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CAUCASONETHES VANDELI PYGMAEUS N. SSP (CRUSTACEA, ISOPODA, ONISCIDEA) FROM MOVILE CAVE (SOUTHERN DOBROGEA, ROMANIA)

ANDREI GIURGINCA[1*], ŞERBAN SÂRBU[1,2]

Abstract. A new subspecies of *Caucasonethes vandeli* Tabacaru, 1993 is described from Movile Cave in Southern Dobrogea.

Key words: Isopoda, Oniscidea, Trichoniscidae, *Caucasonethes*, Movile Cave.

1. INTRODUCTION

41 species of Oniscidea are recorded from Dobrogea, a crossroad of the Western, Southern and, especially, Northern and Southern spreading areas: a third of the species are endemic with Southern Dobrogea harboring a quarter of the endemic species (GIURGINCA & ĆURČIĆ, 2003). This high degree of endemicity can be explained, as our colleague NITZU (2001) has argued, by the particular conditions offered by the karst environment and by the paleoclimate of Dobrogea which played the role of a glacial refuge-namely the Euxinic glacial subrefuge (NITZU, 2001). Most of the endemic species from Southern Dobrogea are recorded from the Movile Cave area.

Movile Cave (SE Romania) is the first known subterranean chemosynthesis-based ecosystem. Sulfur- and methane-oxidizing, as well as nitrifying microorganisms, form the base of the food web in this peculiar ecosystem (SÂRBU & AL., 2019). These microorganisms form microbial mats that cover the water surface and the cave walls adjacent to the water. For cave standards, this is an unusually abundant primary production that allows 51 invertebrates species to thrive here (SÂRBU & AL., 2019). Among the 35 species endemic to this ecosystem, there are four species of Oniscidea: *Trachelipus troglobius* Tabacaru & Boghean, 1989, *Armadillidium tabacarui* Gruia, Iavorschi, Sarbu, 1994, *Haplophthalmus movilae* Gruia & Giurginca, 1998 and, to be described herein, a new subspecies of *Caucasonethes vandeli* Tabacaru, 1993.

Another remarkable species of Oniscidea is *Kithironiscus dobrogicus* Tabacaru & Giurginca, 2003 – representing an isolated northern point in the typically Gondwanian distribution of the family Scleropactidae (TABACARU & GIURGINCA, 2003).

The genus *Caucasonethes* was established by K.W. Verhoeff in 1932 for a new species collected by E.V. Borutzky in 1929, in two caves from the Kutaissi region (Transcaucasia, Georgia) (VERHOEFF, 1932). A second species of *Caucasonethes*, namely *C. vandeli* was described by TABACARU (1993), from material collected by Tr. Orghidan and M. Dumitrescu from two caves located in Central Dobrogea: Peştera Liliecilor de la Gura Dobrogei and Peştera de la Casian (peştera=cave).

During extensive studies on Movile Cave, our colleague dr. Maria Georgescu and one of us (Ş. S) collected a blind and depigmented trichoniscid: we have identified it as a new subspecies of *Caucasonethes vandeli*, a subspecies endemic for Movile Cave.

2. MATERIAL AND METHODS

All the specimens collected by hand and preserved in 75% alcohol were examined with an Optika SZM-4, ver.4.0.0 binocular stereomicroscope.

All taxonomically important structures were dissected and mounted in glycerine as temporary microscope preparations and observed with an Olympus CH2 microscope. For the drawings, we used the Olympus CH2 microscope with an Olympus *camera lucida*.

Details on the cephalon, pereionite I, II and III were studied using an International Scientific Instruments (ISI) DS 130 scanning electron microscope operating at 10 kV.

The specimen was critical-point dried in a Tousimis Samdri 700 at the Center for Electron Microscopy, University of Illinois (USA).

Despite the extraordinary fine resolution in three dimensions provided by the SEM, the dehydration involved in the standard procedure argued against using SEM extensively in the study of the mouthparts and the taxonomically important pleopodes.

2.1. MATERIAL STUDIED

2 males and 6 females**,** Movile Cave**,** Lake Hall, Mangalia, Southern Dobrogea, Romania, 4 April 1987, leg. Maria Georgescu;

5 females, Movile Cave, Lake Hall, Mangalia, Southern Dobrogea, Romania, 26 August 1990, leg. Ş. Sârbu;

2 ovigerous females, Movile Cave, Lake Hall, Mangalia, Southern Dobrogea, Romania, 20 August 1994, leg. Ş. Sârbu;

1 ovigerous female, Movile Cave, Air Bell 3, Mangalia, Southern Dobrogea, Romania, 29 November 1994, leg. Ş. Sârbu;

1 female, Air Bell 3, Mangalia, Southern Dobrogea, Romania, 5 May 1996, leg. Ş. Sârbu. All specimens, including the types, are preserved in the collection of the “Emile Racovitza” Institute of Speleology.

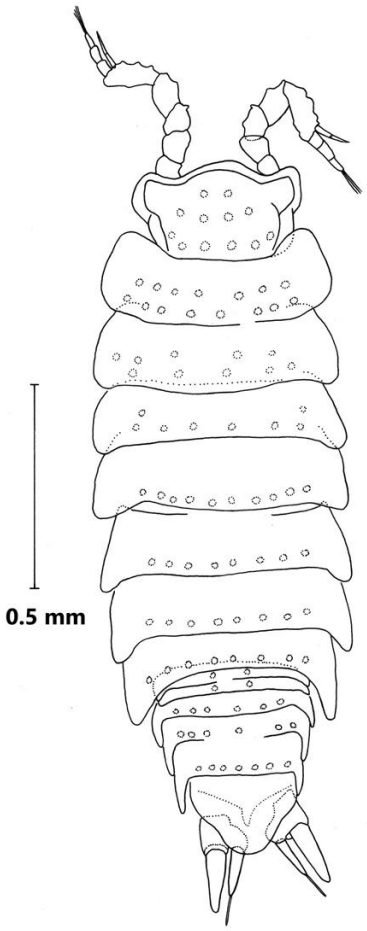

Fig. 1. *Caucasonethes vandeli pygmaeus* n. ssp. habitus.

3. RESULTS

Taxonomy
Order Isopoda Latreille, 1817
Suborder Oniscidea Latreille, 1802
Family Trichoniscidae Sars, 1899
Genus Caucasonethes Verhoeff, 1932

Completely depigmented and blind. Pleopode 1 male: endopodite shaped as a narrow and elongated blade lacking a ciliated rod; exopodite like a triangular blade, lacking a ciliated rod and apically divided in two lobes. Pleopode 2 male: narrow and bi-articulated endopodite with the second article very narrow; rectangular exopodite distinct from the protopodite.

Caucasonethes vandeli pygmaeus Giurginca n. ssp.

Type locality. Movile Cave, South Dobrogea, Romania, 43^{0}49'39" N, 28^{0}33'39" E, 21 m a.s.l.

Type specimens. Holotype: 1 male, Movile Cave, Lake Hall, Mangalia, Southern Dobrogea, Romania, 4 April 1987, leg. Maria Georgescu; **Allotype:** 1 female, Movile Cave, Lake Hall, Mangalia, Southern Dobrogea, Romania, 20 August 1994, leg. Ş. Sârbu; **Paratypes:** 1 male, Movile Cave, Lake Hall, Mangalia, Southern Dobrogea, Romania, 4 April 1987, leg. Maria Georgescu; 5 females, Movile Cave, Lake Hall, Mangalia, Southern Dobrogea, Romania, 26 August 1990, leg. Ş. Sârbu;

Etymology: "pygmaeus" meaning pygmy, due to the very small size.

Diagnosis: *C. vandeli pygmaeus* differs from the nominate subspecies (*C. vandeli vandeli* Tabacaru, 1993) by its very small size (on average 1.5 mm against 3 mm in the nominate subspecies) and differences in the granulations present on the pereionites.

Description:

Size: 1.5 mm in males, 1.75 mm in females (Fig. 1).

Color: depigmented, completely white.

Eyes: absent.

Cephalon: 7–8 granules near the occipital furrow, 4 granules on the vertex and 2 granules on the frons.

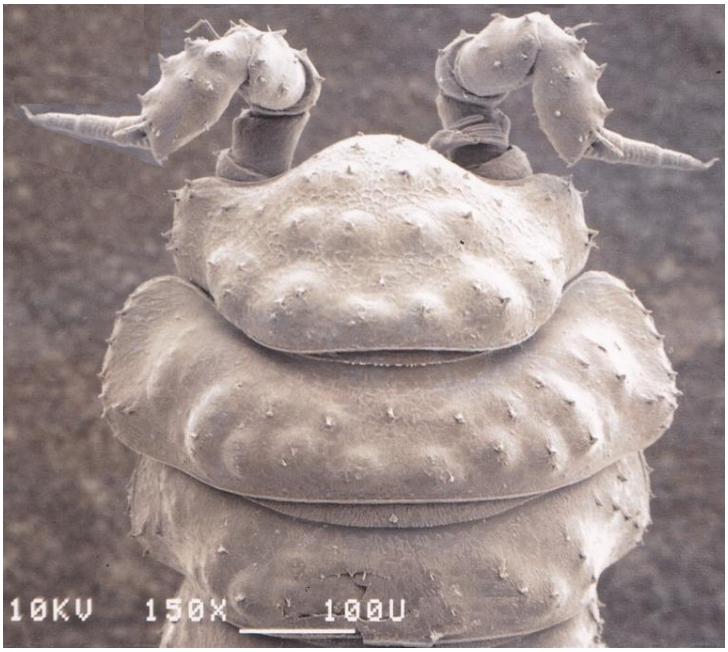

Fig. 2. *Caucasonethes vandeli pygmaeus* n. ssp.: granulation on the cephalon and the first two pereionites (image by R. Olson and Ş. Sârbu).

Tegument: the rows of granules are less regular than in *C. vandeli vandeli*. On pereionite I and II there are only two rows of granules: a row of bigger granules near the posterior edge of each pereionite and a smaller row just in front of them (Fig. 2).

The other pereionites (III–VII) have only one row of granules, although on the third pereionite, in some individuals, there is a small granule, positioned close to the epimerae, in front of the posterior row.

Pleonites 1 and 2 have only 2 granules each, pleonites 2–5 present a single row of 6–7 granules each.

Pleotelson: triangular, with a rounded tip and slightly concave sides; no granules recorded on the pleotelson.

Appendages:

Antennule: three short articles: the first is short and rounded; the second is the shortest; the third is elongated, curved and present 5–6 aesthetascs.

Antenna: short articles; 3, 4 and 5 with pointed tubercles; the fifth article is the longest and presents a long, bi-articulated rod at the distal extremity. Flagellum with three articles, the second being the longest.

Practically, there is no difference between the antenna and the antennule of the two subspecies.

Mouthparts: although the mouthparts of *C. vandeli pygmaeus* are not different from those of *C. vandeli vandeli*, we draw a short description of them here to accompany the drawings, since TABACARU (1993) provided no illustrations for his description.

Maxilliped: palpus with indistinct lobes; endite with a ciliated rod with spines on both sides just like in *C. vandeli vandeli* (Tabacaru, 1993) (Fig. 3A).

Maxillulae (maxilla 1): inner endite with three penicilli, the basal one clearly longer than the other two which are of sub equal in length (Fig. 3E). Outer endite with 9–10 teeth (Fig. 3B, C, D).

Maxilla (maxilla 2): the bilobed, the rounded inner lobe being clearly larger and longer than the outer lobe, and bearing 8 rods and numerous hairs, while the inner lobe presents two long hair-like rods.

Left mandible: *pars incisiva* with four teeth and *lacinia mobilis* with three teeth; two penicilli inserted near the base of *lacinia mobilis* and another one between the *lacinia mobilis* and *pars molaris*; there is penicillum on *pars molaris* (Fig. 3G)

Right mandible: *pars incisive* with only three teeth; on the base of *lacinia mobilis* there is only one penicillum and another one between the *lacinia mobilis* and *pars molaris* but clearly closer to the latter one; there is an additional penicillum inserted on the caudal side of the *pars molaris* (Fig. 3H)

Pereiopode VII: just like in *C. vandeli vandeli*, the pereiopodes have no sexual differences.

Uropodes: short, the endopodite thinner and a third shorter than the exopodite.

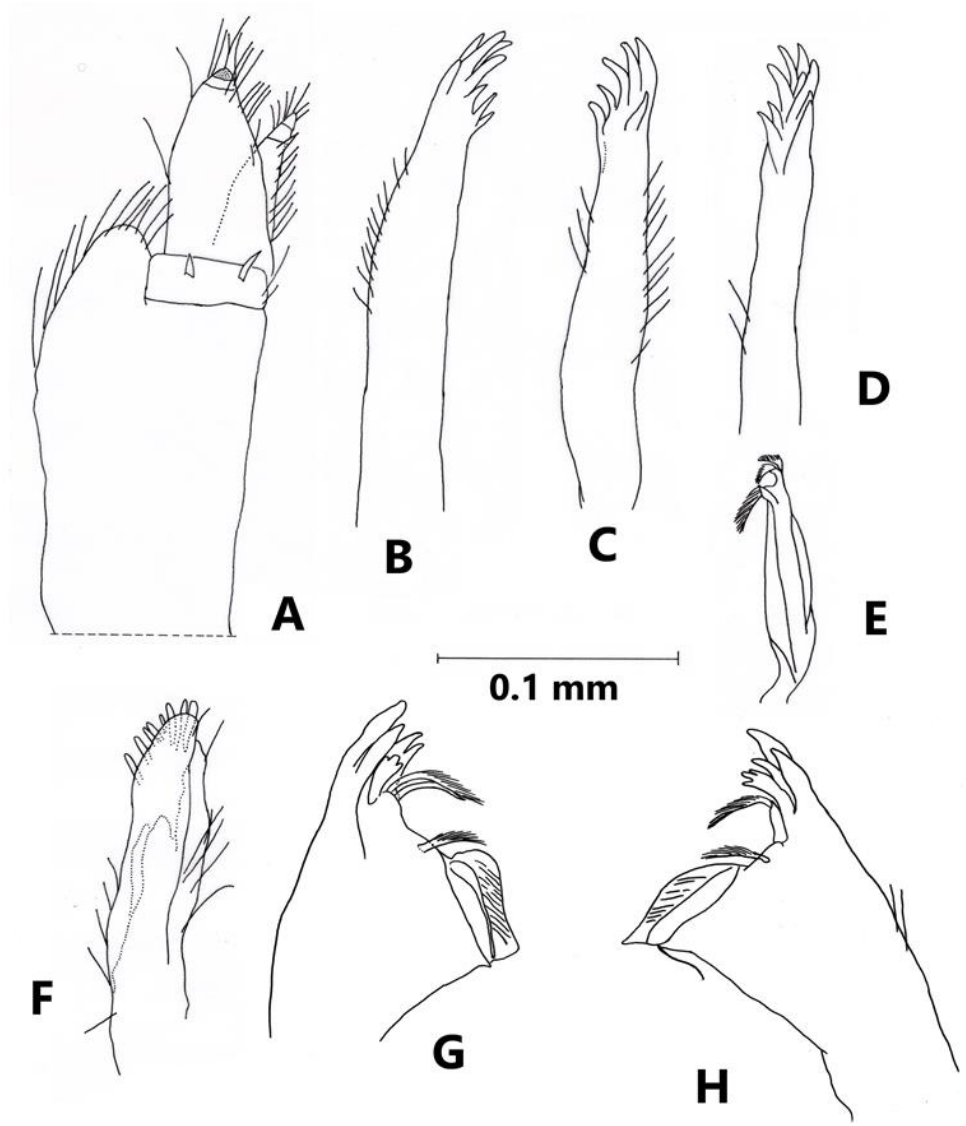

Fig. 3. *Caucasonethes vandeli pygmaeus* n. ssp. mouthparts: A. Maxilliped; B, C & D. Outer endite of maxilla 1; E. Inner endite of maxilla 1; F. Maxilla 2; G & H. Left and right mandibles.

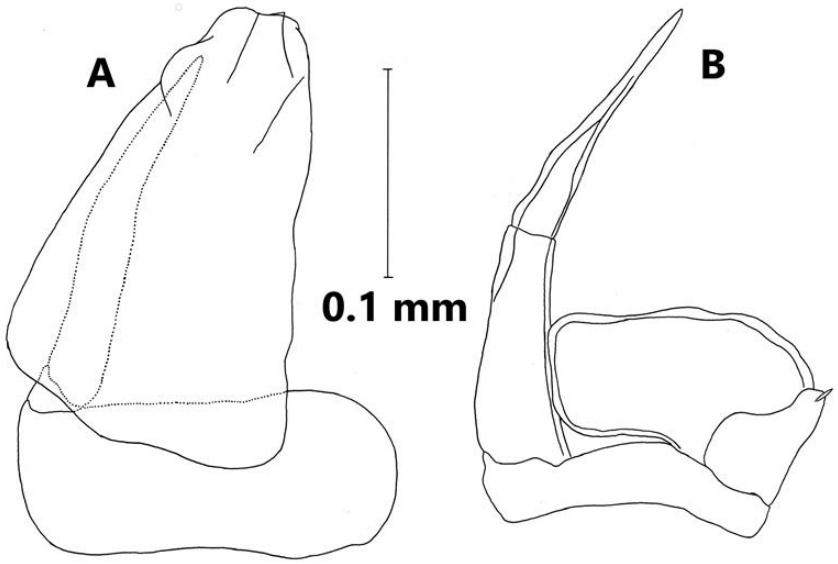

Fig. 4. *Caucasonethes vandeli pygmaeus* n. ssp.: A. Pleopode 1 male; B. Pleopode 2 male.

Male sexual characters:

Genital apophysis: practically identical with *C. vandeli vandeli*.

Pleopode 1: triangular exopodite, apically divided in two lobes. The outer lobe is rounded; the inner lobe presents a pointed outer corner and a rounded inner corner. The endopodite is elongated and unsegmented (Fig. 4A).

Pleopode 2: exopodite rectangular with rounded corners; endopodite bi-articulated, the two sub equal articles. Postero-internal angle of exopodite not prominent as in *C. borutzky* but rounded as in *C. vandeli vandeli* (Fig. 4B).

3. DISCUSSION

Affinities and differences. As pointed above, *Caucasonethes vandeli pygmaeus* differs from *Caucasonethes vandeli vandeli* only in its size and in the granulation of the pereionites. There are no other differences between the two subspecies.

The difference in size between *C. vandeli pygmaeus* and *C. vandeli vandeli* is striking: *C. vandeli pygmaeus* is half the size of the nominate subspecies: 1.5 mm in comparison with 3 mm in *C. vandeli vandeli* (TABACARU, 1993).

At the nominate subspecies, the granulation consists of three rows on the first two pereionites and two rows on the following pereionites (TABACARU, 1993). At *C. vandeli pygmaeus*, there are only two rows of granules on pereionites I and II. The pereionites III–VII present only one row of granules, although, in some individuals, a small granule, positioned toward the epimerae, can be observed in front of the posterior row.

Coexisting species. *Caucasonethes vandeli pygmaeus* is endemic for Movile Cave (Southern Dobrogea) inhabiting a truly extreme environment: the air temperature in Movile Cave is 21°C, the relative humidity is approximately 100%, and no air movement can be detected (SÂRBU & AL., 2019). The atmosphere contains 20% oxygen and around 1% carbon dioxide in the upper level of the cave, while the air-bells become progressively depleted in oxygen (16–7%) and enriched in carbon dioxide (1.5–3.5%) due to the biological activity of the cave fauna and microbiota (SÂRBU & POPA, 1992; SÂRBU, 2000). Water droplets present on the cave walls tend to be acidic, displaying pH values that range between 3.5 and 4 (SÂRBU & AL., 2019). The groundwater that floods the lower cave level contains 30 mg/L H_2S and its pH averages 7.2 (SÂRBU & AL., 2019); a slight current (5 cm/s) is detected in the underwater cave passages. Atmospheric oxygen dissolves into the water at the air–water interface, but below the depth of 1 mm the cave water is completely anoxic (SÂRBU & AL., 2019).

Caucasonethes vandeli pygmaeus shares the cave with three other species of Oniscidea: *Haplophthalmus movilae*, *Trachelipus troglobius* and *Armadillidium tabacarui*.

Armadillidium tabacarui and *Trachelipus troglobius* have been collected only in the Lake Hall, while *Haplophthalmus movilae* inhabits both the Lake Hall and Air-Bell 1 (TABACARU & BOGHEAN, 1989; GRUIA, IAVORSCHI & SÂRBU, 1994; GRUIA & GIURGINCA, 1998). Although collected from the Lake Hall, *Caucasonethes vandeli pygmaeus* is the sole species that penetrates in Air-Bell 3 where the environmental conditions are more restrictive (CO_2=3.5%, O_2=7%) (GRUIA & GIURGINCA, 1998) (Fig. 5).

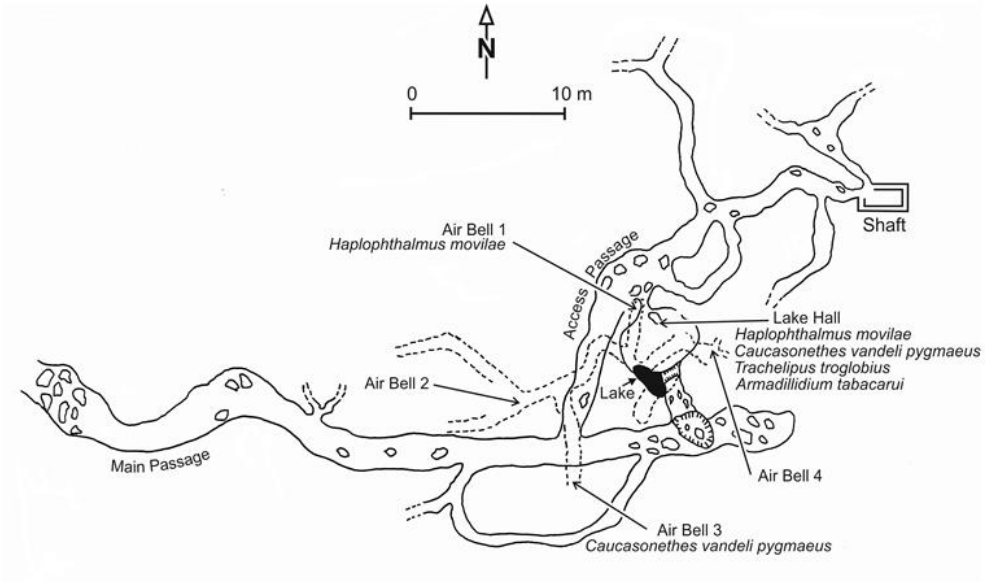

Fig. 5. Map of Movile Cave showing the distribution of the species of Oniscidea within the cave (after CONSTANTINESCU, 1989, modified).

Acknowledgments. Our study has been undertaken within the framework of Program 1 /project 1/2020 of the "Emile Racovitza" Institute of Speleology of the Romanian Academy.

The author is greatly indebted to dr. Maria Georgescu who collected part of the material from Movile Cave and Rick Olson for his help with the SEM imaging. Also, we are very grateful to our colleagues Ştefan Cătălin Baba, dr. Cristian-Mihai Munteanu and dr. Nicolae Cruceru for their invaluable help in improving our drawings and the map of Movile Cave.

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