



A new *Malthinus* (Coleoptera: Cantharidae: Malthininae) adds to the unrivaled diversity of arthropods found in Eocene Baltic amber

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Abstract

A new species of soldier beetle (Cantharidae) from Eocene Baltic amber, *Malthinus fabriziofantii* **sp. nov.**, is described and illustrated. This is yet one more species of Cantharidae documented from the Baltic deposit, a rich accumulation of amber that provides an unparalleled view of Eocene arthropods with more than 3,000 species discovered to date. Creating this remarkable deposit was a favorable blend of environmental elements that included a humid, warm climate; an assortment of different habitats; and conifer trees exuding profuse amounts of resin that trapped hundreds of thousands of insects, arachnids, and other small organisms that would become amber inclusions.

Key words: soldier beetle, paleoentomology, taxonomy, Eocene

Introduction

Cantharidae, familiarly known as soldier beetles, are a diverse family of flattened, slender, soft-bodied beetles (Brancucci 1980; Ramsdale 2022). With more than 5,550 species worldwide (Delkeskamp 1977), soldier beetles occupy every continent except Antarctica, living in disparate habitats including grasslands, forests, mountains, deserts, and small islands (Ramsdale 2002; Konstantinov *et al.* 2009; Pelletier & Hébert 2014; Fanti & Damgaard 2018; Pankowski & Fanti 2022). Species number most in warmer areas of the world and those localities with diverse habitats (Wittmer 1971; Brancucci 1980). Research indicates that such environments prevailed in locales where Baltic amber was created during the Eocene (Sadowski 2017; Sadowski *et al.* 2017; Pankowski & Fanti 2022). These favorable conditions gave rise to over 100 Cantharidae species documented from Baltic amber (Fanti 2017; Pankowski & Fanti 2022, 2023). Sixteen genera of Cantharidae found in this amber are now extinct, while 10 genera have species alive today (Kazantsev 2013; Fanti 2017; Fanti & Damgaard 2018; Fanti & M.J. Pankowski 2018; Fanti & M.K. Pankowski 2018). The latter includes *Malthinus*, a diverse genus with hundreds of living species, many of which thrive across North America and Europe today (Delkeskamp 1977). Although soldier beetles have been described from a variety of ambers, with the vast majority coming from Baltic, Rovno, Bitterfeld, Burmese, Dominican, and Mexican ambers, *Malthinus* species have been documented in only one of type of amber—Baltic (Kuška & Kania 2010; Fanti & Damgaard 2018; Pankowski & Fanti 2022, 2023; Fanti & Vitali 2023). Previous to this paper, just six *Malthinus* species had been described from Baltic amber.

Malthinus is a member of the subfamily Malthininae Kiesenwetter, 1852. Fossil representatives of the subfamily were first documented at the beginning of the 19th century, but the first species from Baltic and Rovno ambers were not described until the beginning of the 21st century (Fanti & Vitali 2017). Among the key diagnostic characters of the Malthininae are their gular suture, mandibles, and shape of their genital segments (Brancucci 1980). Species of *Malthinus* are also known for their shortened elytra, which do not fully cover their hind wings and last abdominal segments. *Malthinus* species today are often found in habitats filled with trees, shrubs, and bushes, where they hunt for small insects on branches and leaves (Fiori 1949; Ramsdale 2002; Fanti & Damgaard 2018; Pankowski & Fanti 2023). *Malthinus* species are small, with bodies only up to about 5.5 mm (Wittmer 1971; Fanti & Damgaard 2018), so it's not surprising that a variety of them became ensnared in resin during the Eocene (Fanti & Damgaard 2018;

Pankowski & Fanti 2023). Here a new species of *Malthinus* is described and illustrated based on a female specimen found in Eocene Baltic amber.

Material & methods

The amber piece containing the holotype was uncovered in a quarry near Yantarny in Russia's Kaliningrad Region. Based on the quarry's stratigraphy, the amber is believed to be of Priabonian (late Eocene) age (Iakovleva *et al.* 2021). The piece was cleaned, polished, and cut into a rounded trapezoid for better viewing of the beetle. Marius Veta (Palanga, Lithuania) prepared the amber and photographed it using a Canon DSLR camera with macro lenses and a focus stacking software, then the plates were processed using PhotoImpact Viewer SE. The specimen was donated to the Museum of Comparative Zoology at Harvard University in Cambridge, Massachusetts (USA).

Systematic paleontology

Family Cantharidae Imhoff, 1856

Subfamily Malthininae Kiesenwetter, 1852

Tribe Malthinini Kiesenwetter, 1852

Genus *Malthinus* Latreille, 1805

Subgenus *Malthinus* Latreille, 1805

Malthinus fabriziofantii M. V. PANKOWSKI sp. nov.

(Figs. 1–3)

Description. Adult, winged, slender, female defined on the basis of the last sternite wide and not triangular in shape. Total length: about 2.9 mm. Antennae: about 1.8 mm. Entirely dark brown with elytra blackish and without yellow spot at apices.

Head almost completely exposed, strongly narrowed behind eyes, very strongly wrinkled, with deep and very wide punctation, interocular dorsal distance about 1.9–2.0 times greater than eye diameter. Eyes rather large, convex, perfectly rounded, located in the upper lateral part of head. Mandibles falciform, elongate. Maxillary palpi 4-segmented, with last palpomere globular and apically pointed. Labial palpi 3-segmented, with last palpomere globular and apically pointed. Antennae filiform, 11-segmented, very short, approximately reaching half of elytra and anterior margin of second abdominal segment; antennomere I extremely elongate, very slightly club-shaped (slightly enlarged from middle to apex); antennomere II elongated, thin, about 1.8–1.9 times shorter than antennomere I; antennomere III as long as antennomere II, thin; antennomeres IV–V sub-equal, longer than previous one; antennomeres VI–VII slightly shorter than previous ones; antennomeres VIII–X shorter than previous ones; antennomere XI elongate, thin, rounded at apex; all antennomeres covered by short setae. Pronotum slightly longer than wide, narrower than head, slightly punctate, equipped with sparse setae, anterior margin straight and bordered, posterior margin straight, sides straight from anterior margin to middle part, sides with a small and rounded expansion after the middle part and slightly restricted near the posterior corners, anterior corners rounded, surface flat. Scutellum triangular shaped. Elytra rather long, revealing last abdominal segment and major part of penultimate segment, wider than pronotum, covered with deep punctation in rows and some setae, parallel-sided, rounded at apex. Hind wings infusate, clearly exceeding elytra and last abdominal segment. Metasternum with rounded posterior margin, covered with dispersed and short setae and punctation. Sternites transverse, wide, with shallow punctation. Last tergite slightly broader than last sternite, which is wide and rounded. Legs slender, pubescent; coxae elongate, stout; trochanters elongate with rounded apex; femora enlarged, rather straight; tibiae cylindrical and thin, equipped with apical spurs, shorter than femora. Tarsomere I thin, elongate; tarsomere II shorter than tarsomere I; tarsomere III short, triangular; tarsomere IV bilobed; tarsomere V elongate, strongly curved, slender; claws simple without tooth.

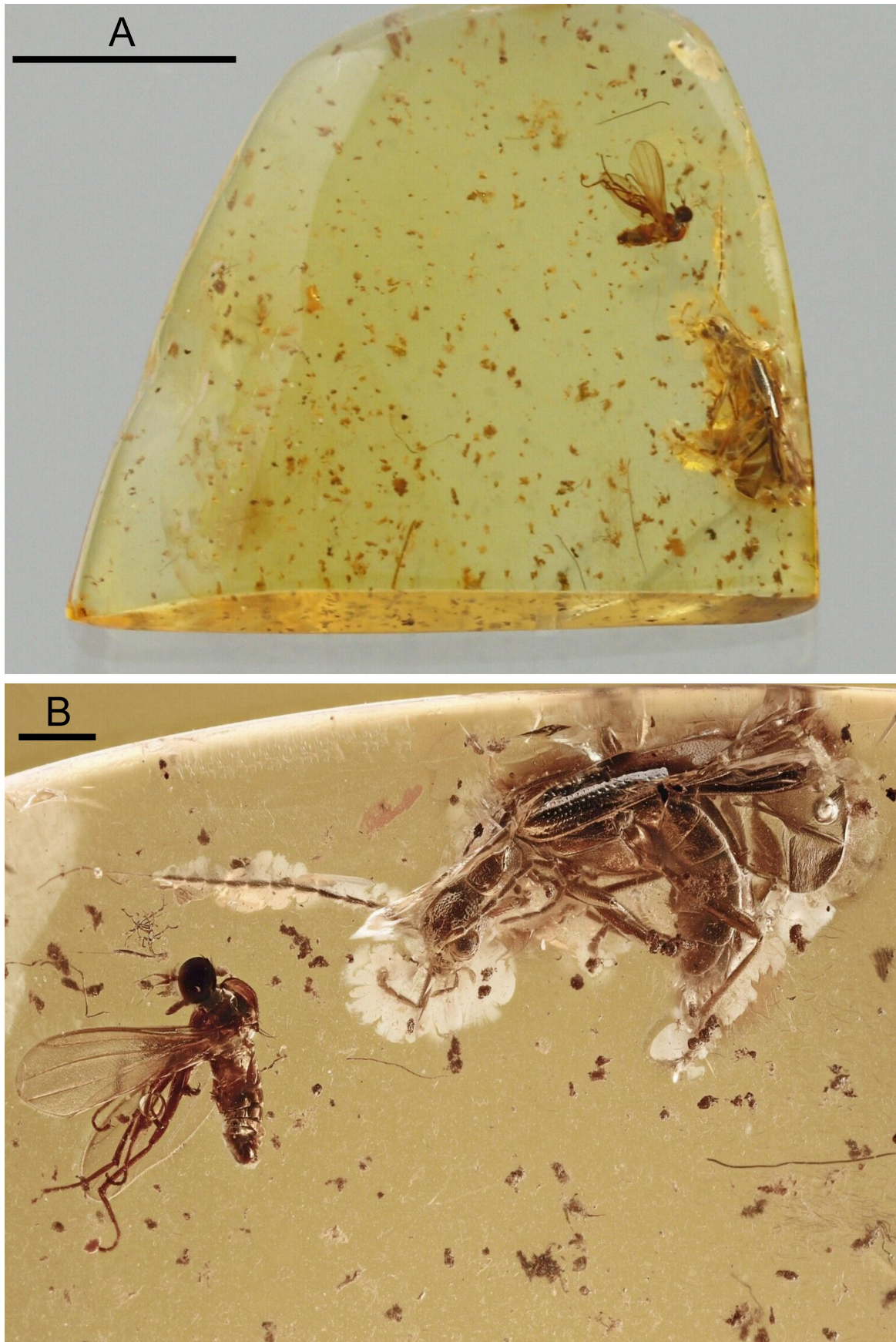


FIGURE 1. *Malthinus fabriziofantii* sp. nov. in Baltic amber. A: amber piece with inclusions, scale bar = 5 mm; B: Holotype, dorso-lateral view, scale bar = 0.5 mm.



FIGURE 2. *Malthinus fabriziofantii* sp. nov. in Baltic amber. Holotype, dorso-lateral view, macro shot, scale bar = 0.5 mm.

Etymology. The species is named after Fabrizio Fanti, an independent researcher in Italy who has devoted his life to the study of Cantharidae and related beetles.

Holotype. Female, inclusion in Baltic amber, deposited in the Museum of Comparative Zoology (MCZ) with catalog number: MCZ:Ent:PALE-45886.

Type locality. Open pit mine (“Primorskoje”) in Yantarny (formerly Palmnicken), Baltic Sea Coast, Sambian Peninsula, Kaliningrad Region, Russia.

Type horizon. Baltic amber, late Eocene, Priabonian, Prussian Formation (37.7 ± 3.0 Ma).

Syninclusions. Botanical remains, stellate hairs, air bubbles, a dagger fly (Empididae).

Systematic placement. The short elytra, the head wrinkled and triangular behind the eyes, small body size, the last maxillary palpomere globular and distally pointed, the elytra with impressed punctuation, and the last abdominal segments not modified clearly place this species in the genus *Malthinus* Latreille, 1805 (Brancucci 1980).

Differential diagnosis. *Malthinus fabriziofantii* sp. nov. is easily recognizable by its pronotum that is elongated and slightly restricted at the posterior corners. It can be distinguished from similar species based on the pronotum of each: In *Malthinus danieli* Kuška & Kania, 2010 and *Malthinus rifbjergi* Fanti & Damgaard, 2018 the pronotum is enlarged posteriorly; in *Malthinus amicitiae* Fanti & Vitali, 2023 the pronotum is rectangular with straight sides; in *Malthinus masoni* M. G. Pankowski & Fanti, 2022 the pronotum is as wide as long and its sides are straight; in *Malthinus karenpankowskiae* M. G. Pankowski & Fanti, 2023 the pronotum is strongly transverse with straight sides; and in *Malthinus pauljohnsoni* M. G. Pankowski & Fanti, 2023 the pronotum is widely expanded at the sides before the posterior corners (Kuška & Kania 2010; Fanti & Damgaard 2018; Pankowski & Fanti 2022, 2023; Fanti & Vitali 2023).

Remarks. The yellow amber piece measures approximately 16 x 13 x 4 mm, and weighs 0.5 grams after preparation. The inclusion is complete. The male of this species is currently unknown.

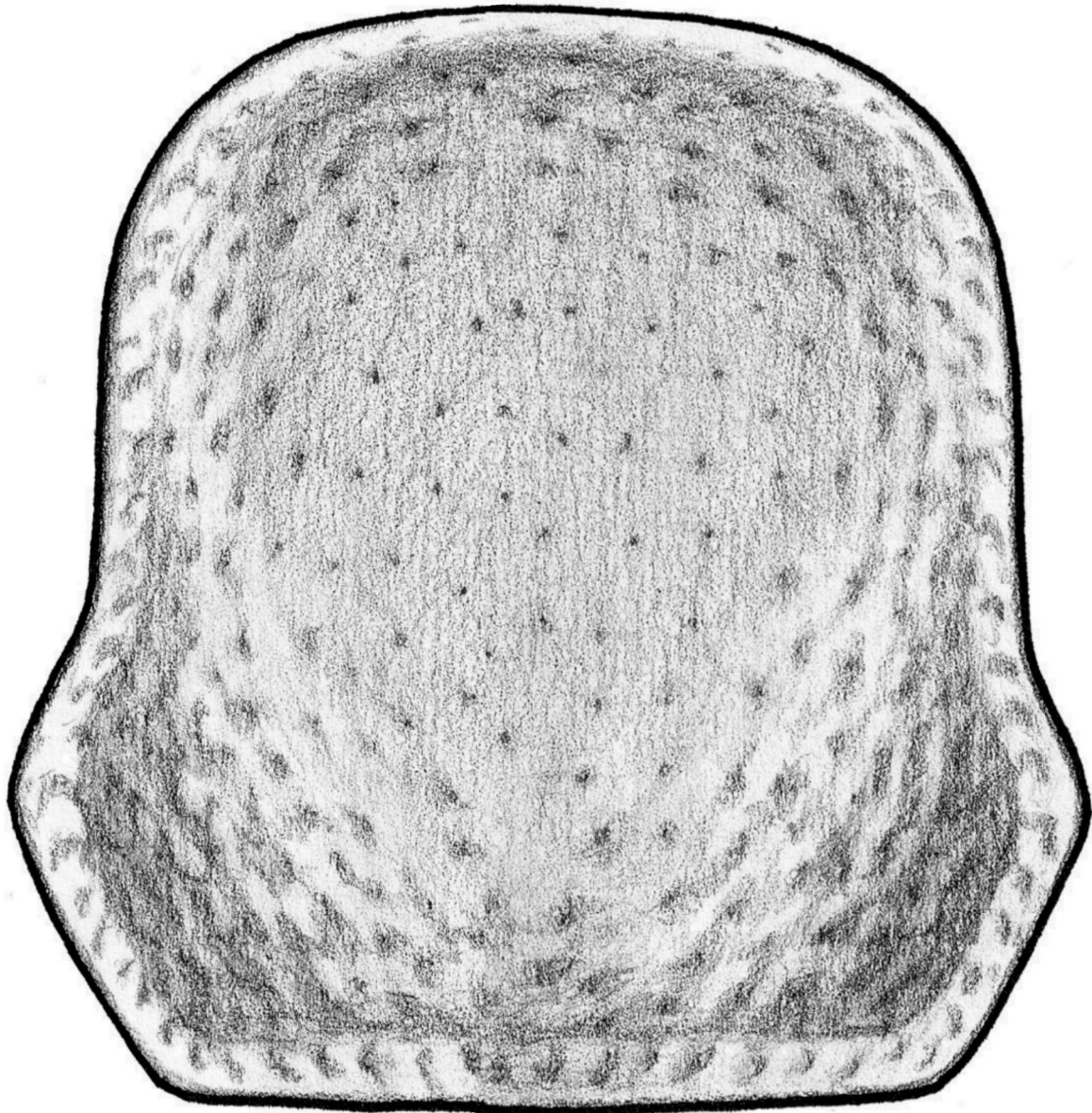


FIGURE 3. *Malthinus fabriziofantii* sp. nov. in Baltic amber. Drawing of pronotum.

Discussion

Malthinus is a member of the subfamily Malthininae Kiesenwetter, 1852, which is subdivided into four extant tribes: Malchinini Brancucci, 1980; Malthinini Kiesenwetter, 1852; Malthodini Böving & Craighead, 1931; Tytthonyxini Arnett, 1962; and two extinct tribes: Mimoplatycini Kazantsev, 2013; and Nothotytthonychini Fanti, 2022 (Brancucci 1980; Kazantsev 2013; Fanti 2022; Motyka *et al.* 2023). The Malthininae were once believed to have evolved relatively recently (Brancucci 1980); then Motyka *et al.* (2023), analyzing genetic data of various Cantharidae, hypothesized that the Malthininae originated during the Cretaceous. New discoveries in amber, particularly in Cretaceous amber, have added to and, in some cases, complicated our understanding of the evolution of Malthininae. For example, two taxa referred to the subfamily Malthininae were documented in Cretaceous Burmese amber (Hsiao *et al.* 2016; Li *et al.* 2022); however, these attributions have been disputed (Fanti 2021, 2022).

The genus *Malthinus* is documented from as early as the Eocene, along with other genera of Cantharidae including *Malthodes*, *Podistra*, *Rhagonycha*, *Silis*, and *Cantharis* (Kazantsev 2013; Fanti 2017; Fanti & Pankowski 2022; Bukejs & Fanti 2023; Pankowski & Fanti 2023). All have been found in Eocene Baltic amber. In fact, almost

110 species of Cantharidae are known from this amber (Fanti 2017; Pankowski & Fanti 2022, 2023), making it critically important for the evolutionary study of soldier beetles. Baltic amber provides an incomparable view of Eocene arthropods, with more than 3,000 species (and some 200 species of plants) described from what is the world's largest amber deposit (Czeczott 1961; Weitschat & Wichard 2010; Sadowski *et al.* 2017, Pankowski & Fanti 2022). This remarkable diversity was likely fostered by the humid, warm-temperate climate present where Baltic amber originated, with the warm-temperate zonobiome of East Asia and North America being the closest contemporary parallels (Sadowski *et al.* 2017). This biodiversity also was propelled by the assortment of different habitats in the area that included mixed mesophytic angiosperm-conifer forests, riparian forests, meadows, back swamps, and coastal lowland swamps (Sadowski 2017; Sadowski *et al.* 2017; Parisi & Fanti 2020; Pankowski & Fanti 2022, 2023). Conifer trees in these habitats exuded copious amounts of resin, perhaps in response to disease, attacks by insects, fires, global climate changes, or another cause (Seyfullah *et al.* 2018), capturing numerous insects, arachnids, and other small organisms to be found millions of years later as amber inclusions. Together, the diverse habitats, warm climate, and resin-weeping trees produced hundreds of thousands of entrapped arthropods revealed to date, as well as the highest number of species documented in any type of amber (Sadowski *et al.* 2017). And with hundreds of tons of amber unearthed every year from an estimated 640,000 tons in this deposit (Weitschat & Wichard 2010; Seyfullah *et al.* 2018), numerous new taxa of Cantharidae and other families will certainly be discovered in the coming years.

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