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Cryptohelops menaticus – a new genus and species of the tribe Helopini (Coleoptera: Tenebrionidae) from the Palaeocene of Menat (France)

Cryptohelops menaticus – *un nouveau genre et une nouvelle espèce de la tribu des Helopini (Coleoptera : Tenebrionidae) du Paléocène de Menat (France)*

Maxim V. Nabozhenko[a,*], Alexander G. Kirejtshuk[b,c]

[a] *Murmansk Marine Biological Institute of Kola Scientific Centre RAS, Institute of Arid Zones of Southern Scientific Centre RAS, Southern Federal University, Chekhov street, 41, 344006 Rostov-on-Don, Russia*
[b] *Zoological Institute RAS, Universitetskaya nab., 1, 199034 St. Petersburg, Russia*
[c] *CNRS UMR 5202, Muséum national d'histoire naturelle, CP 50, Entomologie, 45, rue Buffon, 75005 Paris, France*

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ABSTRACT

A new genus and species, *Cryptohelops menaticus* gen. et sp. n., are described from the Palaeocene of Menat (France). The new genus belongs to the subtribe Helopina of the tribe Helopini (subfamily Tenebrioninae of Tenebrionidae) based on the coarse and dense punctation of the hypomera, shape of the prosternum and metepisterna, a similar appearance to the native genera *Helops* and *Stenohelops* and the structure of the epipleura. The new genus also resembles *Raiboscelis* and *Entomogonus* by having the protibiae excised along the base of the inner side. The new genus is the oldest representative of the tribe Helopini. Four species of *Helops* sensu lato previously described from the Oligocene (*H. wetteravicus* K. Heyden et L. Heyden, 1865) and Miocene (*H. atticus* Redtenbacher in Ungern, 1867; *H. meissneri* Heer, 1847 and *H. molassicus* Heer, 1883) lack important diagnostic characters and should be regarded as members of the tribe Helopini with uncertain generic attribution.

RÉSUMÉ

Un nouveau genre et une nouvelle espèce, *Cryptohelops menaticus* gen. et sp. n. sont décrits dans le Paléocène de Menat (France). Le nouveau genre appartient à la sous-tribu des Helopina de la tribu des Helopini (sousfamille Tenebrioninae des Tenebrionidae) sur la base d'une ponctuation dense et grossière de l'hypomera, de la taille des prosternum et metepisterna, apparence similaire à celle des genres natifs *Helops* et *Stenohelops*, et de la structure des epipleura. Le nouveau genre ressemble aussi à *Raiboscelis* et *Entomogonus* de par les prototibia excisés le long de la base du bord interne. Le nouveau genre est le plus ancien représentant de la tribu des Helopini. Quatre espèces de *Helops* sensu lato, décrites antérieurement, à l'Oligocène (*H. wetteravicus* K. Heyden et L. Heyden, 1865) et au Miocène (*H. atticus* Redteb bacher in Ungern, 1867 ; *H. meissneri* Heer, 1847 et *H. molassicus* Heer, 1883) ne comportent

* Corresponding author.
E-mail address: nalassus@mail.ru (M.V. Nabozhenko).

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pas certains caractères diagnostiques importants et devraient être considérées comme des membres de la tribu des Helopini à attribution générique incertaine.

1. Introduction

The family Tenebrionidae is estimated at more than 20 000 living species and is known from more than 100 extinct species. The present paper describes a new genus and species of the tribe Helopini (subfamily Tenebrioninae sensu str.) from the Middle Palaeocene of Menat (see below). This work is the first of a series of publications devoted to the "Menat" Coleoptera fauna.

Materials from this locality deposited in the Menat Town Museum and National Muséum d'Histoire Naturelle (MNHN) are considerably rich with insect remains but are very difficult to study because of the fragility of the substrate and insect remains, and available specimens are for the most part very incomplete (with missing appendages and unclear segmentation). While the Coleoptera is the largest group of all invertebrate remains obtained from this site (nearly 70% of more than 2000 samples), most beetle remains can be identified only to the family level. The materials recently examined (including re-examination of some types deposited in NMHN) clearly demonstrate the lack of aquatic species (except two specimens of the family Gyrinidae (Piton, 1940; Nel, 1989) and one specimen of Dytiscidae) and absolute dominance of the family Curculionidae among the coleopteran families (more than half of the beetle remains fall within this family). In spite of their great numbers, only a few rather numerous species indicate arboreal inhabitants. This is a unique locality with such a large proportion of weevils, although this family is dominant in many Cainozoic deposits (Kirejtshuk and Ponomarenko, 2012; Kirejtshuk et al., in preparation). The next most abundant coleopterous family is the Buprestidae (about 50 remains). This family is dominant only in the Upper Cretaceous outcrop in Zerkal'naya (Primorsky Kray, Russia: Ponomarenko, pers. comm.) and in the younger site in Geisental (Middle Eocene) where Buprestidae occupy 30–40% of the total number of beetles (Haupt, 1950, 1956; Hörnschemeyer et al., 1995). However, such high numbers seem to be based on particular circumstances because in all other Palaeocene environments the representation of this family is not so significant (Kirejtshuk and Ponomarenko, 2012). It is also significant that the most recent Buprestidae, probably like most fossil members of the family, are/were xylophagous as larvae. Also represented in this fossil assemblage are members of the families Elateridae, Cerambycidae, possibly Chrysomelidae and Nitidulidae as well as some others, all represented by species which today are associated with forest habitats. The present study describes a tenebrionid from this deposit that possesses sufficient diagnostic characters to determine its correct systematic position.

2. Material and methods

The holotype of the species under consideration is deposited in the Menat Town Museum, Village of Menat, Puy-de-Dôme. The specimen was studied using a stereomicroscope Olympus SCX9 in MNHN, and also a stereomicroscope Leica MZ 16.0 in the Zoological Institute (St.-Petersburg) with different modes of light and color filters. The specimen was also examined with a Tescan Vega LSU scanning electron microscope in MNHN to test the characters not clearly visible in the optic stereomicroscope (puncturation, margins of legs, pronotum, elytra) with the Low Vacuum Secondary Electron TESCAN Detector (LVSTD).

3. Geological setting and locality information

The Middle Palaeocene Menat fossil site (Menat Basin, Puy-de-Dôme, France) is a volcanic maar containing a lake about 2–3 km in diameter, which at present contains sedimentary rocks (spongo-diatomites) with remains of diverse aquatic and terrestrial flora and fauna (Nel, 1989, 2008; Piton, 1940; Stroiński and Szwedo, 2012 etc.). This locality has been well known since the beginning of the 20th century (Fritel, 1903; Laurent, 1912 etc.) and a general preliminary overview of its biota was published by Piton (1940). According to Wappler et al. (2009), the plant and insect diversity in the lacustrine outcrop of Menat is comparatively high, confirming the results of Piton (1940), who was the first to describe the fossil flora and fauna. The composition of faunal and floral remains makes it possible to conclude that this lake was surrounded by a forest and the palaeoenvironment was warm and humid. Following the pollen, paleomammalian stratigraphic, and radiometric K/Ar analyses, the age of Menat was estimated as 59 Ma (Kedves and Russel, 1982; Nel, 2008). However, the new estimate based on macroflora postulated its age within 60–61 Ma (Wappler et al., 2009).

4. Systematics

Family: TENEBRIONIDAE Latreille, 1802
Subfamily: TENEBRIONINAE Latreille, 1802
Tribe: HELOPINI Latreille, 1802
Subtribe: HELOPINA Latreille, 1802

Note. The beetle has the distinct characters of the subfamily as well as those of the tribe Helopini; namely an open mouthpart (the cardo and stypes are not closed by the mentum); the mentum widened anteriorly with a median elevation; eyes small and not strongly transversely extended on the underside of the head; the apical maxillary palpomere pelecoid; the antennae subfiliform and moderately thickened; the femora thickened; tibiae long; protarsi widened; metatarsi long, with strongly elongated tarsomeres 1 and 4; epipleura strongly widened at base; striae deep; lateral margin of elytra widely sinuated; prohypomera with coarse large punctures and

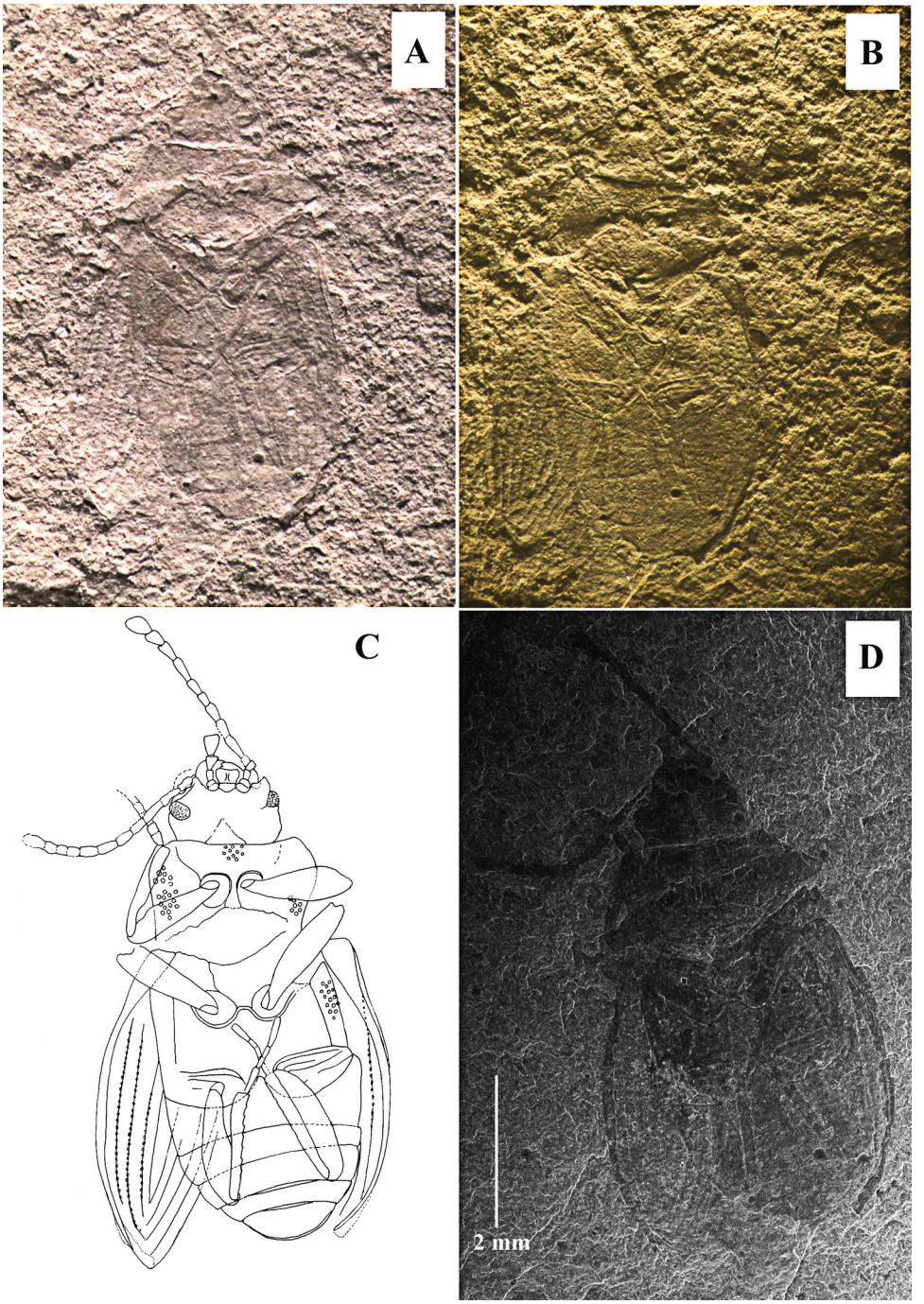

Fig. 1. *Cryptohelops menaticus* gen. et sp. n. from Palaeocene of Menat, holotype, body ventrally; A, B: photographs of holotype (stereomicroscope, different color filters and direction of light), dry print; C: figured holotype; D: holotype, electronic microscopy. Scale bare is for all figures.
Fig. 1. *Cryptohelops menaticus* gen.et sp.n. du Paléocène de Menat, holotype, vue ventrale du corps ; A, B : photographies de l'holotype (stéréomicroscope avec différents filtres de couleur et directions de la lumière), pointe sèche ; C : dessin de l'holotype ; D : holotype vu au microscope électronique. Barre d'échelle identique pour toutes les figures.

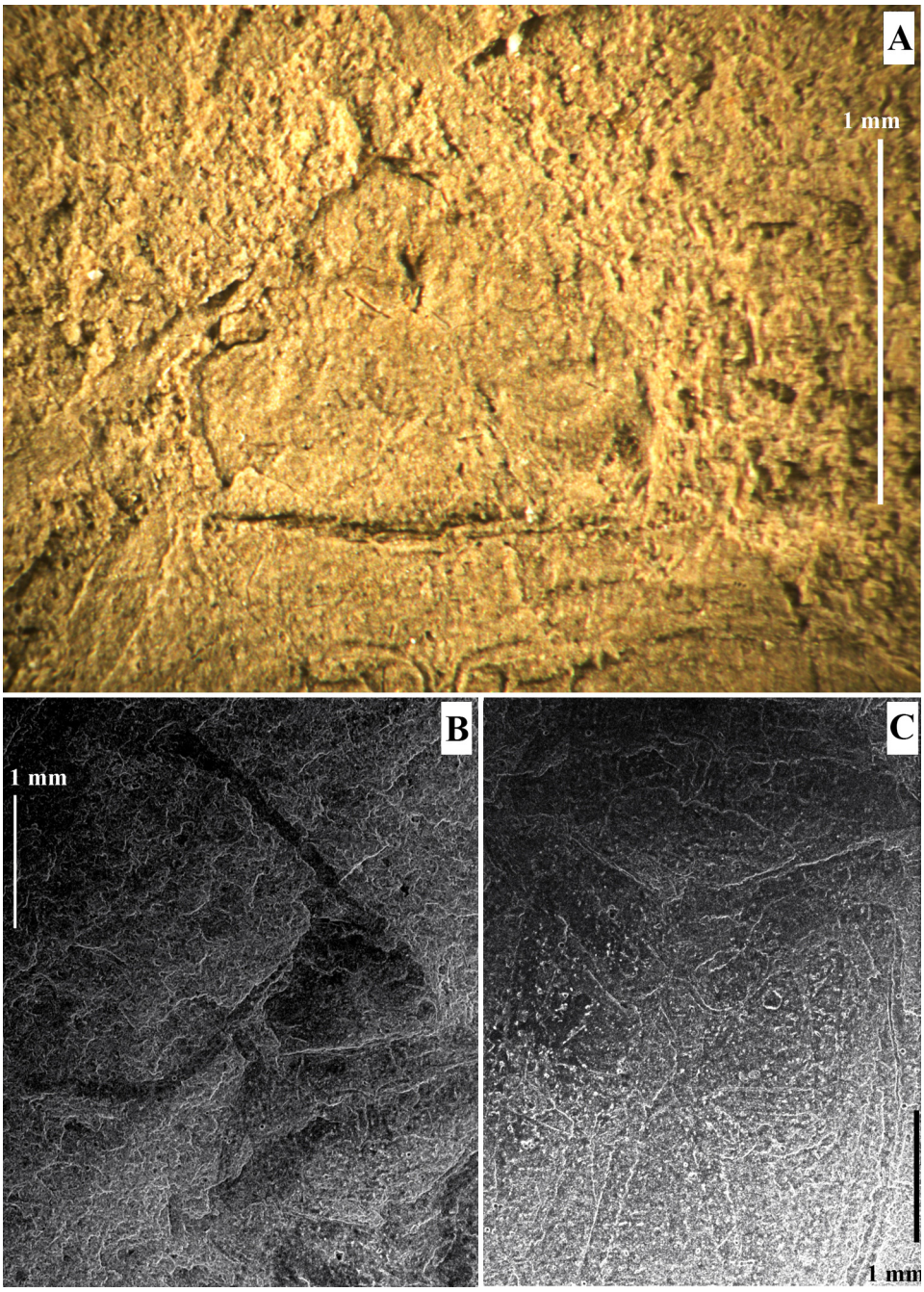

Fig. 2. *Cryptohelops menaticus* gen. et sp. n. from Palaeocene of Menat, holotype, body ventrally; A: head (stereomicroscope), dry print; B: head and prothorax, electronic microscopy; C: meso- and metaventrite, electronic microscopy.
Fig. 2. *Cryptohelops menaticus* gen. et sp. n. du Paléocène de Menat, holotype, vue ventrale du corps ; A : tête (stéréomicroscope), pointe sèche ; B : tête et prothorax, vus au microscope électronique ; C : méso et métaventrite, vues au microscope électronique.

membranes between abdominal segments 3-4 and 4-5 well developed.

Cryptohelops gen. n. (Figs. 1 and 2)

Type species: *Cryptohelops menaticus* sp. n.

Etymology. The name of the new genus is formed from the Greek "kryptos" (cryptus – secret; covert, veiled, clandestine, stealthy, privy) and the generic name *Helops*; gender masculine.

Diagnosis. Body elongate-oval. Head somewhat hypognathous, with clearly visible gula and gular sutures at base of epicranium. Laryngeal margin trisinuated, with projected angles. Mentum transverse, cordiform, with distinct longitudinal elevation in middle. Cardo and stypes

Fig. 3. *Cryptohelops menaticus* gen. et sp. n. from Palaeocene of Menat, holotype, body dorsally (counterpart).
Fig. 3. *Cryptohelops menaicus* gen. et sp. n. de Paléocène de Menat, holotype, le dos du corps (homologue).

rounded, with distinct suture between them. Maxillae elongate, with first palpomere elongate, second one transversely triangular and widened apically (weakly pelecoid), third one somewhat similar but larger. Outer margin of mandibles rounded, with subequal apical teeth. Eyes weakly transverse. Antennae moderately long, somewhat longer than head and prothorax combined, weakly widened from base to apex; scape well developed, antennomere 11 somewhat wider than antennomere 9; antennomere 10 shorter than each of both, weakly asymmetrical. Pronotum weakly cordiform. Prohypomera with very coarse, round punctures; anterior part of prosternum with less coarse and dense punctation. Procoxae round. Prosternal process narrow, widened apically, rimmed near coxal cavities. Femora thickened, tibia straight. Protibia distinctly sinuate at base along inner edge. Outer edge of metatibiae with broad wavy crenulation. Epipleura wide in basal quarter, uniformly narrowing posteriorly and reaching sutural angle of elytra. Striae clearly visible, deep.

Probable bionomy. Taking into consideration the bionomy of the recent relatives and also the large proportion of forested specimens in the deposits of Menat, the type species of this new genus could also be associated with forest habitats.

Cryptohelops menaticus, sp. n.
(Figs. 1–3)

Etymology. The name derives from the type locality "Menat".

Locus typicus and stratum typicum. Menat Basin, Puy-de-Dôme, France. The Middle Palaeocene; approximately 60–61 Ma. Type locality is situated around the small lake near the village of Menat (46° 06′ N; 2° 54′ E). Map is given in Stroiński and Szwedo (2012).

Type material. Holotype (male) deposited in Menat Town Museum, Village of Menat, Puy-de-Dôme: "MNT 05 712A".

The imprints of the holotype (part and counterpart) are well preserved. The part shows clearly visible ventral and partly dorsal surfaces of the body, antennae, head with maxillae, mentum, mandibles (partly), eyes, gula with gular sutures, prosternum, prohypomera, all femora, one protibia with tarsus, both metatibiae with tarsi, punctation of prosternum, prohypomera, metepisterna, elytral striae with punctures, epipleura. Also, the membrane between the abdominal ventrites can also be seen (Fig. 1a, b, d). The counterpart demonstrates mostly outlines of the dorsal sclerites of the specimen and sculpture of their integument.

Description of holotype. Body oval. Head somewhat narrower than prothorax, widest at level of eyes and temples (genae destroyed). Eyes weakly transverse and weakly convex, antennae short, somewhat longer than prothorax and head combined. Dorsal surface of head with comparatively sparse and moderately large punctures, with intervals markedly greater (2–3 times) than a puncture diameter. Apical antennomere nearly twice as long as antennomeres 9 and 10 combined. Antennae slightly and gradually thickening apically. Temples behind eyes weakly rounded, without visible grooves.

Pronotum cordiform, transverse, widest before middle; anterior edge very weakly and widely emarginate. Lateral edges weakly rounded in anterior half and widely sinuate in basal half. Surface of pronotum with comparatively sparse and moderately large punctures, comparable with those on head. Prosternum with moderately coarse and dense punctation (diameter of punctures subequal to distance between punctures). Prohypomera with coarse round dense foveae (punctures). Prosternal process not bordered apically.

Mesoventrite elongate, V-shaped depression not visible. Metaventrite visibly transverse (twice as wide as long). Elytra in base clearly wider than pronotum, with well developed humoral angles. Lateral sides of elytra broadly rounded, sinuated near base. Elytral striae distinct, round punctures connected by narrow deep striae, interspaces between them with sparse and comparatively fine punctuation. Epipleura strongly widened basally and more narrow on toward apex, gradually reaching sutural angle of elytra. Abdominal ventrite 1 longer than following ones (especially laterally), with acute intercoxal process. Anal ventrite widely regularly rounded at apex, distinctly bordered.

Legs long. Femora thickened; inner edge of profemora sinuate in apical part. Procoxal cavities bordered anteriorly; mesocoxal cavities also bordered in posterior part. Intercoxal process between mesocoxae widely rounded. Protibiae straight, not widened apically, clearly excised in basal quarter of inner edge. Metatibiae straight, with outer edge widely waved (crenulate), protarsomeres weakly

distinctly widened, metatarsi long, about 3/4 as long as metatibiae, metatarsomeres 1 and 4 longest.

Body length – 7.0, body width – 2.9 mm.

5. Comparison

The new genus belongs to the helopioid branch of the subtribe Helopini, characterized by the absence of temple grooves, very coarse sculpture of deep fovea (punctures) of the prohypomera, completely rimmed marginal surface of the anal ventrite, and margination of the tibiae. *Cryptohelops* gen. nov. can be distinguished from the genera *Helops*, *Stenohelops* Reitter, 1922 and *Probaticus* Seidlitz, 1896 by the body appearance and the structure of the epipleura, which is very thick at the base and very narrow apically. The new genus differs from all the above genera in the structure of the asymmetric antennomere 11 (males of *Helops*, *Stenohelops* and *Probaticus* have very long antennae with elongate antennomere 11), protibiae excised along the base of the inner edge and serrate metatibiae. The new genus additionally differs from *Stenohelops* in the structure of its prohypomera (*Stenohelops* has fine and sparse punctation) and has epipleura that reach the sutural angle.

The excised outline of the protibial base in *Cryptohelops* gen. nov. is similar to that in *Raiboscelis* Allard, 1876 and *Entomogonus* Solier, 1848. But *Raiboscelis* and *Entomogonus* have clavate tibiae (Nabozhenko and Löbl, 2009; Nabozhenko and Tichý, 2011), while the new genus has carving only in the basal quarter of its protibia. The somewhat elongate and slightly asymmetric apical antennomere is similar to that in *Raiboscelis*, while many other genera of Helopina have a long and modified antennomere 11. The new genus differs also from the two previous genera in the obtuse small body. Iit also differs from *Entomogonus* in the structure of the epipleura (*Entomogonus* has apically widened epipleura), the short antennae and the weakly transverse eyes (*Entomogonus* has strongly transverse elongate eyes). From *Raiboscelis*, the new genus differs in the structure of its humeral angles (*Raiboscelis* has very narrow, tooth-shaped shoulders) and general appearance, since *Raiboscelis* is more slender, elongate and subcylindrical.

The characters of the new genus, which are distinct from all Helopini are the following: metatibiae widely undulating along outer edge and maxillary palpomere 2 pelecoid.

The type species of this new genus cannot be compared with any of the fossil species described under "*Helops*" (see below) and differs from the recent species of *Helops* Fabricius, 1775. Thus, all the species of "*Helops*" can be preliminarily regarded as questionable members of this genus. The new species differs from "*Helops*" *wetteravicus* K. Heyden et L. Heyden, 1865 in the conjoined striae; *"H." meissneri* Heer, 1847 in the smaller body, longer and wider pronotum and apparently conjoined striae; "*H." atticus* Redtenbacher in Unger, 1867 in the smaller body, and apparently conjoined striae. "*Helops molassicus* Heer, 1883 remains unknown to the authors.

6. Discussion

After study of the mostly recent fauna of Tenebrionidae Latreille, 1802 there are known 47 genera of the tribe Helopini proposed for about 700 species in the Palaearctic Region, and also for about 80 described species from America (Nearctic and Neotropical Regions) and 5 species in other regions (Purchart and Nabozhenko, 2012). Fossil Helopini from the Paleogene (Oligocene, *Helops wetteravicus*) and Neogene (Miocene, *Helops meissneri*, *Helops atticus*, *Helops molassicus*) were all assigned to the genus *Helops* sensu lato (Heer, 1847, 1883; Heyden and Heyden, 1865; Redtenbacher in Unger, 1867). Another *Helops* (originally "*Helops* sp.") from the Baltic Amber was mentioned by Klebs (1910) and later by Larsson (1978). Kirejtshuk et al. (2008) published a review of all names proposed for fossil darkling beetles and a more detailed review is given in the catalogue by Kirejtshuk and Ponomarenko (2012). The descriptions of the compression fossil "*Helops*" spp. were based on questionable features, such as the structure of the elytral striae and occasionally the green color tinge of the elytral surface (for example *H. wetteravicus*) and all these specimens should be regarded as *species inquirendae*. *Helops meissneri* is represented by only an elytral imprint with the head and pronotum destroyed (Oeningen, Germany, Upper Miocene). *Helops atticus* was described based on the imprint of the right elytron (Kumi, Greece, Upper Miocene) and the author compared this species with *Erionura gigantea* (Kraatz, 1862) and *Entomogonus saphyrinus* (Allard, 1876) (supposedly members of the subgenus *Entomogonus* Solier, 1848). *Erionura* Reitter, 1903 and *Entomogonus* represent the genera close to *Helops*. *Helops molassicus* is also known only by the imprint of an elytron (Laus, Greenland, Upper Miocene) and the description of *Helops wetteravicus* is based on the imprint of the right elytron (Salzhauzen, Germany, Upper Oligocene).

The subfamily Tenebrioninae is the largest group of the family but is still poorly represented in the fossil record. For now, only 10 of 28 tribes of Tenebrioninae are known from fossils (Kirejtshuk and Ponomarenko, 2012; Kirejtshuk et al., 2008: Alphitobiini Reitter, 1917; Amarygmini Gistel, 1856; Amphidorini LeConte, 1862; Bolitophagini Kirby, 1837; Helopini Latreille, 1802, Opatrini Brullé, 1832; Palorini Matthews, 2003; Pedinini Eschscholtz, 1829; Tenebrionini Latreille, 1802; Toxicini Lacordaire, 1859 and Ulomini Blanchard, 1845). Most members of these tribes were described in the composition of the genera represented in the Recent fauna, and only three generic names were proposed for the extinct species: *Alphitopsis* Kirejtshuk, Nabozhenko et Nel, 2011 (Alphitobiini), *Protelerates* Wickham, 1914 (Amphidorini) и *Eupachypterus* Kirejtshuk, Nabozhenko et Nel, 2010 (Opatrini). Among the 35 fossil tenebrionins described in enough detail to be sure of their attribution, the most numerous are Helopini (four species of *Helops* sensu lato), representatives of the opatrin lineage (three species of Opatrini from *Gonocephalum* Solier, 1834, *Ephalus* LeConte, 1862 and *Ulus* Horn, 1870 and one species of Pedinini from *Leichenum* Dejean, 1834) and Bolitophagini (three species of *Bolithophagus* Illiger, 1798 and *Rhipidandrus* LeConte, 1862). The remaining tribes have only 1–2 species in the fossil record. The oldest species of the subfamily was described from Yixian, the Rubicon of the Jurassic and Cretaceous Yixian, *Alphitopsis initialis* Kirejtshuk, Nabozhenko et Nel, 2011 (Alphitobiini). Taking into consideration the records of other fossil tenebrionids

(Alleculinae) in the Upper Jurassic (Medvedev, 1969), it could be supposed that the subfamily Tenebrioninae had its main differentiations during the Upper Jurassic and Lower Cretaceous. The oldest species of the tribe Helopini here described demonstrates that in the Middle Palaeocene, this tribe was represented by forms that were rather similar to the recent ones (and have similar specializations: widened protarsi, modified pro- and metatibiae, widened apical and preapical palpomeres of maxilla). Such circumstances also support the concept of Mesozoic differentiations of the subfamily Tenebrioninae, most of which seem to have been completed before the Cainozoic.

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