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***TYPHLOLIGIDIUM LITHOPHAGUM* SP. N. (ISOPODA, ONISCIDEA, LIGIIDAE), A NEW SPECIES OF TROGLOBIOTIC WOODLOUSE FROM THE CRIMEAN PENINSULA**

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A new trogllobiotic woodlouse, *Typhloligidium lithophagum* sp. n. (Ligiidae), is described from a vertical karst cave in the Crimea. The diagnostic features of the new species within the trogllobiotic Crimean-Caucasian genus *Typhloligidium* Verhoeff 1918, as well as its affinities are given and discussed.

Keywords: Isopoda, Oniscidea, Ligiidae, *Typhloligidium*, new species, woodlouse, cave, Crimea

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The fauna of terrestrial isopods of the Crimean Peninsula is one of the most diverse in the former USSR (Kuznetsova, Gongalsky, 2012). Despite more than a century long history of study of Crimean woodlice, only few taxonomic papers on the cave fauna of this group have been published (Carl, 1904; Borutzky, 1949, 1950, 1962). At the present time, two species of the genus *Typhloligidium* Verhoeff 1918, *T. coecum* (Carl 1904), and *T. karabijajlae* Borutzky 1962, are known from the Crimean Peninsula and one species, *T. kovali* Gongalsky et Taiti 2014 was described from the Caucasus (Gongalsky, Taiti, 2014).

Lebedev (1927) recorded a trogllobiotic woodlouse species identified as *Ligidium coecum* (= *T. coecum*) inhabiting the Ayanskaya cave in Tshatyr-Dagh. The collection of V.D. Lebedev has been lost but it is most likely that the record referred to the new species described below belongs to the other species, not to *T. coecum*. Some decades later, Borutzky (1962) suggested that the species of the genus *Typhloligidium* inhabiting the caves of Tshatyr-Dagh and referred by Lebedev (1927) belong to an undescribed species. Currently, an access to the cave Ayanskaya is restricted being the part of a sanitary zone protecting the sources of drinking water for Simferopol City. The sampling was carried out in other two vertical caves, Bytshya and Alushtinskaya, both located in the lower plateau of the Tshatyr-Dagh karst massif, the central part of the Main Ridge of the Crimean Mountains. The specimens were collected with an aspirator and fixed in 96% ethanol. Terminology used in the species description is mainly based on Vandel (1960).

Investigation accomplished by the first author in karst caves of the Tshatyr-Dagh massif in February 2015 yielded a rich collection of woodlice specimens of this genus described herewith as a new species. Processing and dissections were done by using a Leica MZ8 binocular microscope. Micro preparations of diagnostic body appendages were done in euparal (Carl Roth GmbH). Line drawings were executed with the help of an Olympus BX41 microscope supplied with an Olympus U-DA camera lucida. Most of the material is deposited in the collection of the Zoological Museum of Moscow University, Russia (ZMMU), partly retained in the private collection of the first author (I.D. Papanin Institute of Biology of Inland Waters of RAS, Borok, Russia), as indicated below.

TAXONOMY

Class Malacostraca Latreille 1802

Order Isopoda Latreille 1817

Suborder Oniscidea Latreille 1802

Family Ligiidae Leach 1814

Genus *Typhloligidium* Verhoeff 1918

Typhloligidium lithophagum

Turbanov et Gongalsky sp. n.

Material. Holotype: ♂ (ZMMU, Mc-1400), Russia, Crimean Peninsula, Tshatyr-Dagh Karst Massif, Vyalovsky Forest area, Bytshya Cave, 14.02.2015, I. Turbanov and A. Bakhanovskaya leg. Paratypes: 3 ♂♂, 4 ♀♀ (ZMMU, Mc-1402), 3 ♂♂,



Fig. 1. Photograph of alive specimen of *Typhloligidium lithophagum* sp. n., in the Bytshya Cave, dorsal view. Photography by I. Turbanov.

4 ♀♀ (private collection of I. Turbanov), same data, together with holotype; 1 ♀ (ZMMU, Mc-1401), Russia, Crimean Peninsula, Tshatyr-Dagh Karst Massif, Vyalovsky Forest area, Alushtinskaya Cave, 11.02.2015, I. Turbanov and A. Evsyukova leg.

Diagnosis. A species of *Typhloligidium* characterized by the antennal flagellum with 18–21 articles; the mandibles with 11–12 free penicils; exopod and endopod of uropods equally protruding backwards, with exopod bearing two different setae at the tip, one being much longer; male exopod of pleopod 1 with 4 long setae at the apex; and a subrectangular exopod of pleopod.

Description. Maximum body length: male 10.5 mm; female 11.2 mm. Holotype body length 10.2 mm. Body depigmented, dorsal surface slightly granulated, eyes absent. Body relatively elongated; pleon narrower than pereon (Fig. 1). Distal corners of pereonite 1 rounded, corner of pereonite 2 obtuse, corners of pereonite 3 to 7 increasingly acute (Fig. 2i). Telson with distal part and distal corners rounded (Fig. 2j). Uropods (Fig. 2j) with protopod bearing a long seta on outer margin; exopod and endopod equally protruding backwards, exopod with a tuft of short setae at apex, endopod is three times narrower than exopod and bearing two apical setae, one much longer than the other. Antennula with three articles (Fig. 2c); first article wide and short bearing two long setae on distal margin; second article twice as long as first, with four setae on distal margin; third article short and narrow, bearing a tuft of setae at apex. Antenna is long and thin, reaching rear margin of pereonite 6 (Fig. 2a); third and fifth articles of peduncle with double seta on distal margin, fourth article with two double setae; flagellum with 18–21 articles, twice as long as fifth article of antenna, and slightly longer than all five articles together; articles of flagellum, ex-

cept for the last three, with 1–2 setae each. No aesthetascs on the apical articles of antenna.

Left mandible (Fig. 2d) with 11 penicils between molar process and lacinia mobilis; the latter is minute and bears three plumose stems; right mandible (Fig. 2e) with non-plumose lacinia mobilis and 12 non-plumose penicils between molar process and lacinia mobilis. Maxillula (Fig. 2f): outer branch with an outer group of 5 strong simple teeth and inner group of 5 serrate teeth, and 2 plumose stems; inner lobe with three plumose penicils. Maxilla with a setose and bilobate apex, two long penicils on inner margin. Maxilliped (Fig. 2h) endite with a large tooth at anteromedial corner and three teeth hidden into tufts of setae; palp with five distinct articles, four distal of which bearing one tuft of setae.

Pereopods (Figs. 3a–3c): dactylus with inner claw distinctly shorter than outer claw; dactylar seta with a hairy distal part. Water conducting system on pereopods 6 and 7 is not visible.

Male: genital papilla of a shape typical of the genus. Exopod of pleopod 1 (Fig. 3d) is triangular with rounded apex bearing 4 long setae, slightly longer than exopod; one short seta on distal margin. Pleopod 2 (Fig. 3e): exopod is subrectangular; endopod is almost three times longer than exopod, narrow, with parallel sides and a small apical lobe directed outwards. Pleopod 3–5: exopods (Figs. 3f–3h) are triangular, slightly decreasing in size from 3 to 5.

Remark. The species belongs to the subfamily Ligiinae due to dissimilar shape of two branches of uropods. The species is assigned to the genus *Typhloligidium* since it has the distal corners of pereonites 1 and 2 rounded and the corner of pereonite 3 acute, this is distinguishing the genus from both *Ligidium* Brandt 1833 and *Tauroligidium* Borutzky 1950 (see the diagnosis of the genus in Gongalsky, Taiti, 2014). *Typhlo-*

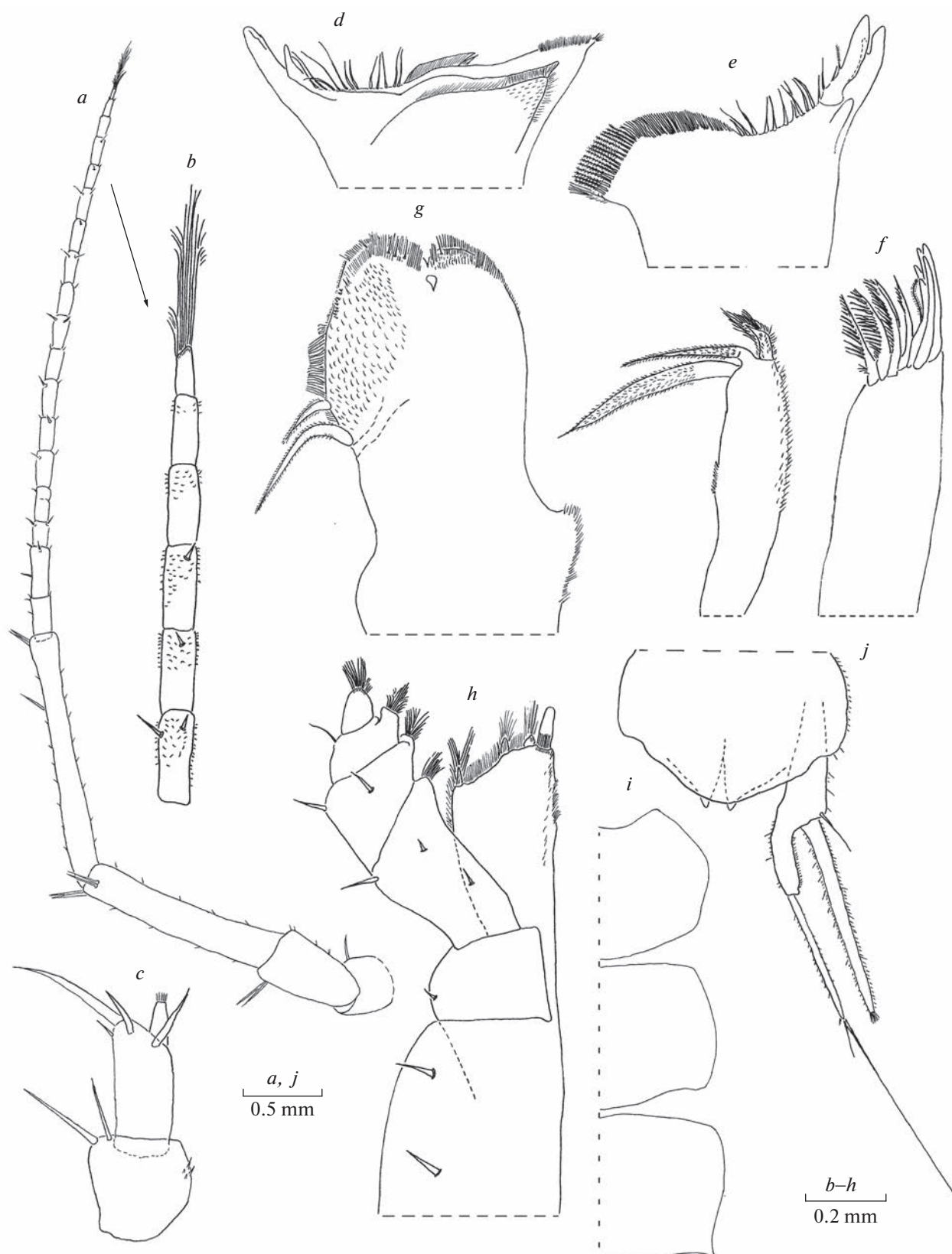


Fig. 2. *Typhloligidium lithophagum* sp. n.: *a* – antenna; *b* – tip of antennal flagellum; *c* – antennula; *d* – left mandible; *e* – right mandible; *f* – maxillula; *g* – maxilla; *h* – maxilliped; *i* – pereonites 1-3, right side; *j* – telson and right uropod. (*a*–*c*, *i*, *j* – male, paratype; *d*–*h* – female, paratype).

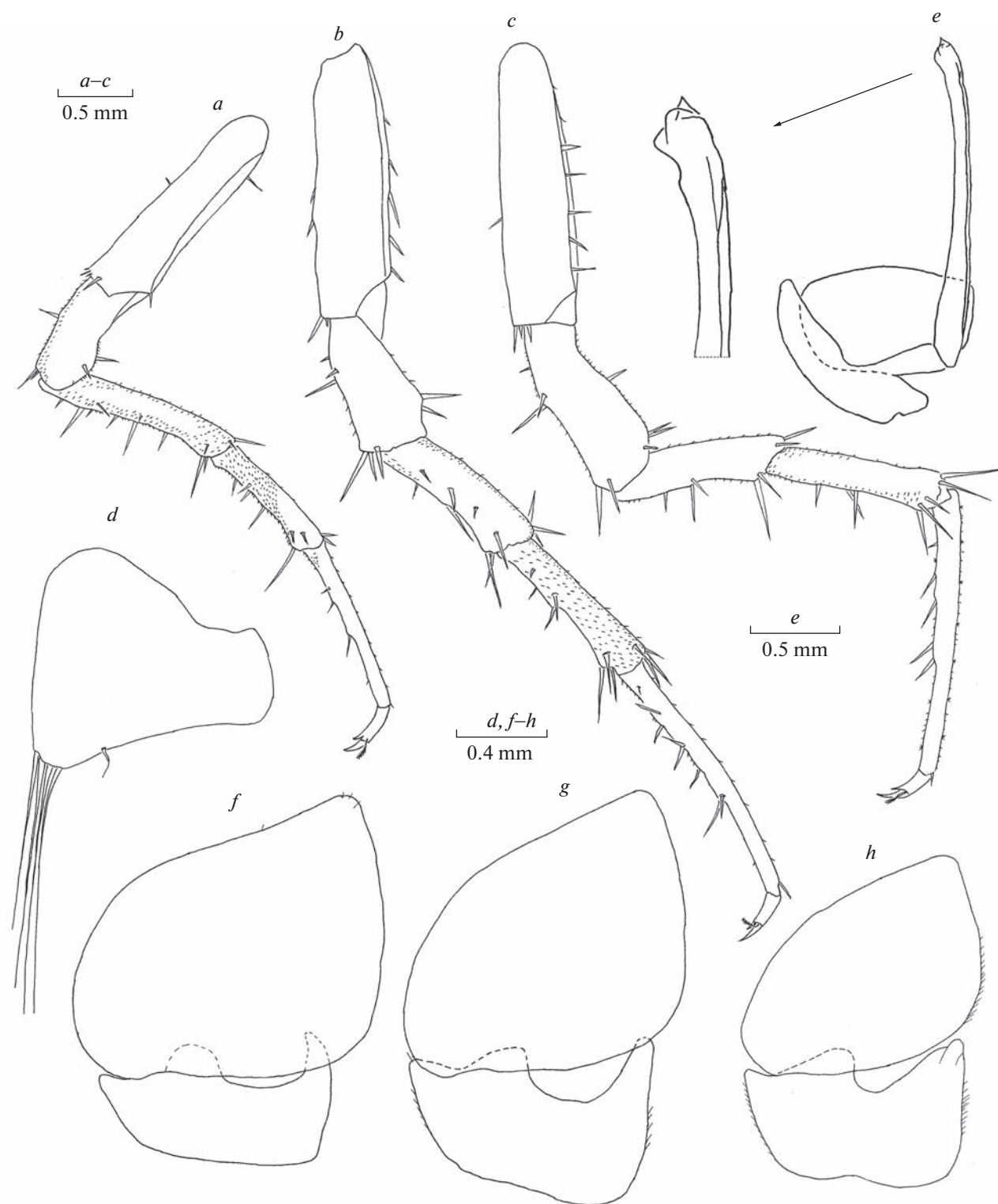


Fig. 3. *Typhloligidium lithophagum* sp. n.: a – pereopod 1; b – pereopod 6; c – pereopod 7; d – exopod of pleopod 1; e – pleopod 2; f – exopod of pleopod 3; g – exopod of pleopod 4; h – exopod of pleopod 5. (a–c – female, paratype; d–h – male, paratype).

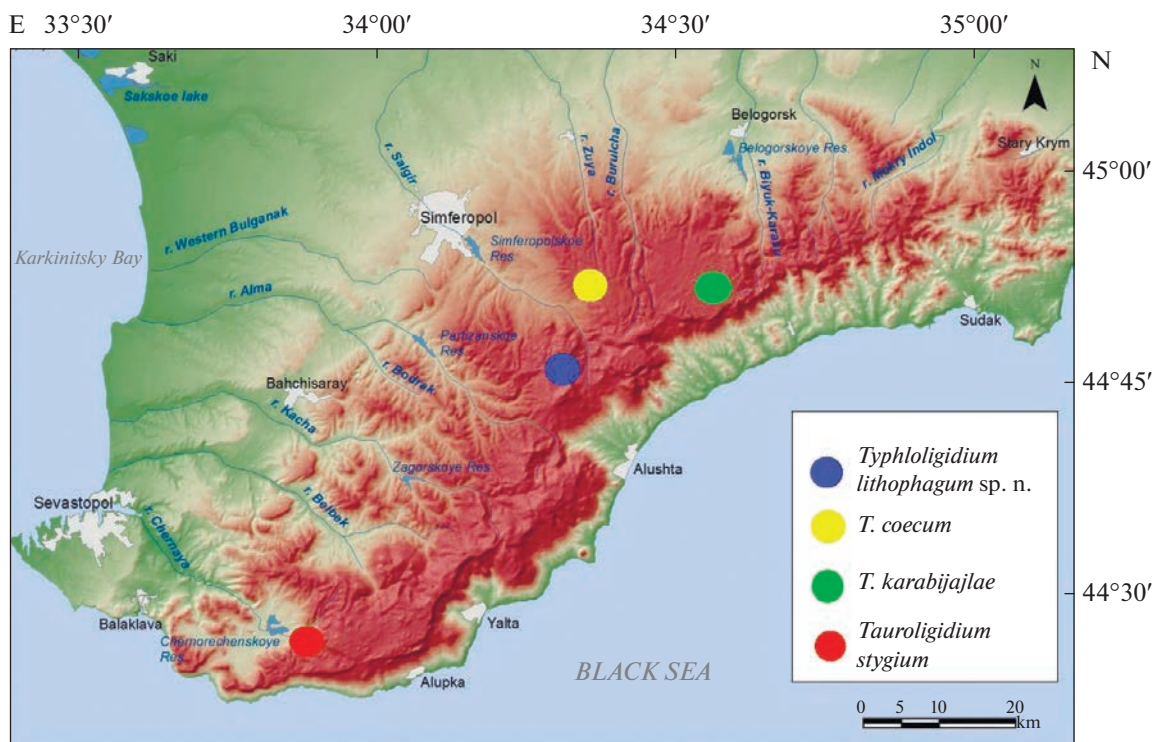


Fig. 4. Distribution of troglomorphic ligiid woodlice (Isopoda, Oniscidea, Ligiidae) in the Crimean Peninsula.

ligidium lithophagum sp. n. differs readily from congeners by the presence of double setae on antennae; the number of penicils on mandibles (11–12 versus <10 in *T. karabijajlae*, and >15 in *T. coecum* and *T. kovalii*); the special shapes of molar process and lacinia mobilis on both mandibles, maxilliped and maxillule and exopod of pleopod 2 in males; the length ratio of uropodal exopod to endopod; and the presence of a small seta on exopod of pleopod 1 in males.

We suggest that the new species seems to be a narrow-range endemic of the Tshatyr-Dagh massif because the massif is a separate karst region according to the karst zonation of the Crimean Peninsula (Vakhrushev, 2009), with the borders delimited by the contact of Upper Jurassic karst limestone rocks to the non-karst foot of the mountain.

Based on the available data on troglomorphic woodlice of the family Ligiidae of the Crimean Peninsula, a preliminary biospeleological regionalization can be presented. *T. lithophagum* sp. n. is morphologically most similar to the other species of the genus *Typhloligidium* living in the neighbouring eastern karst areas of the Crimean Mountains (Karabi-Yayla and Dolgorukovskaya Yayla), but differs substantially from *Tauroligidium stygium* Borutzky 1950 inhabiting the western part of the Crimean Mountains (Ai-Petri karst region). The distribution of troglomorphic ligiid woodlice of the Crimean mountains is shown in Fig. 4. However, troglomorphic woodlice species living in other central and western karst areas of the Crimean Moun-

tains (Babugan, Nikita-Gurzuf and Yalta Karst Massifs) are still unknown. Further studies on troglomorphic woodlice would help to clarify the karst zonation of the Crimean mountains and the zoogeographical relations of troglomorphic fauna. Since the species are morphologically rather similar, we believe that in the future it will be necessary to apply molecular genetic techniques in addition to traditional morphological studies to confirm the affinities of these species.

Etymology. The species name *lithophagum* originates from the Greek “lithos” – stone, and “phageo” – to eat. It acknowledges the contribution of the Crimean Speleologist Club “Zelenye Kamneyedy” (in Russian, “Green Stone Eaters”). The enthusiasts of this club helped us with collecting cave material both in the Crimea and the Caucasus for many years.

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***TYPHLOLIGIDIUM LITHOPHAGUM* SP. N. (ISOPODA, ONISCIDEA, LIGIIDAE), НОВЫЙ ВИД ТРОГЛОБИОНТНОЙ МОКРИЦЫ ИЗ КРЫМА**

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Из вертикальной карстовой пещеры в Крыму описан новый вид троглобионтной мокрицы: *Typhloligidium lithophagum* sp. n. (Ligiidae). Обсуждаются диагностические признаки и родственные отношения вида в пределах троглобионтного крымско-кавказского рода *Typhloligidium* Verhoeff 1918.

Ключевые слова: Isopoda, Oniscidea, Ligiidae, *Typhloligidium*, мокрица, пещера, новый вид, Крым