



A new species of minute beetle (Coleoptera: Clambidae) from Baltic amber (Paleogene, Eocene)

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A new species of Clambidae, *Clambus helheimricus* sp. nov., is described and illustrated from Baltic amber. A list of the smallest beetles described from this Lagerstätte is provided.

The Clambidae Fischer von Waldheim, 1821 (minute beetles) comprises approximately 170 described extant species (Slipinski *et al.* 2011) of small (total length 0.7–2.0 mm) beetles placed into three subfamilies (Crowson 1979; Bouchard *et al.* 2011; Leschen 2016): Calyptomerinae Crowson, 1955; Acalyptomerinae Crowson, 1979; and Clambinae Fischer von Waldheim, 1821. Two of them, Calyptomerinae and Acalyptomerinae are monogeneric (represented by *Calyptomerus* Redtenbacher, 1847 and *Acalyptomerus* Crowson, 1979, respectively) each including four species. The subfamily Clambinae comprises four genera (Crowson 1979; Kirejtshuk & Azar 2008; Leschen 2016): *Clambus* Fischer von Waldheim, 1821 [extant, subcosmopolitan in distribution, the largest and most diverse genus of the family, about 130 spp.]; *Loricaster* Mulsant & Rey, 1861 [extant, Holarctic in distribution, 9 spp.]; *Sphaerotherax* Endrödy-Younga, 1959 [extant, distributed in Australian and South American regions, 5 spp.]; *Eoclambus* Kirejtshuk & Azar 2008 [extinct, known from Lebanese amber, Lower Cretaceous: Barremian, monotypic]. In the present-day Palearctic region, Clambidae are represented (Löbl 2006) by three species of *Calyptomerus*, three species of *Loricaster*, and 37 species of *Clambus*.

Clambus is recorded from Baltic (Klebs 1910; Bachofen-Echt 1949; Larsson 1978, Hieke & Pietrezeniuk 1984; Kulicka & Ślipiński 1996) and Bitterfeld (Schumann & Wendt 1989; Rappsilber 2016) ambers. According to Kirejtshuk & Azar (2008) the representatives of the family are mentioned as not infrequent among the Baltic amber inclusions in different collections. However, the family Clambidae is poorly known in fossils and the Cretaceous *Eoclambus rugidorsum* Kirejtshuk & Azar 2008 is the most ancient and unique described fossil representative of the family to date. In the current paper, the first description of new fossil *Clambus* species from Early Tertiary (Eocene) Baltic amber is provided.

Material and methods

One specimen (holotype) was examined. The amber piece is currently deposited in the private collection of Christel and Hans Werner Hoffeins (Hamburg, Germany) and will be deposited at the Senckenberg Deutsches Entomologisches Institut (Müncheberg, Germany) as part of the institute's amber collection. The amber piece with inclusion was prepared manually and embedded in polyester resin (Hoffeins 2001). Photographs were taken with a Zeiss AxioCamICc 3 digital camera mounted on a Zeiss Stemi 2000 stereomicroscope. The measurements were made using an ocular micrometer in a stereoscopic microscope. The figures were edited using Adobe Photoshop CS8.

The following sources were used for the generic attribution and comparison with recent taxa: Crowson (1979), Endrödy-Younga (1978, 1990a,b, 1993, 1998), Majka & Langor (2009).

Systematic palaeontology

Superfamily Scirtoidea Fleming, 1821

Family Clambidae Fischer von Waldheim, 1821

Subfamily Clambinae Fischer von Waldheim, 1821

Genus *Clambus* Fischer von Waldheim, 1821

The species under consideration belongs to *Clambus* based on a combination of the following characters: (1) metacoxal plates well-developed, large and covering legs and base of abdomen, (2) tarsal formula 4-4-4, (3) eyes wholly divided by a canthus, (4) procoxal cavities open, (5) antennae 10-segmented with 2-segmented club, (6) abdomen with 5 ventrites, (7) antennomere 3 much longer than antennomere 4, (8) metaventrite divided into horizontal and sloping plates.

***Clambus helheimricus* sp. nov. (Figs 1–3)**

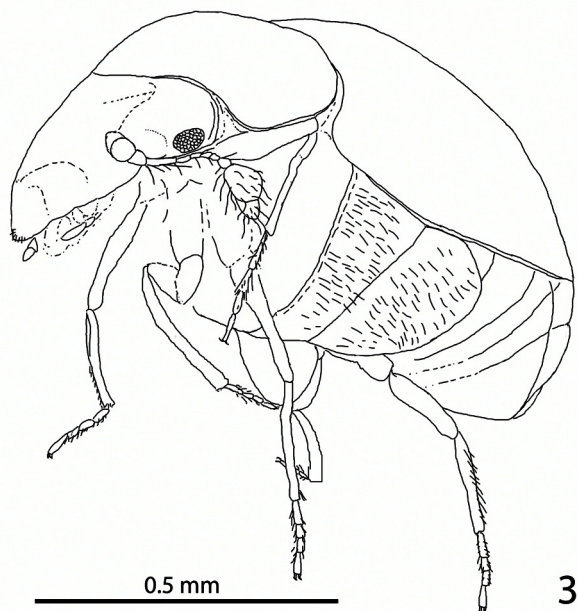
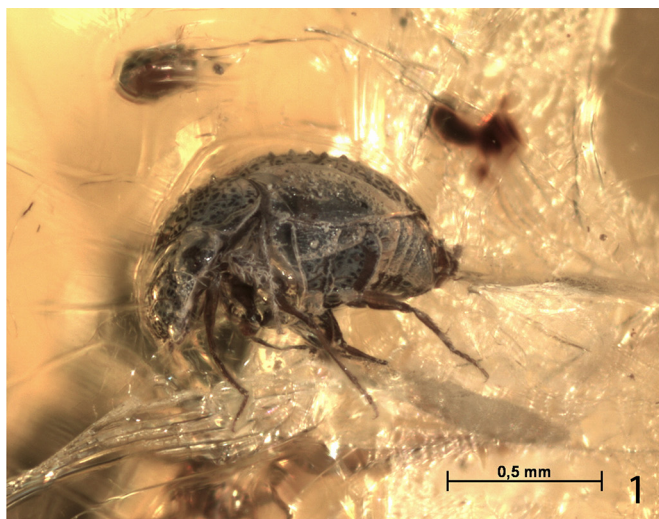
Type material. Holotype No. 1470-2 [CCHH], adult, sex unknown, complete beetle, included in small-sized yellow amber piece embedded in a block of GTS polyester resin with approximate side-length dimensions of 13 × 10 × 5 mm. The specimen is clearly visible in lateral aspect. Syninclusions are represented by one ant specimens (? *Lasius* sp.), three specimens of Acari, the head of an insect (? aphid) and minute particles of detritus.

Type strata. Baltic amber, Upper or mid-Eocene.

Type locality. Yantarny settlement (formerly Palmnicken), Sambian (Samland) Peninsula, Kaliningrad Region, Russia.

Etymology. The specific epithet “helheimricus” is formed after the word Helheimr (Helheim, or Hel)—“concealed place, the underworld”—realm of the dead, existing beneath one of the three roots of the world ash-tree Yggdrasil and ruled by the goddess Hel in the old Scandinavian mythology.

Differential diagnosis. *Clambus helheimricus* sp. nov. differs from extant species of the genus in the following combination of characters: dorsal surface apparently bare, impunctate, and shiny; temporal angles rounded, situated behind posterior margin of eyes; eyes relatively small, longitudinally oval; metaventrite and coxal plates pubescent, not shagreened; posterior horizontal plate of metaventrite moderately reduced in middle, approximately 3× shorter medially than laterally; metacoxal plates sparsely punctate; abdominal ventrites 2–5 pubescent, finely and densely punctate.



FIGURES 1–3. *Clambus helheimricus* sp. nov., holotype, habitus, ventro-lateral view.

Description. *Habitus.* Body length 1.01 mm; maximum width 0.78 mm; rounded, conglobate; convex, smooth, impunctate and shiny dorsally. Body dark brown, legs rufous.

Head. Hypognathous, transverse (approximately 1.4× as wide as long), convex, widest across temporal angles behind eyes, narrower than pronotum. Clypeal margin arcuate, with sparse short setation. Eyes from dorsal view relatively small, longitudinally oval, very finely faceted, consisting of approximately 50 facets. Interfacetal setae absent. Lateral margin of eye diverging from temporal margin. Temporal angles rounded, situated behind posterior margin of eyes. Antennal insertions exposed in dorsal view, widely separated. Antennae distinctly clubbed, relatively short (when posteriorly extended reaching middle of pronotum), consisting of 10 antennomeres. Scape and pedicel enlarged; antennomere 3 long and cylindrical; antennomeres 4–7 elongate; antennomere 8 rounded, as long as wide; antennomeres 9–10 distinctly enlarged and clubbed. Antennomere 9 the largest, triangular with rounded angles, slightly longer than broad. Ratio of antennomere lengths: 6.0: 4.0: 8.0: 4.0: 2.0: 2.0: 2.0: 3.0: 11.0: 5.0. Antennal club covered with long, thick, flexible, white hairs.

Thorax. Pronotum transverse (in dorsal view about 0.41× as long as wide), convex. Lateral pronotal carina rounded. Anterior pronotal angles rectangular, rounded; posterior angles obtuse, broadly rounded. Posterior pronotal margin concave; anterior pronotal margin broadly arcuate. Scutellar shield triangular, as wide as long. Elytra strongly convex, rounded, almost as broad as pronotum basally, approximately 0.7× as long as their maximal combined width and 2.7× as long as pronotum. Elytral punctuation or setation not apparent. Epipleura incomplete, narrow, present only anteriorly. Pro- and mesocoxal cavities open. Horizontal plate of metaventricle narrow in middle (approximately 0.3× as long as its lateral length), densely pubescent. Pubescence long, decumbent.

Legs. Long and slender. Metaxocal plates large, covering metacoxae and abdominal ventrite 1, punctate, pubescent like horizontal plate of metaventricle. Punctuation large, irregular; distance between punctures equal to 1.0–4.0× diameter of one puncture. Coxae cylindrical, projecting. Femora and tibiae slender. Tibiae pubescent. Tarsi tetramerous with tarsomeres simple, cylindrical, pubescent. Tarsomeres 1 and 4 long, almost equal in length; tarsomeres 2 and 3 shorter than tarsomeres 1 and 4. Claws simple, acute, symmetrical.

Abdomen. With five ventrites. Ventrite 1 almost concealed by metacoxal plates; ratio of ventrite lengths 2–5: 2.0: 1.0: 1.0: 2.0. Ventrites 2–5 pubescent, finely and densely punctate. Distance between punctures equal to 0.8–1.0× diameter of one puncture. Ventrite 5 simple, without apparent long pubescence apically.

Remark. Genitalia internal and obscured in this specimen. Metathoracic wings not visible.

Assumed bionomy. Extant representatives of the genus *Clambus* are collected from decaying vegetation, leaf litter and rotten wood. Records indicate that the family is probably feeding on microfungi, though they may be found on Ascomycetes, Myxomycetes and Basidiomycetes, where they feed mainly on spores and hyphae (Leschen 2016). For the fossil species, a similar biology and relation with saproxylic environment and soil litter can be assumed.

Discussion

The body length of the smallest known extant beetle and the smallest known free-living insect (*Scydosella musawasensis* Hall, 1999) is 325 µm according to Polilov (2015). The smallest described beetle from Baltic amber, *Micridium groehni* Polilov & Perkovsky, 2004, is 490 µm long (Polilov & Perkovsky 2004).

The representatives of the family Clambidae together with Ptiliidae, Jacobsoniidae, Corylophidae, Cryptophagidae (Atomariinae), Nitidulidae (Cybocephalinae), Staphylinidae and Latridiidae are among the smallest beetles of the Baltic amber assemblage and are among the smallest known fossil Coleoptera. The beetles from this Lagerstätte less than 1.2 mm in length are listed in Table 1. Such small-sized beetles may be relatively well represented in amber, though their dimensions make them easily overlooked. According to various authors (Klebs 1910; Larsson 1978; Hieke & Pietrezeniuk 1984; Kulicka & Ślipiński 1996), Clambidae are represented by 2–3 singletons in the large European museum collections of Eocene amber. The newly described *Clambus helheimricus* sp. nov. is the first named species of the family from Baltic amber, whereas (as of September 2017) Aderidae are represented by 10 described species, Corylophidae by 1, Cryptophagidae by 2, Jacobsoniidae by 1, Latridiidae by 16, Ptiliidae by 3, and Staphylinidae by 85 species. Calculation and comparison of the real frequency of occurrence of the clambids and abundance of other small coleopterans in succinite is impossible with material available at present. Such questions should be answered by the study of representative (Zherikhin & Eskov 2006; Penney 2016) amber samples, which will be hopefully sampled in future. The possible study of the dimensional classes among included in amber insects could clarify several aspects of amber beetle taphonomy in order to better interpret the fossil record.

TABLE 1. The smallest described beetles from Baltic amber.

No	Family	Species name	Total body length, mm
1	Aderidae	<i>Cnopus kraxteppelinensis</i> Alekseev & Grzymala, 2015	1.1–1.25
2	Clambidae	<i>Clambus helheimricus</i> Alekseev sp. nov.	1.01
3	Cryptophagidae	<i>Atomaria groehni</i> Lyubarsky & Perkovsky, 2014	1.0
4	Jacobsoniidae	<i>Derolathrus groehni</i> Cai, Leschen, Liu & Huang, 2016	0.9
5	Latridiidae	<i>Dienerella nielseni</i> Reike, 2012	0.91
6		<i>Melanophthalma carstengroehni</i> Reike, 2012	1.13
7	Ptiliidae	<i>Micridium groehni</i> Polilov & Perkovsky, 2004	0.49
8		<i>Microptilium geistautsi</i> Dybas, 1961	0.8
9		<i>Ptinella oligocoenica</i> Parsons, 1939	0.8
10	Staphylinidae	<i>Batrisus antiquus</i> Schaufuss, 1890	1.0
11		<i>Bythinus foveopunctatus</i> Schaufuss, 1890	1.0
12		<i>Cryptodiodon corticaroides</i> Schaufuss, 1890	1.0
13		<i>Euconnus sucini</i> Franz, 1976	0.95
14		<i>Euconnus fossilis</i> Franz, 1976	1.05
15		<i>Euconnus liedtkei</i> Franz, 1976	1.1
16		<i>Euconnus wunderlichi</i> Franz, 1983	1.15
17		<i>Euplectus mozarti</i> Schaufuss, 1890	1.0
18		<i>Euplectus quadrioveatus</i> Schaufuss, 1890	1.0
19		<i>Hetereuplectes retrosus</i> Schaufuss, 1890	1.1
20		<i>Hetereuthia elegans</i> Schaufuss, 1890	1.0
21		<i>Heuretus coriaceus</i> Schaufuss, 1890	1.0
22		<i>Monyx spiculatus</i> Schaufuss, 1890	1.07
23		<i>Nugator stricticollis</i> Schaufuss, 1890	1.1
24		<i>Palaeomesoporus electricus</i> Yamamoto & Maruyama, 2016	0.91
25		<i>Pseudolestea insinuans</i> Schaufuss, 1890	1.0
26		<i>Rybaxis glabrella</i> (Schaufuss, 1890)	1.0
27		<i>Semnodiocerus halticaeforme</i> Schaufuss, 1890	0.75
28		<i>Stenichnus laticlavus</i> Schaufuss, 1890	1.0
29		<i>Stenichnus tibubans</i> Schaufuss, 1890	1.0

Acknowledgements

I would like to thank Mrs. Christel Hoffeins and Mr. Hans Werner Hoffeins (Hamburg, Germany) for the loan of the interesting fossil material. I am very thankful to my brother, Dr. Pavel I. Alekseev (Saint-Petersburg, Russia) for providing photographs. I thank two anonymous reviewers and Dr. Matthew L. Gimmel (Santa Barbara Museum of Natural History, California, USA) for valuable suggestions that improved the manuscript.

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