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A new species of *Duvalius* from world's deepest cave (Coleoptera: Carabidae)

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Abstract

The new hypogean ground beetle, *Duvalius abyssimus* **n. sp.**, from Krubera-Voronja, world's deepest cave (Arabika massif, Western Caucasus) is described and illustrated. Diagnostic morphological characters of the imago, male and female genitalia are provided. Its relations with other *Duvalius* Delarouzée species from the Western Caucasus geographic area are discussed. An updated overview of the biocoenosis of its peculiar habitat is made.

Key words: Trechini, Krubera-Voronja Cave, Western Caucasus, Abkhazia, Deep subsurface biosphere

Resumo

Uma nova espécie de carabídeo, *Duvalius abyssimus* **n. sp.**, da gruta mais profunda do Mundo, Krubera-Voronja (maciço de Arábica, Cáucaso Ocidental) é descrita e ilustrada. A descrição fornece os caracteres diagnósticos do imago, genitália masculina e feminina. As suas relações com outras espécies de *Duvalius* Delarouzée do Cáucaso são discutidas e é apontada uma actualização da biocenose do seu peculiar habitat.

Introduction

Cave beetles have always been iconic inhabitants of the subterranean habitats, in fact, they were historically the first cave-adapted species described for science (Camacho 1992). The order Coleoptera represents an important fraction of cave biodiversity, particularly interesting because of the highly endemic patterns of distribution (Zagmajster *et al.* 2008).

The Caucasus region is a world hotspot for biodiversity (Myers *et al.* 2000) and its large extension of limestone has a particular biogeographic interest for cave-adapted species (Sendra & Reboleira 2012). The Western Caucasus harbours some endemic cave-dwelling ground beetles genera, e.g. *Jeannelius* Kurnakov, 1959, *Meganophthalmus* Kurnakov, 1959, *Caucasaphaenops* Belousov, 1999 or *Taniatrechus* Belousov & Dolzhanski, 1994 or *Caucasorites* Belousov & Zamotajlov, 1997 (Belousov 1999; Belousov & Koval 2009; Kryzhanovskij *et al.* 1995; Zamotajlov *et al.* 2010).

The genus *Duvalius* Delarouzée, 1859 has a wide distribution along the Mediterranean area, expanding through Asia (Belousov 1991; Casale & Laneyrie 1982; Casale 2011; Jeannel 1930; Zinetti *et al.* 2013). There are more than 220 species described, assigned to nine subgenera: *Biharotrechus* Bokor, 1922; *Duvalius* s.str.; *Euduvalius* Jeannel, 1928; *Hungarotrechus* Bokor, 1922; *Neoduvalius* Muller, 1913; *Paraduvalius* Knirsch, 1924; *Platyduvalius* Jeannel, 1928; *Trechopsis* Peyerimhoff, 1908 and *Typhloduvalius* Hurka & Pulpan, 1980 (Moravec *et al.* 2003; Anichtchenko 2013). Although it exhibits important differences in external morphology, the truly stronger diagnostic characters lies on the shape of the aedeagus (Jeannel 1930), but a systematic revision is needed to elucidate the taxonomic complexity of the genus (Faille *et al.* 2013).

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Duvalius miroshnikovi from Alek massif, a small mountain ridge that is located approximately 40 km west of Arabika, seems to be the closest species to *D. abyssimus*. *D. miroshnikovi* is distinguished by the size and by the distinct shape of the aedeagus, especially the shape of the median lobe, and by the presence of 4 to 5 setae in the parameres, although the number of these setae is often variable in Trechini (Belousov *et al.* 1995).

Duvalius sokolovi was described based on a short diagnosis and a general habitus illustration of one single female from the Arabika massif. The type locality called as "Trechus Cave" is described as a small cave (≈ 6 meters) where the female holotype was found walking among limestone debris (commonly known as MSS). Without providing further information in the description, the type locality is impossible to be identified by local people or speleologists within the Arabika massif. It is also impossible to revise the type specimen of *D. sokolovi* because it was lost (Golovatch pers. comm.). Furthermore, the available description of *D. sokolovi* is short and does not include many diagnostic features. Even so, *D. sokolovi* can be distinguished from *D. abyssimus* **n. sp.** by its incomplete frontal furrows, the proportional head size related to pronotum and by the posterior border of the elytra, much more prominent (Ljovuschkin 1963).

Given the problems concerning the identity of *D. sokolovi*, this name could be eventually considered as *nomem dubium*.

Ecology and habitat. The specimens of *Duvalius abyssimus* **n. sp.** were collected in the Krubera-Voronja cave by active search in the upper part of the cave, at -60 meters depth, where temperature is about 3 ºC and humidity is 100%. This cave harbours the world's deepest terrestrial subterranean invertebrate community and it is inhabited by arthropods with different degrees of adaptation to subterranean life (Sendra & Reboleira 2012). The richest part of the cave is the basis of the first shaft, where *Duvalius abyssimus* **n. sp.** was found. It has a major input of nutrients from surface and consequently higher richness (Sendra & Reboleira 2012). The pseudoscorpion *Neobisium (Blothrus) birsteini* Lapschoff, 1940 (Neobisiidae), is the main predator widespread along the deepest branch of the cave, together with the opilion and spider of the genera *Nemaspela* Šilhavý, 1966 (Nemastomatidae) and *Troglohyphantes* Joseph, 1881 (Linyphiidae), only found in the upper parts of the cave. A major proportion of this biocoenosis is composed by decomposers: a millipede of the order Chordeumatida and a species of *Leucogeorgia* Verhoeff, 1930 (Julidae); the springtails *Plutomurus ortobalaganensis* Jordana & Baquero, 2012 (Tomoceridae), *Deuteraphorura kruberaensis* Jordana & Baquero, 2012 (Onychiuridae), *Schaefferia profundissima* Jordana & Baquero, 2012 (Hypogastruridae) and *Anurida stereoodorata* Jordana & Baquero, 2012 (Neanuridae) (Jordana *et al.* 2012) and the beetle *Catops cavicis* Giachino, 2011 (Leiodidae) (Giachino 2011).

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