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A new Eocene *Bacanius* species (Histeridae: Dendrophilinae) from Baltic amber

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Abstract. A study of Baltic amber revealed a new fossil species of the genus *Bacanius* LeConte, 1853. *Bacanius gorskii* sp. nov. differs from the congener described previously from Eocene Rovno amber, *B. kirejtshuki* Sokolov and Perkovsky, in the shape of meso-metaventral suture, incomplete subhumeral stria, and the impunctate prosternal lobe (urn:lsid:zoobank.org:pub:EE9C6859-607A-4134-9037-8385601CF42F).

1 Introduction

The clown beetle family (Histeridae) is nearly cosmopolitan in distribution, and it is very diverse both ecologically and morphologically (Caterino and Vogler, 2002). Histerid beetles comprise over 4000 extant species. Ten subfamilies are presently recognized (Zhou et al., 2020): Antigracilinae, an extinct subfamily from the Lower Cretaceous, and the extant subfamilies Niponiinae, Abraeinae, Saprininae, Dendrophilinae, Onthophilinae, Tribalinae, Histerinae, Haeteriinae, and Chlamydopsinae. Histerid beetles, although generalist predators, have widely varied habitats and are associated with different substrates including dung, carrion, fungi, dead and dying trees, leaf litter or other decomposing vegetation, and symbioses with other animals, most spectacularly with social insects (Caterino and Vogler, 2002).

Various histerid genera belonging to subfamilies Abraeinae, Histerinae, and Dendrophilinae have been listed from Baltic amber inclusions (Klebs, 1910; Larsson, 1978; Spahr, 1981), but only two representatives of the tribe Paromalini have been formally described hitherto (Alekseev, 2016). Recently, one fossil species of *Bacanius*, *B. kirejtshuki*, has been described from Eocene Rovno amber (Sokolov and Perkovsky, 2020).

In this study, description of a new species, *Bacanius gorskii* sp. nov., an extinct Eocene representative of the tribe Bacaniini, is presented.

2 Material and methods

The studied *Bacanius* specimen no. 8619 is deposited in the private collection of Andrzej Górski (Bielsko-Biała, Poland) (CAG) and will subsequently be deposited in the collections of the Museum of Natural History, Institute of Systematics and Evolution of Animals, Polish Academy of Sciences (Kraków, Poland) (ISEA PAS) under collection number no. MP/4077/AG col./no. 8619.

The X-ray micro-CT (µCT) observations of specimen "8619" (CAG) were conducted at Daugavpils University, Daugavpils, Latvia (DU), using a Zeiss Xradia 510 Versa system. Scans were performed with a polychromatic X-ray beam at an energy of 40 kV and power of 3 W. Sample-to-detector distance was set to 54.6 mm and source-to-sample distance of 18 mm was used. Tomographic slices were generated from 1601 rotation steps through a 360° rotation, using a 4× objective, and exposure time during each projection was set to 12 s. Acquired images were binned (2 × 2 × 2), giving a voxel size of 1.67 µm. Images were imported into the Dragonfly PRO (ver. 2020.1) software platform for interactive segmentation and 3D visualization. Prior to the full scan, a 10 min warmup scan was conducted with the same scan parameters, except for rotation steps, which had been reduced to 201, and exposure time which was reduced to 3 s.

The photographs were taken using a Nikon SMZ 745T stereomicroscope with a Nikon DS-Fi1 digital camera. Extended depth of field at high magnifications was achieved by combining multiple images from a range of focal planes using Helicon Focus v. 6.0.18 software, and the resulting images were edited to create figures using Adobe Photoshop CS5.

The following sources were used for comparison with taxa and congeners that are presumed to be phylogenetically allied with the fossil material: Reitter (1886, 1912), Kryzhanovskij and Reichardt (1976), Mazur (1977), Mazur and Sawoniewicz (2008), and Sokolov and Perkovsky (2020).

3 Systematic palaeontology

Family **Histeridae** Gyllenhal, 1808

Subfamily **Dendrophilinae** Reitter, 1909

Tribe **Bacaniini** Kryzhanovskij and Reichardt, 1976

Genus *Bacanius* LeConte, 1853

Subgenus *Bacanius* LeConte, 1853

Bacanius gorskii sp. nov.

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Figs. 1–3

Type material

Holotype: no. 8619 [CAG], "HOLOTYPE/*Bacanius gorskii* sp. nov./des. Alekseev V.I. and Bukejs A. 2021"; adult, female. A complete beetle with partially exposed hind wings is included in a transparent, yellow amber piece with dimensions of 15 × 9 mm and maximum thickness of 1.5 mm and preserved without supplementary fixation. Syninclusions: few stellate Fagaceae trichomes.

Type stratum

A predominantly Bartonian age (41.3–37.9 Ma) is interpreted for the extinct central European resin-producing forests, which produced the amber that has eroded out of the Eocene blue earth layers (Bukejs et al., 2019). However, the vast majority of Baltic amber derives from the geological amber-bearing strata that have been assigned a Priabonian age (37.8–33.9 Ma) (Sadowski et al., 2017, 2020).

Type locality

Baltic Sea coast, Gdańsk, northern Poland.

Description

Measurements: body length 1.14 mm, body maximum width 0.83 mm; pronotum length 0.40 mm, pronotum maximum width 0.74 mm; elytra length 0.86 mm, elytra maximum width 0.83 mm.

Body widely oval, rather convex; integument unicolorous black (as preserved).

Head large, partially retracted into prothorax, apparently covered with fine punctation, epistoma without coarse punctures. Frontal stria distinct, complete, slightly arcuate inwardly to vertex. Mandibulae large, curved, apparently bifid. Eyes small, rounded, slightly convex. Antennae clavate, nine-segmented; short, about as long as protibial length, densely covered with minute punctation, with few short setae. Scape large, elongate oval; pedicel widely oval; antennomeres 3 and 8 slightly trapezoidal, oblong; antennomeres 4–7 subquadrate; antennal club without sutures, widely oval, with rounded apex, largest, about as long as antennomeres 3–8 combined, rather densely covered with long and erect setae.

Pronotum transverse, 1.85 times as wide as long, widest at base; punctation indistinct, very sparse and fine, with more distinct small punctures at posterior margin; lateral margins widely rounded, anterior and posterior margins convex. Antescutellar stria absent. Prohypomera impressed, sparsely covered with fine punctation. Prosternal lobe wide, convex, without distinct punctation. Suture between prosternal lobe and prosternal keel indistinct. Prosternal keel with concave base. Scutellum not visible.

Elytra nearly as wide as long, widest medially, completely covering abdomen, not truncate; basal margin concave, as wide as pronotal posterior margin; elytral punctation indistinct: disc apparently impunctate, with fine and sparse punctures conspicuous laterally; dorsal elytral striae absent; subhumeral stria incomplete, shortened and indistinct in apical one-third of elytron length; epipleural stria developed, sinuate.

Mesosventrite almost flat, narrow, about 2.8 times as wide as long, without distinct punctures. Meso-metaventral suture distinct, straight, without punctures. Metaventrite with flat, apparently impunctate disc; with coarse and dense punctation laterally, distance between punctures about 0.5–1.5 times the diameter of one puncture; postmesocoxal stria semicircular; posterior margin slightly convex.

Legs rather long. Femora flattened, slightly widened mesally. Tibiae nearly as long as femora. Protibiae flattened and strongly widened in apical portion, each with one widely triangular outer tooth and two thin apical spurs. Meso- and metatibiae narrower, slightly dilated apically, with two thin, apical spurs. All tarsi pentamerous, long, slender; relative length of metatarsomeres 1–5 equal to 10 : 8 : 8 : 7 : 15. Tarsal claws thin, free, simple.

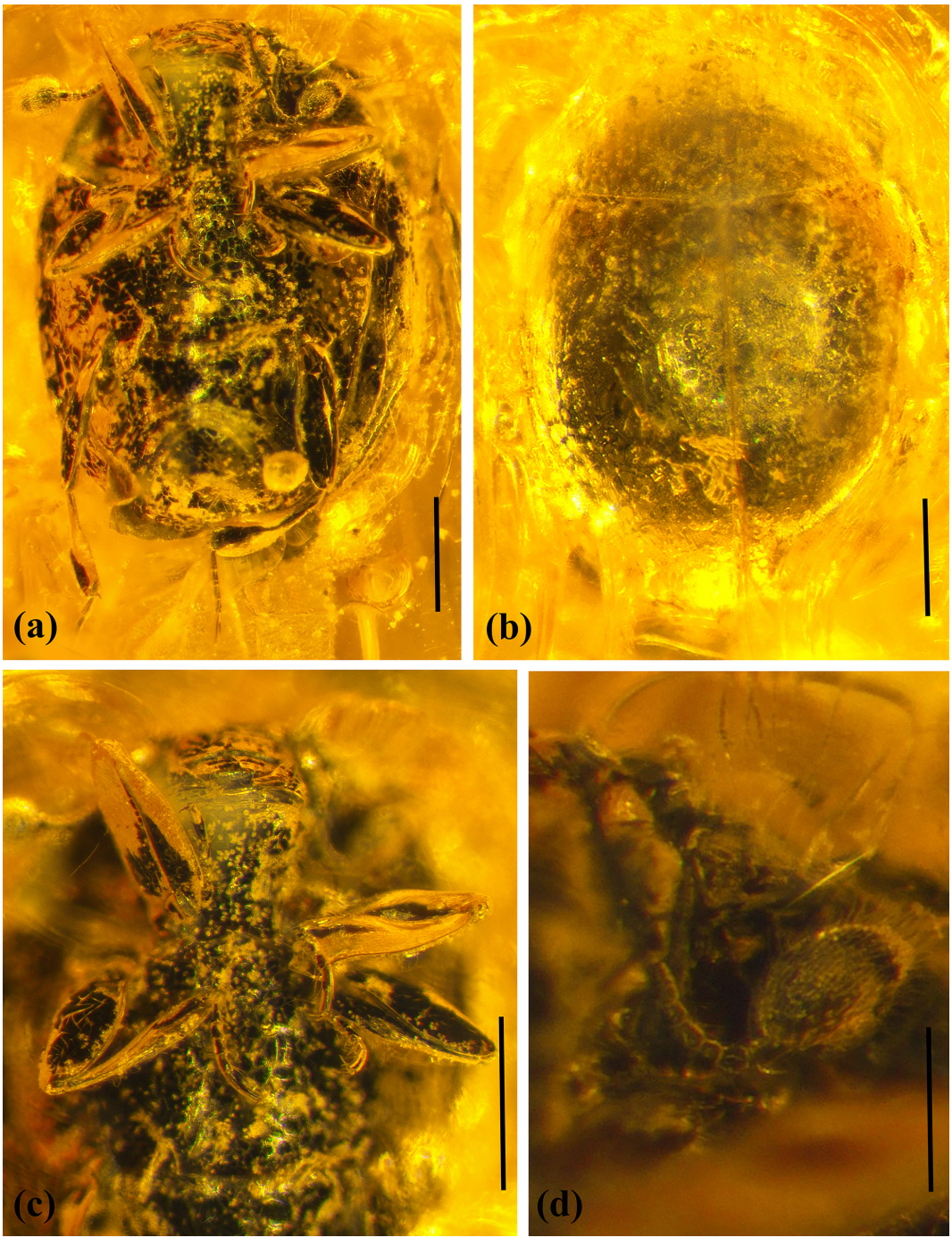

Figure 1. Photomicrographs of *Bacanius gorskii* sp. nov., holotype, 8619 (CAG): **(a)** habitus, ventral view; **(b)** habitus, dorsal view; **(c)** details of forebody, ventral view; **(d)** left antenna. Scale bars: 0.25 mm for **(a)**–**(c)**; 0.1 mm for **(d)**.

Abdominal ventrite 1 largest, distinctly longer than ventrites 2–5 combined, with semicircular postmetacoxal stria; without distinct punctation; sutures between ventrites 1–4 strongly arcuate. Pygidium and propygidium visible in ventral view, without distinct punctation.

Differential diagnosis

The new species is assigned to the subfamily Dendrophilinae based on (1) the prosternum with short lobe, laterally incised to receive the antennae, (2) non-costate elytra, and (3) antennal cavities on prosternum weakly defined. Placement in the tribe Bacaniini is based on a combination of the following

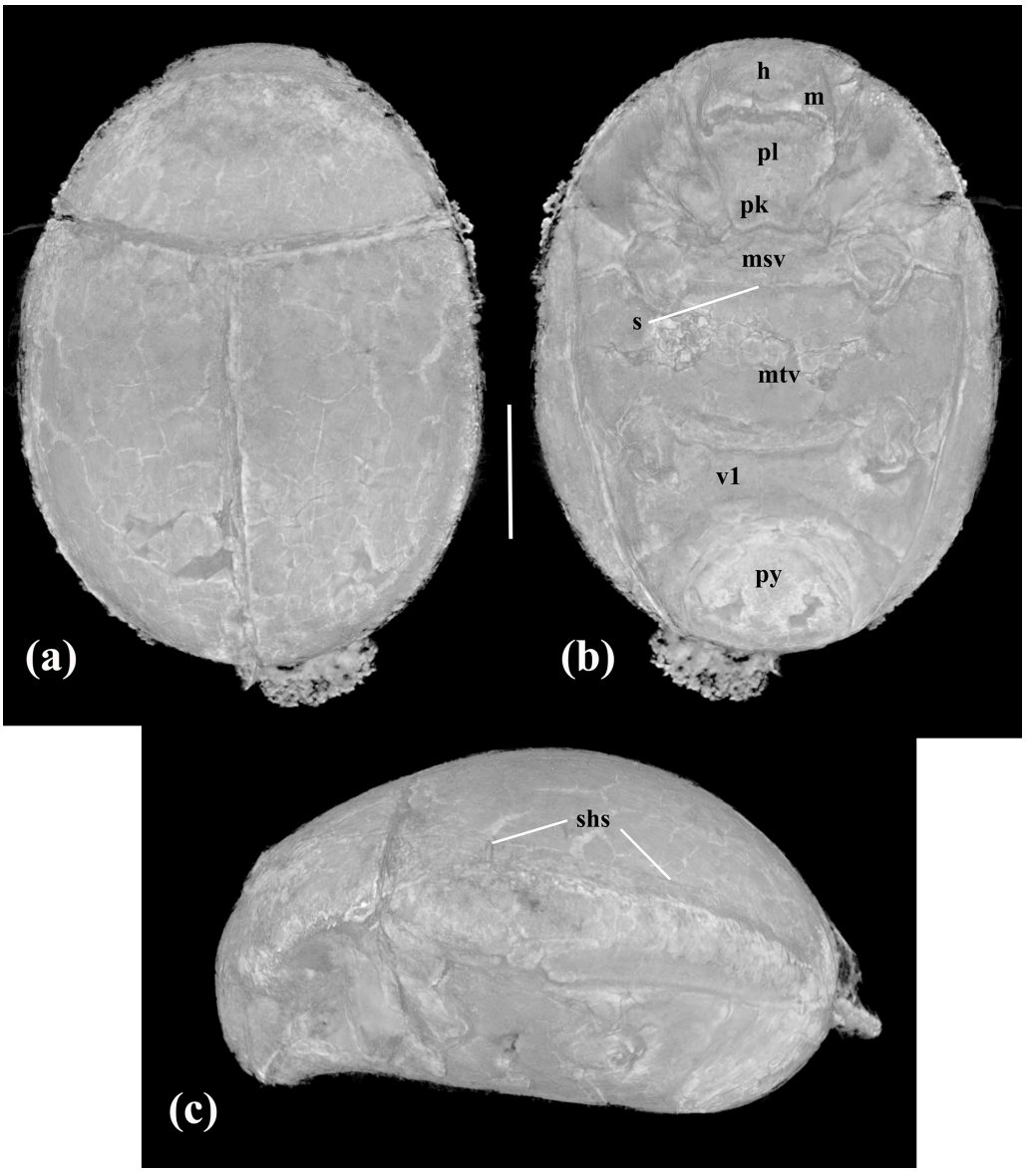

Figure 2. X-ray micro-CT renderings of *Bacanius gorskii* sp. nov., holotype, 8619 (CAG), habitus: **(a)** dorsal view; **(b)** ventral view; **(c)** right lateral view. Scale bar = 0.25 mm. Abbreviations: h – head; m – mandibula; msv – mesoventrite; mtv – metaventrite; pk – prosternal keel; pl – prosternal lobe; py – pygidium; s – meso-metaventral suture; shs – subhumeral stria; v1 – abdominal ventrite 1.

characters: (1) the bent short propygidium (visible only ventrally) and large pygidium, (2) general habitus (small size, with round and convex body), (3) elytral disc without dorsal striae, and (4) scutellum not visible.

The specimen under study differs from representatives of the genus *Cyclobacanius* Müller, 1925 in that the elytra are without a distinct elliptical area on the elytral disc margined by punctation, and the metaventrite is without longitudinal lines. It differs from representatives of the genus *Abraeomorphus* Reitter, 1886 in lacking semicircular femoral lines on the metaventrite and from the genus *Australanius* Gomy, 2009 based on the absence of discal striation. The shape of the prosternal lobe in the new fossil species is similar to representatives of the anophthalmic and Sardinian endemic genus *Sardulus* Patrizi, 1955 (Magrini, 2005; Magrini and Fancello, 2005; Magrini et al., 2012; Magrini and Onnis, 2019); however, *Bacanius gorskii* sp. nov. differs from *Sardulus* based on the presence of eyes and elytral suhumeral stria. The new species from Baltic amber lacks an arcuate antescutellar stria on the pronotal base, in contrast to representatives of the subgenus *Muellerister* Cooman, 1936 (of the genus *Bacanius*); of the genus *Neobacanius* Müller, 1925; or of several representatives of *Abraeomorphus*. The subgenus *Gomyister* Mazur, 1984 (genus *Bacanius*) is characterized by

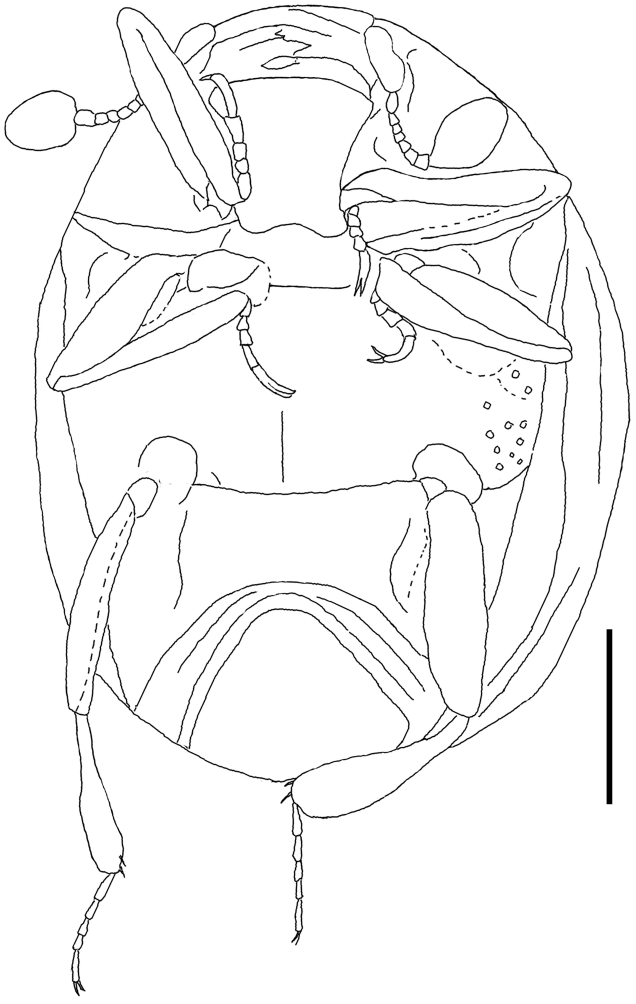

Figure 3. *Bacanius gorskii* sp. nov., outline drawing of habitus, ventral view. Scale bar = 0.25 mm.

the presence of a complete subhumeral stria (Mazur, 1984; Mazur and Sawoniewicz, 2008), but the new fossil species has an incomplete subhumeral stria. Based on the previously mentioned combination of characters, we tentatively place *Bacanius gorskii* sp. nov. in the nominative subgenus.

Bacanius (s.str.) *gorskii* sp. nov. differs from the Eocene *Bacanius kirejtshuki* Sokolov and Perkovsky, 2020 described from Rovno amber in that it possesses a straight, impunctate, finely impressed meso-metaventral suture (differing from the convex, coarsely punctate meso-metaventral suture of *B. kirejtshuki*); an apically reduced subhumeral stria (complete in *B. kirejtshuki*); and an impunctate prosternal lobe (sparsely punctate in *B. kirejtshuki*). The new species can be easily distinguished from the other two known histerid beetles in Baltic amber, *Carcinops donelaitisi* Alekseev, 2016 and *Xestipyge ikanti* Alekseev, 2016, based upon its convex and rounded body shape, absence of dorsal elytral striae, and distinctly smaller body size.

Derivatio nominis

Patronymic, this new species is named in honour of Andrzej Górski (Bielsko-Biała, Poland), collector of this amber piece.

Remarks

Sex of the examined specimen determined was based on micro-CT results. We were unable to identify any sclerotized structure resembling an aedeagus in the abdominal cavity, and therefore we presume the specimen in question is a female.

4 Discussion

The life history of extant Bacaniini is little known. Members of the tribe are mainly recorded living in rotting wood, sometimes in leaf litter or in nests of social insects like termites and ants (Kryzhanovskij and Reichardt, 1976), or even belonging to the hypogean and troglophilous faunas (Vomero, 1973; Magrini, 2005). Representatives of Bacaniini, like several other microhisterid taxa, have their mouthparts adapted to consume fungal spores, as well as the larvae of tiny arthropods (Kovarik and Caterino, 2000). A mixed sporophagous–predaceous diet in rotten wood of fallen and standing trees could be assumed as the ecological niche for the fossil species described in the present paper.

The Paleogene entomofauna of Baltic amber has been in the focus of palaeontological research for nearly a century. Dozens of new coleopteran taxa described yearly from this amber deposit show our fragmented knowledge of general coleopteran biodiversity in this lagerstätte, as well as the need for ongoing study of its inclusions. The newly described species is the third formally described from Baltic amber. Described histerid inclusions are also known from three fossil resins of different ages and locations (Chatzimanolis et al., 2006; Poinar and Brown, 2009; Caterino et al., 2015; Caterino and Maddison, 2018; Zhou et al., 2019; Jiang et al., 2020; Sokolov and Perkovsky, 2020): (1) *Trypanaeus hispaniolus* Chatzimanolis, Caterino and Engel, 2006 from early Miocene Dominican amber; (2) *Bacanius kirejtshuki* Sokolov and Perkovsky, 2020 from upper Eocene Rovno amber; and (3) *Pantostictus burmanicus* Poinar and Brown, 2009, *Cretonthophilus tuberculatus* Caterino et al., 2015, *Amplectister tenax* Caterino and Maddison 2018, *Promyrmister kistneri* Zhou et al., 2019, and *Onthophilus yingae* Jiang et al., 2020 from Cretaceous Burmese amber. The new discovery in Baltic amber adds to the growing number and diversity of fossil representatives known for this group.

Data availability. All material included in the paper is deposited in the private collection of Andrzej Górski (Bielsko-Biała, Poland) (CAG) and will subsequently be deposited in the collection of the Museum of Natural History, Institute of Systematics and Evolution

of Animals, Polish Academy of Sciences (Kraków, Poland) (ISEA PAS), and all data are included in the description. X-ray microtomography volume renderings of the habitus and antenna of *Bacanius gorskii* sp. nov., holotype, 8619 (CAG) are available as Video Supplements.

Video supplement. Volume renderings of X-ray microtomography of the habitus and antenna of *Bacanius gorskii* sp. nov., holotype, 8619 (CAG). The videos are available at

- https://doi.org/10.5446/49327 (Bukejs, 2021a),
- https://doi.org/10.5446/49328 (Bukejs, 2021b).

Author contributions. VIA and AB designed the study, performed specimen identification and systematic placement, and prepared new species description. Both authors drafted the manuscript and suggestions that improved the manuscript.

Competing interests. The authors declare that they have no conflict of interest.

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