



A new fossil soldier beetle (Coleoptera, Cantharidae, Silinae) from Eocene Baltic amber

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Abstract

A new genus and species of fossil soldier beetle *Markus karenae* **gen. et sp. nov.** is described and illustrated from Eocene Baltic amber. Its morphological characteristics place it in the taxonomic position of the subfamily Silinae. It is characterized by a particular lateral pronotal shape with two difform processes, pronotum slightly longer than wide, with a blunt and evident angle near the basal angles, anterior and posterior margins flat and with shallow punctation, and lateral margin strongly granulose and in relief. Furthermore, each of its legs has a claw with one acute tooth at the base, except for the posterior legs where the tooth appears to be blunt. The new taxon is morphologically compared with the other fossil representatives of Silinae from Baltic amber, and with extant Palearctic genera.

Key words: soldier beetle, paleoentomology, new genus, new species, Tertiary, Yantarny, amber

Introduction

The subfamily Silinae Mulsant, 1862, is widespread and very rich in genera and species, especially in Southern Asia and South America. Europe has very few species, but they include the common species *Autosilis nitidula* (Fabricius, 1792) and *Silis ruficollis* (Fabricius, 1775), as well as another species in Georgia: *Silis mingrelica* (Kazantsev, 1994) (Kazantsev & Brancucci 2007; Kazantsev 2011). In addition, three genera are found in Siberia and the East Palearctic region: *Asiosilis* Wittmer, *Eusilis* Reitter and *Podosilis* Wittmer. In fossil records, the subfamily is known (Fanti 2017a) from two genera described by Kazantsev (2013) and Alekseev & Kazantsev (2014): *Electrosilis* and *Curche*. Additional specimens at the generic level *Silis* sp. are cited by Klebs (1910) and Bachofen-Echt (1949) from Baltic amber. There is also one species from Miocene Mexican (Chiapas) amber (Wittmer 1963), one species from Eocene/Miocene Dominican amber (Poinar & Fanti 2016), and another species as a compressed fossil from the Eocene of Florissant, Colorado, USA (Wickham 1914). Finally, a fragment very similar to *Autosilis nitidula* (but probably not belonging to that species) is known from Tertiary strata (Eocene-Oligocene) in Aix-en-Provence, France (Serres 1843). This paper reports on the discovery of a new genus and species of soldier beetle from Baltic amber.

Material and methods

The amber specimen was discovered in a quarry in Yantarny, Kaliningrad region, Russia. The specimen is shaped roughly like a drop and has been polished to allow for better views of the inclusion. The amber measures approximately 30x17x7 mm and weighs 1.7 grams. We donated the specimen to the Smithsonian National Museum of Natural History (NMNH), where it is preserved under accession No. USNM645350. Photographs were taken with a camera Canon 70D and macrolens Canon MPE-65mm, with the addition of focus stacking software Helicon Focus. The drawing has been handmade with China ink. Estimates of the age of Baltic amber are considered to be between 47.8–41.2 MY (Lutetian – Middle Eocene) and 37.8–33.9 MY (Priabonian – Upper Eocene) based on K-

Ar dating, palynological biostratigraphy and foraminiferan assemblages (Perkovsky *et al.* 2007; Cohen *et al.* 2013 updates). The age of Baltic amber is also sometimes considered Early Oligocene (27.82–33.9 MY) based on its inclusions and their biogeographical relationships with extant species (Cohen *et al.* 2013 updates; Vitali & Damgaard 2016). The amber found at Yantarny is here considered to be dated from the Eocene.

Systematic description

Family Cantharidae Imhoff, 1856

Subfamily Silinae Mulsant, 1862

Tribe Silini Mulsant, 1862

Genus *Markus* FANTI & PANKOWSKI gen. nov.

Type Species. *Markus karenae* FANTI & PANKOWSKI sp. nov., by present designation. The genus is at present monotypic.

Diagnosis. The characteristics suggesting that the new taxon belongs to the subfamily Silinae include the long elytra covering the abdomen, antennae filiform 11-segmented, evident tibial spurs, unequal maxillary palpomeres with the last segment securiform, and a pronotum with modified lateral margins. *Markus* gen. nov. is characterized by a pronotum slightly longer than wide, narrowed posteriorly, sides not straight but slightly rounded, with a blunt and evident angle near the basal angle, anterior and posterior margins flat and with shallow punctation, lateral margin strongly granulose and in relief. The pronotum also has two irregular processes on each side, with the upper one wide at the base and equipped with a long pointed appendix, and the lower one that is very long and enlarged apically and flat, inserted almost on the lateral margins but seemingly branching from the beginning of the propleurs. It furthermore shows a rounded head, a narrow elytra that widens posteriorly from about the first third to the apex, and all anterior and median legs with inner claw equipped with a long and acute tooth at the base.

Etymology. Latinization of Mark. Genus named after Mark Pankowski of Rockville, Maryland, USA, father of one of the authors who encouraged his love of paleontology. The gender of the new genus is masculine.

***Markus karenae* FANTI & PANKOWSKI sp. nov.**

(Figs. 1–2)

Description. Male alate, body and legs entirely dark brown with testaceous head and black antennae. Body length (from anterior margin of clypeus to apex of elytra): 4.5 mm; antennal length: 3.3–3.5 mm; elytra: 3.0 mm; head and prothorax: 1.5 mm. Head round and completely exposed, as wide as pronotum, slightly rugose with some short hairs. Eyes spherical and strongly protruded, interocular dorsal distance about 1.9–2.0 times longer than eye diameter. Maxillary palpomeres 4-segmented, palpomere III very long and cylindrical and with a few long hairs, palpomere IV securiform with a short lobe at the upper edge; labial palpomeres 3-segmented and with hairs, last palpomere very elongated, globular and slightly pointed at apex. Antennae 11-segmented, covered with a few short and some long hairs, filiform, relatively long, posteriorly reaching about the mid-length of elytra, scape elongated and enlarged, pedicel (antennomere II) short, antennomere III 1.5 times as long as II, IV–XI subequal in length and slightly longer than III. Pronotum with numerous long hairs and without cavities, slightly longer than wide, posteriorly narrowed and sides slightly rounded, with blunt and evident angle near the basal angles, anterior and posterior margins flat and with shallow punctation, in middle with longitudinal glabrous part, lateral margins strongly granulose and in relief, and with two irregular processes on sides that appear to branch from the beginning of propleurs; the first (frontal) one large at the base and equipped with a long, slender and pointed appendix covered with long hairs, the second (posterior) one without hairs, cylindrical and slender at basal half part and its apical part flattened and wide with the external side winding. Scutellum triangular-shaped with rounded apex. Elytra long, completely covering abdomen, wider than pronotum, narrowed at humeri and widened posteriorly

from about the first third to the apex, rounded at apices, whole surface very finely rugose with shallow punctation, and covered with numerous hairs and without traces of costae. Metathoracic wings present and large, clear and with few veins. Metasternum and abdominal segments with dense numerous, fine and short pubescence, penultimate ventrite without incision, last ventrite very narrow compared to the previous one, not elongated, wide and roundish. Legs moderately long and covered with hairs; coxae very long and robust; trochanters squat; femora short and thickened, mesofemora slender compared with pro- and metafemora, tibiae cylindrical and about as long as femora, each with a big spur; tarsi 5-segmented, tarsomere I fine and moderately elongated, II shorter and slightly apically enlarged, III short and triangular shaped, IV strongly bilobed, V elongated and very fine; each leg with inner claw bearing acute and long tooth basally, except for posterior legs with blunt tooth. Female unknown, sexual dimorphism is supposed.

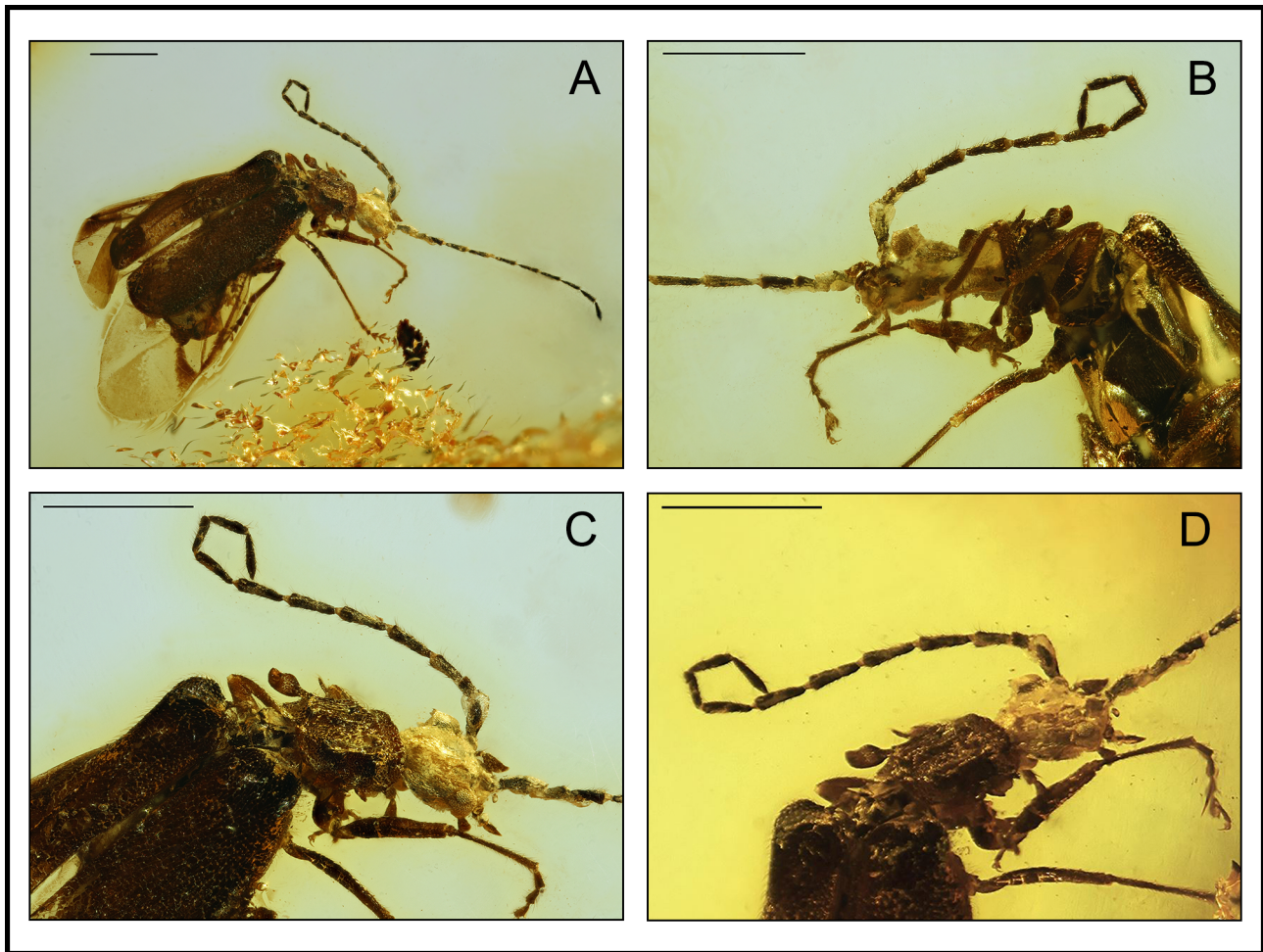


FIGURE 1. *Markus karenae* gen. et sp. nov. in Baltic amber. A: Holotype, global view (dorsal), bar = 1.0 mm. B: Holotype, detail of head and thorax (ventral view), bar = 1.0 mm. C and D: Holotype, detail of head and pronotum (dorsal views), bar = 1.0 mm.

Etymology. Species named after Karen Pankowski of Rockville, Maryland, USA, mother of one of the authors and a true inspiration.

Holotype. Male, adult specimen included in Baltic amber, accession No. USNM645350 in the NMNH.

Type locality. Russia, Kaliningrad Region, Sambian Peninsula, amber quarry near Yantarny.

Type horizon. Middle Eocene (Lutetian) (47.8–41.2 MY) to Late Eocene (Priabonian) (37.8–33.9 MY).

Syninclusions. Two masses of plant fragments (detritus) and small wood remains.

Differential diagnosis. This new genus is monotypic and easily recognizable by the particular structure of the pronotum with two difform processes on its sides and without depressions on the surface, and with lateral margins strongly granulose and slightly in relief. In fact, *Autosilis* Kazantsev has only the inner claw with a tooth at the base, glabrous pronotum without distinct pores in rounded cavities in the front half, and relatively short lateral

processes, while *Silis* Charpentier has mesonotum with pores placed in deep cavities, and lateral processes, reduced in males, shorter than *Markus* gen. nov. (Kazantsev 1994, 1997). The new genus differs from *Eusilis* because of the widened fourth tarsal segment (narrowed and not bilobed in *Eusilis*), and from *Podosilis* in the presence of an acute tooth in all inner claws of the legs (blunt tooth only in the anterior tarsi and with inner claws cleft at apex in *Podosilis*), and from *Asiosilis* because both claws of all tarsi in *Asiosilis* males have a broad tooth at the base (Kazantsev 1994). Furthermore, the new genus differs from the fossil *Electrosilis* Kazantsev because *Electrosilis* shows an unmodified lateral margin of pronotum with only slightly explanate sides, small roundish pores and small posterior angles (Kazantsev 2013), while the fossil *Curche* Alekseev & Kazantsev has a pronotum with an additional anterior incision and angular process as well as two very large and deep depressions (Alekseev & Kazantsev 2014).

Remarks. The amber specimen is very clear and transparent. There are some sparse, very small and not deep (superficial) fractures rather far from the inclusion. The inclusion is complete with only the anterior right irregular process, and the tooth of the metathoracic legs not easily visible.

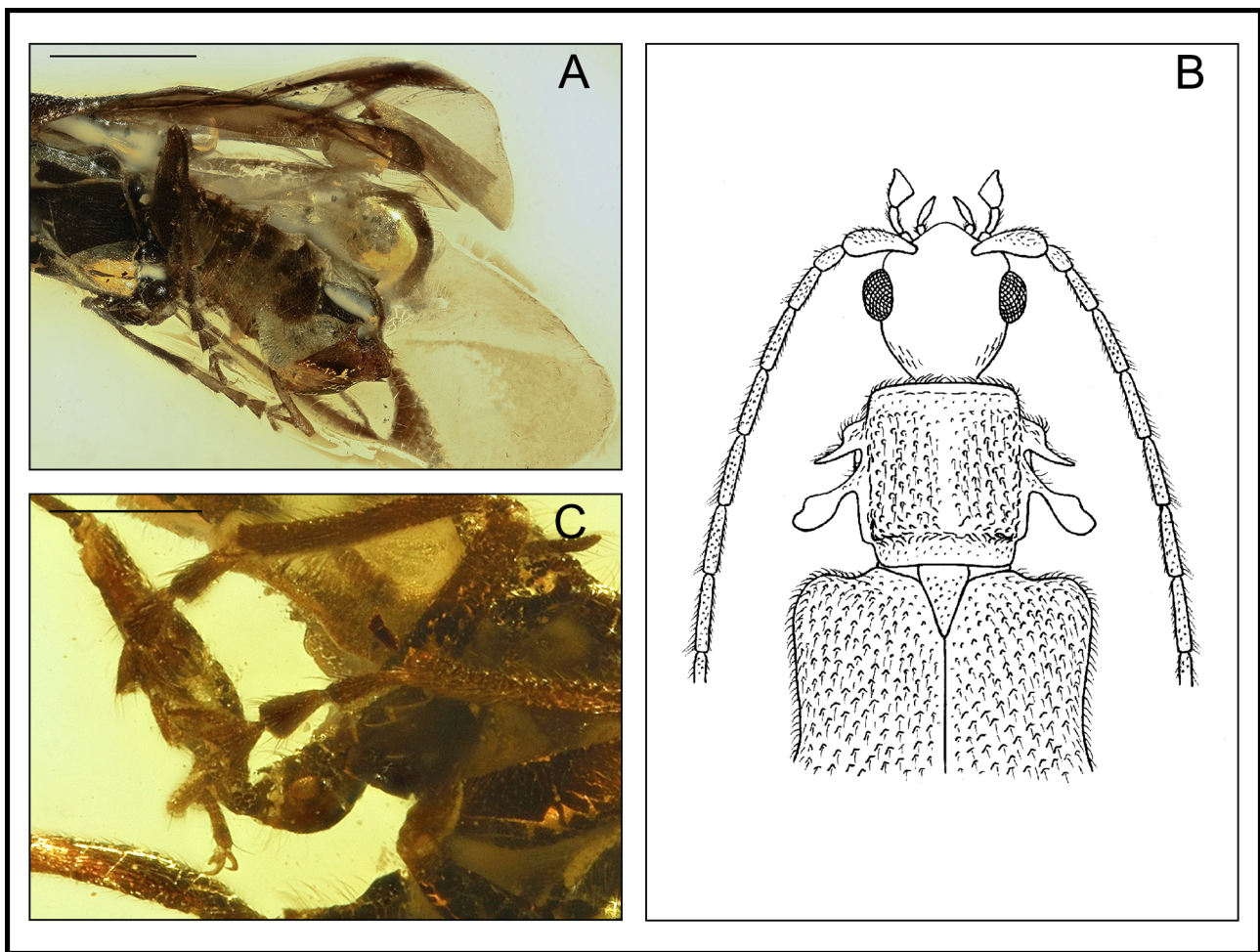


FIGURE 2. *Markus karenae* gen. et sp. nov. in Baltic amber. A: Holotype, detail of last sternites, bar = 1.0 mm. B: Reconstruction habitus (detail of pronotum). C: Holotype, detail of mesothoracic leg (tarsus and claws), bar = 300 µm.

Discussion

A characteristic that appears to be diagnostic for the subfamily Silinae in living and fossil species is the pronotal shape with the presence/absence of pores and cavities and lateral processes. The number of antennomeres appears to be consistently 11 and therefore is not useful for determination and discrimination. The characteristics of the antennae, however, appear to be quite diagnostic for the subfamily Cantharinae (Fanti 2017b). The presence of pores in deep cavities probably could be related to the release of pheromones (Brancucci 1980) into the

environment, and seeing the absence of these peculiarities in *Markus*, we believe the strong granulation, in relief, near the lateral margins, could be related to this function. The unique appearance of *Markus* does not allow us to establish affinities with other genera. In fact, the irregular processes might fall close to *Silis* and particularly close to *Autosilis*, as the characteristics of its teeth make it more related to *Asiosilis*. Thus, without seeing other characteristics and particularly the aedeagus (not possible in most fossils), the phylogenetic relationships remain unclear.

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