

REVISION OF THE GENUS *SERBOIULUS* STRASSER, 1962 (DIPLOPODA, JULIDAE)

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Abstract - *Serboiulus lucifugus* Strasser, 1962 and *S. deelemani* Strasser, 1972 are upgraded to the species level from subspecific status under *Serboiulus* Strasser, 1962. The position of the genus *Serboiulus* in the tribe Typhloiulini Verhoeff, 1930 is discussed, and a key to serboiulid species is presented.

Key words: Diplopoda, Julidae, *Serboiulus*, new species, evolution, Serbia

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INTRODUCTION

The genus *Serboiulus* Strasser, 1962 represents a small genus within the prolific tribe Typhloiulini Verhoeff, 1930. It includes the following members: *Serboiulus lucifugus lucifugus* Strasser, 1962; *S. lucifugus deelemani* Strasser, 1971; and *S. spelaeophilus* Gulička, 1967. Strasser (1969) described *Serboiulus popovi* Strasser, 1969 from several caves in Western Bulgaria (Mramornata Peštera Cave, Šokjovec Cave, and Temna Dupka Cave). However, Strasser (1973) revised this species and treated it as being synonymous with *S. spelaeophilus*.

The main reason for establishing this genus was the presence of a reduced flagellum (Strasser, 1962). The distribution of representatives of the genus *Serboiulus* is restricted to a few caves in Eastern Serbia and Western Bulgaria. Zoogeographically, these regions belong to the massif of the Stara Planina Mountain.

On the basis of abundant material from the type-localities of both subspecies of *Serboiulus lucifugus*, viz., *S. lucifugus lucifugus* and *S. lucifugus deelemani*, we analyzed their taxonomic status, as well as relationships with *S. spelaeophilus* and the representatives of closely-related genera.

Diagnostic remarks. - The genus *Serboiulus* includes three members from a few caves in the massif of the Stara Planina Mountain (Eastern Serbia and Western Bulgaria). The head is without eyes and with two occipital setae. Coloration is light- or even dark-brown. Ozopores are in sutures. Metazonites are with gentle striae. The epiproct is well-developed and mainly curved downwards. The first leg-pair is hook-shaped. The penis is bilobed. In all species, a promerital flagellum is absent. The mesomerite is straight or curved orally. The opisthomerite is slender. An opisthomerite lamella is present or absent. A velum is present.

***SERBOIULUS LUCIFUGUS* STRASSER, 1962,
NEW STATUS
(Figs. 2-3, 7-8)**

Syn.: *Serboiulus lucifugus lucifugus* Strasser, 1962, n. syn.

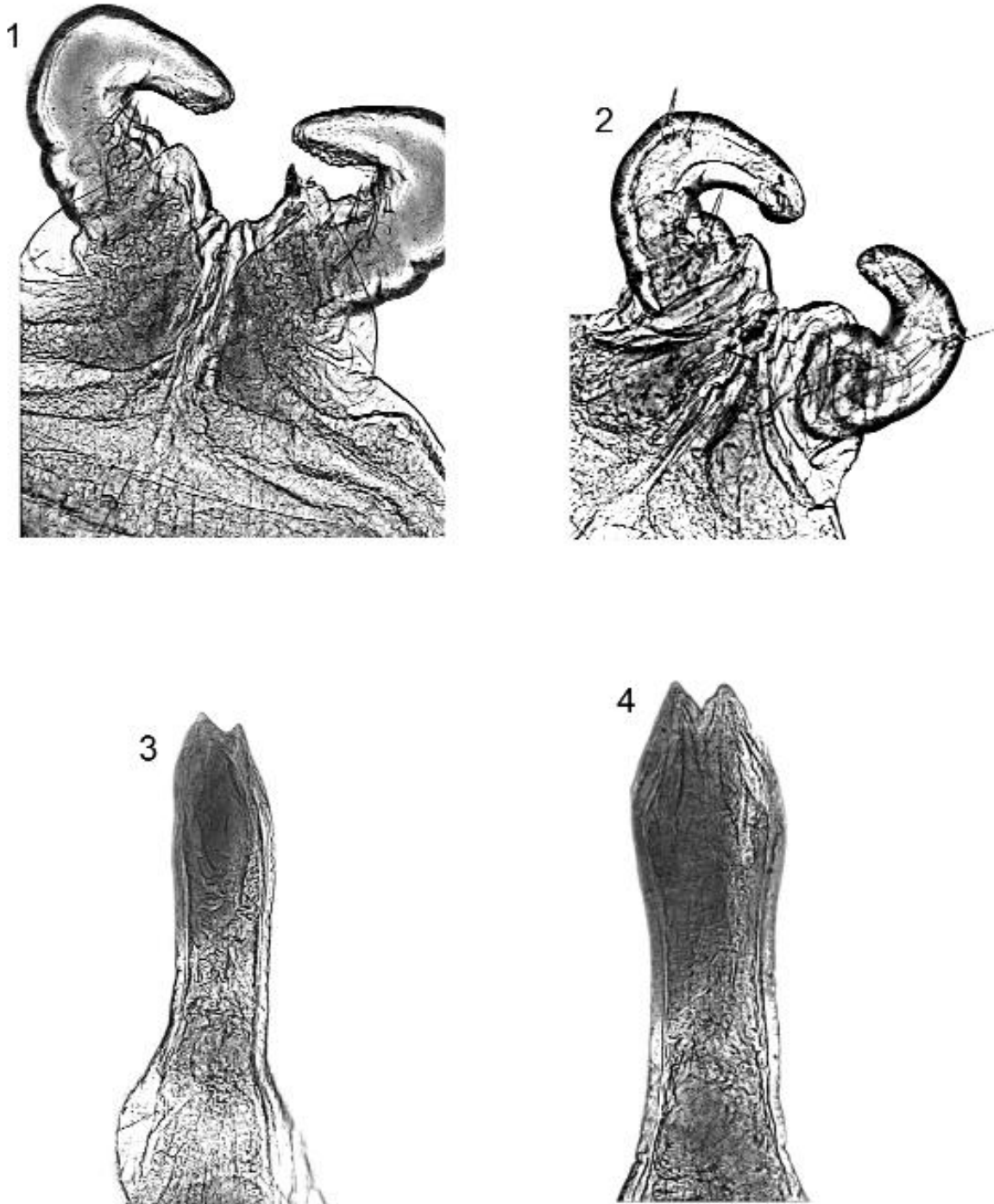
Material examined. Five topotype males (three males examined), from the Prekonoška Pećina Cave, village of Prekonoge, near Svrlijig, Svrlijske Planine Mountains, Eastern Serbia, 11 May 2004; collected by D. Pavličević.

**SYSTEMATIC PART
JULIDAE LEACH, 1814
SERBOIULUS STRASSER, 1962**

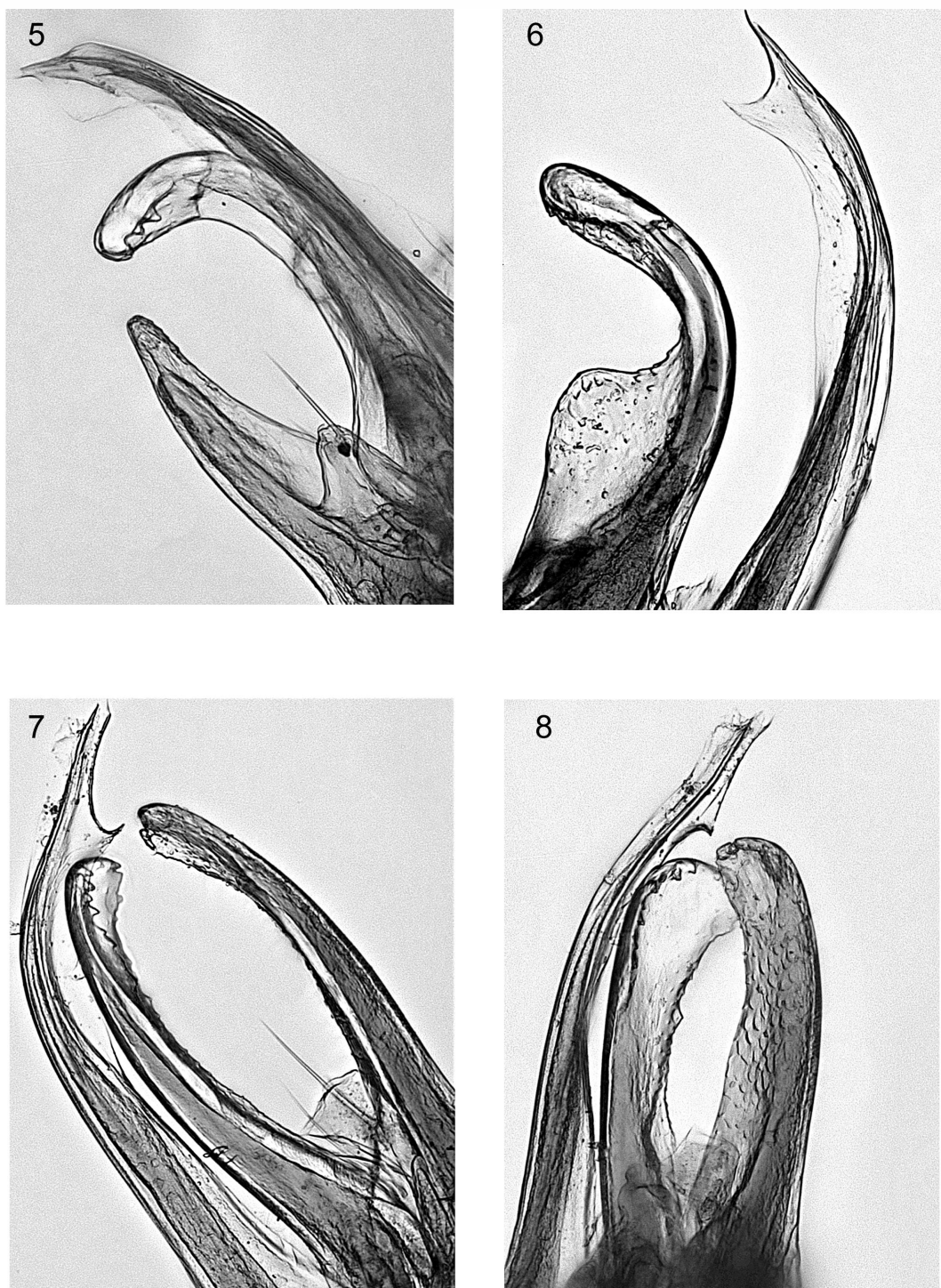
Syn.: *Balkaniulus* Gulička, 1967
Type species: *Serboiulus lucifugus* Strasser, 1962

***SERBOIULUS DEELEMANI* STRASSER, 1971,
NEW STATUS
(Figs. 1, 4, 5-6)**

Syn.: *Serboiulus lucifugus deelemani* Strasser, 1962, n. syn.



Figs. 1-4. First legpair and penis. 1 - *Serboiulus deelemanni* Strasser, 1972, from the Vetrena Dupka Cave, village of Vlasi, Eastern Serbia, first legpair, oral view; 2 - *Serboiulus lucifugus* Strasser, 1962, from the Prekonoška Pećina Cave, village of Prekonoge, Eastern Serbia, first legpair, oral view; 3 - *Serboiulus deelemanni* Strasser, 1972, from the Vetrena Dupka Cave, village of Vlasi, Eastern Serbia, penis, caudal view; 4 - *Serboiulus lucifugus* Strasser, 1962, from the Prekonoška Pećina Cave, village of Prekonoge, Eastern Serbia, penis, caudal view.



Figs. 5-8. Gonopods. 5 - *Serboiulus deelemani* Strasser, 1972, from the Vetrena Dupka Cave, village of Vlasi, Eastern Serbia, gonopods, mesal view; 6 - *Serboiulus deelemani* Strasser, 1972, from the Vetrena Dupka Cave, village of Vlasi, Eastern Serbia, mesomerite and opisthomerite, lateral view; 7 - *Serboiulus lucifugus* Strasser, 1962, from the Prekonoška Pećina Cave, village of Prekonoge, Eastern Serbia, gonopods, lateral view; 8 - *Serboiulus lucifugus* Strasser, 1962, from the Prekonoška Pećina Cave, village of Prekonoge, Eastern Serbia, gonopods, antero-lateral view.

Material examined. Nine topotype males (five males analyzed), from the Vetrena Dupka Cave, village of Vlasi, near Pirot, 16 October 2001; collected by D. Pavíćević.

SERBOIULUS SPELAEOPHILUS GULIČKA, 1967

Syn.: *Serboiulus (Balkaniulus) spelaeophilus* Gulička, 1967

Material examined. According to the original description (Gulička, 1967; Strasser, 1969, 1973).

Remarks. Gulička (1967) established the new subgenus *Balkaniulus* on the basis of structure of the promerite, which in *S. spelaeophilus* has a wide apico-lateral lobe and an opisthomerite lamella. Shape of the mesomerite and that of the opisthomerite are somewhat peculiar and clearly separate this species from other *Serboiulus* representatives. However, it is known that shape of the promerite is highly variable within the Julidae (Mauriès *et al.* 1997) and that in different typhloiulines the opisthomerite lamella is well-developed, vestigial, or even reduced. We assume that all characters mentioned by Gulička (1967) in his erection of the new subgenus reflect only the species level, so we treat the subgenus *Balkaniulus* as a synonym with the genus *Serboiulus*.

DISCUSSION

In his excellent review of the Typhloiulini, Strasser (1962) pointed out the existence of some body structures (number of pleurotergites, body length, length of antennomeres or length/breadth ratios of antennomeres) in this tribe, that can be very useful for distinguishing some representatives of even closely-related taxa. In Table 1 we summarize some of the main characters of *S. lucifugus lucifugus* and *S. lucifugus deelemani* pointed out by Strasser (1962). It is evident that, as far as the genus *Serboiulus* is concerned, most of these characters are not valid for discrimination of the given subspecies. The only more or less useful features are the number of sensillae on antennomeres V and VI and the number of setae on pleurotergite VII (Table 1). Generally, males of *S. lucifugus lucifugus* have more than 16 setae on somite VII, while males of *S. lucifugus deelemani* have less than 16 setae on the same somite. On the other hand, *lucifugus* males have a smaller number of sensillae on antennomeres V and VI than *deelemani* ones. However, on the basis of the analyzed males we have to note that the number of setae on the above-mentioned structures is highly correlated with body size. Larger males have a high number of sensillae on both antennomeres, as well as numerous setae on somite VII. We suppose that in a larger sam-

Table 1. Some linear measurements, morphometric ratios, setations, and number of pleurotergites in *Serboiulus lucifugus* Strasser, 1962 and *S. deelemani* Strasser, 1971.

Characters	<i>Serboiulus lucifugus</i>	<i>Serboiulus deelemani</i>
Body length (in mm)	28.00-34.00	28.00-40.10
Hmax (in mm)	1.10-1.20	1.00-1.30
Number of pleurotergites	48-60	49-60
Apodous pleurotergites	1-2	2
Number of setae on pleurotergite VII	17-18	12-15
Labral setae	4-5	4
Supralabral setae	15	4
Stipital setae	3-5	3-5
Number of setae on lamellae linguales	4	4
Length of antennae (in mm)	2.25-2.38	1.95-2.47
Number of sensillae on antennomere V	13-14	17-20
Number of sensillae on antennomere VI	18-19	20-22
Length/breadth ratio of antennomere I	1.00	0.50-1.00
Length/breadth ratio of antennomere II	3.33-3.61	2.67-4.15
Length/breadth ratio of antennomere III	2.67-3.11	1.50-2.67
Length/breadth ratio of antennomere IV	2.61-3.11	2.00-2.67
Length/breadth ratio of antennomere V	1.78-2.10	2.00-2.15
Length/breadth ratio of antennomere VI	1.76-2.16	1.50-2.125
Length/breadth ratio of antennomere VII	1.00	1.00

ple these characters will be similar and cannot be used for valid discrimination.

We thoroughly analyzed structure of body parts which are more or less in direct correlation with sperm transfer and which in our opinion have great taxonomic and phylogenetical value. Legs of the first pair, as in numerous julids, are hook-shaped. In adult males from the Vetrena Dupka Cave, the tibiotarsal part is without setae (Fig. 1); all males from the Prekonoška Pećina Cave have two setae on the tibiotarsal part (Fig. 2). Moreover, in *S. lucifugus lucifugus* the border between basal podomerae is much more distinct than in *S. lucifugus deelemani*. The penis in both subspecies is quite similar. The basal part is expanded and rounded; the median part is almost parallel-sided; and the apical part is bi-lobed (Figs. 3-4).

Great differences exist in shape and size of the gonopods. In both taxa promerites are without an external lobe. In *S. lucifugus lucifugus*, the promerite is elongated and quadrangular (Fig. 8), but in *S. lucifugus deelemani* it is clearly triangular, with a wider basal part and a considerably tapering top (Fig. 5). The mesomerite in *lucifugus* is of the same height as the promerite and apically has a clear row of teeth on the anterior side (Figs. 7-8); in *deelemani* the mesomerite is considerably longer than the promerite, strongly curved cephally, and with only a few teeth on the anteroapical side (Fig. 5). Moreover, in the latter taxon the mesomerite possesses strongly developed lateral outgrowths (Fig. 6); such structures do not exist in the subspecies *lucifugus*. The opisthomerite is generally similar in both taxa, but in males from the Vetrena Dupka Cave the velum is well-developed, terminating subapically in the solenomerite; as a result, the free part of the solenomerite in these taxa is very short (Fig. 6). In *lucifugus* the velum is much shorter and the apical free part of the solenomerite is considerably longer (Fig. 7). We think it unnecessary to explain the importance of this character because the apical part of the solenomerite is directly involved in sperm transfer to female vulvae.

On the basis of both body and gonopod structure, we feel that important differences exist between the two subspecies and that both taxa deserve full specific rank as *Serboiulus lucifugus* and *S. deelemani*. Both species differ greatly from *S. spelaeophilus* in shape of both the promerite and the mesomerite, as well as in structure of the opisthomerite (see Key to the species of *Serboiulus*).

The genus *Serboiulus* possesses some apomorphies, such as: absence of eyes, hook-shaped legs of the first pair, absence of a flagellum, presence of only one lobe on the caudal side of the promerite, and development of the mesomerite as an independent branch. Generally, the trend in evolution of the gonopods in julids involves the appearance of a free mesomerite (Enghoff, 1987). This means that *Serboiulus* members are highly evolved taxa. It is interesting that a flagellum is also absent in representatives of the genus *Trogloiulus* Manfredi, 1931 from Northern Italy. It is probable that both taxa have evolved independently and represent two phyletic lineages within *Typhloiulus* sensu lato. One strongly plesiomorphic feature is retention of pigments in all *Serboiulus* species. Unusual dark pigmentations may be a result of their recent isolation in cave systems.

Zoogeographically, the genus *Serboiulus* belongs to the category of Balkan elements, and its evolution is probably correlated with geotectonic events in the Carpatho-Balkan Arc in the past.

Key to the species of *Serboiulus*

This key is based mainly on structure of the gonopods in adult males:

1. Promerite with wide, rounded apical lobe; internal lobe without setae; mesomerite straight; velum a small triangular tooth; opisthomerite with denticulated caudal margin.....*S. spelaeophilus* Gulička, 1967
- Promerite without apical lobe, internal lobe with setae; mesomerite curved cephally; velum well-developed; opisthomerite with entire caudal margin.....2
2. Mesomerite longer than promerite, strongly curved orally, with massive lateral lobe; apical free part of solenomerite short....*Serboiulus deelemani* Strasser, 1971
- Mesomerite shorter than promerite, gently curved orally, without lateral lobe; apical free part of solenomerite long.....*Serboiulus lucifugus* Strasser, 1962

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РЕВИЗИЈА РОДА *SERBOIULUS* STRASSER, 1962 (DIPLOPODA, JULIDAE)

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На основу абундантног материјала са типских локалитета извршена је ревизија рода *Serboiulus* Strasser, 1962. Комплексне упоредно-морфолошке студије подврста *Serboiulus lucifugus lucifugus* Strasser, 1962 и *S. lucifugus deelemani* Strasser, 1972, показале су да оба таксона представљају добре врсте. На основу филогенетских односа са осталим

родовима у оквиру трибуса Typhloiulini Verhoeff, 1931 утврђено је да истраживани род представља високоеволуирани таксон. Утврђено је да је његова еволуција у директној корелацији са геотектонским догађајима у карпато-балканском луку и на целом Балканском полуострву у прошлости. Дат је кључ за детерминацију представника рода *Serboiulus*.