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A new taxon of the soldier beetles' genus †*Poinarelektronmiles* from Burmese amber (Coleoptera: Cantharidae)

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Abstract
Poinarelektronmiles cuaroni **sp. n.**, a new fossil species of soldier beetles from the Cretaceous Burmese amber is diagnosed and illustrated, in this document. It is characterized by the antennomeres V-IX with an extremely long antennal process, and the last antennomere is very robust. Unlike what some authors have recently proposed, and as in other genera of Cretaceous soldier beetles, the antennal processes are evidently inserted at the apex of the antennomeres, in the intersegmental zone between the apex and the base of the next antennomere.

Key words: Resin, Burmese amber (Kachin amber), paleoentomology, taxonomy, new species.

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Introduction

The soldier beetles (family Cantharidae) with over 5100 species are distributed on all continents except Antarctica (Delkeskamp 1977; Bouchard et al. 2009). At the fossil stage the family has been known since 1847, with first taxa described as adpression / compression fossils from Oeningen, Germany and Radoboj, Croatia (Heer 1847; Fanti 2017). After the first description in 2016 of a representative of soldier beetles in Burmese amber (Poinar & Fanti 2016), in just six years already over 30 species are known, as indicated in the checklist below (*e.g.,* Fanti et al. 2018; Fanti & Ellenberger 2018; Hsiao & Huang 2018; Ellenberger & Fanti 2019; Fanti & Damgaard 2019, 2020; Hsiao et al. 2021; Yang et al. 2021, 2022; Li et al. 2022; Zhao et al. 2022), noticeably increasing the knowledge of the evolution of these insects. However, a review of these genera is underway by the second author.

A description of a new representative of the extinct genus *Poinarelektronmiles* Fanti & Damgaard, 2020 is given here. Currently, only three specie from this amber resource: *Poinarelektronmiles ellenbergeri* Fanti & Damgaard, 2020, *Myamalycocerus vitalii* Fanti & Ellenberger, 2016, and the new species here described, are known with long elytra surpassing the last abdominal segment. Compared to the living fauna of the subfamily Cantharinae, to which the vast majority of these species of this amber belong, the elongated elytra appear a rather rare character, which however is also found in the species *Molliberus albae* Peris & Fanti, 2018 from the Cretaceous Spanish amber (Peris & Fanti 2018).

Checklist of the Burmese amber soldier beetles:

Brevipterus acutiapicis Y. Yang, H. Liu & W. Zhao in Zhao, Liu, Geiser & Yang, 2022
Brevipterus megacephalus Y. Yang, H. Liu & W. Zhao in Zhao, Liu, Geiser & Yang, 2022
Brevipterus obtusiapicis Y. Yang, H. Liu & W. Zhao in Zhao, Liu, Geiser & Yang, 2022
Brevipterus strungei (Fanti & Damgaard, 2019)
Burmomiles bilineatimaculatus Y. Yang, Geiser & H. Liu in Yang, Zhao, Geiser, Zhang, Bai & Liu, 2021
Burmomiles blixenae Fanti & Damgaard, 2019
Burmomiles laticollis Y. Yang, Geiser & H. Liu in Yang, Zhao, Geiser, Zhang, Bai & Liu, 2021
Burmomiles oblongoculus Y. Yang, Bai & W. Zhang in Yang, Zhao, Geiser, Zhang, Bai & Liu, 2021

Burmomiles willerslevorum Fanti, Damgaard & Ellenberger, 2018
Cretocantharis veda Hsiao, Li, Ren & Pang, 2021
Elektrokleinia picta Ellenberger & Fanti, 2019
Elektrokleinia steffenseni Fanti & Damgaard, 2020
Hukawngichthyurus kiawkhaingwini Fanti & Ellenberger, 2018
Hukawngichthyurus maha Hsiao, Li, Ren & Pang, 2021
Myamalycocerus vitalii Fanti & Ellenberger, 2016
Ornatomalthinus elvirae Poinar & Fanti, 2016
Palaeocantharis panna Hsiao, Li, Ren & Pang, 2021
Poinarelektronmiles ellenbergeri Fanti & Damgaard, 2020
Sanaungulus christensenae Fanti & Damgaard, 2019
Sanaungulus curtipennis Fanti, Damgaard & Ellenberger, 2018
Sanaungulus emarginaticollis Y. Yang, H. Liu & Bai in Yang, Zhao, Geiser, Zhang, Ren, Bai & Liu, 2022
Sanaungulus fabriciusi Fanti & Damgaard, 2019
Sanaungulus ghitaenoerbyae Fanti, Damgaard & Ellenberger, 2018
Sanaungulus imparitibius Y. Yang, H. Liu & W. Zhao in Yang, Zhao, Geiser, Zhang, Ren, Bai & Liu, 2022
Sanaungulus laticoxa Y. Yang, H. Liu & Ren in Yang, Zhao, Geiser, Zhang, Ren, Bai & Liu, 2022
Sanaungulus lethi Fanti & Damgaard, 2020
Sanaungulus morellii Fanti & Damgaard, 2020
Sanaungulus multiramus Y. Yang, H. Liu & W. Zhao in Yang, Zhao, Geiser, Zhang, Ren, Bai & Liu, 2022
Sanaungulus rosenzweigi Fanti & Damgaard, 2020
Sanaungulus ruficollis Y. Yang, H. Liu & W. Zhao in Yang, Zhao, Geiser, Zhang, Ren, Bai & Liu, 2022
Sanaungulus ruicheni (Hsiao & Huang, 2018)
Sanaungulus strungei Fanti & Damgaard, 2019
Sanaungulus troelsikloevedali Fanti & Damgaard, 2019
Nothotytthonyx serratus Y.-D. Li, Biffi, Kundrata & Cai in Li, Biffi, Kundrata, Huang & Cai, 2022
Archaeomalthodes rosetta Hsiao, Ślipiński & Pang in Hsiao, Ślipiński, Deng & Pang, 2016

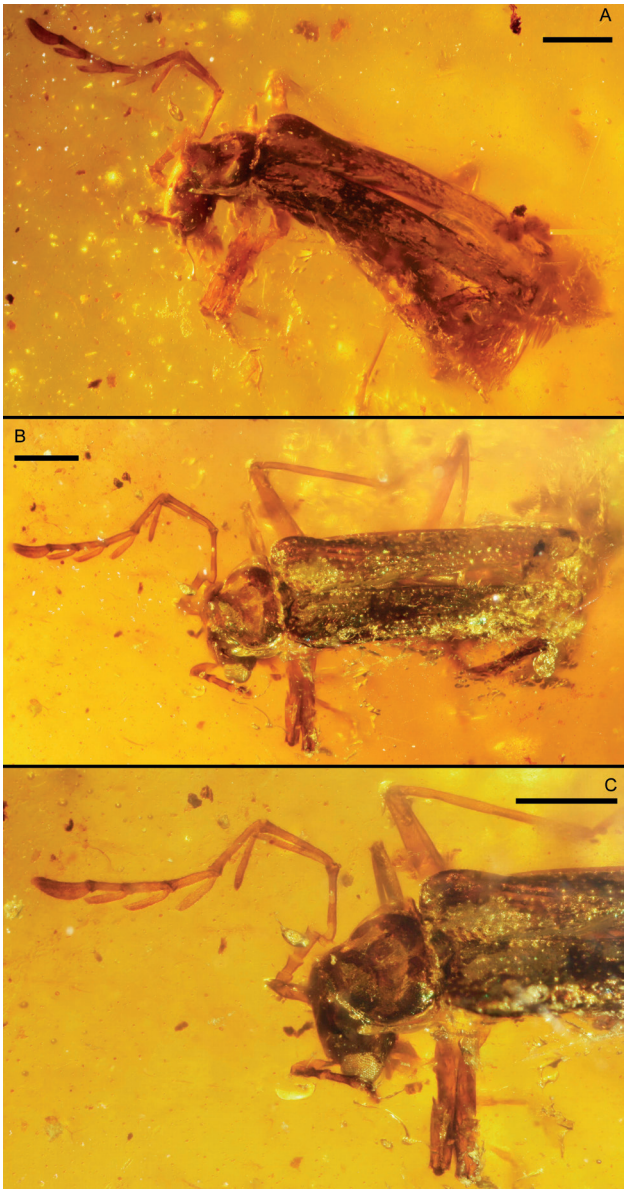

Fig. 1 – *Poinarelektronmiles cuaroni* **sp. nov.**, holotype: **A**, dorso-lateral view; **B**, dorsal view; **C**, detail of head, antennae, pronotum and elytra (humeral zone). Scale lines: 0.5 mm.

Material and methods

The Holotype is imbedded in Cretaceous Burmese (Kachin) amber of the Hukawng Valley in northern Myanmar. Burmese amber from this location is currently dated to the earliest Cenomanian, mid-Cretaceous, with an age of 98.79 ± 0.62 Mya (Shi et al. 2012). The amber has been cleaned and polished for highligthed the features useful for description. Photographs was taken with a camera Canon with lens Laowa 25mm F2.8 2.5-5X, stacking system MJKZZ Q-Rail250Plus. Tables were processed with PhotoImpact Viewer SE program, and the reconstruction of the *habitus* and antenna were made free-hand with china ink, digital reworked with Photoshop 2019. The Holotype is provisionally deposited in the personal entomology collection of the first Author (Andrea Bramanti), in Pietrasanta (Lucca), with the access code 121, and will be donated to the Natural History Museum of the University of Pisa, at Calci.

Taxonomy

Order Coleoptera Linnaeus, 1758
Superfamily Elateroidea Leach, 1815
Family Cantharidae Imhoff, 1856
Subfamily Cantharinae Imhoff, 1856
Tribe Cantharini Imhoff, 1856
Genus †*Poinarelektronmiles* Fanti & Damgaard, 2020

Poinarelektronmiles cuaroni sp. n.

Type material. Holotype. Sex undefined, adult specimen in a Burmese (Kachin) amber piece, with the Catalog number 121 in the Andrea Bramanti collection (Pietrasanta, Lucca, Italy), and later donated to the Natural History Museum of University of Pisa, Italy. Type locality: Myanmar, Kachin state, Myitkyina District, Hukawng Valley. Type horizon: Lowermost Cenomanian (98.79 ± 0.62 Mya), mid-Cretaceous.

Differential diagnosis. *Poinarelektronmiles cuaroni* sp. nov., differs from the only other known species of the genus: *Poinarelektronmiles ellenbergeri* Fanti & Damgaard, 2020 in having pectinate antennae with the antennomeres V-IX, instead of antennomeres III-IX, equipped with a long antennal process (Fanti & Damgaard 2020). Furthermore, in the new species here described the last antennomere is securiform and much more robust (Fig. 2).

Etymology. Named in honor of the movie director, screenwriter, and film producer Alfonso Cuarón Orozco (Mexico City: November 28, 1961), a dear friend of the first author.

Description. Adult, alate, slender. Sex undefined. Entirely testaceous-brown. Head transverse, rounded behind the eyes, slightly covered by the pronotum, surface pubescent with shallow and rare punctation. Eyes prominent, convex, rounded, inserted laterally to the head. Mandibles not visible. Maxillary palps 4-segmented, with the last palpomere short and slightly securiform. Labial palps 3-segmented with the last palpomere securiform. Antennae 11-segmented, pectinate, inserted in the upper part of the head and far from the eyes, slightly surpassing half of abdomen and metathoracic legs; scape slightly club-shaped, robust, elongated; antennomere II very short, about 3.5 times shorter than scape; antennomere III longer and slightly narrower than previous one, enlarged apically; antennomere IV robust, about 1.6 times longer than third; antennomere V extremely elongated, the longest, narrower than previous one, at apex with an extremely long antennal process which is rounded apically and slightly longer than the subsequent antennomere; antennomere VI extremely long, narrow, slightly shorter than previous one, with at apex an antennal process similar to the previous one; antennomere VII shorter than previous one, narrow, enlarged apically, with an apical process sturdier than previous ones; antennomeres VIII-IX subequal in length, with an apical process which is robust, longer than antennomere and squared apically; antennomere X shorter than previous one, without antennal process; antennomere XI short, very robust, rounded apically, deeply securiform; all antennomeres with short setae (Fig. 1). Pronotum slightly transverse, slightly narrower than head, enlarged at posterior corners, anterior margin undulate and finely bordered, sides rounded and bordered, posterior margin almost straight and bordered, surface completely flat with pubescence (just perceptible). Scutellum wide at base and pointed posteriorly with rounded apex. Elytra elongated, surpassing the last abdominal segment, at humeri wider than pronotum and narrower posteriorly, parallel-sided, not dehiscent, rounded at apex, surface presenting shallow or slightly in relief punctation gathered in confused striae (Fig. 1). Metathoracic wings covered by elytra and not visible. Sternum subquadrate. Sternites transverse and wide, last tergite rounded and wide. Legs elongated and equipped with pubescence; coxae short; trochanters elongated, rounded apically; femora straight, cylindrical and slightly flat in the center, sturdier than tibiae; tibiae thin, elongated, cylindrical, longer than femora. Tarsal formula 5-5-5; first tarsomere elongated, thin; second tarsomere elongated, thin, shorter than first; third tarsomere triangular-elongated, more than 2 times shorter than second; fourth tarsomere strongly bilobed with lobes extremely thin and long; fifth tarsomere very elongated, straight, very thin and slightly enlarged apically; claws simple, apparently with a very small tooth near the base (Figs. 1–2).

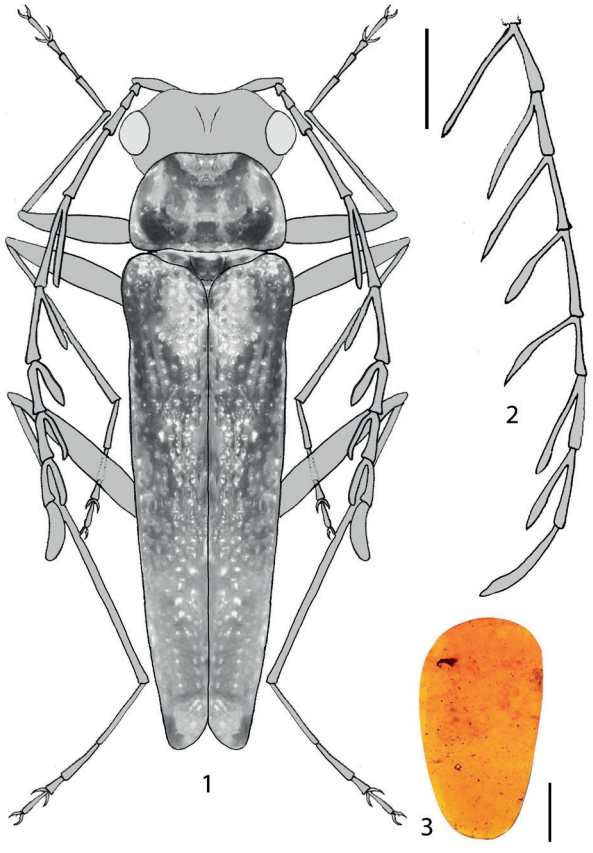

Fig. 2 – *Poinarelektronmiles cuaroni* **sp. nov.**, holotype: 1, reconstruction of *habitus*; **2**, *Poinarelektronmiles ellenbergeri* Fanti & Damgaard, 2020: reconstruction of part of the antenna; **3**, *Poinarelektronmiles cuaroni* **sp. nov.**, holotype: picture of the amber with the holotype's inclusion. Scale lines: 0.5 mm (1–2); 10.0 mm (3).

Measurements (mm). Body length: 3.4; elytra: length 2.5, width 0.8 at humeri; pronotum: length 0.5, width 0.6.

Syninclusions. Elytron, botanical remains and air bubbles.

Systematic placement. The head rounded behind the eyes, pronotum smooth without depressions or thickening, slender and long elytra covering and very slightly surpass the abdomen, and the pectinate antennae with long antennal processes, make this new species belonging to the genus *Poinarelektronmiles* Fanti & Damgaard, 2020. The other genera of Cretaceous Burmese amber have elytra more abbreviated or pronotum with depressions (Fanti & Damgaard 2020; Zhao et al. 2022). Other genera: *Nothotytthonyx* and *Archaeomalthodes* have the last maxillary palpomere globular and pointed, a character which makes them belong to a different subfamily.

Remarks. Piece of amber 38 mm long, 22 mm wide and 8 mm high. The inclusion is complete, except for the left antenna preserved up to the middle of the fifth antennomere, the legs are partially folded and the ventral view is scarcely evident due to the emulsion and shape of the amber.

Discussion

The study of fossil remains allows important phylogenetic, evolutionary, morphological and environmental reconstructions, and as regards the family Cantharidae, the Cretaceous remains are extremely important given that the entire family evolved in this period. *Poinarelektronmiles cuaroni* **sp. n.** has elongated elytra that surpass the abdomen, an apparently very rare character for this fauna. The causes, however, that force the elitral reduction are not yet known.

Yang et al. (2021, 2022) change the position of the antennal processes in some species of *Burmomiles* Fanti, Damgaard & Ellenberger, 2018 and *Sanaungulus* Fanti, Damgaard & Ellenberger, 2018 described by some authors (Fanti et al. 2018; Fanti & Damgaard 2019), only based on the original illustrations. These specimens, on the other hand, have antennal processes at the apex of the antennomere right in the intersegmental area, as is evident also in other Burmite cantharids, as well as is extremely evident in the species here described *Poinarelektronmiles cuaroni* **sp. n.** Although, some of the species described by Yang et al. (2022) have moved them slightly beyond the base, sometimes perhaps also because they are disjointed. However, we believe that the controversy about the positioning of these antennomeres is really sterile.

Furthermore, Yang et al. (2021, 2022) consider *Sanaungulus ruicheni* (Hsiao & Huang, 2018) with filiform antennae not belonging to this genus and insert it in *incertae sedis*. Yang et al. (2022), however, strangely they do not take into consideration the other *Sanaungulus* with filiform antennae already described (Fanti & Damgaard 2020). As already is well-known, the antennae in many genera of Cantharidae have a species level valence and in many others are sexual dimorphism. Thus, *Sanaungulus ruicheni* is still here considered, hopefully definitively, to belong to the genus *Sanaungulus*. Therefore, for other similar reasons, such as head rounded or triangular behind eyes, proposed by Fanti (2018), also the taxonomical attributions of *Ornatomalthinus* Poinar & Fanti, 2016 and *Sanaungulus* are not controversial as indicated in Li et al. (2022).

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