



# Discovery of *Hemilepistus (Hemilepistus) klugii* (Brandt, 1833) (Isopoda, Oniscidea) in the Republic of Georgia with an overview of the ecology and biology of the subgenus

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## Abstract

The terrestrial woodlice *Hemilepistus (Hemilepistus) klugii* (Brandt, 1833) is reported from Georgia for the first time, with a commentary on the species composition of the genus *Hemilepistus* Budde-Lund, 1879 in the Caucasus. A short review of the ecology of the subgenus *H. (Hemilepistus)* is also provided.

## Key words

Agnaridae, CaBOL, Chachuna Managed Reserve, South-Caucasus, woodlice

## Introduction

*Hemilepistus* was established as a subgenus of the genus *Porcellio* Latreille, 1804 (Budde-Lund 1879) until Verhoeff (1930) raised it to the generic level, splitting it into two subgenera: *Hemilepistus* and *Desertellio*, based on the absence or presence of a frontal line between the frons and the epistome. Originating in Central Asia (Schmalfuss 1998), the genus has expanded its distributional range to North Africa (Lincoln 1970) and the Caucasus (Schmalfuss 2003, Kuznetsova et al. 2012).

Until the end of the first decade of the 21<sup>st</sup> century, all finds of representatives of the genus *Hemilepistus* in the South-Caucasus were known only from the territory of Azerbaijan (Schmalfuss 2003, Kuznetsova et al. 2012), rep-

resented by three species: *H. (Hemilepistus) klugii* (Brandt, 1833), *H. (Desertellio) elongatus* Budde-Lund, 1885 and *H. (Desertellio) ruderalis* Pallas, 1771 (syn. *Hemilepistus russionovae* Borutzky, 1951 (Kashani 2019)). To date, only a single *Hemilepistus* species has been reported from Georgia. The very first mention of this undoubtedly remarkable desert agnarid presence in Georgia was given by Kashani et al. (2012) in an article devoted to finding *H. elongatus* in Iran. During the study of additional material stored in the Staatliches Museum für Naturkunde, Stuttgart (SMNS), a male and a female (SMNS 13082) of the above-mentioned species, collected in Vashlovani National Park (Georgia) in 1983, were found in the museum's collection. Here we report the first record of the second species – *H. (Hemilepistus) klugii* (Brandt, 1833) from Georgia.

## The new record

The material for the present study was collected at the foot of Qila Kupra (Chachuna Managed Reserve) mud volcanoes and Dalis Mta (Dali mountain) Reservoir by the “Caucasus Barcode of Life” (CaBOL- <https://ggbc.eu/>) team of the Iliia State University (ISU) in 2021-2022 season. Additional material was collected from the same location on November 6, 2021. The specimens were collected during the day by hand from burrows in the ground, then preserved in 96% ethanol and deposited in the collection of ISU (Table 1). Species identification was done using the key provided by Kashani et al. (2010).

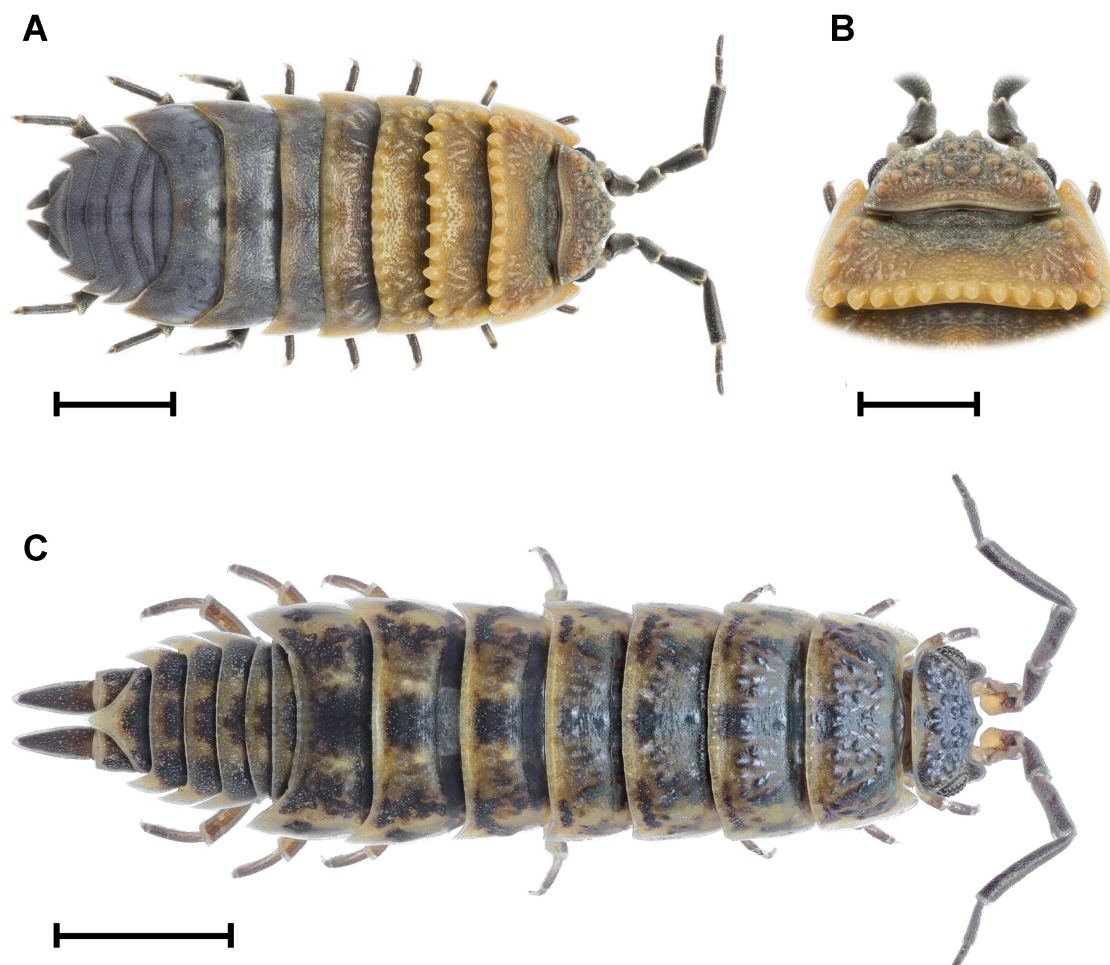
Photos of preserved *Hemilepistus (Hemilepistus) klugii* (Fig. 1A,B) (CaBOL-ID 1020602) and *H. (Desertellio) elongatus* (Fig. 1C) (CaBOL-ID 1023332) were taken using a Canon EOS 550D camera and Canon EF 100 mm f/2.8 Macro USM lens. Digital images were prepared using Zerene Stacker image stacking software and Adobe Photoshop CS6. In addition, photos of the natural habitat and burrows of *H. klugii* are given at Fig. 2.

The newly recorded *Hemilepistus klugii* differs from the other potential congeners that might occur in the area in the arrangement of tubercles on the head, forming a large

circle of eight tubercles in the middle of the head which may encircle no or a few large ones, and a row of 3–5 large tubercles that run to the postero-lateral margins (Fig. 1B).

Study of the life cycle of *Hemilepistus klugii* (Kashani et al. 2011), together with studies on the biology of other *Hemilepistus* species has shown that desert woodlice feed on dead or living tissues of plants, playing a significant role as primary decomposers of plant remains, having symbiotic relations with microorganisms decomposing nitrogen-free compounds and in this way regulating the microbial activity in the soil (Borutzky 1958, Kozlovskaja 1974, Kozlovskaja and Striganova 1977). In spring, they feed on the soil surface while carrying dry plant remains to the bottom of the self-dug burrows, where the humidity is close to saturation, so the plant remains become soft and are used for food during the summer (Lazshak 1952).

Unlike most terrestrial isopods, the members of the subgenus *Hemilepistus (Hemilepistus)* display strictly monogamous behavior. In spring adults form monogamous co-operative pairs in which partners recognize each other individually and later form, with their progeny, strictly closed family communities (Linsenmair 1984). Life cycle and population structure of *H. klugii* in Georgia remain unknown and require further studies.



**Figure 1.** *Hemilepistus (Hemilepistus) klugii* (Brandt, 1833), Qila Kupra (Chachuna Managed Reserve); **A:** dorsal view (the scale bar: 4 mm). **B:** dorsal view of the head, showing tubercles form a large circle on middle of head (scale bar: 1 mm). **C:** *H. (Desertellio) elongatus* Budde-Lund, 1885, Dalis Mta Reservoir (Chachuna Managed Reserve) (scale bar: 4 mm).

**Table 1.** *Hemilepistus (Hemilepistus) klugii* (Brandt, 1833) and *H. (Desertellio) elongatus* Budde-Lund, 1885 collected by the CaBOL team in Georgia.

Location	Latitude	Longitude	Altitude (m)	Date	Sex	CaBOL-ID
<i>H. (Hemilepistus) klugii</i>						
Qila Kupra	41.3338°	45.7692°	411	18.04.2021	♀	1010068
Qila Kupra	41.3338°	45.7692°	411	18.04.2021	♂	1020602
Qila Kupra	41.3338°	45.7692°	411	18.04.2021	♂	1020603
Qila Kupra	41.3338°	45.7692°	411	18.04.2021	♀	1020604
Qila Kupra	41.3338°	45.7692°	411	06.11.2021	♀	1011130
Qila Kupra	41.3338°	45.7692°	411	06.11.2021	♀	1011189
Qila Kupra	41.3338°	45.7692°	411	18.04.2022	♂	1023325
Qila Kupra	41.3338°	45.7692°	411	18.04.2022	♀	1023326
Qila Kupra	41.3338°	45.7692°	411	18.04.2022	♀	1023327
Qila Kupra	41.3338°	45.7692°	411	18.04.2022	♀	1023328
<i>H. (Desertellio) elongatus</i>						
Dalis Mta Reservoir	41.2758°	45.8877°	268	18.04.2022	♂	1023332
Dalis Mta Reservoir	41.2758°	45.8877°	268	18.04.2022	♂	1023333
Dalis Mta Reservoir	41.2758°	45.8877°	268	18.04.2022	♂	1023334

**Figure 2.** Natural habitat and burrows of *H. klugii* (Chachuna Managed Reserve). **A:** Qila Kupra, 18.04.2021; **B:** Qila Kupra, 18.04.2022; **C and D:** *H. klugii* in its burrow covering the entrance with body.

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## References

- Borutzky E (1958) Soil woodlice of the genus *Hemilepistus* (biology and systematics). Zoologicheskii Zhurnal 37: 1462-1475. (In Russian).
- Budde-Lund G (1879) Prospectus generum specierumque Crustaceorum Isopodum Terrestrium. Copenhagen, pp. 1-10.
- Kashani GM, Sari A, Hosseini S (2010) Terrestrial isopods of the subgenus *Hemilepistus (Hemilepistus)* Budde-Lund, 1879 (Isopoda: Oniscidea) from Iran. Zootaxa 2549(1): 54-68.

- Kashani GM, Sari A, Hosseinie S, Malek M, Entezari E (2011) Life cycle and population structure of the terrestrial isopod *Hemilepistus klugii* (Brandt, 1833) (Isopoda: Oniscidea) in Iran. *Journal of Natural History* 45(33-34): 2081-2094. <https://doi.org/10.1080/00222933.2011.582965>.
- Kashani GM, Sari A (2012) Discovery of *Hemilepistus elongatus* Budde-Lund, 1885 (Isopoda, Oniscidea) in Iran: redescription and intraspecific character variability. *ZooKeys* 176: 13-22. <https://doi.org/10.3897/zookeys.176.2271>.
- Kashani GM (2019) Revision of the terrestrial isopods of the subgenus *Hemilepistus*; (*Desertellio*) Verhoeff, 1930 (Isopoda: Oniscidea). *Zootaxa* 4555(4): 531-547. <https://doi.org/10.11646/zootaxa.4555.4.5>.
- Kozlovskaja LS (1974) Significance of soil invertebrates in the nitrogen and carbon turnover. Ways of the study and development of swamps in the North-Western part of the USSR. Moscow, pp. 58-70. (In Russian).
- Kozlovskaja LS, Striganova BR (1977) Food, digestion and assimilation in desert woodlice and their relations to the soil microflora. *Ecological Bulletins* 25: 240-245.
- Kuznetsova DM, Gongalsky KB (2012) Cartographic analysis of woodlice fauna of the former USSR. *ZooKeys* 176: 1-11. <https://doi.org/10.3897/zookeys.176.2372>
- Lazshak TA (1952) Materials to the biology of the desert woodlice *Hemilepistus cristatus* B.-L. -Izvestii Akademiy Nauk of Turkmenskoj SSR 5: 22-27. (In Russian).
- Lincoln RJ (1970) A review of the species of *Hemilepistus* s. str. Budde-Lund, 1885 (Isopoda, Porcellionidae). *Bulletin of the British Museum of natural History. Zoology* 20: 111-130.
- Linsenmair KE (1984) Comparative studies on the social behaviour of the desert isopod *Hemilepistus reaumuri* and of a *Porcellio* species. *Symposium of the Zoological Society of London* 53: 423-453
- Schmalzfuss H (1998) The terrestrial isopod fauna of the central Near East countries: Composition and biogeography. *Israel Journal of Zoology* 44(3-4): 263-271.
- Schmalzfuss H (2003) World catalog of terrestrial isopods (Isopoda: Oniscidea). *Stuttgarter Beiträge zur Naturkunde, Serie A* 654: 1-341.
- Verhoeff K (1930) Über Isopoden aus Turkestan. *Zoologischer Anzeiger* 91: 101-125.