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3D-reconstruction of the female of fossil *Revelieria groehni* Sergi, Perkovsky et Reike, 2013 (Coleoptera: Latridiidae) from Eocene Baltic amber

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Based on a well-preserved specimen from Eocene Baltic amber, female of *Revelieria groehni* Sergi, Perkovsky et Reike, 2013 (Coleoptera: Latridiidae) is described and illustrated using X-ray micro-computed tomography (μCT). The sexual dimorphic characters of this species are briefly discussed.

Key words: palaeontology, Latridiinae, Paleogene, fossil resin, X-ray micro-CT, sexual dimorphism.

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INTRODUCTION

Latridiidae Erichson, 1842 is small coleopteran family with approximately 850 described extant species worldwide (Rücker 2020a). The family includes 33 genera in two subfamilies and shows remarkable diversity in Eocene Baltic amber. To date, 16 species belonging to 10 genera of minute brown scavenger beetles are known from this fossil resin (Borowiec 1985; Bukejs et al. 2011, 2012a, 2012b; Reike 2012; Reike et al. 2013, 2017; Sergi et al. 2013). The knowledge of Baltic amber latridiid assemblage can be treated as relatively complete. One genus of this assemblage is extinct (*Dieneremia* Reike et al., 2013) and eight genera are extant, comparatively diverse and widely distributed in Recent World. Only genus *Revelieria* Perris, 1869 has "intermediate" position between these extreme points, i.e. it is extant but it has got restricted diversity and geographical range, including only two extant species (Rücker & Sergi 2013; Rücker 2020b), *R. californica* Fall, 1899 and *R. genei* (Aube, 1850), with the climate-limited distribution in west of North America and

Mediterranean (Rücker 2010). This unusual circumstance among still existing Eocene genera made the detailed study of fossil *Revelieria* especially interesting.

Original description of *Revelieria groehni* Sergi, Perkovsky et Reike, 2013 was based on three specimens from Baltic amber examined with optical study only (Sergi et al. 2013). In the current paper, the female of *R. groehni* was described and illustrated in details using both optic method and X-ray micro-computed tomography.

MATERIAL AND METHODS

The material examined is deposited in the private collection of Jonas Damzen (Vilnius, Lithuania) [JDC]. The amber piece was polished by hand, allowing improved views of the included specimens, and was not subjected to any supplementary fixation.

Observations of the studied beetle specimen were made using a Nikon SMZ 745T stereomicroscope. The photographs were taken using a Canon 70D camera with a macro lens (Canon MPE-65 mm). 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 X-ray micro-CT (μCT) observations of specimen were conducted at the Daugavpils University, Daugavpils, Latvia using Zeiss Xradia 510 Versa system. Scans were performed with a polychromatic X-ray beam at an energy of 30 kV and power of 2 W. Sample to detector distance was set to 29 mm and source to sample distance 14.4 mm. Tomographic slices were generated from 1601 rotation steps through a 360-degree rotation, using a 4× objective, and exposure time during each projection was set to 6 seconds. Acquired images were binned (2×2×2) giving a voxel size of 2.2 μm. Images were imported into Dragonfly PRO (ver. 2020.1) software platform for interactive segmentation and 3D visualization. Prior to the full scan a 13-minute warmup scan was conducted with the same scan parameters except rotation steps which had been reduced to 201 and exposure time which was reduced to 1 second.

SYSTEMATIC PALAEONTOLOGY

Family Latridiidae Erichson, 1842
Subfamily Latridiinae Erichson, 1842
Genus *Revelieria* Perris, 1869

***Revelieria groehni* Sergi, Perkovsky et Reike, 2013**
(Figs. 1–3; Appendices 1–3)

Material examined. Specimen with collection number JDC-9116 [JDC], adult, female. A complete beetle is included in a transparent, yellow amber piece with dimensions of 14×8×2 mm, and preserved without supplementary fixation. Syninclusion: one stellate trichome of Fagaceae.

Strata. Middle–Late Eocene, 48–34 Ma (Seyfullah et al. 2018; Bukejs et al. 2019; Sadowski et al. 2017, 2020).

Locality. Yantarny settlement (formerly Palmnicken), Sambian (Samland) Peninsula, Kaliningrad region, Russia.

Description of female. Measurements: total body length 1.6 mm; pronotum length 0.35 mm, pronotum maximum width 0.47 mm; elytra length 1.07 mm, elytra maximum combined width 0.75 mm. Body elongate, moderately convex dorsally and ventrally; blackish-brown as preserved, shiny; glabrous dorsally.

Head transverse, twice wider than long from above; covered with dense and moderately large punctures larger than diameter of one eye facet; head together with eyes slightly narrower than anterior margin of pronotum; vertex convex. Compound eyes lateral, hemispherical, prominent,

entire, with distinct facets; vertical diameter 1.25× transverse diameter. Distance between eyes equal to about 2.3× transverse diameter of one eye. Frontoclypeal suture distinct. Clypeus strongly transverse, with anterior margin widely concave. Antennal insertion located before anterior edge of eye in the distance about 0.5× longitudinal eye diameter. Antennae slender; 11-segmented, with three terminal antennomeres forming loose antennal club; moderately long (extending to posterior third of pronotum). Scape and pedicel rounded, as long as wide; antennomeres 3–9 almost cylindrical, slightly dilated apically; antennomere 10 subconical, antennomere 11 egg-shaped, with rounded apex. Relative length ratios of antennomeres 1–11 equal to 10:7:5:5:4:5:5:5:6:5:10.

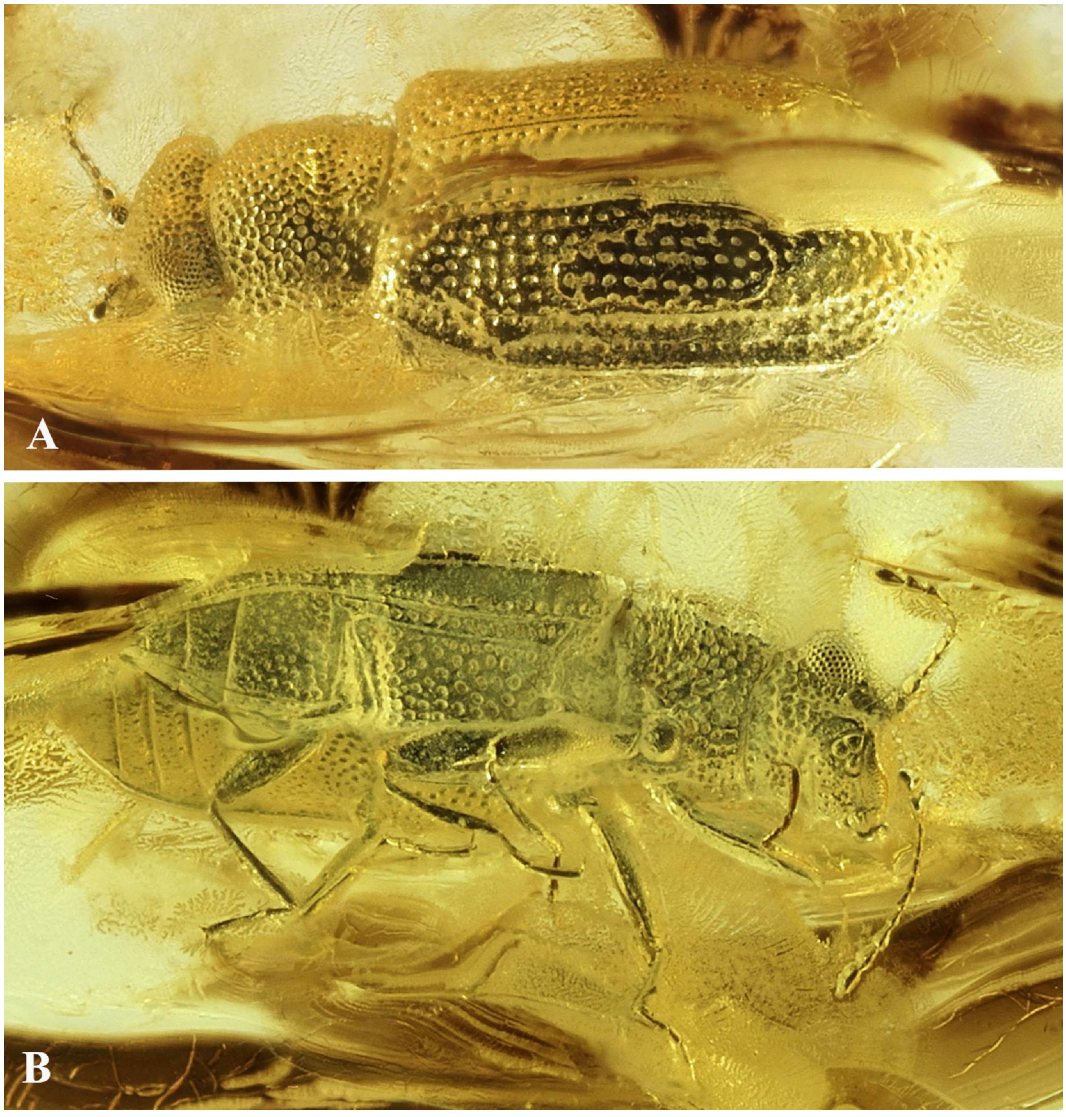

Fig. 1. Photomicrographs of *Revelieria groehni*, female, Baltic amber, JDC-9116 [JDC], habitus: A – dorso-lateral view; B – ventro-lateral view.

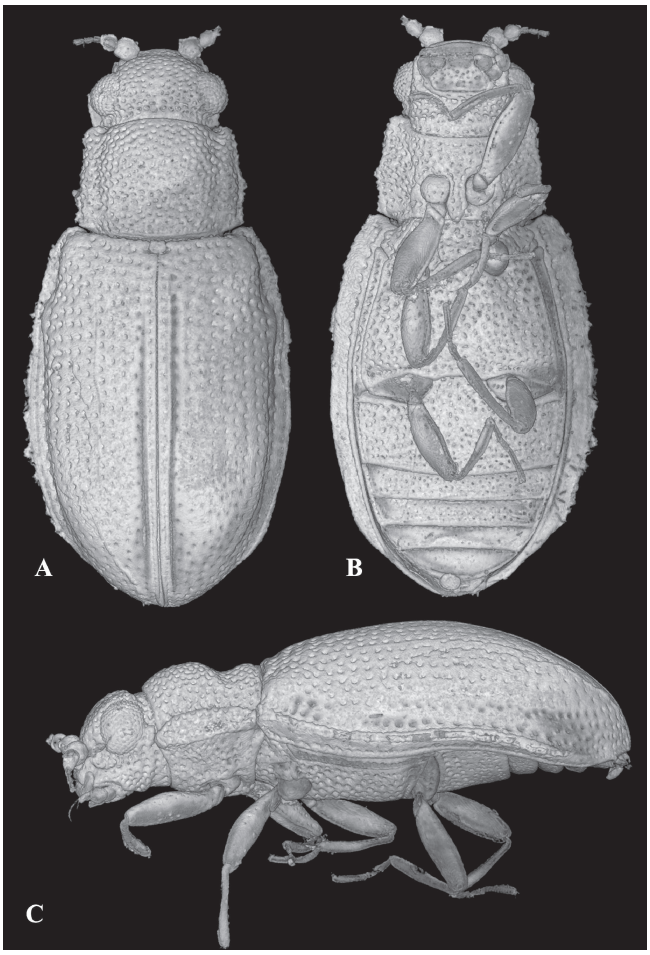

Fig. 2. X-ray μCT renderings of *Revelieria groehni*, female, Baltic amber, JDC-9116 [JDC], habitus: A – dorsal view; B – ventral view; C – left lateral view.

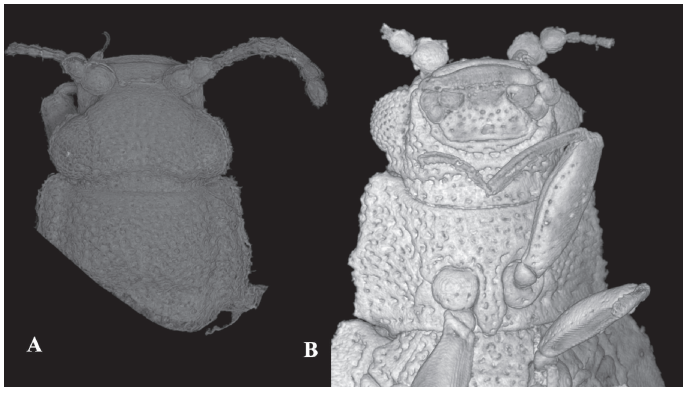

Fig. 3. X-ray μCT renderings of *Revelieria groehni*, female, Baltic amber, JDC-9116 [JDC], details of forebody: A – dorsal view; B – ventral view.

Prothorax. Pronotum transverse, about 1.34× as wide as long, widest at midlength, slightly narrowed both anteriad and posteriad. Lateral margins almost straight, lateral sides explanate. Posterior margin slightly convex; anterior margin convex in dorsal view. Pronotal disc convex, densely and coarsely punctate; distance between punctures equal to 0.2–0.5× diameter of one puncture. Posterior angles distinct, nearly orthogonal; anterior angles narrowly rounded, slightly protruding anteriorly. Pronotum with transverse shallow impression at the base. Prohypomera and prosternum densely and coarsely punctate; procoxal cavities closed; prosternal process lanceolate, punctate, narrowly rounded at apex, about 0.5× as wide as transverse diameter of procoxa, extending to posterior margin of prothorax.

Pterothorax. Scutellar shield distinct, small, transverse, with shallow emargination anteriorly, impunctate. Elytra moderately convex, oval, widest at midlength, about 1.43× as wide as long, laterally explanate; elytral anterior margin distinctly wider than pronotal posterior margin. Elytral punctation arranged in 12 rows; punctation irregular in posterior half of elytra, dense, coarse, with distance between punctures in row equal to 0.5–1× diameter of one puncture. Punctures become smaller on the posterior half of disk and on the apex of elytra. Humeral calli distinct, but not prominent. Elytral apices almost straight. Elytra along suture not connate. Metathoracic wings apparently reduced to micropterous form (Appendix 3). Epipleura wide, gradually narrowed posteriorly, reaching abdominal ventrite 4, covered with one row of punctures. Mesoventrite coarsely punctate. Metaventrite moderately convex, with discrimen distinct in posterior one-fourth; covered with dense and coarse punctures, 2.25× as long as mesoventrite. Metanepisternum narrow and long, about 12.0× as long as wide; with one row of coarse punctures. Mesocoxae closed.

Legs slender, moderatelly long. Procoxae rounded, as long as wide, separated by prosternal process; mesocoxae subspherical, widely separated by distance about 1.0× diameter of mesocoxa; metacoxae elongate, transverse, widely separated by intercoxal process of abdominal ventrite 1, distance between metacoxae 2.0× distance between mesocoxae). Femora spindle-shaped, slightly flattened; femora and tibiae equal in length. Protibiae evenly curved, simple, without teeth on outer margin, and without apical spur. Middle and hind tibiae slender, straight. Tarsal formula 3–3–3. Tarsi long; metatarsus about 0.8× as long as metatibia. Tarsomeres subcylindrical, last tarsomere longest in all legs. Relative length ratios of metatarsomeres 1–3 equal to 1:1:2. Pretarsal claws simple, small and thin.

Abdomen with five visible ventrites. Relative length ratios of abdominal ventrites 1–5 equal to 18:5:5:4:6 (measured medially). Ventrite 1 with transverse intercoxal process, coarsely punctate, without femoral lines. Punctation of ventrites 2-5 finer and sparser.

Notes. Specimen JDC-9116 is morphologically similar to the holotype and paratypes of *Revelieria groehni* and identified as female (there is no sclerotized aedeagus-like structure present inside abdomen) of this species, showing typical for the genus sexual dimorphism in protarsus with three tarsomeres. Both known extant representatives of *Revelieria* possess secondary sexual character: tarsal formula 2-3-3 in the males and 3-3-3 in the females (Rücker & Sergi 2013). According to original description, the holotype and two paratypes of *R. groehni* from Baltic amber have 3-segmented protarsi, however the sex of the fossil specimens was considered unknown (Sergi at al. 2013).

Additionally, the following character is mentioned (and provided with outline drawing) for the holotype of this species: "*Fore tibia slightly thickened and evenly curved inwards, with 5 small irregular teeth on outer margin and with short spur on apex*" (Sergi at al. 2013, fig. 2). The female under study JDC-9116 have the simple protibiae, without denticles on the outer margin and without apical spur. The careful re-examination of the holotype and new records in amber should answer the question about tarsal formula of extant and extinct species, as well as presence of dimorphism in denticulation of the protibiae in *R. groehni*.

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Appendix 1. *Revelieria groehni* Sergi, Perkovsky et Reike, 2013, female, Baltic amber, JDC-9116 [JDC], X-ray microtomography volume rendering of the habitus.
Supplementary video: https://doi.org/10.5281/zenodo.6393905

Appendix 2. *Revelieria groehni* Sergi, Perkovsky et Reike, 2013, female, Baltic amber, JDC-9116 [JDC], X-ray microtomography volume rendering of the forebody.
Supplementary video: https://doi.org/10.5281/zenodo.6393929

Appendix 3. *Revelieria groehni* Sergi, Perkovsky et Reike, 2013, female, Baltic amber, JDC-9116 [JDC], X-ray microtomography volume rendering of the habitus with metathoracic wings in green colour.
Supplementary video: https://doi.org/10.5281/zenodo.6393946

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