

Three new species and a new genus of soldier beetles (Coleoptera: Cantharidae) from Baltic amber

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Abstract: In the present paper a new fossil and extinct genus and three new species of soldier beetles (Family Cantharidae) from Baltic amber are described: *Groehnionycha yantarnyca* gen. et sp. nov.; *Podistra* (s. str.) *carsten-groehni* sp. nov.; *Malthodes* (s. str.) *camerinii* sp. nov. It is the second *Malthodes* with some abdominal cuticular vesicles extruded. The new taxa are also compared with all fossil species.

Key words: Soldier beetles, paleoentomology, taxonomy, resin, new taxa.

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Introduction

The genus *Malthodes* Kiesenwetter, 1852, is widespread and common in the Holarctic region, with about 600–650 known species (Delkeskamp 1977; Kazantsev & Brancucci 2007). It is also known from about 30 fossil species in Baltic amber (*e.g.*, Kazantsev 2013; Fanti 2017a, b; Fanti & Damgaard 2018; Parisi & Fanti 2020, 2024; Pankowski & Fanti 2023; Fanti & Pankowski 2024; Pankowski & Fanti 2024). Two other fossil species are known from Bitterfeld amber (Fanti 2019) and two from Rovno amber (Kazantsev 2010; Kazantsev & Perkovsky 2014). As adpression fossils, a taxon from the Oligocene brown coals of Brunstatt, France (Förster 1891) and another from Miocene of the Vlădiceni deposits, Romania (Pintilioaie *et al.* 2021) are known. A new species from Baltic amber is described herein. The genus *Malthodes* easily gets trapped in amber due to its small size. The shape of the last male abdominal segments, different at a specific level, allows for easy identification and, being an evidently very plastic characteristic, makes the genus *Malthodes* an interesting subject for ecological-environmental and biogeographical studies. The genus *Podistra* Motschulsky, 1839 has been known in fossil amber only since 2018 and to date five species have been described in Baltic amber (Fanti & Damgaard 2018, 2020; Fanti 2020, 2021; Pankowski & Fanti 2023). Another species is known as a compression fossil from Rott, Germany (Fanti & Walker 2019). A

new species of *Podistra* from Baltic amber and a new extinct genus, probably related at least morphologically to the living genus *Rhagonycha* Eschscholtz, 1830, are described in the present paper.

Geological Setting and Stratigraphy

The amber pieces come from Yantarny, Sambian Peninsula, Kaliningrad region, Russia. This amber horizon was formed during Lutetian-Priabonian (Weitschat & Wichard 2010; Seyfullah *et al.* 2018; Bukejs *et al.* 2019).

Material and Methods

The specimens have been re-polished in order to highlight the inclusions and were donated by the writer (the new *Malthodes*) to the Center for Paleontology at the Illinois Natural History Survey, University of Illinois at Urbana-Champaign [INHSP], USA, or by Jonas Damzen (Vilnius, Lithuania) to Carsten Gröhn (Glinde, Germany) [CCGG], and subsequently deposited in the Center of Natural History (Centrum für Naturkunde – CeNak; formerly Geologisch-Paläontologisches Institut und Museum der Universität Hamburg [GPIH]), Hamburg, Germany. The photographs were taken by Aleksej Damzen (Vilnius, Lithuania) with a Canon 90D camera with a macro lens (Canon MPE-65 mm). Extended depth of field at high magnifications was achieved by stacking multiple images from a range of focal planes using Helicon Focus v. 6.0.18 software, and the final images were edited to create figures using Adobe Photoshop 7.0. Figures were then reprocessed using the PhotoImpact Viewer SE program.

Systematic Paleontology

Order Coleoptera Linnaeus, 1758
Superfamily Elateroidea Leach, 1815
Family Cantharidae Imhoff, 1856
Subfamily Cantharinae Imhoff, 1856
Tribe Cantharini Imhoff, 1856

Groehnionycha gen. nov.

Figure 1

urn:lsid:zoobank.org:act:EE931F6A-0CF8-4750-9339-9FF0BF3BADDB

Type species. *Groehnionycha yantarnyca* sp. nov.

Etymology. Named in honor of Carsten Gröhn (Glinde, Germany), a well-known Baltic amber specialist, with the suffix “*ōnycha*” = claw (classical ending to indicate representatives of the family Cantharidae, with reference to the morphology of the claws considered important in generic level systematics). The gender is feminine.

Diagnosis. The 4-segmented maxillary palps with the last palpomere securiform, 5-5-5 tarsal formula, pronotum without modified lateral margin, tarsomeres III–IV without ventral lobes, smooth elytra, and absence of a long neck permits this new genus to be assigned to the family Cantharidae and its subfamily Cantharinae. The new genus is characterized by the last maxillary palpomere slightly securiform, the

third tarsomere straight apically, a pronotum transverse sub-rectangular, claws simple with an obtuse tooth at base, and the tarsomere 5 attached at the apex of tarsomere 4.

Groehnionycha yantarnyca sp. nov.

Figure 1

urn:lsid:zoobank.org:act:2A8DC0F9-E1B2-4135-A51A-D1A9874ABEB3

Holotype. Female, in Baltic amber, deposited under accession number GPIH 5205, CCGG 8703 (ex coll. Jonas Damzen: JDC-12754).

Type Locality. Primorskoye Amber Mine, Yantarny, Sambian Peninsula, Kaliningrad region, Russia.

Type Horizon. Middle Eocene: Lutetian (47.8–41.2 Mya) to late Eocene: Priabonian (37.8–33.9 Mya).

Etymology. Derived from the type locality Yantarny = Yantarnyi (Russian: Янтарный), an urban-type settlement in Kaliningrad Oblast, Russia.

Diagnosis. As for the genus by monotypy.

Description. Adult, winged, slender. Female, based on the last abdominal segments wide and relatively short antennae. Body length: about 7.0 mm. Entirely dark brown. Head partially covered by pronotum, slightly restricted behind eyes, narrower than pronotum, wrinkled and equipped with several short setae and superficial or slightly impressed punctuation. Eyes rounded, large and prominent, inserted in the dorsolateral part of the head. Mandibles short, extremely robust, without tooth. Maxillary palps 4-segmented, unequal in length, with the terminal palpomere slightly securiform. Labial palps 3-segmented with the last segment short, very slightly securiform and enlarged that appears rather globular. Antennae filiform, 11-segmented, relatively short, surpassing the half elytra, not reaching the last abdominal segments; antennomere I (scape) elongated, rather robust, club-shaped; antennomere II short and approximately 2.1 times shorter than scape; antennomeres III–VIII long, sub-equal; antennomeres IX–X sub-equal, slightly shorter than previous ones; antennomere XI elongated, apically rounded; all antennomeres covered by long and short pubescence. Pronotum large, transverse, subrectangular, approximately 1.3 times wider than long, surface almost flat equipped with scattered and long setae, posterior margin and sides almost straight, margins and sides bordered, anterior corners strongly rounded, posterior corners obtuse. Scutellum elongated with apex rounded. Elytra wider than pronotum, slender, elongated, not covering the last abdominal segment and partially the penultimate, parallel-sided, apex rounded, surface pubescent with setae very long and without punctuation. Posterior wings completely covered by elytra. Legs rather long and robust; all pubescent, pro- and mesocoxae very robust, metacoxae elongated and rather robust; trochanters short, at apex elongated in a kind of point; femora widened, cylindrical, curved; pro- and mesotibiae longer than pro- and mesofemora, metatibiae shorter than metafemora, tibiae cylindrical and curved, thinner than femora, equipped at apex with a spur. Tarsi 5-segmented; tarsomere I very long and about 1.5 times longer than second; tarsomere III shorter than second, triangular shaped, completely straight apically; tarsomere IV bilobed with lobes that are long and rounded apically; tarsomere V thin, curved, attached at the apex of tarsomere 4; claws simple with an obtuse and very small tooth basally. Metasternum slightly rounded apically; sternites transverse, wide and pubescent; last tergite wide, narrower than penultimate tergite; last sternite wide and rounded. Male unknown.

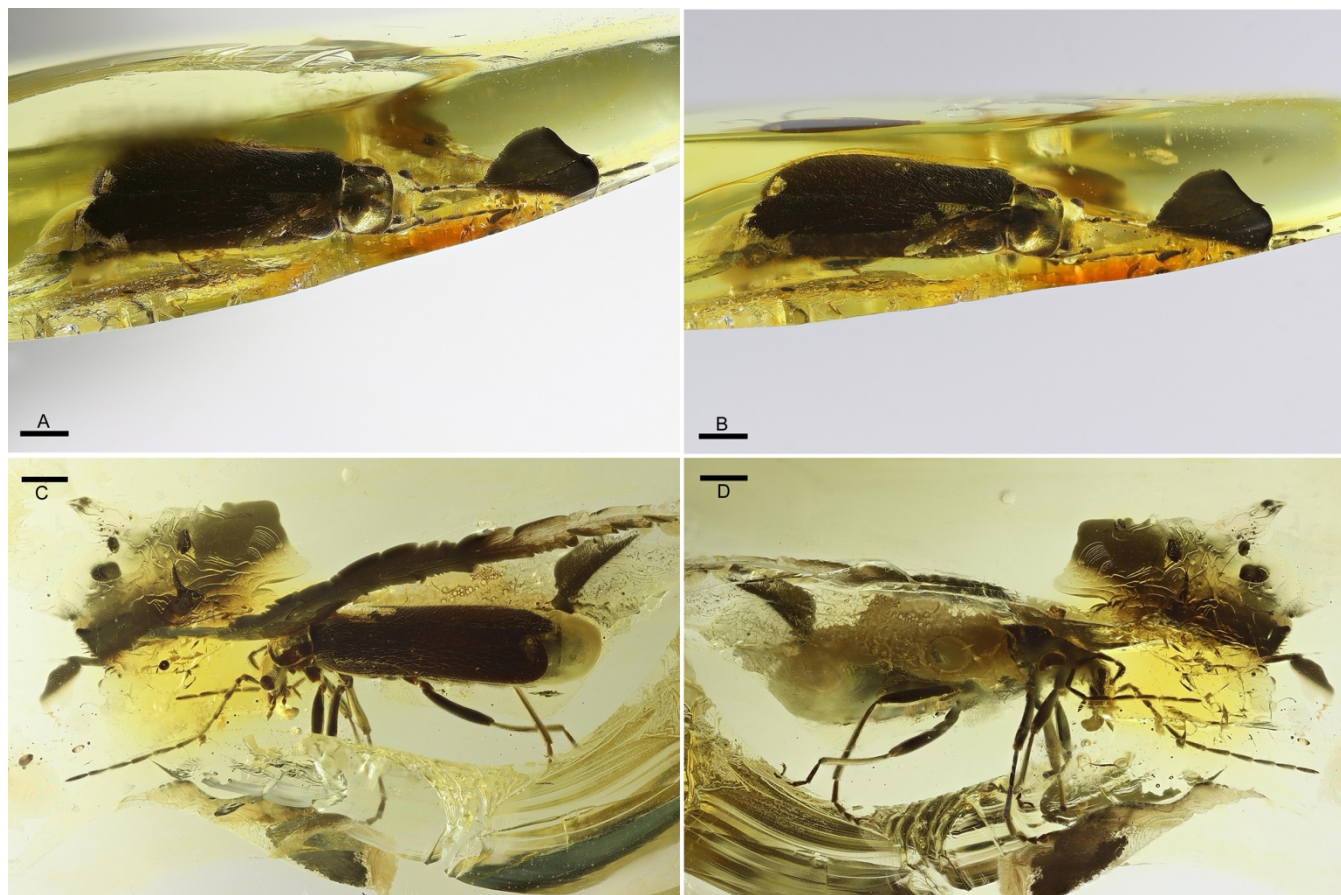


Figure 1. *Groehnionycha yantarnyca* gen. et sp. nov. in Baltic amber, holotype: **A–B**, dorsal view; **C**, dorso-lateral view; **D**, ventral view. Scale bar = 1.0 mm.

Remarks. The yellow amber piece, measures approximately $34 \times 8 \times 3$ mm. The inclusion has some ventral parts covered with milky emulsion (German term: “Verlumung” acc. Hoffeins 2012), the left posterior leg complete and preserved in the amber but with tarsus detached from the third tarsomere, left middle leg preserved up to the tibia, and left anterior leg detached from the tibia but with the last three tarsomeres and claws preserved in the amber piece.

Genus *Podistra* Motschulsky, 1839
Subgenus *Podistra* Motschulsky, 1839

Podistra (Podistra) carstengroehni sp. nov.

Figure 2

urn:lsid:zoobank.org:act:376289B5-6868-40A5-A316-46619E4B79FF

Holotype. Female, in Baltic amber, deposited under accession number GPIH 5206, CCGG 8704 (ex coll. Jonas Damzen: JDC-12871). The clear and yellow amber piece, rectangular in shape, measures approximately $20 \times 9 \times 5$ mm. The inclusion is complete except the left antenna which is preserved only up to the sixth antennomere.



Figure 2. *Podistra (Podistra) carstengroehni* sp. nov. in Baltic amber, holotype: **A**, dorso-lateral view; **B**, ventral view. Scale bar = 1.0 mm.

Type Locality. Primorskoye Amber Mine, Yantarny, Sambia Peninsula, Kaliningrad region, Russia.

Type Horizon. Middle Eocene: Lutetian (47.8–41.2 Mya) to late Eocene: Priabonian (37.8–33.9 Mya).

Etymology. Named in honor of Carsten Gröhn (Glinde, Germany), a well-known Baltic amber specialist, who has dedicated his life to developing knowledge of this precious resin.

Diagnosis. The new species described herein is easily recognizable from *Podistra* subgenus *Absidia* Mulsant, 1862 due to the claws without a basal tooth (Fanti & Damgaard 2018, 2020; Fanti 2020). The new species differs from *Podistra* (*P.*) *guthriei* Fanti, 2021 (Baltic amber) in the different shape of last sternite, by a pronotum more depressed centrally and more raised at the anterior and posterior margins, as well as its bigger size (Fanti 2021). Additionally, the new species differs from *Podistra* (*P.*) *madelineae* Pankowski & Fanti, 2023 (Baltic amber) as the latter has an almost flat pronotum and a different last sternite (Pankowski & Fanti 2023).

Description. Adult, winged, slender. Female, based on the last abdominal segments wide. Body length: about 6.8–7.0 mm (head and pronotum folded, therefore the length in life may be slightly different). Entirely brown. Head completely exposed, rather elongated, pubescent with short and several setae, wrinkled and equipped with punctation. Eyes convex, perfectly rounded, inserted in the lateral-upper part of the head. Maxillary palps 4-segmented; last palpomere slightly securiform, very elongated, pointed apically with the apex thin and rounded. Labial palps 3-segmented with the terminal palpomere securiform, elongated and squared apically. Antennae 11-segmented, filiform, pubescent with sparse and very short setae, inserted close to the eyes, short, not totally reaching the half of elytra; antennomere I (scape) club-shaped, enlarged and robust from middle to apex; antennomere II short, globular from middle to apex, about 2.0 times shorter than scape; antennomeres III–IV sub-equal in length, about 1.5 times longer than antennomere II; antennomeres V–IX longer than previous ones (antennomeres V and VIII slightly longer than others); antennomere X elongate, about 1.3–1.4 times shorter than previous one; antennomere XI short, rounded apically. Pronotum longer than wide, rectangular, slightly narrower than head, almost flat but with a transversal strong concavity near the basal margin and a small depression in the center, surface equipped with sparse and long setae, posterior margin straight and strongly bordered and raised, anterior margin straight and strongly bordered and slightly raised, sides straight and strongly bordered, corners roundish, propleura elongated and rounded centrally. Scutellum triangular-shaped, very elongated. Elytra wider than pronotum, elongate, parallel-sided, rounded apically, very feebly wrinkled and equipped with long setae. Posterior wings approximately as long as elytra. Legs robust, densely pubescent; coxae massive; trochanters elongate with rounded apex; femora widened, very slightly curved; tibiae thin, cylindrical, with a robust apical spur; tibiae shorter than femora. Tarsal formula 5-5-5; tarsomere I elongate; tarsomere II short, about 1.4 times shorter than first; tarsomere III triangular-shaped, extremely feebly lobed at apical sides; tarsomere IV lobed with lobes not particularly long, robust and rounded apically; tarsomere V thin, elongate, cylindrical and curved; claws simple, without tooth at base. Metasternum short, rounded apically; sternites transverse and slightly pubescent; last tergite wider than last sternite; last sternite transverse with apex slightly emarginate and very slightly lobed at sides. Male unknown.

Remarks. The securiform last maxillary palpomere, the long elytra and the rectangular pronotum place this taxon in the genus *Podistra*. Based on the absence of the basal tooth of the claws, the species could be placed in the subgenus *Podistra*. Although the subgenus *Pseudoabsidia* Wittmer, 1969 has simple claws, it

has recently been synonymized with the nominotypical subgenus (Kazantsev 2023), and with the taxonomy of the subgenera that remains largely unclear.

Subfamily Malthininae Kiesenwetter, 1852
Tribe Malthodini Böving & Craighead, 1931
Genus *Malthodes* Kiesenwetter, 1852
Subgenus *Malthodes* Kiesenwetter, 1852

Malthodes (Malthodes) camerinii sp. nov.
Figures 3–4

urn:lsid:zoobank.org:pub:952B04B0-5707-47B6-82B5-0F794CB0B06C

Holotype. Male, in Baltic amber, deposited under accession number INHS-P5102 (ex coll. Jonas Damzen: JDC-12833). The clear and yellow amber piece, rectangular in shape, measures approximately 30 × 19.5 × 5 mm. The inclusion is well visible.

Type Locality. Primorskoye Amber Mine, Yantarny, Sambian Peninsula, Kaliningrad region, Russia.

Type Horizon. Middle Eocene: Lutetian (47.8–41.2 Mya) to late Eocene: Priabonian (37.8–33.9 Mya).

Etymology. Named in honor of my friend Giuseppe Camerini (Italy), a well-known expert on fireflies (family Lampyridae), and strongly involved in the teaching, study, and conservation of the genus *Luciola* Laporte, 1833.

Diagnosis. *Malthodes camerinii* sp. nov. is very similar to *M. ceranowiczae* Kuśka & Kupryjanowicz, 2005, from which it differs in the last sternite being very slightly curved at mid-length (straight in *M. ceranowiczae*) and less restricted in the middle (Kuśka & Kupryjanowicz 2005). *M. camerinii* sp. nov. differs also from *M. ceranowiczae* by the slightly shorter and wider last tergite (Kuśka & Kupryjanowicz 2005).

Description. Adult, winged, slender. Male, based on the last abdominal segments strongly modified. Body length: about 3.0 mm. Entirely dark brown, without yellow spots on elytra. Head completely exposed, rounded behind eyes, slightly narrower than pronotum, equipped with shallow punctation and sparsely short setae. Eyes rounded, very large and prominent, inserted laterally to the head. Mandibles elongated, falciform, large at base and thin apically, concave on the internal side, internally with small denticles. Maxillary palps 4-segmented, unequal in length, with the terminal palpomere globular and distally pointed. Labial palps 3-segmented with the terminal palpomere globular and pointed. Antennae filiform, 11-segmented, long, slightly surpassing the elytra, not reaching the last abdominal segments; antennomere I (scape) elongated, rather robust, very slightly club-shaped; antennomere II approximately 2.2 times shorter than scape; antennomere III very slightly longer than previous one; antennomeres IV–VII elongated, sub-equal in length, longer than previous one; antennomeres VIII–X sub-equal in length, slightly shorter than previous ones; antennomere XI elongated, apically rounded; all antennomeres pubescent. Pronotum large, transverse, approximately 1.4 times wider than long, wider at base, surface undulating with thin pubescence and shallow punctation, posterior margin straight and strongly bordered, anterior margin bordered, sides sinuous and bordered, corners rounded. Scutellum elongated, large, with apex almost truncate (very slightly rounded). Elytra wider than pronotum, short, slender, parallel-sided, wide basally then narrowed towards the middle, apex rounded, surface with very long



Figure 3. *Malthodes (Malthodes) camerinii* sp. nov. in Baltic amber, holotype: **A**, dorsal view; **B**, ventral view. Scale bar = 0.5 mm.

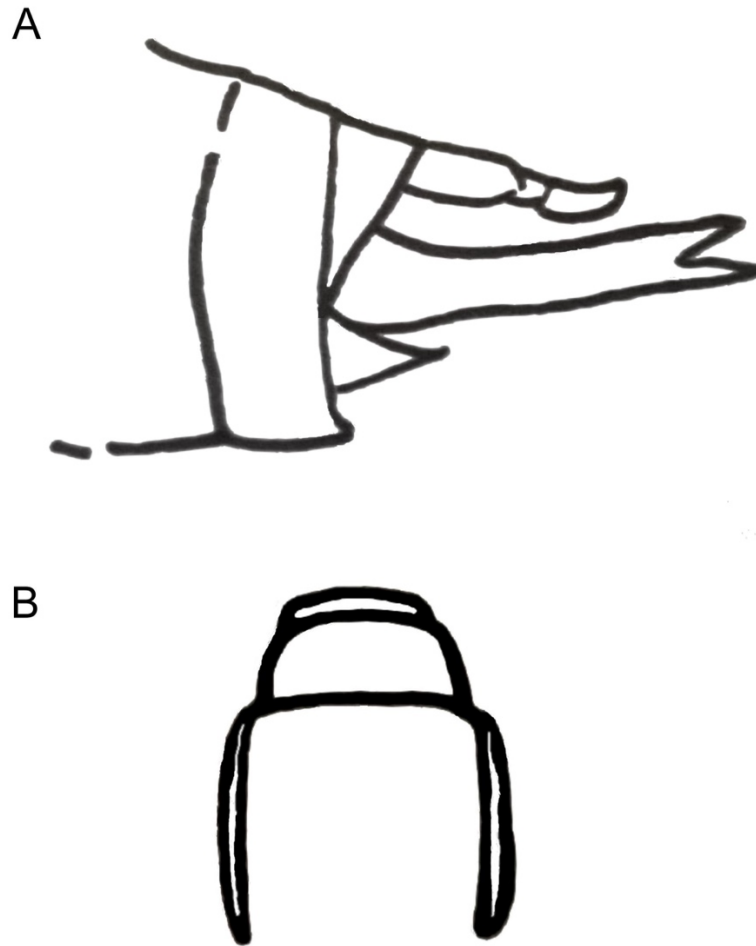


Figure 4. *Malthodes (Malthodes) camerinii* sp. nov. in Baltic amber, line drawings: **A**, last abdominal segments in ventro-lateral view; **B**, last tergites in dorsal view.

pubescence. Posterior wings dark, surpassing the elytra and the abdominal segments. Anterior legs short, median and posterior legs rather long; coxae robust; trochanters short, rounded; femora widened; pro- and mesotibiae slightly shorter than pro- and mesofemora, metatibiae approximately as long as metafemora, tibiae cylindrical and thinner than femora. Tarsi 5-segmented; tarsomere I long and about 2.2 times longer than second; tarsomere III slightly shorter than second, triangular shaped; tarsomere IV bilobed; tarsomere V thin, curved; claws simple. Penultimate tergite (tergite 9) rather wide with sides very slightly folded; last tergite (tergite 10) very short and slightly narrower than penultimate tergite; last sternite (sternite 9) long and flat, very slightly curved close to the middle, not restricted in the middle, forked apically thus with lobes rather long and evident with apex rounded. Metasternum slightly rounded apically; sternites transverse and pubescent with five and four abdominal cuticular vesicles extruded for side (which are large, gray and spongy). Female unknown.

Remarks. This new, extinct species clearly belongs to the subfamily Malthininae, based on its last maxillary palpomere being globular and pointed distally. Its rounded head behind the eyes, short elytra,

filiform antennae, and in particular, strongly modified last abdominal segments (both tergites and sternites), place the new species in the genus *Malthodes*.

Discussion

Extant soldier beetles are well-known to have concentrated alkaloids and acids for defense and accessory glands to repel avian predators and protect eggs (Moore & Brown 1978; Eisner *et al.* 1981; Durvaux *et al.* 2007; Haritos *et al.* 2012), exudates which are also toxic to humans if accidentally ingested (Yilmaz *et al.* 2014). The origin and evolution of this defensive strategy in soldier beetles is not well known, but accessory glands also have been found in two specimens of the subfamily Cantharinae embedded in Cretaceous Burmese (Kachin) amber (Poinar *et al.* 2007; Poinar & Fanti 2016) that are 98.79 ± 0.62 million years old (Shi *et al.* 2012); and even more recently in *Malthodes josephi* Fanti & Pankowski, 2018, a species preserved in Eocene Baltic amber (47.8–33.9 mya) (Fanti & Pankowski 2018). Here, another specimen of the genus *Malthodes* that possesses these extruded glands (Poinar *et al.* 2007; Poinar & Fanti 2016; Fanti & Pankowski 2018) is described, thus demonstrating that this defensive strategy was already present in many Cantharidae early in their diversification. Many Cantharidae, especially of the subfamily Cantharinae, also have aposematic color and a mimicry complex with many other insects families, such as Lycidae, Lampyridae, Pyrochroidae, Meloidae, Coccinellidae, and Elateridae (Ohba & Meyer-Rochow 2012; Fanti & Pankowski 2020), which traits likely play an important role in coevolution with the alkaloid-based defensive strategies. It's worth noting that, in living Malthininae (including *Malthinus* Latreille, 1805 and *Malthodes*), often a couple of bright, well visible yellow spots are evident on the elytral apex. Although no extant species has been reported to have such defensive cuticular vesicles (but which can be found in Melyridae: Malachiinae, a rather similar subfamily), it is easy to look at elytral spots as remnants of an ancient aposematic warning to predators. It must be said that, both in extant and extinct Malthininae, in certain species the apical elytral spots are either missing or not evident (Fanti 2021). That might be an indication of the aposematic colour defense fading away in this group, but many other explanations are certainly possible.

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