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REVIEW OF THE GENUS *LAMELLOTYPHLUS* TABACARU, 1976 (DIPLOPODA, JULIDAE) WITH DESCRIPTION OF *LAMELLOTYPHLUS BELEVODAE* N. SP. FROM SERBIA

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Abstract — The millipede *Lamellotyphlus belavodae* n. sp. is described on the basis of specimens from Bele Vode Cave in Eastern Serbia. Taxonomic relationships among members of the genus *Lamellotyphlus* Tabacaru, 1976 (and some related taxa) and certain biogeographical and phylogenetic details are also briefly discussed. A key to species of the genus is presented.

Key words: Diplopoda, *Lamellotyphlus,* taxonomy, phylogeny, biogeography, Serbia

INTRODUCTION

The taxonomic history of *Lamellotyphlus* commenced with Tabacaru's (1976) description of *Typhloiulus* (*Lamellotyphlus*) *mehedintzensis* Tabacaru, 1976 from Romania. In his revision of the genus *Nepalmatoiulus* Mauriès, 1983, Enghoff (1987) elevated *Lamellotyphlus* to full generic rank and based on the presence of a "promesomerital forceps" included it in the tribe Leucogeorgini Verhoeff, 1930 of the subfamily Oncoiulinae Verhoeff, 1909. Both Tabacaru (1976) and Enghoff (1987) postulated that *Typhloiulus staregai* Strasser, 1973, from Bulgaria, probably belongs to the genus *Lamellotyphlus*. Makarov et al. (2002) described another troglobitic species, *Lamellotyphlus sotirovi* Makarov, Mitić & Ćurčić, 2002, from Eastern Serbia. The same authors accepted full generic rank for *Lamellotyphlus*, but they considered it to be a member of the tribe *Typhloiulini* Verhoeff, 1930. Tabacaru et al. (2002-2003) analyzed cavernicolous diplopods of Romania and pointed out the phylogenetic importance of a fringed lamella placed between the mesomerite and opisthomerite, something found in numerous *Typhloiulus* species; they retained the generic position of *Lamellotyphlus,* but without preciselly designating its taxonomic position within the family Julidae Leach, 1814. Within the family Julidae, Enghoff and Kime (2004) recognized *Lamellotyphlus* as a valid genus with two species: *L. mehedintzensis* and *L. sotirovi*.

During investigation of several caves in Eastern Serbia, student members of the „Endemit" Ecological Society of Belgrade University's Faculty of Biology, collected

interesting specimens of millipedes. After careful examination of the sample, we consider these millipedes to be a new species belonging to the genus *Lamellotyphlus*. In the present paper, we discuss its phylogenetic position within the family Julidae, and present for the first time a key to species of the genus *Lamellotyphlus*.

SYSTEMATIC PART

JULIDAE LEACH, 1814

LAMELLOTYPHLUS TABACARU, 1976

Type species: *Lamellotyphlus mehedintzensis* Tabacaru, 1976

Diagnostic remarks. Head without eyes and with two occipital setae. Mandibular lobes in adult males absent. Coloration light- or even dark-brown. Ozopores behind sutures. Metazonites with gentle striae. Posterior edges of metazonites with setae. First leg-pair in adult males hook-shaped. Penis bilobed. Promerite with flagellum. Posterior gonopods without coxal piece. Opisthomerite and mesomerite fused in unique block through massive lamella. Opisthomerite with velum.

LAMELLOTYPHLUS BELEVODAE MAKAROV, NEW SPECIES

(Figs. 1–7)

Material examined. Holotype male, Serbia, Iron Gate National Park, Mt. Miroč, Bele Vode Cave, 26.07.2004, leg. members of "Endemit" Ecological Society, Belgrade. Paratypes: four males and five females, same place, date, and collectors, taken together with holotype. Non-types: fragments of two males and four females, same place, date, and collectors, taken together with holotype. All material is deposited in the collection of the Institute of Zoology, Faculty of Biology, University of Belgrade, Belgrade, Serbia.

Etymology. After its type locality.

Description. Coloration brownish. Body length: 44.80-56.50 mm (44.80 in holotype male). Hmax.: 1.85-2.00 mm (1.85 mm in holotype male). Body with 49 + telson (male) or 48-49 + telson (female) pleurotergites (two apodous pleurotergites). Labrum with three teeth; 12 labral and four supralabral setae. Head with two occipital setae, without eyes.

Antennae (in holotype male): length 2.19 mm; distance between antennal sockets 0.24 mm. Length of antennomeres I-VIII (in mm): 0.20 (I), 0.43 (II), 0.41 (III), 0.43 (IV), 0.39 (V), 0.25 (VI), 0.10 (VII), and 0.06 (VIII). Length/breadth ratio of antennomeres I-VII: 1.50 (I), 4.80 (II), 2.93 (III), 2.53 (IV), 1.70 (V), 1.32 (VI), and 0.50 (VII). Antennomeres V and VI with 12 and nine terminal bacilliform sensillae, respectively; antennomeres VII with 20-21 small terminal microsetae arranged in a semicircle sub-apically.

Gnathochilarium: Stipites with three distal setae each, lamellae linguales each with three setae arranged in one median row. Prementum triangular, two times shorter than lamellae linguales.

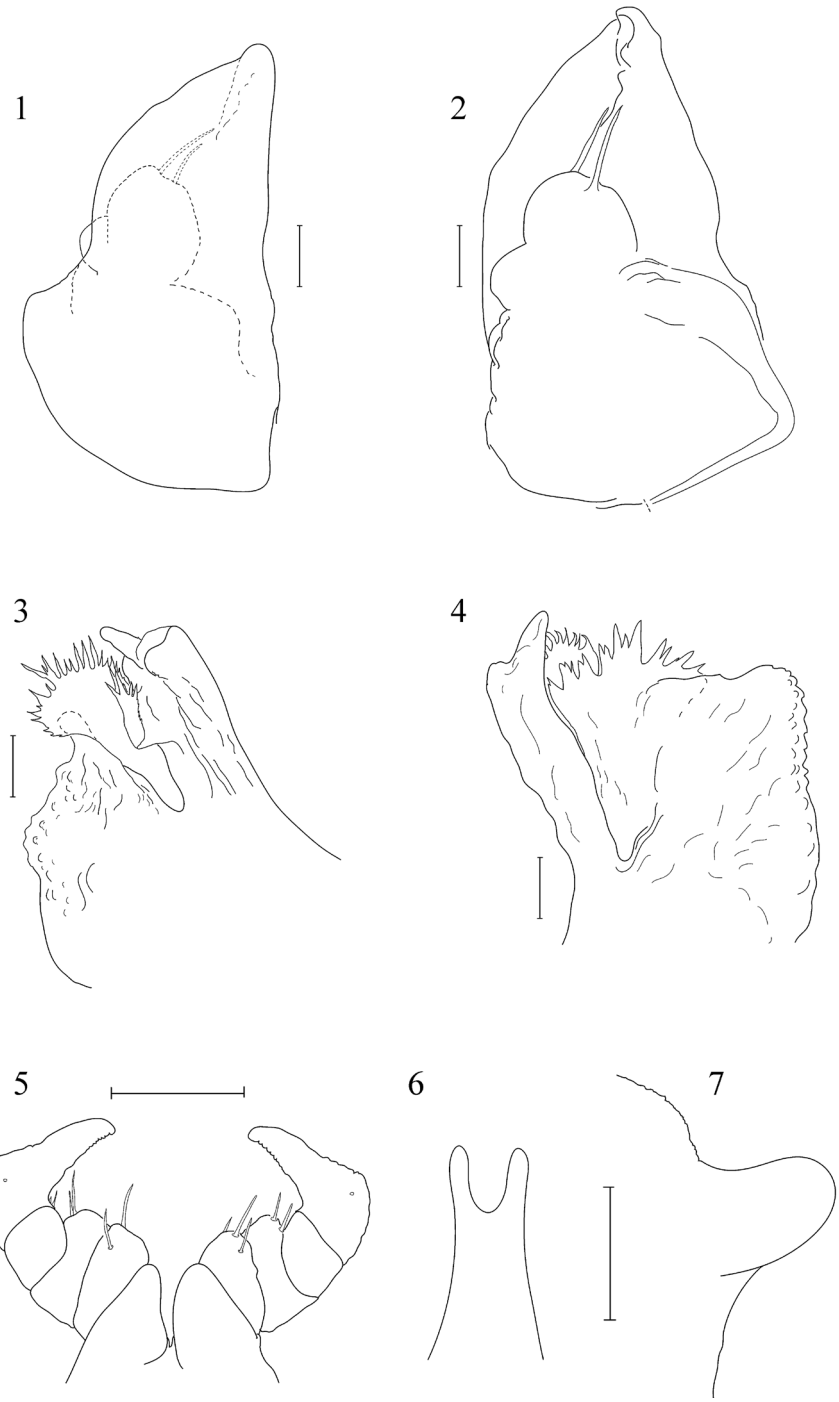


Fig. 1-7. *Lamellotyphlus belevodae* n. sp. Holotype male. 1 – Promerite, oral view; 2 – Promerite, caudal view; 3 – Opisthomerite, mesal view; 4 – Opisthomerite, lateral view; 5 – Leg-pair 1, caudal view; 6 – Penis, caudal view; 7 – Ventral margin of seventh male pleurotergum. Scale lines for Figs. 1–4 are 0.02 mm; those for Figs. 5–7 are 0.05 mm.

Collum broader than head, with posterior row of 12 setae.

Metazonite with 14-16 setae (on midbody somites in holotype male). Surface of metazonites with gentle striation (28 striae between ozopores on midbody somites in holotype male). Suture clearly visible, ozopores lying behind the constriction. Male pleurotergum 7 with a widely rounded distomarginal tooth, slightly curved downwards (Fig. 7).

Telson with short epiproct covered with three or four rows of long setae. Paraproct with marginal row of seven long setae and three or two rows of short setae. Hypoproct quadrangular with two setae.

Length of midbody legs (in holotype male) 1.30 mm. Legs without adhesive pads. First pair of legs hook-shaped (Fig. 5). Penis behind second leg-pairs bilobed (Fig. 6).

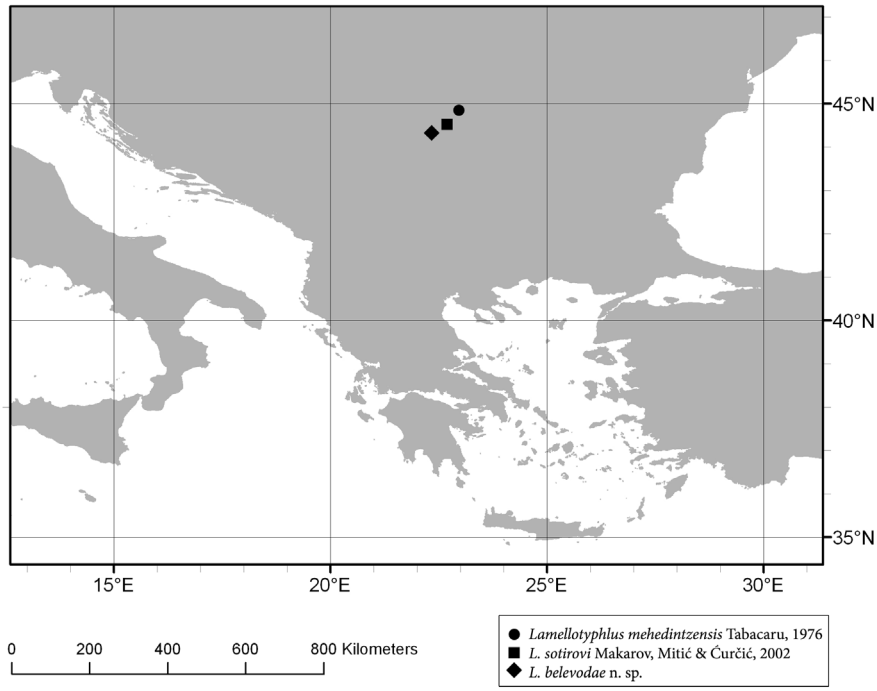
Gonopods. Promerite as wide as high. Basal part of promerite almost quadrangular. Apical part of promerite rounded, on caudal side bearing small outgrowths. All margins of promerite without tubercles or granulations (Figs. 1–2). Parabasal internal lobe massive, rounded with two apical setae. Parabasal external lobe small and without modifications. Flagellum present (Fig. 2). Presumptive mesomerite massive, on oral side gently tuberculated, and connected with basal and sub-medial part of opisthomerite by a median lamella. Apical margin of lamella strongly dentate (Fig. 4). Opisthomerite consisting of a velum and a solenomerite. Velum massive, enlarged, and with dentate apical margin. Apical part of solenomerite sub-divided into a long and thin flagellar outgrowth and a massive caudal part, which is bilobed apically (Figs. 3–4).

Diagnosis. The new species clearly differs from congeners (*L. mehedintzensis* and *L. sotirovi*) in the absence of a meso-opisthomeral lamellar connection in the apical and median part of the solenomerite.

DISCUSSION

The genus *Lamellotyphlus* includes three species: *L. mehedintzensis* from several caves in the western part of the Mehedinti Mountains and Plateau in Romania (Tabacaru et al., 2002-2003); *L. sotirovi* from Buronov Ponor Pit on Mt. Miroč in Serbia; and *L. belevodae* from Bele Vode Cave, Iron Gate National Park, Mt. Miroč in Serbia (Map 1).

Tabacaru (1976) and Enghoff (1987) shared the view that *Typhloiulus staregai* from Bulgaria belongs to the genus *Lamellotyphlus*. In our opinion, it is possible that Strasser (1973) actually described a juvenile male. Interestingly, Strasser (1973) recorded the presence of «... schmalem, schare zweispitzigen Penis...» in *T. staregai*. It is noteworthy that in the collection of diplopods maintained by the Institute of Zoology of Belgrade University's Faculty of Biology, we found juvenile males belonging to the genus *Typhloiulus* with unmodified first leg-pairs and with a penis. To judge from Strasser's (1973) drawings, structure of all parts of the gonopods in *T. staregai* is juvenile-like (similar structure of juvenile gonopods was noted by us in



Map 1. Distribution of the genus *Lamellotyphlus* Tabacaru, 1976.

«junior» males of *Serboiulus lucifugus* Strasser, 1962). From Strasser's (1973) description, it is evident that the opisthomerite in *T. staregai* is without a velum. Moreover, the lamella between the opisthomerite and mesomerite in this species is much more like the same structure in some other typhloiulid species [*T. strictus* (Latzel, 1882) or *T. albanicus* Attems, 1929]. Such facts about structure of the gonopods lead us to assume that *T. staregai* does not belong to the genus *Lamellotyphlus*, even if Strasser's description (1973) was based on juvenile males.

Before treating the taxonomic position of the genus *Lamellotyphlus* and its relationships with other close-related Typhloiulini, it is necessary to resolve certain problems of the terminology applied to some parts of the posterior gonopods. Strasser (1962) in his monograph on the Typhloiulini recognized the significance of a lamella between the mesomerite and the opisthomerite, which he called an "intermediate membrane", and stressed the phylogenetic importance of this lamella or "intermediate membrane" which is characteristic of the subgenus *Typhloiulus* and which is considered as a vestige of the ancient primitive coherence once existing between the opisthomerite and the mesomerite". The position of the lamella on the posterior gonopods is quite different among typhloiulids. It may be connected only with the opisthomerite (*T. bureschi* Verhoeff, 1926) or mesomerite (*T. strictus*),

inserted just between the opisthomerite and the mesomerite (*T. incurvatus* Verhoeff, 1899), or even missing (*T. bosniensis* Strasser, 1966). The velum is an opisthomeral apical or sub-apical mesal outgrowth oriented toward the mesomerite. It varies considerably in shape, ranging from a triangular or sub-triangular, transparent, lamellar sub-apical outgrowth (as in *T. strictus*, *T. albanicus*, or *T. bureschi*) to a thin, pointed, slightly curved, apical or sub-apical outgrowth (as in *T. bosniensis* or *T. incurvatus*). There are no representatives of the genus *Typhloilus* sensu stricto with a lamellar connection between the opisthomerite and mesomerite; on the other hand the velum appears in almost all typhloiulids as an independent structure.

Makarov et al. (2002) remarked that in representatives of the genus *Lamellotyphlus*, the velum is free and their median lamella is not homologous with a membranous velum. If we accept Enghoff's opinion (1987) that the mesomerite in higher julids is developed as an independent branch, two ways of explaining the phylogeny of *Lamellotyphlus* are possible. First, the genus *Lamellotyphlus* is closer to the ancestral state — the meso-opisthomeral complex is plesiomorphic in relation to the condition in "higher julids". The second scenario is that all members of the genus *Lamellotyphlus* represent an independent phylogenetic lineage developing parallel with other members of the genus *Typhloiulus sensu lato*.

In the above-cited paper, Makarov et al. considered relationships between the genera *Lamellotyphlus* and *Banatoiulus*. Tabacaru (1985) described the genus *Banatoiulus* Tabacaru, 1985 and noted that in regard to the absence of a mesomerite it shared similarities with the subfamily Brachyiulinae. However, he also listed a number of characters indicating a close relationship between the genera *Banatoilus* and *Typhloiulus*: absence of eyes and pigments, absence of mandibular lobes in adult males, presence of setae on posterior edges of the metazonites, presence of sternal "plaque" on the anterior gonopods, presence of a flagellum, presence of a telopodite on the anterior gonopods, and absence of a coxal process on the posterior gonopods. Enghoff (1987) supposed that *Banatoiulus* may be phylogenetically close to the Oncoiulinae, but differs at least in not having a well-developed pro/mesomerital forceps. According to Makarov et al. (2002), Tabacaru's (1985) description of the genus *Banatoiulus* suggests that the oral lobe of the opisthomerite is likely to be a presumptive mesomerite. The median lobe in same genus resembles the velum. It follows that an intermediate condition has developed in representatives of the genus *Lamellotyphlus*. We note that in the new species, the apical and median parts of the opisthomerite are without lamellar connections. This condition may be a step leading to formation of the mesomerite as an independent branch. For these reasons, we prefer the first possible scenario in evolution of the gonopods in *Lamellotyphlus* and closely related typhloiulid taxa. In other words, we suppose that the genus *Banatoiulus* is the most basal typhloiulid taxon (without a mesomerite); the next step in evolution of the gonopods appears in the genus *Lamellotyphlus* (with a lamellar connection between the opisthomerite and the presumptive mesomerite); finally, the mesomerite appears as a free and independent branch in numerous representatives of the genus *Typhloiulus*.

Key to species of the genus *Lamellotyphlus*

1. Hypoproct with two setae.

2

– Hypoproct with four setae.

L. sotirovi Makarov, Mitić & Ćurčić, 2002

2. Body length < 30 mm; solenomerite with basomesal "claw"; apical part of solenomerite with lamellar connection.

L. mehedintzensis Tabacaru, 1976

– Body length > 30 mm; solenomerite without basomesal "claw"; apical part of solenomerite without lamellar connection.

L. belevodae Makarov n. sp.

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