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Two new species of the genus *Anthroherpon* Reitter, 1889 from northern Montenegro with notes on the “*A. ganglbaueri*” species group (Coleoptera: Leiodidae: Leptodirini)

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Abstract

Two new species of *Anthroherpon* belonging to the “*ganglbaueri*” species group are described from northern Montenegro: *Anthroherpon sinjajevina* n. sp. and *Anthroherpon cecai* n. sp. Based on morphological investigations of other species of this group, we elevate *A. udrzali* Giachino & Vailati from subspecies to species rank, and suggest the synonymy of *A. brckoensis* Giachino & Guéorguiev with *A. ganglbaueri alticola* Knirsch. An identification key of the *ganglbaueri* species group (*sensu* Guéorguiev, 1990) is given and the distributions of species and subspecies are mapped and discussed.

Key words: Coleoptera, Anthroherponina, Leptodirini, *Anthroherpon*, *sinjajevina* sp. n., *cecai* sp. n., troglobitic species, taxonomy, Montenegro

Introduction

The genus *Anthroherpon* Reitter, 1889 belongs to the tribe Leptodirini, subtribe Anthroherponina which was recently revised (Perreau & Pavićević, 2008). The genus comprises 27 species and 62 subspecies (Perreau, 2004) divided into seven species groups (Guéorguiev, 1990). Most of species have been described in the late XIXth century or the first half of the XXth century (Apfelbeck, 1889; 1894; 1907; Reitter, 1903; 1908; 1911; 1913; Müller, 1910; Matcha, 1916; Jeannel, 1924; 1930; 1934; 1947; Winkler, 1925; 1938; Knirsch, 1927, 1929; Zariquiev, 1927). After a break of several decades due to political conditions, new collections were performed and several new species and subspecies were subsequently described (Giachino & Guéorguiev, 1993; Giachino & Vailati, 2005). Synthetic revisions of *Anthroherpon* have been undertaken by Jeannel (1924, 1930) and Guéorguiev (1990).

The genus is widely distributed in subterranean habitats of the southern Dinaric range: South Croatia, Bosnia and Herzegovina, Montenegro, south Serbia and north Albania. This European region is known as the major hotspot of biodiversity in the world for subterranean fauna, not only for Coleoptera but also for most of zoological groups (Deharveng & al., 2012). The genus *Anthroherpon* shows the most pronounced troglobiomorphic morphological characters not only among Leptodirini but also among subterranean Coleoptera: extremely long appendages, extreme elongation of the fore-body (head and pronotum), hemispherical elytra, and complete anophthalmy.

The “*ganglbaueri*” species group was introduced by Guéorguiev (1990) from the reinterpretation of Jeannel's “sectio I” and “sectio II” (Jeannel, 1924). The group is defined by the following set of characters: pronotum without annular constriction in the last third of its length, sides of pronotum sinuate in the basal half, protarsi more than half as long as protibiae, profemora not enlarged in the basal parts, last antennomere longer than the penultimate and body length above 5 mm. Presently it contains four species: *A. brckoensis* Giachino & Guéorguiev,

1993; *A. ganglbaueri* Apfelbeck, 1894, with four subspecies (including *alticola* Knirsch, 1927, *distinguendum* Müller, 1913; *intermedium* Winkler, 1938); *A. matulici* Reitter, 1903; *A. matzenaueri* Apfelbeck, 1907 with four subspecies (including *augustae* Zariquiey, 1927; *taliensis* Zariquiey, 1927); *A. udrzali* Giachino & Vailati, 2005. The monophyly of this group is not formally established, just as the other species groups of the genus, since the phylogeny of *Anthroherpon* is poorly understood. A detailed investigation of the phylogeny of *Anthroherpon*, combining morphological and molecular methods, is currently being undertaken by one author of this paper (I. Njunjić).

This paper gives a short overview on the *ganglbaueri* species group, excluding the subspecies, describing two new species: *A. sinjajevina* and *A. cecai*, raising *A. udrzali* from subspecies of *A. matzenaueri* to species rank, and suggesting the new synonymy of *A. brekoensis* with *A. ganglbaueri alticola*.

Material and methods

The external morphology of specimens was examined using Leica MZ 75 and Leica M10 stereomicroscopes. Male and female genitalia were cleared in KOH 0.1 N, female genitalia have been stained with Azoblack (Carayon, 1969), both sexes mounted in Euparal on glass slides, and fixed on the pin under the specimen. Microphotographs were taken on a Leica DIAPLAN or a Zeiss AXIOLAB microscope with a camera diagnostic instrument Spot INSIGHT IN1820. Macrophotographs were taken using a Nikon SMZ 1000 stereomicroscope with a Canon EOS 60D camera (Fig. 1) and a digital microscope Keyence Z20 (Fig. 2). Digital pictures were processed using the Helicon Focus software 5.3 (<http://www.heliconsoft.com/heliconsoft-products/helicon-focus/>) (except Fig. 2). Scanning electron microscopy was performed at the National Museum of Natural History (Paris) on a Hitachi SU3500 after gold coating with a Jeol JFC 1200 sputter coater.

The following abbreviations for collections and institutions are used: CDPV: Dragan Pavićević Collection, Belgrade, Serbia; CINJ: I. Njunjić Collection, Belgrade, Serbia; CJLK, Jan Lakota (Ružomberok, Slovakia); CMPR: Michel Perreau Collection, Paris, France; MNHN: Muséum National d'Histoire Naturelle, Paris, France; NMPC: Entomologické Oddělení Národního Muzea, Prague, Czech Republic; MZBS: Museo de Zoología, Barcelona, Spain.

The following abbreviations for morphological details are used: HL: head length (measured from the posterior margin of clypeus); HW: maximum width of head; HL/HW: ratio length of head/maximum width of head; PL: pronotum length (measured along the median line); Pwmax: maximum width of pronotum (largest transverse width); Pwmin: minimum width of pronotum (shortest transverse width); EL: elytral length (as linear distance measured along the median line from base to the apex); EW: maximum width of elytra.

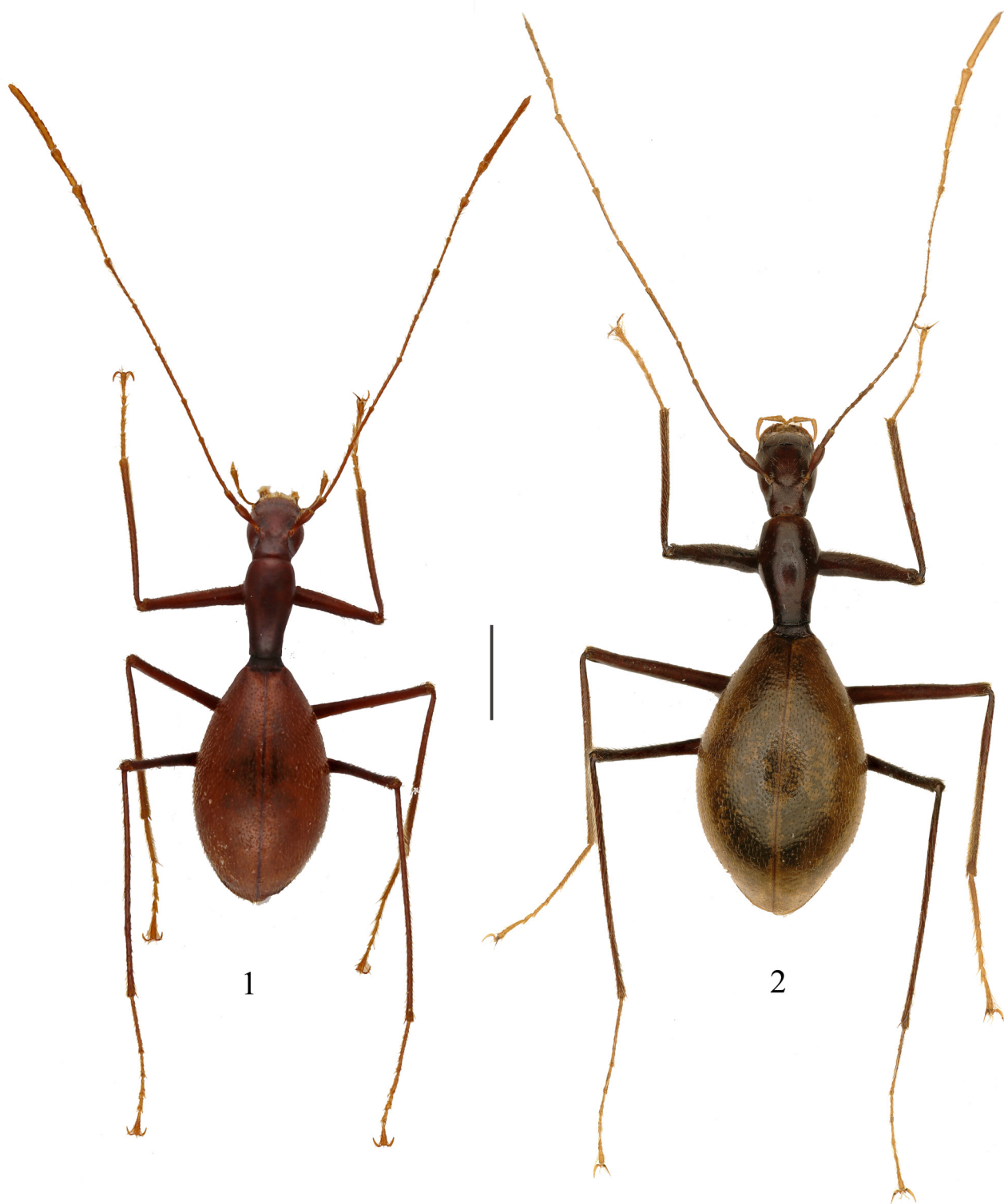
References to type material are abbreviated as HT: holotype; PT: paratype.

Taxonomy

Anthroherpon sinjajevina sp. n.

Type material. Holotype male labeled as follows: “MONTENEGRO, Sinjajevina Mt, Njegovude, village Rudanca, Blažova pećina, 1470 m, 25.06.2013, leg. I. Njunjić” (white label, printed) / “HOLOTYPUS *Anthroherpon sinjajevina* sp.n. I. Njunjić, M. Perreau & D. Pavićević det. 2014” (red label, printed), (MNHN). Paratypes: 5♂ 10♀, 18.07.2010. (MNHN, CINJ, CMPR, CDPV), 7♂ and 12♀, same cave, 25.06.2013, leg. I. Njunjić (MNHN, CINJ, CMPR, CDPV). All paratypes are labeled with white, printed locality labels and with red printed labels “PARATYPUS *Anthroherpon sinjajevina* sp.n. I. Njunjić, M. Perreau & D. Pavićević det. 2014”.

Diagnosis. Habitus illustrated in Fig. 1. Distinct from the other species of the group by the following characters: second antennomere approximately two times shorter than the first one. Sides of pronotum convergent behind the anterior third of the pronotum length, the sides parallel on the basal fourth of the pronotum length. Elytral surface with microreticulation between punctures. Pronotum without symmetrical dorsal impressions. Parameres shorter than median lobe (setae excluded) with a constriction in the preapical region and with acute apex (Fig. 6c).



FIGURES 1–2. Habitus of male. 1: *A. sinjajevina* n. sp. 2: *A. cecai* n. sp. Scale bar is 1 mm.

Description. Body length 5.6 to 5.9 mm (HT 5.71 mm). General morphology leptodiroid; head wider than pronotum, elytra physogastric; eyeless; wingless, and depigmented.

Head: hypognathous, wider in the anterior part and wider than the pronotum, HL 1.13–1.22 mm (HT 1.19 mm), HW 0.73–0.76 mm (HT 0.73 mm). Surface rough with evident microreticulation visible without scanning electron microscopy and with sparse and short pubescence. Penultimate maxillary palpomere approximately 1.2 times longer than the last one. Antennae 1.20 (males) or 1.05 (females) longer than the whole body. Second antennomere very

short in comparison to the other antennomeres, approximately 2 times shorter than the first one. Last antennomere approximately 2 times (male) or 1.7 times (females) longer than the penultimate.

TABLE 1. Antennal formula of the holotype of *Anthroherpon sinjajevina* sp. n. (mm).

Article	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
Length	0.42	0.2	0.8	0.55	0.8	0.66	0.69	0.42	0.51	0.52	1.02

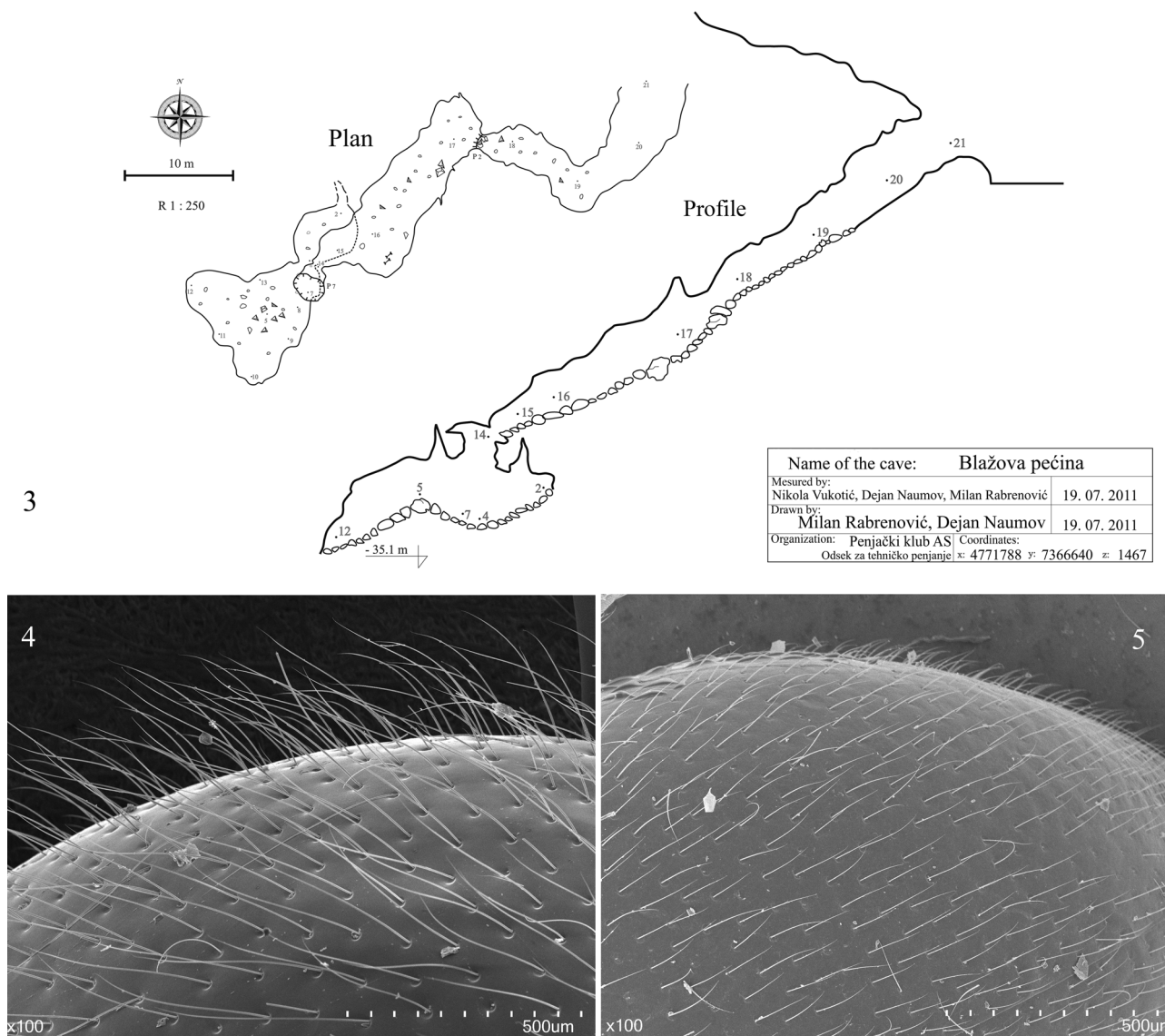


FIGURE 3. Map of Blažova pečina.

FIGURES 4–5. Elytral punctation and setation. 4: *A. matulici*. 5: *A. ganglbaueri ganglbaueri*.

Pronotum: distinctly longer than wide with maximum width in anterior third, mean Pwmax/Pwmin: 1.6 (HT 1.61 mm). Sides convergent behind the anterior third of the pronotum length, the sides parallel on the basal fourth of the pronotum length. Dorsal surface microreticulated and with a few punctures randomly disposed. Short and very sparse setae are randomly disposed mostly in the posterior part.

Mesothoracic pedunculus around 2 times wider than long and with stronger microreticulation than the pronotum.

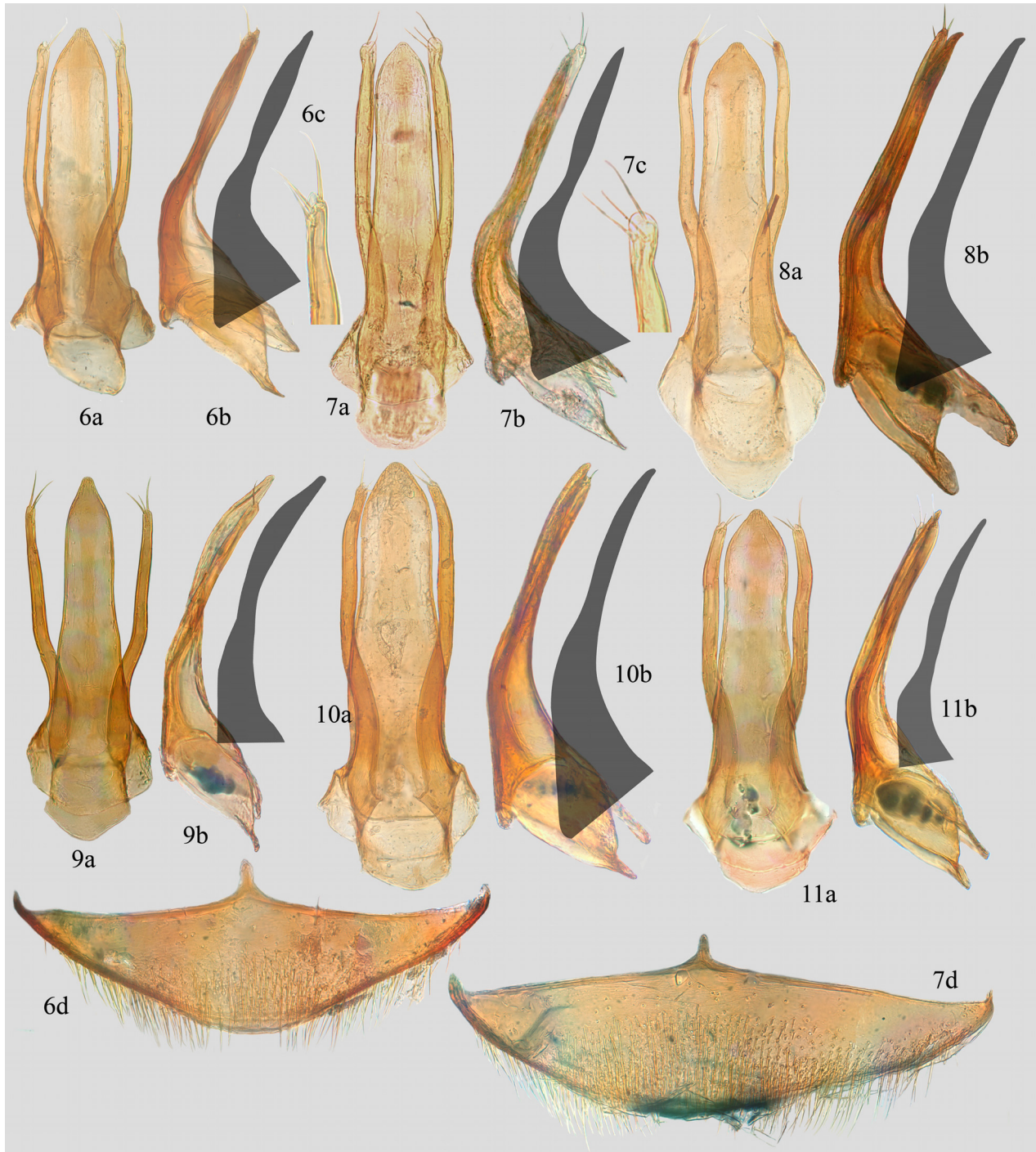
Elytra elliptic, with maximum width in the mid-section, mean EL/EW 1.70 (males; HT 1.73), 1.60 (females). Surface with regularly spaced punctation and with microreticulation between the punctation. Pubescence short, dense and semi-erected.

Legs: long, slender, femora gradually thicken in the basal parts, tibiae straight. Male protarsi with five

protarsomeres, female protarsi with four protarsomeres, mesotarsi and metatarsi with five tarsomeres in both sexes. Tarsi not dilated, tarsal empodium with two setae.

Aedeagus: median lobe thicker at the base and with triangular apex in dorsal view (Fig. 6a), strongly curved in the basal region then more or less straight and flat in the central and apical region in lateral view (Fig. 6b). Parameres shorter than the median lobe (setae excluded) with a constriction in the preapical region, with acute apex and three apical setae (Fig. 6c). Endophallus without sclerotized structures.

Female genitalia: abdominal ventrite VIII with a short and narrow anterior expansion (fig. 6d). Urite IX without appendicular parts. Spermatheca: weakly sclerified, C shaped, short and slightly widened in the apical region.



FIGURES 6–11. Genital structures of *Anthroherpon* of the *ganglbaueri* group. a: aedeagus, dorsal view; b: aedeagus, lateral view with profile of the median lobe; c: apex of parameres; d: abdominal ventrite VIII of females. 6: *A. sinjajevina* n. sp. 7: *A. cecai* n. sp. 8: *A. matulici*. 9: *A. ganglbaueri ganglbaueri*. 10: *A. matzenaueri matzenaueri*. 11: *A. udrzali*.

Distribution. *A. sinjajevina* n. sp. is presently known only from the type locality Blažova pećina, situated near the village Rudanca near Njegovuđe, on Sinjajevina Mt, Montenegro. Blažova pećina is a small and simple cave consisting in two chambers divided by a 9 m deep vertical section (Fig. 3). The bottom of the first chamber is covered with leaf litter, branches and old trunks while the rest of the channel is covered with rock debris and blocks of 0.3 to 0.8 m.

Etymology. From Sinjajevina Mountain, where the type locality is situated.



FIGURE 12. Distribution map of the species of the *A. ganglbaueri* group. Legends of colors are given only for regions where *Anthroherpon* of the *ganglbaueri* species group live. Map after Wikipedia © Sémhur / Wikimedia Commons / CC-BY-SA-3.0 (modified); data after http://www.summitpost.org/dinaric-alps/155326#chapter_14.

***Anthroherpon cecai* sp. n.**

Type material. Holotype male labeled: „MONTENEGRO, Durmitor Mt, village Mala Crna Gora, Poda, Crna jama (= Jama u Podu), 1900 m, 07.08.1993, leg. A. Milosavljević“ (white label, printed) / „HOLOTYPUS *Anthroherpon*

cecai sp.n. I. Njunjić, M. Perreau & D. Pavićević det. 2014“ (red label, printed), (MNHN). Paratypes: 3♀, same date as holotype (MNHN, CDPV); 1♂, same locality, 03.08.1992, leg. A. Milosavljević, 1♂, same locality, 05.07.1991, leg. S. Ognjenović (MNHN, CDPV). All paratypes are labeled with white, printed locality labels and with red printed labels „PARATYPUS *Anthroherpon cecai* sp.n. I. Njunjić, M. Perreau & D. Pavićević det. 2014“.

Diagnosis. Habitus illustrated in Fig. 2. Distinct from the other species of the group by the following characters: second antennomere approximately two times shorter than the first one. Lateral sides of the pronotum parallel on the basal fifth of the pronotum length. Pronotum with two symmetric dorsal impressions on the anterior half of the pronotum length (with variable extension and deepness, absent in some specimens). Elytral surface microreticulated between the punctation. Parameres as long as the median lobe (setae excluded), with preapical constriction and with rounded apex (fig. 7c).

Description. Body length from 6.59 to 7 mm. (HT 6.59 mm). General morphology leptodiroid; pronotum slightly wider than the head, wide elytra; eyeless; wingless and depigmented.

Head: hypognathous, wider in the anterior part, HL 1.34- 1.35 mm (HT 1.35 mm), HW 0.81- 0.85 mm (HT 0.81 mm). Surface shiny, microreticulated and with sparse and short pubescence. Penultimate maxillary palpomere approximately 1.4 times longer than the last one. Antennae 1.20 (males) or 1.00 (females) longer than the whole body. Second antennomere approximately 2 times shorter than the first one. Last antennomere approximately 1.7 times (males) or 1.6 times (females) longer than the penultimate. Antennal formula: see Table 1.

TABLE 1. Antennal formula of the holotype of *Anthroherpon cecai* sp. n. (mm).

Article	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
Length	0.48	0.27	0.93	0.6	0.95	0.8	0.86	0.86	0.61	0.67	1.07

Pronotum strongly narrowing towards the base with maximum width in anterior third, Pwmax/Pwmin: 1.65-1.73 (HT: 1.65 mm). Sides convergent in the anterior third and parallel on the basal fifth of the pronotum length. Dorsal area with two symmetric impressions more or less extended transversally (the conformation is variable according to the specimen and absent in some specimens), located on the anterior quarter of the pronotum length. Surface microreticulated, with short and sparse setae regularly disposed.

Mesothoracic pedunculus short, around 2.8 times wider than long and with stronger microreticulation than the pronotum.

Elytra elliptical, with maximum width in the mid-section, EL/EW approximately 1.6 (males; HT 1.74), 1.65 (females). Surface with regularly spaced punctation and with microreticulation between the punctation. Pubescence short, dense and semi-erected.

Legs long, slender, femora gradually thicken in the basal parts, tibiae straight. Male with five protarsomeres, female with four protarsomeres, mesotarsi and metatarsi with five tarsomeres in both sexes. Tarsi not dilated, tarsal empodium with two setae.

Aedeagus with median lobe elongated, slightly wider in basal part and with rounded apex in dorsal view (Fig. 7a), strongly curved in the basal region then more or less straight and flat in the central and apical region in lateral view (Fig. 7b). Parameres as long as the median lobe (apical setae excluded), with a preapical constriction, rounded at the apex, and with three long apical setae (Fig. 7c). Endophallus without sclerotized structures.

Female genitalia: abdominal ventrite VIII with a short and narrow anterior expansion (Fig. 7d). Urite IX without appendicular parts. Spermatheca: weakly sclerotized, C shaped, short and slightly widened in the apical region.

Etymology. After our colleague and friend Aleksandar Milosavljević-Ceca, speleologist (Belgrade) and finder of the first specimens of this species.

Associated fauna. *Leonhardella (L.) antennaria antennaria* Apfelbeck 1907 and *Neobisium* sp. (Pseudoscorpiones).

Distribution. *A. cecai* sp. is presently known only from the type locality: Crna jama pit (-121 m). All *Anthroherpon* specimens were collected on the very bottom while *Leonhardella* and Pseudoscorpiones were found on the walls from the entrance to the bottom of the pit.

Anthroherpon udrzali Giachino & Vailati, 2005 n. stat.

Anthroherpon matzenaueri udrzali Giachino & Vailati, 2005: 150. (holotype in CJLK)
type locality: Montenegro, Orjen planina, pećina u Kučericama

Material examined. 1♂: Orjen planina, pećina u Kučericama (CMPR)

Further description. Body length: 7.05 mm. Pronotum with strong microreticulation, sparse and regularly spaced punctation. Pwmax/Pwmin: 1.87. Elytra in an elongated oval shape: EL/EW: 1.93. Elytral surface with strong and dense punctation, with traces of transversal alignments of the punctation in the anterior third of the elytral length, without microreticulation. Aedeagus with median lobe triangularly narrowed at the apex in dorsal view (Fig. 11a), strongly curved in the basal region then more or less straight and flat in the central and apical region, the dorsal side sinuate in lateral view (Fig. 11b). Parameres thick, slightly shorter than the median lobe (apical setae excluded) with three apical setae.

The thickness of parameres and the disposition of the elytral punctation with traces of transversally aligned punctation (unusual in the subtribe Anthroherponina) support the change of status from subspecies to species rank. This status is consistent with the geographic location of this population in the maritime belt of Dinarides (Orjen) rather than in the central belt as the other subspecies of *A. matzenaueri* (Fig. 12).

Remarks

Both new species occur along the southern banks of the Tara river (Fig. 12), they share two characters which seem to be synapomorphies: the second antennomere approximately two times shorter than the first one and the external side of parameres preapically sinuated (Figs. 6a, 7a).

The aedeagi of the other species of the group are illustrated to aid identification and complete the identification key: *A. matulici* (Figs. 8a, 8b), *A. ganglbaueri ganglbaueri* (Figs. 9a, 9b) and *A. matzenaueri matzenaueri* (Figs. 10a, 10b). *A. brckoensis*, reported from Brčko in northern Bosnia (Giachino & Guéorguiev, 1993) is evidently a mistake. Brčko is located far outside the distribution area of the genus *Anthroherpon*, and moreover located outside the Dinarides range (Hajna, 2012). The exact wording of the label is „brčka“ without anymore detail. The general morphology shows strong similarity with *A. ganglbaueri* and especially with *A. g. alticola*. As the revision of subspecies is not the topic of this paper, we suggest here the possible synonymy of *A. brckoensis* with *A. g. alticola* without establishing it formally.

Identification key

The following identification key of the *A. ganglbaueri* species group modifies and updates the key given by Guéorguiev (1990). It is dedicated to practical identification of species and does not correspond to the phylogeny of the group, which has not yet been addressed.

1. Pubescence of elytra extremely long and erect. Elytral surface with very strong and sparse punctation, without microreticulation between punctation (Fig. 4) *matulici* Reitter
- Pubescence of elytra shorter and semi-erected or recumbent. Elytral surface with smaller and denser punctation (Fig. 5) ... 2
2. First antennomere approximately two times longer than the second one. Parameres with a preapical constriction (Figs. 6c, 7c) 3
- First antennomere approximately 1.5 times longer than the second one. Parameres regularly arcuate near the apex (Figs. 8a-11a) 4
3. Size smaller: less than 6.1 mm (Fig. 1). Lateral sides of the pronotum parallel on the posterior fourth of the pronotum length. Penultimate maxillary palpomere approximately 1.2 times longer than the last one. Parameres of the aedeagus shorter than the median lobe (apical setae excluded) and with an acute apex (Fig. 6c) *sinjajevina* n. sp.
- Size larger: more than 6.4 mm (Fig. 2). Lateral sides of the pronotum parallel on the posterior fifth of the pronotum length. Penultimate maxillary palpomere approximately 1.4 times longer than the last one. Parameres of the aedeagus as long as the median lobe (apical setae excluded) and with a rounded apex (Fig. 7c) *cecai* n. sp.
4. Pronotum with its largest width at the anterior quarter of its length, and with the lateral sides parallel on the basal third of its length *ganglbaueri* Apfelbeck
- Pronotum with its largest width at the anterior third of its length and with its lateral sides parallel at most on the basal fourth of its length 5

5. Elytral surface with weaker and uniformly dispersed punctation. Elytra less elongate in males, less than 1.75 times longer than wide. *matzenaueri* Apfelbeck
- Elytral surface with stronger punctation and with clear traces of transversal alignments in the humeral region (anterior third of the elytral length). Elytra very elongate in males, more than 1.9 times longer than wide. Body length ~7 mm *udrzali* Giachino & Vailati

Biogeography

Fig. 12 shows the geographic distribution of the species of the *A. ganglbaueri* species group, in relation to the main geomorphological units of Dinarides according to http://www.summitpost.org/dinaric-alps/155326#chapter_14. Dotted lines separate the three main belts, from south to north: maritime belt; central belt or High Dinaric Alps; northeastern belt. Different colors indicate the three main massifs where *Anthroherpon* of the *ganglbaueri* species group live: high Herzegovina mountains; maritime and central Montenegro; high Montenegrin plateaus (for exhaustive nomenclature of all massifs of the Dinarides, cf. above cited URL). The distribution areas of species are roughly aligned on the main geomorphological and tectonic alignments, parallel to the coast line:

In the maritime belt: *A. udrzali* in Orjen and *A. matulici* in Orjen and in Garač.

In the central belt: *A. ganglbaueri*, *A. matzenaueri*, *A. cecai* and *A. sinjajevina*. *A. ganglbaueri* is located in high Herzegovina, each one of the subspecies occurring in one of the main massifs of this region (except Čvrstica and Lebršnik): *A. g. alticola* in Prenj; *A. g. ganglbaueri* in Velež; *A. g. distinguendum* in Crvanj; *A. g. intermedium* in Baba. *A. matzenaueri* is located in the high Montenegrin massifs, the three subspecies are aligned along the Golija-Vojnik-Maganik line: *A. m. matzenaueri* in Golija; *A. m. taliensis* in Žurim; *A. m. augustae* in Maganik and Vojnik. It should be noticed that Maganik and Žurim are contiguous and belong to the same Morača massif, but accommodate two different subspecies while Maganik and Vojnik are not contiguous and accommodate the same subspecies. The new species *A. cecai* and *A. sinjajevina* are aligned along massifs located on the south bank of Tara river (respectively Mala Crna Gora and Rudanci).

However this correlation between tectonics of Dinarides and species distribution leaves opened some problems as the questionable disconnected distribution of *A. matzenaueri augustae* in the two distant massifs of Maganik and Vojnik. More generally, the relevance of the subspecific taxa is not addressed in this paper. Without additional experimental data, it is untimely to make further hypothesis on the phylogeny of taxa of this group and the relations between phylogeny and distribution. Molecular investigations of all taxa of *Anthroherpon* are in progress and will help to clarify the distributional and evolutionary patterns of the genus.

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