A new cave pseudoscorpion (Pseudoscorpiones: Neobisiidae) from western Georgia

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Abstract

A new species of pseudoscorpion, *Neobisium* (*Ommatoblothrus*) *achaemenidum* n. sp. is described from a karst cave of western Georgia. Illustrations of diagnostic characters are provided to facilitate taxon recognition.

Keywords: Caucasus • taxonomy • Tetra cave

Introduction

The pseudoscorpions of Georgia have been poorly studied. A total of 26 species and subspecies attributed to the family Neobisiidae Chamberlin, 1930 have been recorded from Georgia hitherto (Harvey 2013). The genus *Neobisium* Chamberlin, 1930 includes 19 species and subspecies belonging to two subgenera, *Neobisium* (*Neobisium*) Chamberlin, 1930 and *Neobisium* (*Blothrus*) Schiodte, 1849, which occur in Georgia (Harvey 2013). Because the pseudoscorpion fauna of Georgia has been poorly studied, it is likely to be more diverse than the available records published in the literature suggest.

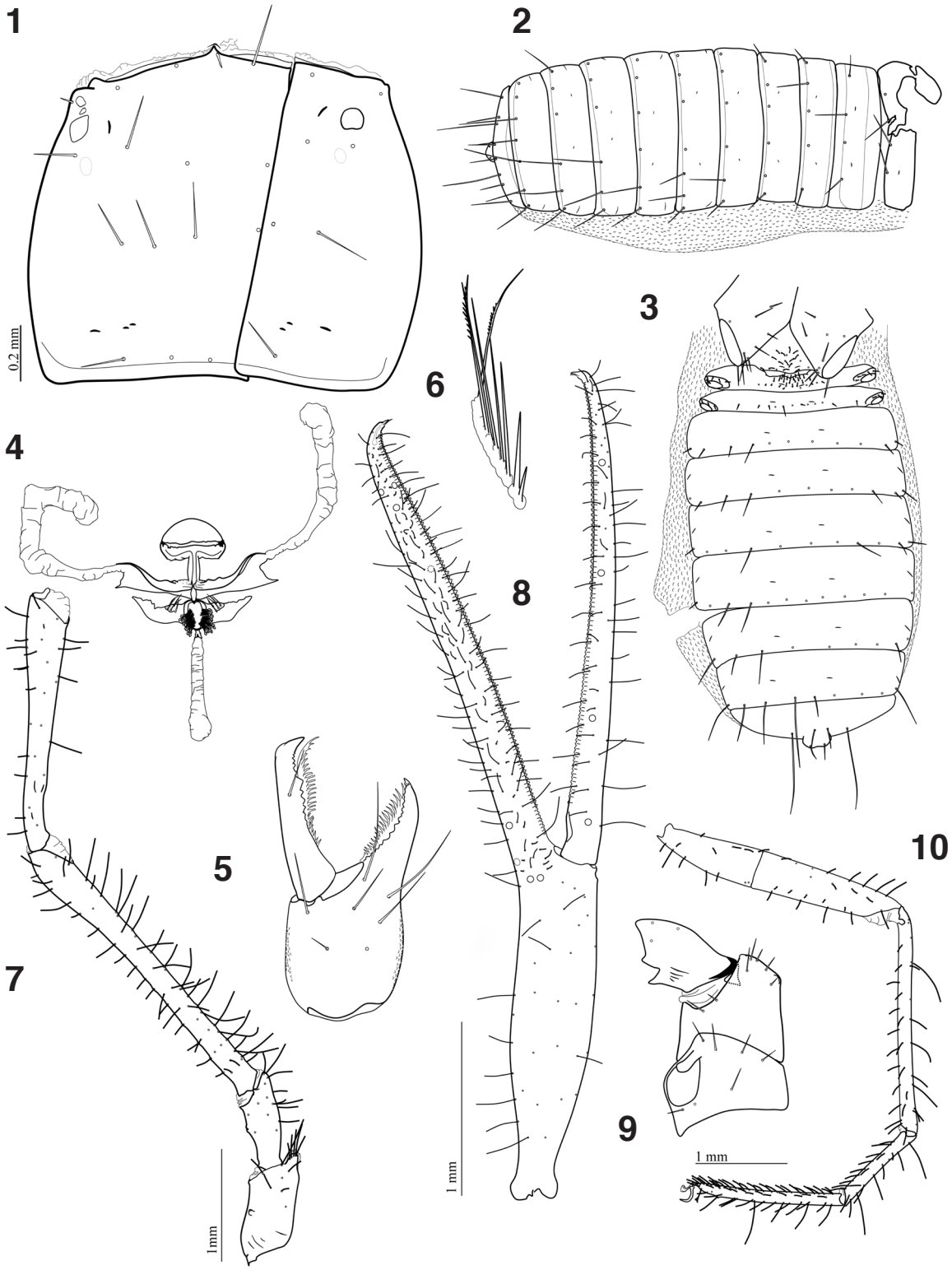
In this contribution, a new cave-dwelling species of the subgenus *Neobisium* (*Ommatoblothrus*) Beier, 1956 is described and illustrated, based on single male which is the first record of the subgenus for the Caucasus.

Material and methods

The studied pseudoscorpion was hand collected from Tetra cave (vicinity of Tskaltubo, west Georgia). It was preserved in 96% alcohol, cleared in 60% lactic acid, and permanently mounted in Swan's fluid on a dished glass microscope slides supported by 18 mm coverslips. The prepared material was measured at the highest possible magnification using an ocular graticule, and illustrated using a drawing tube attached to an Olympus CH–2 compound microscope. Morphological terminology and mensuration follow Chamberlin (1931), Harvey (1992), Harvey *et al*. (2012), and Judson (2007).

Noticeably, the left chela of the male holotype was lost during collection. The specimen was deposited in the collection of the Acarology Laboratory, Ilia State University, Tbilisi, Georgia (ISUTG).

Abbreviations: L = length; W = width; D = depth; M = microseta. Trichobothriotaxy: *eb* = external basal; *esb* = external sub-basal; *est* = external sub-terminal; *et* = external terminal; *ib* = internal basal; *isb* = internal sub-basal; *ist* = internal sub-terminal; *it* = internal terminal; *t* = terminal; *st* = sub-terminal; *sb* = sub-basal; *b* = basal.



Figs. 1–10: *Neobisium* (*Ommatoblothrus*) *achaemenidum* n. sp., holotype ♂. **1** carapace, dorsal view; **2** tergites, dorsal view; **3** sternites, dorsal view; **4** genital organ; **5** chelicera, dorsal view; **6** rallum; **7** basal segments of pedipalp, dorsal view; **8** right chela, lateral view; **9** right coxae I–II, ventral view; **10** right leg IV (trochanter omitted), retrolateral view.

Neobisiidae Chamberlin, 1930

***Neobisium* Chamberlin, 1930**

***Neobisium* (*Ommatoblothrus*) Beier, 1956**

***Neobisium* (*Ommatoblothrus*) *achaemenidum* n. sp.** (Figs. 1–10)

Etymology: This species is named in honour of the Achaemenid kingdom, the first Persian Empire, extending from Anatolia and Egypt across western Asia to northern India and central Asia, as far as central Georgia.

Material examined: Holotype ♂, GEORGIA: Imereti region, east of Tskaltubo, Tetra cave, 42°19′N 42°37′E, 115 m a.s.l., dark zone; 29 July 2017 (ISUPS15).

Diagnosis: *Neobisium* (*Ommatoblothrus*) *achaemenidum* n. sp. differs from all other species of the genus with elongated appendages, a blunt tooth located distal to the middle of the movable cheliceral finger, and the form of the eyes (anterior eyes with strong lens, definitely visible, and posteriors mostly reduced as eyespots), by the following combination of characters: the shape of epistome (visible and apically pointed); the carapacal chaetotaxy: the presence of two preocular microsetae on anterior margin (one microseta on each side) and four setae on posterior margin; the tergal chaetotaxy (tergites I–II with 4 setae); the trichobothriotaxy, especially the position of trichobothrium *ist* in the fixed chelal finger (distal to middle, at the same level as *st*); the morphometric characters, e.g. femur size is 2.87/0.31 mm and chela (with pedicel) is 4.40/0.45 mm; movable chelal finger with 93 and fixed chelal finger with 112 continuous similar teeth.

Description of male. Body length: 4.10 mm. Carapace: mainly brown, basal line of posterior margin pale; entirely smooth; wider than length, approximately 0.88× longer than broad (it is broken!); with two pairs of eyes, anterior eyes corneate and large with strong lens, posterior ones as eyespots; with 22 setae, anterior margin with 4 long setae and 2 microsetae, 1 seta situated each side between eyes, posterior margin with 4 setae, chaetotaxy (Fig. 1): m4m:6:6:4; most setae long and acute; transverse furrows more or less present; epistome small, short and apically pointed (Fig. 1); anterolateral corners without protuberances; with 8 lyrifissures, one pair situated at the same level as anterior eyes and three pairs located on posterior margin.

Tergites I–VIII yellowish brown, IX–XI brown; smooth; all setae simple and acute; uniseriate; I–V with two median, VI–IX with two median and two lateral, X with two lateral lyrifissures, and XI without any lyrifissures; X–XI with two long tactile setae situated sub-medially; chaetotaxy: 4:4:5:6:6:7:6:6:6:2T1T2:2T2T2:2 (Fig. 2).

Sternites yellowish brown, lighter in colour than tergites; entirely smooth; without median suture line; genital area with 18 setae on anterior operculum, 30 microsetae on posterior operculum (Fig. 3); genital organ with long lateral and median genital sacs, 5 pairs of setae located each side (Fig. 4); anterior spiracles with 5 and posterior spiracles with 3 short and acute suprastigmal setae; all setae acute and simple; II–V with two median, V–X with two median and two lateral lyrifissures; IV–XI uniseriate; X–XI with two long tactile setae situated sub-medially; chaetotaxy: 18:(5)30(5):(3)12(3):11:11:11:12:9:9:4:2 (Fig. 3). Pleural membrane granulate.

Chelicera brown; hand with 7 acuminate setae (left hand with 6 acuminate setae); galea knob–like, not pronounced, with an indistinctly hyaline convexity; galeal seta situated at same level as the large tooth on movable finger; fixed finger with 15 relatively short, blunt and close-set teeth; movable finger with 11 teeth, a very large, stout and relatively blunt tooth located distal to middle of finger (Fig. 5); serrula interior with 21 and exterior with 26 blades; rallum with 8 blades, 6 posterior blades simple, smooth and acuminate, 2 anterior blades long and denticulate, 2–3 proximalmost blades smallest (Fig. 6).

Pedipalp trochanter, femur and patella brown, chela dark brown; entirely smooth (Figs. 7–8); coxa including manducatory process with 12 setae, manducatory process with 5 acuminate setae, median setae longest; trochanter with two very small dorsal ridges, without stout and short seta, L/W 3.03; femur without distinct pedicel, loss of microprotuberances, most setae on prolateral margin longer than those on retrolateral margin, long setae without enlarged alveoli (Fig. 7), L/W 9.26; patella with indistinct pedicel (L = 0.57 mm); patella distinctly shorter and wider than femur, with 3 lyrifissures situated basally, L/W 6.25; chela (with pedicel) L/W 9.77; chela (without pedicel) L/W 9.11; chelal setae simple and acute; movable finger distinctly longer (1.46×) than hand (with pedicel); chelal hand cylindrical, not ovate in dorsal view and with parallel sides in lateral view; chelal hand (with pedicel) L/W 4.26; fixed finger with 8 and movable finger with 4 trichobothria (Fig. 8); fixed finger with trichobothria *et*, *it* and *est* aggregated in distal fifth of finger, trichobothrium *it* located at same level as *et*, *ist* distal to middle of finger, *isb* on retrolateral face and basal fifth of finger, *ib* proximal to *isb*, *eb* and *esb* located sub-basally; movable finger with trichobothrium *st* situated slightly closer to *t* than *sb*, *sb* distinctly closer to *b* than to *st*; distance *b–sb* as long as distance *t–st*; several short sensory setae densely situated along the fixed finger in lateral view, of which 7 short sensory setae located between trichobothria *eb* and *isb*; basal half of fixed finger not illustrated in dorsal view [left chela lost!]; basal half of movable finger with 2 sensory setae in lateral view; prolateral face of chelal hand without long setae at base of fixed finger; fixed finger with 112 even, retroconical and contiguous teeth, reaching slightly distal to level of trichobothrium *ib*; movable finger with 93 contiguous teeth, of which 46 retroconical, cusped and large teeth situated in distal half of the finger, basal teeth reduced in size and lack of cusp, not reaching to level of trichobothrium *b*; nodus ramosus of fixed chelal finger situated distinctly distal to *et* (Fig. 8).

Legs brown, lighter in colour than carapace, darker than anterior tegites; smooth; coxa I with indistinct, blunt and circular anterolateral process, mediolateral face with an unclear projection (Fig. 9); coxal chaetotaxy: 7:7:5:10; sub–terminal setae bifid, both rami with distinct denticulations; claws simple; arolia simple and shorter than claws. Leg I: femur L/D 10.12; patella L/D 7.67; femur 1.49x longer than patella; tibia L/D 8.00; metatarsus L/D 6.82; tarsus L/D 9.54. Leg IV (Figure 10): femur L/D 2.67; patella L/D 3.92; femur + patella L/D 6.60; tibia with a long tactile setae situated proximal to middle (TS = 0.23), and moderately long tactile seta situated distal to middle (TS = 0.78), L/D 16.00; metatarsus with two tactile setae, one situated basally (TS = 0.09), other located distal to middle (TS=0.84), L/D 8.23; tarsus with tactile seta situated slightly distal to middle (TS = 0.59), L/D 12.46.

Dimensions (in mm.): ♂ carapace 1.18/1.37. Pedipalp trochanter 0.97/0.32; femur 2.87/0.31; patella 2.25/0.36; chela (with pedicel) 4.40/0.45; chela (without pedicel) 4.10; hand (with pedicel) L.1.92; movable finger L. 2.80. Leg I femur 1.72/0.17; patella 1.15/0.15; tibia 1.20/0.15; metatarsus 0.75/0.11; tarsus 1.05/0.11. Leg IV femur 1.07/0.40; patella 1.57/0.40; femur + patella 2.64; tibia 2.40/0.15; metatarsus 1.07/0.13; tarsus 1.62/0.13.

Discussion

A total of five cave-dwelling pseudoscorpion species belonging to four subgenera of the genus *Neobisium* inhabiting eight caves in western Georgia have been recorded (Barjadze *et al*. 2015): *Neobisium* (*Blothrus*) *birsteini* (Lapschoff, 1940) found in Krubera-Voronya (43°24′N 40°21′E) and Tarkili (43°11′N 40°39′E) caves, both in Abkhazeti; *Neobisium* (*Blothrus*) *verae* (Lapschoff, 1940) found in Meliis (42°27′N 43°5′′E, Racha district), Sataplia I (42°19′N 42°40′E, Imereti district), and Tsakhi (42°31′N 42°53′E, Racha district) caves; *Neobisium* (*Heoblothrus*) *sakadzhianum* Krumpál, 1984 found in Sakadzhia (42°17′N 43°17′E, Imereti district) cave; *Neobisium* (*Neobisium*) *crassifemoratum* (Beier, 1928) found in Kelasuri (42°59′N 41°4′E, Abkhazeti) cave; *Neobisium* (*Neobisium*) *labinskyi* Beier, 1937 found in Kelasuri and Tetra (42°19′N 42°37′E, Imereti district) caves.

Čurčić (1984) noted that only the presence of granulations on the pedipalpal segments in the genus *Neobisium* seems to be insufficient to create a separate subgenus *Heoblothrus* (Beier, 1963). Therefore, the species belonging to the subgenus *Heoblothrus* may be attributed to the subgenus *Blothrus* Schiodte, 1849 because of the presence of only two eyespots/reduced eyes on the carapace and the dental structure of just two distal rallar blades. Members of the subgenera *Ommatoblothrus* Beier, 1956 and *Neobisium* Chamberlin, 1930 can be easily separated from the other subgenera found in the country by the presence of at least two corneate eyes on the carapace. The subgenus *Neobisium* can be usually recognized from the subgenus *Ommatoblothrus* by its normal extremities in length.

A total of 27 known troglobiont pseudoscorpion species belonging to the subgenus *Neobisium* (*Ommatoblothrus*) are mostly distributed in western, southeastern and southwestern Europe and rarely found in the Middle East (Harvey 2013).

According to Beier (1963), Mahnert (1980), and Gardini & Rizzerio (1986), based on the presence of four setae on the posterior margin of the carapace, the presence of an epistome, the presence of two anterior corneate eyes and two posterior eyespots on the carapace, the presence of a large blunt sub-median tooth on the movable cheliceral finger, the tergal chaetotaxy (tergites I–II with 4 setae), the position of trichobothrium *ist* in the fixed chelal finger (ratio ~0.70, *ist* situated distal to middle of the finger but not located very close to the trichobothrial group containing *et*, *est*, and *it*), and the similar length of the chelal teeth in the fixed chelal finger, the new species *N*. (*O*.) *achaemenidum* resembles *N*. (*O*.) *patrizii romanum* Mahnert, 1980 from Italy, and *N*. (*O*.) *gracile* Heurtault, 1979 from France.

Trichobothriotaxy can best differentiate the new species from *N*. (*O*.) *gracile*. For example, in *N*. (*O*.) *gracile*, trichobothrium *st* is located very close to *t*, at the same level as *est*, and *it* situated proximal to *et*, approximately at the same level as *t* (see Heurtault 1979: fig. 5). In addition, *N*. (*O*.) *achaemenidum* n. sp. is distinctly larger than *N*. (*O*.) *gracile*. For example, the pedipalpal femur size is 2.15/0.26 mm, and the patella is 1.70/0.30 mm in *N*. (*O*.) *gracile* (Heurtault 1979).

The new species differs from *N*. (*O*.) *patrizii romanum* by lack of microsetae on the anterior margin of the carapace, and the morphometric data. The pedipalp of *N*. (*O*.) *patrizii romanum* is obviously smaller than that of *N*. (*O*.) *achaemenidum*, e.g. the pedipalpal femur size is 2.41/0.25 mm, the patella is 1.88/0.31 mm, and the chelal (with pedicel) proportion is 7.90× for the female type of *N*. (*O*.) *patrizii romanum* (Mahnert 1980).

The only record of a cave-dwelling species of the subgenus *N*. (*Ommatoblothrus*) in the Middle East and central Asia was published by Kunt, Yağmur & Elverici (2008) who recorded the species *N*. (*O*.) *epirense* from Turkey. The new species described here from Georgia represents the first record of the subgenus *N*. (*Ommatoblothrus*) in the Caucasus.

N. (*Heoblothrus*) *sakadzhianum* was originally described based on one male holotype from Sakadzhia cave, which is located in the same region as Tetra cave and belongs to the same, Sataplia-Tskaltubo karst massif. There are only a few kilometres between these two caves. Tetra cave is quite isolated from Sakadzhia because it is a closed cave without flowing water inside (Tatashidze, Tsikarishvili & Jishkariani 2009).

Noticeably, speciation in caves is quicker and more diversified than in the other environments. The pseudoscorpions are not very vagile (with weak ability to move from a cave to another cave even in small distance). Their extension is linked to individual caves, maximum cave systems or their edges. Due to the effect of relatively stable factors, cave-dwelling species seem to be confronted with convergent species development and significantly different cave conditions allow them to form new species.

Regardless of the geographical distribution, *N*. (*Heoblothrus*) *sakadzhianum* is morphologically and morphometricaly very close to *N*. (*O*.) *achaemenidum*. For example, the pedipalpal femur size is 3.03/0.32 mm, the patella is 2.42/0.33 mm, and the chelal hand (with pedicel) is 2.06/0.53 mm in the male holotype of *N*. (*H*.) *sakadzhianum* (Krumpál 1984). In *N*. (*H*.) *sakadzhianum*, the pedipalpal shape, e.g. the chelal hand with parallel sides in lateral view (see Krumpál 1984: fig. 3), the presence of 110 teeth in the fixed and 103 teeth in the movable chelal fingers, the cheliceral dentation and chaetotaxy (Krumpál 1984: fig. 2), the shape of the pedal coxa I (Krumpál 1984: fig. 9), and the setal arrangement on the genital opercula are very close to the same morphological characters of *N*. (*O*.) *achaemenidum*.

Nonetheless, based on the description of the male holotype by Krumpál (1984), *N*. (*H*.) *sakadzhianum* can be differentiated from the newly found male from Tetra cave by the presence of two eyespots on the carapace (there are two corneate anterior eyes and two eyespots in *N*. (*O*.) *achaemenidum*), the carapacal chaetotaxy: loss of microsetae on the anterior margin (two microsetae located on the anterior margin of the carapace in *N*. (*O*.) *achaemenidum*), the presence of a minor epistome with rounded apex (it is small with a pointed apex and easily observed in *N*. (*O*.) *achaemenidum*), the presence of sparse, fine granules on the pedipalpal femur, patella, and chelal hand (the pedipalp is completely glabrous in *N*. (*O*.) *achaemenidum*), the position of trichobothria on the fixed chelal finger, e.g. trichobothrium *et* is located 2.42 mm and *ist* 1.97 mm from the base

of the finger (those are located respectively 2.15 and 1.67 mm from the finger base in *N*. (*O*.) *achaemenidum*), and the situation of trichobothrium *st* in the movable chelal finger which is located distinctly closer to trichobothrium *t* than to *sb* (see Krumpál 1984: fig. 3) (it is located slightly closer to trichobothrium *t* than to *sb* in *N*. (*O*.) *achaemenidum*). In addition, leg IV of *N*. (*O*.) *achaemenidum* is smaller than that of *N*. (*H*.) *sakadzhianum*, e.g. the femur + patellal size is 2.96/0.35 mm, and the tarsal length is 1.98 mm for the holotype of *N*. (*H*.) *sakadzhianum*.

Mahnert (1979) redescribed the types of *N*. (*B*.) *birsteini* (a male) and *N*. (*B*.) *verae* (a tritonymph) originally found in Georgia. Apart from the structure of the cheliceral rallum (all blades are simple) and the pleurae (longitudinally striped) in *N*. (*B*.) *birsteini*, the male from Georgia has a different shape of epistome, which is triangular in shape, large and pointed (see Mahnert 1974: fig. 7) and also the trichobothrium *st* is located apparently close to trichobothrium *t* in the movable chelal finger (see Mahnert 1974: fig. 10).

In due attention to the presence of total of 20 setae on the carapace, the absence of corneate eyes, the situation of trichobothrium *it* located distal to *et* in lateral view (see Schawaller 1983: fig. 42), and the chelal teeth numbers (fixed chelal finger with 85–100 and movable chelal finger with 60 teeth), the male of *N*. (*B*.) *verae* described by Schawaller (1983) from Georgia differs from *N*. (*O*.) *achaemenidum*.

Notably, Schawaller (1983) reported *N*. (*N*.) *labinskyi* from the same locality (Tetra cave) which seems to co-occur with the new highly troglomorphic *Neobisium* species. However, it is not known exactly from which part of the cave *N*. (*N*.) *labinskyi* was sampled. Also, this species is not a troglobiont and is widespread all around Georgia (Kvavadze, Arabuli & Murvanidze, 2008).

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