Apart from the specimen presented in this study, *Lithobius remyi* has so far been reported from two other localities, namely Građa Cave (type locality; syn. Gradje pećina;

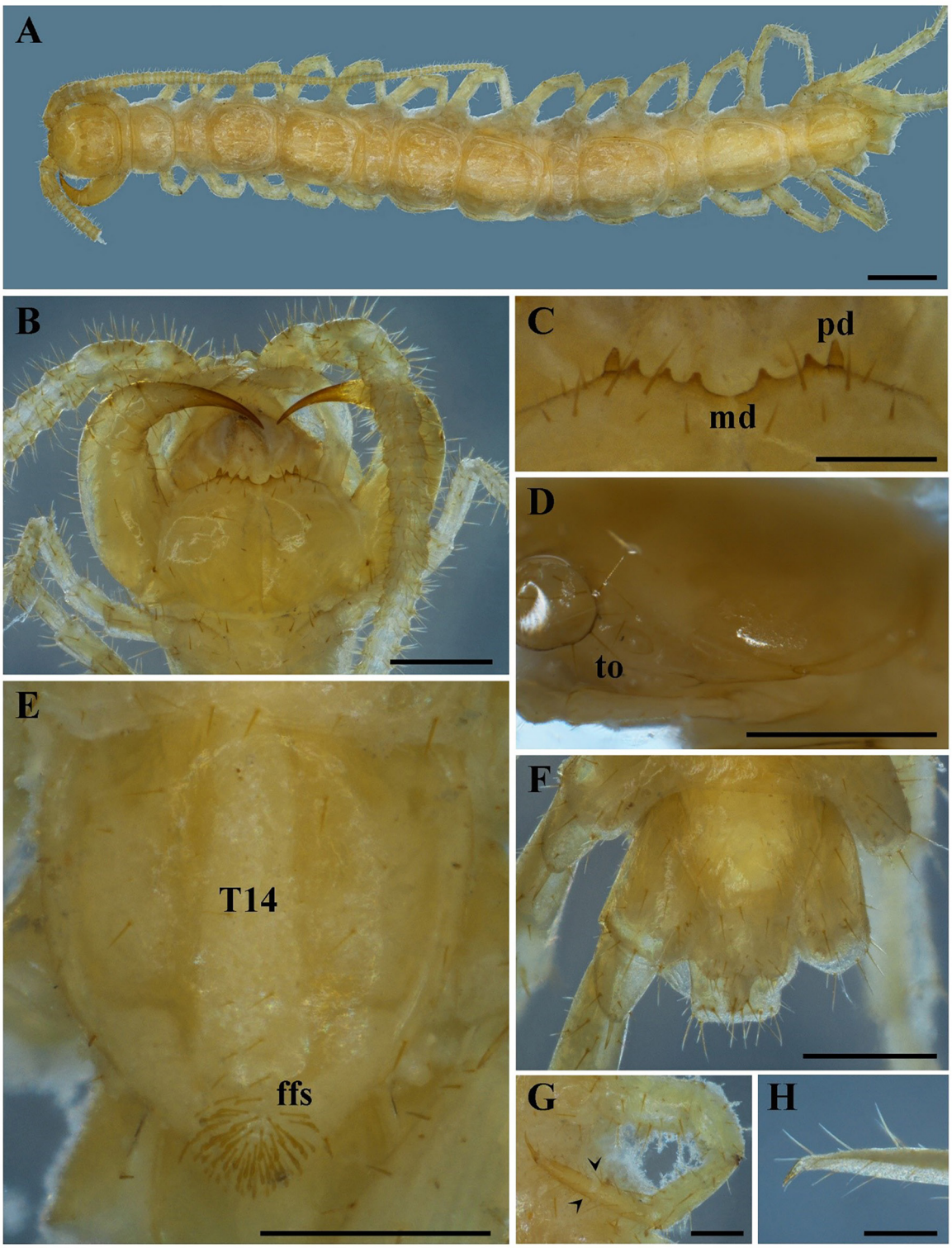


**Fig. 1.** *Lithobius remyi* Jawłowski, 1933, external morphology. **A**, habitus, dorsal view; **B**, forcipular segment, ventral view; **C**, forcipular coxosternal teeth, ventral view; **D**, head, dorso-lateral view; **E**, tergite 14, dorsal view; **F**, posterior part of body, ventral view; **G**, left leg of first pair of walking legs, anterior view; **H**, ultimate pretarsus and tarsus 2 of left ultimate leg, lateral view. Abbreviations: **ffs** – field of fine setae; **md** – medial diastema; **pd** – porodont; **T14** – tergite 14; **to** – Tömösváry's organ. Black arrows point to tarsal articulation on walking legs. (Scale bars: A = 1 mm; B, D, E, F = 0.5 mm; C, G, H = 0.2 mm.)

**Table 1.** Plectrotaxy in *Lithobius remyi* Jawłowski, 1933 from Karamakaz Cave, Serbia.

| Leg pairs | Ventral side | | | | | Dorsal side | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | C | t | P | F | Ti | C | t | P | F | Ti |
| 1 | – | – | – | m | m | – | – | – | – | a |
| 2 | – | – | – | m | m | – | – | (a) | – | a |
| 3 | – | – | – | m | m | – | – | a | – | a |
| 4 | – | – | – | m | m | – | – | – | – | a |
| 5 | – | – | – | m | m | – | – | – | – | a |
| 6 | – | – | – | m | m | – | – | – | – | a |
| 7 | – | – | – | m | m | – | – | – | – | a |
| 8 | – | – | – | m | m | – | – | – | – | a |
| 9 | – | – | (m) | m | m | – | – | – | – | a |
| 10 | – | – | (m) | m | m | – | – | – | – | a |
| 11 | – | – | m | m | m | – | – | – | – | a |
| 12 | – | – | mp | mp | m | – | – | p | – | a |
| 13 | – | m | mp | mp | m | – | – | p | p | a |
| 14 | – | m | amp | m | – | a | – | p | – | – |
| 15 | – | m | amp | m | – | a | – | p | – | – |

C – coxa, t – trochanter, P – prefemur, F – femur, Ti – tibia, a, m, p spines in respectively, anterior, medial and posterior position.

near the village of Petnjik, in the municipality of Berane) in Montenegro and the Merkurth Cave in Albania (Jawłowski 1933; Stoev 1996) (Fig. 2). At the same time, a small number of localities also correspond to a low number of collected specimens (four from Montenegro and only one from Albania), which supports the claim that this is a poorly known centipede species and that every new find is valuable for understanding its biology and distribution. The new locality presented here, the Karamakaz Cave, represents the first record of *L. remyi* in Serbia. This cave is located near the top of a cliff at the entrance to the Rugovska Gorge near Peć (Kosovo and Metohija). It is a cave hermitage on the right bank of the Pećka Bistrica River with an approximately 100 m long channel that ends in a large hall richly decorated with cave ornaments (Ćukić 1971). To my knowledge, there is no information in the literature about other cave fauna reported from this cave.

Morphologically, the specimen from Karamakaz Cave shows a striking similarity with previous recorded specimens, with the exception of a slightly larger number of antennal articles: 65–66 in the specimen from Serbia (this study) vs. 56–59 in the specimens from Montenegro (Jawłowski 1933) and 62–64 in the specimen from Albania (Stoev 1996). The number of coxosternal teeth is also the same as in Stoev's specimen (2+3), but is somewhat variable compared to Jawłowski's specimens (3+3 to 3+4). In addition, some differences in plectrotaxy are also observed. Compared to the specimen from Albania, the most noticeable differences are in the arrangement of spurs of the penultimate and ultimate legs. This is reflected in the presence of the VaP spur (which is also absent in the specimens from Montenegro), the presence of the DaC and the absence of the DmP (all in both pairs of legs; see Table 1). All these differences represent the variability of certain morphological features within a species.

The most recognizable feature of the species *L. remyi* is a field of fine setae on the posterior margin of T14 in males (Fig. 1E). This unique feature has not yet been observed in any other *Lithobius* species. According to Jawłowski (1933) a field of fine setae is completely absent in females. Due to the absence of this feature, the females of this species are very similar to those of *L. matulicii* and differ only in a few details, such as some differences in plectrotaxy (more pronounced in *L. remyi*), the lower number of antennomeres in *L. remyi* (56–66 vs 76–110) and tripartite gonopodal claw in *L. remyi* compared to the bipartite claw in *L. matulici* (for comparison details see Dányi et al. 2019). However, plectrotaxy and the number of antennomeres, must be considered as features that depend on the developmental stage of the specimens (see Stojanović et al. 2023). Therefore, the gonopodal claws have proven to be the most reliable feature for distinguishing the females of these species.

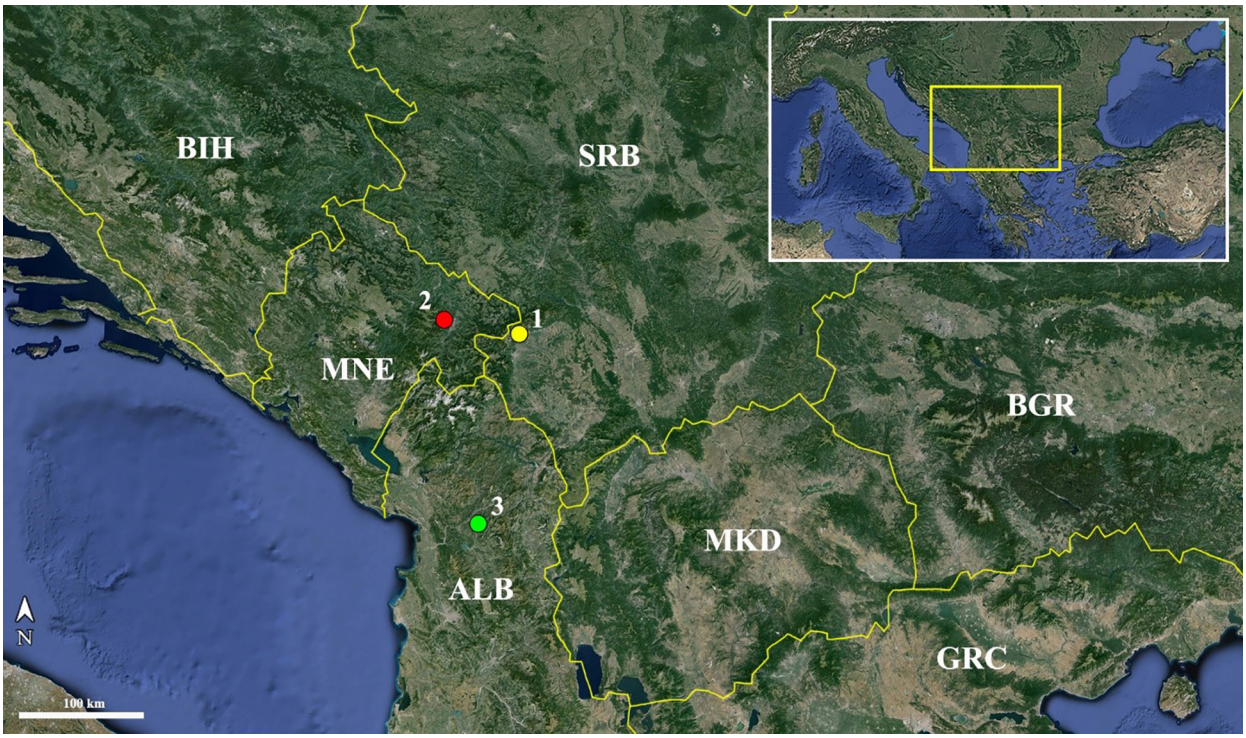


**Fig. 2.** Distribution of *Lithobius remyi*. **1**. Karamakaz Cave; **2**. Građa Cave; **3**. Merkurth Cave. Abbreviations: ALB – Albania; BGR – Bulgaria; BIH – Bosnia and Herzegovina; GRC – Greece; MKD – North Macedonia; MNE – Montenegro; SRB – Serbia.

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